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Merci-M sro
Bezručova 3457/2
080 01 **Prešov,** Slovakia

Slovak University of Agriculture in Nitra,
Faculty of Agrobiology and Food Resources
Institute of Plant and Environmental Sciences
Trieda A. Hlinku 2, 949 76 Nitra, **http://www.uniag.sk/**

Effect of activated water by the IPS device on germination, growth, production and quality of plant biomass

Final report for research activities 2021

Contracting office: Merci M s.r.o., Prešov, Slovakia Company
director – project coordinator: František Pancurák

Research workplace:
Slovak Agricultural University in Nitra, Faculty of Agrobiology and Food Resources,
Institute of Plant and Environmental Sciences
Coordinator for the workplace: doc. **Ing. Ján Brindza, CSc.**

Research team: doc.
Ing. Ján Brindza, CSc. and collective
Institute of Biodiversity Protection and Biosafety, Faculty of Agrobiology and Food Resources,
Slovak Agricultural University in Nitra **Ing.**
Marián Miko, PhD., Ing. Ján Gažo, PhD. and collective
Department of Genetics and **Plant Breeding, Faculty of Agrobiology and Food Resources,**
Slovak Agricultural University in
Nitra **doc. Ing. Ľuboš Vozár, PhD., Ing. Peter Kovár, PhD and**
the team of the Department of Plant Production and **Grassland Ecosystems, Faculty of Agrobiology and Food Resources, Slovak**
Agricultural University in Nitra **Ing. Vladimíra Horčinová Sedláčková, PhD.**
Mgr. Olga Grygorieva, PhD.
Ing. Jana Šimková
Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources,
Slovak Agricultural University in Nitra

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In Nitra, January 2022

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AQIPS-01

Characteristics of activated water by the IPS device GDV camera

AQIPS-01-E01 Development of a test device for controlling the flow pressure of water
AQIPS-01-E02 Characterization of the energetics of activated water by the IPS system with the parameters of the GDV camera

Development of a test device for controlling the flow pressure of water

AQIPS-01-E01

Contents

A. Methodology of the experiment

Objective: Development of a device prototype for testing the regulation of water pressure flow through the IPS	
Place of	**device Institute of Biodiversity Protection and Biological Safety**
development Implementation period of device development: 10.1.2021	
– 31.3.2021 **Applied device: IPS system;**	
Rationale for the development of a specialized device: The device for regulating the pressure of the water flow in **the pipeline with the simultaneous measurement of the temperature** is not **available in the world.** In order to understand the **complex** properties of the activated water created **by the IPS device, it is necessary to know at least the water pressure itself, which can change due to the influence of various known and unknown factors. Therefore, it was necessary to develop a device that allows a simple method and system to regulate and create** flow in **the pipeline at different p**	
Basic methodology: A range from 5 Pa **-** 450 Pa **is required** to regulate the water flow pressure in the pipeline. In the device, **it is required to create an ingenious system of pressure regulation with a controller for opening and closing** the water. To determine and **regulate pressures, incorporate a digital pressure gauge into the device. For the simultaneous determination of the very dynamic indicator of the water temperature, a digital thermometer** is also installed in th **The device needs to be processed in** a small size with **the possibility of transfer to different places with** simple **assembly and disassembly.**	
Authors and solvers: doc. Ján Brindza, CSc., doc. Ing. Vladimír Cvikloviÿ, PhD.	

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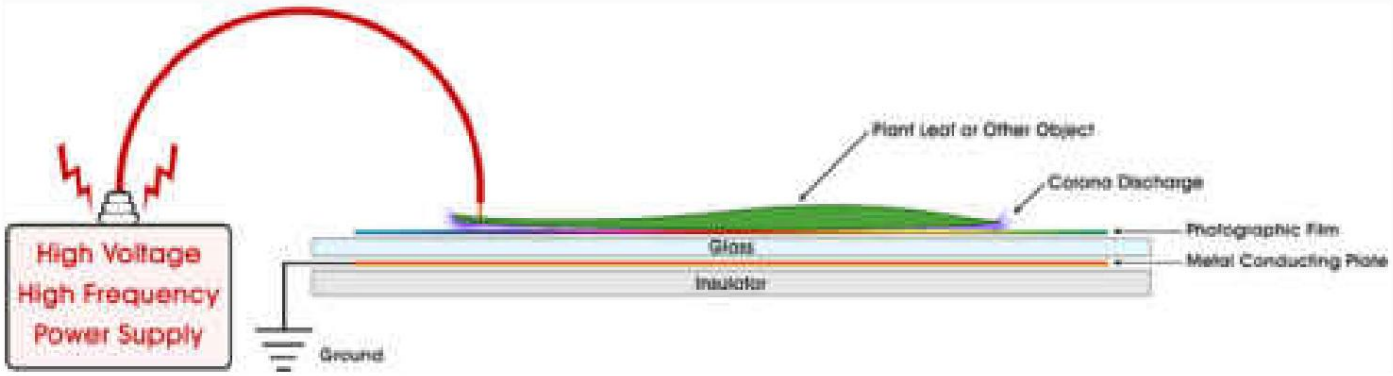
B. Introduction to the issue

"We can safely declare that biological life on Earth depends on the anomalous properties of water that distinguish it from all other substances on Earth." Konstantin Korotkov

Kirlian photography, the study of which can be traced back to the late 17th century, was officially invented in 1939 by Semyon Davidovitch Kirlian. The Kirlian photographic process reveals visible "aura-glows" around photographed objects. These photos have been the subject of many myths and controversies over the years. Interestingly, many of them were originally used to explain the Kirlian phenomena, presented by the inventor himself together with his wife.

The process of taking a Kirlian photo is quite simple and does not even require the use of a camera. First, a sheet of photographic film is placed on top of a metal plate. Then the object to be photographed is placed on top of the film. To create the initial exposure, you need to apply a high voltage current to the metal plate. In this way, it is possible to create an electric coronal discharge between the object and the metal plate. Kirlian photography, which shows a luminous, glowing silhouette around the photographed object, becomes visible as the film develops.



Kirlianova photography (melayukini.net)

Kirlian photography is essentially a set of photographic techniques used to capture the electrical coronal discharge phenomenon. This technique was variously known as electrography', 'electrophotography', "corona discharge photography" (CDP), "bioelectrography", "gas discharge visualization (GDV)", "electrophotonic imaging (EPI)", and in Russian literature also as "kirlianography".

The special photo documentation of the Kirlians has become the basis of many newly created instruments and devices that are now commonly used in various fields of research, medicine and in various production processes.

dr. Konstantin Korotkov is considered one of the few leading scientists who worships science. Korotkov and his group developed quantum electrophonic imaging (EPI), also called gas-discharge visualization (GDV) method, which provides real-time monitoring of energy systems.

As a professor of computer science and biophysics at the St. Petersburg University of Information Technology, Mechanics and Optics in Russia, Dr. Korotkov's technique for measuring and quantifying light that is invisible to the human eye. "In 1995, our group developed a gas discharge visualization (GDV) camera based on modern optics, electronics and image processing."

The electro-photonic energy-information field (aura - biofield - energy-information field) of people, plants, liquids, powders, inanimate objects is captured by a video camera and translated into a computer model that provides real-time measurements that can be used in many areas: medicine, psychology, sound therapy, biophysics, genetics, forensic science, agriculture, ecology and water. "The German scientist Fritz Popp referred to this phenomenon as the field of bio-photonics" (Korotkov 2002). In the submitted reports, the term glow = energy-information field will be used instead.

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Plants convert photon energy from the Sun into electron energy through photosynthesis. In humans and animals, a series of transformations in complex chains of albumin molecules transform light energy into bodily energy. Water and air are responsible for these transformations. "Basically, we and all living things are light" - with a little help from air and water. **It is true that for the final energy-information field it is necessary to consider the quality of the water.**

According to Dr. Korotkova has living water ("structured water"), which is found in the pristine natural environments, such as a waterfall or a mountain stream, the largest energy-information field.

"When we take water from a natural source, this life force or energy-informational field **is reduced within about 60 hours.**

"By examining a drop of structured water found in nature, we see a dynamic energy pattern of light. In ordinary tap water, the energy-information field is more static, while distilled water - which is **completely dead - presents itself as static." What happens to us and our energy-informational field** if we drink **structured water?**

"In 2014, French researcher Guy Londechamp presented his results of a five-year study of subjects who drank structured water prepared in his structured device. After testing more than 100 people, 80% of the participants showed an increase in their energy fields after drinking one glass of structured water."

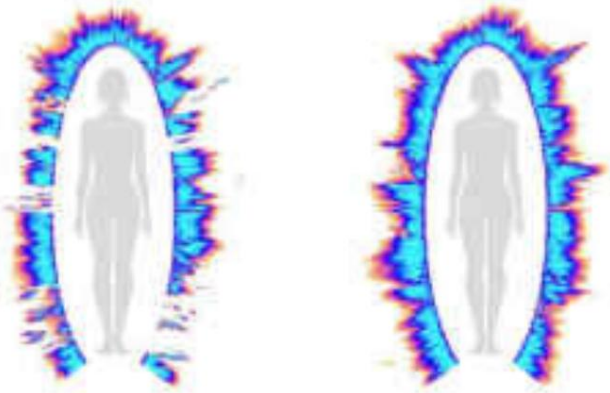

Figure 1 (left) Before structured water Figure 2 (right) **After drinking a glass of structured** water (Aura **breaks in Figure 1 indicate an energy imbalance, while Figure 2 indicates increased energy)** (Korotkov 2020)

These experiments also showed that it is possible to structure water and therefore increase its energetic glow by passing regular water through a structuring device. "German scientist Fritz Popp created the field of bio-photonics," (Korotkov 2002). **"It turns out that light radiation is an integral part of all quantum glows." processes. Is possible fix weak**

"Good water is naturally one of the prerequisites for longevity," states Korotkov (2002). **"Animals and** plants, of **fully applies pre** course."

"A large experiment was carried out in India under the leadership of scientists from the Tamil Nadu Agricultural Universit Farmers were given specially structured devices that mimic the flow of water in mountain streams.

Local Indian farmers were asked to irrigate some of their fields with structured water and some with normal water. all expectations!" "The results exceeded

Conventional water was used on 0.375 acres, while structured water was used on areas of the same size. In the experiments, they achieved the following results, which is documented in Table 1

Table 1 Plant species Effect of conventional water (kg) Effect of structured water (kg)

Wheat sown	355	640
Edible tomato	1326	2042
Garden beans	**0.702 from**	**1.458 from the bush**
Annual pepper	**bush** 38.5	68,7

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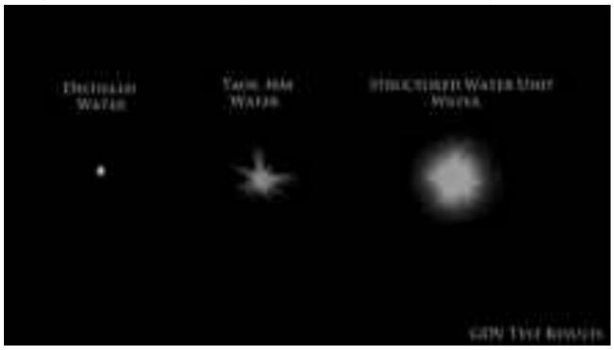
dr. Korotkov strongly believes that awareness of the energy-information field factor can help people achieve health and wellness by seeing their reaction to many life situations using the GDV camera technique.

An illustrative example is the water flowing through the Natural Action water devices with high pressure shows a higher degree of adhesion and density. Statistical analyzes are evidence of water activation, but do not show its full potential. Measuring photon potentials with the speed of light as a scale depends on changes in motion. The preferred frame of reference is video capture analysis.



Fritz-Albert Popp of Biophotonic in Germany shows an increase in density of up to 20% using his electroluminescence analysis. His lab works with PMS2. The machine captures photon emissions through highly sensitive photon multipliers and explains the lattice structures and their behavior. While a current of 50 volts is applied, the water contracts and emits photons. In other words, Natural Action Water has encapsulated the microparticles in clusters so they can no longer escape. Heavily polluted water would have a higher score because it has more impurities (microparticles) inside, making the water more electrolytic. More biophotomission means lower density!

The benefits result from use and show significant positive health changes that can be measured immediately after consuming water structured with Natural Action Water Devices. The human energy field shows an increase in symmetry and density between 5-20% with the first glass of structured water.

Structured water is a dynamic state of molecular bonding and information exchange. This type of water is beneficial for human life and is in harmony with nature. When one drinks and surrounds one's environment with healthy water, health continues to improve over time. Undoubtedly, these water units have the fantastic ability to make unhealthy water, drained of life force, healthy and ready to drink again in a matter of moments. Information brought to any type of water, even spring water fresh from a mountain stream, is beneficial and yet improves the oxygenation and bioavailability of the water.

The IPS Premium_Active device was tested in the experiments presented in this final report.

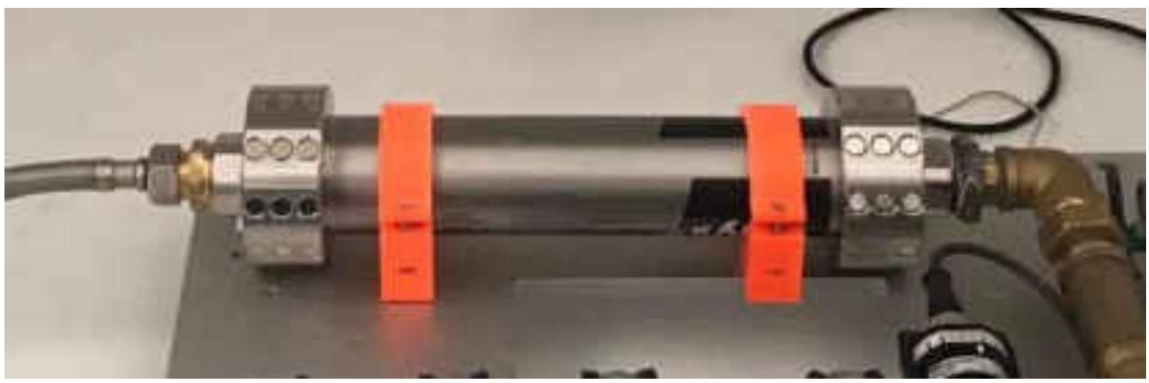


Figure 1 Tested IPS Premium_Active device in experiments

C. Results

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Figure 2 Developed device for regulating water pressures in the flow

D. Conclusions

The research team has developed a fully functional, portable, original device that allows creating structured water with an IPS device at different water flow pressures for experimental and practical use. The device has not yet been patented.

E. References

1. **Chaplin,** Martin F. (2001). **Water: its importance for life. Biochemistry and Molecular Biology Education,** 29, 54-59.
2. **Korotkov,** K. (2004) **Measurement of energy fields: State of the science.** Backbone Publishing Co: Fair Lawn.
3. **Mikesell,** NL (1974). **Cell regeneration.** Arizona.
4. Orlov, D. (2009) EPI/GDV **methodological manual .** SPbSUITMO: St. Petersburg, Russia.
5. **Popp,** Fritz-Albert (2009). **Electroluminescence analyzes with the Natural Action water device.**
6. **Popp,** FA: Biophoton analysis **of food quality. In: Food quality** - holistic methods and concepts. CF **Müller, Karlsruhe (1988),** 87-112.
7. **Köhler,** B.; Lambing, K.; Neurohr, W.; Nagl, W.; Popp, FA and Wahler, J.: **Biophoton measurement as a complement to conventional food quality assessment. In: Recent advances in biophoton research and their application.** World Scientific, Singapore-New **Jersey-London-Hong Kong** (1992), p. 393-413.

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Characterization of the energetics of the activated water by the IPS system parameters by the GDV camera

AQIPS-01-E02

Contents

A. Methodology of the experiment

1. **Objective of the experiment: Pilot analysis of samples of activated water produced by the IPS device at different flow**

pressures 2. Water activation device used: IPS Premium

3. Used device for flow pressures: developed in experiment AQIPS-01-E02

4. **Place of sample preparation: Slovak Agricultural University in Nitra**

5. Table 1 Applied variants of activated water by the IPS KalyxX BlueLine device - basic designation of the tested samples of activated water:

Serial number	Designation of the sample	Basic description of the sample
1.	WI0R1	Tap water without IPS device activation - control variant
2.	WI005	Water activation at a flow pressure of 5 Pa
3.	WI010	Water activation at a flow pressure of 10 Pa
4.	WI020	Water activation at a flow pressure of 20 Pa
5.	WI030	Water activation at a flow pressure of 30 Pa
6.	WI040	Water activation at a flow pressure of 40 Pa
7.	WI050	Water activation at a flow pressure of 50 Pa
8.	WI060	Water activation at a flow pressure of 60 Pa
9.	WI070	Water activation at a flow pressure of 70 Pa
10.	WI080	Water activation at a flow pressure of 80 Pa
11.	WI090	Water activation at a flow pressure of 90 Pa
12.	WI100	Water activation at a flow pressure of 100 Pa
13.	WI150	Water activation at a flow pressure of 150 Pa
14.	WI200	Water activation at a flow pressure of 200 Pa
15.	WI250	Water activation at a flow pressure of 250 Pa
16.	WI300	Water activation at a flow pressure of 300 Pa
17.	WI350	Water activation at a flow pressure of 350 Pa
18.	WI400	Water activation at a flow pressure of 400 Pa
19.	WI450	Water activation at a flow pressure of 450 Pa
20.	WI500	Water activation at a flow pressure of 500 Pa

6. **Workplace providing GDV analysis of water samples:** Prague ALFA-MED sro

7. Applied equipment for water analysis: GDV camera

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8. Electro-photonic imaging (EPI) / Gas discharge visualization (GDV)

a) It works on the principle of the Kurilÿan effect (Karlina & Kirlian, 1961) b)
Measurement from the availability of electrical energy due to a pulsed electrical signal

c) The method of drawing stimulated electrons and photons from the skin layer from the skin

d) It works through the impression of capturing images from emitted photons from the body

e) Well studied by the physical electronic method known as "photoelectron emission" (Kostyuk, Cole, Meghanathan, Isokpehi, & Cohly, 2011) 9. Technical parameters

of the GDV camera (Konstantin Korotkov, 2004)

a) Repetition frequency: 11.0 - 3.0 kHz b)
Voltage amplitude: 1000.0 - 4000.0 V c)
Maximum pulse power consumption: 80 W

d) Limitation of the schematic impulse impulse current: at the level of 1mA

e) Parameter stability: at least 0.1% f) CCD
matrix resolution: 800 x 600

9. Indices used for characterization and analysis of GDV gram (Alexandrova et al., 2002; Jakovleva Korotkov, 2012) a) GDI background

area (S)

- ÿAbsolute value and measured in pixels

b) Average intensity (I)

- ÿEvaluation of light intensity averaged over the image area c)

Energy (E) ÿLight

- energy in Joules, calculated from experiments as E = S * I * 0.00002

d) Normalized Area (NA)

- ÿGDI area ratio to the area of the inner oval e) Integral

area coefficient (JgS)

- ÿThe extent to which a person's GDV-gram area deviates from the ideal model

f) Emission coefficient (ES)

- ÿPerformance of small fragments removed from GDV-gram and measured in pixels

g) Form factor (FC)

- ÿFC = L*2/S (L = length of outer contour of GDI; S = background area of GDI) h)

Fractality Coefficient (FrC)

- ÿCalculated according to the algorithm as a ratio of GDI parameters

10. Evaluated sample characteristics

a) Time dependence of the intensity of the EPC image of the gas discharge around the tested samples of activated water by the IPS device obtained at different flow pressures

b) Time dependence of the EPC gas discharge area around the tested IPS activated water samples device obtained at different flow pressures

c) Time dependence of the EPC communication of the gas discharge image around the tested samples of activated water by the IPS device obtained at different flow pressures

11. Authors and solvers: doc. Ján Brindza, CSc., Ing. Vladimíra Horÿinova Sedláÿková, PhD., Mgr. Olga Grygorieva, PhD.

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B. Introduction to the issue

The gas-discharge visualization method (GDV - gas-discharge visualization method) is a computer registration and analysis of the glow (aura) of the gas discharge (GDV-images) of any biological objects placed in a high-intensity electromagnetic field. The GDV method is based on the stimulation of the emission of photons and electrons from the surface of the object during the transmission of short electrical impulses. In other words, when an object is placed in an electromagnetic field, it is primarily electrons, and to some extent photons, that are
"extracted" from the surface of the object. This process is called "photoelectron emission" and has been quite well studied using physical electronic methods. The emitted particles are accelerated in the electromagnetic field and create electronic avalanches on the surface of the dielectric (glass). This process is called "sliding gas discharge". The discharge causes a glow (aura) due to the excitation of molecules in the surrounding gas, and this glow is measured by the GDV method. Such emission is called "spontaneous". Measuring the spontaneous emission of electrons in air is almost impossible - it can only be done in a vacuum, and the spontaneous emission of photons is measured using a highly sensitive photomultiplier. This emission was first measured by Professor Aleksandr Gurvich in the 1930s and proved that the exchange of ultraviolet photons is a method used by biological systems to regulate information. Currently, extremely weak photon emissions from biological objects are being investigated in a field called "biophotonics". A large part of the conducted research showed that photons are emitted by all biological objects: plants (Kobajashi, 2003), blood (Voeikov, 2001), water (Voeikov, 2001), human skin (Cohen, Popp, 1998).

Therefore, it has been categorically proven that all biological objects emit photons and that these photons participate in the processes of physiological regulation and, above all, in oxidative regeneration chain reactions. In other words, all biological objects, including humans, glow (create an aura) day and night!
Biological life depends on the use of photon energy from the sun. This energy is then converted into electron energy, and as a result, a series of transformations in the complex chains of albumin molecules are transformed into the energy of our body. Thus, it can be said that biological life is based on light energy, and organic compounds serve as working material for the transformation of this energy. The basic components for all transformations are water and air (Korotkov et al., 2004).

As a result, we are all children of the Sun, we live from the light of the world and we ourselves radiate light! However, the registration of "biophotons" - spontaneous photoemission - is an extremely complex procedure requiring special conditions, the most important of which is complete darkness. Before the measurement begins, the test subjects should spend an hour in a room illuminated by dark red light, then they should be placed in a completely dark room measuring 2 x 1.5 x 2 m, where they should remain for another 10 minutes. complete darkness until the beginning of the measurement. This eliminates any "secondary luminescence" of the skin cover after exposure to sunlight or artificial light. The measurement process itself takes up to 45 minutes (Edwards et al., 1989). So the process of measuring spontaneous photoemission is very complex and long. It must be measured with a special and unique device,

The data obtained by measuring extremely weak "biophotons" is invaluable scientific information, because it underlines the role of electrophoton processes in the functioning of the body. These scientific results are one of the scientific bases for justifying the physical processes of GDV bioelectrography. In the GDV/EPC (EPC – Dynamic Electrophotonic Capture) method, electron and photon emissions are excited or stimulated, and the resulting glow is subsequently intensified a thousand times. This makes it possible to perform measurements under normal circumstances, under normal lighting, without special preparation of objects. All information in the GDV method is obtained thanks to the computer processing of images and mass data. Without computer processing methods and specialized software, the registration of the glow of biological objects would have no practical meaning. Therefore, the GDV software is an integral part of the GDV system, and only with the help of the GDV software is it possible to obtain complete information about the biological object carried by electrons and "biophotons".

GDV measures the stimulated optoelectronic emission of a biological object. During the measurement process, an electric current flows through the circuit of the GDV device. Thanks to the design of the device, the current is pulsed and very small - microamps. That is why the current does not cause any significant physiological effects and is completely safe for the human body. But what kind of current is it from a biophysical point of view?

Electric current can depend on the transfer of electrons or ions. When voltage pulses lasting longer than a few milliseconds are applied to the skin envelope, tissue depolarization and transport

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of ions. This is the reason why in many electrophysical methods, such as electroencephalography or electroacupuncture, tissue polarization occurs due to overlapping electrodes, which is a major problem that is solved by using special pastes or gels. The GDV method uses short pulses, so there is no depolarization, not currents

a They are stimulated ionic

(https://www.auraphotographys.com/your%20bio-well%20camera.html).

The obtained data show that the electrophotonic (EPC) method has high selectivity and sensitivity in use for the study of objects in the liquid phase, especially for different types of water. The information obtained depends on the chemical composition of water, but the determining and most curious dependence is the dependence on the structural composition liquids. Electrophotonic parameters are determined by the emission activity of the surface layer of the liquid, which depends from the presence of surface-active valences. This property is apparently determined by the near-surface structure clusters, which means that the electrophotonic method is one of the informative methods for studying structurally informative properties of liquids https://waterjournal.org/archives/korotkov/ A new method of monitoring

water properties has been developed - dynamic electrophotonic (EPC) analysis is based on measuring water using processing computer programs to measure how the water surface was stimulated by electromagnetic field photon emissions. The technology is based on the well-known gas discharge visualization (GDV) method. Numerous experiments have demonstrated the high sensitivity of EPC analysis for the detection of weak changes in water under the influence of electromagnetic fields, air, light and other subtle factors (TOP FEATURE WATERTODAY OF THE DAY)

C. Results – visual documentation from GDV analysis

The images presented show the results of a new method of monitoring water properties, which is referred to as dynamic electrophotonic (EPC - Dynamic Electrophotonic Capture) analysis. The method is based on the measurement and computer processing of the emission of photons stimulated by an electromagnetic field from the water surface of the tested sample.

The technology is based on the well-known method of gas discharge visualization (GDV). Numerous experiments have demonstrated the high sensitivity of EPC analysis for the detection of weak water transformations under the influence of electromagnetic fields, air, light and other subtle factors.

There is ample evidence to suggest that the properties of the EPC image are apparently determined by the structure of clusters near the surface, which means that the electrophotonic method is one of the informative ones methods for studying structural properties of liquids.

In each figure, there is a comparison of the indicator (intensity - communication - area) of the EPC image of the control sample (number 1) with the tested sample of activated water by the IPS device at a certain water flow pressure in the pipe.

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1. Time dependence of the intensity of the EPC image of the gas discharge around the tested samples of activated water by the IPS device obtained at different flow pressures

Comparison of the tested sample of water activated by the IPS device to the control sample (1) without water activation by the IPS device.

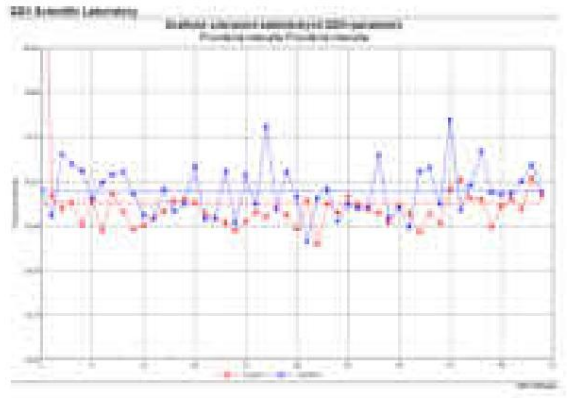

Figure 1: Parameters of the Intensity sign at a pressure of **5Pa**

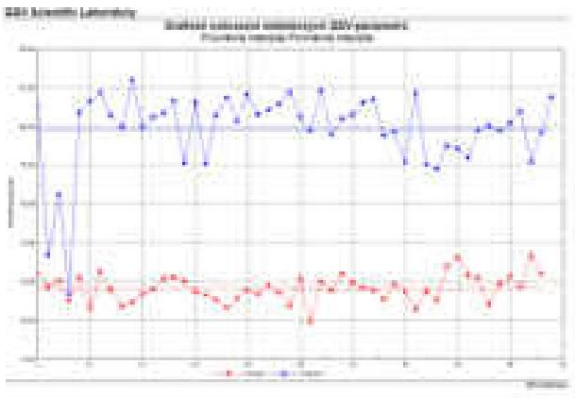

Figure 2: Parameters of the Intensity sign at a pressure of **10Pa**

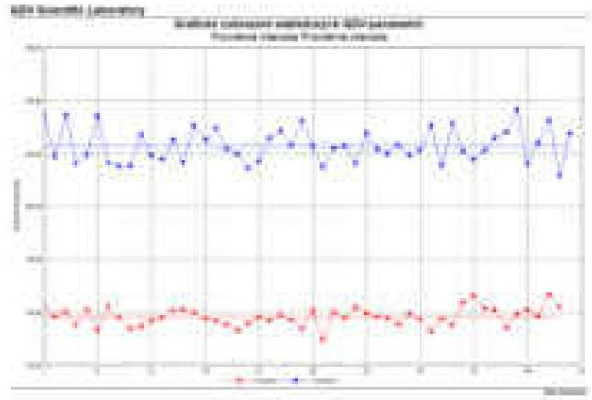

Figure 3: Parameters of the Intensity sign at a pressure of **20Pa**

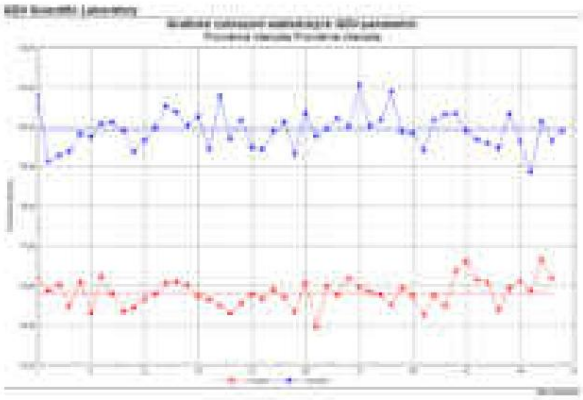

Figure 4: Parameters of the Intensity sign at a pressure of **30Pa**

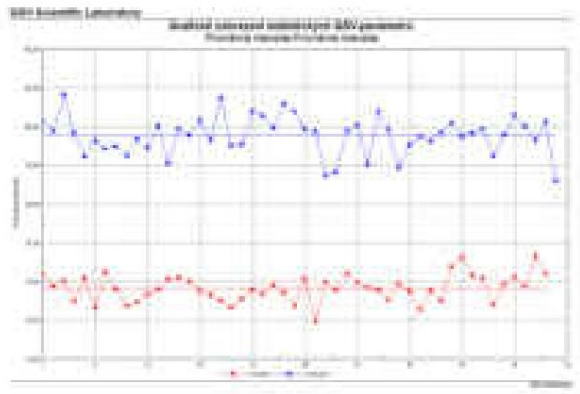

Figure 5: Parameters of the Intensity sign at a pressure **of 40 Pa**

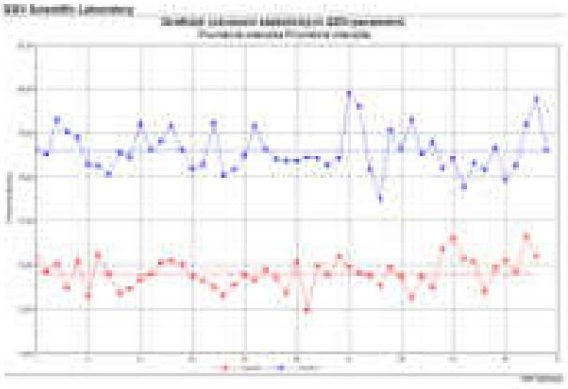

Figure 6: Parameters of the Intensity sign at a pressure of **50Pa**

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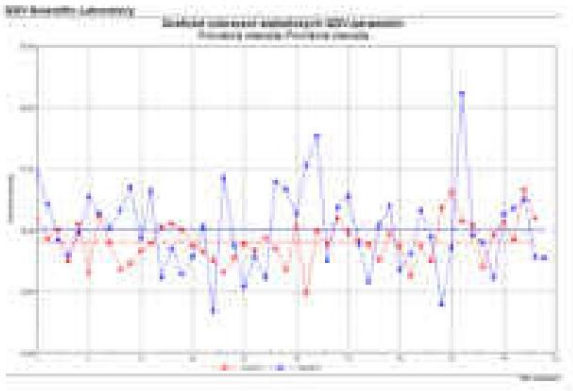

Figure 7: Parameters of the Intensity sign at a pressure of 60Pa

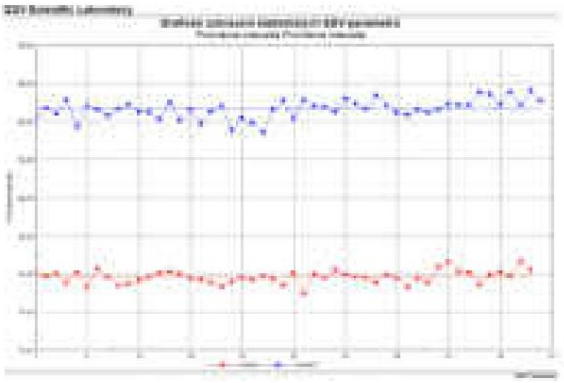

Figure 8: Parameters of the Intensity sign at a pressure of 70Pa

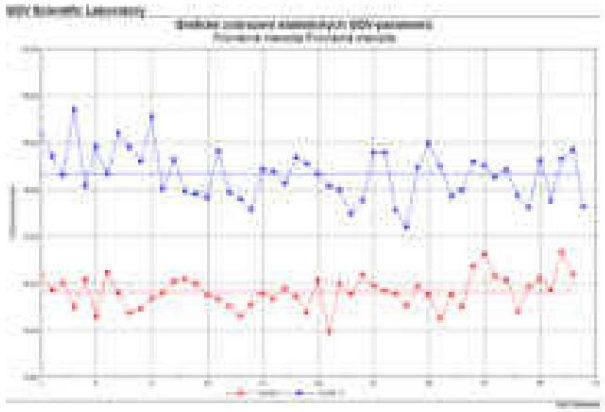

Figure 9: Parameters of the Intensity sign at a pressure of 80Pa

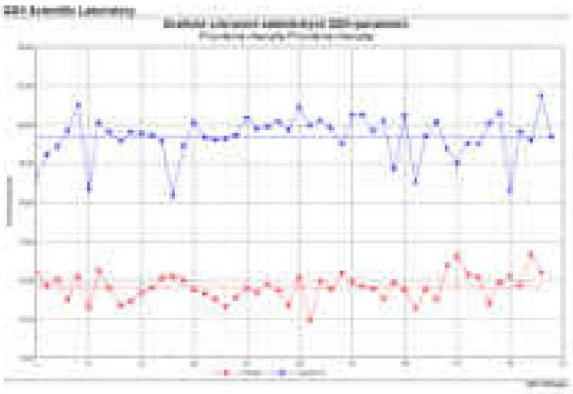

Figure 10: Parameters of the Intensity sign at a pressure of 90Pa

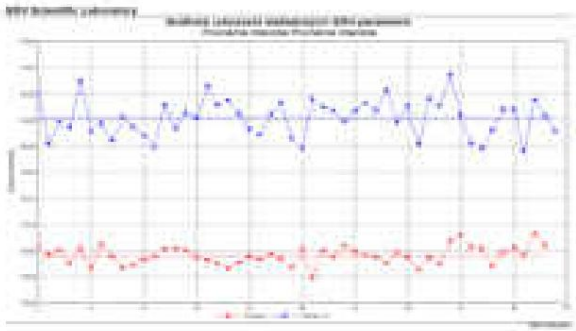

Figure 11: Parameters of the Intensity sign at a pressure of 100Pa

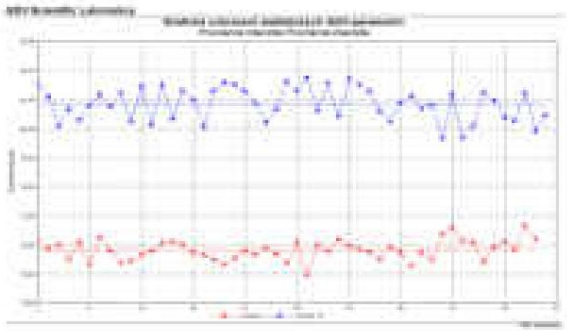

Figure 12: Parameters of the Intensity sign at a pressure of 150Pa

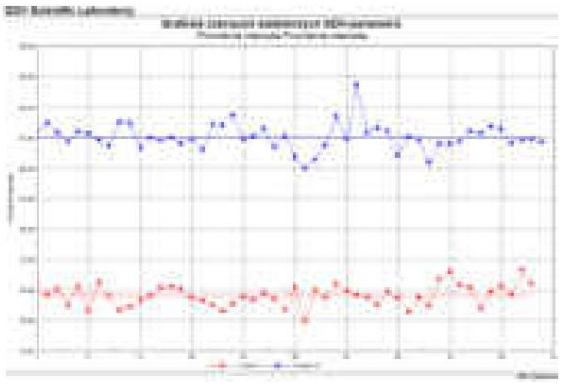

Figure 13: Parameters of the Intensity sign at a pressure of 200Pa

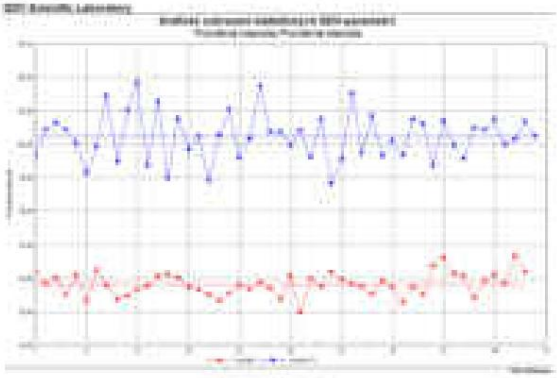

Figure 14: Parameters of the Intensity sign at a pressure of 250 Pa

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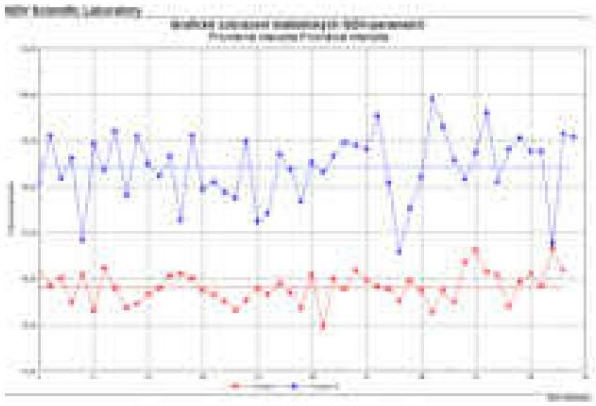

Figure 15: Parameters of the Intensity sign at a pressure of 300Pa

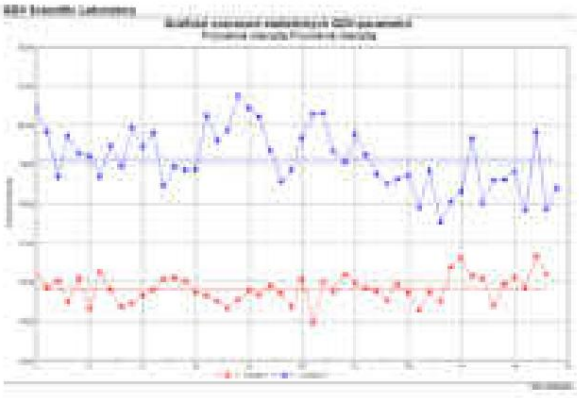

Figure 16: Parameters of the Intensity sign at a pressure of 350 Pa

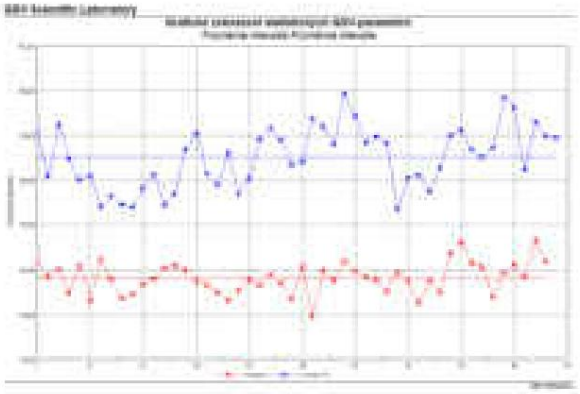

Figure 17: Parameters of the Intensity sign at a pressure of 400Pa

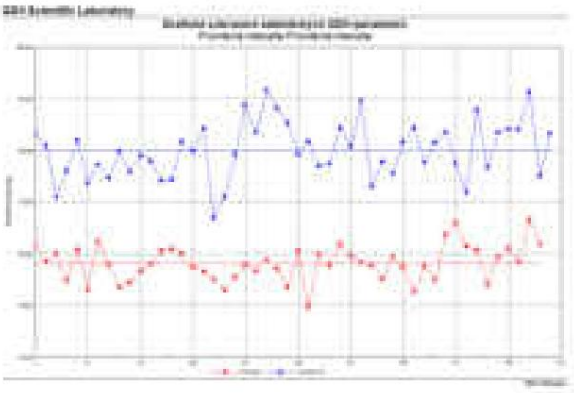

Figure 18: Parameters of the Intensity sign at a pressure of 450Pa

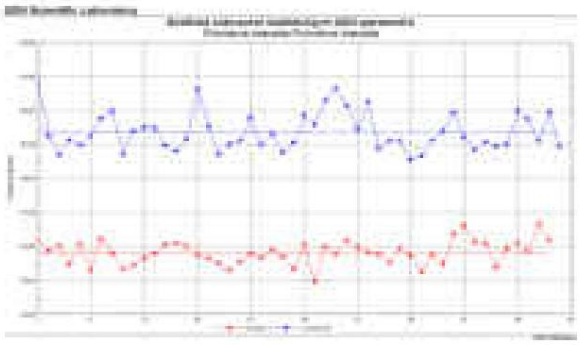

Figure 19: Parameters of the Intensity sign at a pressure of 500Pa

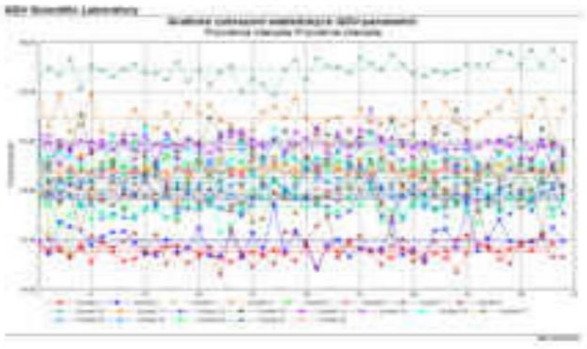

Figure 20: Character parameters Intensity all samples

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2. Time dependence of the EPC communication of the gas discharge image around the tested samples of activated water by the IPS device obtained at different flow pressures

Comparison of the tested sample of activated water by the IPS device to the control sample (1) without activation water by IPS device.

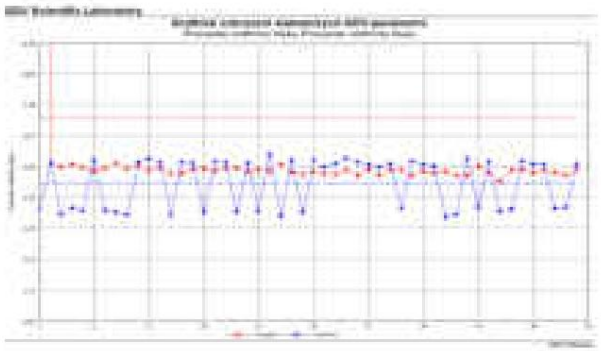

Figure 21: Parameters of the Communication sign at a pressure of 5Pa

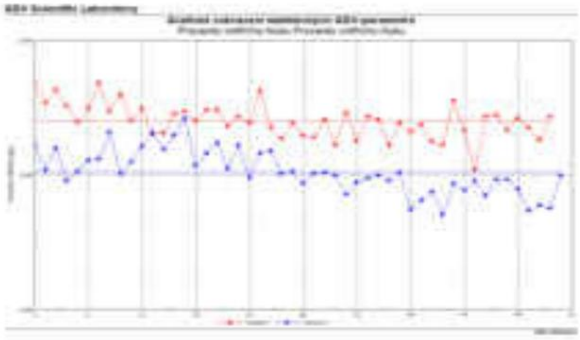

Figure 22: Parameters of the Communication sign at a pressure of 10Pa

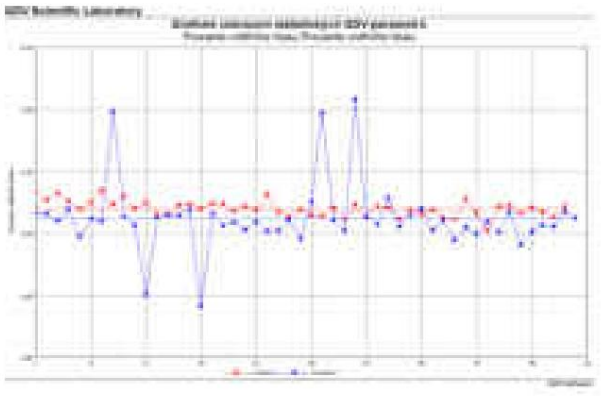

Figure 23: Parameters of the Communication sign at a pressure of 20Pa

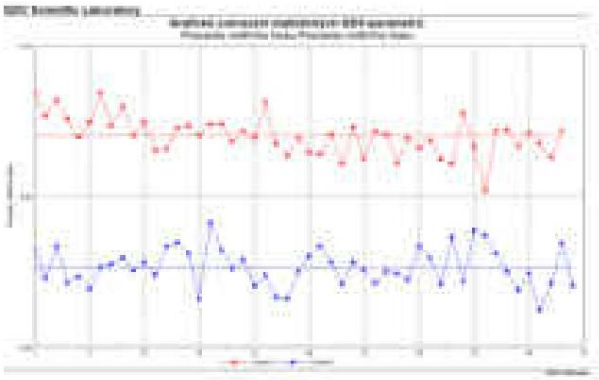

Figure 24: Parameters of the Communication sign at a pressure of 30Pa

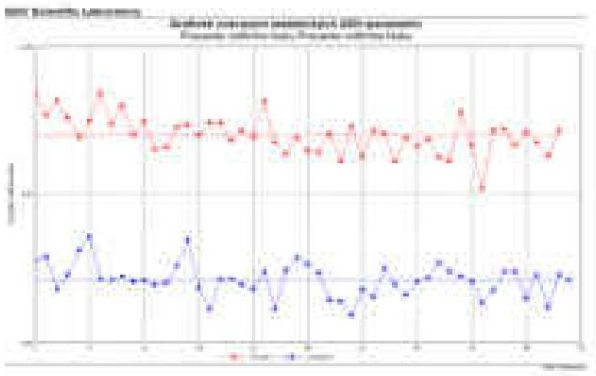

Figure 25: Parameters of the Communication sign at a pressure of 40Pa

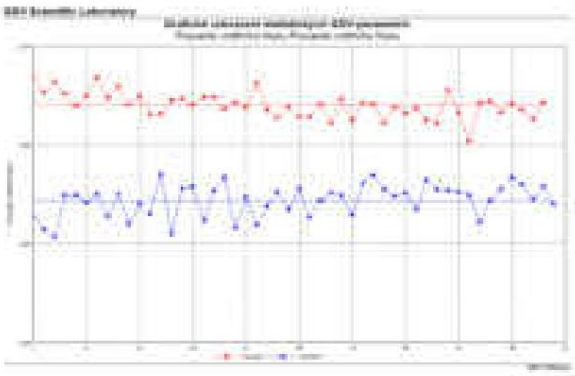

Figure 26: Parameters of the Communication sign at a pressure of 50Pa

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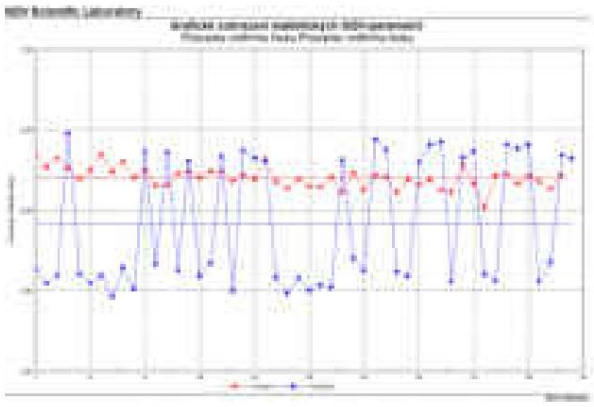

Figure 27: Parameters of the Communication sign at a pressure of 60Pa

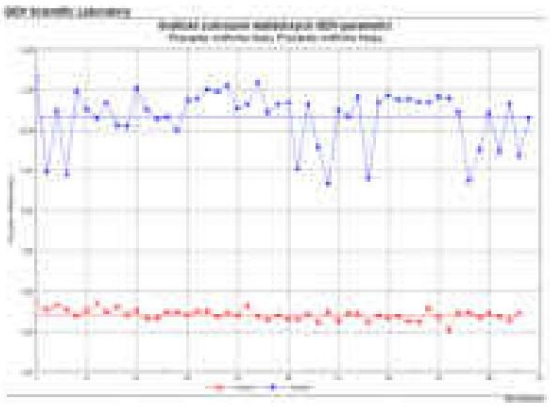

Figure 28: Parameters of the Communication sign at a pressure of 70Pa

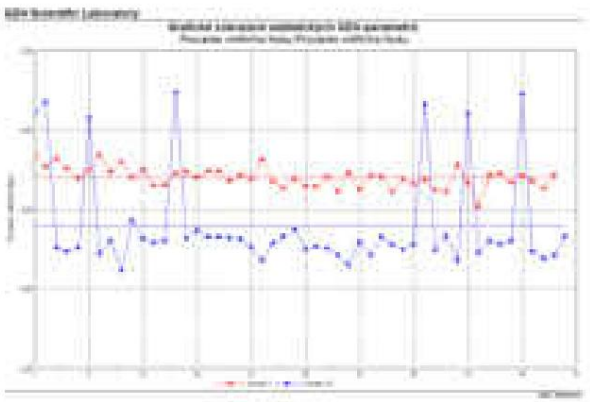

Figure 29: Communication sign parameters at 80Pa pressure

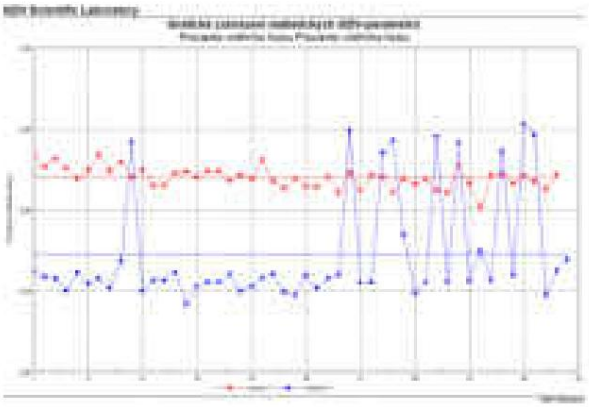

Figure 30: Communication sign parameters at 90Pa pressure

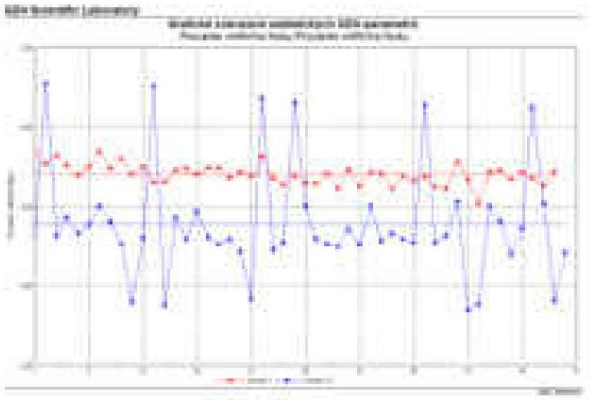

Figure 31: Communication character parameters at 100Pa pressure

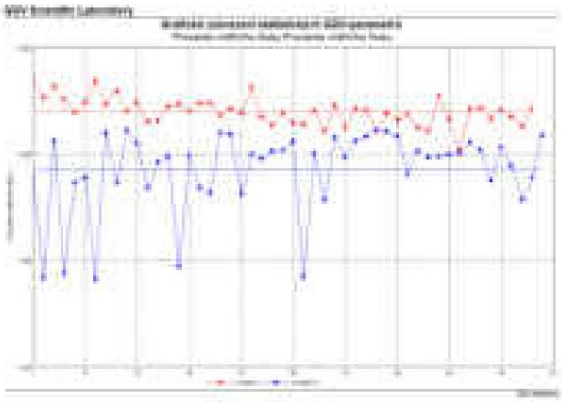

Figure 32: Communication character parameters at 150Pa pressure

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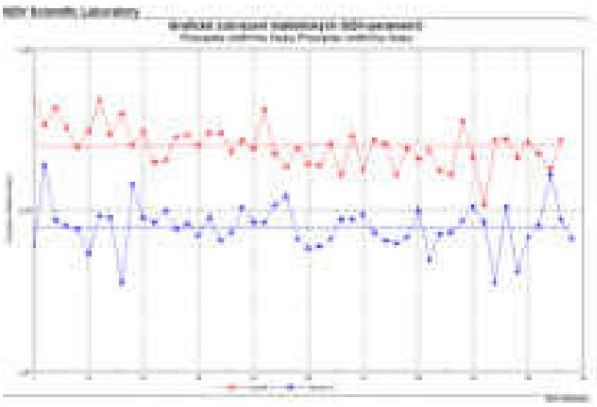


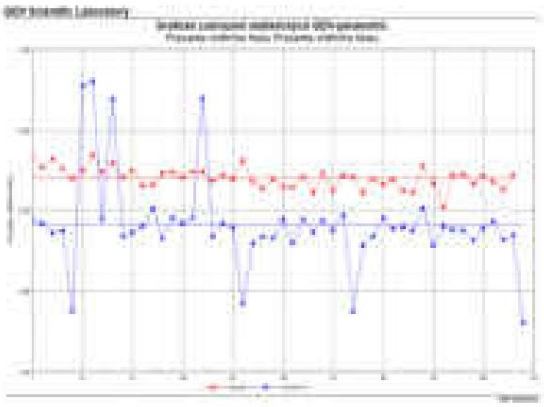
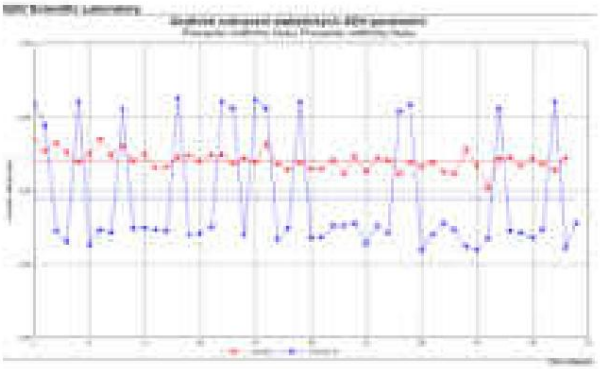


Figure 33: Communication character parameters at 200Pa pressure Figure 34: Communication character parameters at 250Pa pressure



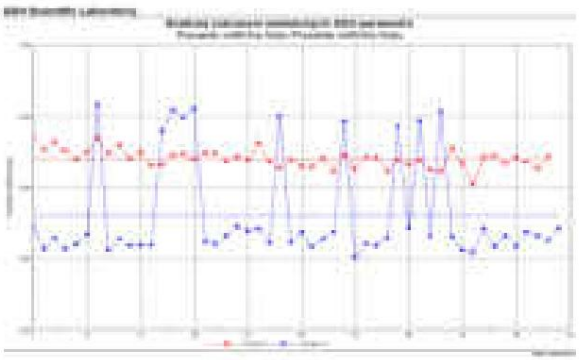
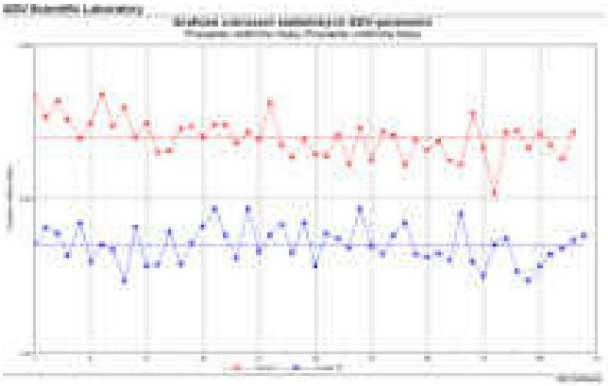


Figure 35: Communication sign parameters at 300Pa pressure Figure 36: Communication sign parameters at 350Pa pressure



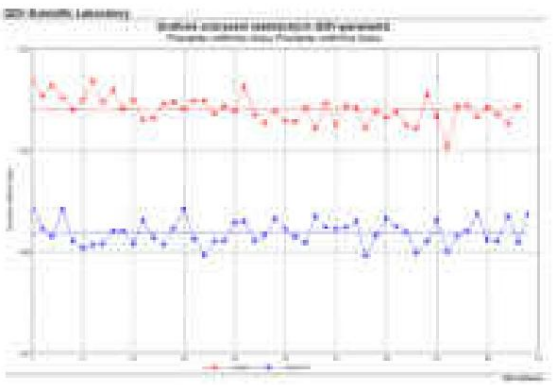
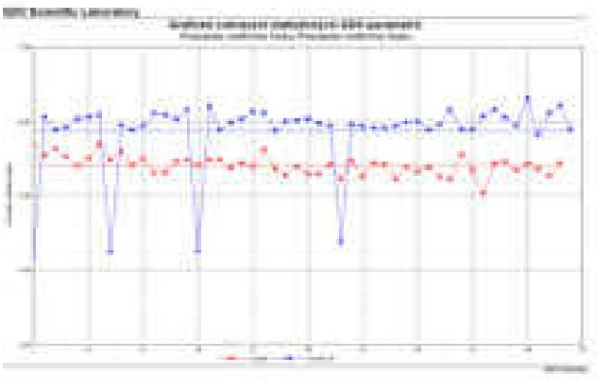


Figure 37: Communication character parameters at 400Pa pressure Figure 38: Communication character parameters at 450Pa pressure



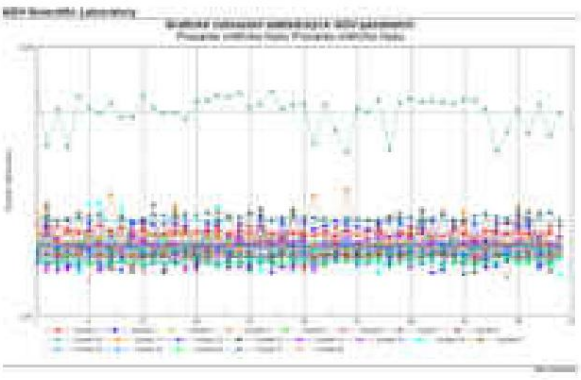


Figure 39: Communication character parameters at 500Pa pressure Figure 40: Communication character parameters all samples

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3. Time dependence of the EPC area of the gas discharge around the tested samples of IPS activated water obtained by the device at different flow pressures. Comparison of the tested sample of water activated by the IPS device to the control sample (1) without water activation by the IPS device.

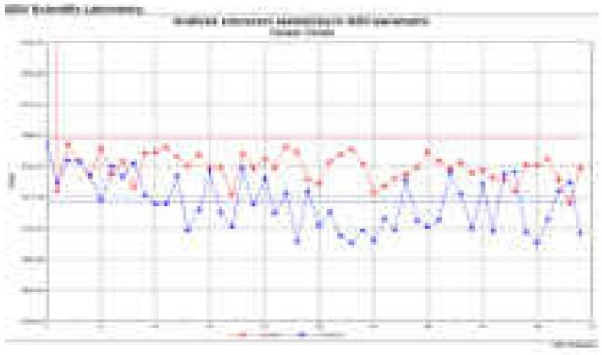

Figure 41: Area character parameters at 5Pa pressure

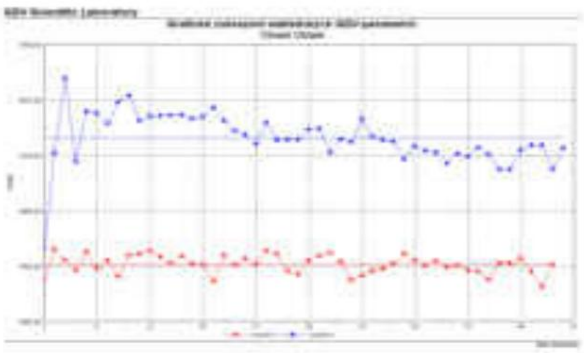

Figure 42: Area character parameters at 10Pa pressure

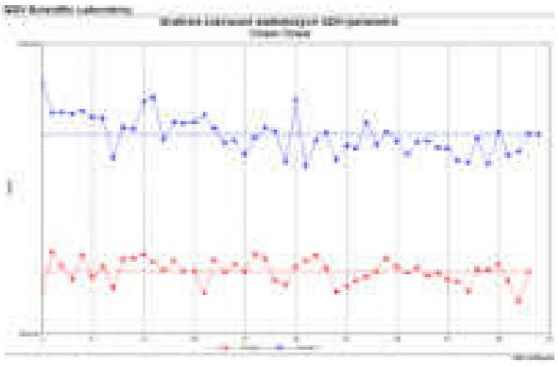

Figure 43: Area character parameters at 20Pa pressure

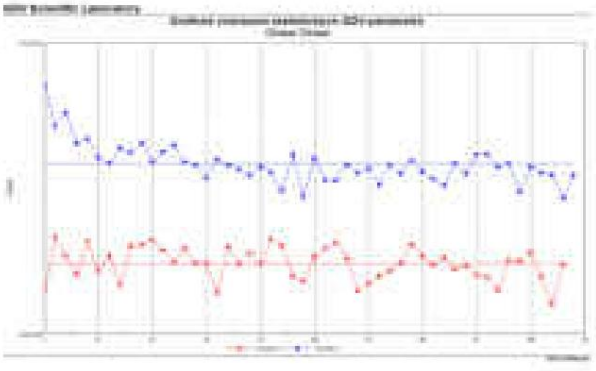

Figure 44: Area character parameters at 30Pa pressure

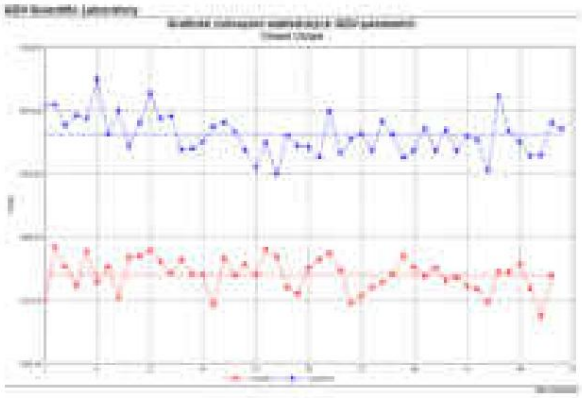

Figure 45: Area character parameters at 40Pa pressure

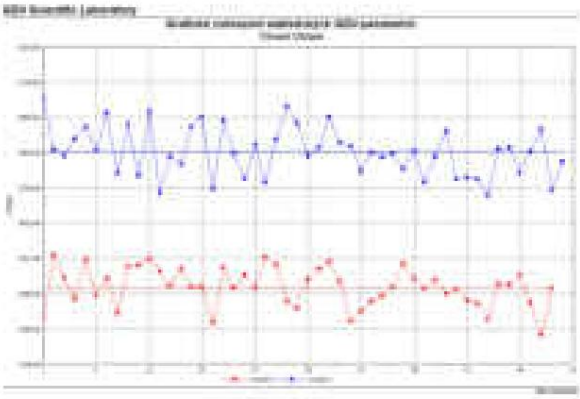

Figure 46: Parameters of the Area sign at a pressure of 50Pa

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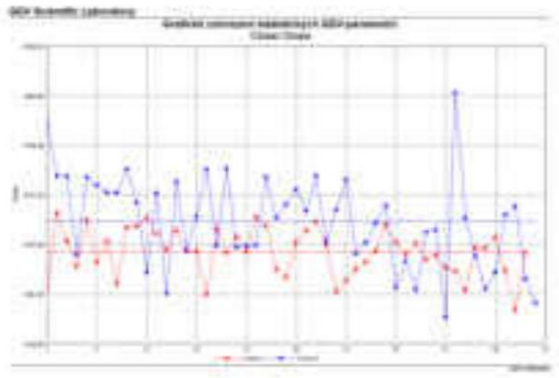


Figure 47: Area character parameters at 60Pa pressure

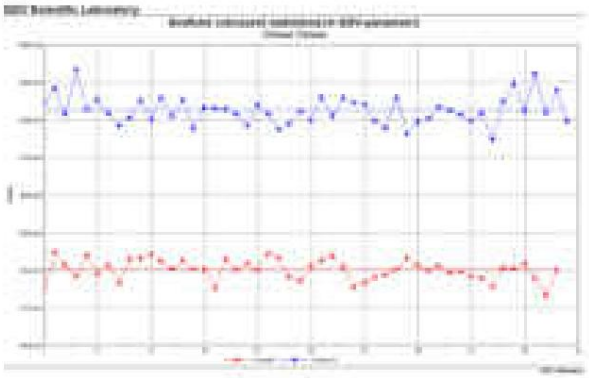


Figure 48: Area character parameters at 70Pa pressure

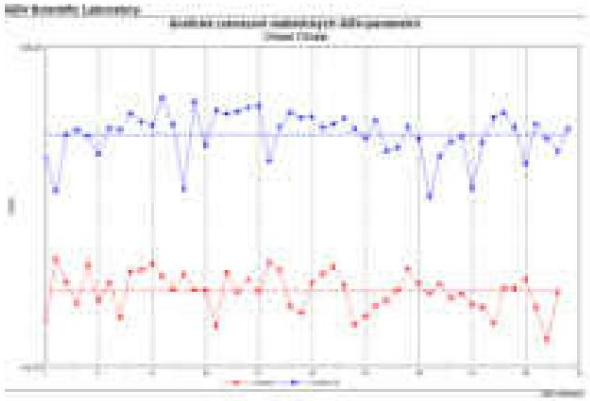


Figure 49: Parameters of the Area sign at a pressure of 80Pa

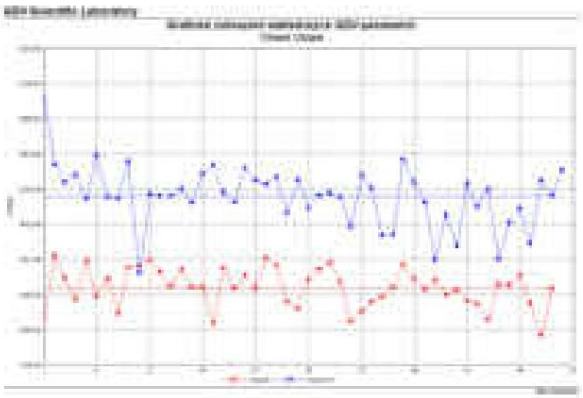


Figure 50: Area character parameters at 90Pa pressure

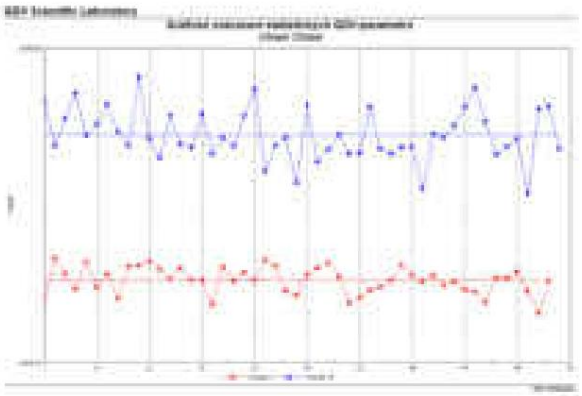


Figure 51: Area character parameters at 100Pa pressure

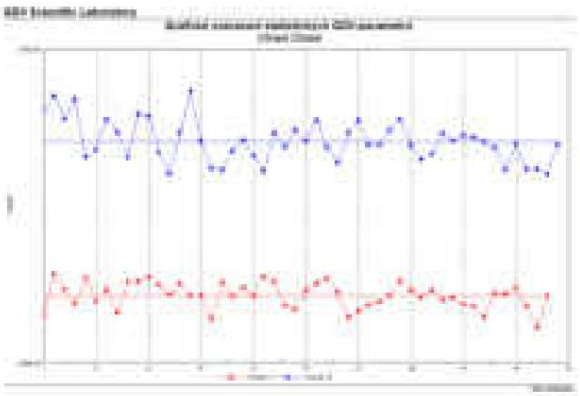
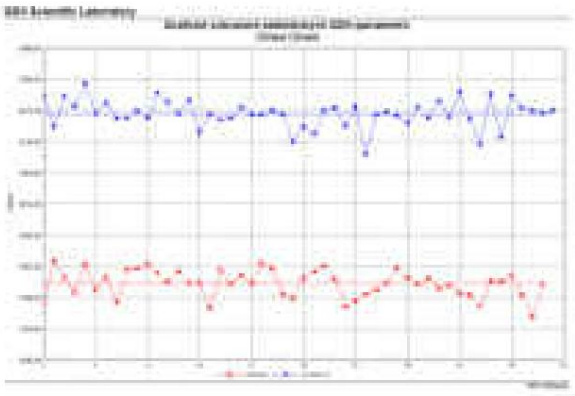


Figure 52: Area character parameters at 150Pa pressure



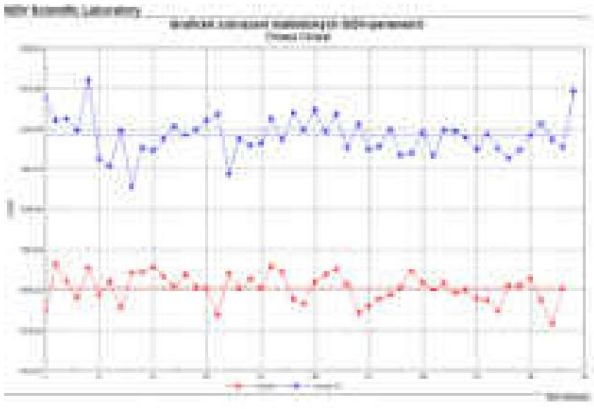


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Figure 53: Area character parameters at 200Pa pressure

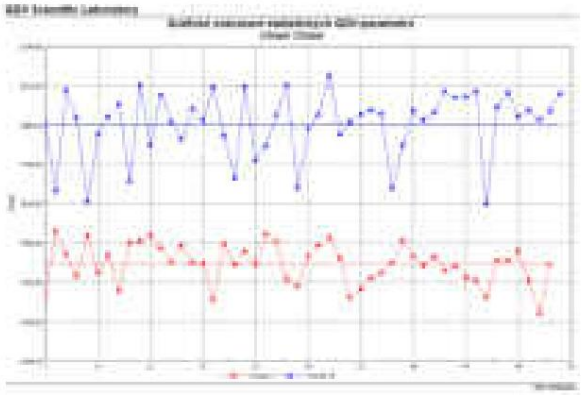

Figure 54: Area sign parameters at 250Pa pressure

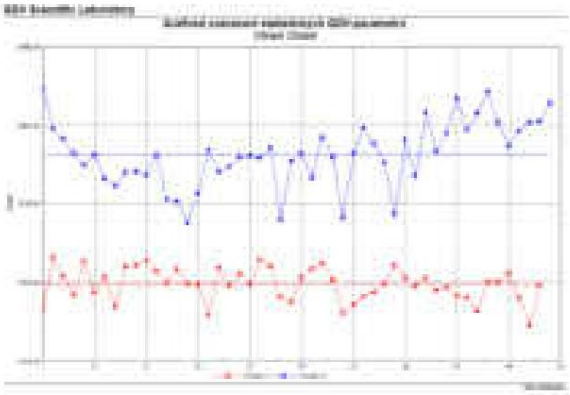

Figure 55: Area character parameters at 300Pa pressure

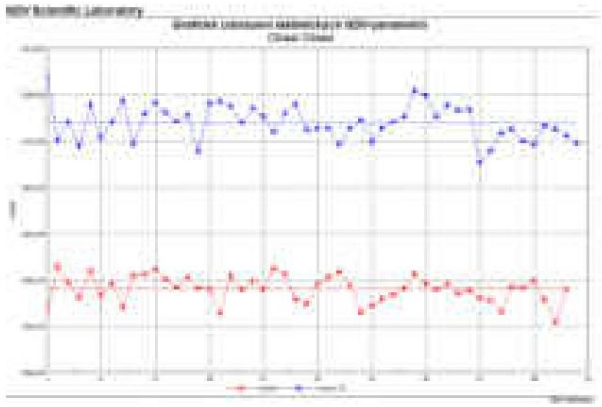

Figure 56: Area character parameters at 350Pa pressure

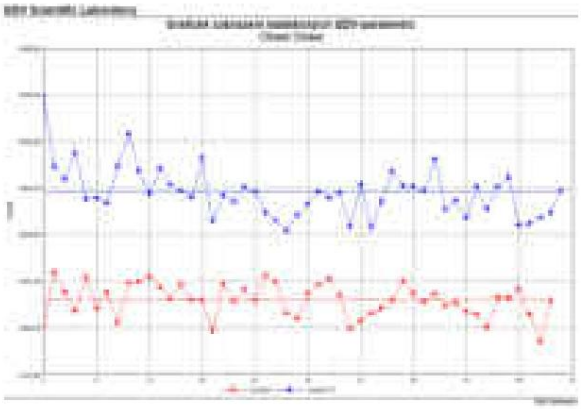

Figure 57: Area character parameters at 4000Pa pressure

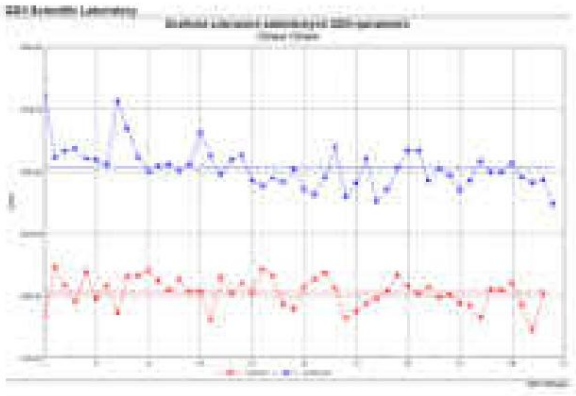

Figure 58: Area character parameters at 450Pa pressure

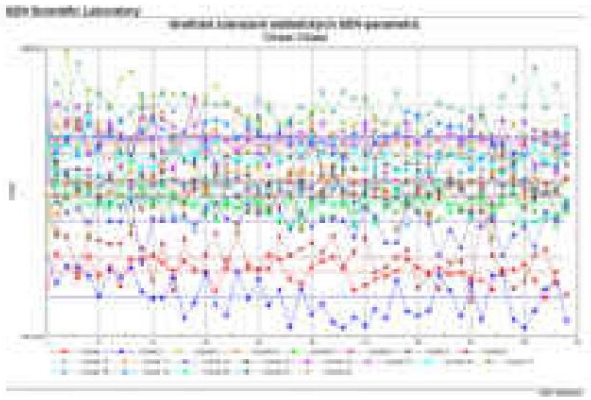

Figure 59: Area character parameters at 500Pa pressure

Figure 60: Parameters of the Area all samples feature

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4. Comparison of time dependence of EPC image intensity, EPC area dependence and dependence communication of the EPC image of the gas discharge around the tested samples of activated water by the IPS device obtained at individual flow pressures with the overall variability of the evaluated parameters for all samples

Comparison of the tested sample of water activated by the IPS device to the control sample (1) without water activation by the IPS device.

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Figure 61: Parameters of the dependence sign of the EPC image in intensity, communication and area at a pressure of 5Pa

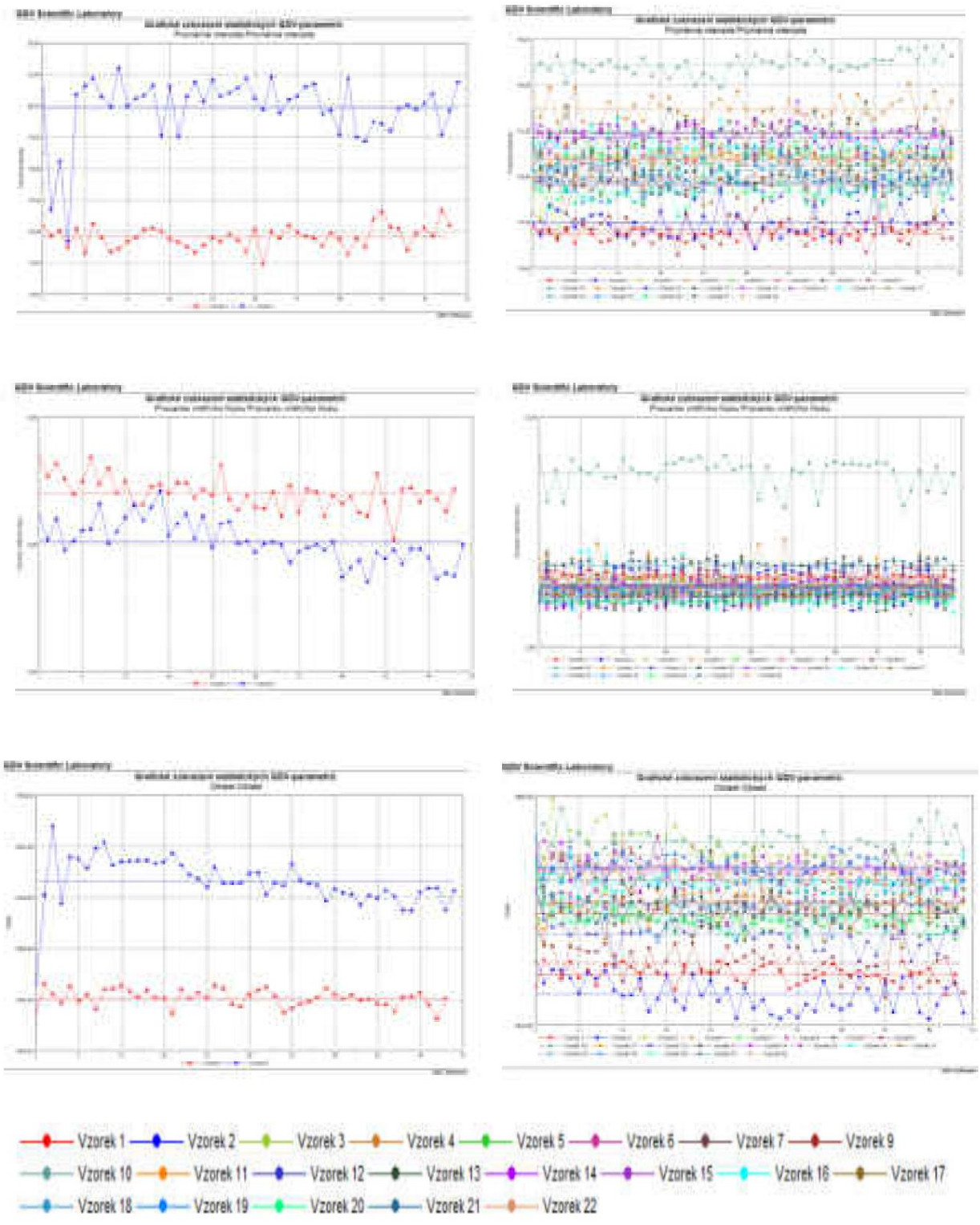

Figure 62: Character parameters intensity, communication and area at a pressure of 10Pa

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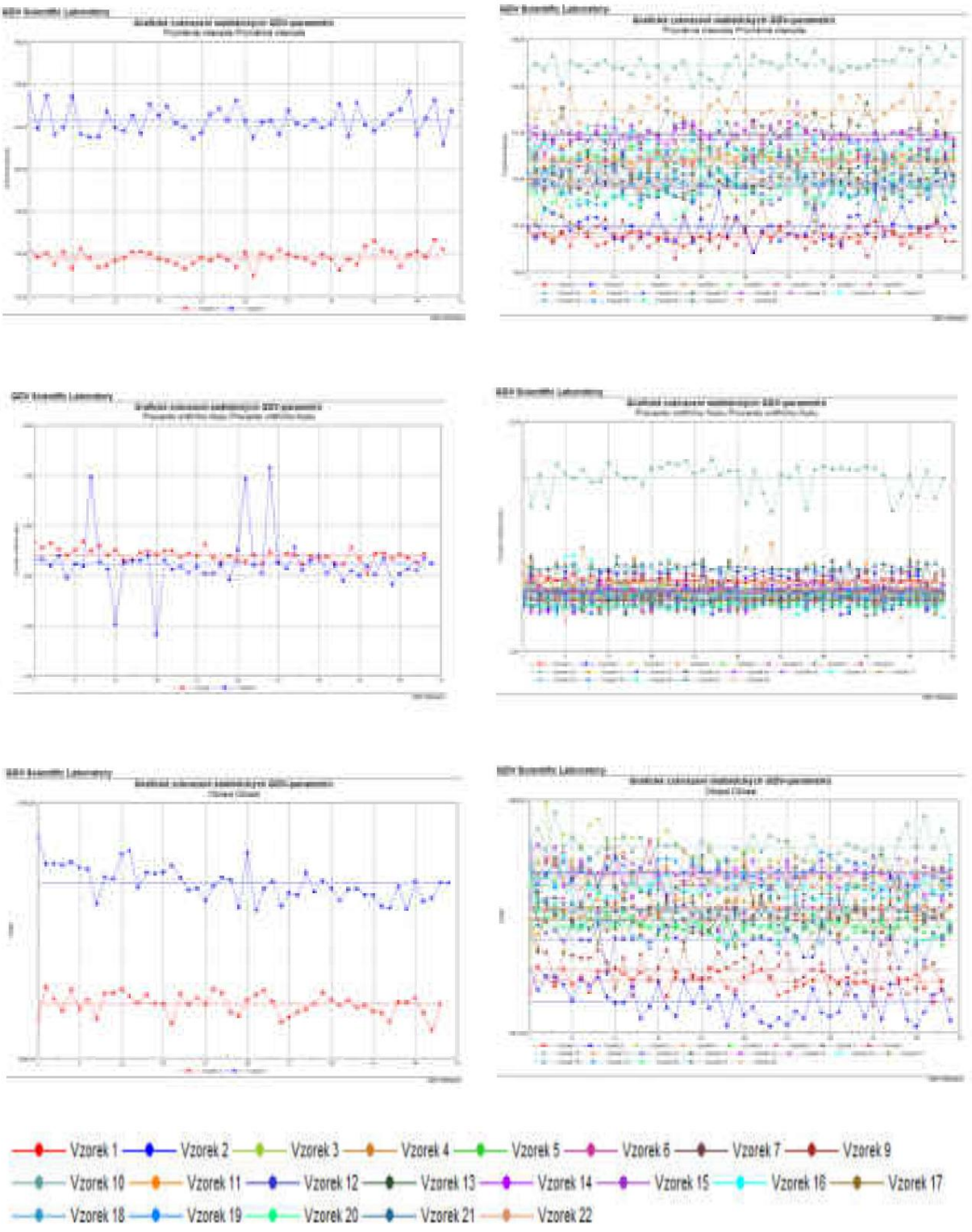

Figure 63: Character parameters intensity, communication and area at a pressure of 20Pa

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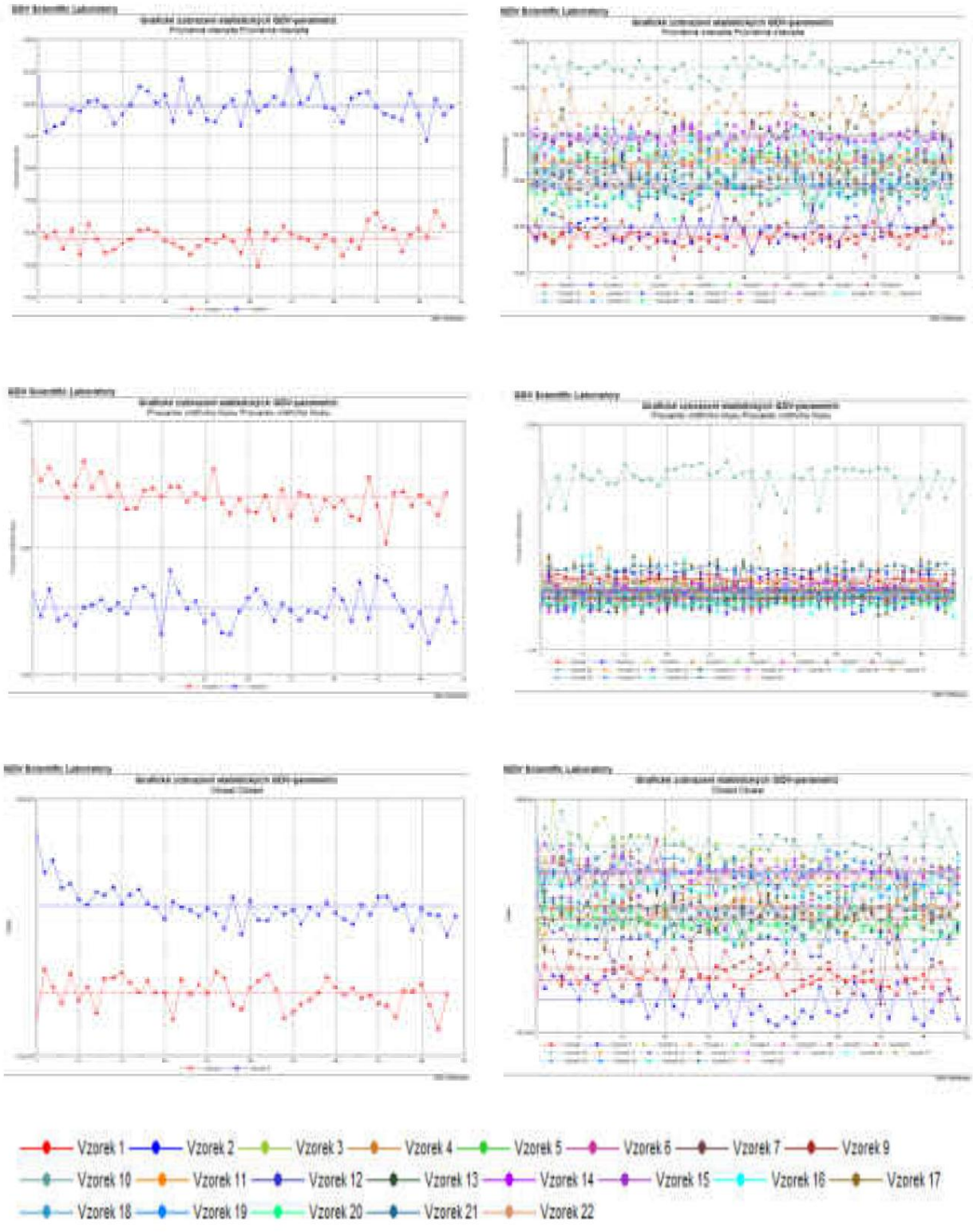

Figure 64: Character parameters intensity, communication and area at a pressure of 30Pa

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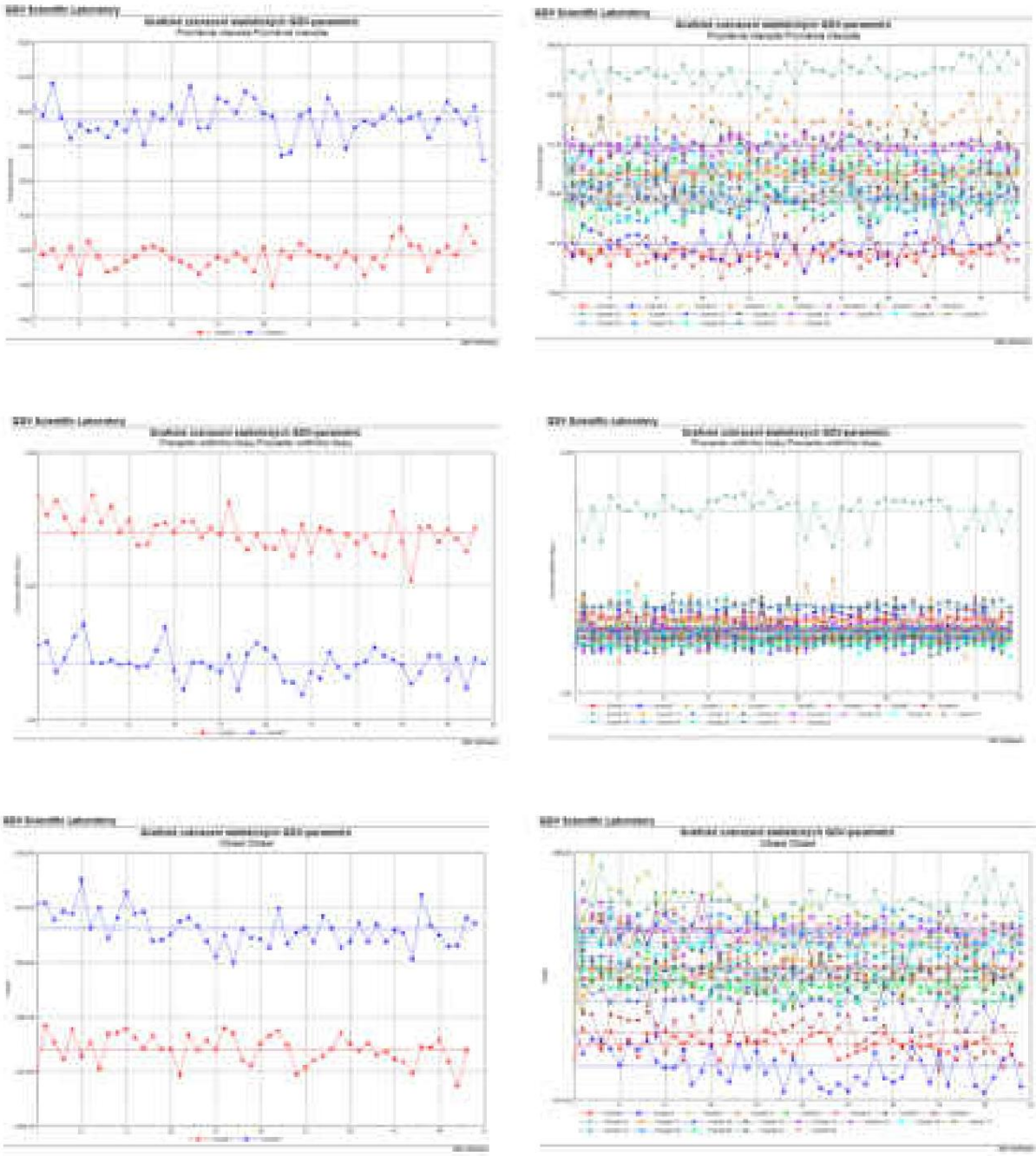

Figure 65: Character parameters intensity, communication and area at a pressure of 40Pa

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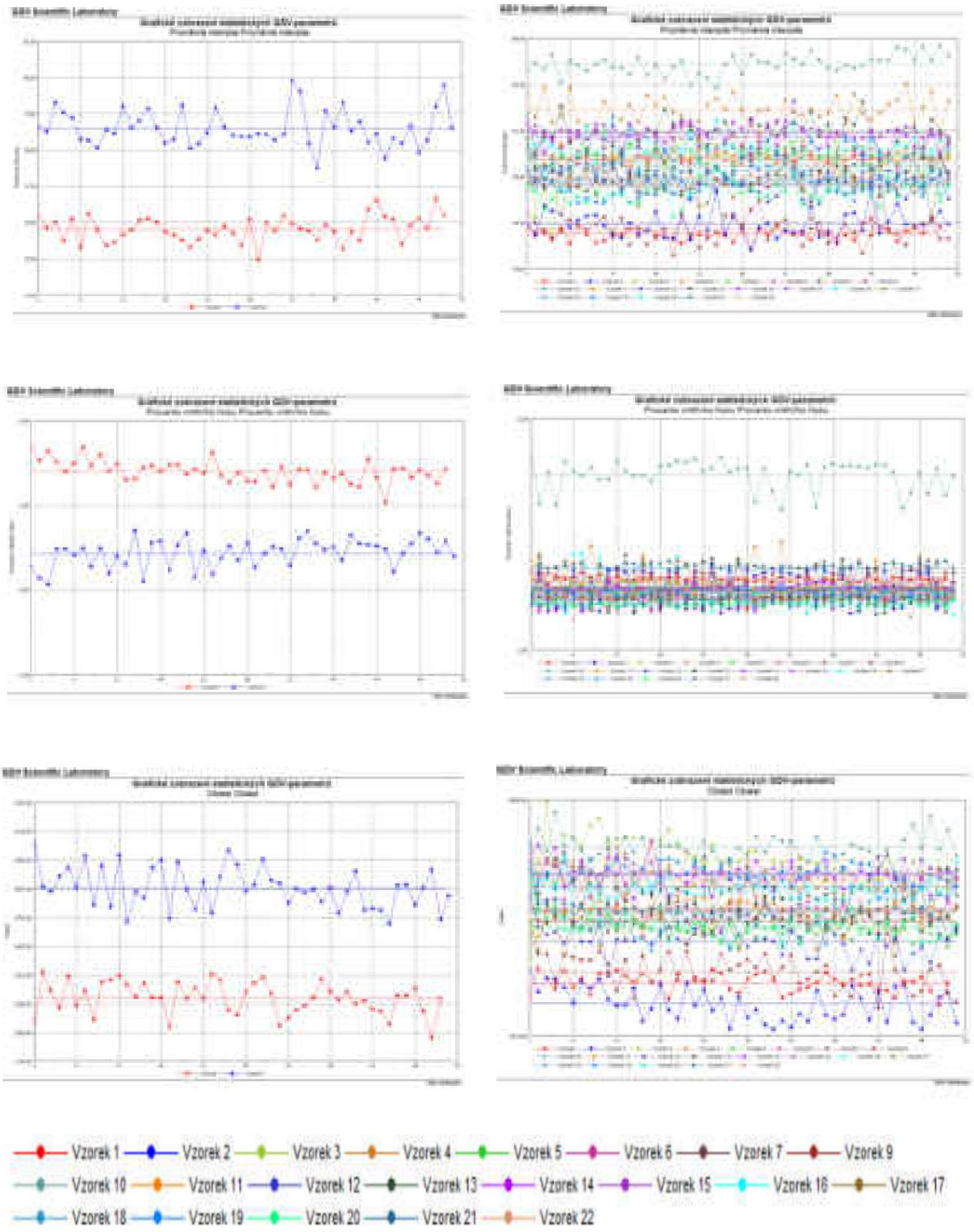

Figure 66: Character parameters intensity, communication and area at a pressure of 50Pa

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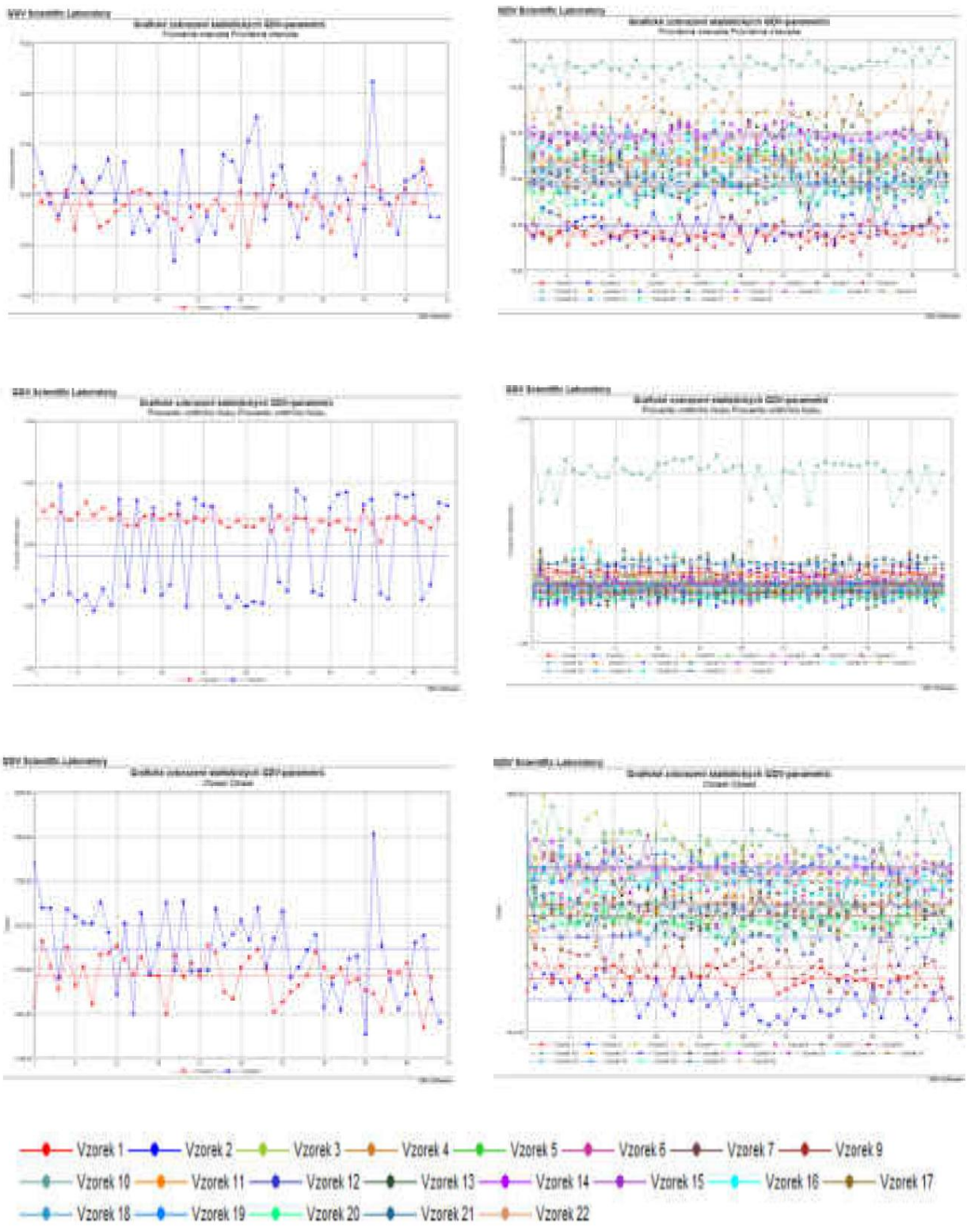

Figure 67: Character parameters intensity, communication and area at a pressure of 60Pa

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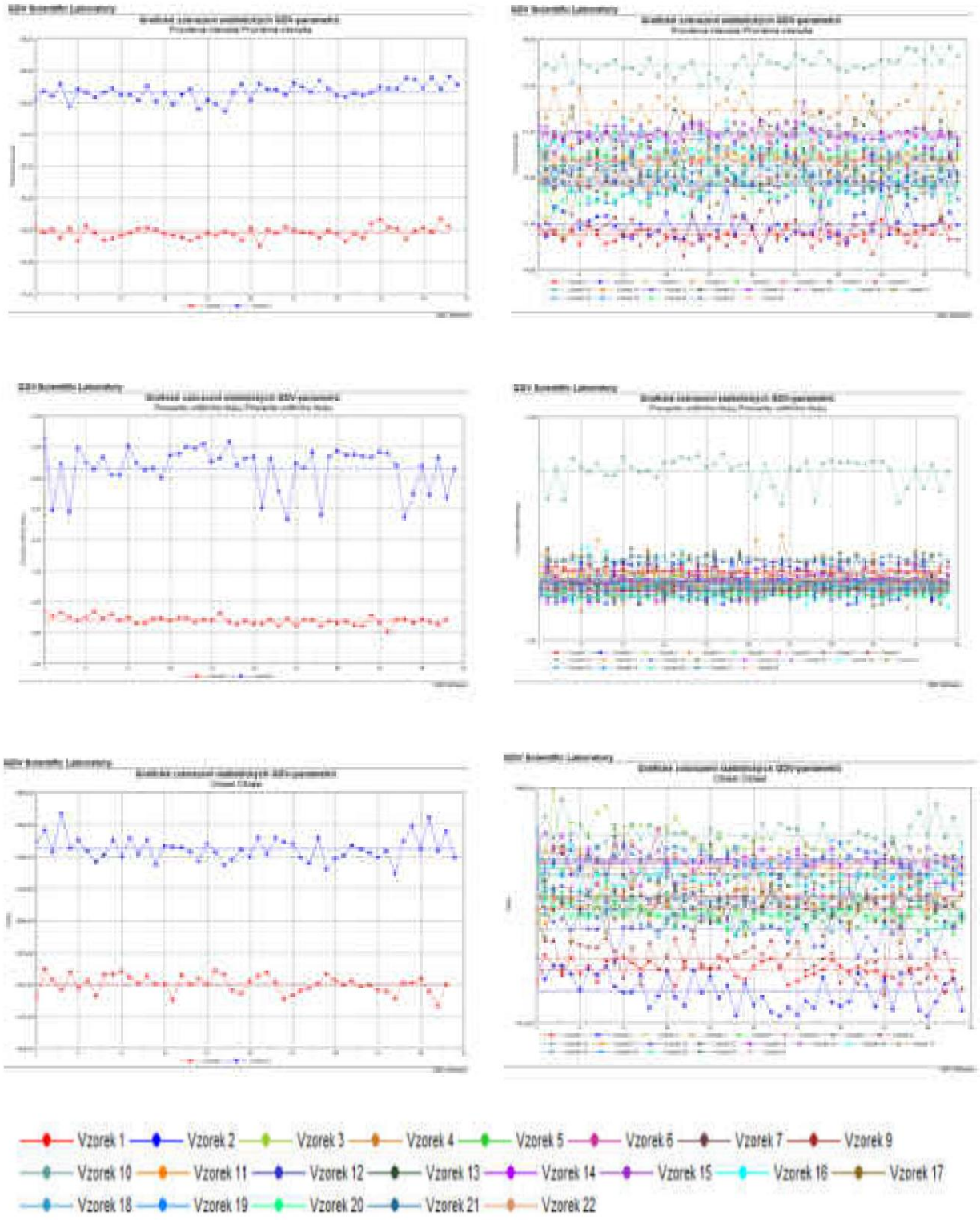

Figure 68: Character parameters intensity, communication and area at a pressure of 70Pa

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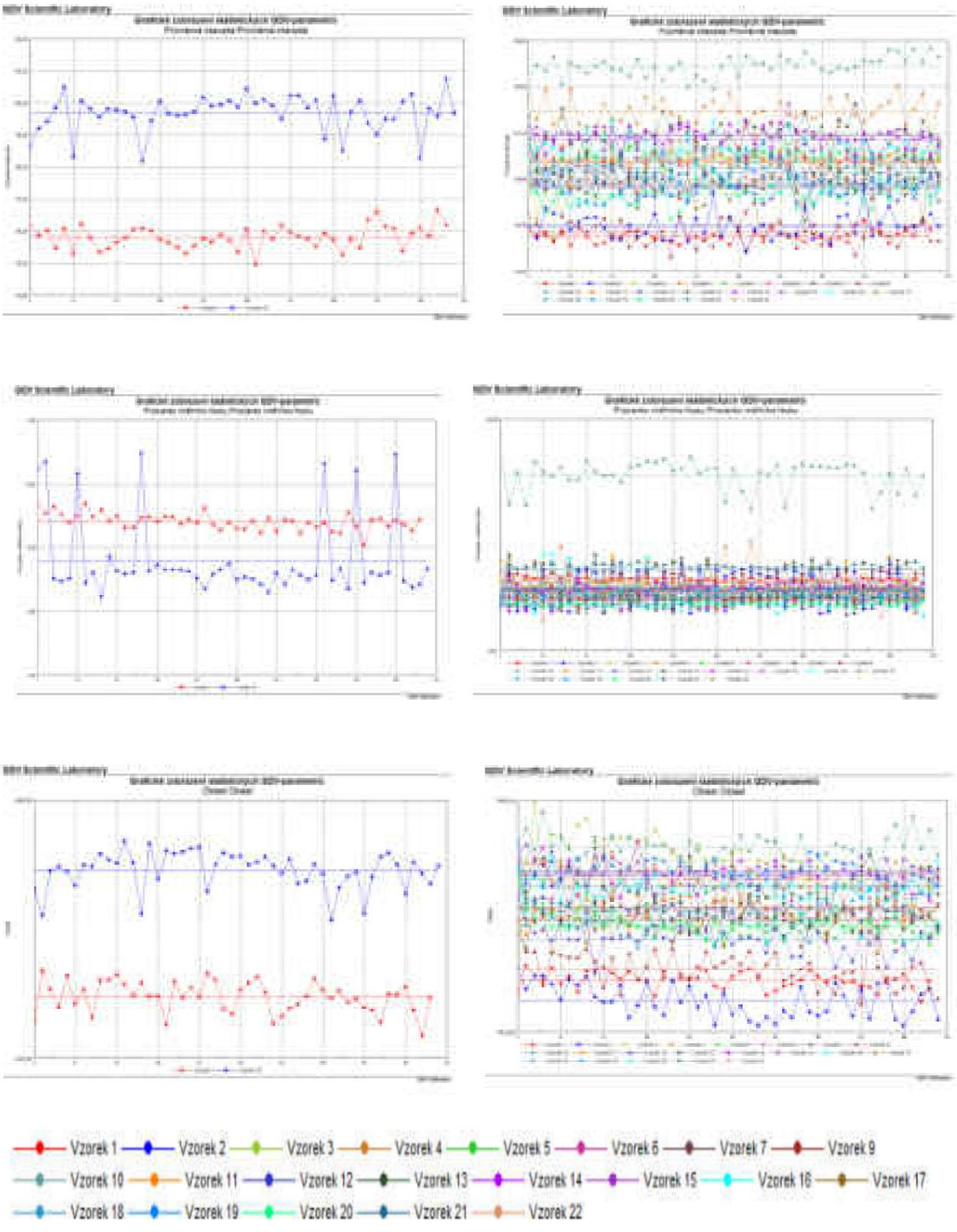

Figure 69: Character parameters intensity, communication and area at a pressure of 80Pa

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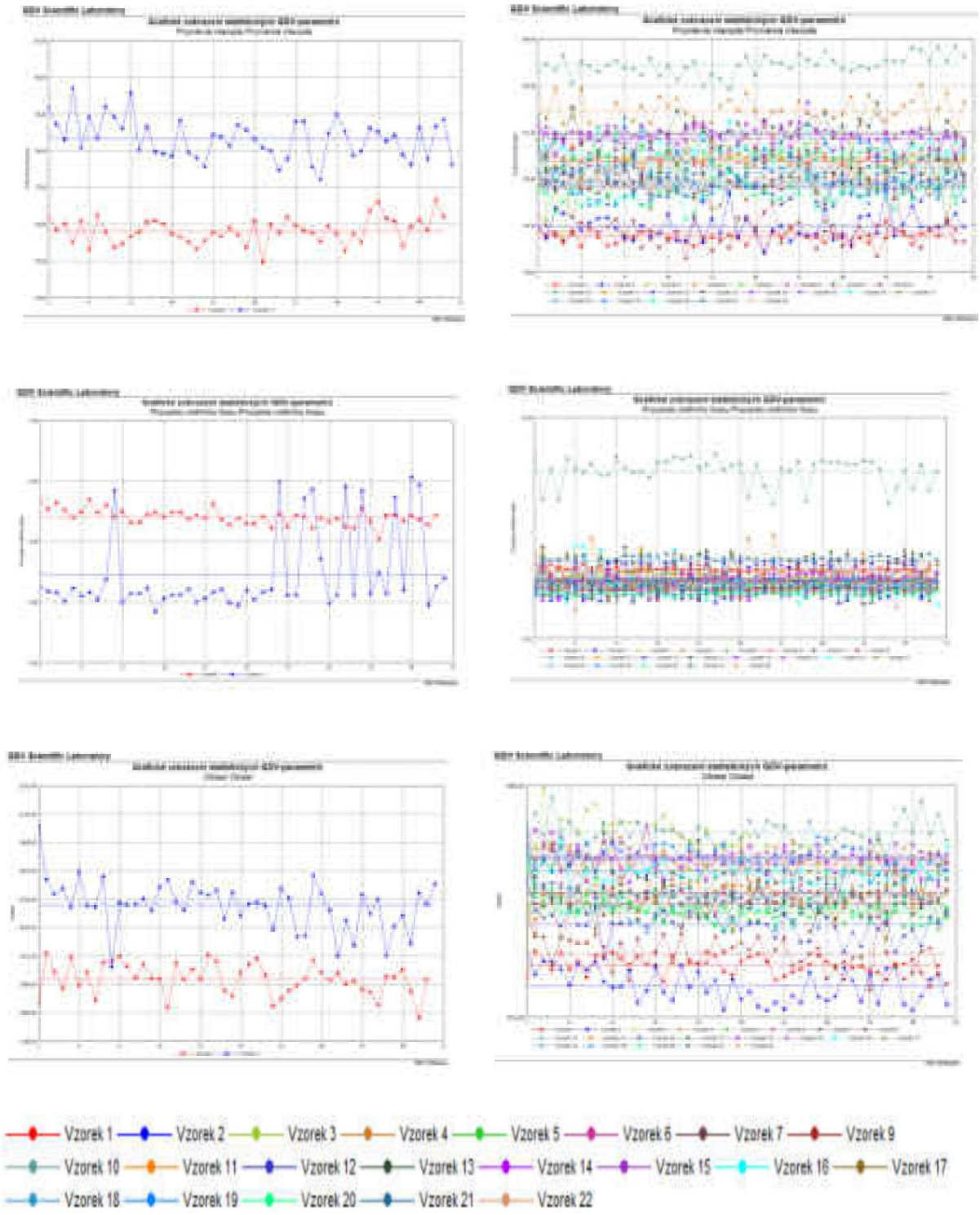

Figure 70: Character parameters intensity, communication and area at a pressure of 90Pa

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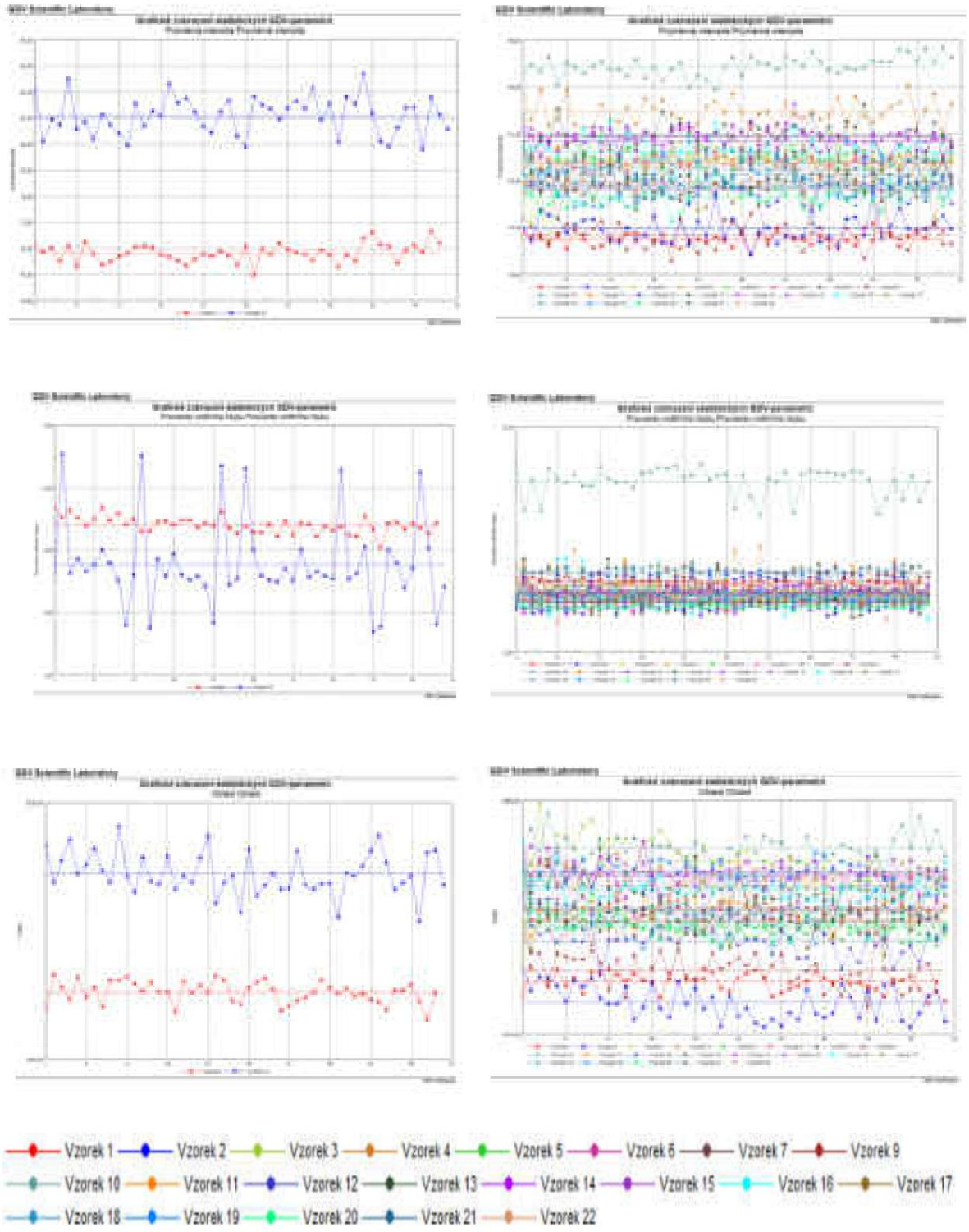

Figure 71: Character parameters intensity, communication and area at a pressure of 100Pa

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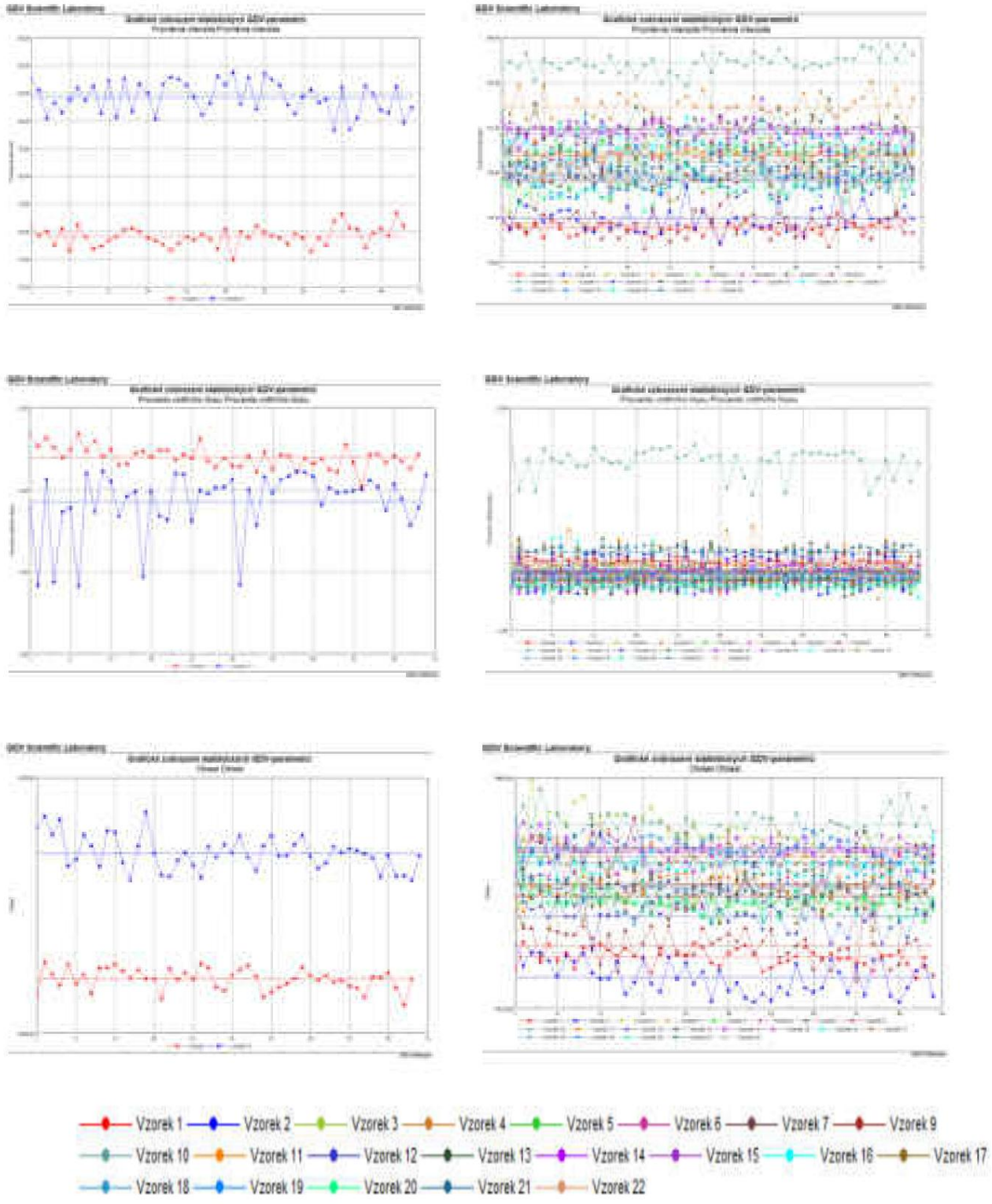

Figure 72: Character parameters intensity, communication and area at a pressure of 150Pa

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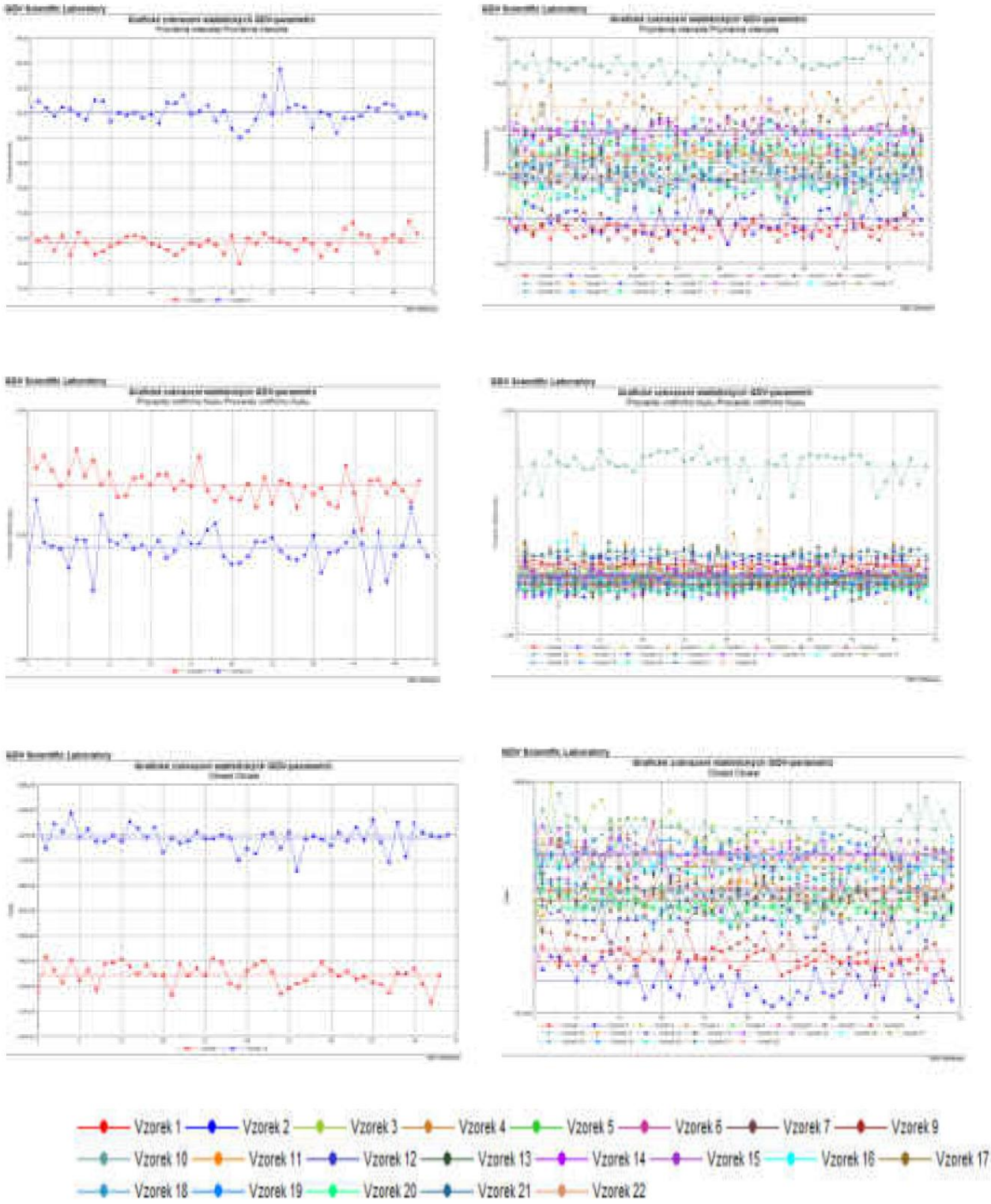

Figure 73: Character parameters intensity, communication and area at a pressure of 200Pa

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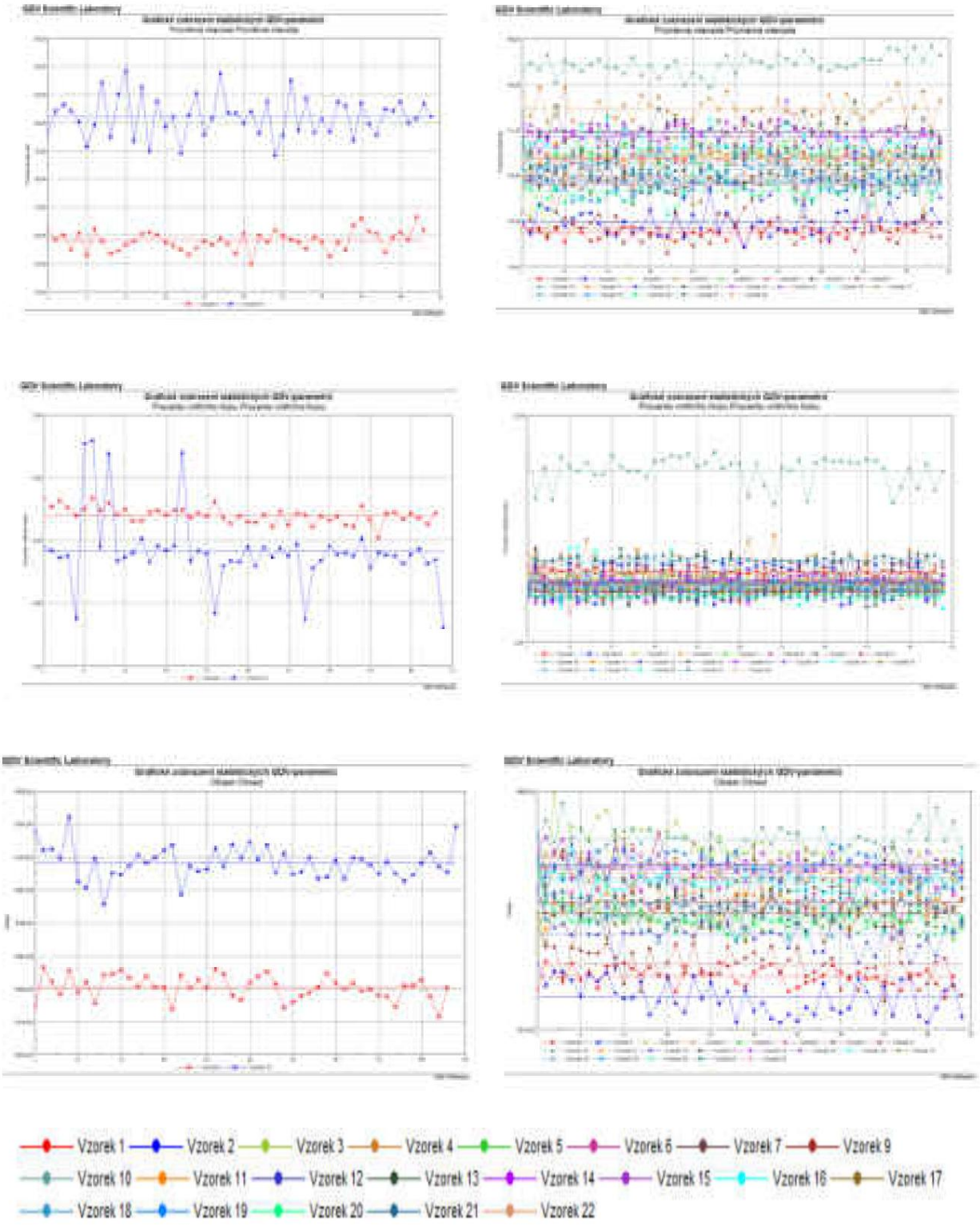

Figure 74: Character parameters intensity, communication and area at a pressure of 250Pa

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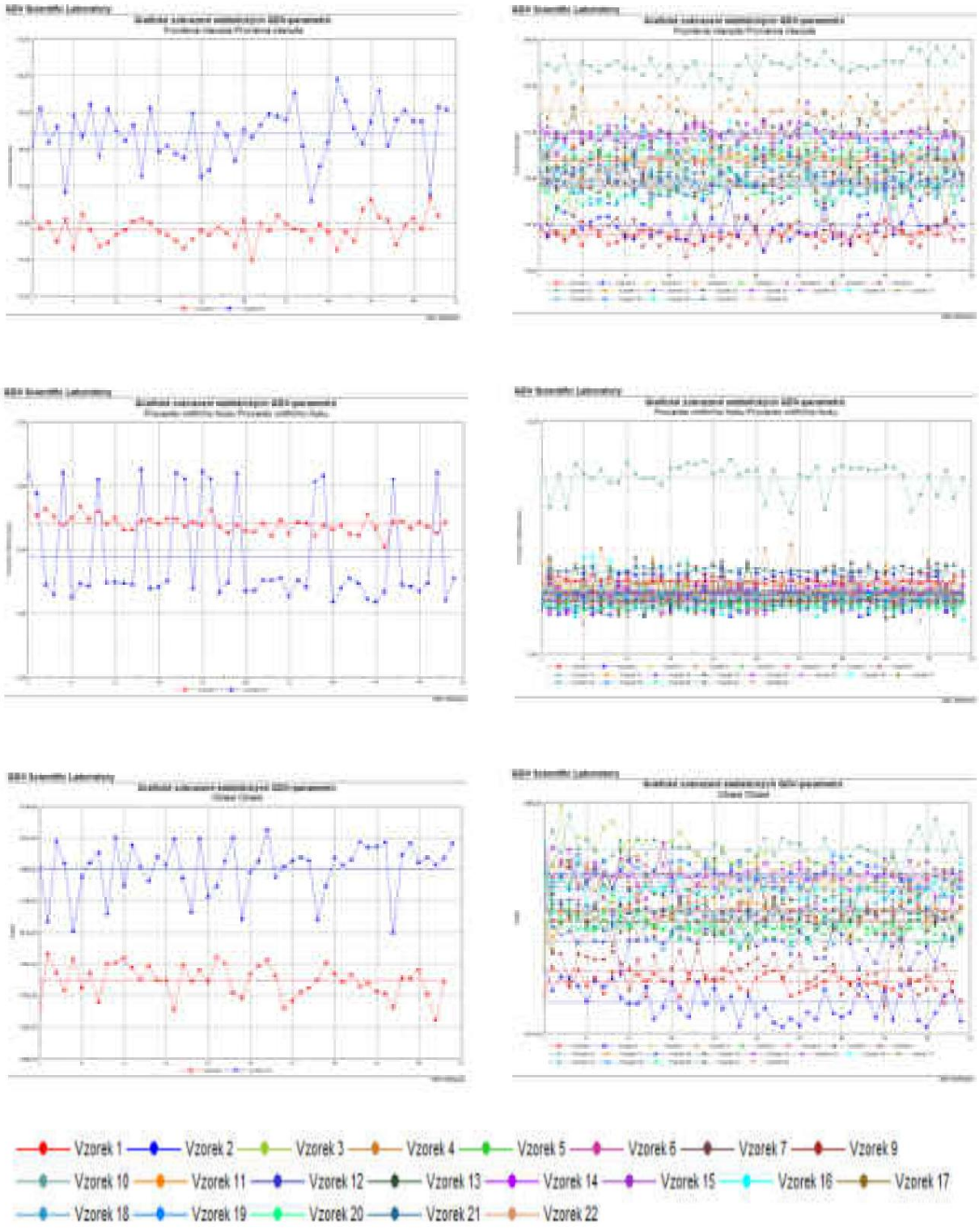

Figure 75: Character parameters intensity, communication and area at a pressure of 300Pa

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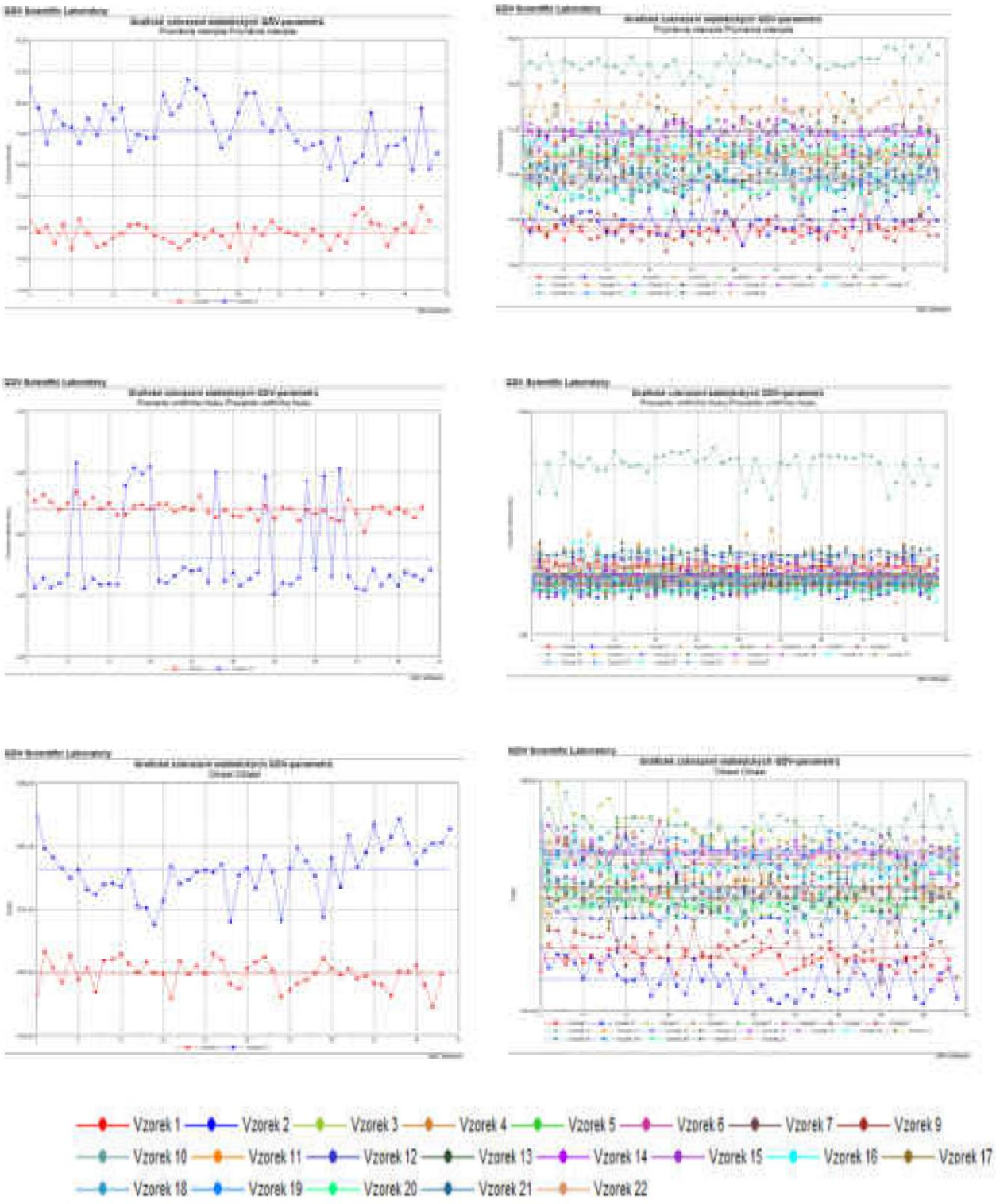

Figure 76: Character parameters intensity, communication and area at a pressure of 350Pa

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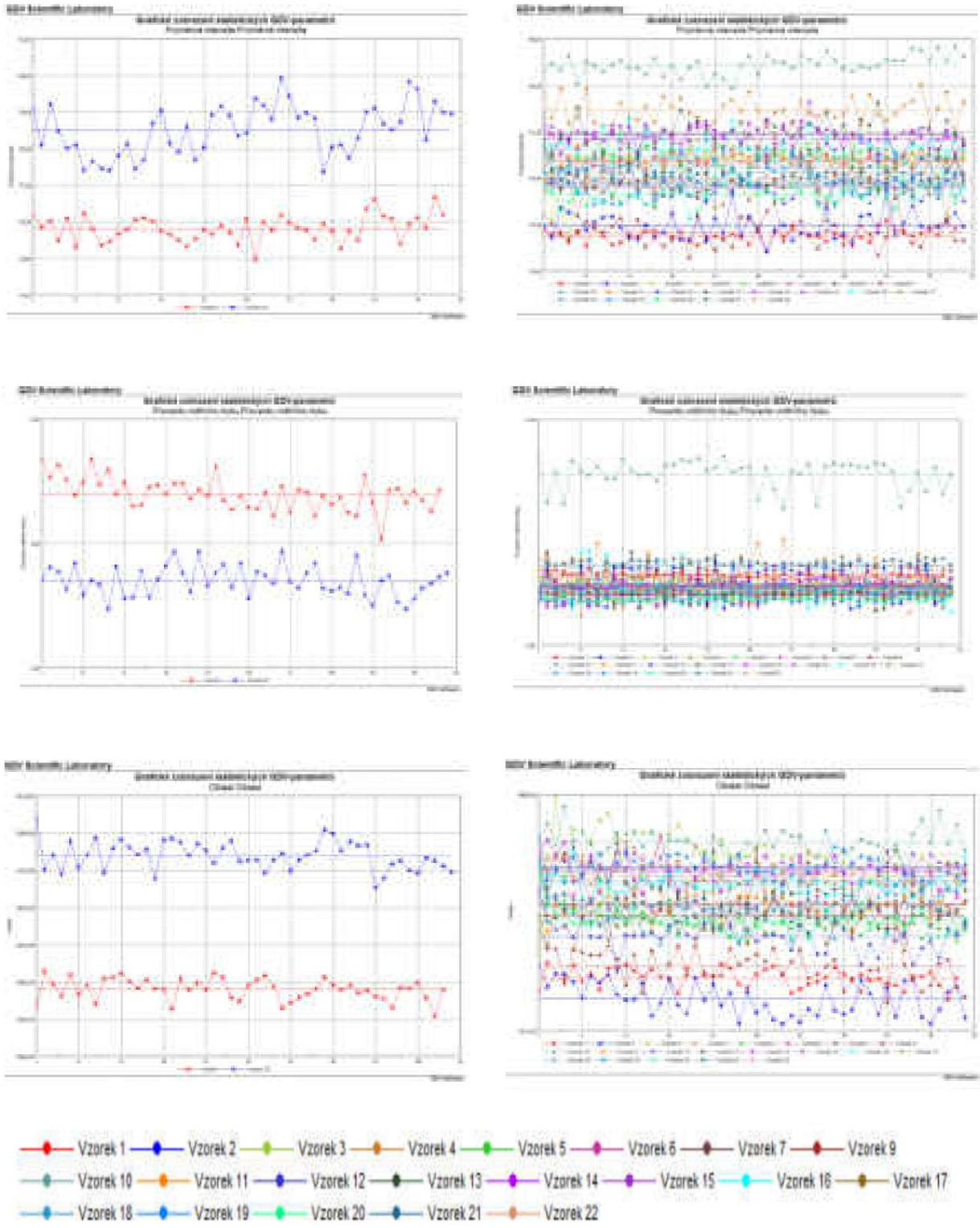

Figure 77: Character parameters intensity, communication and area at a pressure of 400Pa

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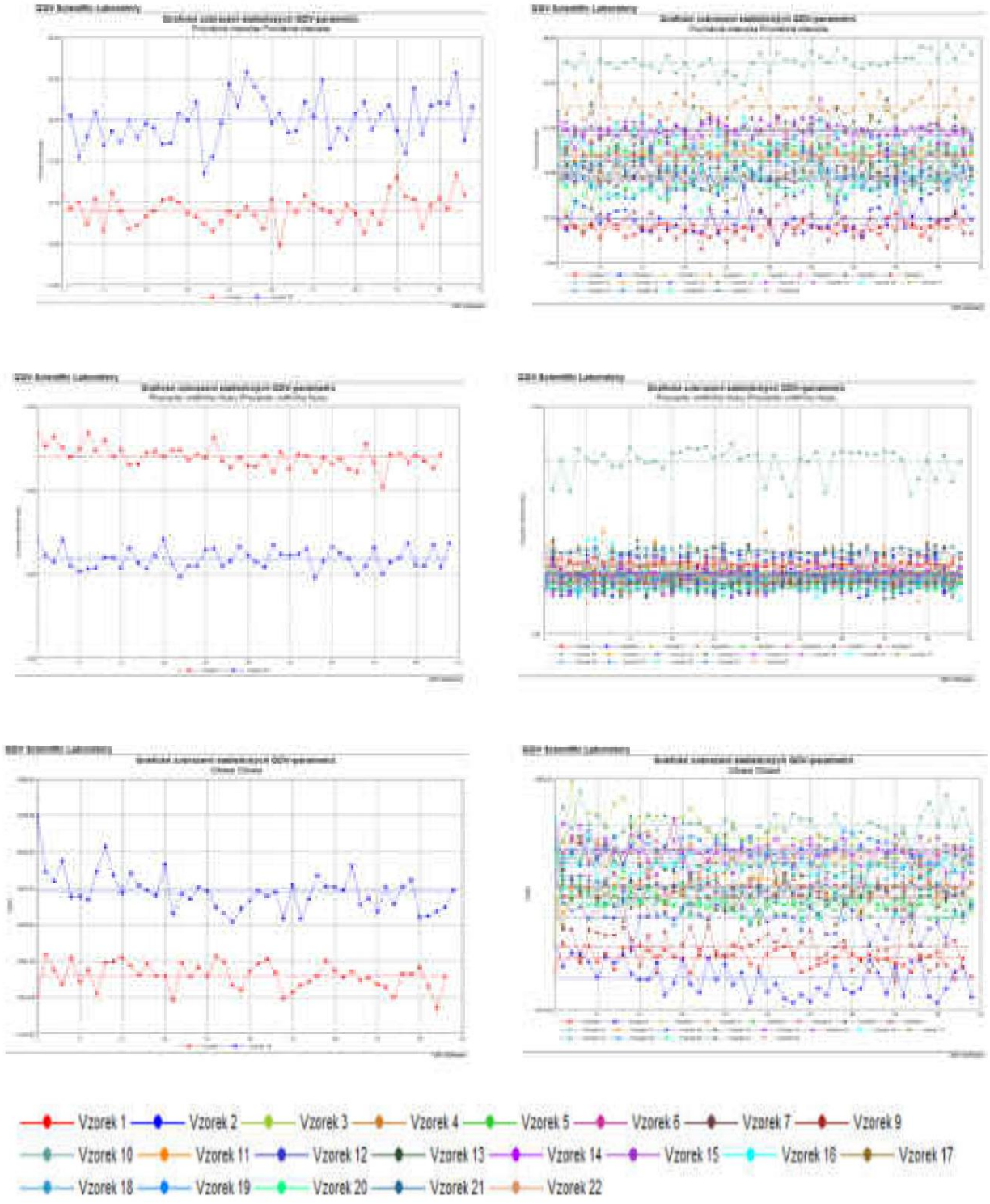

Figure 78: Character parameters intensity, communication and area at a pressure of 450Pa

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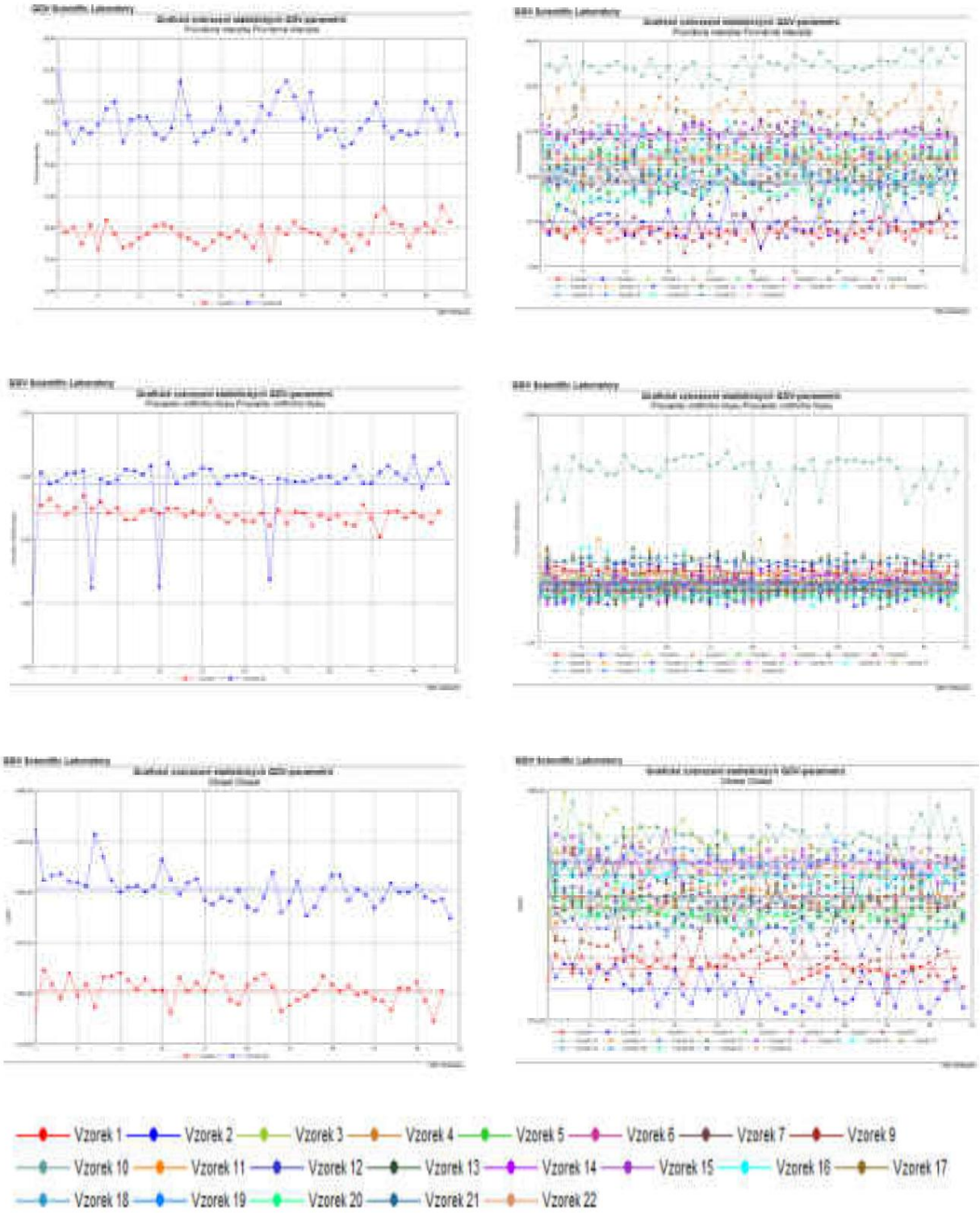

Figure 79: Character parameters intensity, communication and area at a pressure of 500Pa

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D. Conclusions

In the presented experiment, for the first time, the evaluation of samples of activated water created by the IPS device at 19 flow pressures (5-500 Pa) was ensured using the gas-discharge visualization method (GDV - gas-discharge visualization method) with computer registration and analysis of their glow - aura - energetically - information field located in a highly intense electromagnetic field.
In short, it would be possible to characterize the given method as an assessment of "water energetics" (energy information field of water).

It is a method that has been actively used for more than 15 years, mainly in medicine and other scientific fields. Despite the fact that the opinions of skeptics and "hard materialists" still prevail, that the given methods are just delusions, the expansion and official practical use of the GDV camera in 76 countries of the world (except Slovakia, of course) for medical purposes and thousands of scientific papers presented in leading scientific journals clearly proves the validity of the given method also for the study of new and hitherto unknown properties of water.

The reason for the application of the given method in the evaluation of structured water samples with the original and unique IPS device is very simple. It is not possible to evaluate the physico-chemical parameters of structured water using the methods used so far. The structuring of water itself is realized at the level of quantum physics, the knowledge of which is not generally known even in the intellectual community. By "structuring the water" it changes
especially its energy-information field, which is very sensitive to many known and less known and especially many unknown factors of the environment and the influence of the actions and thinking of the person himself - the researcher who works with water.

It is currently the most widely used for the evaluation of energy-information fields of biological objects
GDV system with specific technical and software equipment. We do not yet own this system at SPU in Nitra. Therefore, we used the knowledge, experience and technical equipment of ALFA-MED s.r.o. in Prague.

In total, we created and evaluated 19 activated water samples with the IPS device. As a control, we used sample 1 – water obtained directly from the water supply in the SPU laboratory in Nitra. With this sample, we compared other samples of activated water at the level of time dependence of intensity, area and communication of EPC images. The EPC images produced clearly document that the IPS device is unique and original for water structuring. In essence, it creates unique properties in water, which was also confirmed by the employees of ALFA-MED s.r.o., who unequivocally stated that they had never met water with such different characteristics of energy and information fields. However, the effects of these samples need to be verified in specific experiments with plants, which is documented by the research team based on the results of other experiments.

E. References

5. Aleksandrova E., Zarubina T., Kovelkova M., Strychkov P., Yakovleva E. 2009. GDV analysis of arterial hypertension. http://www.bio-well.eu/assets/files/papers/Medicine/2009 Jakovleva.pdf 6. Alexandrova R., Fedoseev G., Korotkov K., Philippova N., Zayzev S., Magidov M., Petrovsky I. 2002.
Bioelectrogram analysis of bronchial asthma in patients. In The field of human energy: A study with GDV bioelectrography (pp. 92–102). Fair Lawn, United States: Backbone Publishing Co.
7. Babelyuk VY, Gozhenko AI, Dubkova GI, Korolyshyn TA, Kikhtan VV, Babelyuk NV, ...Popovych IL 2017. Causal relationships between parameters visualization of gas discharge and the main neuroendocrine factors of adaptation. In Journal of Physical Education and Sport, 17(2), p. 624–637. https://doi.org/10.7752/jpes.2017.02094

Machine Translated by Google

8. **Bell I.,** Lewis DA, Brooks AJ, Lewis SE, Schwartz GE 2003. **Visualization of** gas discharge Evaluation of **ultramolecular doses of homeopathic** remedies in **a blinded, controlled** conditions. In *J Altern Complement Med,* 9, p. 25-37.

9. **Bhargav H., Srinivasan T., Bista S., Mooventhan A., Suresh V., Hankey A., Nagendra H. 2017. Acute effects of mobile phone radiation on subtle energy levels of teenagers using electrophotonic imaging technique: A randomized controlled trial. In *International Journal** of Yoga,* 10(1), p. 16–23. https://doi.org/10.4103/0973-6131.186163

10. **Bhargav P.,** Suresh V., **Hankey A., Bhargav H. 2016. Application of a gas discharge visualization** technique to assess the effects of **mobile phone-** induced **electromagnetic field** on **adolescent subtle energy** levels **and the protective value of yoga.** In ***International journal of yoga*** - philosophy, **psychology and parapsychology, 4(2), p.** 36–41. https://doi.org/10.4103/ijny.ijoyppp 11. **Bhat RK,** Deo G., Mavathur R., Srinivasan **T.**

2016. Correlation of Electrophotonic Imaging Parameters with Fasting Blood Sugar in **Healthy,** Prediabetic , and Diabetic **Study Participants . .**
In ***Journal of complementarily based evidence*** *and* ***alternative medicine,*** 22(3), p. 441–448. https://doi.org/10.1177/2156587216674314 12. **Bhat RK,**

Mavathur R., Srinivasan T. 2017. Type 2 diabetes mellitus and yoga: Electrophotonic p. 152–159.
imaging perspective. In *International* *Journal of Yoga,* https://doi.org/ 10(3), 10.41030973/-6131.213469 13. **Bundzen**

PV, Korotkov KG, **Korotková** AK, Mukhin VA, Priyatkin NS 2005. **Psychophysiological correlates of athletic success** in **athletes training** for **the Olympics.** In *Human Physiology,* 31, p. 316-323.

14. **Bundzen PV,** Korotkov KG, Unestahl LE 2002. **Altered** states of consciousness: **A review of experimental data obtained by a multi-technique approach.** In *J Altern Complement Med,* 8, p. 153-167.

15. **Buyantseva LV,** Korotkov KG, Qian Z., Bascom R., Ponomarenko GN 2002. Bioelectrography of **gas discharge visualization (GDV)** in hypertensive patients. In ***Measuring the Human Energy Field:*** **State** Science (pp. **31–53). Fair Lawn, United States: Backbone Publishing Co.**

16. **Ciesielska IL 2009. Images of corona discharges as a source of information on the influence of** textiles **on people. In** *Autex Research Journal.*

17. **Cioca G., Giacomoni P., Rein G. 2004. Correlation between** GDV and measures of heart rate variability: **New** measurements. In *Area Energy Measurement:* **Current Research (pp.** 59–64). Fair Lawn, **United States: Backbone Publishing Co.**

18. **Cohly H., Kostyuk N., Isokpehi R., Rajnarayanan R. 2009. Bioelectrographic method of preventive** health care. In ***ORNL Annual Biomedical Science and Engineering Conference,*** BSEC 2009. https://doi.org/10.1109/BSEC.2009.5090493 19. **Del Giudice E.,** Vitiello G. 2006.

The role of the electromagnetic field in **domain** formation in the symmetry **-breaking phase** transition process . In *Phys Rev A.,* 74, p. 1-9.

20. **Deo G., Itagi RK, Thaiyar MS, Kuldeep K. 2015. Effect of anapanasati meditation** technique **through electrophotonic imaging parameters: A pilot study. *In International Journal*** *of Yoga,* 8(2), p. 117–121. https://doi.org/10.41030973/-6131.158474 21. **Deo G.,** Kumar IR, Srinivasan TM, Kushwah

KK 2015. Changes in electrophotonic imaging
parameters associated with **long-term meditators and short-term meditators** in **older** adults **practitioners of meditation. In *European Journal of Integrative Medicine,*** 7(6), p. 663–668. https://doi.org/10.1016/j.eujim.2015.08.004 22. **Deo G., Kumar IR,**

Srinivasan TM, Kushwah, KK 2016. Cumulative effect of short- and long-term **meditation** practice in **men and women on electrophotonic** imaging psychophysiological parameters. : **a cross-sectional study. In *Journal of Complementary and Integrative Medicine,*** 13(1), p. 73–82. https://doi.org/10.1515/jcim-2015-0050

Machine Translated by Google

23. Froehlich H. 1968. Long-range coherence and energy storage in biological systems. In Int J Quant Chem, 2, p. 641-649.
24. Gagua P., Gedevanishvili E., Georgobiani L., Kapanadze A., Korotkov K., Korotkina S., ...Kriganivski E. 2004. Application of the GDV technique in oncology. In Measurement of Energetic Fields: Series of bioelectrography GDV. Vol. I. (pp. 43–50). Fair Lawn, United States: Backbone Publishing Co.
25. Gayathri V., Tl A., Shivakumar K. 2018. Effect of yoga on endocrine and nervous system in adolescent children: Assessment Using EPI parameters. In Journal of Ayurvedic and Herbal Medicine, 4(1), p. 18–21.
26. Gibson S., Williams B. 2005. The effect of music and focused meditation on the human energy field measured gas discharge visualization (GDV) technique and profile of mood states. In Fine Energy and Energy Medicine, 16, p. 57-60.
27. Gudáková G., Galinkin V., Korotkov K. 1990. Study of the development phases of CANDIDA fungi by the technique of Gas Discharge Visualization (Kirlian effect). In J Mycol Fitol, 24, p. 174-179 (In Russ).
28. Hacker GW, Pawlak E., Pauser G., Tichy G., Jell H., Posch G., ...Hutter J. 2005. Biomedical evidence of the influence of geopathic zones on the human body: Scientifically traceable effects and methods of harmonization. In Forschende Komplementarmedizin Und Klassische Naturheilkunde, 12(6), p. 315–327. https://doi.org/10.1159/00008 29. Hacker GW, Pawlak E., Pauser G., Tichy G., Jell H., Posch G., Kraibacher G., Aigner A., Hutter J. 2005. Biomedical Evidence for the Influence of Geopathic Zones on the Human Body: Scientifically Traceable effects and methods of harmonization. In Forsch Komplementärmed Klass Naturheilkd, 12, p. 315-327.
30. Hao BL 1985. Chaos. World Science: Singapore.
31. Chai BH, Zheng GM, Zhao Q., Pollack G. 2008. Spectroscopic studies of dissolved substances in aqueous solutions. In J Phys Chem, 112, p. 2242-2247.
32. Chaplin MF 2000. A proposal for structuring water. In Biophys Chem, 83, p. 211-221.
33. Chez RA 2002. Measuring the human energy field: The state of the science. National Institute of Health, Samueli Institute: Maryland.
34. Johansson B. 2009. Effects of functional water on heart rate, heart rate variability and salivary immunoglobulin in healthy humans: A pilot study. In J Altern Complement Med, 15, p. 871-877.
35. Korotkov K. 1985. Physical processes in the sliding discharge of gases. In J Technical Physics Letters, 412, p. 67-70 (In Russ).
36. Korotkov K. 2002. The field of human energy: a study with GDV Bioelectrography. Backbone Publishing: NY. pp. 360.
37. Korotkov K., Bundzen P., Bronnikov V., Logníková L. 2005. Bioelectrographic correlates of the phenomenon direct vision. In J Altern Complement Med., 11, p. 885-893.
38. Korotkov K., Gurvitz B., Krilov B. 1998. A new conceptual approach to early cancer diagnosis. In Consciousness and Physical Reality, 3, p. 51-58 (In Russ).
39. Korotkov K., Korotkin D. 2001. Concentration dependence of gas discharge around inorganic droplets electrolytes. In J Appl Phys, 89, p. 4732-4737.
40. Korotkov K., Križanovský E., Borisová M., Hayes M., Matravers P., Momoh KS, Peterson P., Shiozawa K., Vainshelboim A. 2004. Investigation of the temporal dynamics of gas outflow around liquid droplets. In J Appl Phys., 95, p. 3334-3338.
41. Korotkov KG, Matravers P., Orlov DV, Williams BO 2010. Application of electrophoton analysis capture (EPC) based on gas discharge visualization (GDV) technique in medicine: Systematic overview. In J Altern Complement Med., 16(1), p. 13-25.
42. Rubik B., Brooks A. 2005. Digital high voltage electrophotographic measurements of finger tips subjects before and after Qigong. In Evidence Based Integrative Medicine, 2, p. 245-242 43. Sviridov L., Stepanov A., Hlopunová O., Koroktov K., Ahmeteli G., Korotkina S., Kriganovski E. 2003. Registration of the agglutination reaction using the gas discharge visualization technique. Modern microbiology. In Proceedings of the conference in St. Petersburg, p. 32-33. (In Russian)

Machine Translated by Google

44. Vainshelboim AL, Hayes MT, Korotkov K., Križanovský E., Momoh KS 2004. Investigation
natural and synthetic flavors and aromas using the dynamic gas discharge visualization technique. In
Proceedings of the PITTCON conference: Chicago, p. 149-150.
45. Vainshelboim AL, Hayes MT, Momoh KS 2005. Bioelectrographic testing of mineral samples:
Comparison of techniques. In J Altern Complement Med., 11, p. 299-304.
46. Voeikov VL, Del Giudice E. 2009. Aquatic respiration – the basis of the living state. In VODA, 1, p. 52-75.
47. Wiggins PM 2002. Enzymes and the two states of water. In J Biol Phys Chem, 2, p. 25-37.
48. URL1: https://www.auraphotographys.com/your%20bio-well%20camera.html

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AQIPS-02

Characteristics of activated water by the IPS device
GDV camera

AQIPS-02-E01a Effect of activated water by the IPS system on germination and growth of wheat (Triticum aestivum L.)
AQIPS-02-E01b Effect of activated water by the IPS system on germination and growth of wheat (Triticum aestivum L.)
AQIPS-02-E02a Effect of activated water by the IPS system on the germination and growth of corn (Zea mays L.)
AQIPS-02-E02b Effect of activated water by the IPS system on the germination and growth of corn (Zea mays L.)
AQIPS-02-E03a Effect of activated water by the IPS system on the germination and growth of cannabis (Cannabis sativa L.)
AQIPS-02-E03b Effect of activated water by the IPS system on germination and growth of hemp (Cannabis sativa L.)
AQIPS-02-E03c Effect of activated water by the IPS system on the germination and growth of cannabis (Cannabis sativa L.)
AQIPS-02-E04a Effect of activated water by the IPS system on the germination and growth of cress (Lepidium sativum L.)
AQIPS-02-E04b Effect of activated water by the IPS system on the germination and growth of cress (Lepidium sativum L.)
AQIPS-02-E04c Effect of activated water by the IPS system on germination and growth of cress (Lepidium sativum L.)

Effect of activated water with the IPS system on germination and growth of wheat (Triticum aestivum L.)

AQIPS-02-E01a

Contents

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A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species
2. Plant species: Sown wheat (Triticum aestivum L.)
3. Designation of the plant species in the experiments: Ta 4. Start date of the experiment: 29/7/2021 5. End date of the experiment: 9/8/2021 6. Method of growing plants: Petri dishes, sand substrate, laboratory conditions
7. Evaluation of the experiment: Image analysis
8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in IPS device experiments Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Variant description	Designation	Variant description
Tafw-c	Tap water - control	Tasw-c	Tap water is stagnant - check
Tafw05	Created water at a pressure of 05Pa	Tasw05	Created water at a pressure of 05Pa
Tafw10	Created water at a pressure of 10Pa	Tasw10	Created water at a pressure of 10Pa
Tafw15	Created water at a pressure of 15Pa	Tasw15	Created water at a pressure of 15Pa
Tafw25	Created water at a pressure of 25Pa	Tasw25	Created water at a pressure of 25Pa
Tafw50	Created water at a pressure of 50Pa	Tasw50	Created water at a pressure of 50Pa
Tafw75	Created water at a pressure of 75Pa	Tasw75	Created water at a pressure of 75Pa
Tafw100	Created water at a pressure of 100Pa	Tasw100	Created water at a pressure of 100Pa
Tafw200	Created water at a pressure of 200Pa	Tasw200	Created water at a pressure of 200Pa
Tafw300	Created water at a pressure of 300Pa	Tasw300	Created water at a pressure of 300Pa
Tafw400	Created water at a pressure of 400Pa	Tasw400	Created water at a pressure of 400Pa
Tafw450	Created water at a pressure of 450Pa	Tasw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water 10.1. Effects on seed germination

Marking		Characteristics of samples
NK -		Seeds without germination
ZK +		Beginning of germination
PK ++		Full germination
PL +++		First leaves

10.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR -		No growth
PR +		Slow plant growth - Blockage of growth
NO ++		Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS ++++		Extremely intensive growth

Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

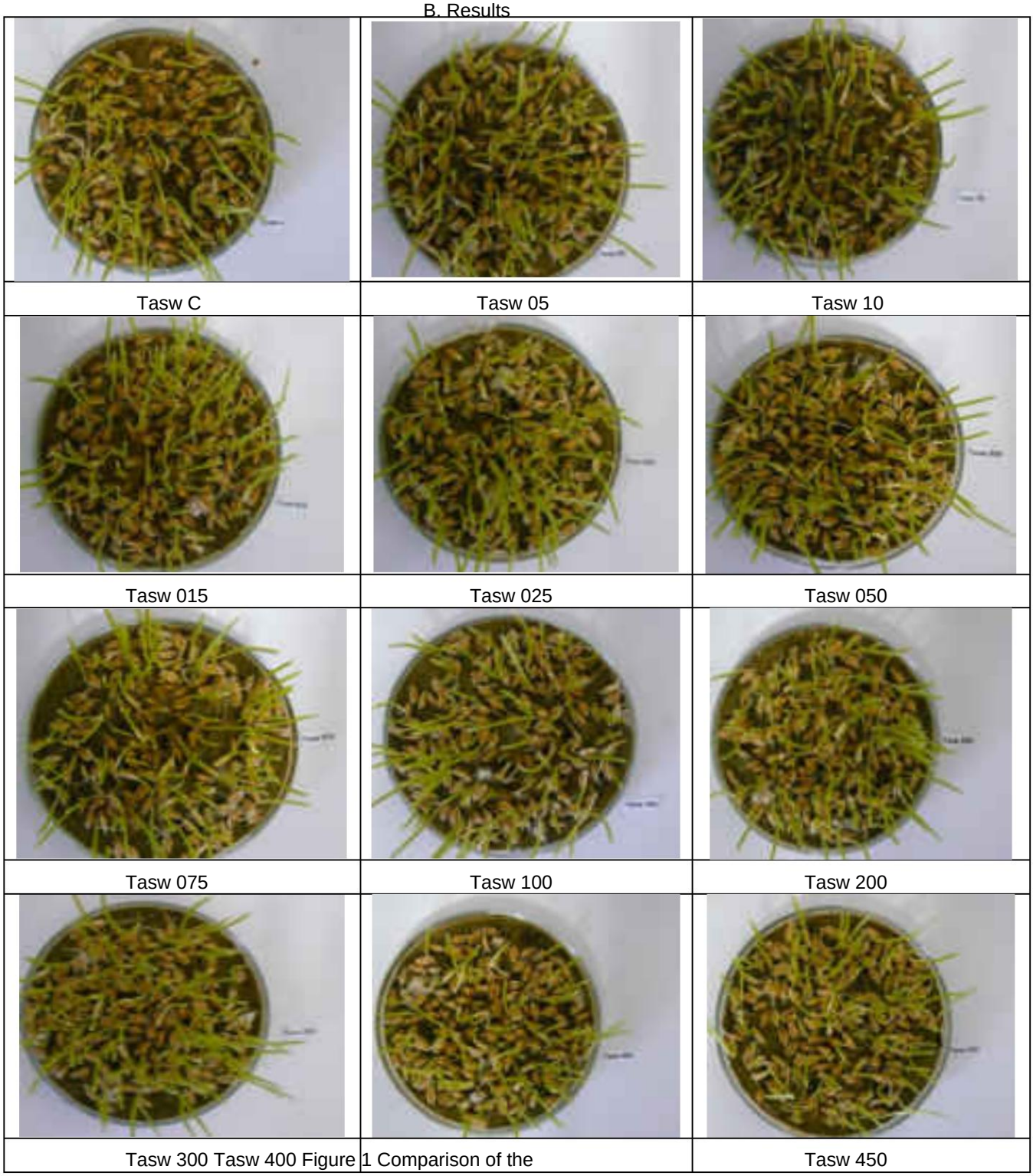

Figure 1 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 3 days from the start of the experiment (J. Šimková, 2021)

Rating

3 day	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450
	++	++	++	++	++	++	++	++	++	++	+	+

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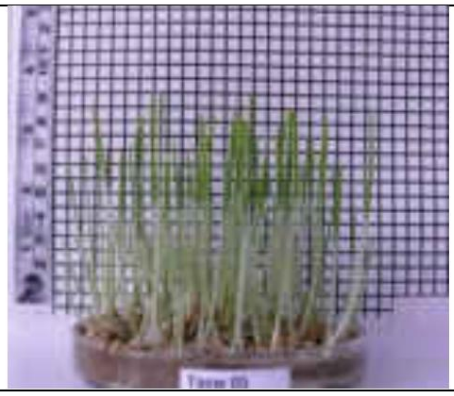
Tasw C



Tasw 05

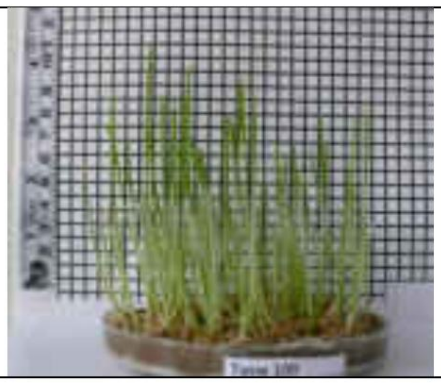
Tasw 10

Tasw 015

Tasw 025

Tasw 050

Tasw 075



Tasw 100

Tasw 200

Tasw 300

Tasw 400 Figure

Tasw 450

2 Comparison of tested variants with activated stable water at different pressures for germination and emergence of spring wheat *(Triticum aestivum* L.) **seeds** in sand after 4 **days from the start of the experiment (J. Šimková,** 2021)

4 day Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450			
	++	++	++	+	+	++	++	++	++	++	+	+		

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Tasw C

Tasw 05

Tasw 10

Tasw 015

Tasw 025

Tasw 050

Tasw 075

Tasw 100

Tasw 200

Tasw 300

Tasw 400

Tasw 450

Figure 3 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 5 days from the start of the experiment (J. Šimková, 2021)

5 day	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450				
	++	++	++	++	+	++	++	+	++	++	+	+				

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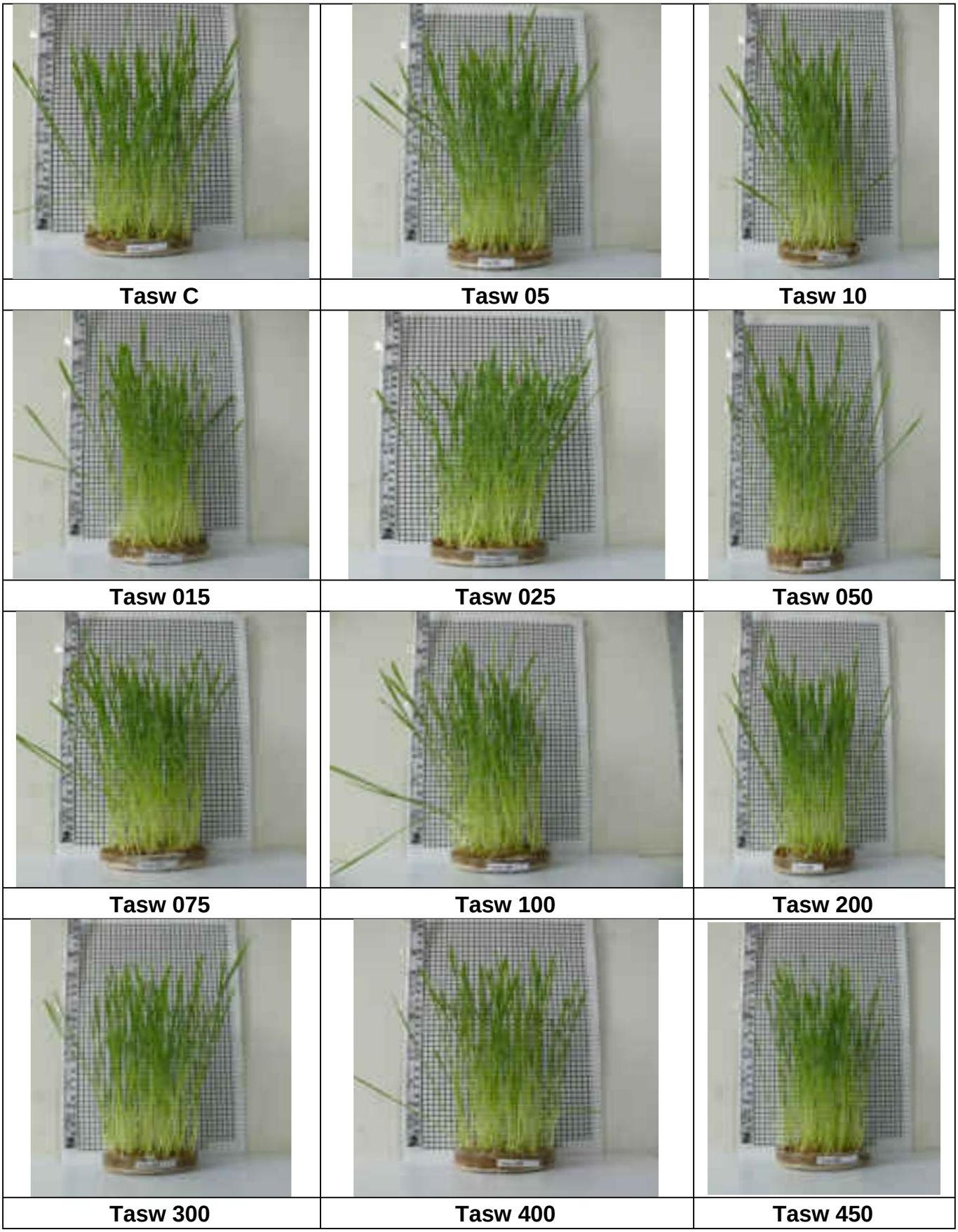

Figure 4 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of spring wheat *(Triticum aestivum* L.) **seeds** in sand after 7 **days from the start of the experiment (J. Šimková, 2021)**

7 day	**Taswc**	**Tasw5**	**Tasw10**	**Tasw15**	**Tasw25**	**Tasw50**	**Tasw75**	**Tasw100**	**Tasw200**	**Tasw300**	**Tasw400**	**Tasw450**			
	+	++	++	++	+	+	++	++	++	++	++	++	++	++	+

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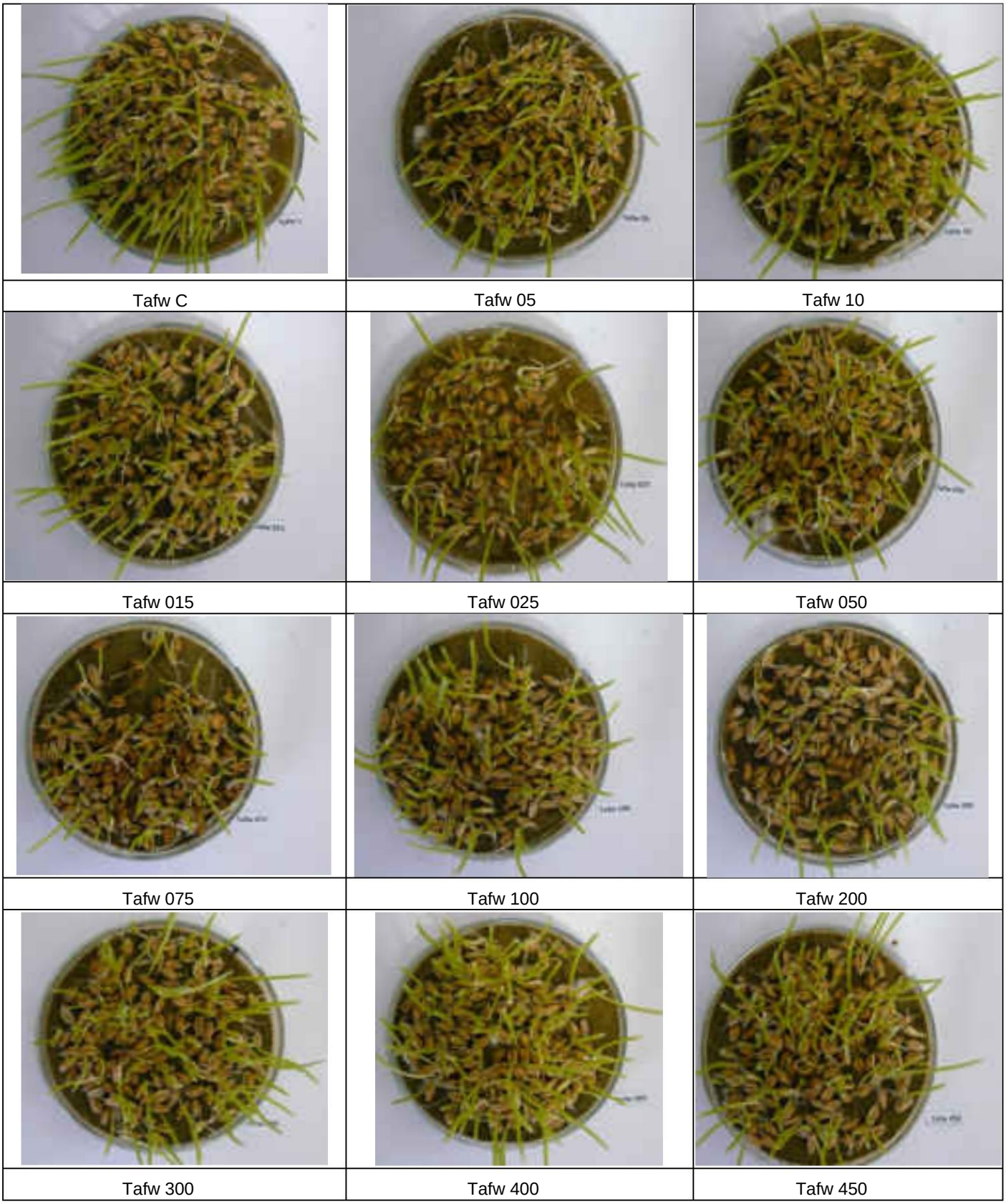

Figure 5 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds after 3 days from the start of the experiment (J. Šimková, 2021)

3 day	Tafwc	Tafw5	Tafw10	Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450				
	++	+	++	++	+	++	+	++	+	++	++	++				

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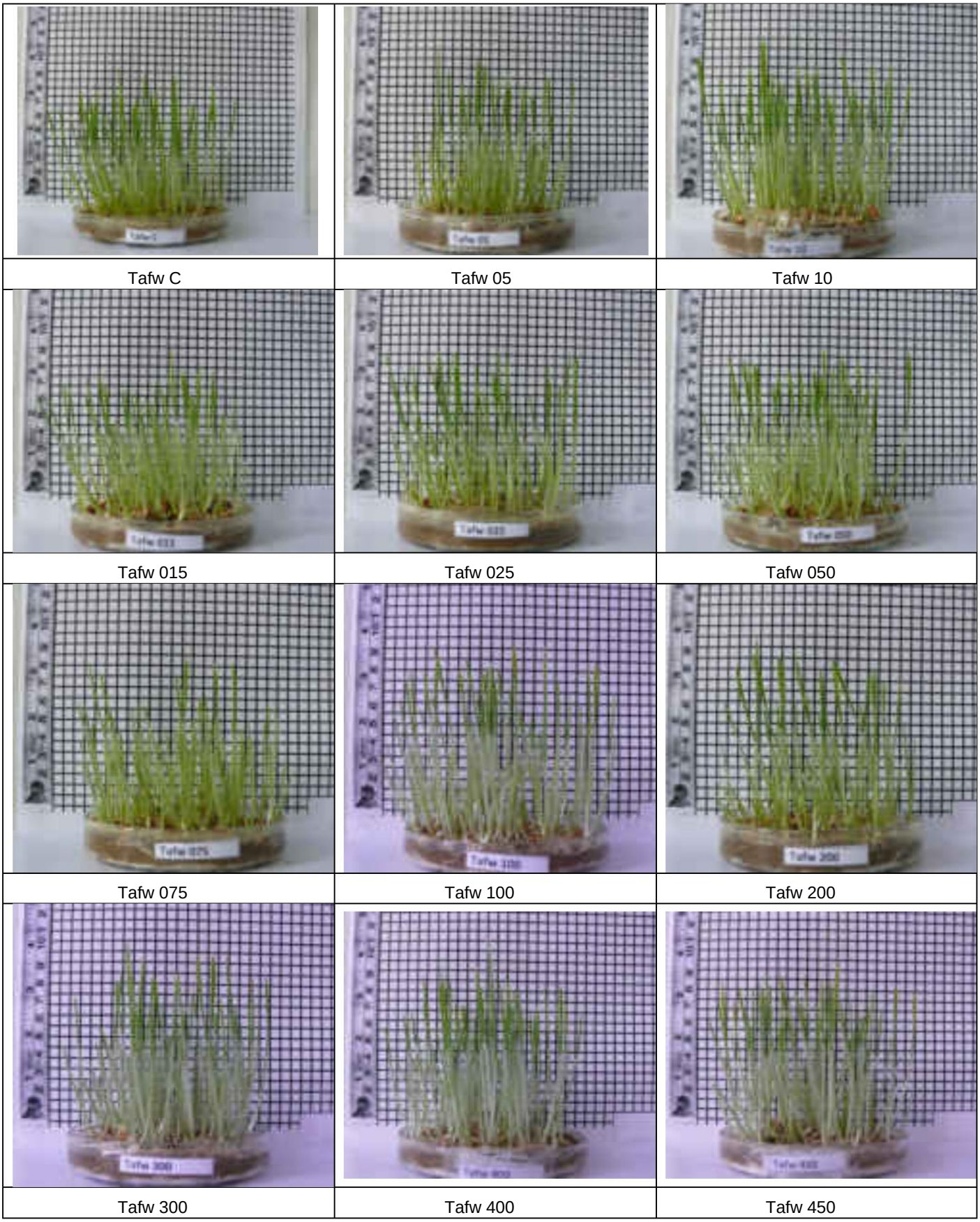

Figure 6 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds after 4 days from the start of the experiment (J. Šimková, 2021)

4 day	Tafwc	Tafw5	Tafw10	Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450				
	+	++	++	+	+	++	+	++	++	++	++	++				

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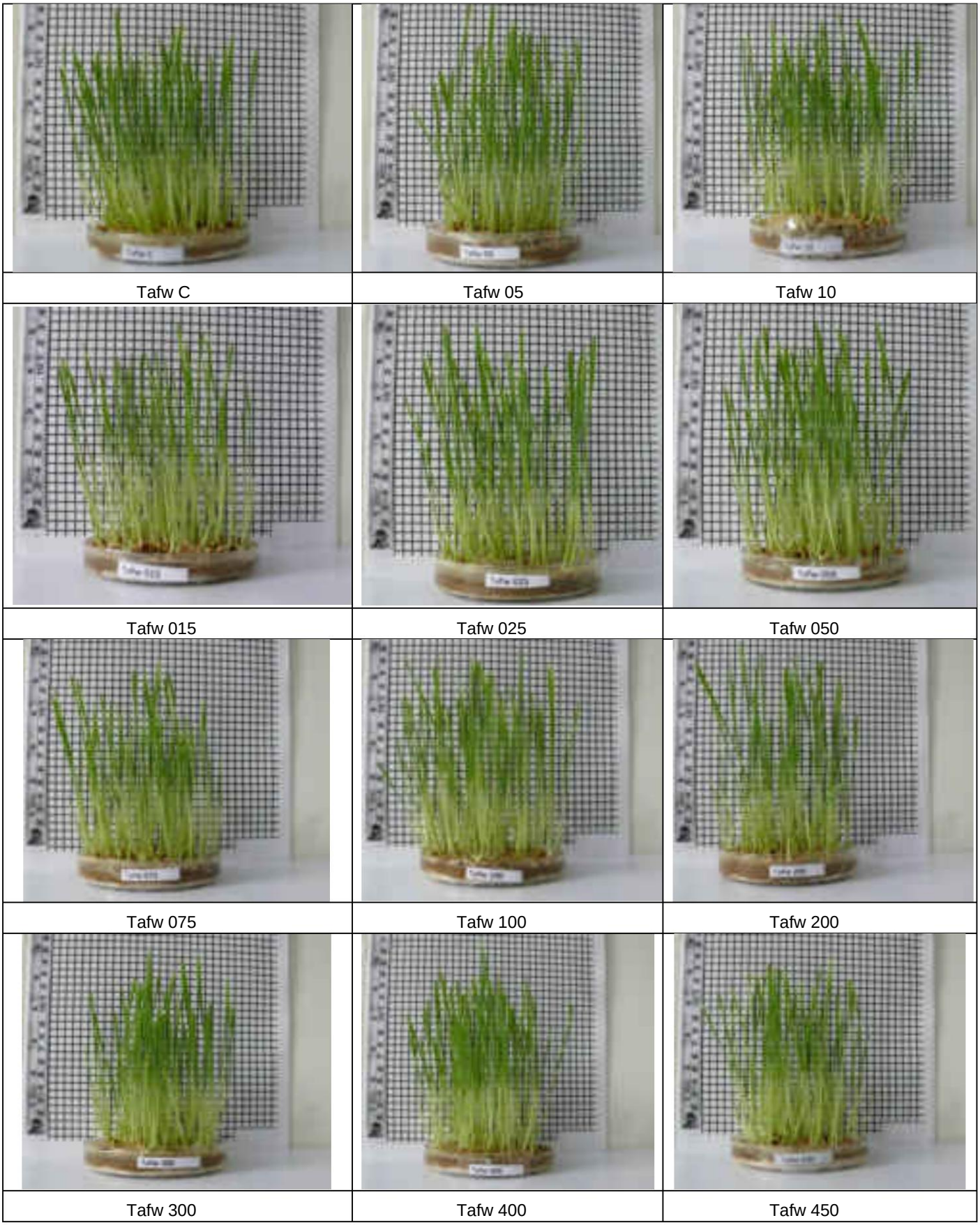

Figure 7 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds after 5 days from the start of the experiment (J. Šimková, 2021)

5 day	Tafwc	Tafw5	Tafw10	Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450				
	+	+	++	+	++	++	+	++	+	++	++	++				

Machine Translated by Google

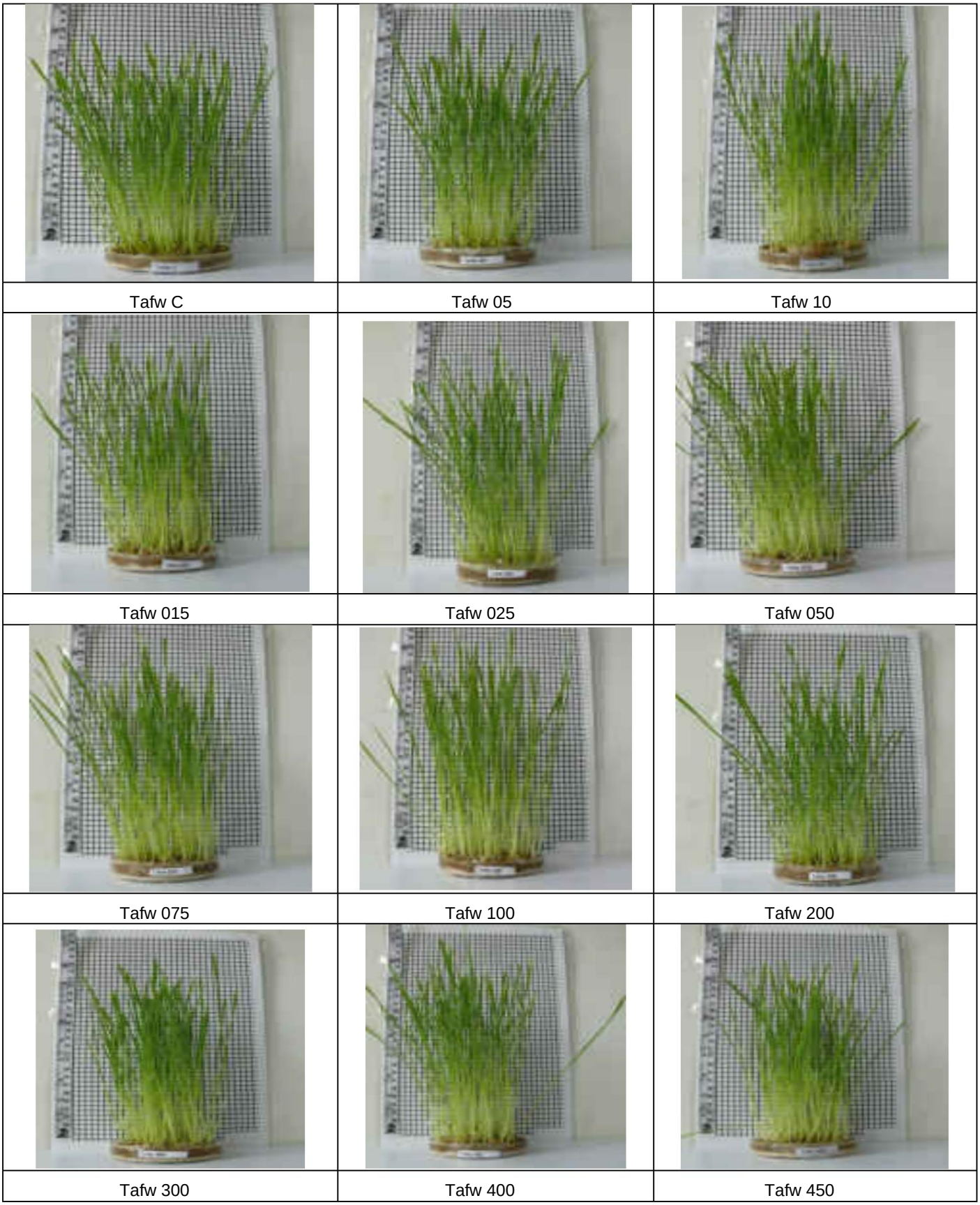

Figure 8 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of spring wheat (Triticum aestivum L.) seeds after 7 days from the start of the experiment (J. Šimková, 2021)

7 day	Tafwc	Tafw5	Tafw10	Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450				
	++	++	++	++	+	+	++	++	++	+	++	++	+			

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C. Conclusions

Plant type Sown			Applied water			The beginning of the experiment			Termination of the experiment		Experiment	
wheat (Ta) Stable-activated-sw 29/7/2021 Day ÿTaswc Tasw5 Tasw10 Tasw15									9.8.2021		AQIPS-02-E01a	
Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450					
3	++	++		++	++	++	++	++	++	++	++	+	+
4	++	++		++	+	+	++	++	++	++	++	+	+
5	++	++		++	++	+	++	++	+	++	++	+	+
7		+	++	++	+	+	++	++	++	++	++	++	+
Sown wheat (Ta) fresh - activated-fw 29/7/2021 Day ÿTafwc Tafw5 Tafw10									9.8.2021		AQIPS-02-E01a	
Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450				
3	++	+		++	++	+	++	+	++	+	++	++	++
4		+	++	++	+	+	++	+	++	++	++	++	++
5		+	+	++	+	++	++	+	++	+	++	++	++
7	++	++		++	+	+	++	++	++	+	++	++	+

Marking		Plant growth intensity
BR -		No growth
PR +		Slow plant growth - Blockage of growth
NO ++		Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS ++++		Extremely intensive growth

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Effect of activated water by the IPS system on the germination and growth of triticale wheat (Triticum aestivum L.)

AQIPS-02-E01b

Contents

A. Methodology of the experiment 1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species

2. Plant species: Sown wheat (Triticum aestivum L.)

3. Designation of the plant species in the experiments: Ta 4. Start date of the experiment: 13/8/2021 5. End date of the experiment: 20/8/2021 6. Method of growing plants: Petri dishes, sand substrate, laboratory conditions, weighing samples 10g

7. Evaluation of the experiment: Image analysis

8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in IPS device experiments Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Description of variant	Designation	Variant description
Tafw-c	Tap water - control Created water	Tasw-c	Tap water to stand - check
Tafw05	at a pressure of 05Pa Created water	Tasw05	Created water at a pressure of 05Pa
Tafw10	at a pressure of 10Pa Created water	Tasw10	Created water at a pressure of 10Pa
Tafw15	at a pressure of 15Pa Created water	Tasw15	Created water at a pressure of 15Pa
Tafw25	at a pressure of 25Pa Created water	Tasw25	Created water at a pressure of 25Pa
Tafw50	at a pressure of 50Pa Created water	Tasw50	Created water at a pressure of 50 Pa
Tafw75	at a pressure of 75Pa Created water	Tasw75	Created water at a pressure of 75Pa
Tafw100	at a pressure of 100Pa Created water	Tasw100	Created water at a pressure of 100Pa
Tafw200	at a pressure 200Pa Created water	Tasw200	Created water at a pressure of 200Pa
Tafw300	at a pressure of 300Pa Tafw400	Tasw300	Created water at a pressure of 300Pa
Created	water at a pressure of 400Pa Tafw450	Tasw400	Created water at a pressure of 400Pa
Created	water at a pressure of 450Pa 9. Methodology	Tasw450	Created water at a pressure of 450Pa

for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		Characteristics of samples
etc	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

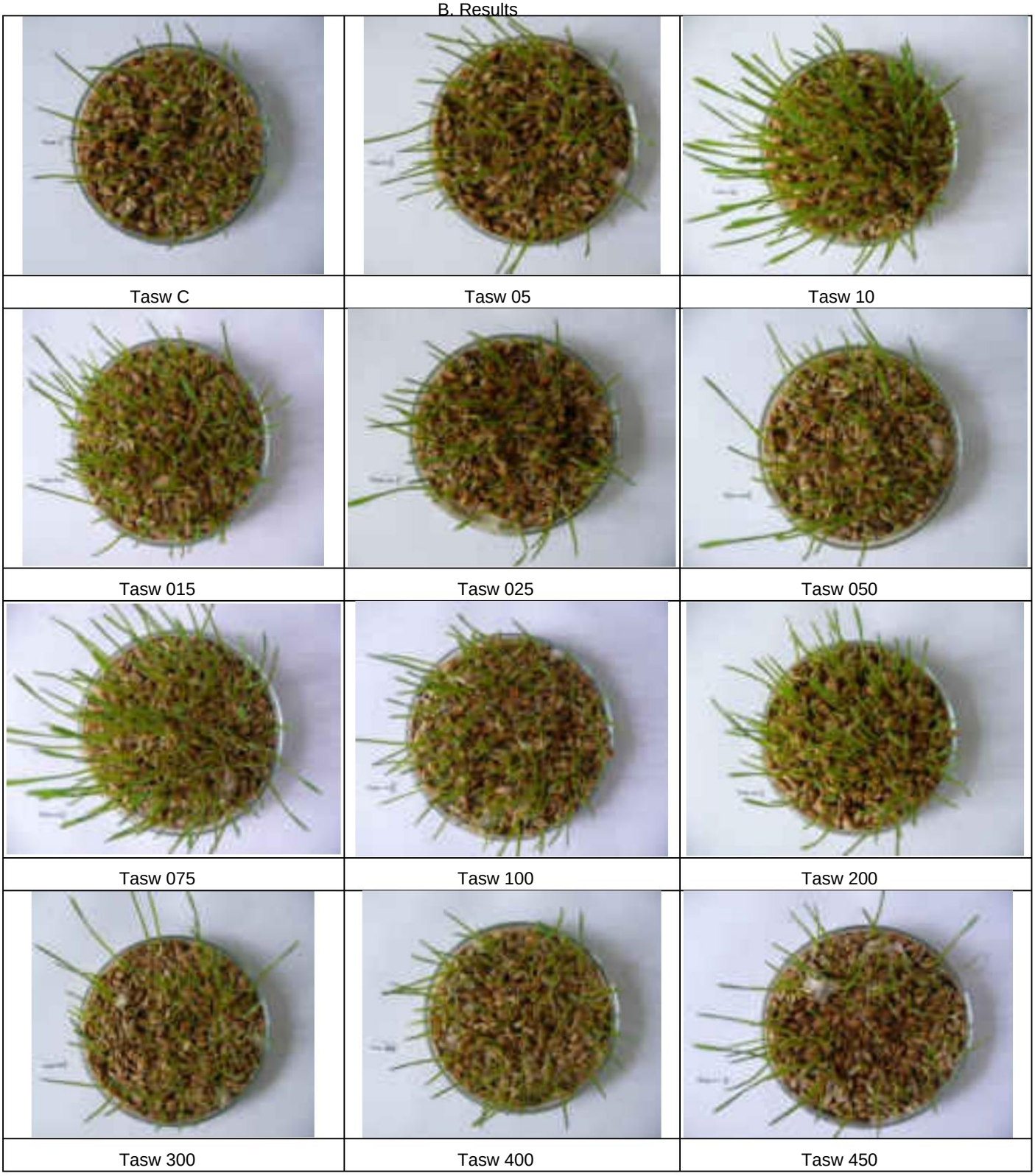

Figure 1 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 4 days from the start of the experiment weighing 10g (J .Šimková, 2021)

4 day Tasw0	Tasw5		Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450	
	+	++	+++	++	+	++	+++	++	++	+	++	+	

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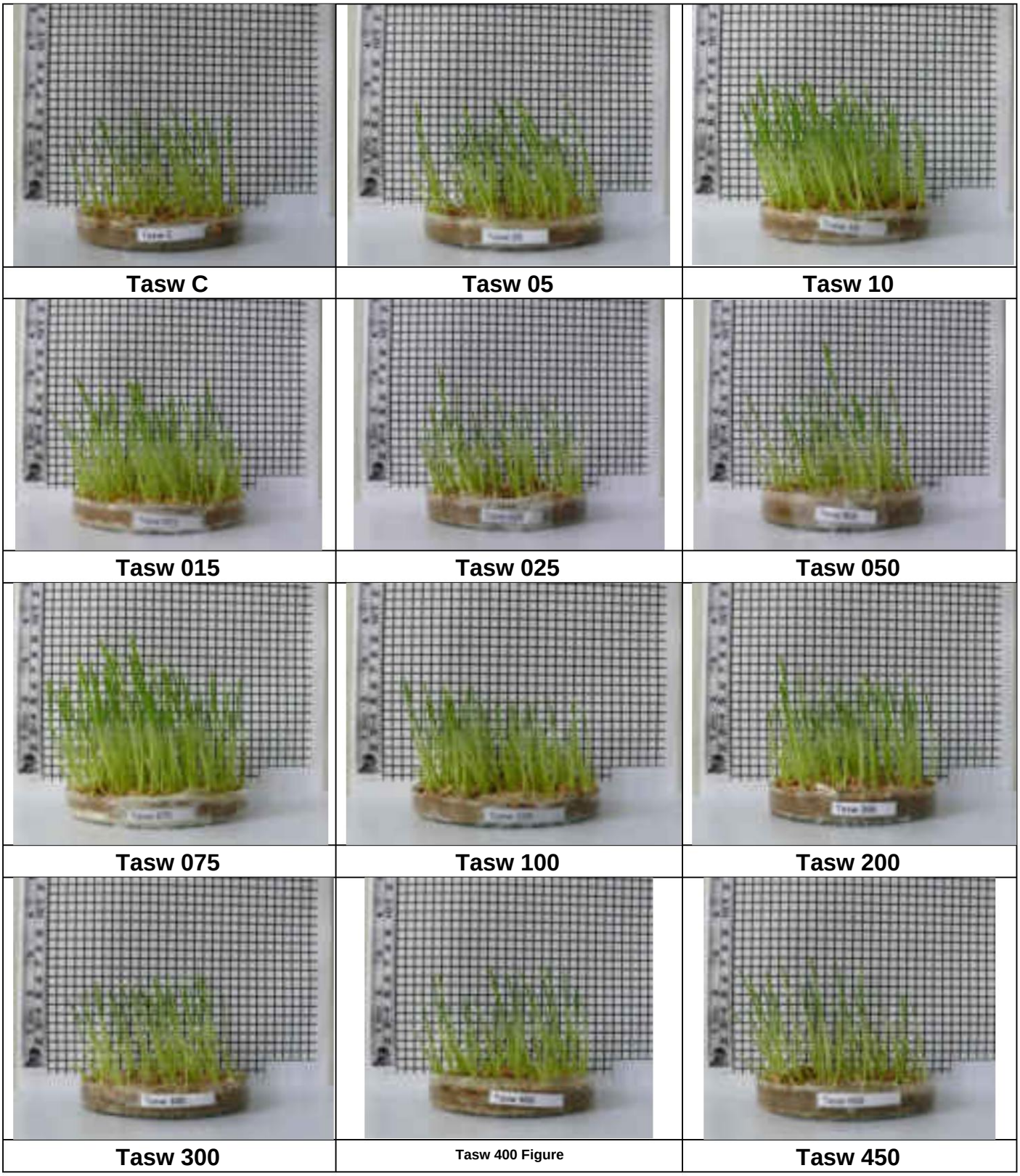

2 Comparison of tested variants with activated stable water at different pressures for the germination and emergence of spring wheat *(Triticum aestivum* L.) **seeds** in sand after 4 **days from the start of the experiment weighing 10 g (J .Šimková, 2021)**

4 day	**Taswc**	**Tasw5**	**Tasw10**	**Tasw15**	**Tasw25**	**Tasw50**	**Tasw75**	**Tasw100**	**Tasw200**	**Tasw300**	**Tasw400**	**Tasw450**
	+	++	+++	++	+	++	+++	++	++	+	++	+

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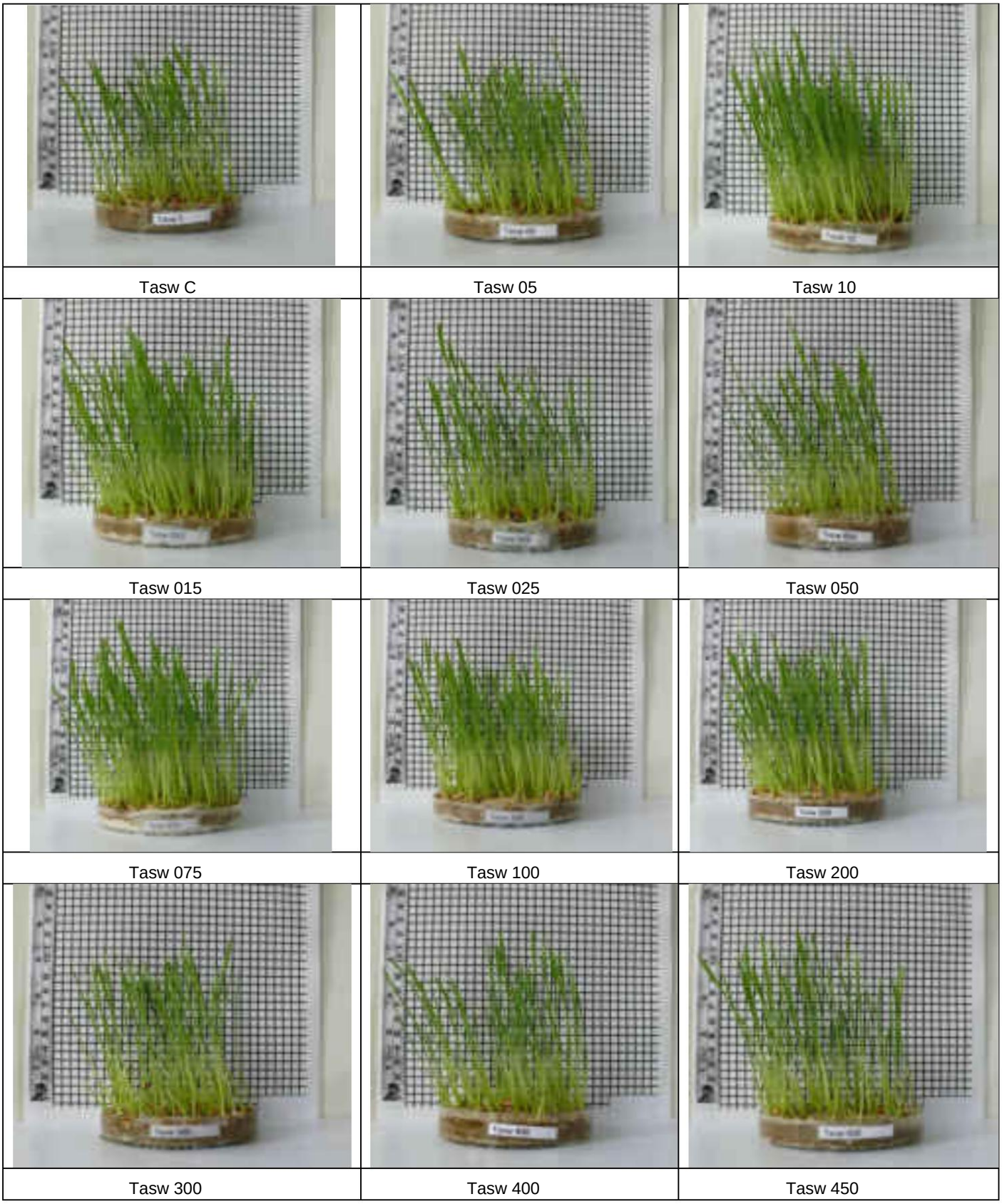

Figure 3 Comparison of tested variants with activated stable water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 5 days from the start of the experiment weighing 10 g (J .Šimková, 2021)

	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450		
5 day	+	++	+++	+++	+	+	+++	++	++	++	++	+	++	

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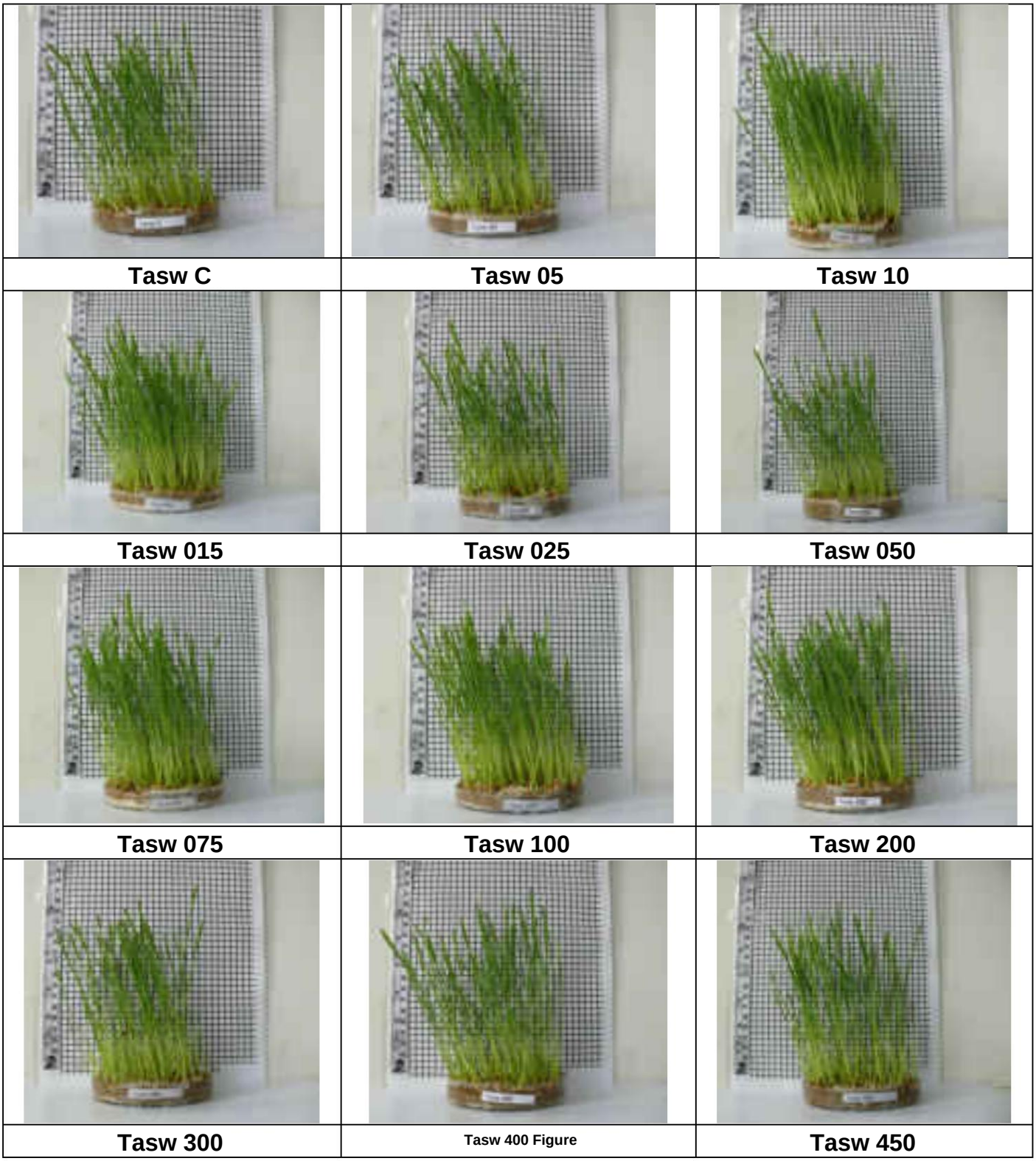

4 Comparison of tested variants with activated stable water at different pressures for the germination and emergence of spring wheat *(Triticum aestivum* L.) **seeds** in sand after 6 **days from the start of the experiment weighing 10 g (J .Šimková, 2021)**

6	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450				
day	+	++	+++	+++	+	+	+++	++	++	++	++	+				

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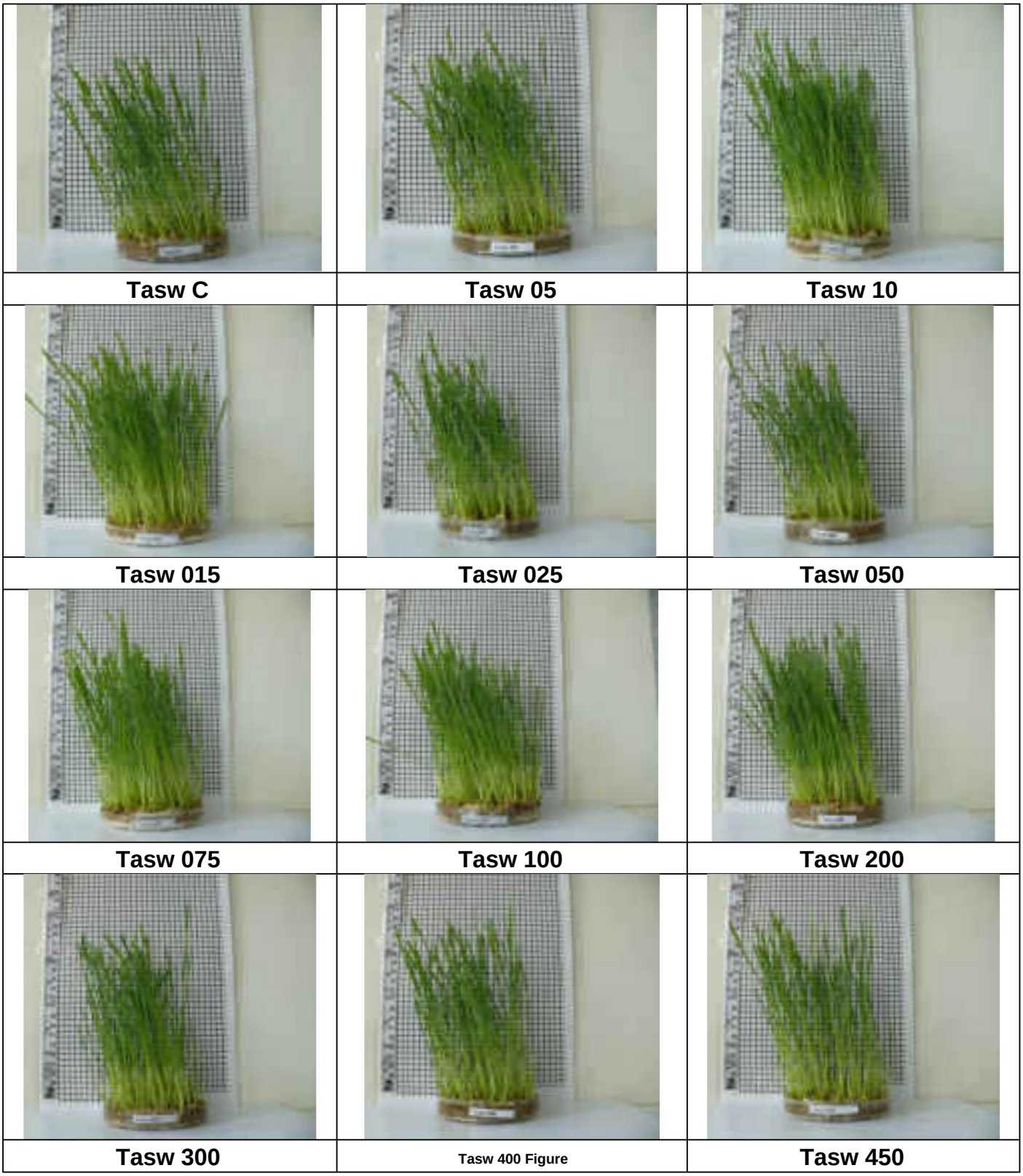

5 Comparison of tested variants with activated stable water at different pressures for the germination and emergence of spring wheat *(Triticum aestivum* L.) **seeds** in sand after 7 **days from the start of the experiment weighing 10 g (J .Šimková, 2021)**

7	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450				
day	+	++	+++	+++	+	+	+++	++	+++	++	+	+				

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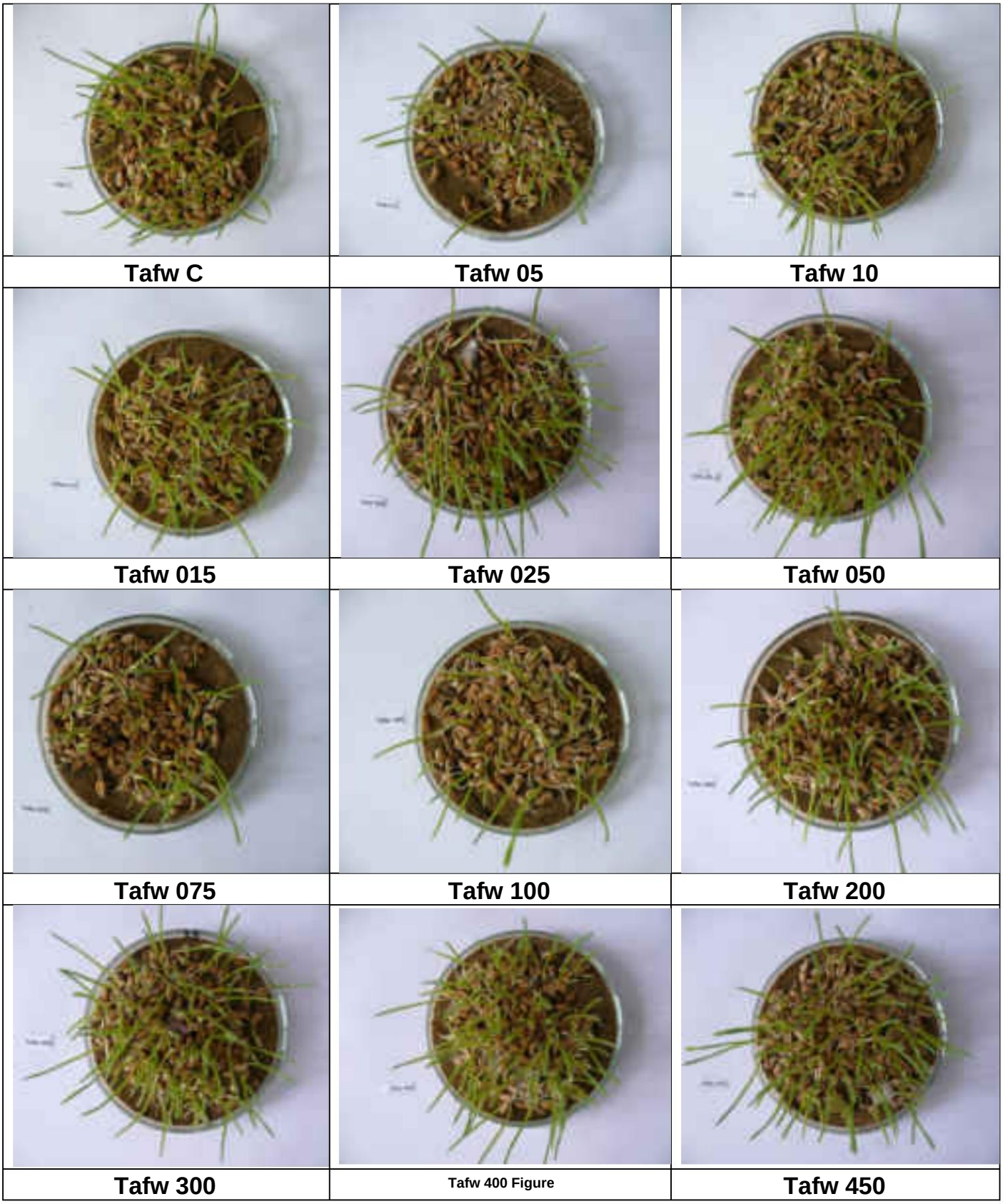

6 Comparison of the tested variants with activated fresh water at different pressures for the germination and **emergence of spring wheat** *(Triticum aestivum* L.) seeds in sand after 4 **days from the start of the experiment weighing 10 g (J .Šimková, 2021)**

4	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450				
day	++	+	++	++	++	++	++	+	+	+++	+++	+++	+++			

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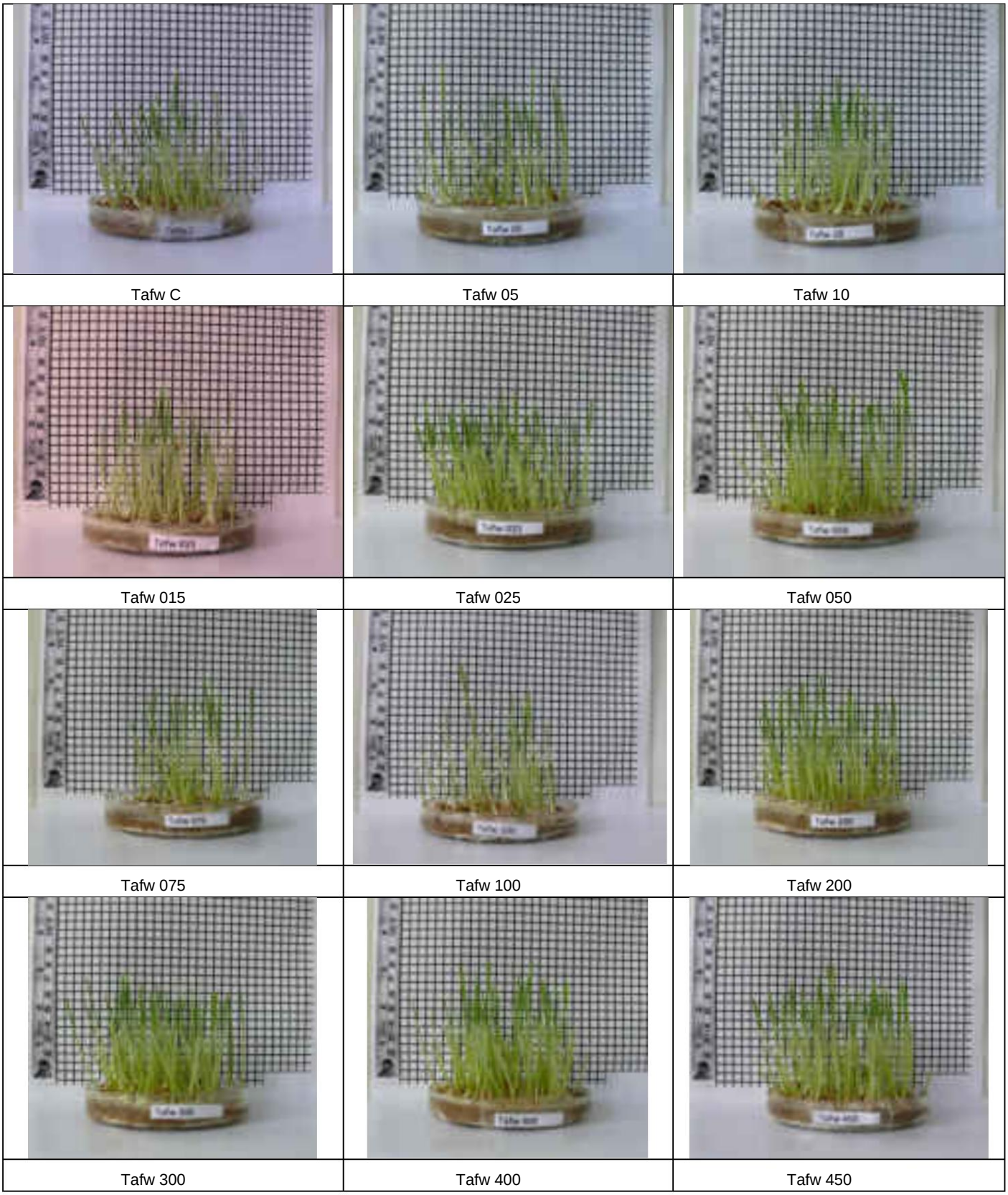

Figure 7 Comparison of tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 4 days from the start of the experiment weighing 10 g (J .Šimková, 2021)

4 day	Tasw c	Tasw5	Tasw 10	Tasw 15	Tasw 25	Tasw 50	Tasw 75	Tasw 100	Tasw 200	Tasw 300	Tasw 400	Tasw 450
	++	+	++	++	++	++	+	+	+++	+++	+++	+++

Machine Translated by Google

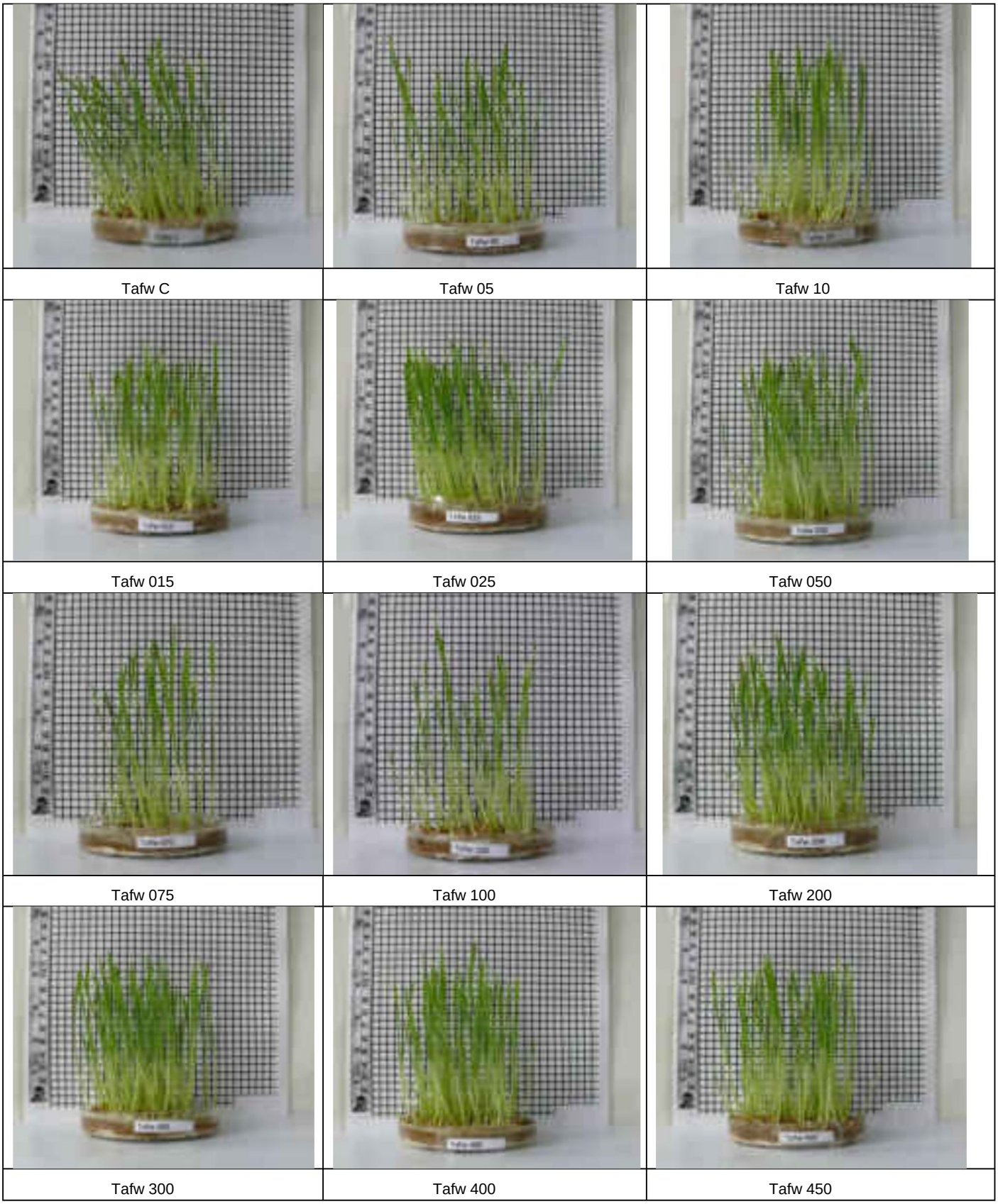

Figure 8 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 5 days from the start of the experiment, weighing 10 g (J. Šimková, 2021)

5th day of	Tasw c	Tasw5	Tasw 10	Tasw 15	Tasw 25	Tasw 50	Tasw 75	Tasw 100	Tasw 200	Tasw 300	Tasw 400	Tasw 450
	++	+	++	++	+++	++	+	+	+++	+++	+++	+++

Machine Translated by Google

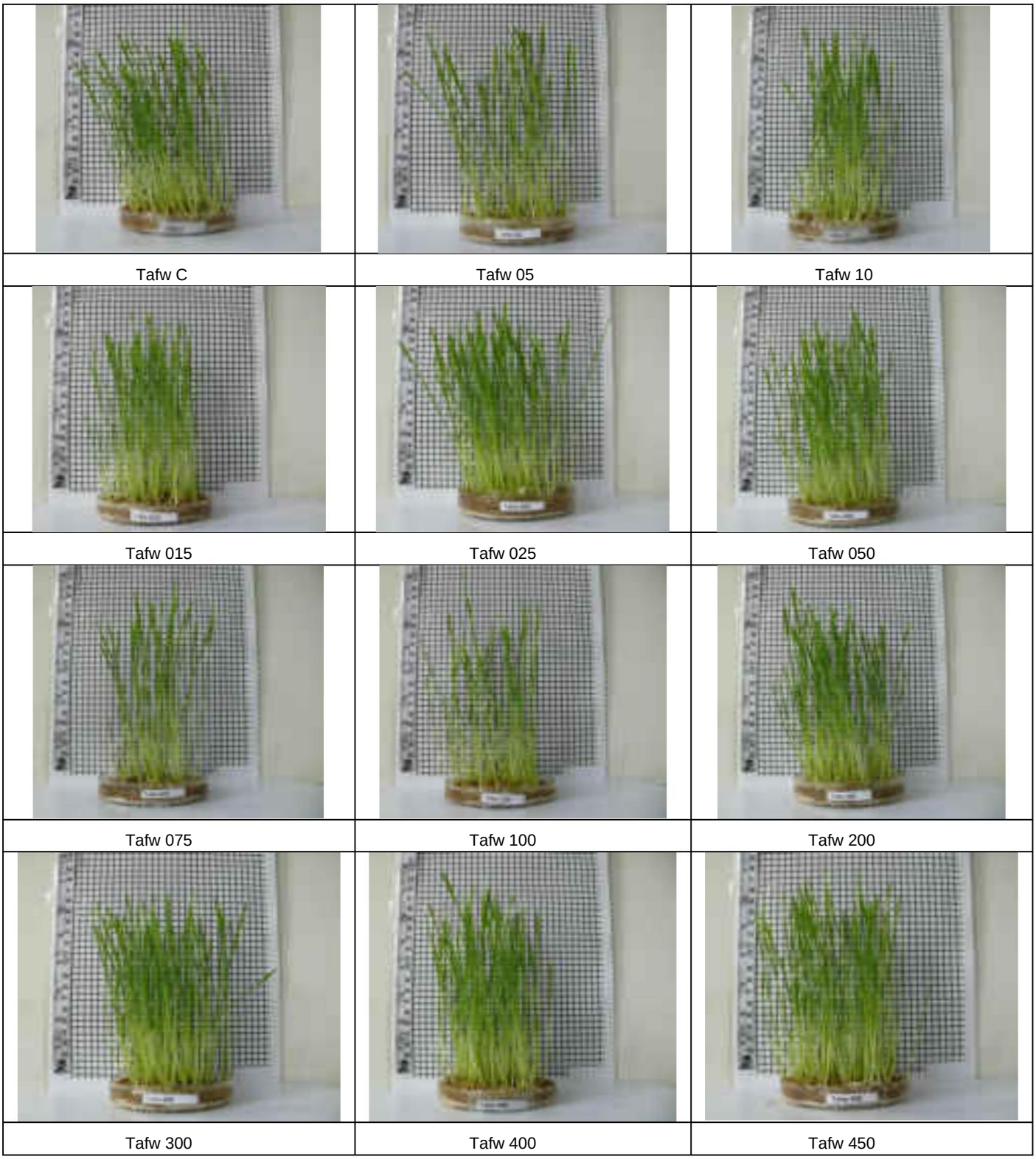

Figure 9 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of spring wheat (Triticum aestivum L.) seeds in sand after 6 days from the start of the experiment weighing 10 g (J .Šimková, 2021)

6 day	Taswc	Tasw5	Tasw10		Tasw15	Tasw25	Tasw 50	Tasw 75	Tasw 100	Tasw 200	Tasw 300	Tasw 400	Tasw 450
	++	+	+		++	+++	++	+	+	++	+++	+++	+++

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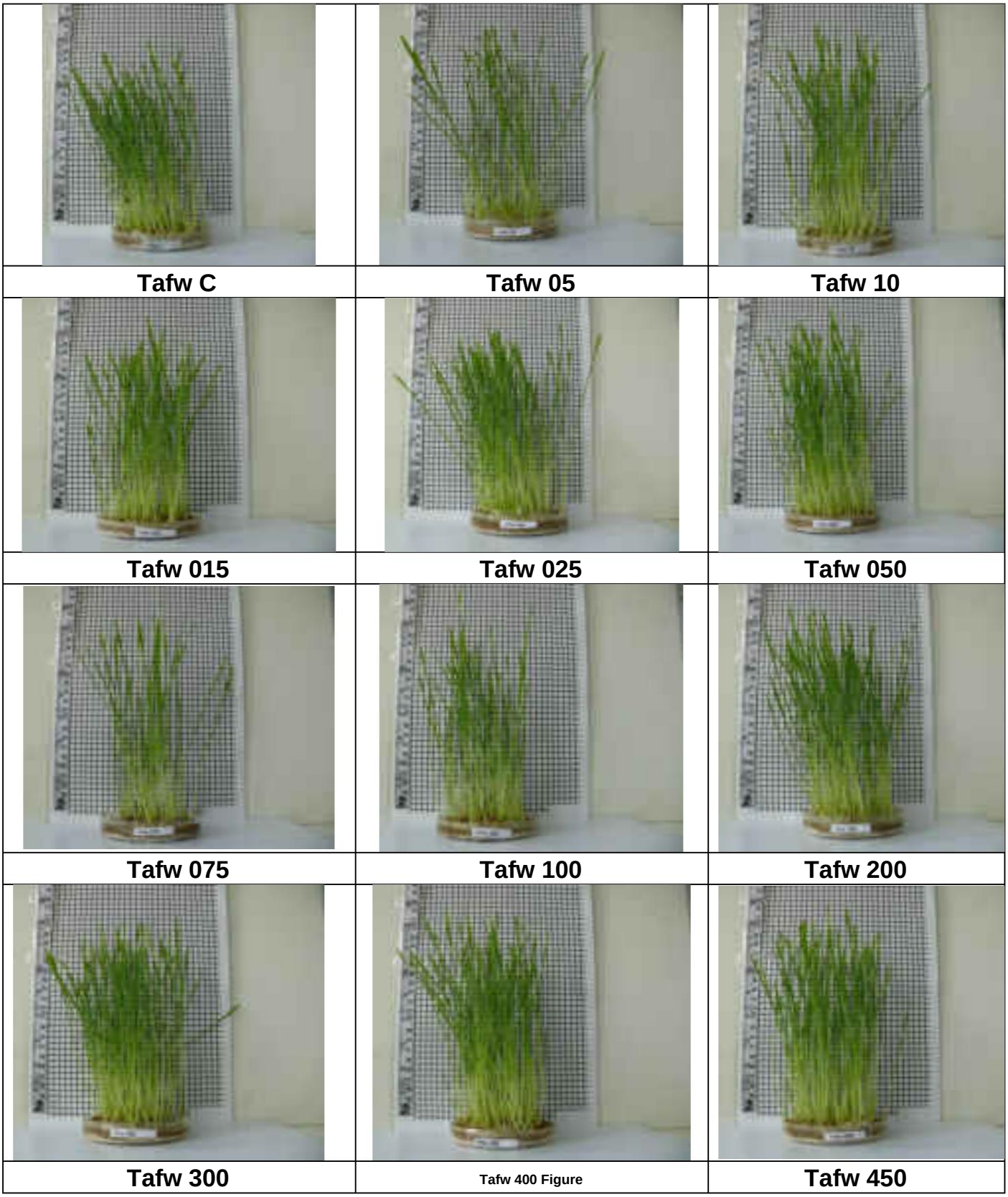

10 Comparison of tested variants with activated fresh water at different pressures for the germination and **emergence of spring wheat** *(Triticum aestivum* L.) seeds in sand after 7 **days from the start of the experiment weighing 10 g (J .Šimková, 2021)**

7 day	Taswc	Tasw5	Tasw 10	Tasw 15	Tasw 25	Tasw 50	Tasw 75	Tasw 100	Tasw 200	Tasw 300	Tasw 400	Tasw 450
	++	+	++	++	+++	++	+	+	++	+++	+++	+++

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C. Conclusion

Pšenica chart			Stable - activated-sw			13.8.2021			20.8.2021		AQIPS-02-E01b	
Day ŷ	Taswc	Tasw5	Tasw10	Tasw15	Tasw25	Tasw50	Tasw75	Tasw100	Tasw200	Tasw300	Tasw400	Tasw450		
4	+	++	+++	++	+	++	+++	++	++	+	++	+		
4	+	++	+++	++	+	++	+++	++	++	+	++	+		
5	+	++	+++	+++	+	+	+++	++	++	++	+	++		
6	+	++	+++	+++	+	+	+++	++	++	++	++	+		
7	+	++	+++	+++	+	+	+++	++	+++	++	+	+		

Pšenica chart			fresh - activated-fw			13.8.2021			20.8.2021		AQIPS-02-E01b	
Day ŷ	Tafwc	Tafw5	Tafw10	Tafw15	Tafw25	Tafw50	Tafw75	Tafw100	Tafw200	Tafw300	Tafw400	Tafw450		
4	++	+	++	++	++	++	++	+	+	+++	+++	+++	+++	
4	++	+	++	++	++	++	++	+	+	+++	+++	+++	+++	
5	++	+	++	++	+++	++	+	+	+	+++	+++	+++	+++	
6	++	+	+	++	+++	++	+	+	+	++	+++	+++	+++	
7	++	+	++	++	+++	++	+	+	+	++	+++	+++	+++	

Marking		Plant growth intensity
BR -		No growth
PR	+	Slow plant growth - Blockage of growth
NO ++		Normal plant growth - Plant growth
AND	+++	Intensive plant growth
ER ++++ Extremely intensive growth		

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Effect of activated water by the IPS system on germination and growth of maize *(Zea mays* L.) AQIPS-02-E02a

Contents

A. Methodology of the experiment 1. Aim

of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species

2. Plant species: Corn *(Zea mays* L.)

3. Designation of plant species in experiments: Am

4. Date of starting the experiment: 22.6.2021

5. Date of ending the experiment: 2.7.2021 6.

Method of growing plants: Petri dishes, sand substrate, 10 seeds laboratory conditions 7. Evaluation of the experiment: Image analysis

8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in IPS device experiments Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Variant description	Designation	Variant description
Zmfw-c	Tap water - control	Zmsw-c	Tap water is stagnant - check
Zmfw05	Created water at a pressure of 05Pa	Zmsw05	Created water at a pressure of 05Pa
Zmfw10	Created water at a pressure of 10Pa	Zmsw10	Created water at a pressure of 10Pa
Zmfw15	Created water at a pressure of 15Pa	Zmsw15	Created water at a pressure of 15Pa
Zmfw25	Created water at a pressure of 25Pa	Zmsw25	Created water at a pressure of 25Pa
Zmfw50	Created water at a pressure of 50Pa	Zmsw50	Created water at a pressure of 50Pa
Zmfw75	Created water at a pressure of 75Pa	Zmsw75	Created water at a pressure of 75Pa
Zmfw100	Created water at a pressure of 100Pa	Zmsw100	Created water at a pressure of 100Pa
Zmfw200	Created water at a pressure of 200Pa	Zmsw200	Created water at a pressure of 200Pa
Zmfw300	Created water at a pressure of 300Pa	Zmsw300	Created water at a pressure of 300Pa
Zmfw400	Created water at a pressure of 400Pa	Zmsw400	Created water at a pressure of 400Pa
Zmfw450	Created water at a pressure of 450 Pa	Zmsw450	Created water at a pressure of 450 Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Designation		Characteristics of samples
NK -		Seeds without germination
ZK +		Beginning of germination
PK ++		Full germination
PL	+++	First leaves

10.2. Effects on growth - plant height when observed

Designation	Intensity of plant growth
BR - No growth	PR Slow plant growth
- Blockage of growth	
NO ++	Normal plant growth - Plant growth
AND +++	Intensive plant growth
IS ++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

Zmsw C

Zmsw 05

Zmsw 010

Zmsw 015

Zmsw 025

Zmsw 050

Zmsw 075

Zmsw 100

Zmsw 200

Zmsw 300

Zmsw 400 Figure

Zmsw 450

1 Comparison of the tested variants with activated stable water at different pressures for the germination and **emergence of corn** *(Zea mays* L.) seeds **after 2 days from the start of the experiment (J. Šimková, 2021)**

2 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450			
	++	++	++	++	++	++	++	+	+	++	++	+++	+++		

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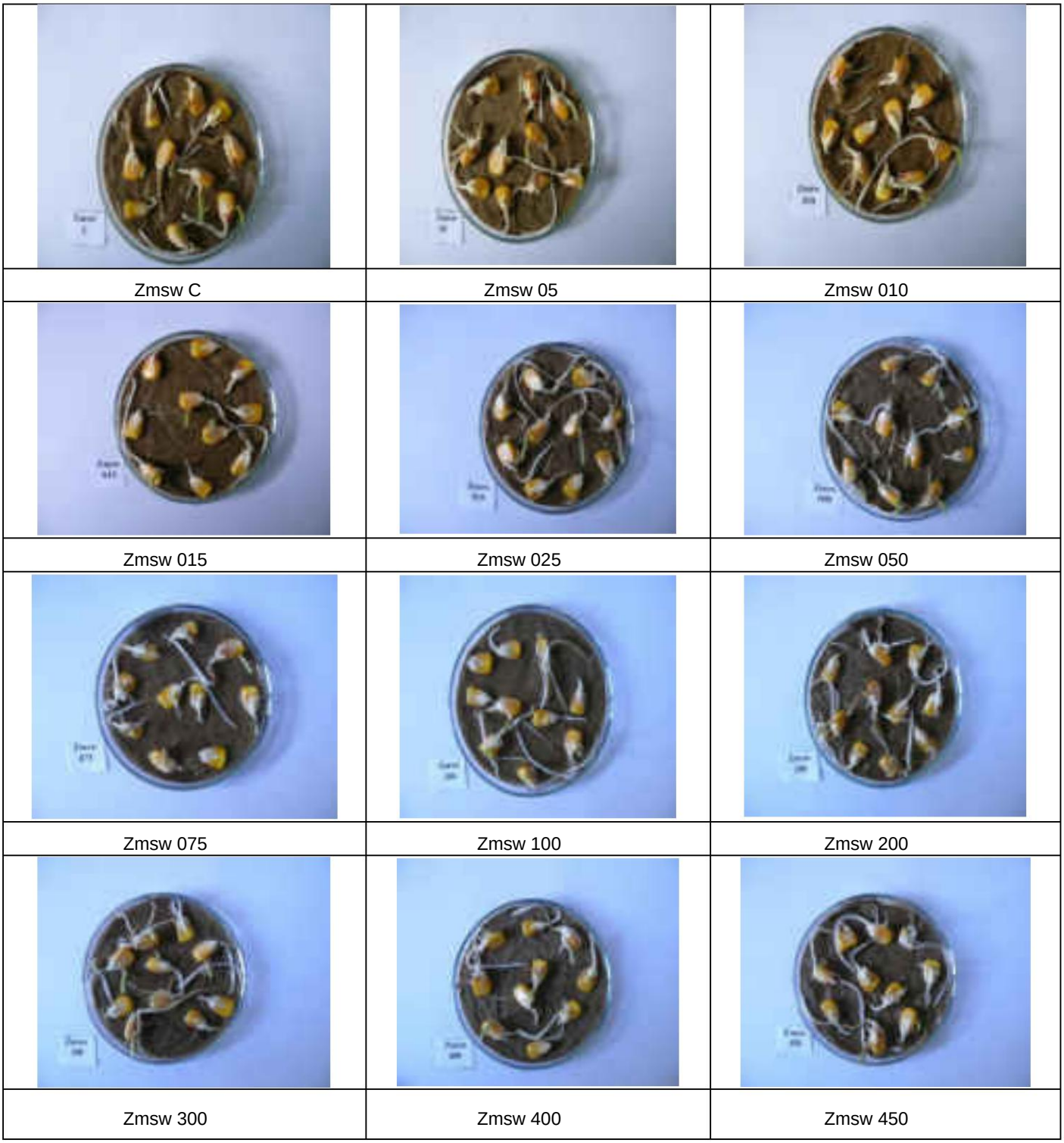

Figure 2 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 3 days from the start of the experiment (J. Šimková, 2021)

3 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450
	++	++	++	+	+++	+++	+	+	++	++	++	++

Machine Translated by Google

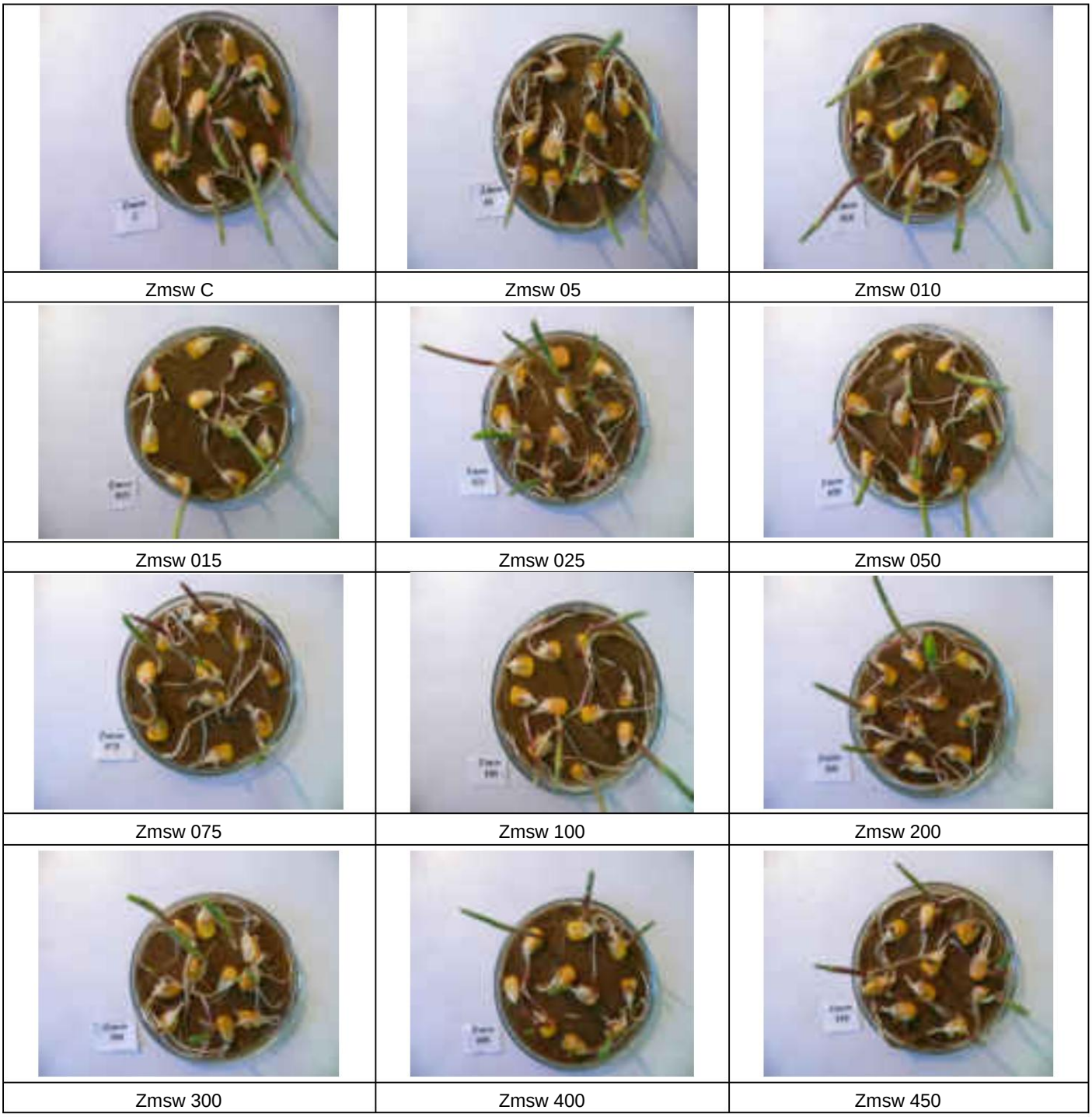

Figure 3 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 4 days from the start of the experiment (J. Šimková, 2021)

4 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450
	+++	+++	+++	+	+++	+++	++	+	++	++	++	++

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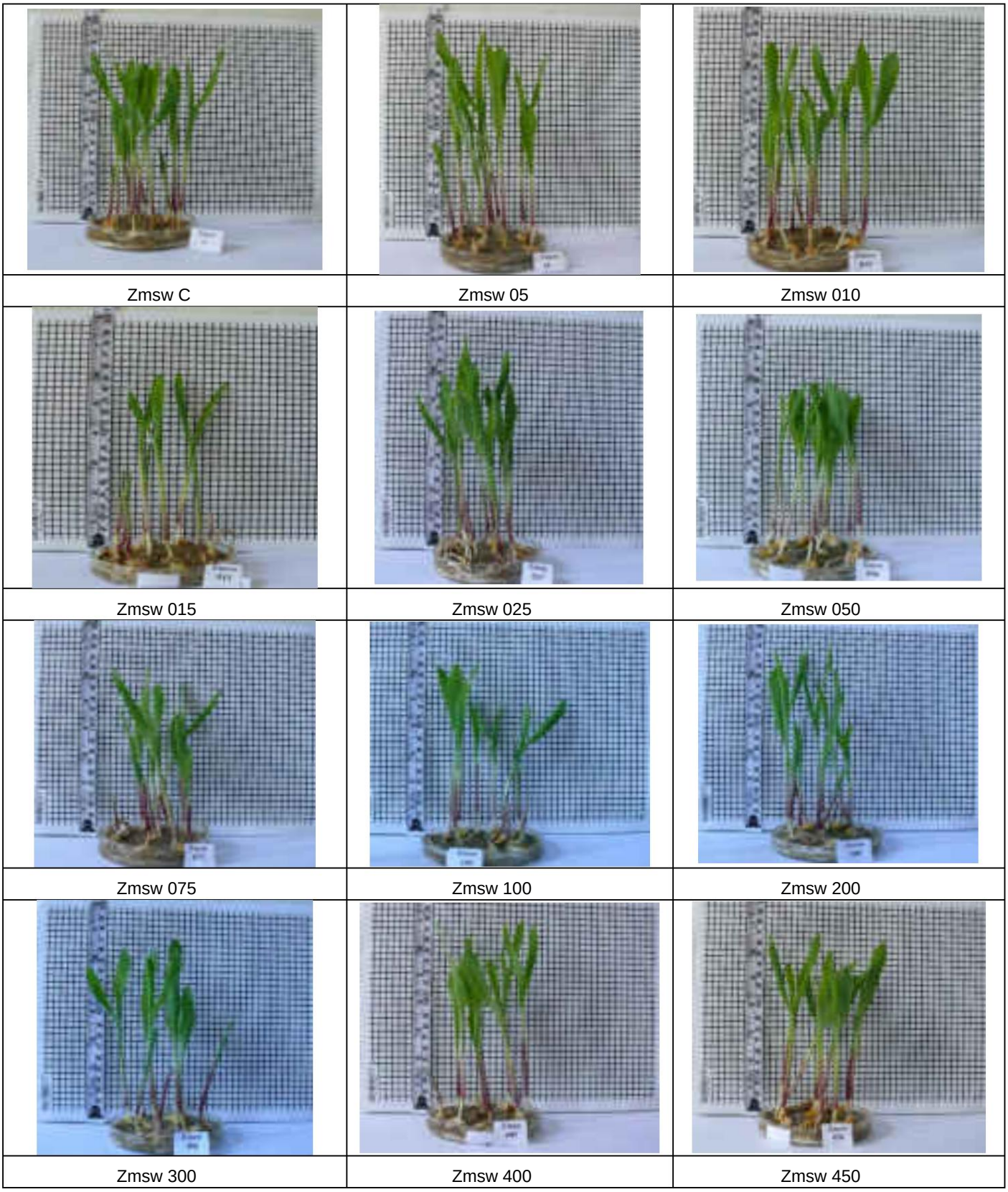

Figure 4 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 6 days from the start of the experiment (J. Šimková, 2021)

6 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450	
	++	++	+++	+	+++	++	++	+	++	++	++	++	

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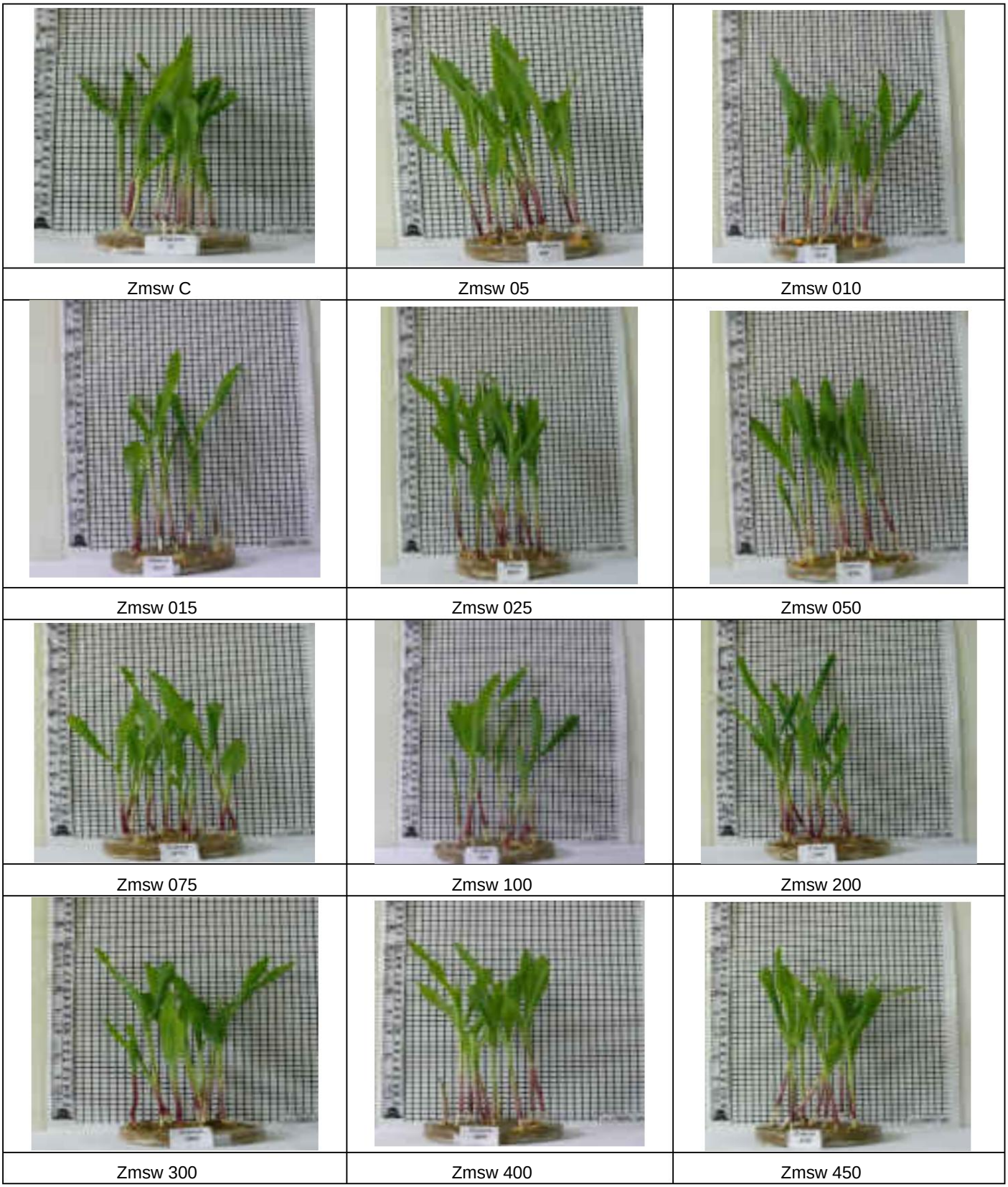

Figure 5 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 7 days from the start of the experiment (J. Šimková, 2021)

7 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450			
	++	++	++	+	++	++	++	+	++	++	++	++			

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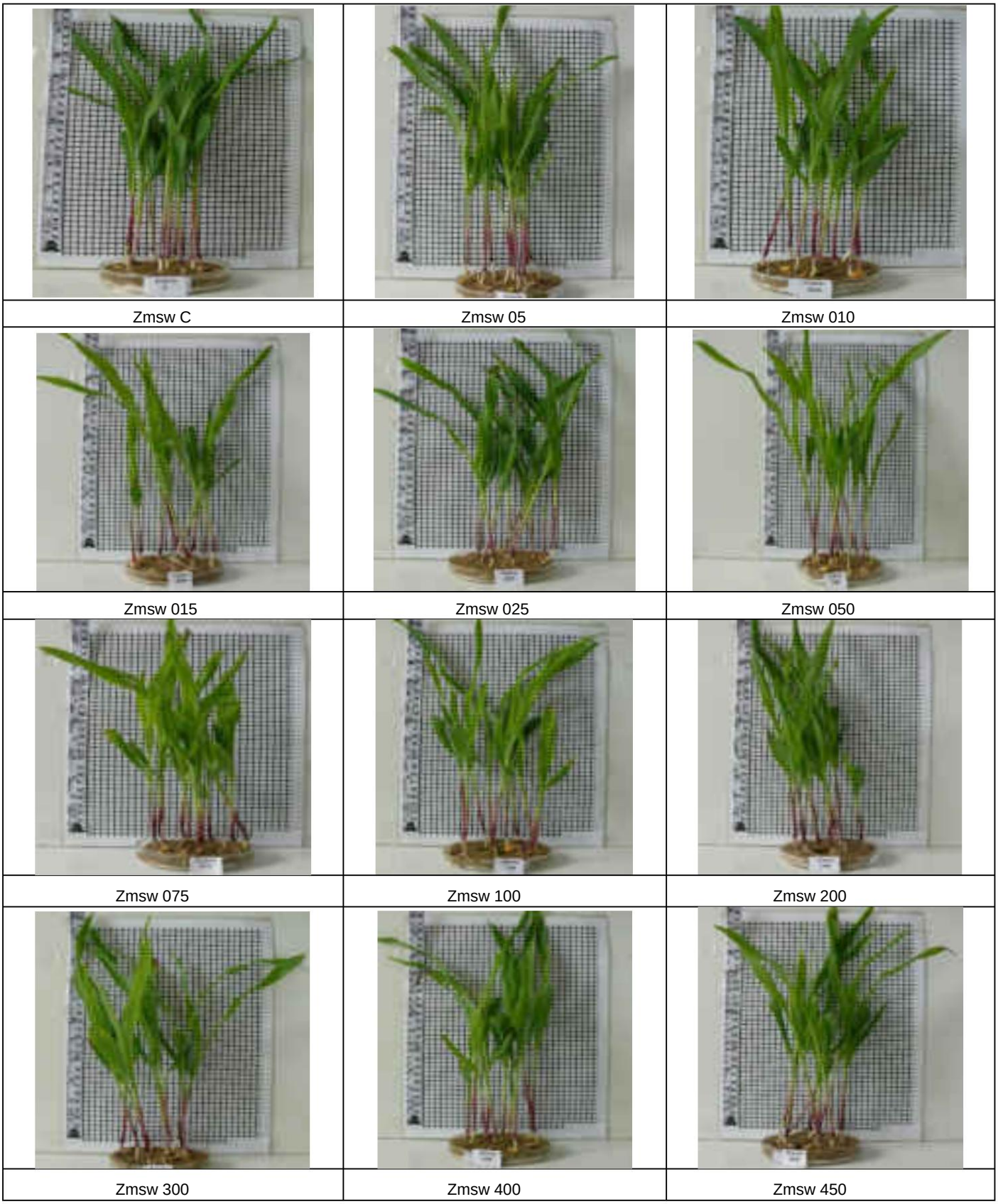

Figure 6 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 10 days from the start of the experiment (J. Šimková, 2021)

10 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450	
	++	++	++	+	++	++	++	+	++	++	++	++	

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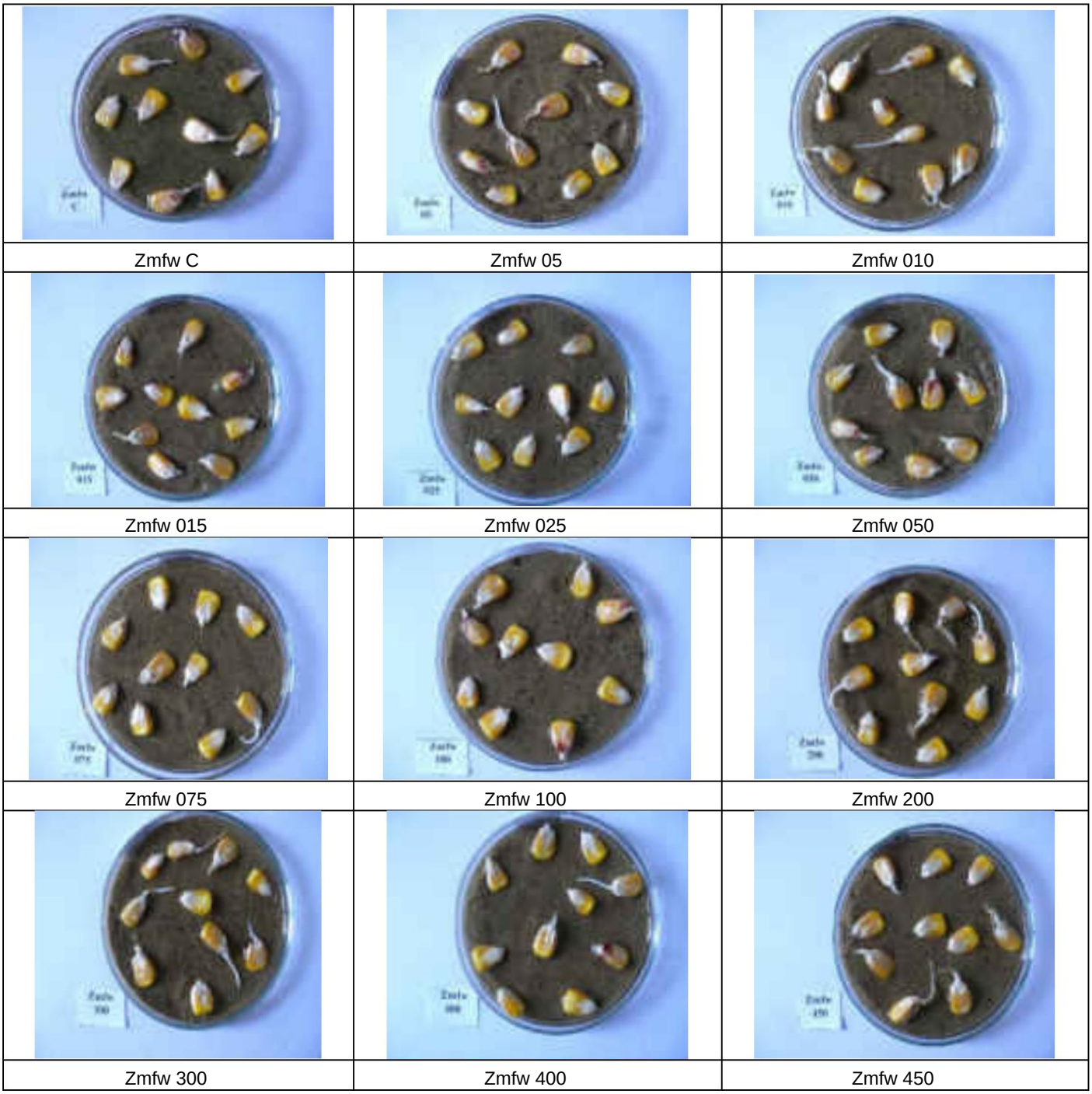

Figure 7 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 2 days from the start of the experiment (J. Šimková, 2021)

2 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
	++	++	+++	+	+	++	+	+	++	++	+	++				

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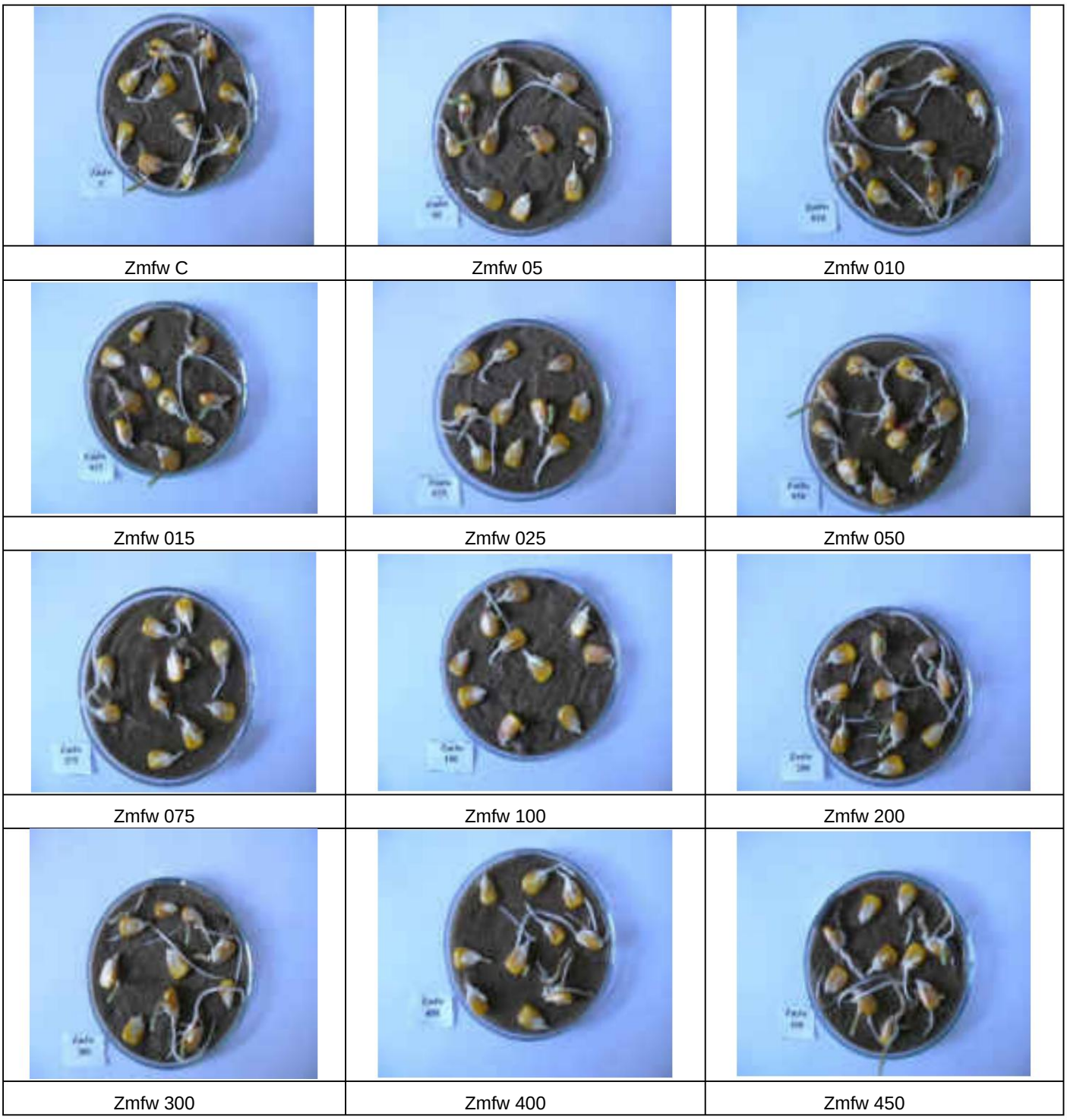

Figure 8 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 3 days from the start of the experiment (J. Šimková, 2021)

3 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
	++	++	++	+++	++	++	++	++	+	+	++	++	+	++		

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Zmfw C	Zmfw 05	Zmfw 010
		
Zmfw 015	Zmfw 025	Zmfw 050
		
Zmfw 075	Zmfw 100	Zmfw 200
		
Zmfw 300	Zmfw 400	Zmfw 450

Figure 9 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 4 days from the start of the experiment (J. Šimková, 2021)

4 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
	++	++	++	+++	++	+	+++	++	+	+++	+++	+	++			

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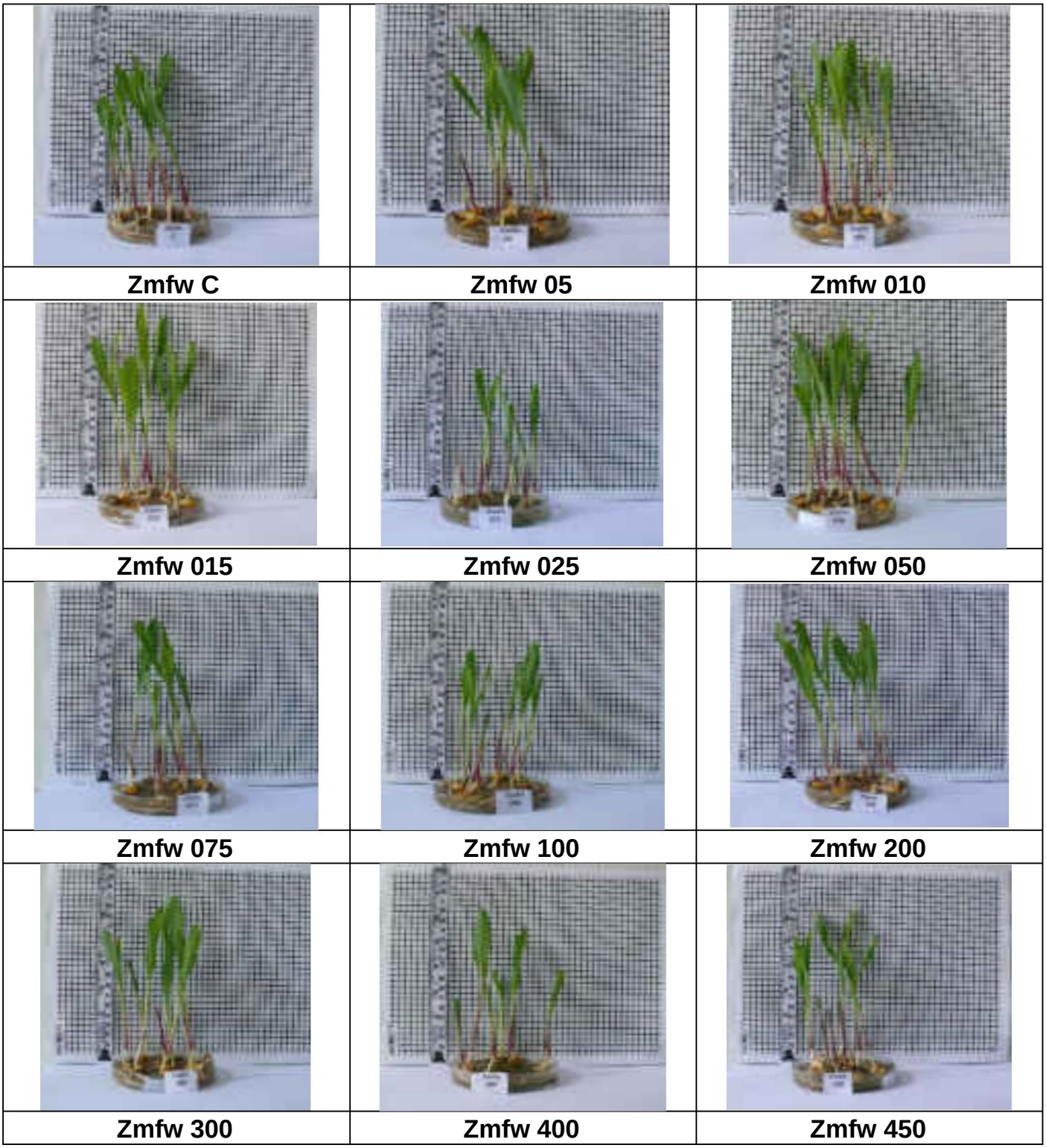

Figure 10 Comparison of the tested variants with **activated fresh water at different pressures for the germination** and **emergence of corn** *(Zea mays* L.) seeds after 6 **days from the start of the experiment (J. Šimková, 2021)**

6 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450			
	++	++	++	+++	++	+	+++	++	+	++	++	+	++		

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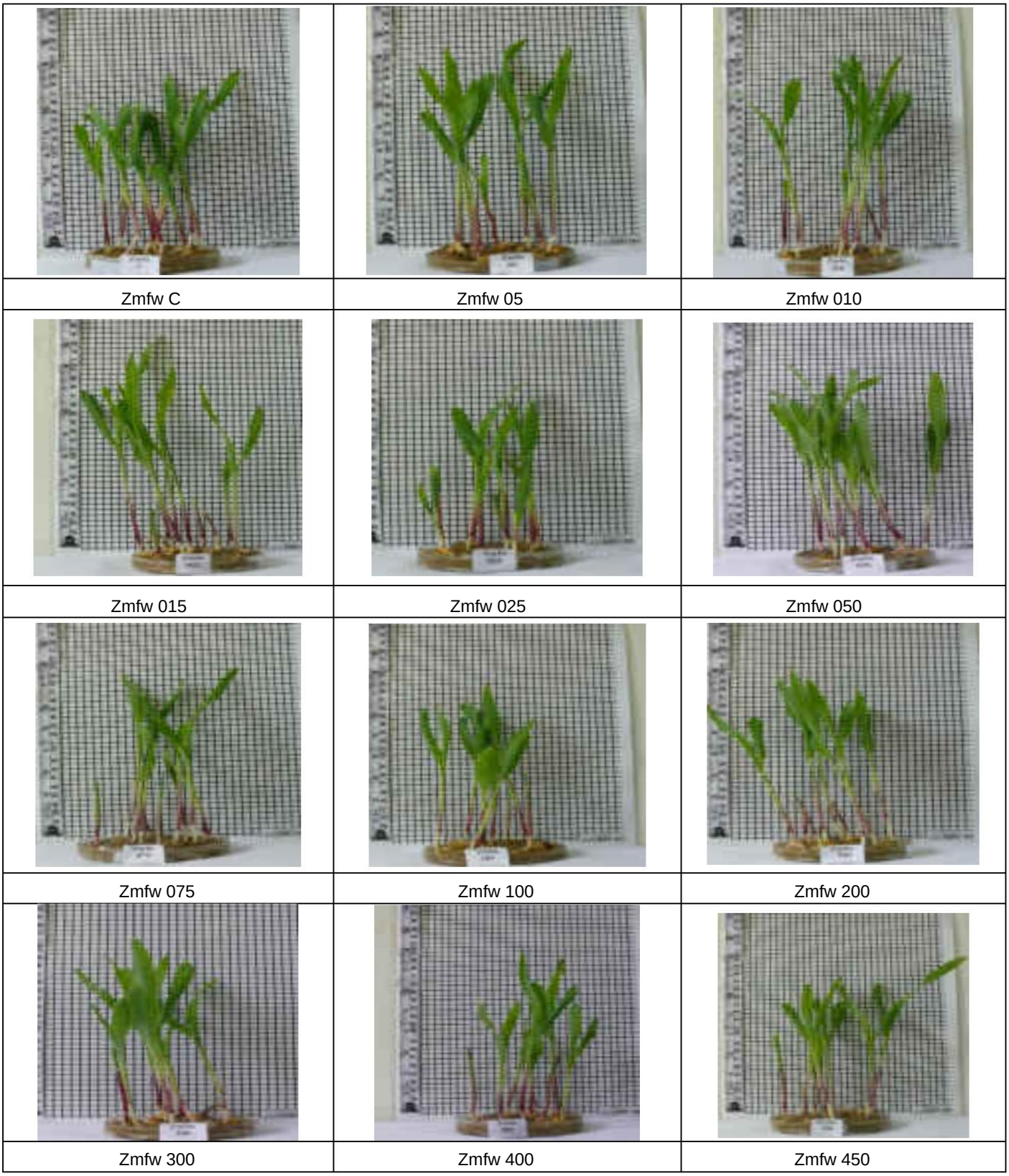

Figure 11 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 7 days from the start of the experiment (J. Šimková, 2021)

7 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
	++	++	++	++	++	+	+++	+	++	++	++	++	+	+		

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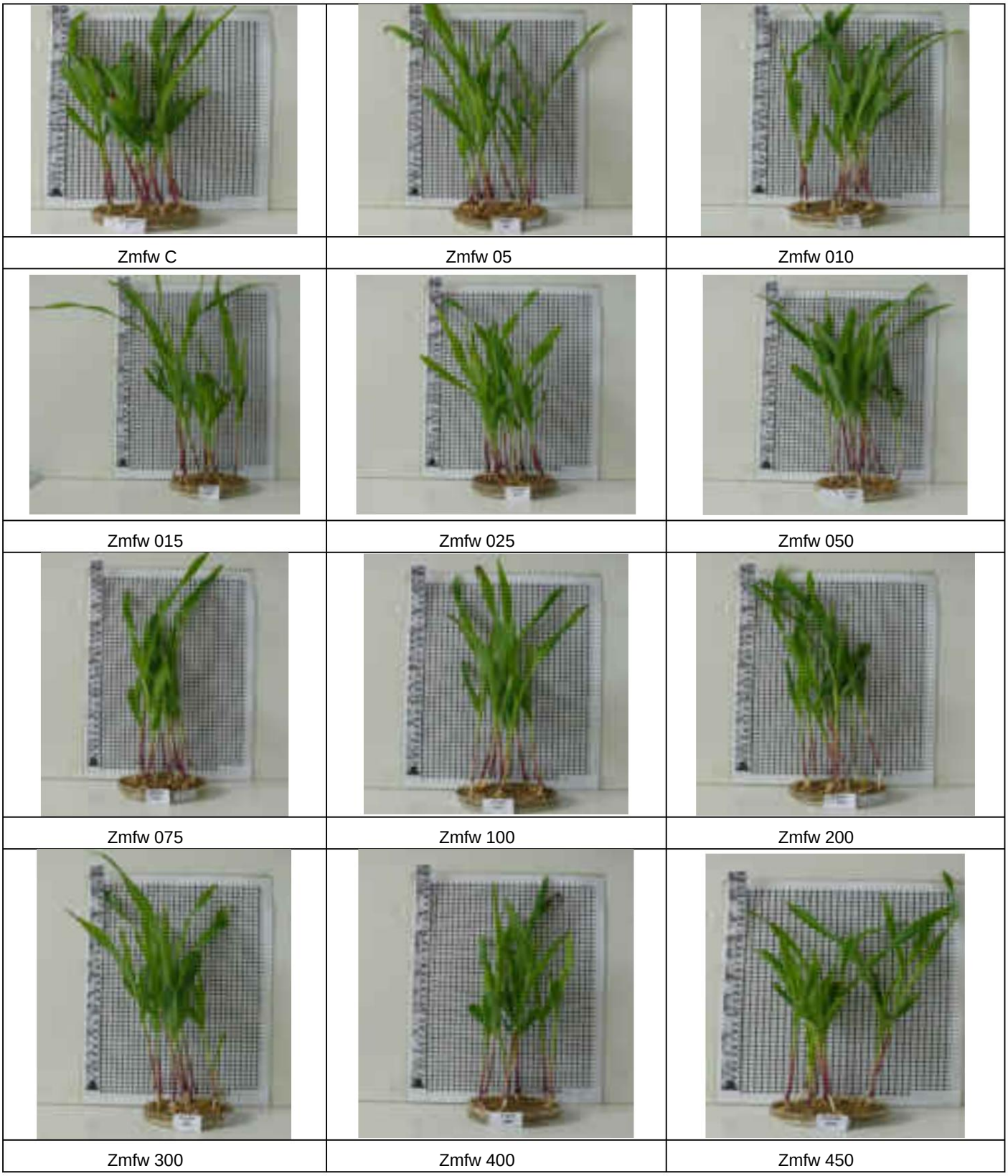

Figure 12 Comparison of the tested variants with activated fresh water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 10 days from the start of the experiment (J. Šimková, 2021)

10 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450		
	++	++	++	++	+	+++	+	++	++	++	++	++	++	

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C. Conclusions

Corn sown			stable - activated-sw 22.6.2021						2.7.2021		AQIPS-02-E02a	
Day ŷ	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450				
2	++	++	++	++	++	++	++	+	+	++	++	+++	+++			
3	++	++	++	+	+++	+++	+	+	++	++	++	++				
4	+++	+++	+++	+	+++	+++	++	+	++	++	++	++				
6	++	++	+++	+	+++	++	++	+	++	++	++	++				
7	++	++	++	+	++	++	++	+	++	++	++	++				
10	++		++	++	+	++	++	++	+	++	++	++				
Corn sown			fresh - activated-fw 6/22/2021						2.7.2021		AQIPS-02-E02a	
Day ŷ	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
2	++	++	+++	+	+	++	+	+	++	++	+	++				
3	++	++	+++	++		++	++	+	+	++	++	+	++			
4	++	++	+++	++	+	+++	++	+	+++	+++	+	++				
6	++	++	+++	++	+	+++	++	+	++	++	+	++				
7	++	++	++	++	+	+++	+	++	++	++	+	+				
10	++		++	++	+	+++	+	++	++	++	++	++				

Designation		Intensity of plant growth
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
NR	++	Normal plant growth - Plant growth
IR	+++	Intensive plant growth
ER	++++	Extremely intensive growth

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Effect of activated water by the IPS system on the germination and growth of maize (Zea mays L.) AQIPS-02-E02b Contents

A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species
2. Plant species: Corn (Zea mays L.)
3. Designation of the plant species in the experiments: Zm 4. Date of starting the experiment: 20/8/2021 5. Date of ending the experiment: 2/9/2021 6. Method of growing plants: Petri dishes, sand substrate, 10 seeds, laboratory conditions
7. Evaluation of the experiment: Image analysis
8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in experiments with an IPS device Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Description of the variant	Designation	Variant description
Zmfw-c	Tap water - control	Zmsw-c	Tap water is stagnant - check
Zmfw05	Created water at a pressure of 05Pa	Zmsw05	Created water at a pressure of 05Pa
Zmfw10	Created water at a pressure of 10Pa	Zmsw10	Created water at a pressure of 10Pa
Zmfw15	Created water at a pressure of 15Pa	Zmsw15	Created water at a pressure of 15Pa
Zmfw25	Created water at a pressure of 25Pa	Zmsw25	Created water at a pressure of 25 Pa
Zmfw50	Created water at a pressure of 50Pa	Zmsw50	Created water at a pressure of 50 Pa
Zmfw75	Created water at a pressure of 75Pa	Zmsw75	Created water at a pressure of 75Pa
Zmfw100	Created water at a pressure of 100Pa	Zmsw100	Created water at a pressure of 100Pa
Zmfw200	Created water at a pressure of 200Pa	Zmsw200	Created water at a pressure of 200Pa
Zmfw300	Created water at a pressure of 300Pa	Zmsw300	Created water at a pressure of 300Pa
Zmfw400	Created water at a pressure of 400Pa	Zmsw400	Created water at a pressure of 400Pa
Zmfw450	Created water at a pressure of 450Pa	Zmsw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		Characteristics of samples
etc	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

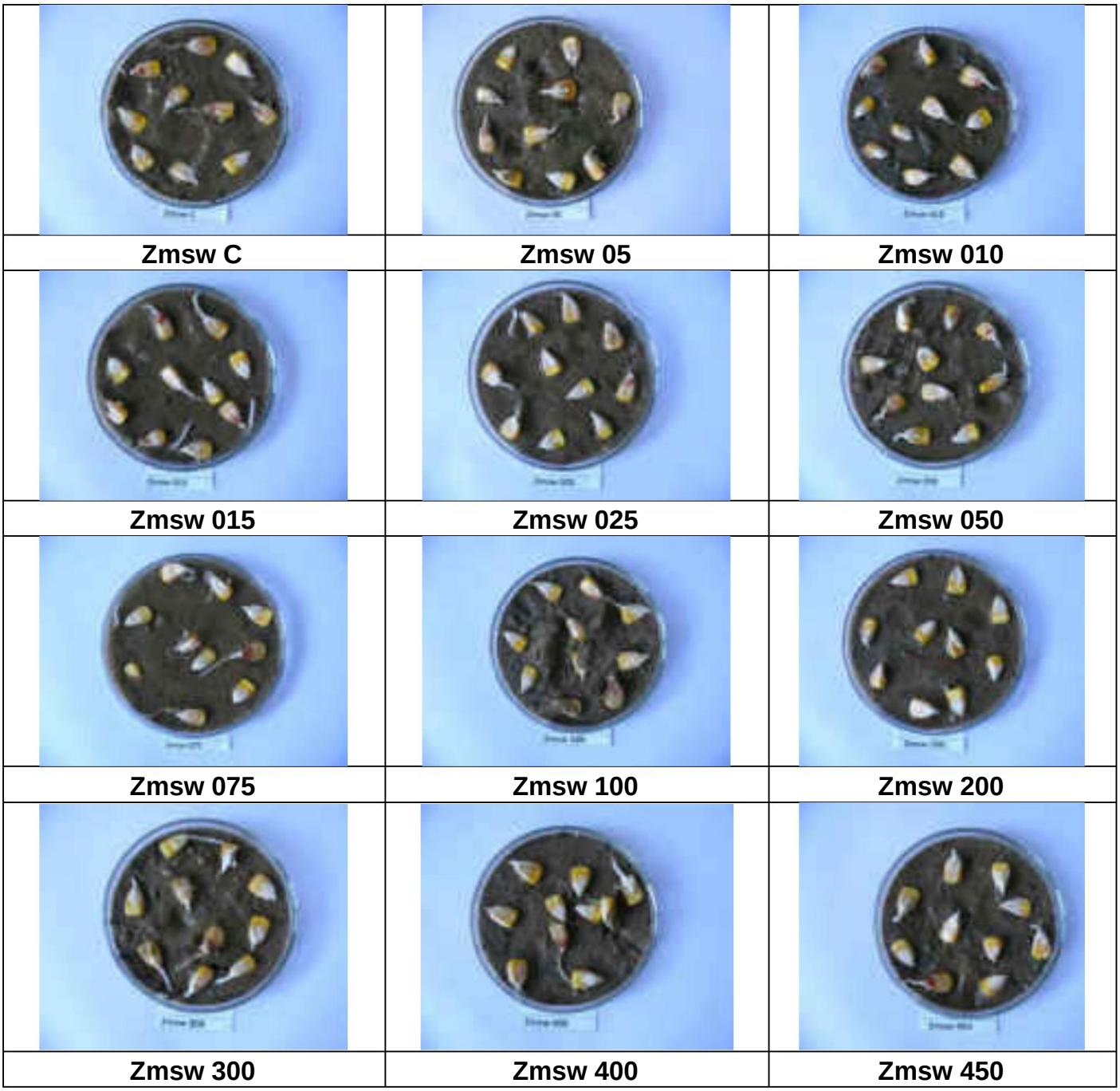

Figure 1 Comparison of the tested variants with activated stable water at different pressures for the germination and **emergence of corn** *(Zea mays* L.) seeds **after 3 days from the start of the experiment (J. Šimková, 2021)**

3 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450			
	++	++	++	++	++	++	++	++	++	++	+	++	++	++	

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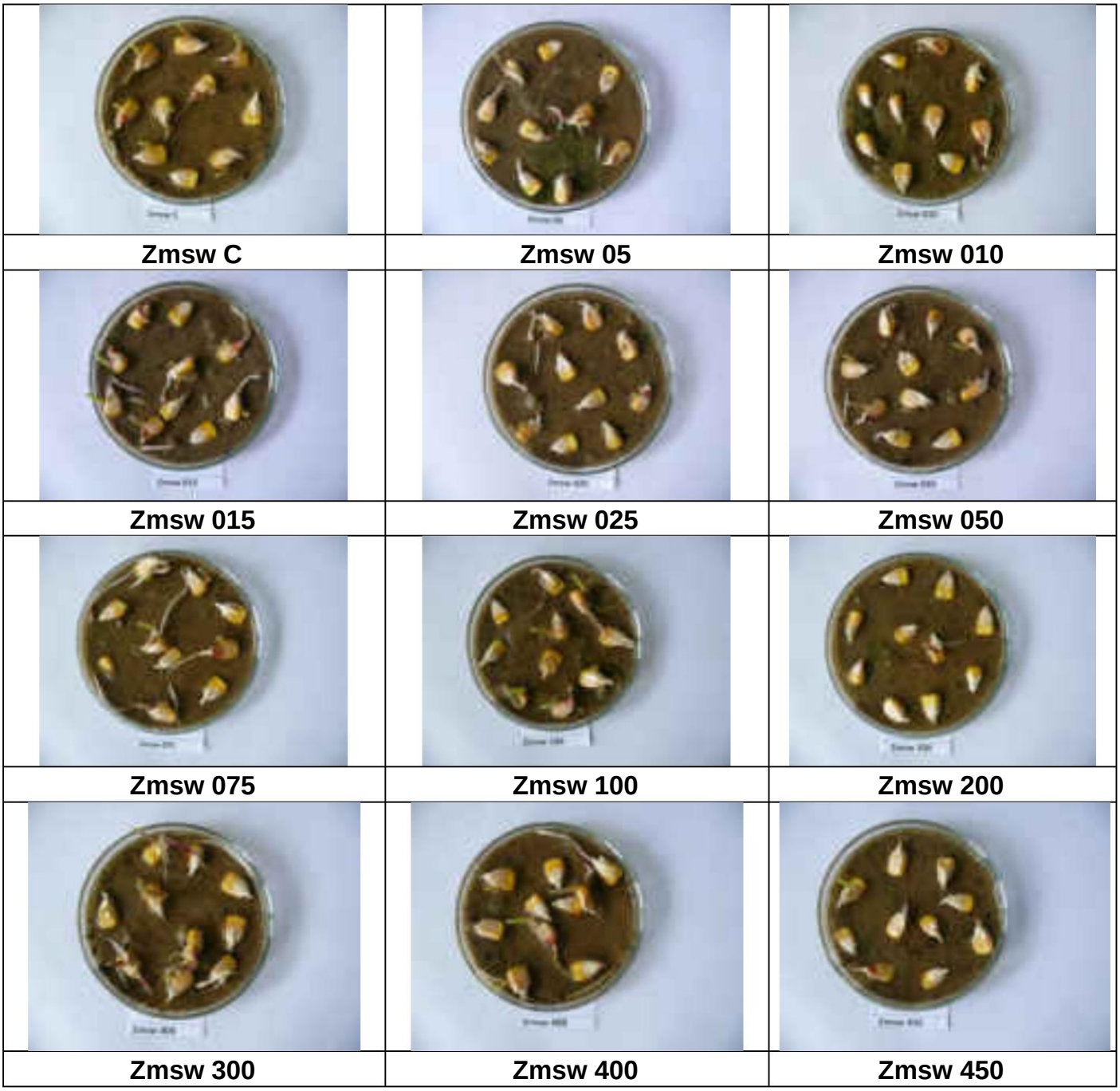

Figure 2 Comparison of the tested variants with activated stable water at different pressures for the germination and **emergence of corn** *(Zea mays* L.) seeds after 4 **days from the start of the experiment (J. Šimková, 2021)**

4 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450			
	++	++	+	++	+	+	++	++	+	++	++	+			

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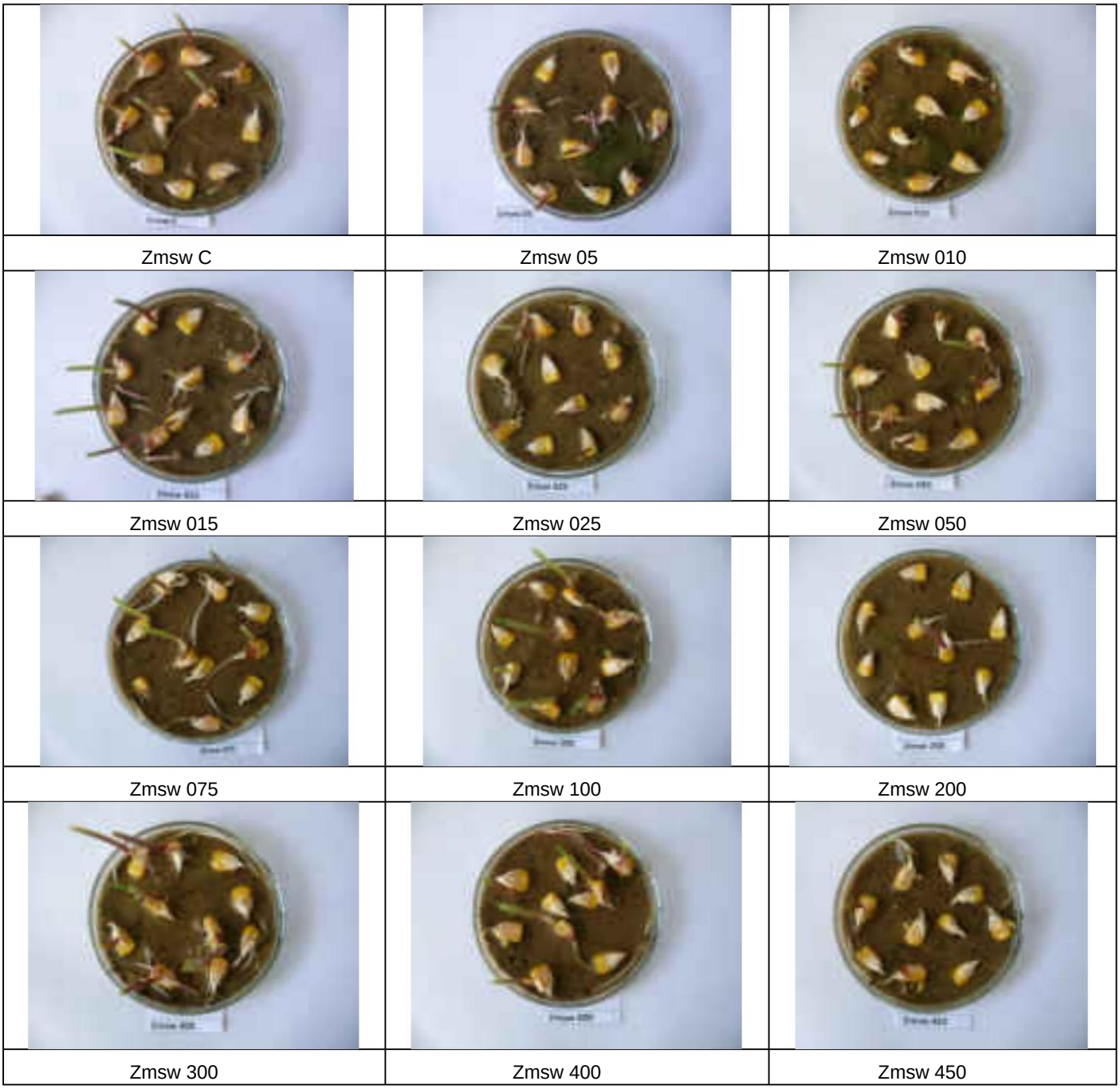

Figure 3 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 5 days from the start of the experiment (J. Šimková, 2021)

5 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450
	++	++	+	++	++	++	++	++	+	+++	++	+

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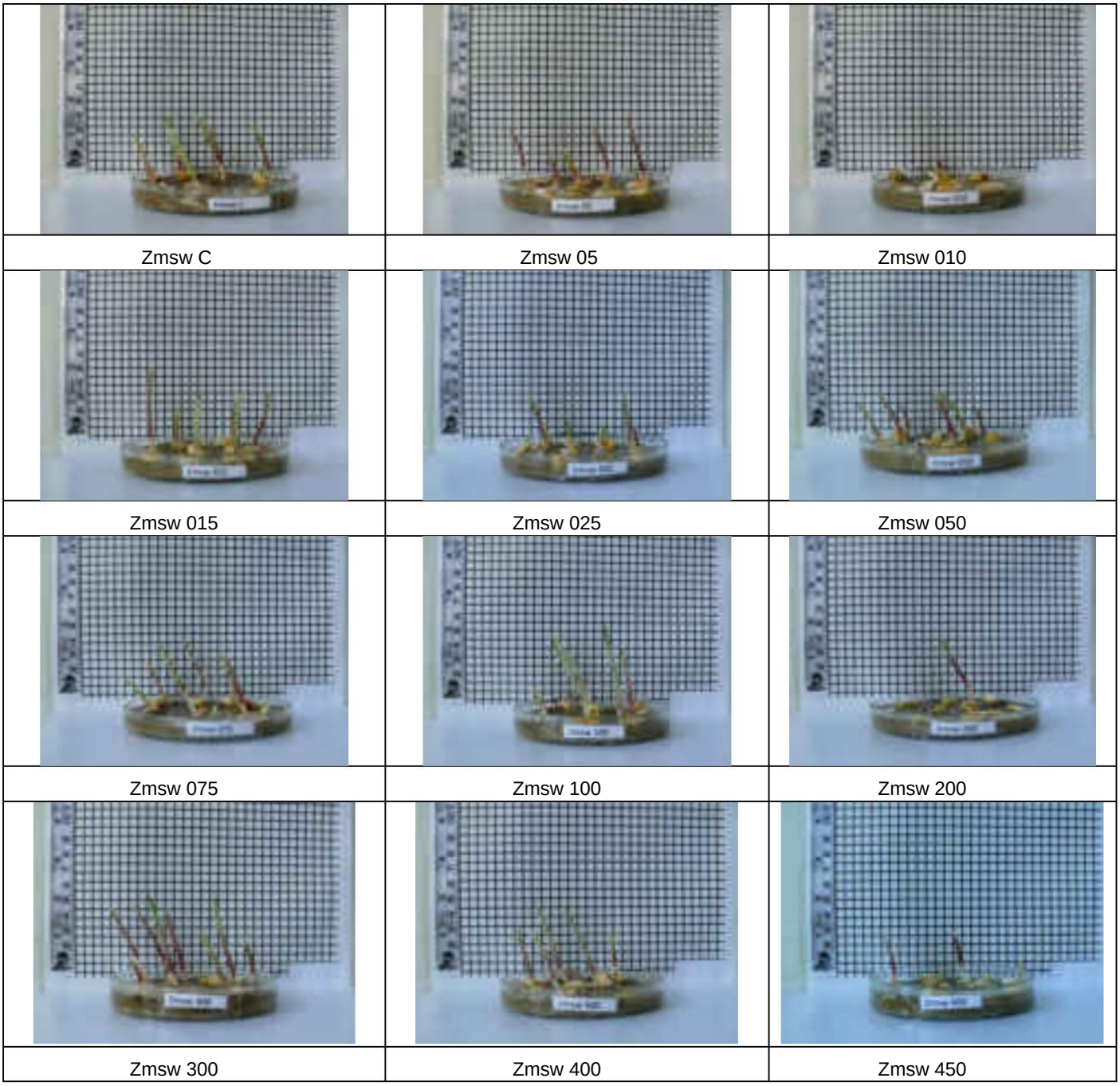

Figure 4 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 5 days from the start of the experiment (J. Šimková, 2021)

5 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450
	++	++	+	++	++	++	+++	++	+	+++	++	+

Machine Translated by Google

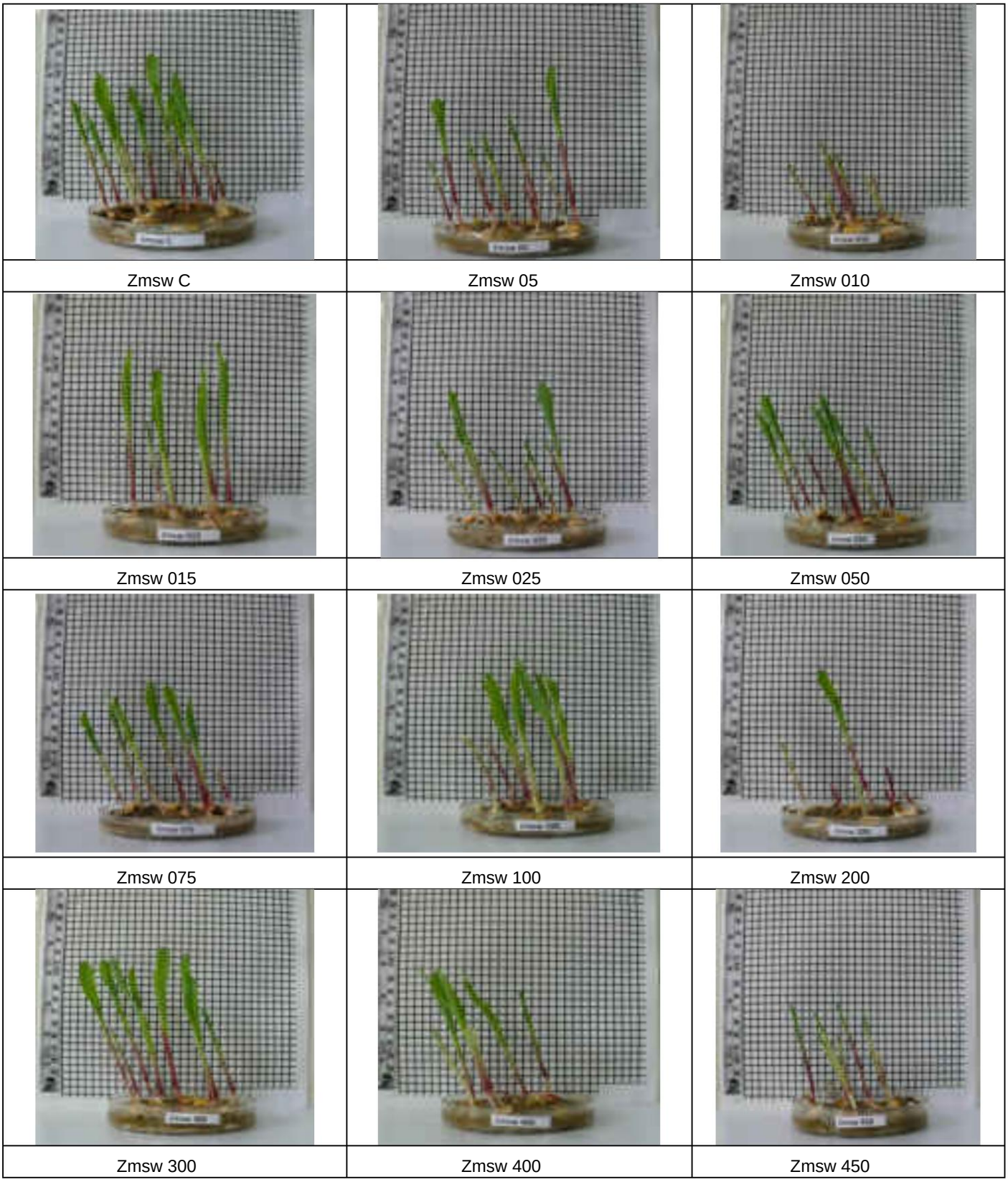

Figure 5 Comparison of the tested variants with activated stable water at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 7 days from the start of the experiment (J. Šimková, 2021)

7 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450			
	+++	++	+	++	++	++	+++	+++	+	+++	++	+			

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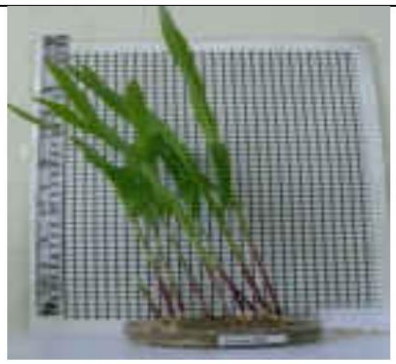
Zmsw C	Zmsw 05	Zmsw 010
		
Zmsw 015	Zmsw 025	Zmsw 050
		
Zmsw 075	Zmsw 100	Zmsw 200
		
Zmsw 300	Zmsw 400	Zmsw 450

Figure 6 Comparison of the tested variants with activated stable water (sw) at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 13 days from the start of the experiment (J. Šimková, 2021)

13 day	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450	
	++	++	+	++	++	+++	++	++	+	+++	++	++	

Machine Translated by Google

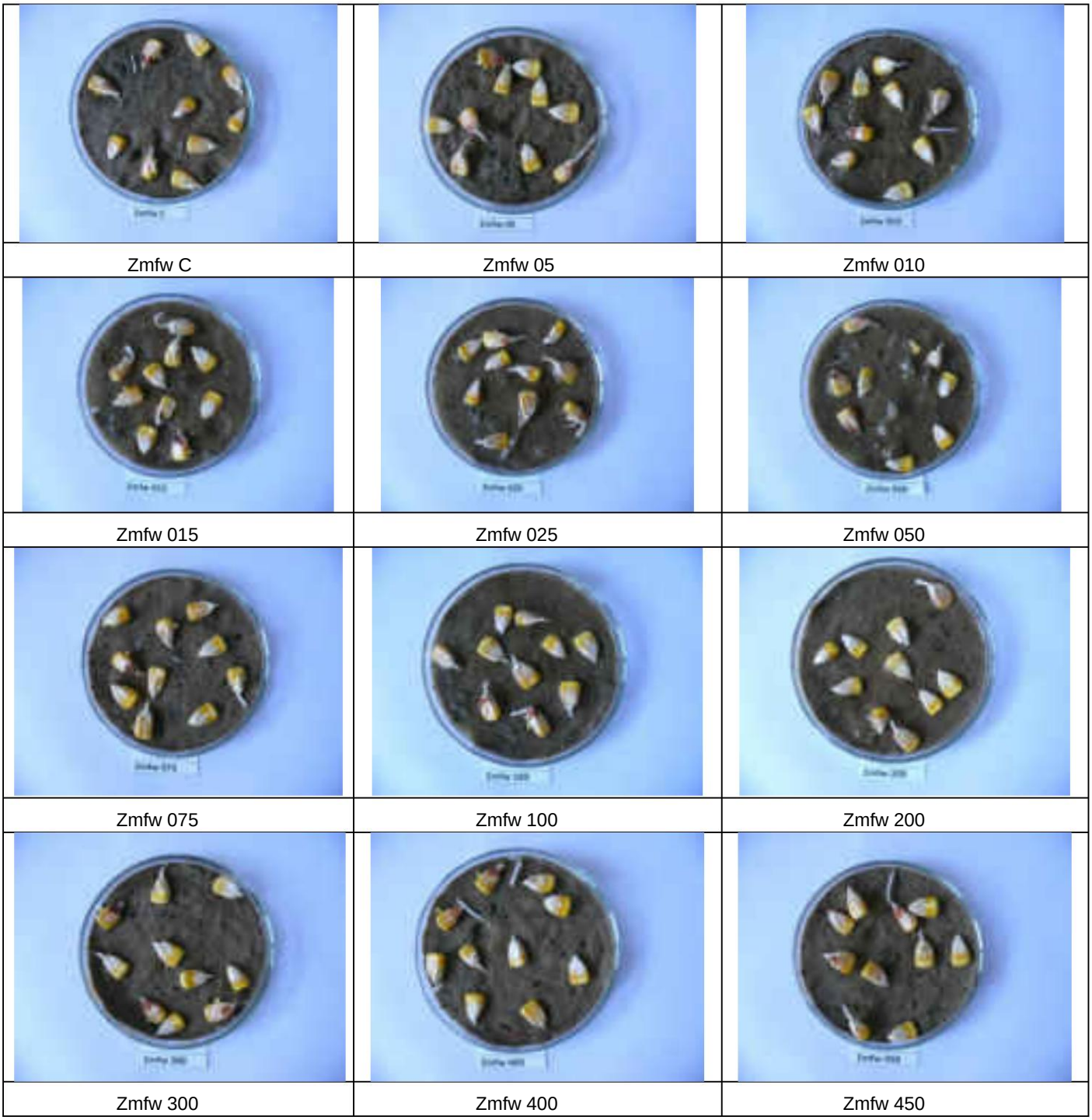


Figure 7 Comparison of the tested variants with activated fresh water (fw) at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 3 days from the start of the experiment (J. Šimková, 2021)

3 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450
	++	++	++	++	++	+	++	++	+	++	+++	++

Machine Translated by Google

Zmfw C

Zmfw 05

Zmfw 010

Zmfw 015

Zmfw 025

Zmfw 050

Zmfw 075

Zmfw 100

Zmfw 200

Zmfw 300

Zmfw 400 Figure

Zmfw 450

8 Comparison of the tested variants with activated fresh water (fw) **at different pressures for the germination** and **emergence of corn** *(Zea mays* L.) seeds after 4 **days from the start of the experiment (J. Šimková, 2021)**

4 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450			
	++	++	++	++	++	+	++	++	+	++	++	++			

Machine Translated by Google

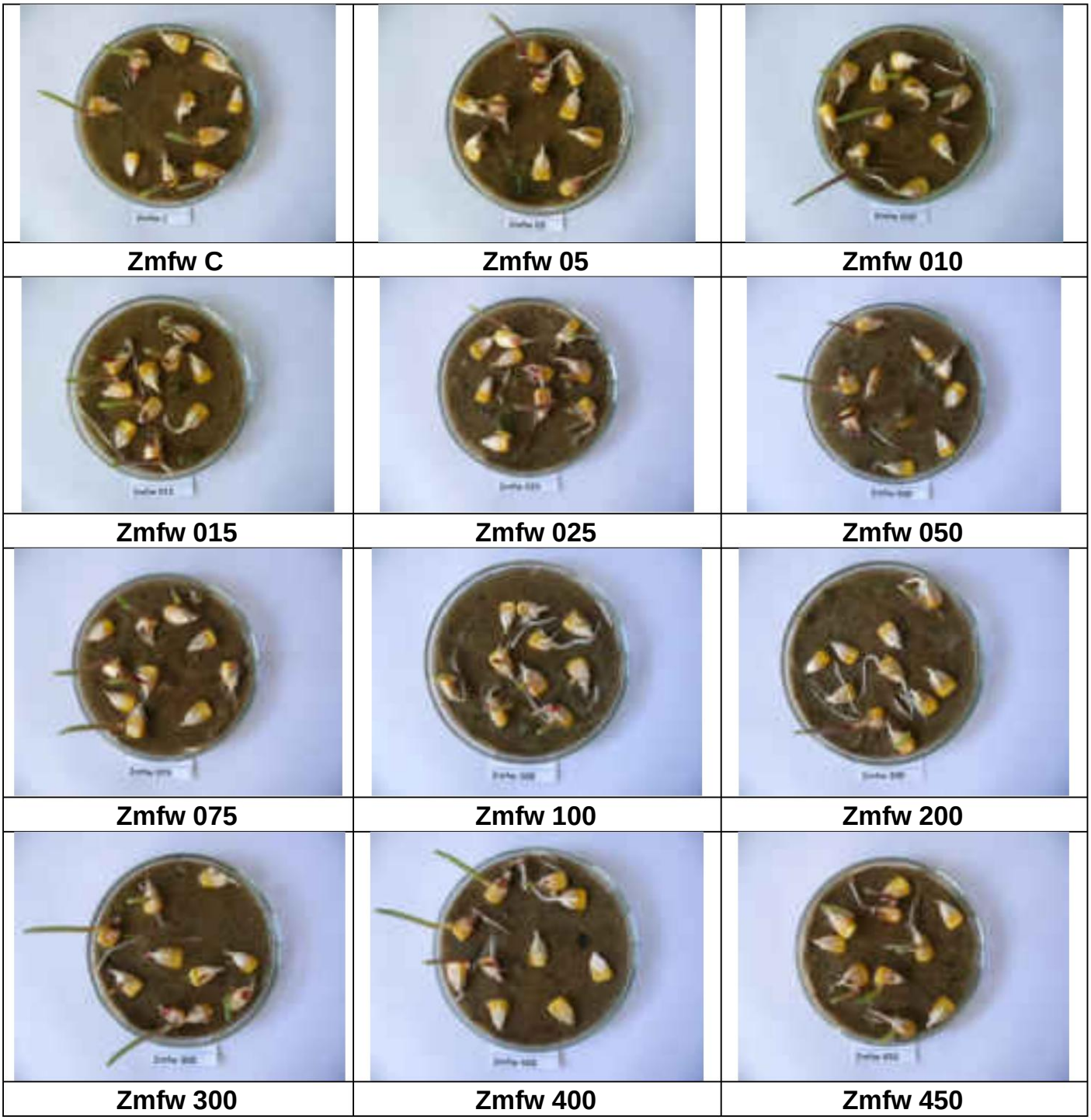


Figure 9 Comparison of the tested variants with activated fresh water (fw) **at different pressures for the germination** and **emergence of corn** *(Zea mays* L.) seeds after 5 **days from the start of the experiment (J. Šimková, 2021)**

5 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450			
	++	++	++	++	++	++	+	++	++	+	++	++	++		

Machine Translated by Google

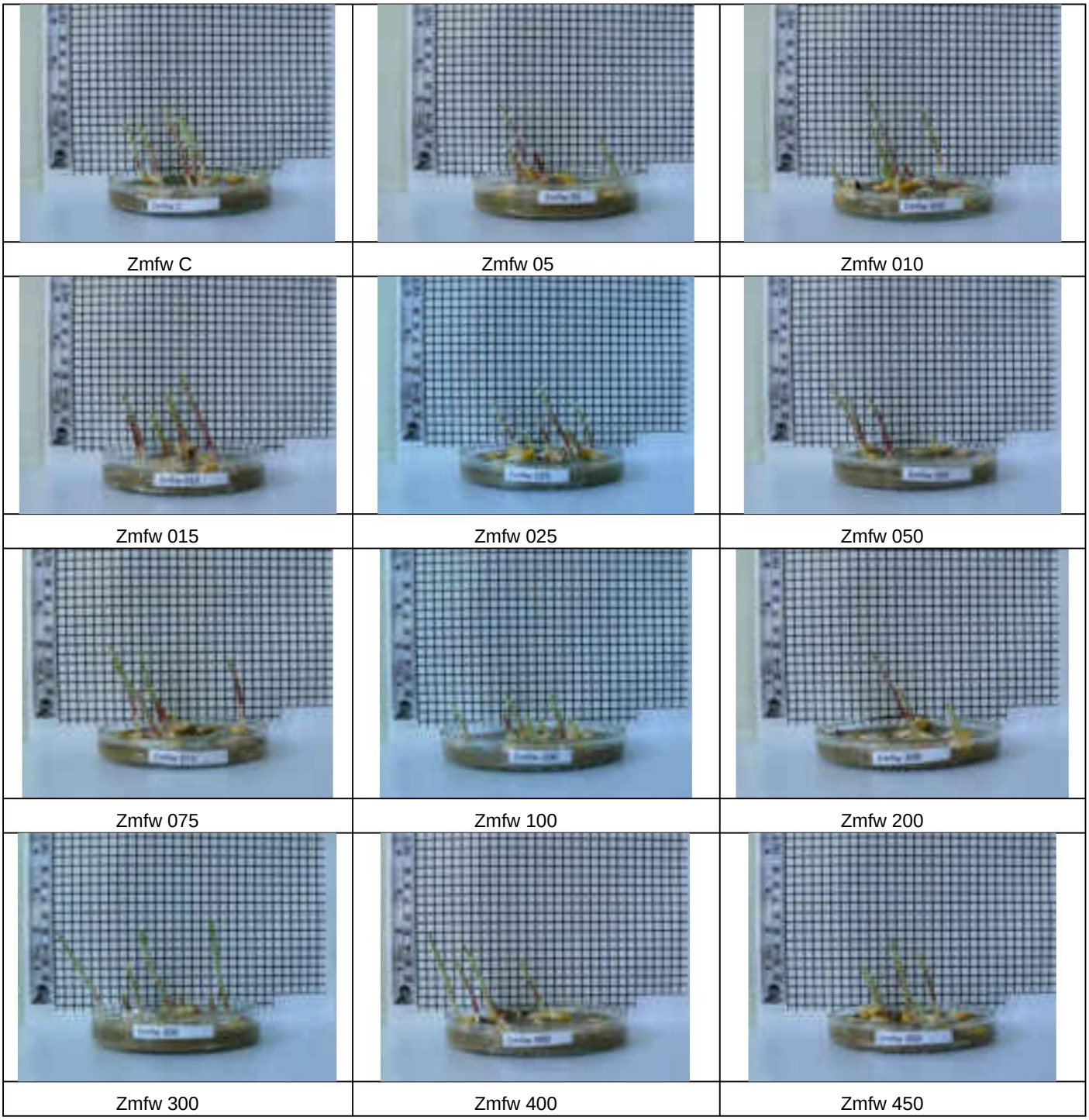


Figure 10 Comparison of the tested variants with activated fresh water (fw) at different pressures for the germination and emergence of corn (Zea mays L.) seeds after 5 days from the start of the experiment (J. Šimková, 2021)

5 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450				
	++	++	++	+++	++	+	++	+	+	+++	++	++				

Machine Translated by Google

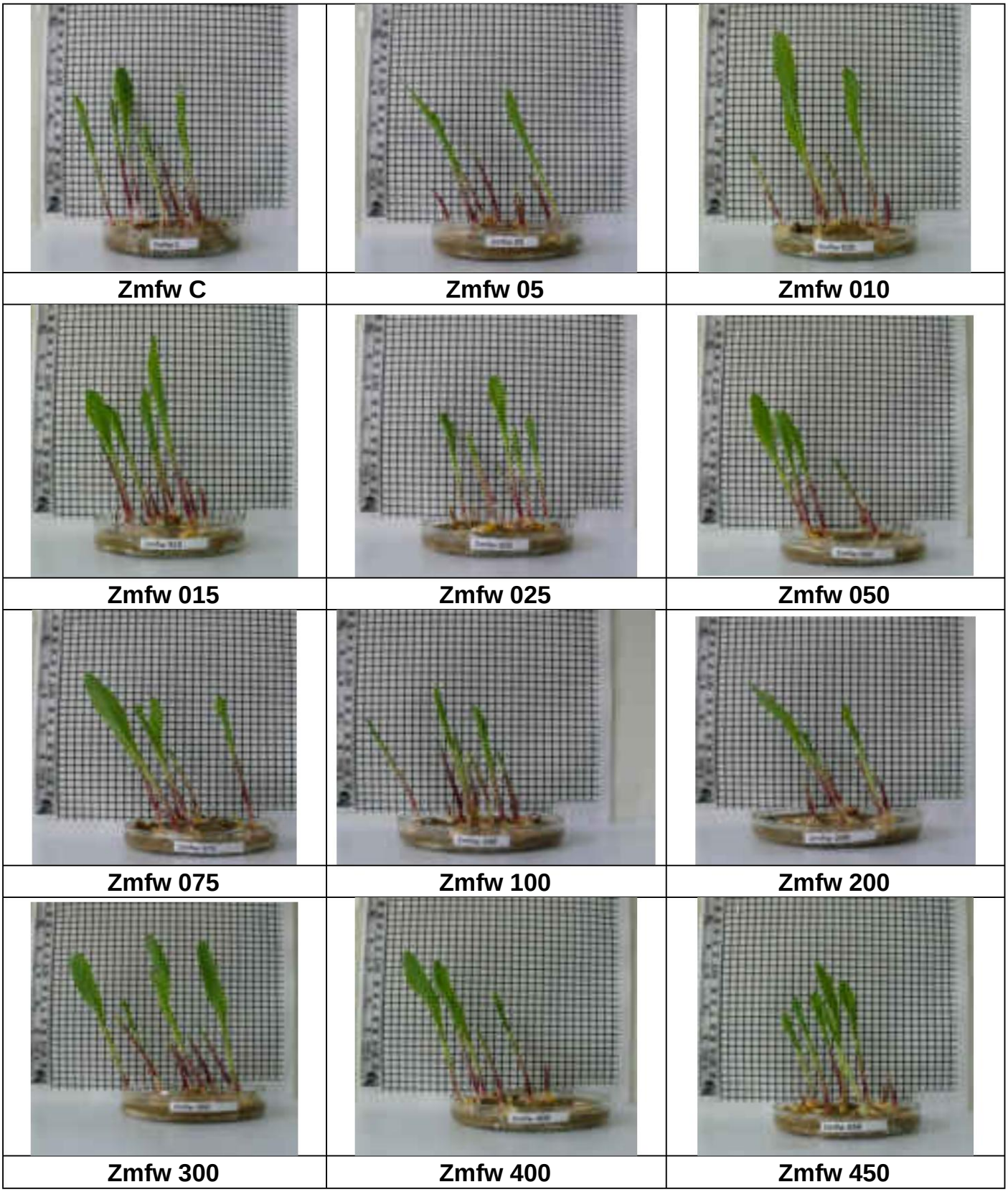


Figure 11 Comparison of the tested variants with activated fresh water (fw) **at different pressures for the germination** and **emergence of corn** *(Zea mays* L.) seeds after 7 **days from the start of the experiment (J. Šimková, 2021)**

7 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450			
	++	+	++	++	++	+	++	+	+	++	++	++			

Machine Translated by Google

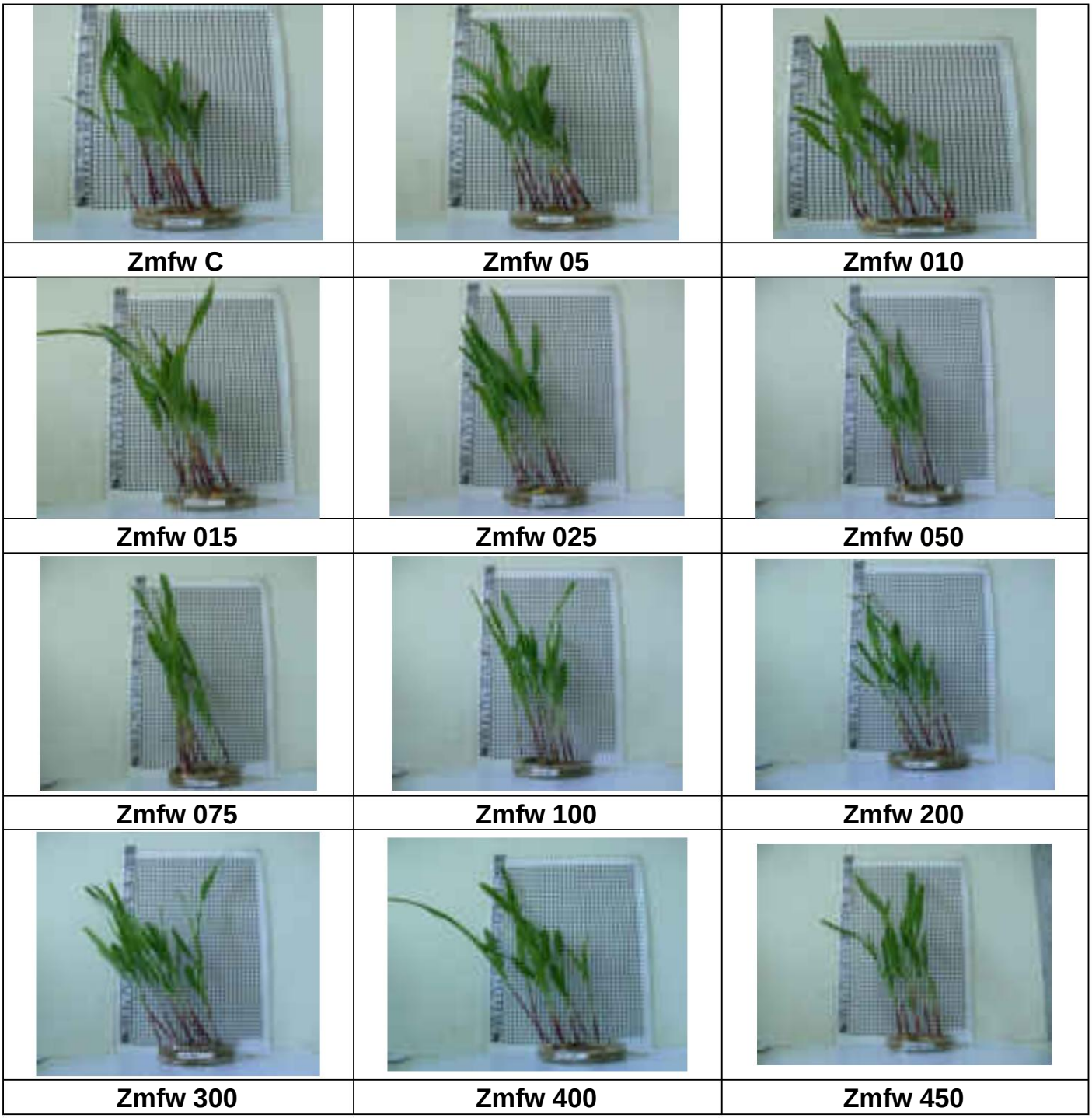


Figure 12 Comparison of the tested variants with activated fresh water (fw) **at different pressures for the germination** and **emergence of corn** *(Zea mays* L.) seeds after 13 **days from the start of the experiment (J. Šimková, 2021)**

13 day	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450			
	+++	++	++	+++	++	+	+++	++	++	+++	++	++			

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C. Conclusions

Corn sown			Stable - activated-sw 20.8.2021						2.9.2021		AQIPS-02-E02b	
Day ŷ	Zmswc	Zmsw5	Zmsw10	Zmsw15	Zmsw25	Zmsw50	Zmsw75	Zmsw100	Zmsw200	Zmsw300	Zmsw400	Zmsw450		
3	++	++	++	++	++	++	++	++	+	++	++	++		
4	++	++	+	++	+	+	++	++	+	++	++	+		
5	++	++	+	++	++	++	++	++	+	+++	++	+		
5	++	++	+	++	++	++	+++	++	+	+++	++	+		
	+++	++	+	++	++	++	+++	+++	+	+++	++	+		
7 13	++	++	+	++	++	+++	++	++	+	+++	++	++		

Corn sown			Fresh - activated-fw 20.8.2021						2.9.2021		AQIPS-02-E02b	
Day ŷ	Zmfwc	Zmfw5	Zmfw10	Zmfw15	Zmfw25	Zmfw50	Zmfw75	Zmfw100	Zmfw200	Zmfw300	Zmfw400	Zmfw450		
3	++	++	++	++	++	+	++	++	+	++	+++	++		
4	++	++	++	++	++	+	++	++	+	++	++	++		
5	++	++	++	++	++	+	++	++	+	++	++	++		
5	++	++	++	+++	++	+	++	+	+	+++	++	++		
7	++	+	++	++	++	+	++	+	+	++	++	++		
13	+++	++	++	+++	++	+	+++	++	++	+++	++	++		

Marking		Plant growth intensity
BR -		No growth
PR +		Slow plant growth - Blockage of growth
NO ++		Normal plant growth - Plant growth
IR +++		Intensive plant growth
ER ++++		Extremely intensive growth

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Effect of activated water by the IPS system on the germination and growth of hemp (Cannabis sativa L.)

AQIPS-02-E03a

Contents

A. Methodology of the experiment 1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species

2. Plant species: Sown hemp Cannabis sativa L.

3. Designation of the plant species in the experiments: Cs 4. Date of starting the experiment: 31.5.2021 5. Date of ending the experiment: 8.6.2021 6. Method of growing plants: Petri dishes with water, laboratory conditions

7. Evaluation of the experiment: Image analysis

8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in experiments with an IPS device Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Description of the variant	Designation	Description of the variant
Csfw-c	Tap water - control	Cssw-c	Tap water withstands - control
Csfw05	Created water at a pressure of 05Pa	Cssw05	Created water at a pressure of 05Pa
Csfw10	Created water at a pressure of 10Pa	Cssw10	Created water at a pressure of 10Pa
Csfw15	Created water at a pressure of 15Pa	Cssw15	Created water at a pressure of 15Pa
Csfw25	Created water at a pressure of 25Pa	Cssw25	Created water at a pressure of 25Pa
Csfw50	Created water at a pressure of 50Pa	Cssw50	Created water at a pressure of 50Pa
Csfw75	Created water at a pressure of 75Pa	Cssw75	Created water at a pressure of 75Pa
Csfw100	Created water at a pressure of 100Pa	Cssw100	Created water at a pressure of 100Pa
Csfw200	Created water at a pressure of 200Pa	Cssw200	Created water at a pressure of 200Pa
Csfw300	Created water at a pressure of 300Pa	Cssw300	Created water at a pressure of 300Pa
Csfw400	Created water at a pressure of 400Pa	Cssw400	Created water at a pressure of 400Pa
Csfw450	Created water at a pressure of 450Pa	Cssw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		Characteristics of samples
etc	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

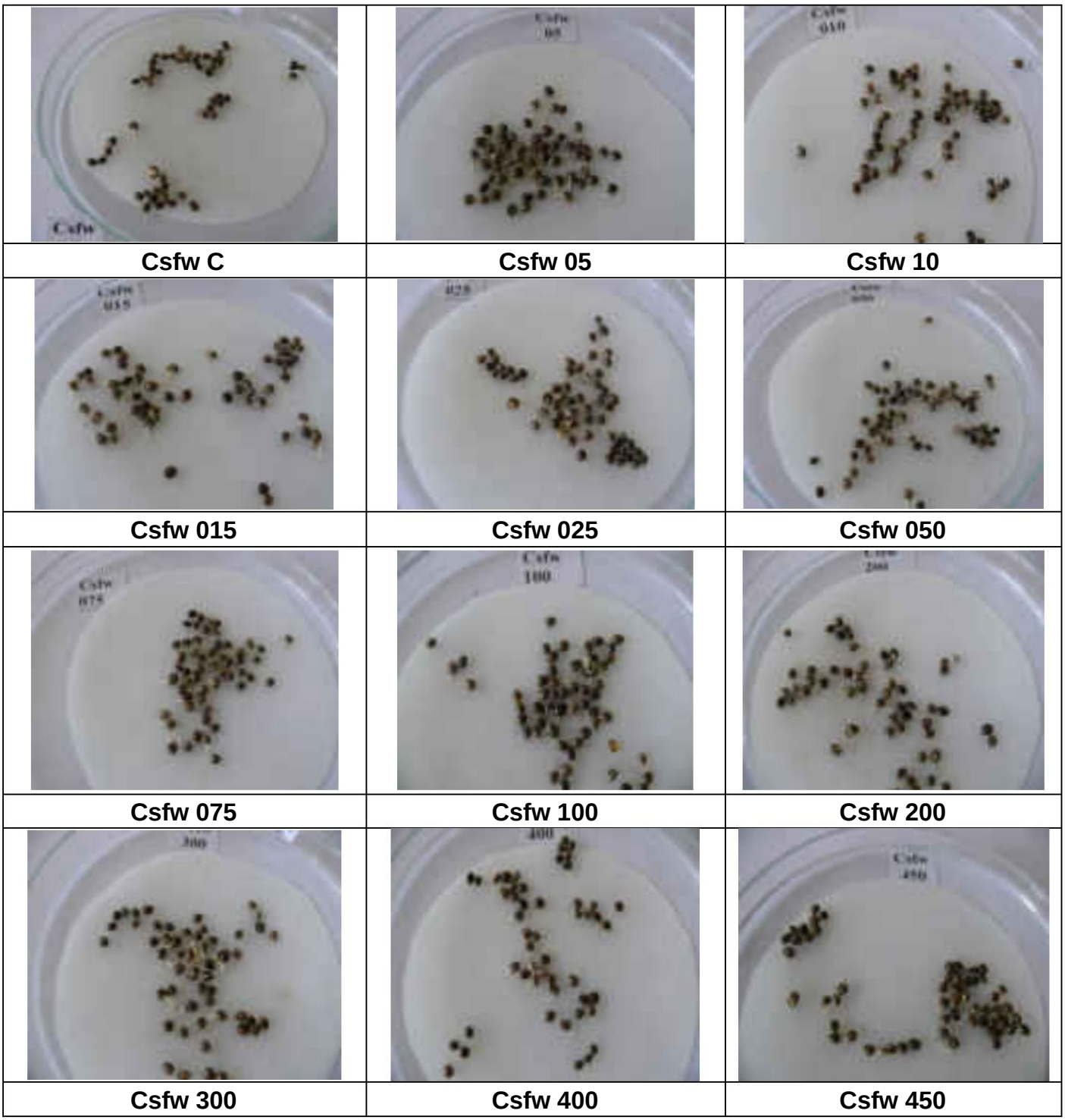

Figure 1 Comparison of tested variants with fresh activated water (fw) at different pressures for germination and **emergence of** cannabis seeds *(Cannabis sativa* L). **after 2 days from the start of the experiment (J. Šimková, 2021)**

2 days	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450				
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

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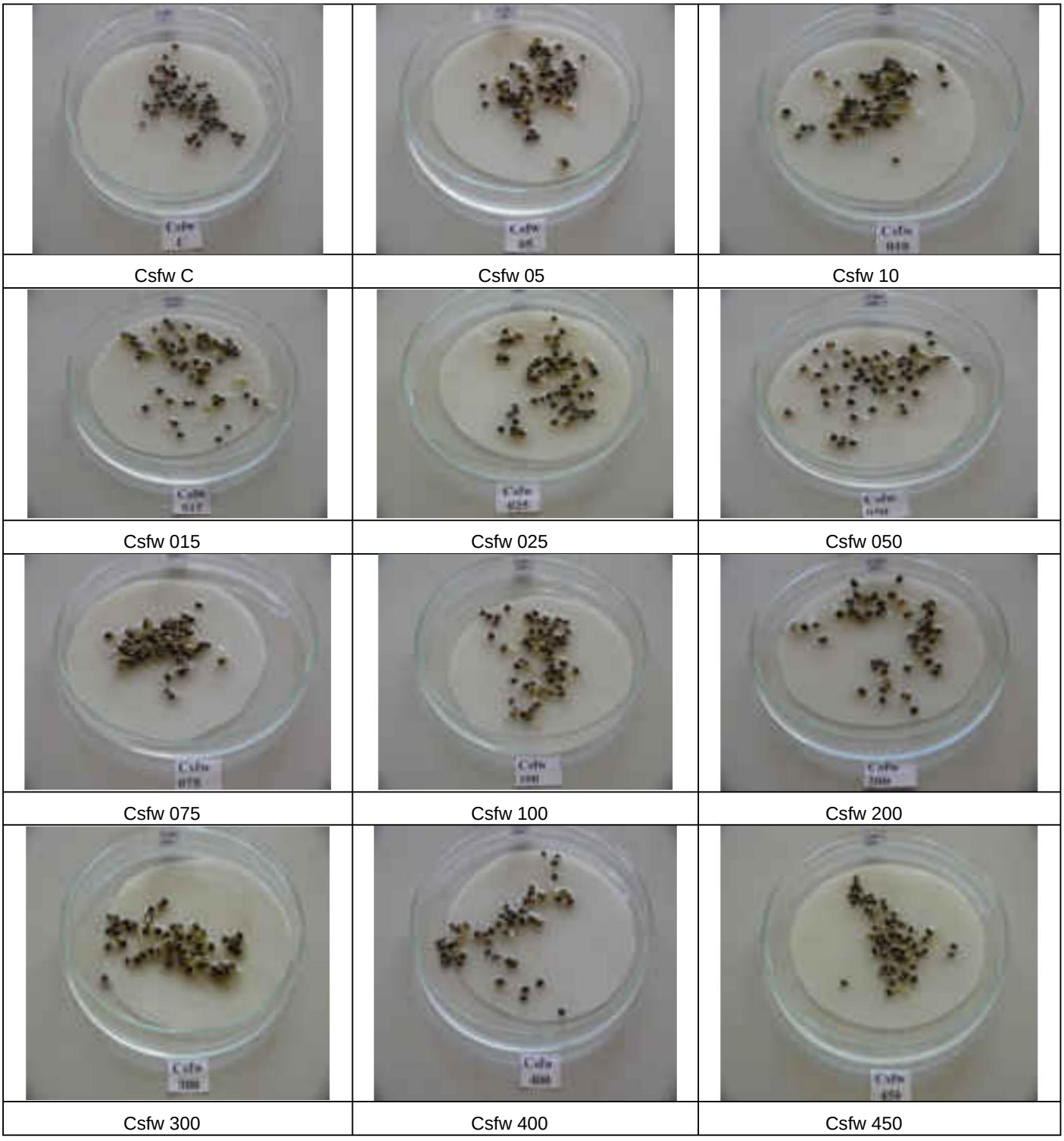

Figure 2 Comparison of tested variants with fresh activated water (fw) at different pressures for germination and emergence of cannabis seeds (Cannabis sativa L). after 4 days from the start of the experiment (J. Šimková, 2021)

4 days	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450		
	+	+	++	++	+	+	+	+	+	++	+	++		

Machine Translated by Google

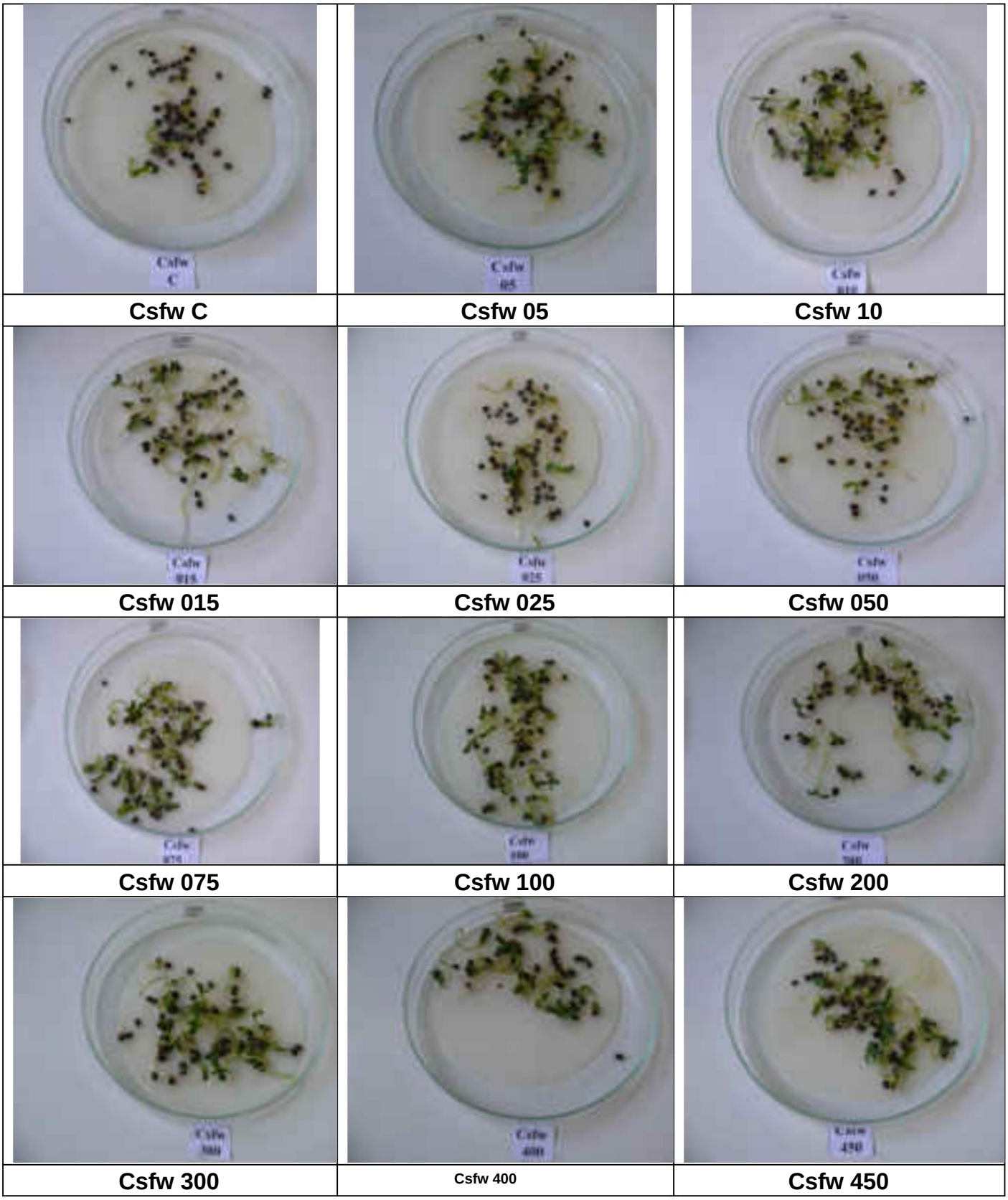

Figure 3 Comparison of tested variants with fresh activated water (fw) at different pressures for germination and **emergence of** cannabis seeds *(Cannabis sativa* L). after 8 **days from the start of the experiment (J. Šimková, 2021)**

8 days	**CSfwc CSfw5 CSfw10 CSfw15 CSfw25 CSfw50 CSfw75 CSfw100 CSfw200 CSfw300 CSfw400 CSfw450**											
	+	++	++	++	+	+	++	++	++	++	++	++

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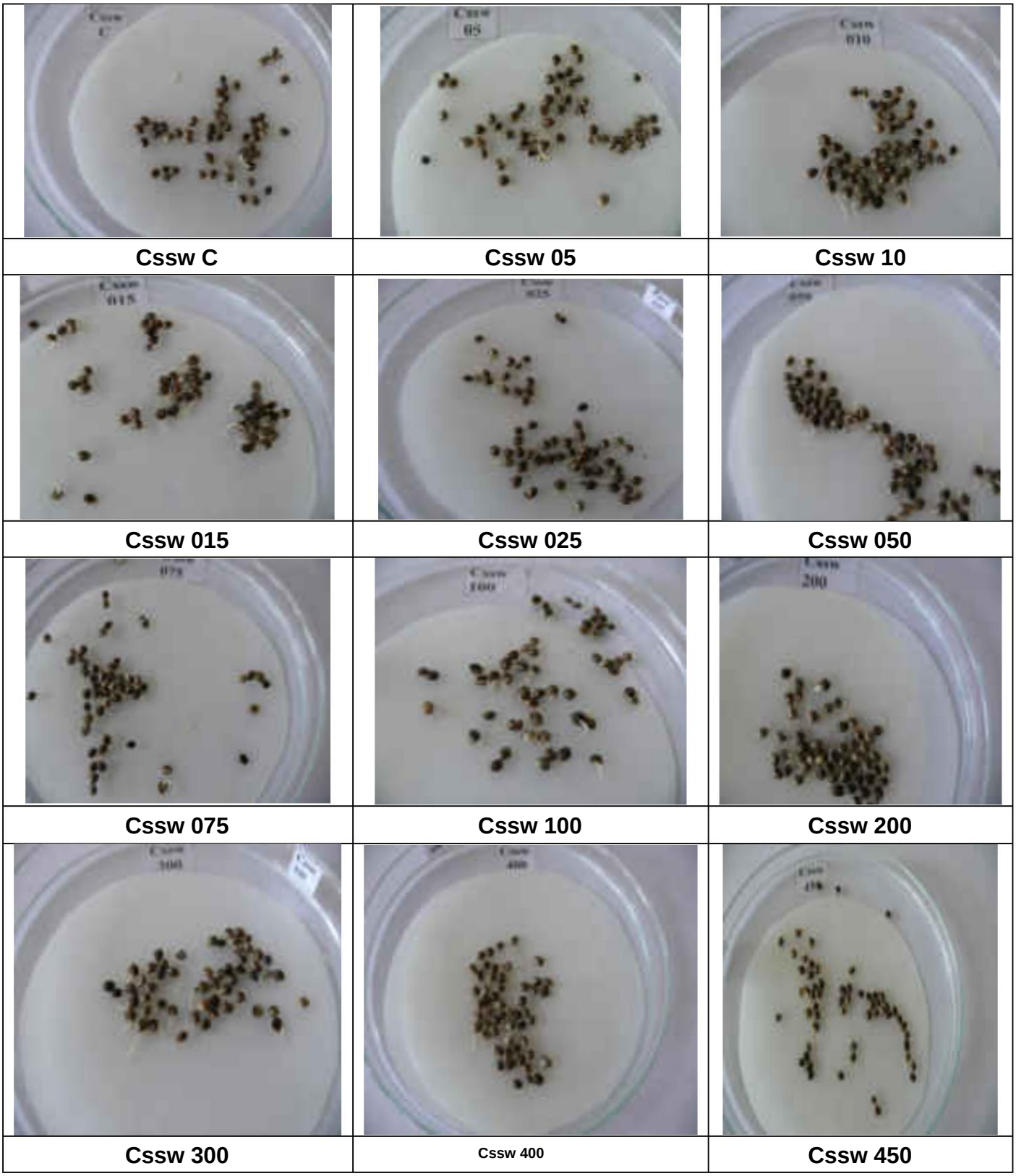

Figure 4 Comparison of the tested variants with stable activated water (sw) at different pressures for the germination and **emergence of hemp seeds** *(Cannabis sativa* L.) **after 2 days from the start of the experiment (J. Šimková, 2021)**

2 dňoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

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Cssw C

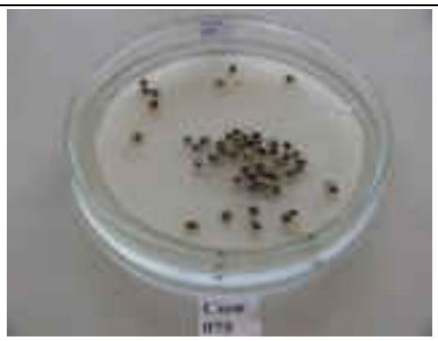
Cssw 05

Cssw 10

Cssw 015

Cssw 025

Cssw 050



Cssw 075

Cssw 100

Cssw 200

Cssw 300

Cssw 400

Cssw 450

Figure 5 Comparison of the tested variants with stable activated water (sw) at different pressures for germination and emergence of cannabis seeds (Cannabis sativa L). after 4 days from the start of the experiment (J. Šimková, 2021)

4 dňoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	+	++	+	+	+	+	+	+	++	+	+	+	+		

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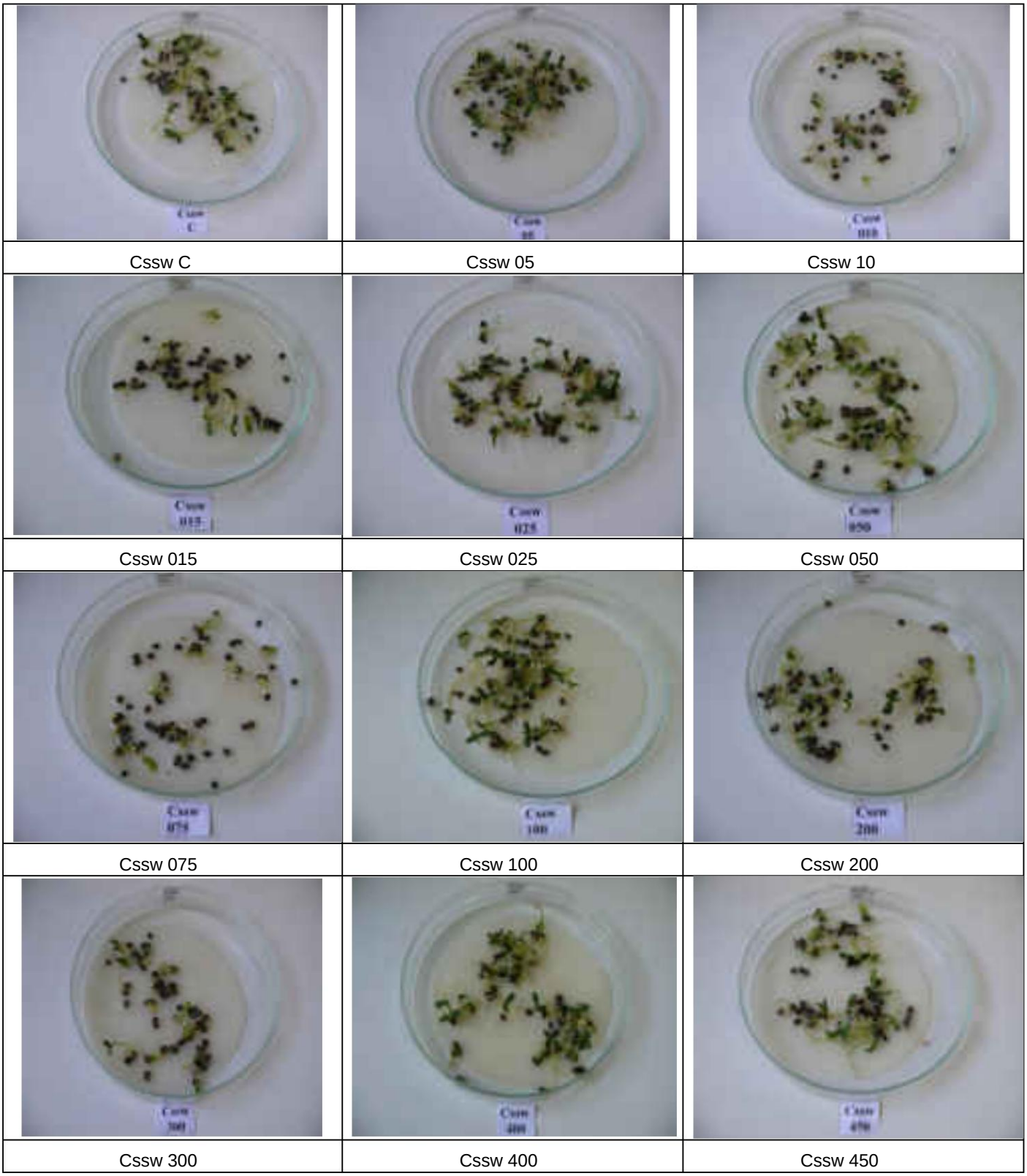

Figure 6 Comparison of tested variants with stable activated water (sw) at different pressures for germination and emergence of hemp seeds (Cannabis sativa L.) after 8 days from the start of the experiment (J. Šimková, 2021)

8 dÿoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	++	++	+	+	++	++	+	++	++	+	++	++			

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C. Conclusions

Plant species			Applied water			The beginning of the experiment			End of experiment		Experiment	
Chart button			Stable - activated-sw 31.5.2021						8.6.2021		AQIPS-02-E03a	
Day ŷ	Csswc	Cssw5	Cssw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450				
2	+	+		+	+	+	+		+	+	+	+	+	+	+	+
4	+	++		+	+	+	+		+	+	++		+	+	+	+
8	++	++		+	+	++	++		+	++	++		+	++	++	++
Chart button			Fresh - activated-fw 31.5.2021						8.6.2021		AQIPS-02-E03a	
Day ŷ	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450				
2	+	+		+	+	+	+		+	+	+	+	+	+	+	+
4	+	+		++	++	+	+		+	+	+	+	+	++	+	++
8	+	++		++	++	+	+		+	++	++		++	++	++	++

Designation	Intensity of plant growth
BR -	No growth
PR +	Slow plant growth - Blockage of growth
NR ++	Normal plant growth - Plant growth
IR +++	Intensive plant growth
ER ++++	Extremely intensive growth

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Effect of activated water with the IPS system on germination and growth of cannabis

(Cannabis sativa L.) AQIPS-02-E03b

Contents

A. Methodology of the experiment 1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species

2. Plant species: Sown hemp *Cannabis sativa* L.

3. Designation of the plant species in the experiments: Cs 4. Date of starting the experiment: 21.6.2021 5. Date of ending the experiment: 28.6.2021 6. Method of growing plants: Petri dishes with sand, laboratory conditions

7. Evaluation of the experiment: Image analysis

8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in experiments with an IPS device Control sample without activation		**Stable activated water (sw)** Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	**Variant description**	**Designation**	**Variant description**
Csfw-c	Tap water - control	Cssw-c	Tap water is **stagnant -** check
Csfw05	**Created water at a pressure of 05Pa**	Cssw05	**Created water at a pressure of 05Pa**
Csfw10	**Created water at a pressure of 10Pa**	Cssw10	**Created water at a pressure of 10Pa**
Csfw15	**Created water at a pressure of 15Pa**	Cssw15	**Created water at** a pressure of 15Pa
Csfw25	**Created water at a pressure of 25Pa**	Cssw25	**Created water at a pressure of 25Pa**
Csfw50	**Created water at a pressure of 50Pa**	Cssw50	**Created water at a pressure of 50Pa**
Csfw75	**Created water at a pressure of 75Pa**	Cssw75	**Created water at a pressure of 75Pa**
Csfw100	**Created water at a pressure of 100Pa**	Cssw100	**Created water at a pressure of 100Pa**
Csfw200	**Created water at a pressure of 200Pa**	Cssw200	**Created water at a pressure of 200Pa**
Csfw300	**Created water at a pressure of 300Pa**	Cssw300	**Created water at a pressure of 300Pa**
Csfw400	**Created water** at a pressure of 400Pa	Cssw400	**Created water at a pressure of 400Pa**
Csfw450	**Created water at a pressure of 450Pa**	Cssw450	**Created water at a pressure of 450Pa**

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		**Characteristics of samples**
etc	-	**Seeds without germination**
ZK	**+**	**Beginning of germination**
PK	**++**	**Full germination**
PL	**+++**	**First leaves**

9.2. Effects on growth - plant height when observed

Marking		**Plant growth intensity**
BR	-	**No growth**
PR	**+**	**Slow plant growth - Blockage of growth**
No.	**++**	**Normal plant growth - Plant growth**
AND	**+++**	**Intensive plant growth**
IS	**++++**	**Extremely intensive growth**

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

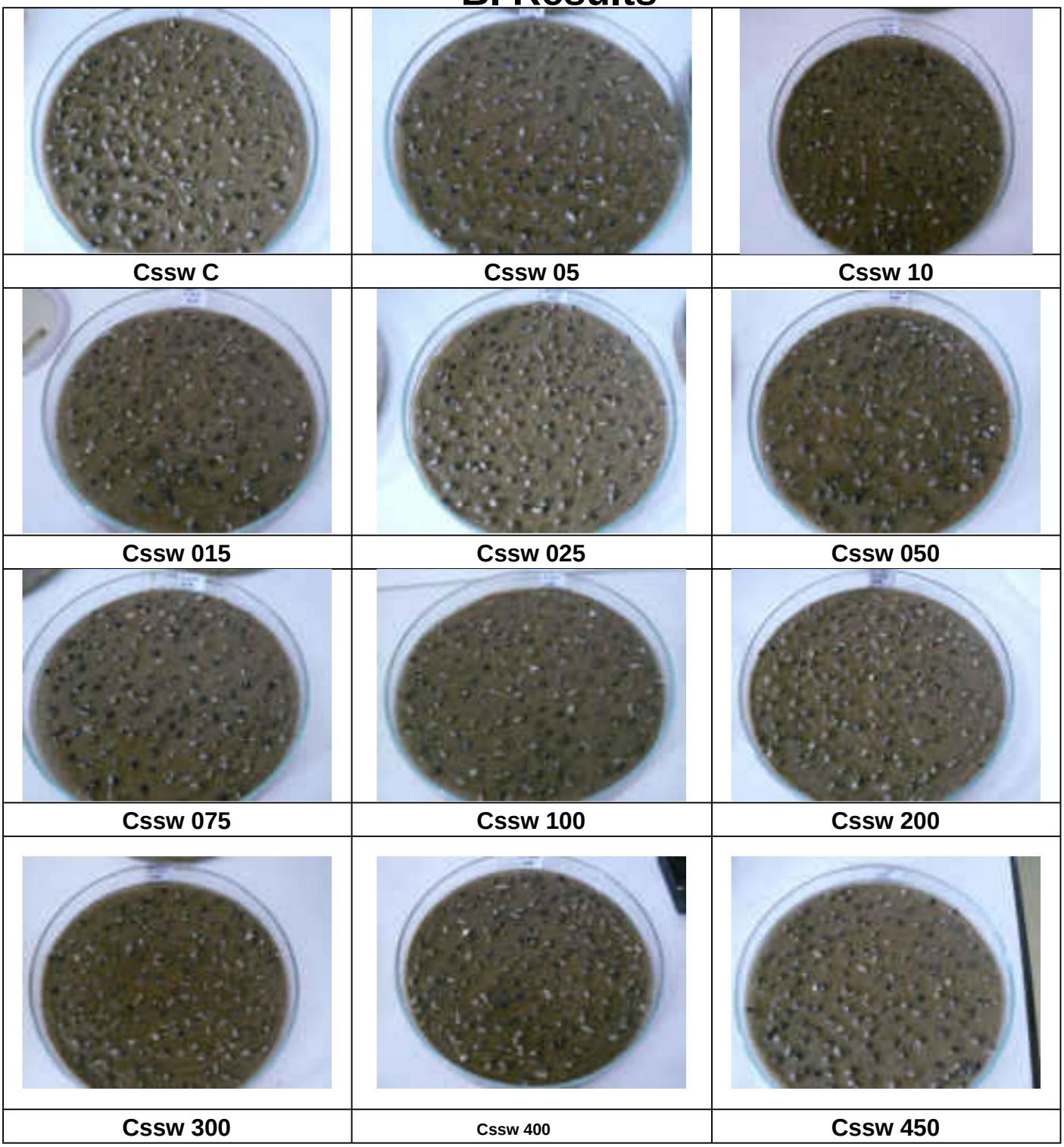

Figure 1 **Comparison of tested variants with** stable activated water (sw) **at different pressures for the germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in **sand after 24 hours from the start of the experiment (J. Šimková, 2021)**

24 hod. CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450				
	+	+	+	+	+	+	+	+	+	+	+	+				

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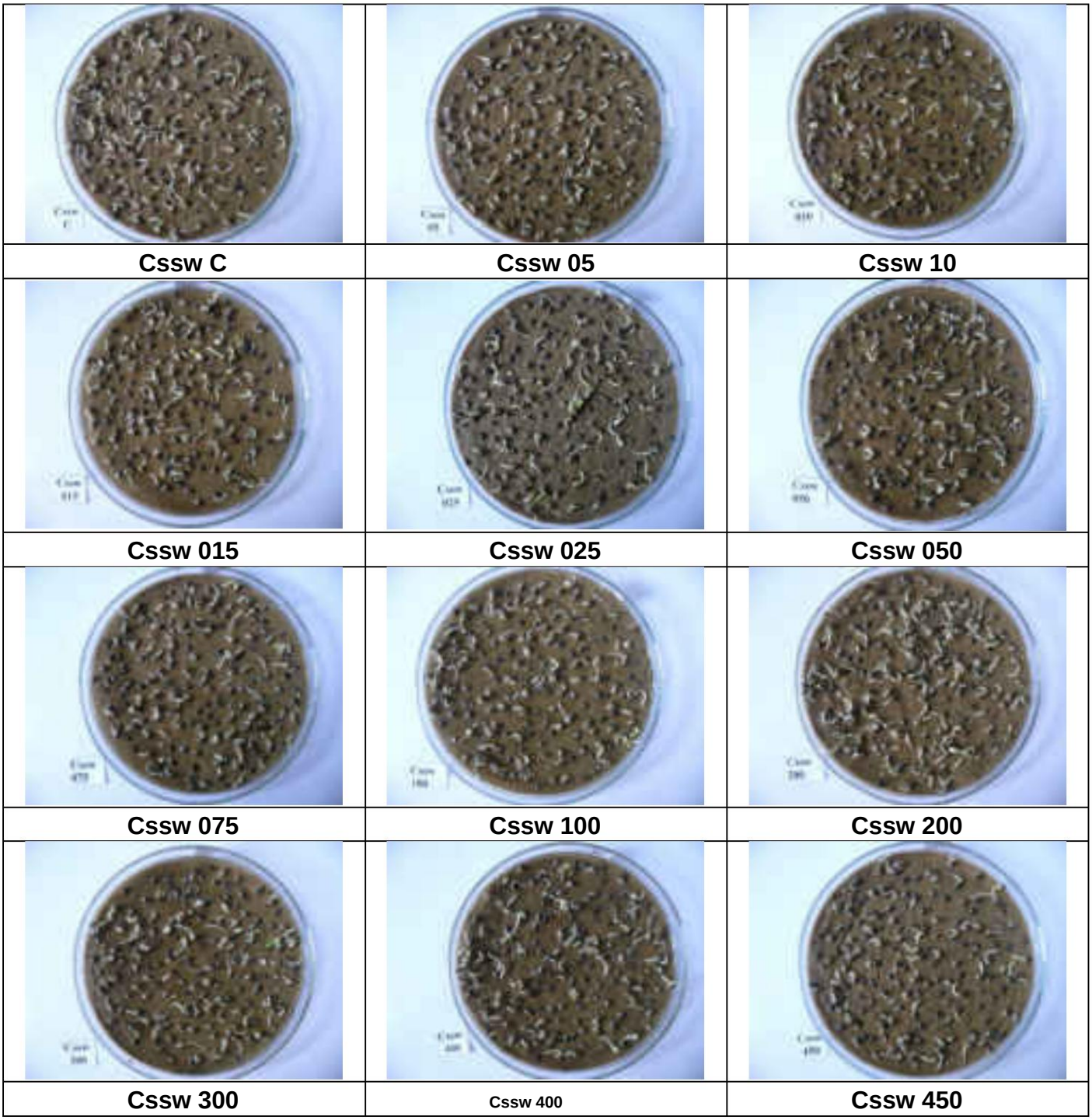

Figure 2 Comparison of tested variants with stable activated water (sw) **at different pressures for the germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in sand after 2 **days from the start of the experiment (J. Šimková,** 2021)

2 dÿoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

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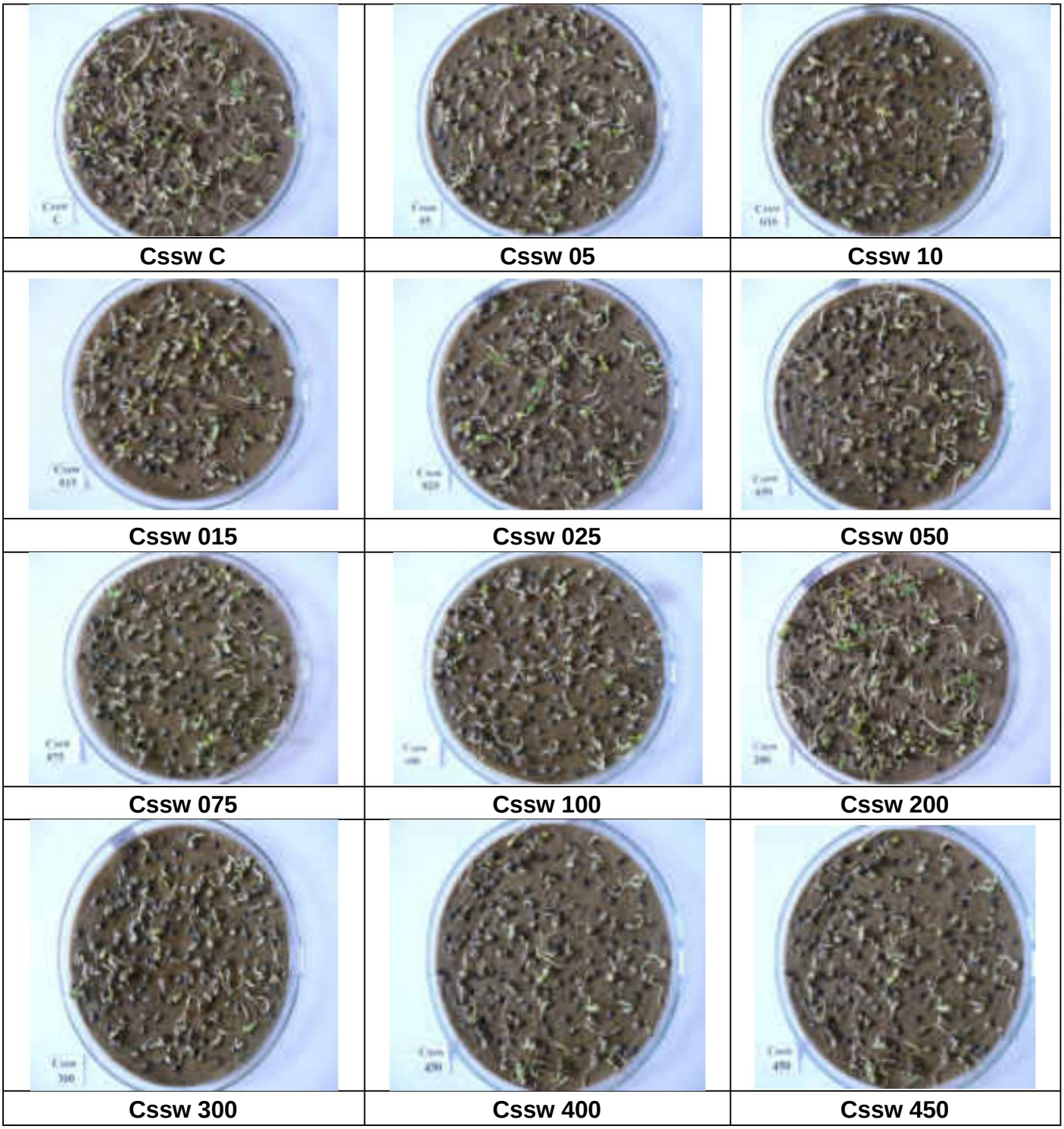

Figure 3 Comparison of the tested variants with stable activated water (sw) **at different pressures for the germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in sand after 3 **days from the start of the experiment (J. Šimková,** 2021)

3 days	**CSswc**	**CSsw5**	**CSsw10**	**CSsw15**	**CSsw25**	**CSsw50**	**CSsw75**	**CSsw100**	**CSsw200**	**CSsw300**	**CSsw400**	**CSsw450**
	++	+	+	+	++	+	+	+	++	+	+	+

Machine Translated by Google

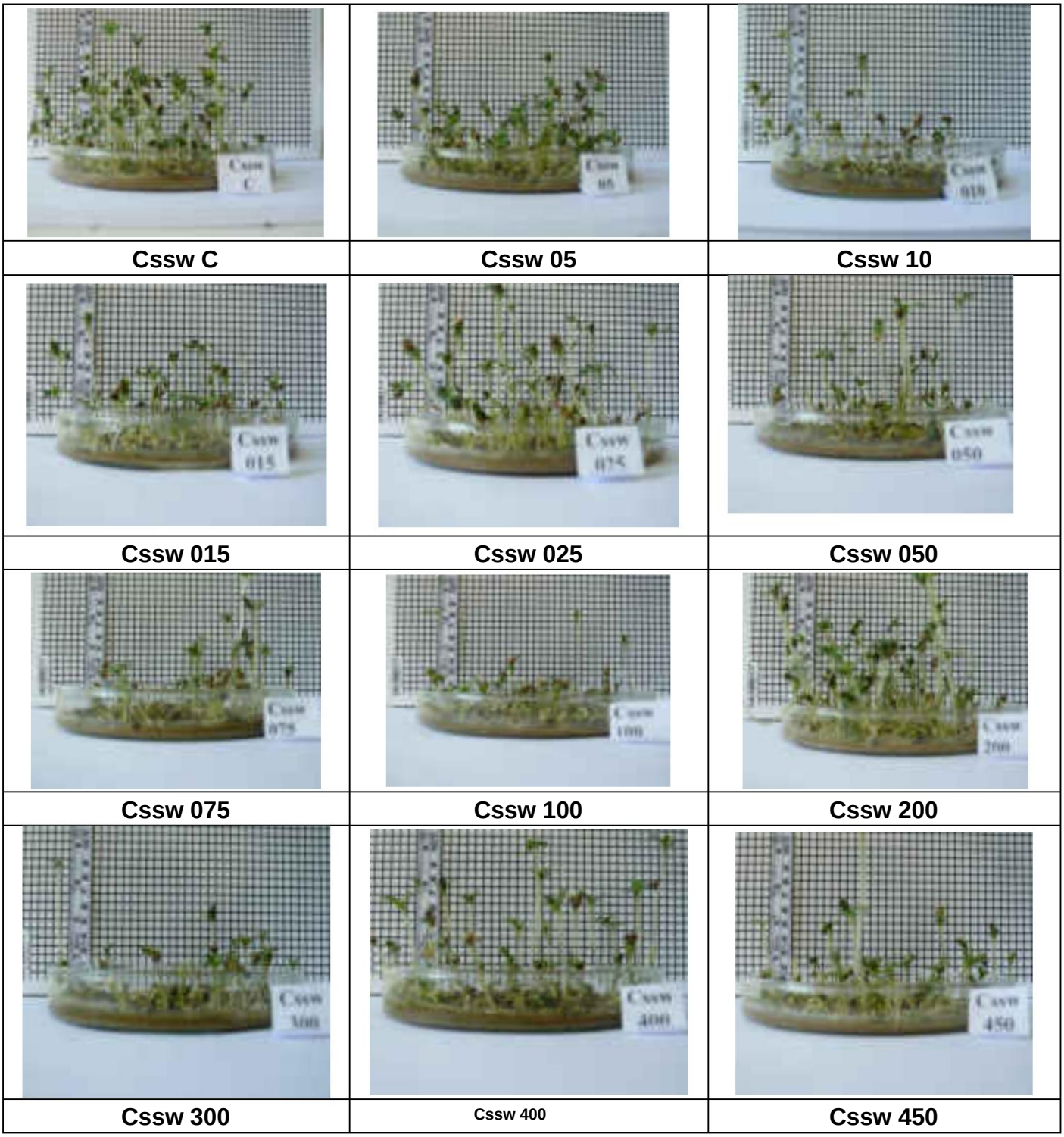

Figure 4 Comparison of tested variants with stable activated water (sw) **at different pressures for germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in sand after 5 **days from the start of the experiment (J. Šimková,** 2021)

5 dÿoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	++	+	+	+	++	+	+	+	++	+	++	+			

Machine Translated by Google

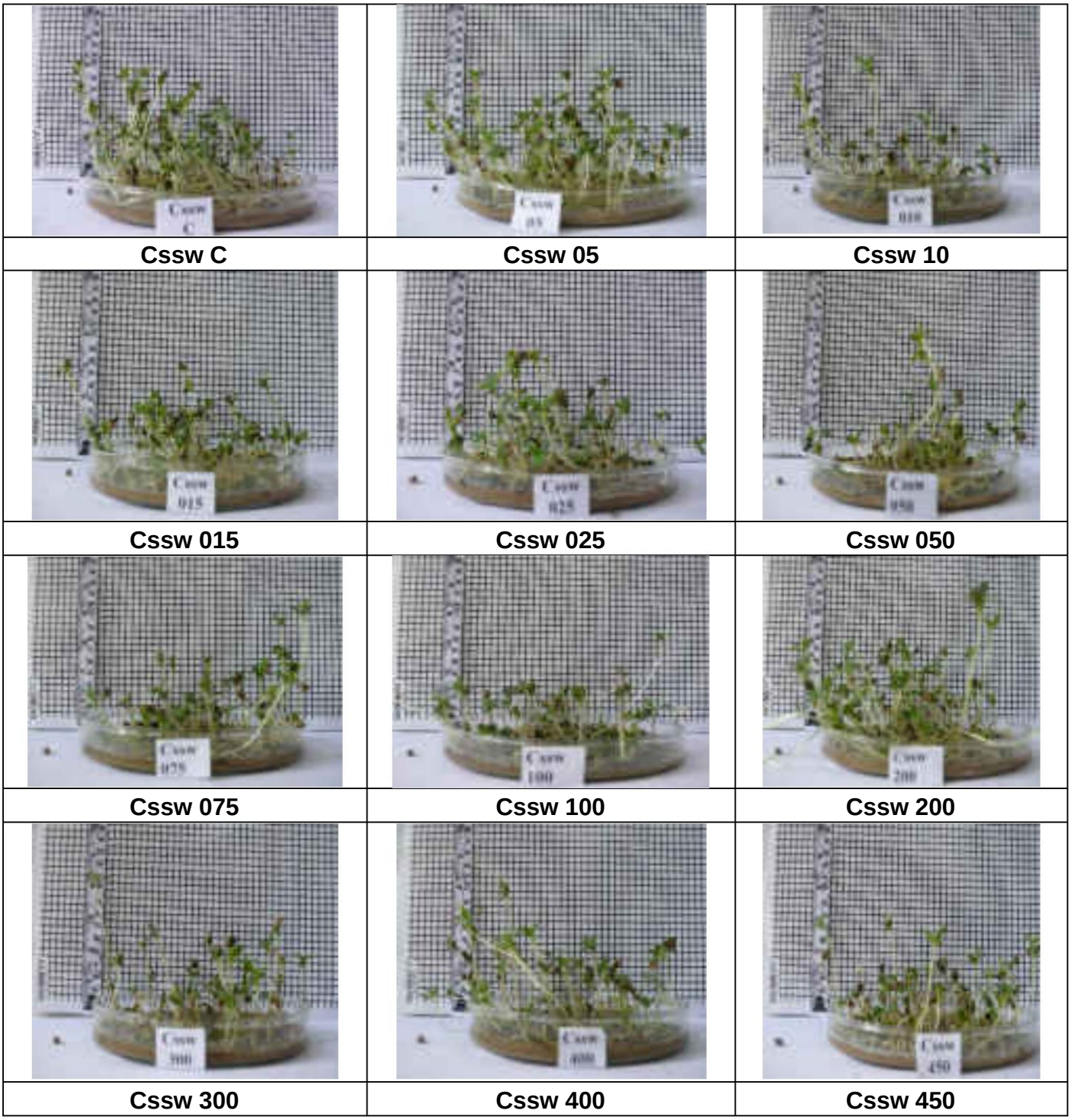

Figure 5 Comparison of the tested variants with stable activated water (sw) **at different pressures for the germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in sand after 7 **days from the start of the experiment (J. Šimková,** 2021)

7 dňoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	++	++	+	+	++	+	+	+	++	+	+	+			

Machine Translated by Google

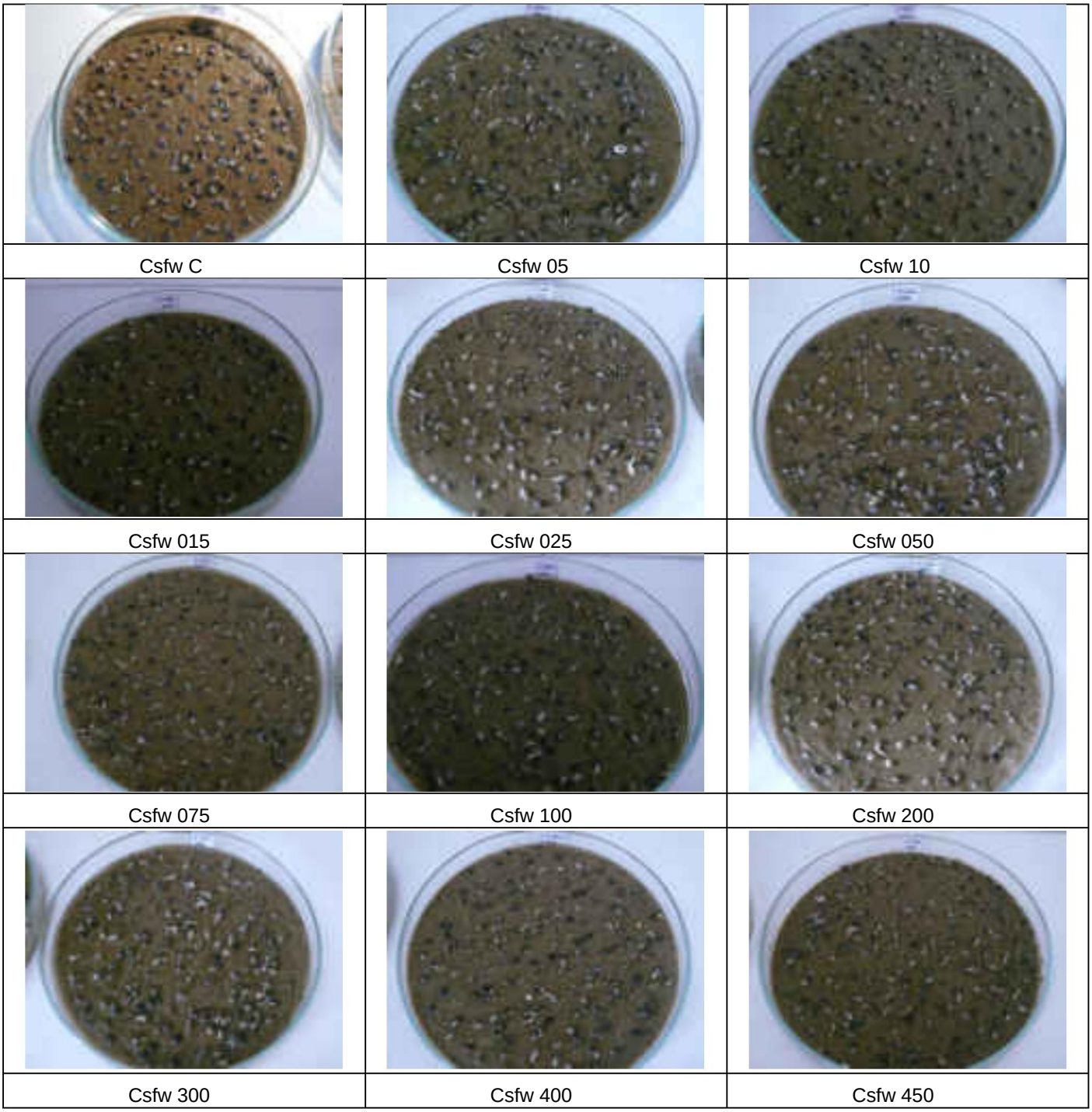

Figure 6 Comparison of the tested variants with fresh activated (fw) water at different pressures for the germination and emergence of hemp seeds (Cannabis sativa L.) in sand after 24 hours from the start of the experiment (J. Šimková, 2021)

24 hod.	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450
	+	+	+	+	+	+	+	+	+	+	+	+

Machine Translated by Google

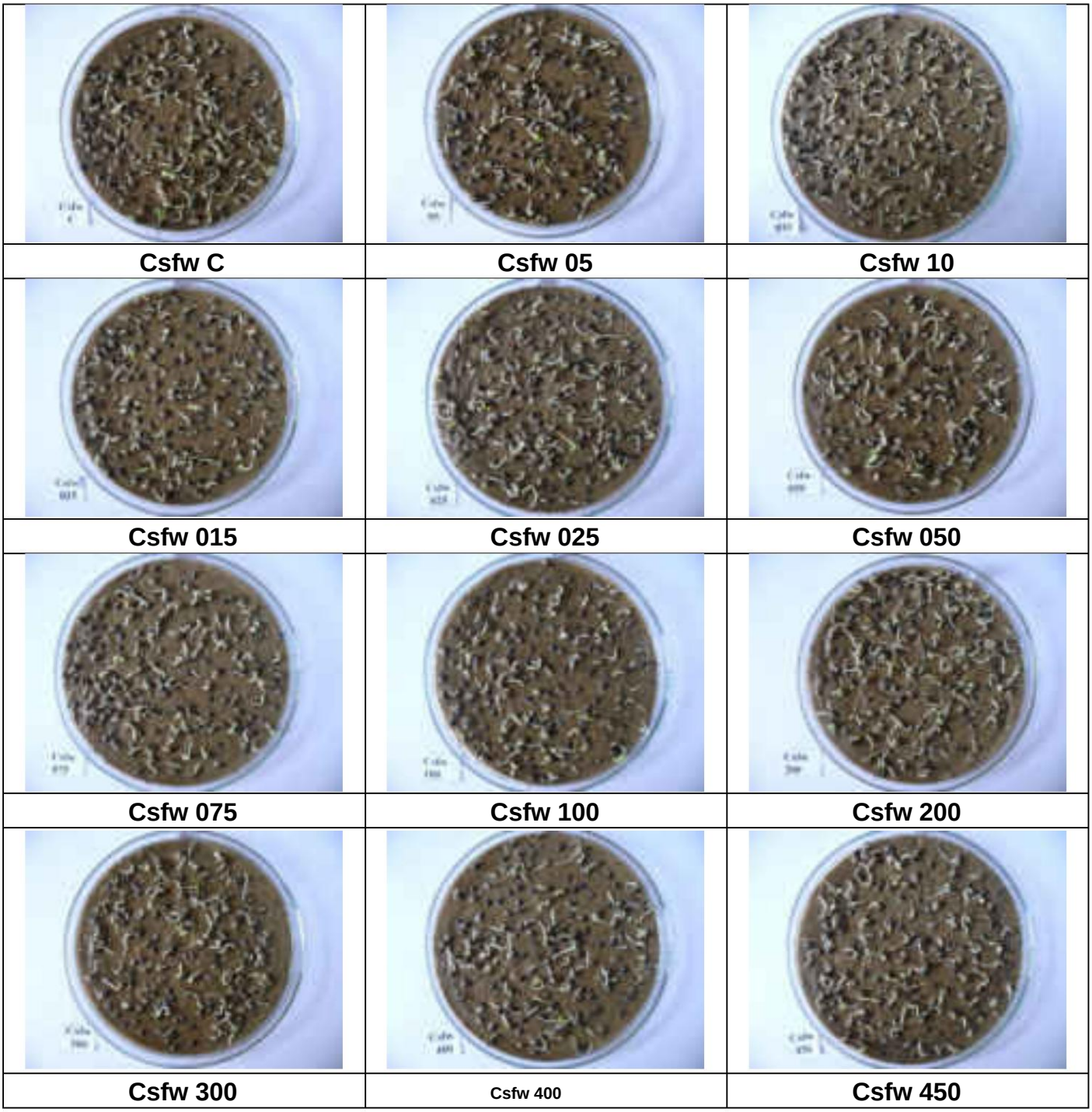

Figure 7 Comparison of the tested variants with fresh activated water (fw) **at different pressures for the germination** and **emergence of hemp seeds** *(Cannabis sativa* L.) in sand after 2 **days from the start of the experiment (J. Šimková,** 2021)

2 days	**CSfwc CSfw5 CSfw10 CSfw15 CSfw25 CSfw50 CSfw75 CSfw100 CSfw200 CSfw300 CSfw400 CSfw450**											
	++	++	+	+	++	+	+	+	++	+	+	+

Machine Translated by Google

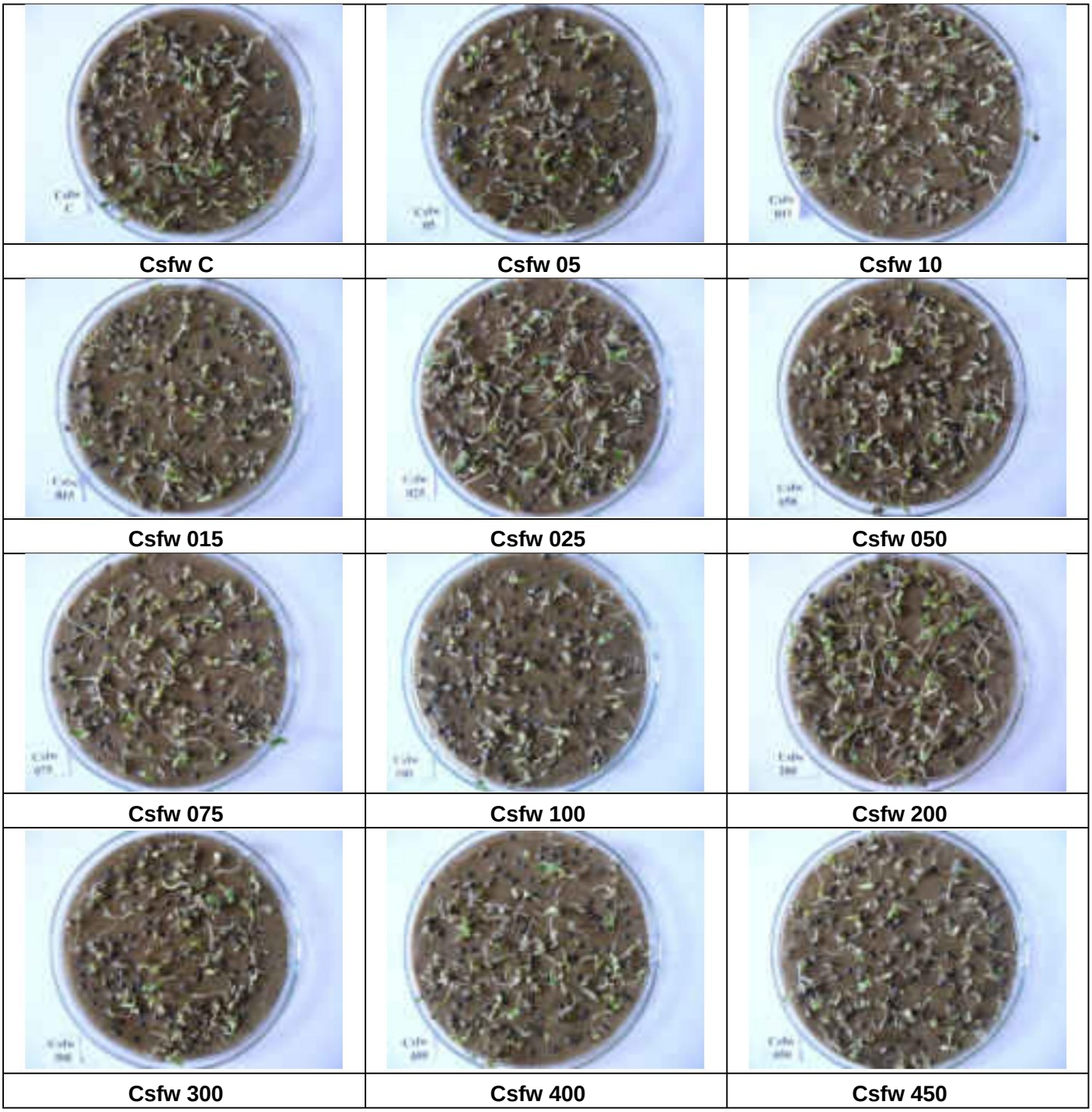

Figure 8 Comparison of tested variants with fresh activated water at different germination pressures and **germination of hemp seeds** *(Cannabis sativa* L.) in sand after **3 days from the start of the experiment (J. Šimková,** 2021)

3 days	**CSfwc CSfw5 CSfw10 CSfw15 CSfw25 CSfw50 CSfw75 CSfw100 CSfw200 CSfw300 CSfw400 CSfw450**											
	++	+	++	+	+++	+	+	+	++	+	+	+

Machine Translated by Google

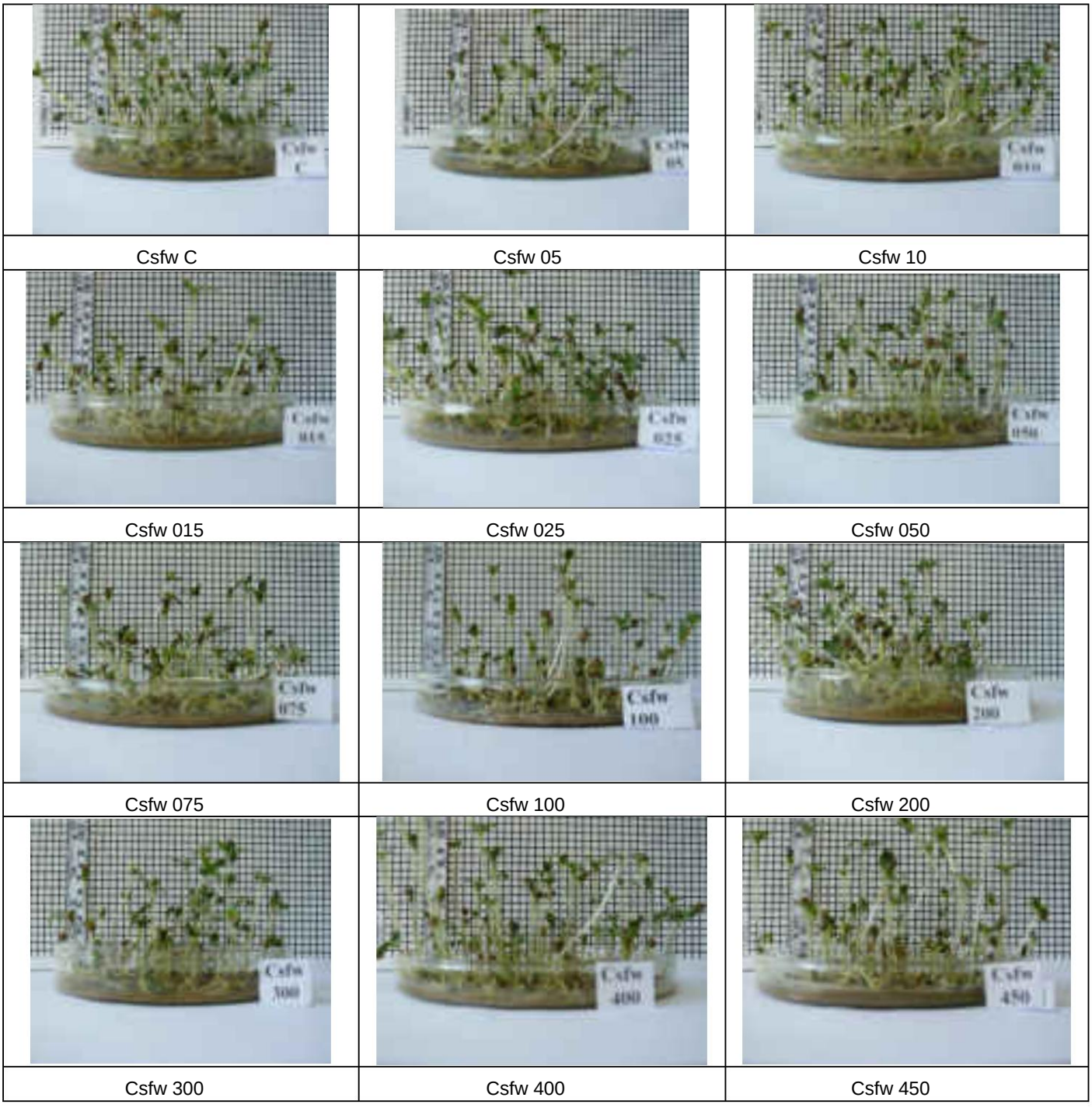

Figure 9 Comparison of the tested variants with fresh activated water (fw) at different pressures for the germination and emergence of hemp seeds (Cannabis sativa L.) in sand after 5 days from the start of the experiment (J. Šimková, 2021)

5 days	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450		
	++	+	++	+	+	+	+	+	++	+	++	++		

Machine Translated by Google

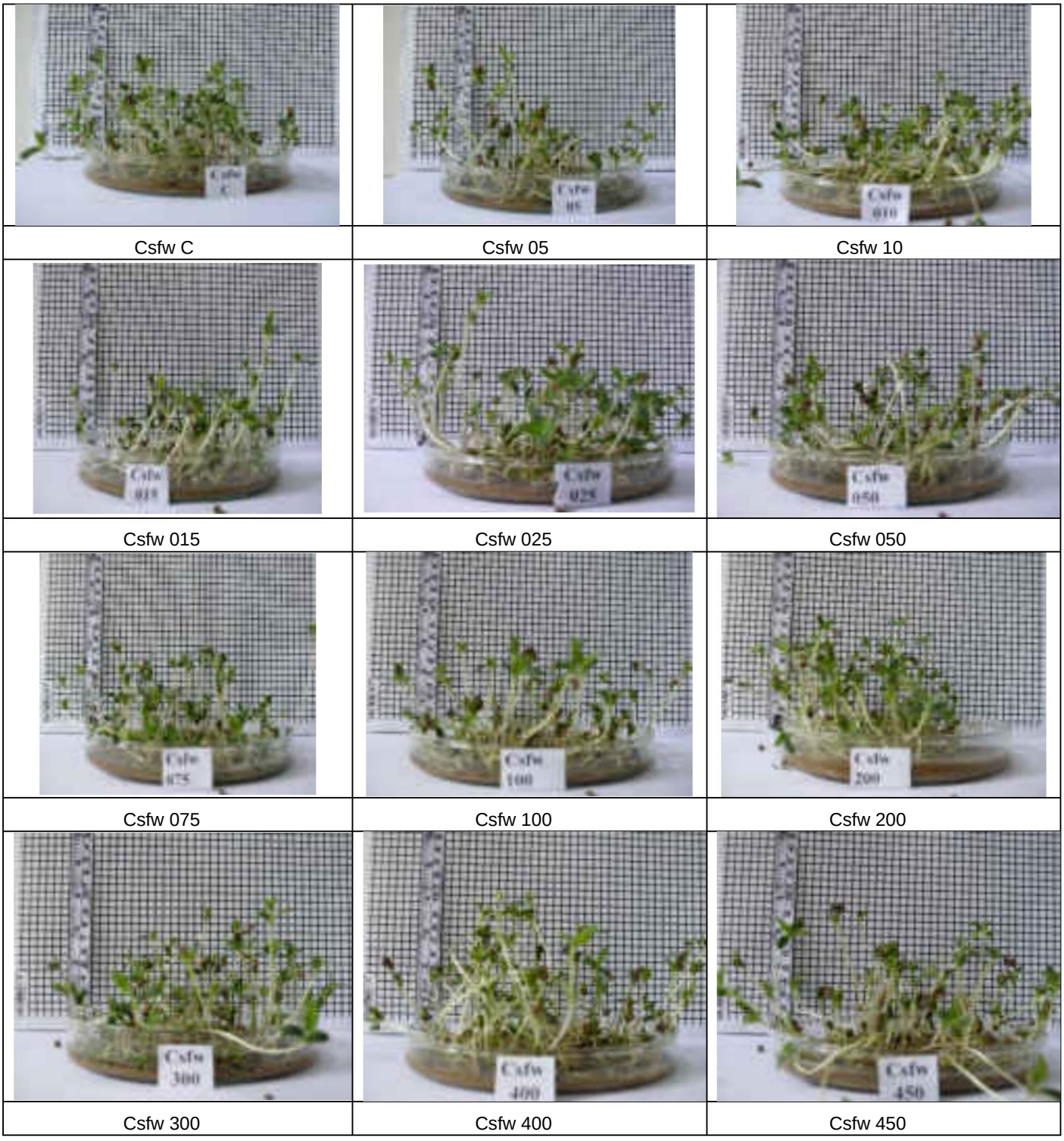

Figure 10 Comparison of the tested variants with fresh activated water (fw) at different pressures for the germination and emergence of hemp seeds (Cannabis sativa L.) in sand after 7 days from the start of the experiment (J. Šimková, 2021)

7 days	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450		
	++	+	+	+	++	+	+	+	++	++	++	+		

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C. Conclusions

Chart button			Stable - activated-sw 21.6.2021						28.6.2021		AQIPS-02-E03b	
Day ÿ	Csswc	Cssw5	Cssw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450		
24 hours	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	++	+	+	+	++	+	+	+	+	+	+	+	+	+
5	++	+	+	+	++	+	+	+	+	+	+	+	++	+
7	++	++	+	+	++	+	+	+	+	+	+	+	+	+
Chart button			Fresh - activated-fw 21.6.2021						28.6.2021		AQIPS-02-E03b	
Day ÿ	CSfwc	CSfw5	CSfw10	CSfw15	CSfw25	CSfw50	CSfw75	CSfw100	CSfw200	CSfw300	CSfw400	CSfw450		
24 hours	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	++	++	+	+	++	+	+	+	+	+	++	+	+	+
3	++	+	++	+	+++	+	+	+	+	+	++	+	+	+
5	++	+	++	+	+	+	+	+	+	+	++	+	++	++
7	++	+	+	+	++	+	+	+	+	+	++	++	++	+

Marking		Plant growth intensity
BR -		No growth
PR +		Slow plant growth - Blockage of growth
NO ++		Normal plant growth - Plant growth
IR +++	Intensive plant growth	
ER ++++	Extremely intensive growth	

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The effect of activated water with the IPS system on the germination and growth of hemp (Cannabis sativa L.)

AQIPS-02-E03c Contents

A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on plant growth species

2. Plant species: Cannabis sativa L 3. Designation of plant species in experiments: Cs, location: Nitra N, pot no.

4. Trial start date: 24.8.2021 5. Trial termination date: 13.10.2021 6. Method of growing plants: pots, laboratory conditions, variety: Felina 32 (16 seeds)

7. Characteristics evaluated by measurement: plant length, total plant weight, weight of fresh chaff, dry chaff, weight of fresh leaves + stems, weight of dry leaves + stems 8. Experimental variants

Marking of samples for water flooding and morphological measurements

Stable activated water (sw), Location: Nitra N, pot no	
Designation	Description of the variant Cssw-c Water from the tap can withstand - check Produced water at a pressure of 05Pa
Cssw05	
Cssw10	Created water at a pressure of 10Pa
Cssw15	Created water at a pressure of 15Pa
Cssw25	Created water at a pressure of 25Pa
Cssw50	Created water at a pressure of 50Pa
Cssw75	Created water at a pressure of 75Pa
Cssw100	Created water at a pressure of 100Pa
Cssw200	Created water at a pressure of 200Pa
Cssw300	Created water at a pressure of 300Pa
Cssw400	Created water at a pressure of 400Pa
Cssw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		Characteristics of samples
etc	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Results

Table 1 Average values of evaluated morphometric features of hemp plants determined in experimental variants with the application of activated water in laboratory conditions (Nitra)

	total weight (g) 21.5 23.0	fresh chaff 5.7	No. leaves +	dry chaff PL	dry stems + leaves	length (cm)
CSNCÿ	24.1	3.9		1.4	3.7	32,3
CSN5ÿ	25.9	5.4		1.3	4.7	33,4
CSN10ÿ	25.6	3.8		1.2	3.8	37,5
CSN15ÿ	10.9	7.5		0.2	4.9	33,6
CSN25ÿ	19.9	1.6	stems	1.7	4.7	31,9
CSN50ÿ	24.3	3.3		0.4	1.9	32,4
CSN75ÿ	14.1	7.4	15.6	0.6	3.5	32,5
CSN100ÿ	28.7	3.5	19.1	1.6	4.6	34,3
CSN200 no	18.7	6.8	18.9	0.8	2.0	32,9
CSN300ÿ	24.7	2.1	22.1	1.3	5.2	35,3
CSN400ÿ	12	4.7	17.9	0.6	3.9	37,7
CSN450ÿ		12	9.3	1.0	3.9	35,6
n			16.4	16.6 10.612	21.9 16.6 19.9 12	12
min	10,9	1,6	9,3	0,15	1,9	19,8
max	28,7	7,5	22,1	1,7	5,2	29,2
x	21,78	4,64	17,08	1,00	3,90	24,50
s	5,15	1,96	3,93	0,50	1,06	2,76
sx	1,49	0,57	1,14	0,14	0,31	0,80
IN	23,64	42,20	23,03	49,68	27,09	11,27

Table 2 Comparison of the values of correlation coefficients between the assessed traits of hemp (Cannabis sativa L.) by the Pearson method

	total weight (g)	fresh chaff	No. leaves + stems	dry chaff PL	dry stems + leaves	plant length (cm)
total weight (g) fresh chaff						
no. leaves +	1	1				
stems dry chaff PL	0,74	0,46				
dry stems + leaves	0,94	0,85	1			
plant length (cm)	0,49	0,62	0,21	1		
	0,93 0,26	-0,04	0,91 0,38	0,42 -0,01	1 0,22	1

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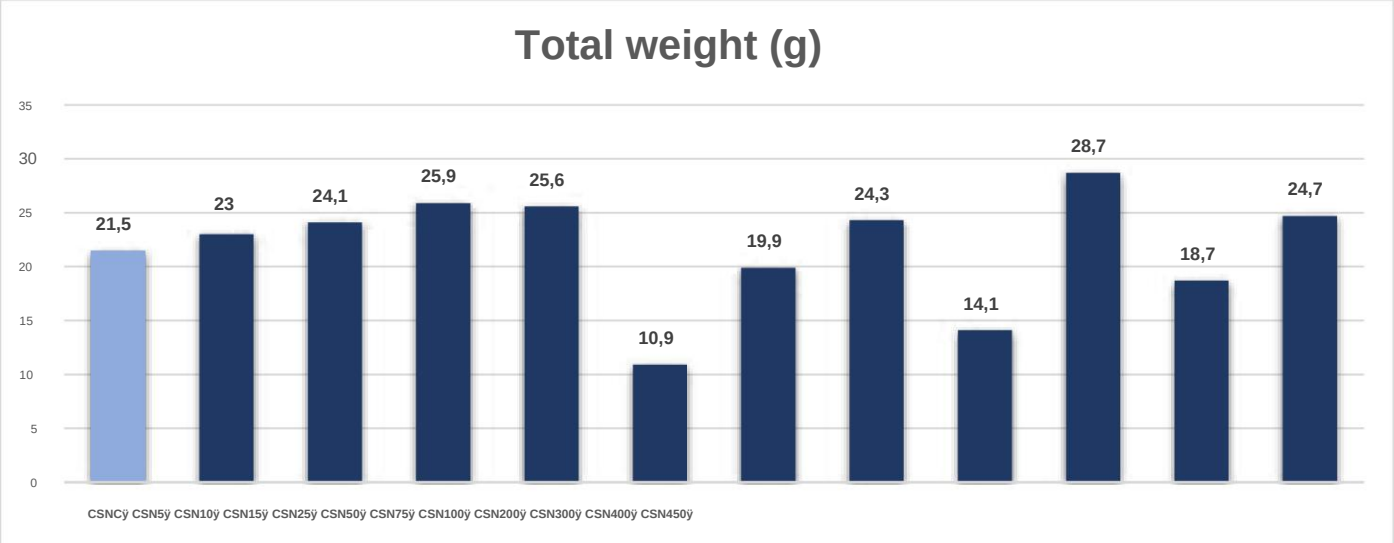

Figure 1 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water by the IPS system on plant weight** (g) of hemp *(Cannabis sativa* L.) in **fresh condition at the Nitra site (2021)**

Compared to the control variant, the weight increased from the application of water obtained at 5 Pa to 25 Pa. Subsequently, there were significant changes in the alternation of effects on reducing and increasing plant weight. In general, the highest plant weight was obtained after the application of water obt 300 Pa.

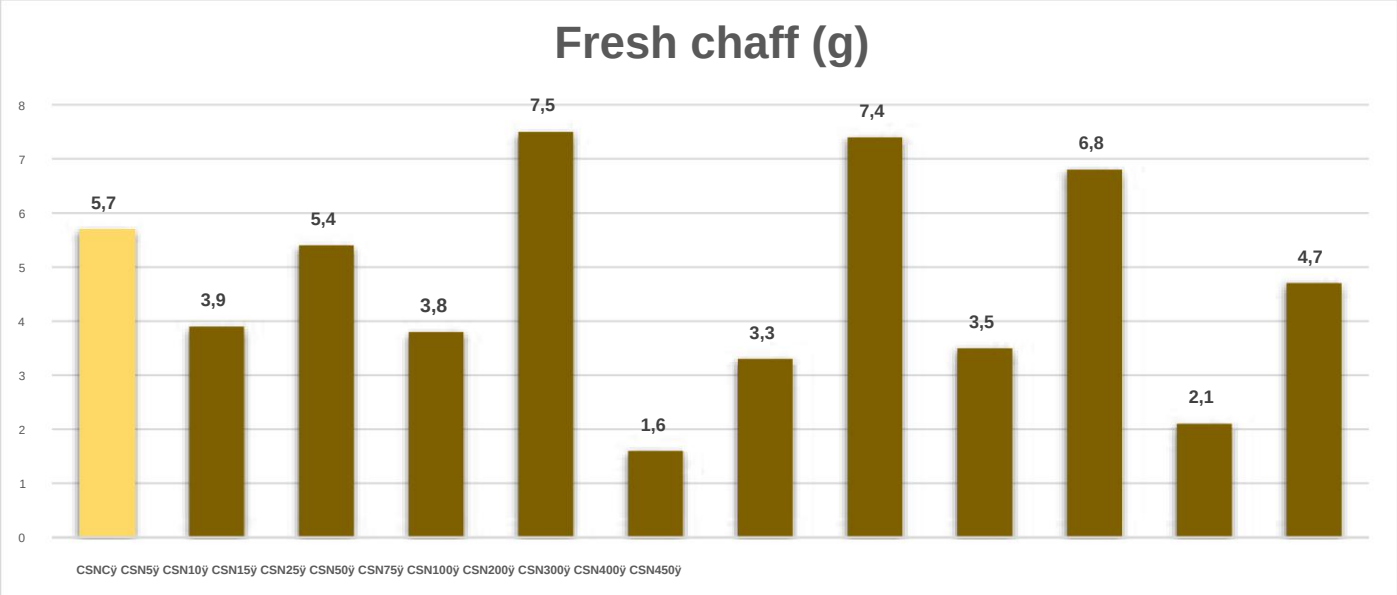

Figure 2 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water by the IPS system on the weight of chaff of** hemp plants *(Cannabis sativa* L.) in **the fresh state at the Nitra site (2021)**

Compared to the control variant, an increase in the weight of fresh chaff was noted only after the application of water obtained at 25 Pa, 100 Pa and 300 Pa. After applying water at other pressures, we they noted a decrease in the weight of fresh chaff.

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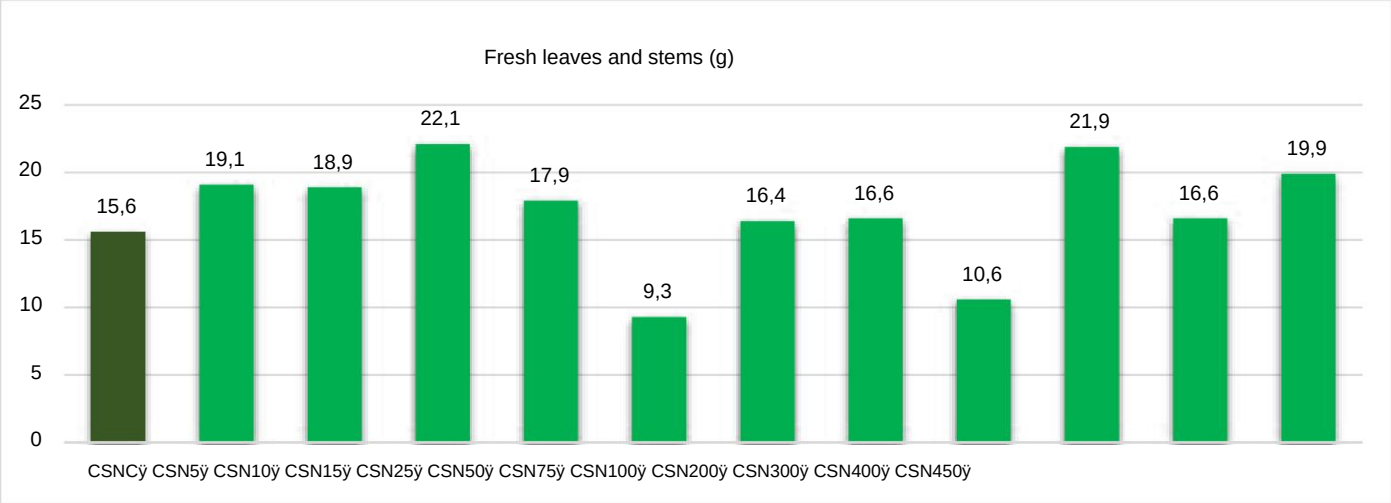

Figure 3 Comparison of varieties of hemp grown in pots watered at different pressures of activated water with the IPS system on the weight of leaves and stems of hemp plants (Cannabis sativa L.) in the fresh state at the Nitra site (2021)

Compared to the control variant, we recorded an increase in the weight of fresh leaves from the stems only after the application of water obtained at 5 Pa, 10 Pa, 15 Pa, 25 Pa, 300 Pa and 450 Pa. After applying water at other pressures of 50 Pa and 200 Pa, we noted a decrease in the weight of the given sign.

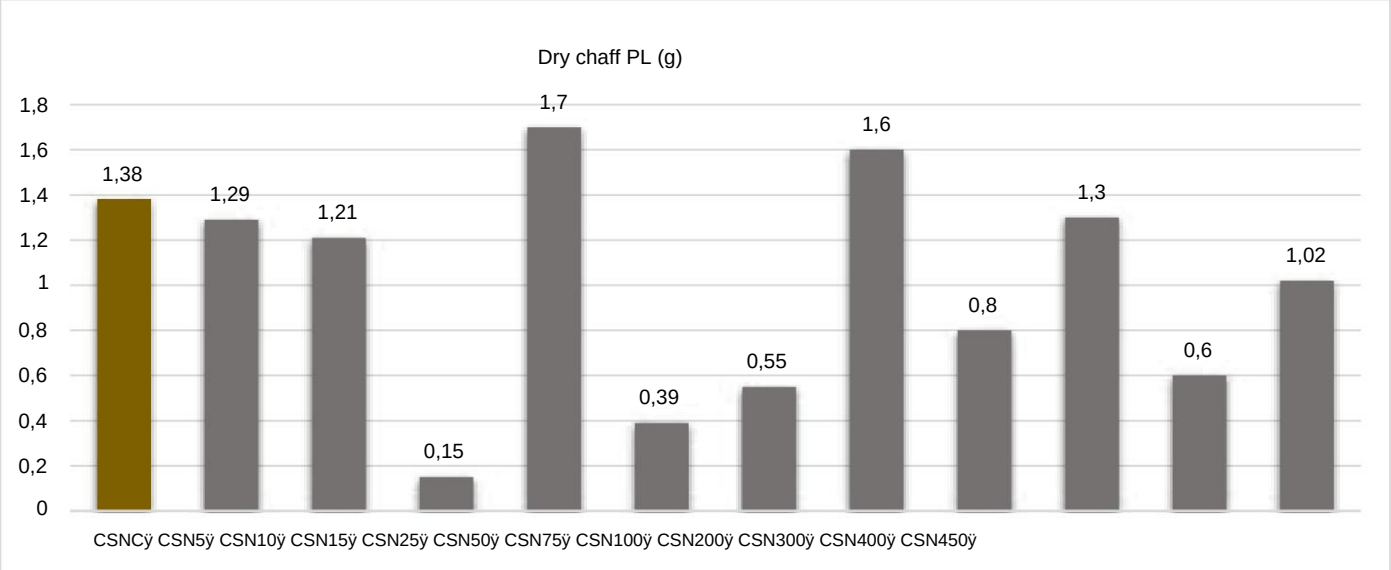

Figure 4 Comparison of varieties of hemp grown in pots watered at different pressures of activated water by the IPS system on the weight of chaff of hemp plants (Cannabis sativa L.) in the dry state at the Nitra site (2021)

Compared to the control variant, we recorded an increase in the weight of dry chaff only after the application of water obtained at 25 Pa and 100 Pa. After applying the water obtained from the others at the other pressures, we noticed a significant reduction in the weight of the dry chaff.

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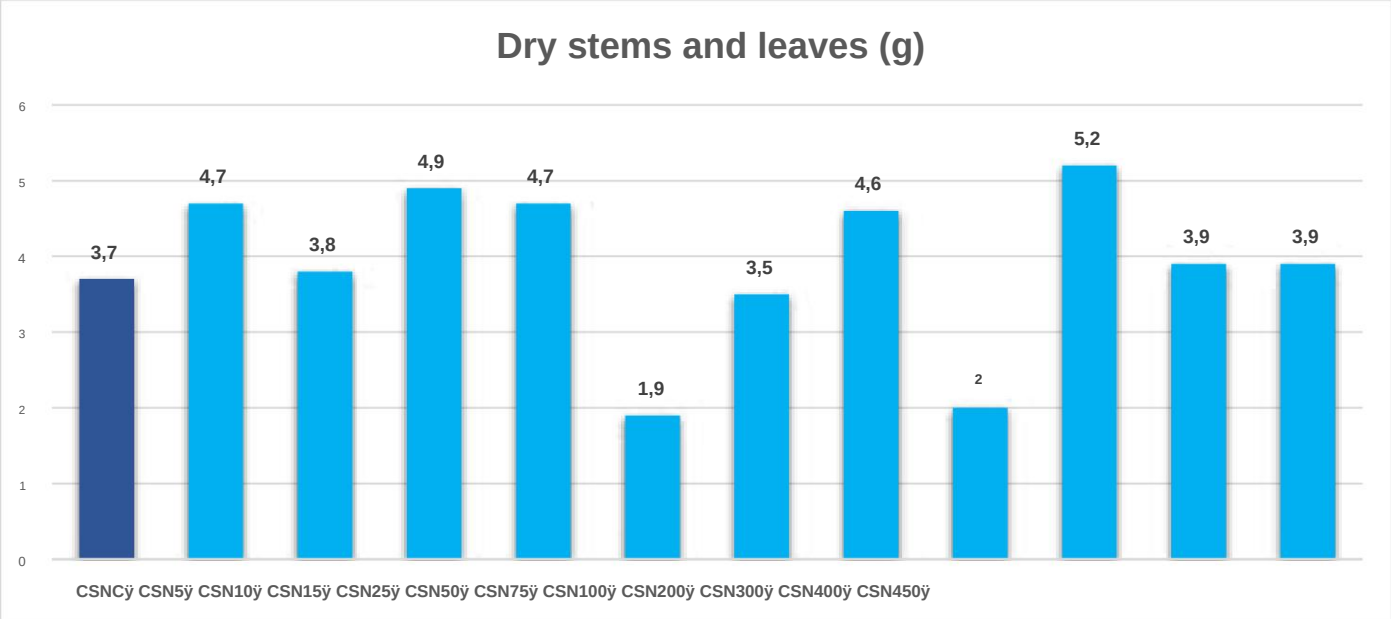

Figure 5 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water by the IPS system on the weight** of stems and leaves of hemp **plants** *(Cannabis sativa* L.) in the dry state **at the Nitra site (2021)**

Compared to the control variant, an increase in the weight of dry stems with leaves was noted only after the application of water obtained at 5 Pa, 15 Pa, 25 Pa, 100 Pa and 300 Pa. After applying water at pressures of 50 Pa and 200 Pa, we noted a decrease in the weight of dry stems with leaves.

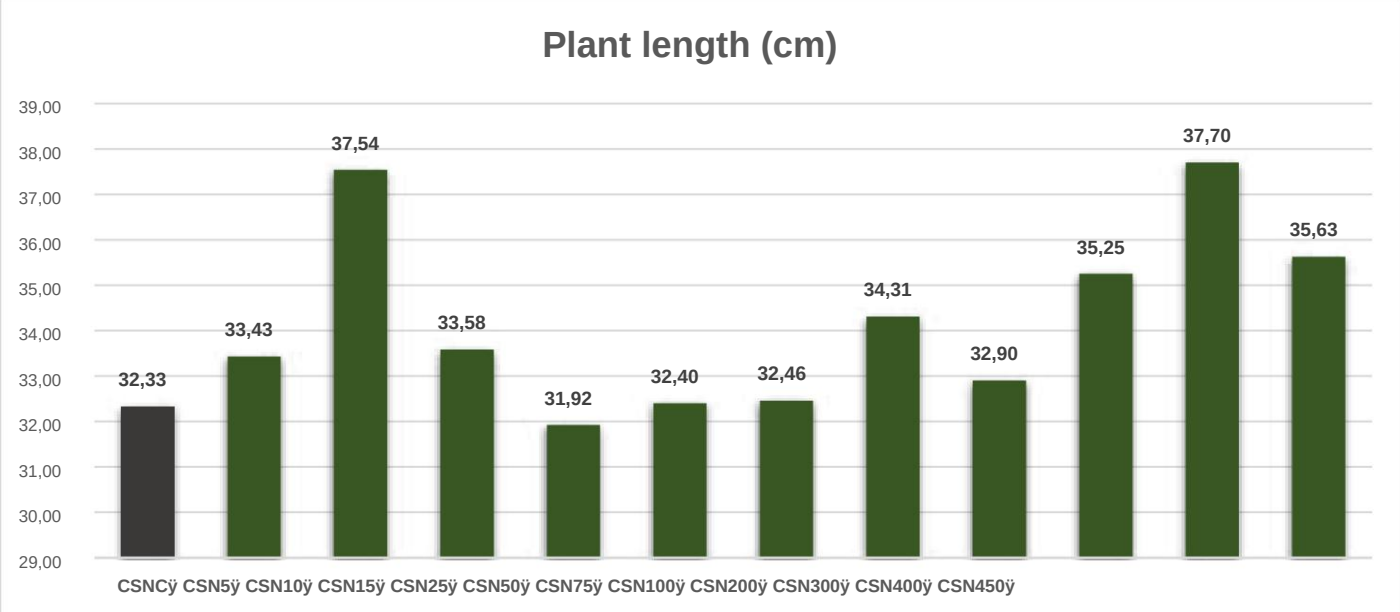

Figure 6 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water by the IPS system** on the length of hemp **plants** *(Cannabis sativa* L.) **at the Nitra site (2021)**

Compared to the control variant, we recorded a significant increase in plant length (cm) only after the application of water obtained at 10 Pa, 100 Pa, 300 Pa, 400 Pa and 450 Pa. After the application of the water obtained from the others at the other pressures, we noted a persistence at the level of the control varia

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C. Image documentation

		
Cssw C	Cssw 05	Cssw 10
		
Cssw 015	Cssw 025	Cssw 050
		
Cssw 075	Cssw 100	Cssw 200
		
Cssw 300	Cssw 400	Cssw 450

Figure 7 Comparison of the tested variants with stable activated water (sw) at different pressures for germination and emergence of hemp seeds sown Cannabis sativa L. after 3 days from the start of the experiment (J. Šimková, 2021)

3 days	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450		
	+	+	+	+	+	+	+	+	+	+	+	+	+	+

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Figure 8 Comparison of the tested variants with stable activated water (sw) at different pressures for the germination and emergence of hemp seeds sown Cannabis sativa L. after 7 days from the start of the experiment (J. Šimková, 2021)

7 days	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450
	++	++	++	++	++	++	++	++	+	++	++	+

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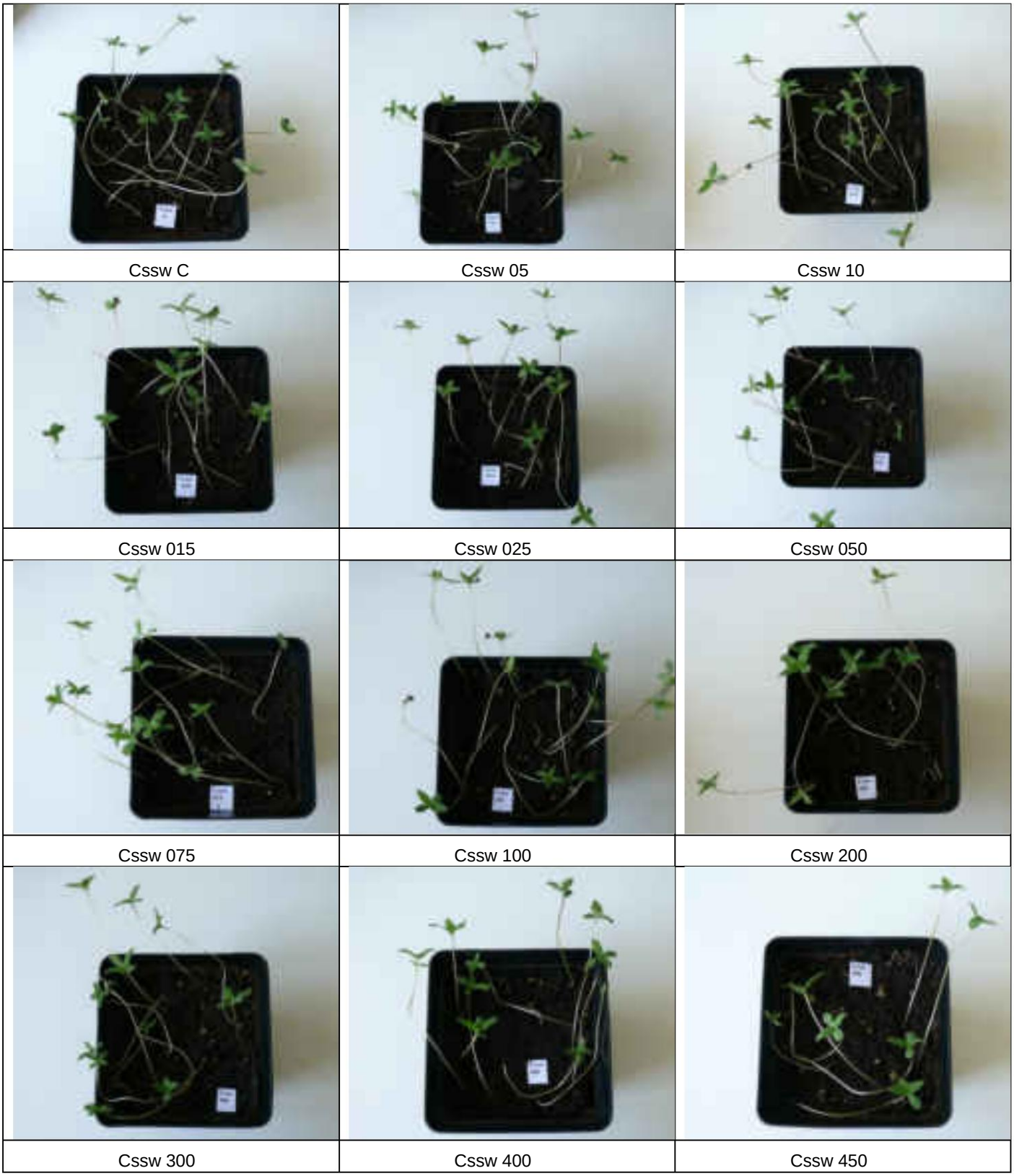

Figure 9 Comparison of tested variants with stable activated water (sw) at different pressures for the germination and emergence of hemp seeds sown Cannabis sativa L. after 9 days from the start of the experiment (J. Šimková, 2021)

9 dňoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	++	++	++	++	++	++	++	++	++	+	++	++	+		

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Cssw C	Cssw 05	Cssw 10
		
Cssw 015	Cssw 025	Cssw 050
		
Cssw 075	Cssw 100	Cssw 200
		
Cssw 300	Cssw 400	Cssw 450

Figure 10 Comparison of the tested variants with stable activated water (sw) at different pressures for the germination and emergence of hemp seeds sown Cannabis sativa L. after 21 days from the start of the experiment (J. Šimková, 2021)

21 days	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450		
	++	++	++	++	++	++	++	++	++	++	++	++	++	++

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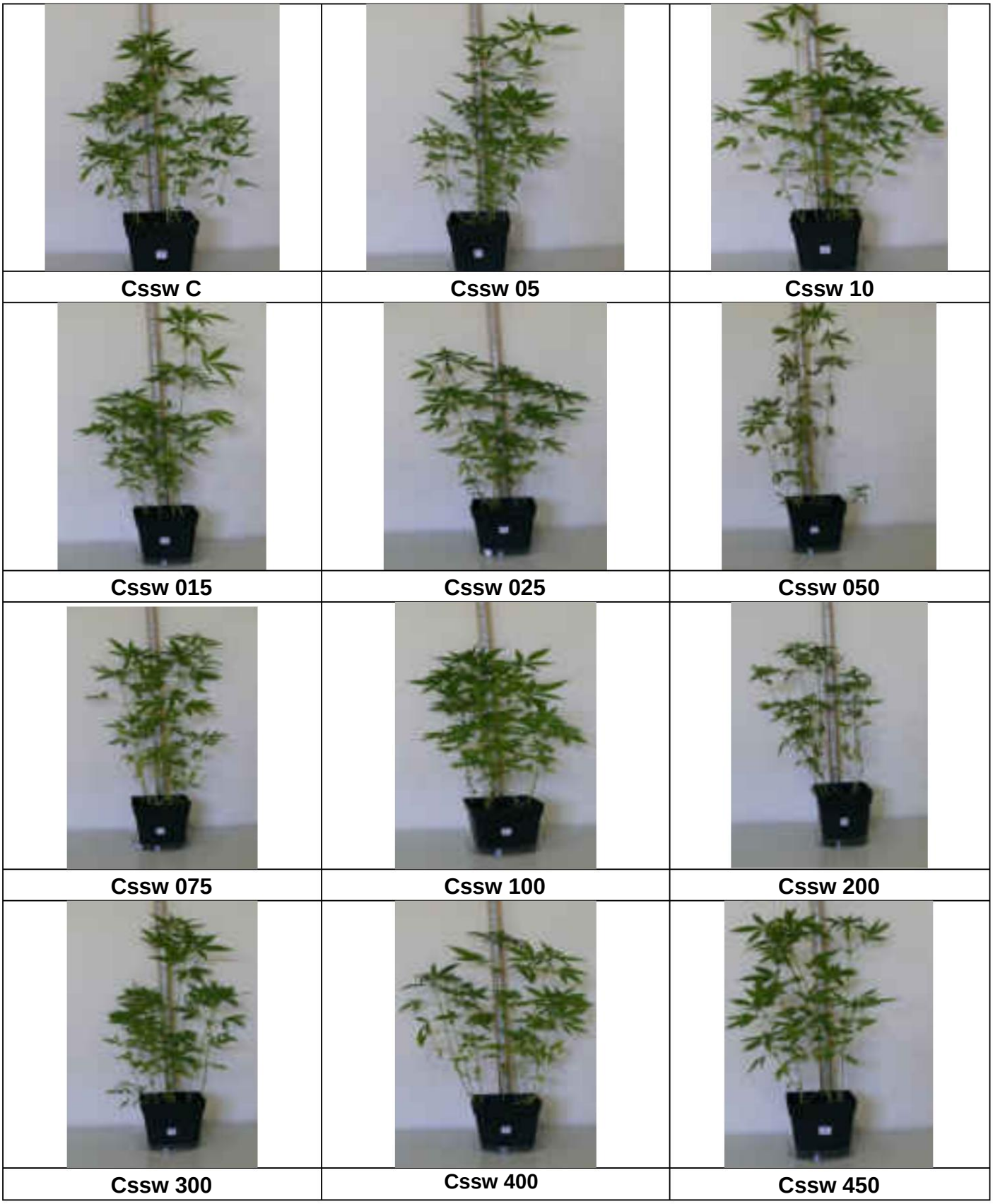

Figure 11 Comparison **of the tested variants with** stable activated water (sw) **at different pressures for germination and emergence of hemp seeds sown** *Cannabis sativa* L. after 51 **days from the start of the experiment (J. Šimková, 2021)**

51 dÿoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	++	++	++	++	++	+	++	+++	+	++	++	++			

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Figure 12 Comparison of the tested variants with stable activated water (sw) at **different pressures for the germination and emergence of hemp seeds sown** *Cannabis sativa* L. after 56 **days from the start of the experiment (J. Šimková, 2021)**

56 dňoch	CSswc	CSsw5	CSsw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450			
	+++	+++	++	++	++	+	++	+++	+	++	++	+++			

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D. Conclusions

Chart button			Stable - activated-sw 24.8.2021						13.10.2021		AQIPS-02-E03c	
Day [y]	Csswc	Cssw5	Cssw10	CSsw15	CSsw25	CSsw50	CSsw75	CSsw100	CSsw200	CSsw300	CSsw400	CSsw450
3	+	+	+	+	+	+	+	+	+	+	+	+
7	++	++	++	++	++	++	++	++	++	+	++	++
9	++	++	++	++	++	++	++	++	++	+	++	++
21	++	++	++	++	++	++	++	++	++	++	++	++
51	++	++	++	++	++	+	++	+++	+	++	++	++
56	+++	+++	++	++	++	+	++	+++	+	++	++	+++

Designation	Intensity of plant growth
BR -	No growth
PR +	Slow plant growth - Blockage of growth
NO ++	Normal plant growth - Plant growth
IR +++	Intensive plant growth
ER ++++	Extremely intensive growth

Compared to the control variant, the plant weight increased from the application of water obtained at 5 Pa to 25 Pa. Subsequently, there were significant changes in the alternation of effects on reducing and increasing plant weight. In general, the highest plant weight was obtained after the application of water obtained at
300 Pa.

Compared to the control variant, an increase in the weight of fresh chaff was noted only after the application of water obtained at 25 Pa, 100 Pa and 300 Pa. After applying water at other pressures, we
they noted a decrease in the weight of fresh chaff.

Compared to the control variant, we recorded an increase in the weight of fresh leaves from the stems only after the application of water obtained at 5 Pa, 10 Pa, 15 Pa, 25 Pa, 300 Pa and 450 Pa. After applying water at other pressures of 50 Pa and 200 Pa, we noted a decrease in the weight of the given sign.

Compared to the control variant, we recorded an increase in the weight of dry chaff only after the application of water obtained at 25 Pa and 100 Pa. After applying the water obtained from the others at the other pressures, we noticed a significant reduction in the weight of the dry chaff.

Compared to the control variant, an increase in the weight of dry stems with leaves was noted only after the application of water obtained at 5 Pa, 15 Pa, 25 Pa, 100 Pa and 300 Pa. After applying water at pressures of 50 Pa and 200 Pa, we noted a decrease in the weight of dry stems with leaves.

Compared to the control variant, we recorded a significant increase in plant length (cm) only after the application of water obtained at 10 Pa, 100 Pa, 300 Pa, 400 Pa and 450 Pa. After the application of the water obtained from the others at the other pressures, we noted a persistence at the level of the control variant.

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Effect of activated water by the IPS system on the germination and growth of watercress (Lepidium sativum L.) AQIPS-02-E04a

Contents

A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species
2. Plant species: Cress siata Lepidium sativum L. (Ls – designation of the species)
3. Designation of the plant species in the experiments: Ls
4. Date of establishment of the experiment: 26.5.2021
5. End date of the experiment: 11/06/2021
6. Method of growing plants: Petri dishes, laboratory conditions
7. Evaluation of the experiment: Image analysis
8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in IPS device experiments Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Description of the variant	Designation	Variant description
Lsfw-c	Tap water - control	Lssw-c	Tap water is stagnant - check
Lsfw05	Created water at a pressure of 05Pa	Lssw05	Created water at a pressure of 05Pa
Lsfw10	Created water at a pressure of 10Pa	Lssw10	Created water at a pressure of 10Pa
Lsfw15	Created water at a pressure of 15Pa	Lssw15	Created water at a pressure of 15Pa
Lsfw25	Created water at a pressure of 25Pa	Lssw25	Created water at a pressure of 25Pa
Lsfw50	Created water at a pressure of 50Pa	Lssw50	Created water at a pressure of 50Pa
Lsfw75	Created water at a pressure of 75Pa	Lssw75	Created water at a pressure of 75Pa
Lsfw100	Created water at a pressure of 100Pa	Lssw100	Created water at a pressure of 100Pa
Lsfw200	Created water at a pressure of 200Pa	Lssw200	Created water at a pressure of 200Pa
Lsfw300	Created water at a pressure of 300Pa	Lssw300	Created water at a pressure of 300Pa
Lsfw400	Created water at a pressure of 400Pa	Lssw400	Created water at a pressure of 400Pa
Lsfw450	Created water at a pressure of 450Pa	Lssw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Marking		Characteristics of samples
etc	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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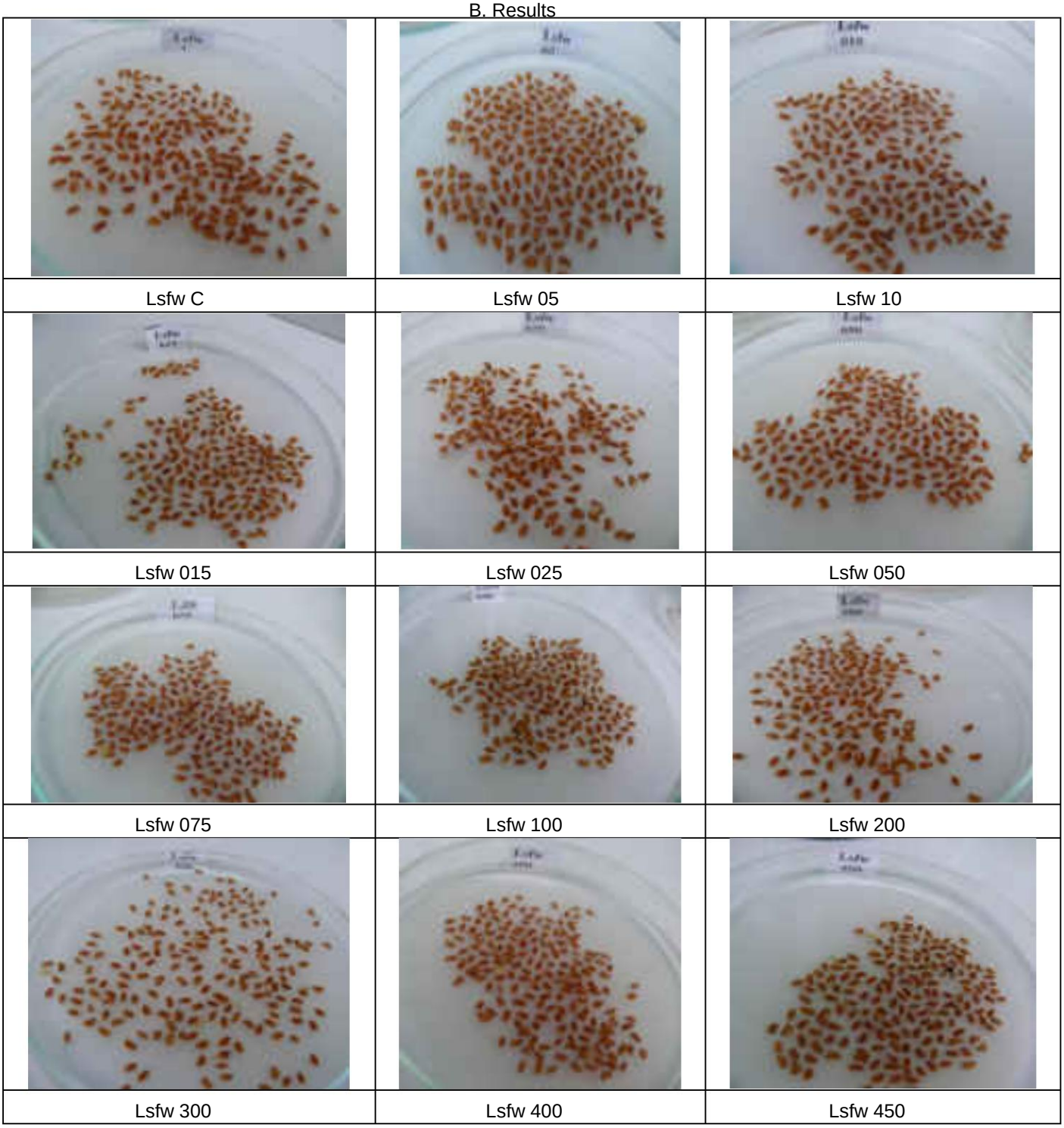

Lsfw C	Lsfw 05	Lsfw 10
Lsfw 015	Lsfw 025	Lsfw 050
Lsfw 075	Lsfw 100	Lsfw 200
Lsfw 300	Lsfw 400	Lsfw 450

Figure 1 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of watercress seeds sown Lepidium sativum L. after 24 hours from the start of the experiment (J. Šimková 2021)

24 hours	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450			
	+	+	+	+	+	+	+	+	+	+	+	+			

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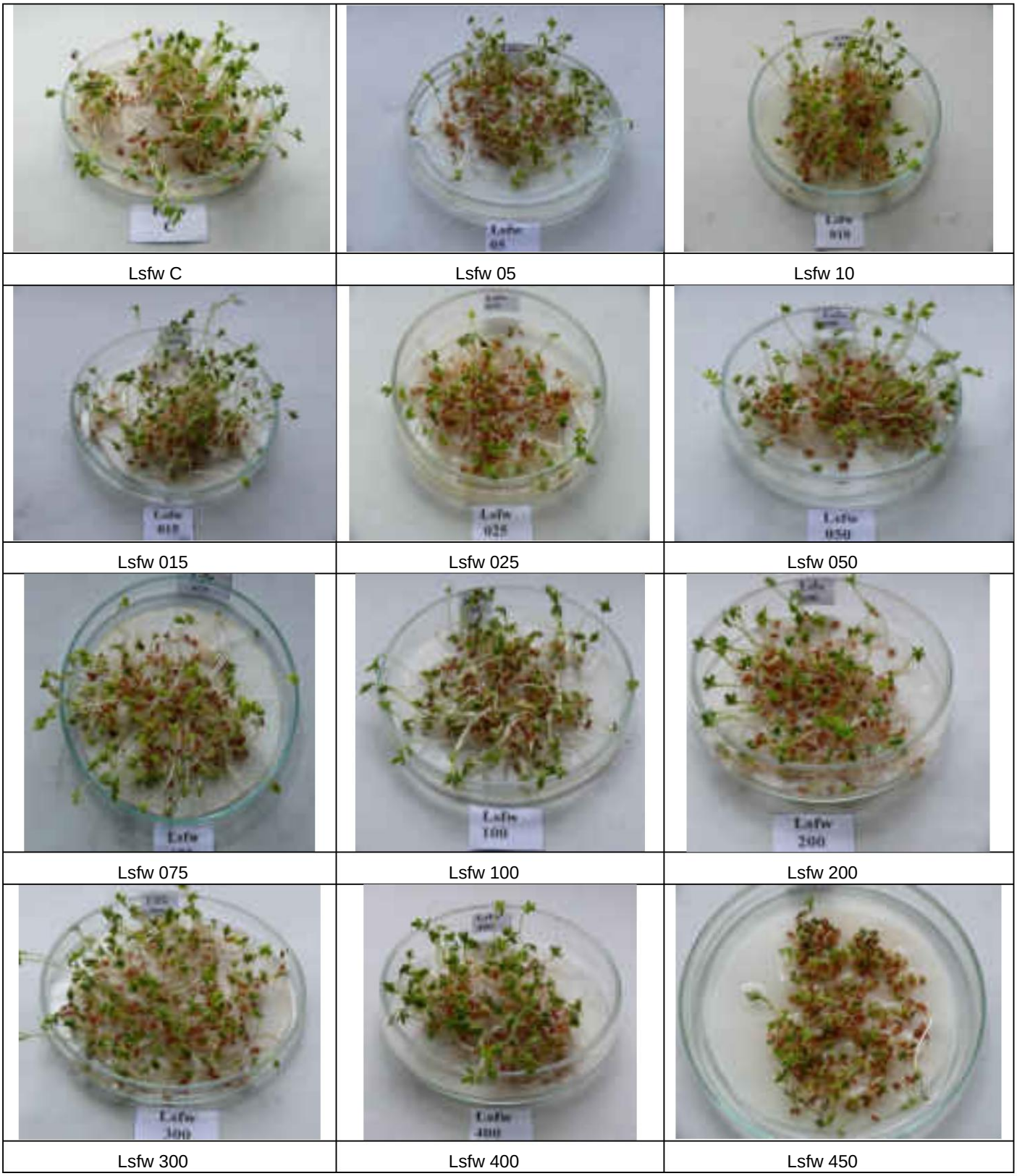

Figure 2 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 5 days from the start of the experiment (J. Šimková, 2021)

5 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	++	++	++	++	++	++	++	++	++	++	++	+

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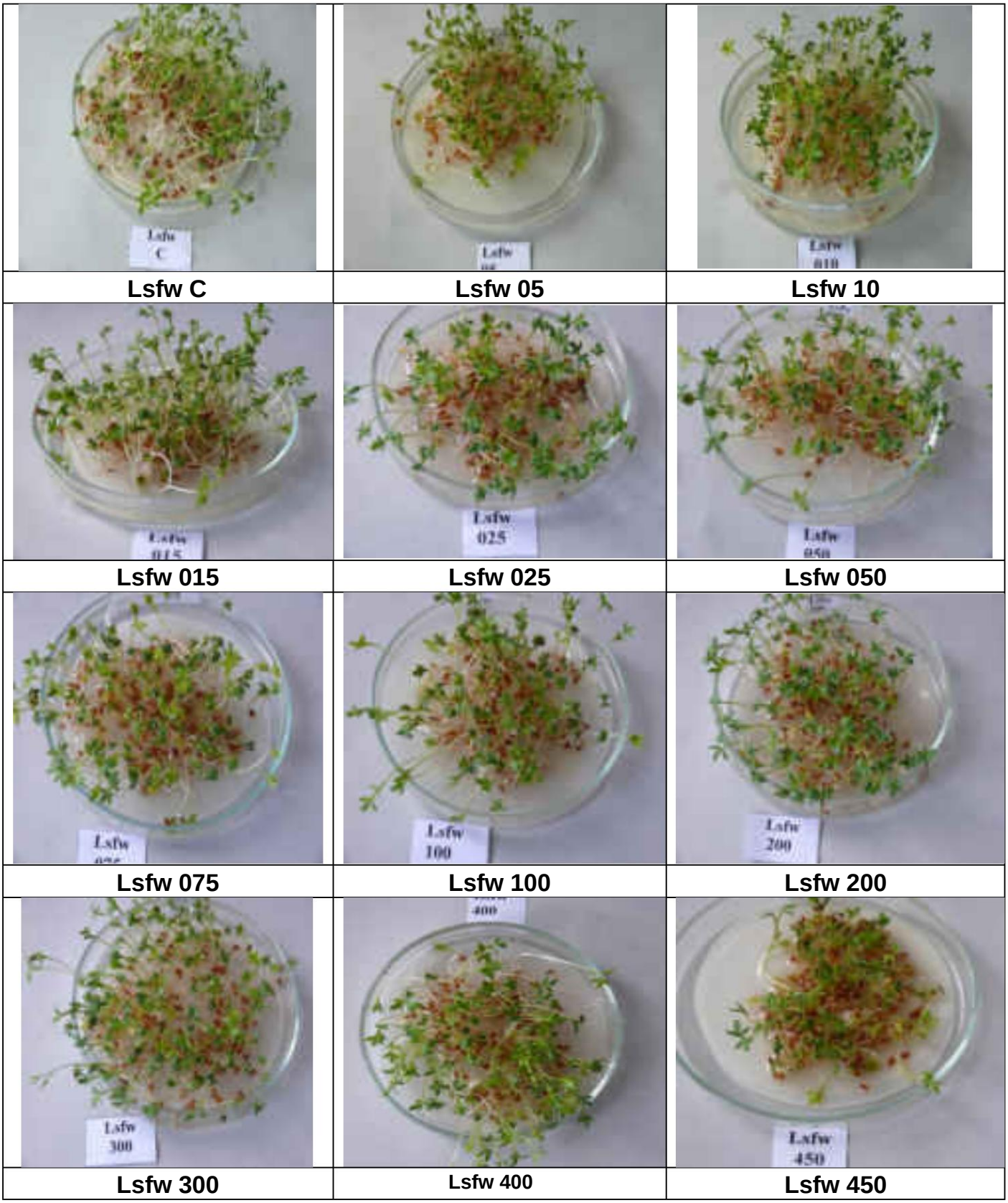


Figure 3 Comparison of tested variants with activated fresh water at different pressures for germination and **emergence of cress seeds sown** *Lepidium sativum* **L. after 6 days from the start of the experiment (Šimková 2**

6 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	++	++	++	++	++	++	++	++	++	++	++	+

Machine Translated by Google

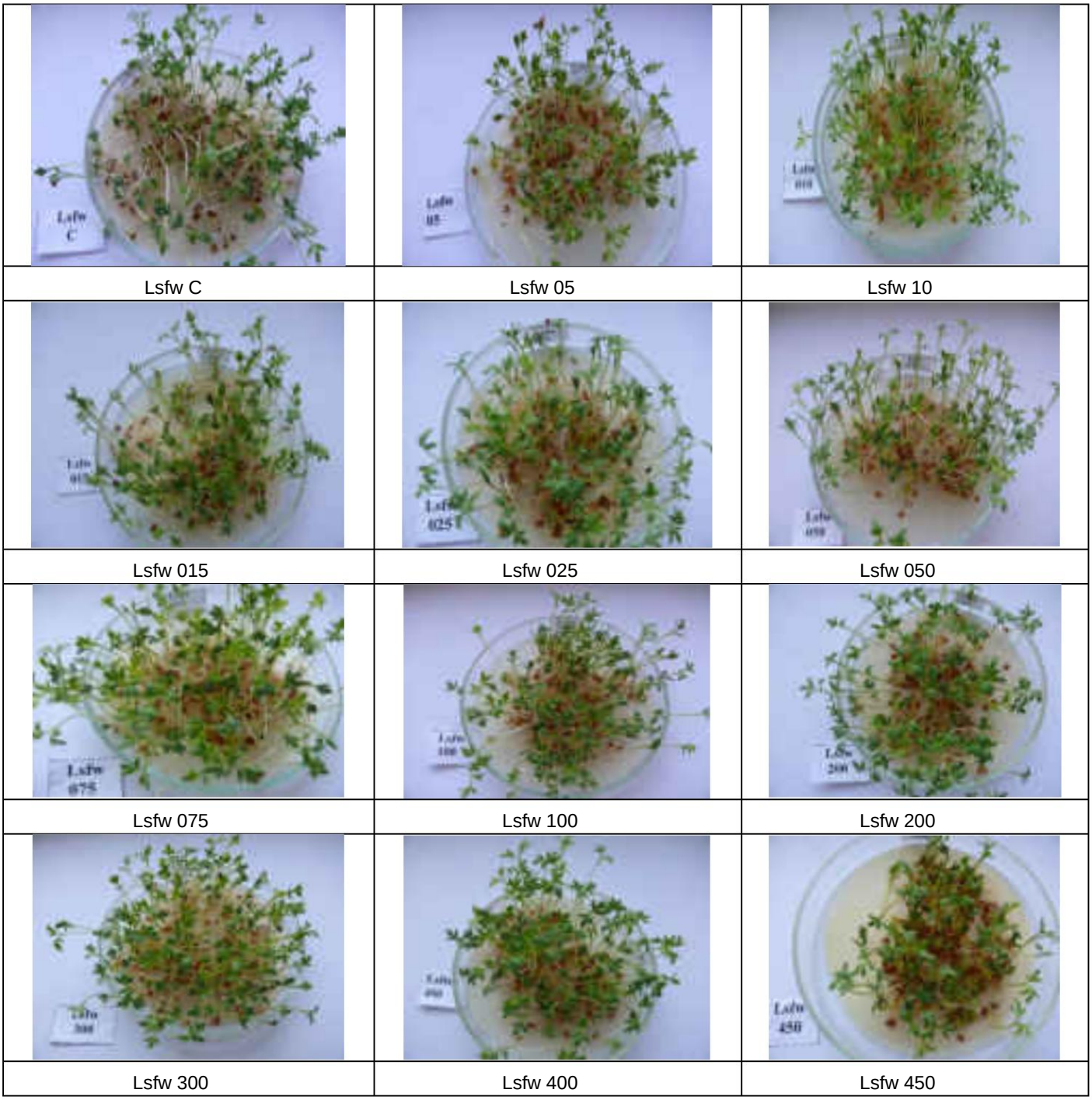


Figure 4 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 7 days from the start of the experiment (J. Šimková 2021)

7 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	++	++	++	++	++	++	++	++	++	++	++	+

Machine Translated by Google

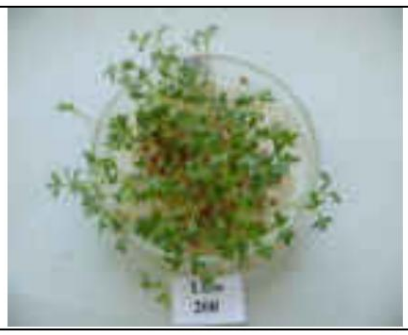
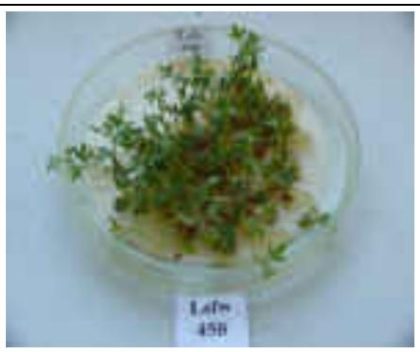
		
Lsfw C	Lsfw 05	Lsfw 10
		
Lsfw 015	Lsfw 025	Lsfw 050
		
Lsfw 075	Lsfw 100	Lsfw 200
		
Lsfw 300	Lsfw 400	Lsfw 450

Figure 5 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 9 days from the start of the experiment (J. Šimková 2021)

9 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450		
	++	++	++	++	++	++	++	++	++	++	++	++	++	+

Machine Translated by Google

Lsfw C

Lsfw 05

Lsfw 10

Lsfw 015

Lsfw 025

Lsfw 050

Lsfw 075

Lsfw 100

Lsfw 200

Lsfw 300

Lsfw 400

Lsfw 450

Figure 6 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 13 days from the start of the experiment (J. Šimková 2021)

13 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450		
	++	++	+++	++	++	++	++	++	++	++	++	+++	+	

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Lsfw C	Lsfw 05	Lsfw 10
		
Lsfw 015	Lsfw 025	Lsfw 050
		
Lsfw 075	Lsfw 100	Lsfw 200
		
Lsfw 300	Lsfw 400	Lsfw 450

Figure 7 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 16 days from the start of the experiment (J. Šimková 2021)

16 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450		
	+	+	+++	+++	++	++	+++	++	++	++	+++	+		

Machine Translated by Google

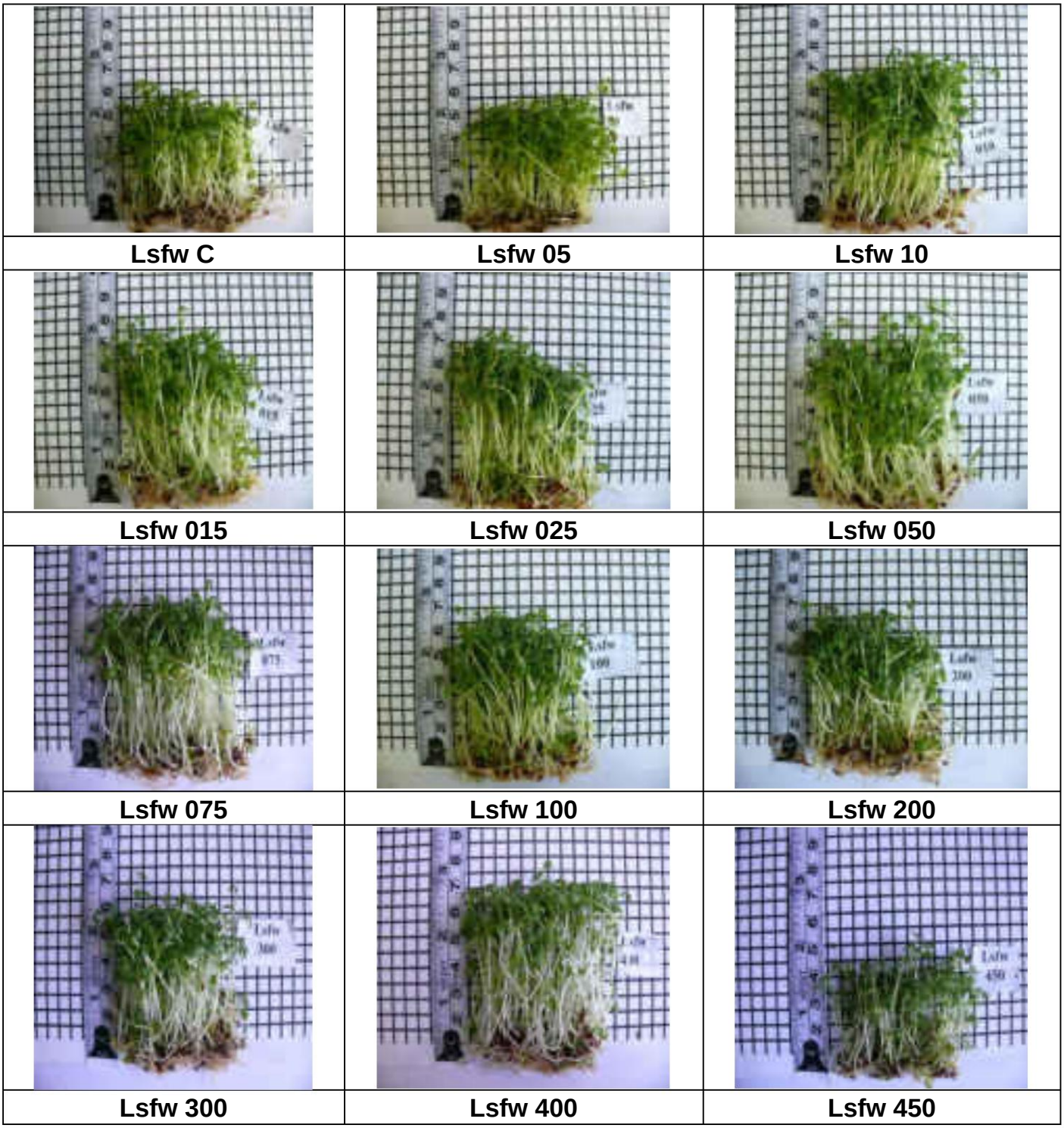

Figure 8 Comparison of tested variants with activated fresh water at different pressures for germination and **emergence of cress seeds** *Lepidium sativum* **L. after 16 days from the start of the experiment (J. Šimková** 2021)

16 today	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450					
h	+	+	+++	+++	++	+++	+++	++	++	++	+++	+					

Machine Translated by Google

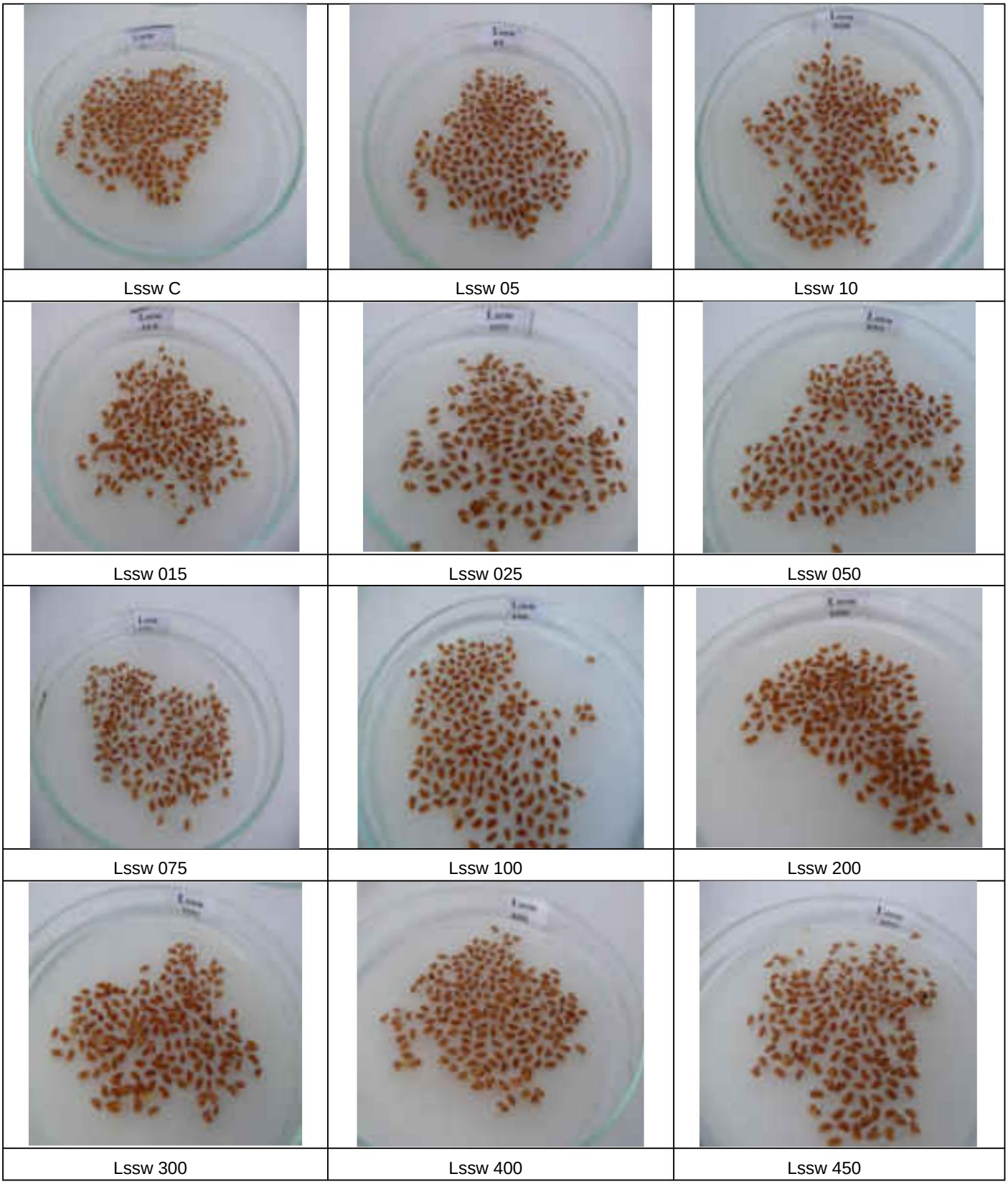

Figure 9 Comparison of the tested variants with stable activated water at different pressures for the germination and emergence of cress seeds sown Lepidium sativum L. after 24 hours from the start of the experiment
(J. Šimková 2021)

24 hours	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	++	++	++	++	++	++	++	+	+	++	++	+		

Machine Translated by Google

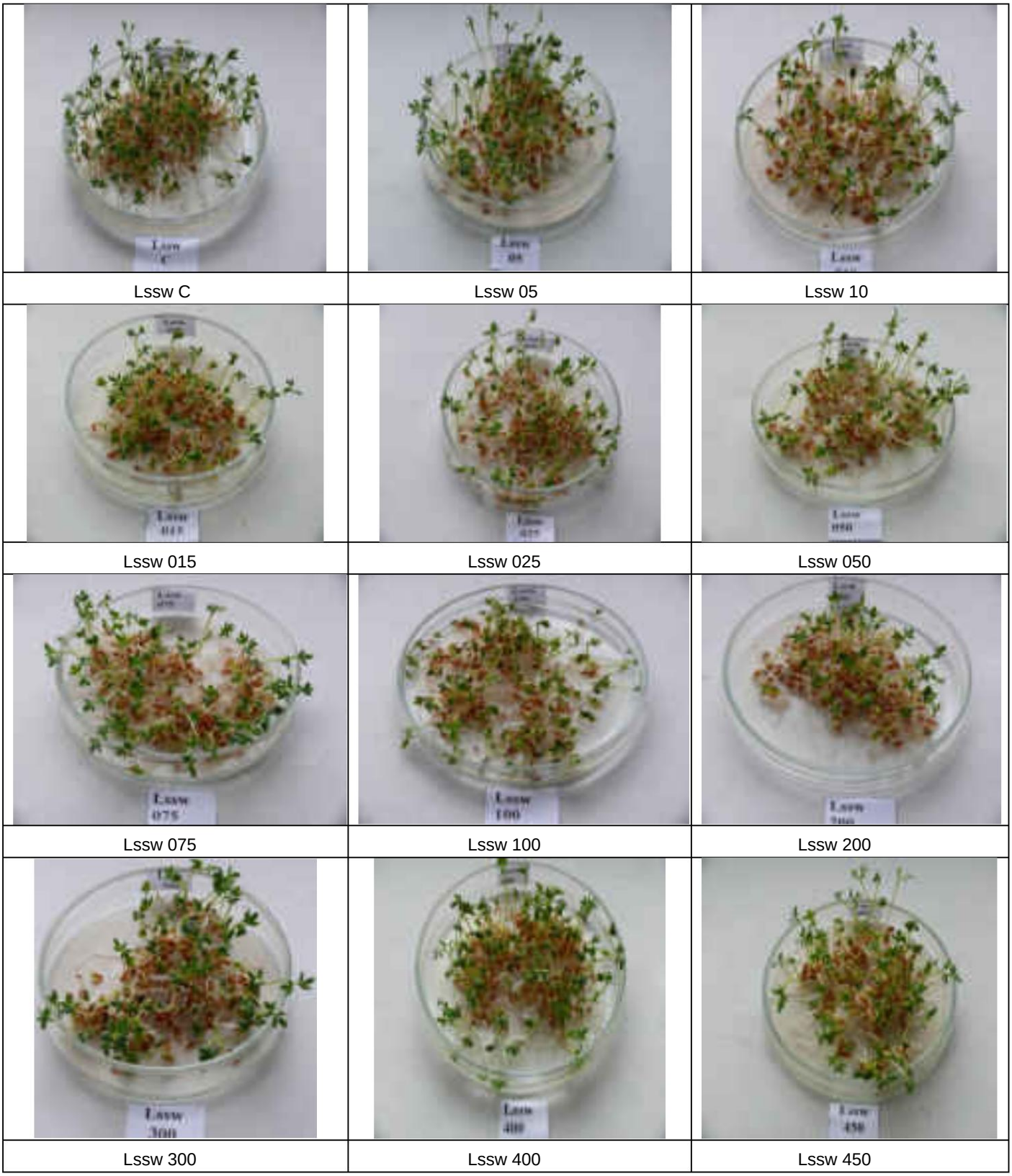

Figure 10 Comparison of tested variants with stable activated water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 5 days from the start of the experiment (J. Šimková 2021)

5 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+++	+++	++	++	++	++	++	++	+	++	++	+	++	

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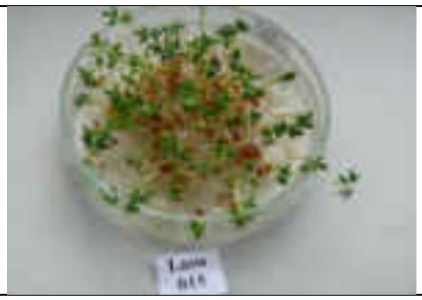
Lssw C

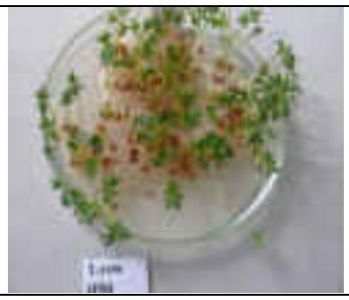
Lssw 05

Lssw 10



Lssw 015

Lssw 025



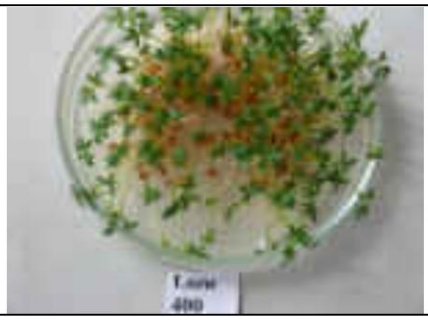
Lssw 050

Lssw 075

Lssw 100

Lssw 200

Lssw 300



Lssw 400

Lssw 450

Figure 11 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 6 days from the start of the experiment (J. Šimková 2021)

6 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450				
	++	++	++	++	+	++	++	++	++	++	++	++	++	+	+++	++

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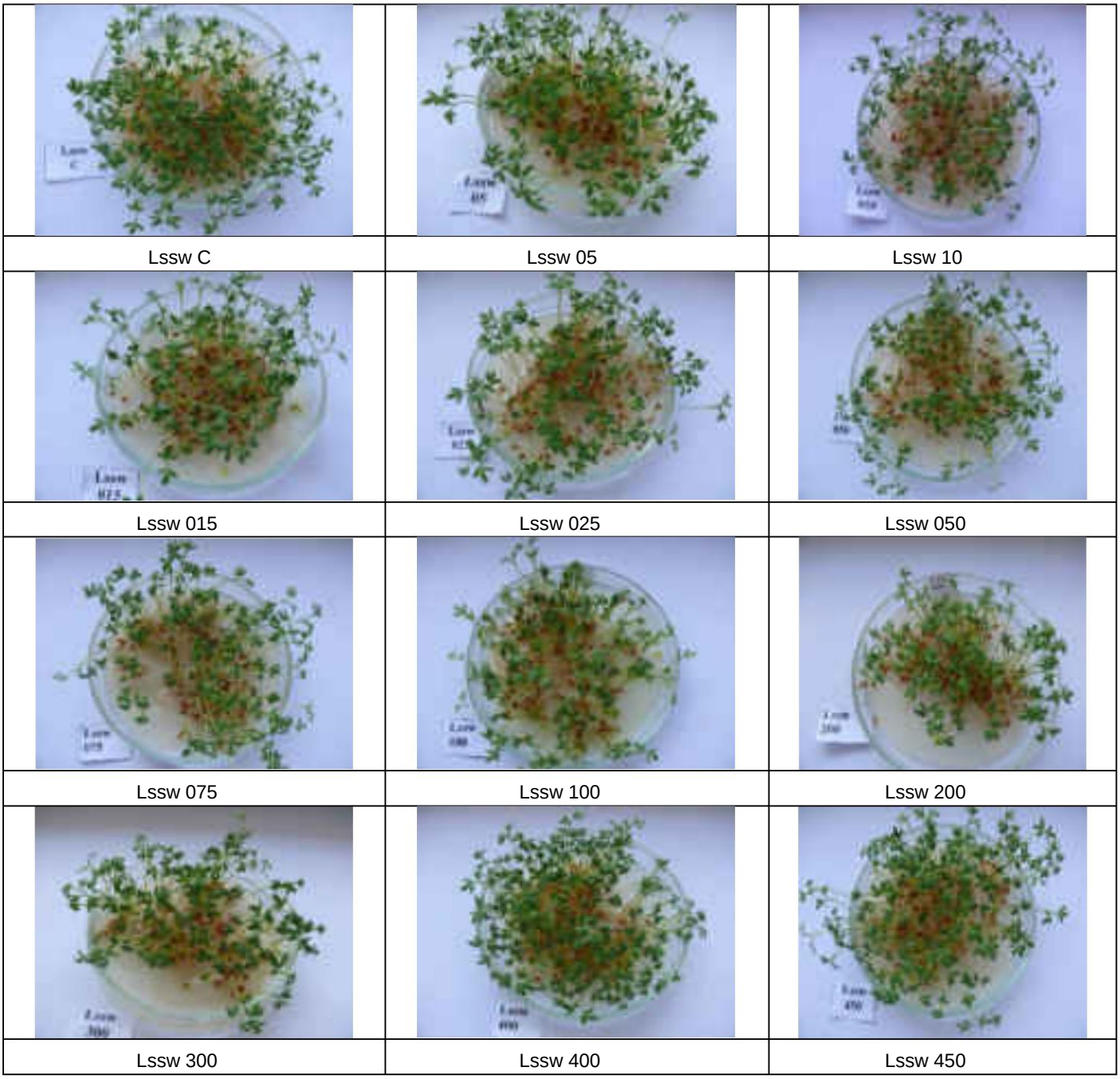

Figure 12 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 7 days from the start of the experiment (J. Šimková 2021)

7 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450				
	+++	+++	++	++	++	++	++	++	++	++	++	+++	++			

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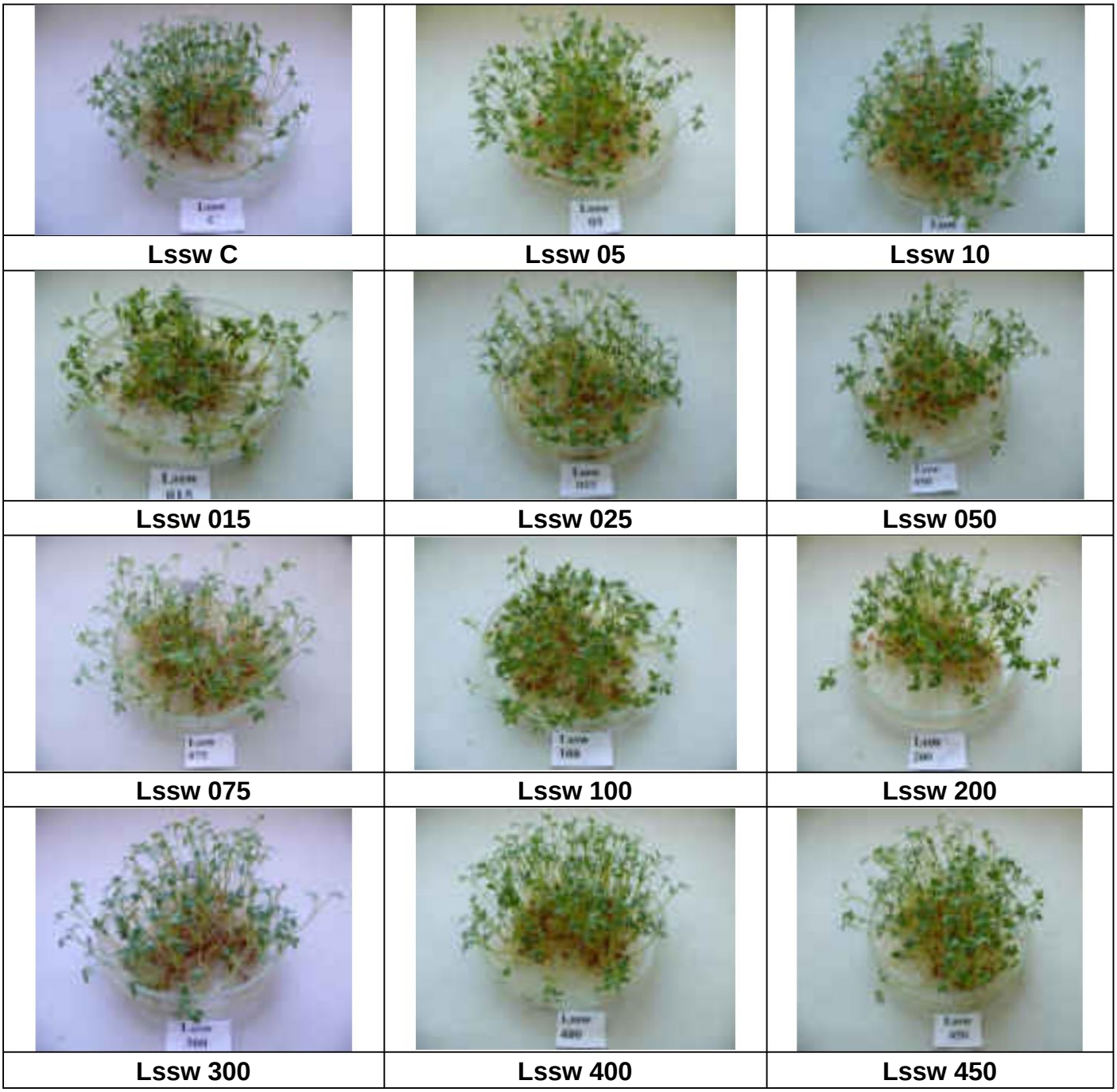

Figure 13 Comparison of tested variants with activated stable water at different pressures for germination and **emergence of cress seeds** *Lepidium sativum* L. after 9 **days from the start of the experiment (J. Šimková 2021**

9 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450			
	+++	+++	++	++	++	++	++	++	++	++	+++	+++	+++		

Machine Translated by Google

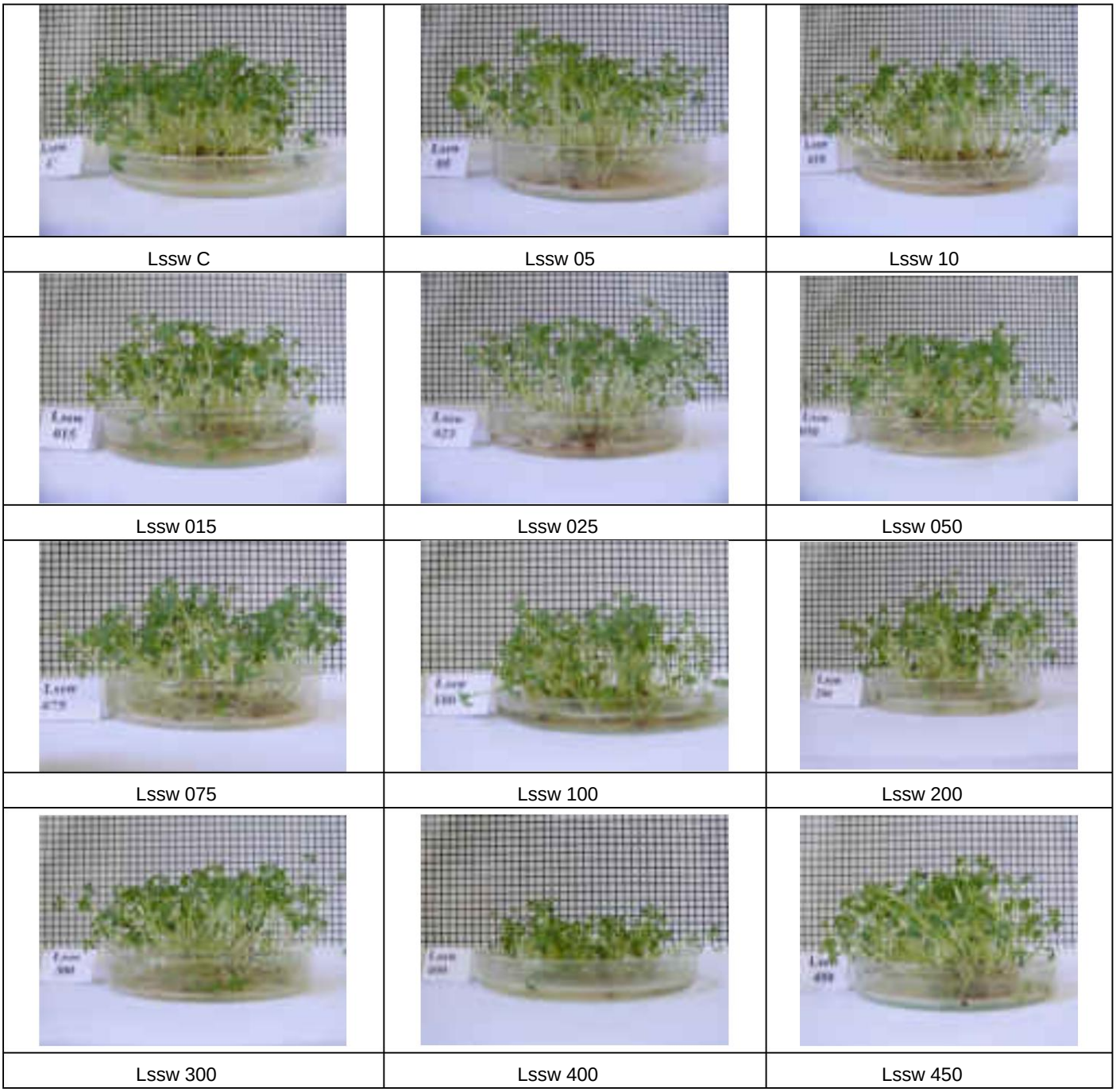

Figure 14 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 13 days from the start of the experiment (J. Šimková 2021)

13 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+++	++	++	++	++	++	++	++	++	++	++	++	+	+++

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Lssw C

Lssw 05

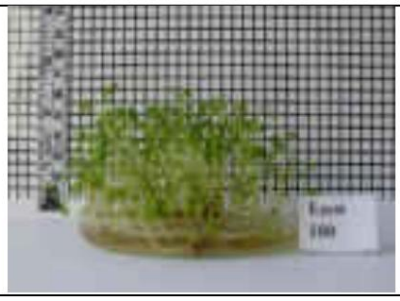
Lssw 10

Lssw 015

Lssw 025

Lssw 050

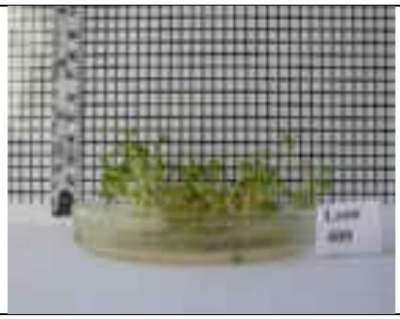
Lssw 075



Lssw 100

Lssw 200

Lssw 300



Lssw 400

Lssw 450

Figure 15 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 16 days from the start of the experiment (J. Šimková 2021)

16 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+++	++	++	++	++	++	++	+++	++	+++	+++	+	+++	

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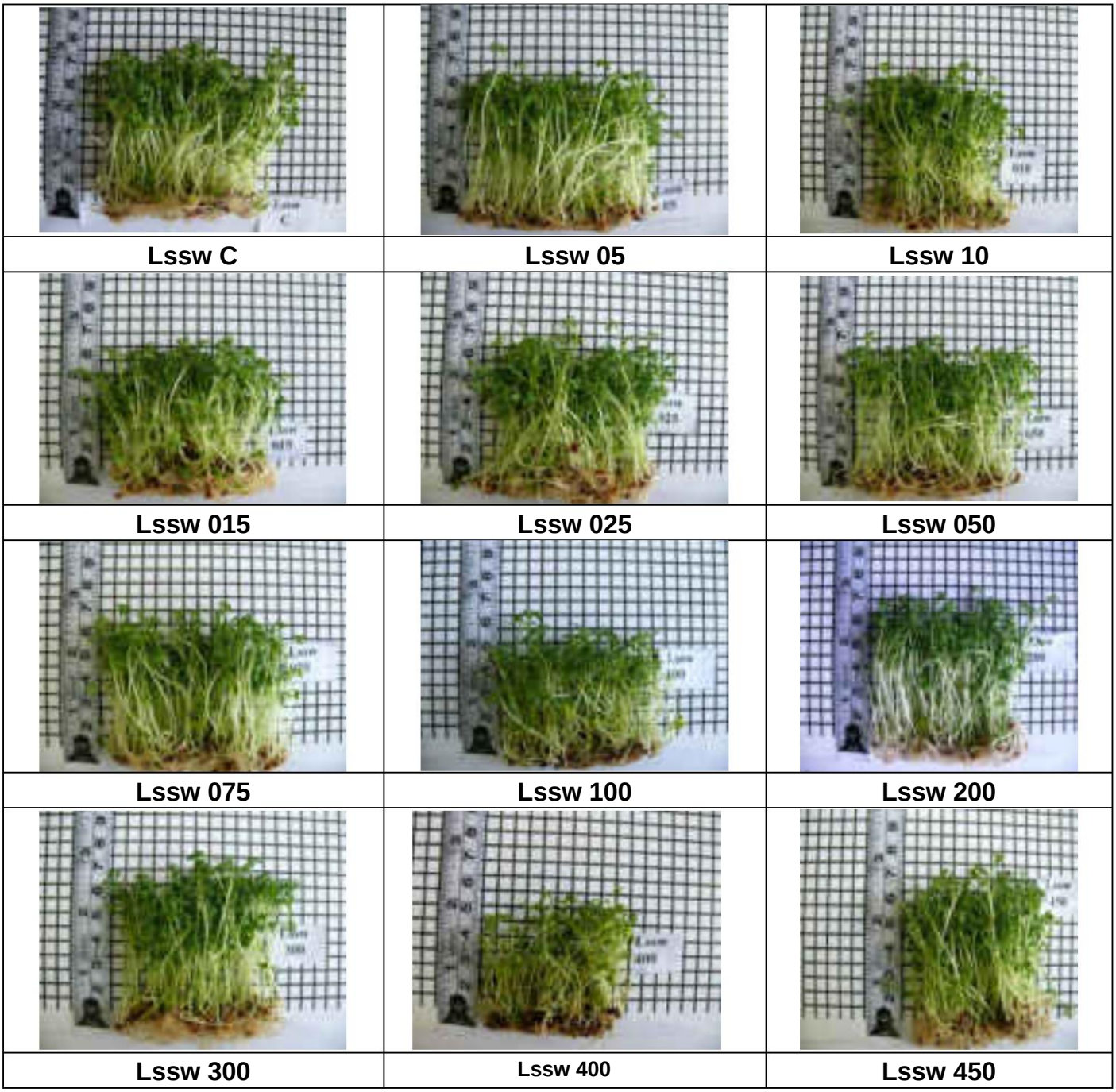

Figure 16 Comparison of the tested variants with activated stable water at different pressures for the germination and **emergence of cress seeds** *Lepidium sativum* L. after 16 **days from the start of the experiment, the end of the experiment** (J. **Šimková 2021)**

16 days	**LSswc**	**LSsw5**	**LSsw10**	**LSsw15**	**LSsw25**	**LSsw50**	**LSsw75**	**LSsw100**	**LSsw200**	**LSsw300**	**LSsw400**	**LSsw450**
	+++	++	++	++	++	++	++	+++	++	+++	+	+++

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C. Conclusion

Plant species			Applied water			The beginning of the experiment			Ending experiment		Experiment	
Cress sow (Ls) stable-activated-sw 26/5/2021 Day ÿLsswc Lscw5									11.6.2021		AQIPS-02-E04a	
Lssw10 Lssw15 Lssw25 Lssw50 Lssw75 Lssw100 Lssw200 Lssw300 Lssw400 Lssw450												
24 hours. ++		++	++	++	++	++	++	+	+	++	++	+
5 +++ +++			++	++	++	++	++	+	++	++	+	++
6	++	++	++	+	++	++	++	++	++	+	+++	++
7 +++ +++			++	++	++	++	++	++	++	++	+++	++
9 +++ +++			++	++	++	++	++	++	++	+++	+++	+++
13 +++ ++			++	++	++	++	++	++	++	++	+	+++
16 +++ ++ 16 +++ +			++	++	++	++	+++	++	+++	+++	+	+++
+ Cress sown (Ls)			++	++	++	++	+++	++	+++	+++	+	+++
fresh - activated-fw 26.5.2021									11.6.2021		AQIPS-02-E04a	
Day ÿ	Lsfwc Lsfw5 Lsfw10 Lsfw15 Lsfw25 Lsfw50 Lsfw75 Lsfw100 Lsfw200 Lsfw300 Lsfw400 Lsfw450											
24 h. +		+	+	+	+	+	+	+	+	+	+	+
5	++	++	++	++	++	++	++	++	++	++	++	+
6	++	++	++	++	++	++	++	++	++	++	++	+
7	++	++	++	++	++	++	++	++	++	++	++	+
9	++	++	++	++	++	++	++	++	++	++	++	+
13 ++		++	+++	++	++	++	++	++	++	++	+++	+
16	+	+	+++ +++		++	++	+++	++	++	++	+++	+
16	+	+	+++ +++		++	+++	+++	++	++	++	+++	+

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Effect of activated water by the IPS system on the germination and growth of cress (Lepidium sativum L.)

AQIPS-02-E04b

Contents

A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species
2. Plant species: Cress siata Lepidium sativum L. (Ls – designation of the species)
3. Designation of the plant species in the experiments: Ls I 4. Date of establishment of the experiment: 10.6.2021
5. End date of the experiment: 16.6.2021 6. Method of growing plants: Petri dishes, laboratory conditions
7. Evaluation of the experiment: Image analysis
8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in experiments with an IPS device Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation	Variant description	Designation	Variant description
Lsfw I-c	Tap water - control	LsswI-c	Tap water is stagnant - check
Lsfw I 05	Created water at a pressure of 05Pa	LsswI 05	Created water at a pressure of 05Pa
LsfwI 10	Created water at a pressure of 10Pa	LsswI 10	Formed water at a pressure of 10Pa
LsfwI 15	Created water at a pressure of 15Pa	LsswI 15	Created water at a pressure of 15Pa
LsfwI 25	Created water at a pressure of 25Pa	LsswI 25	Created water at a pressure of 25Pa
LsfwI 50	Created water at a pressure of 50Pa	LsswI 50	Created water at a pressure of 50Pa
LsfwI 75	Created water at a pressure of 75Pa	LsswI 75	Created water at a pressure of 75 Pa
LsfwI 100	Created water at a pressure of 100Pa	LsswI 100	Created water at a pressure of 100Pa
LsfwI 200	Created water at a pressure of 200Pa	LsswI 200	Created water at a pressure of 200Pa
LsfwI 300	Created water at a pressure of 300Pa	LsswI 300	Created water at a pressure of 300Pa
LsfwI 400	Created water at a pressure of 400Pa	LsswI 400	Created water at a pressure of 400Pa
LsfwI 450	Created water at a pressure of 450Pa	LsswI 450	Created water at a pressure of 450 Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Designation		Characteristics of samples
NK	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Image documentation

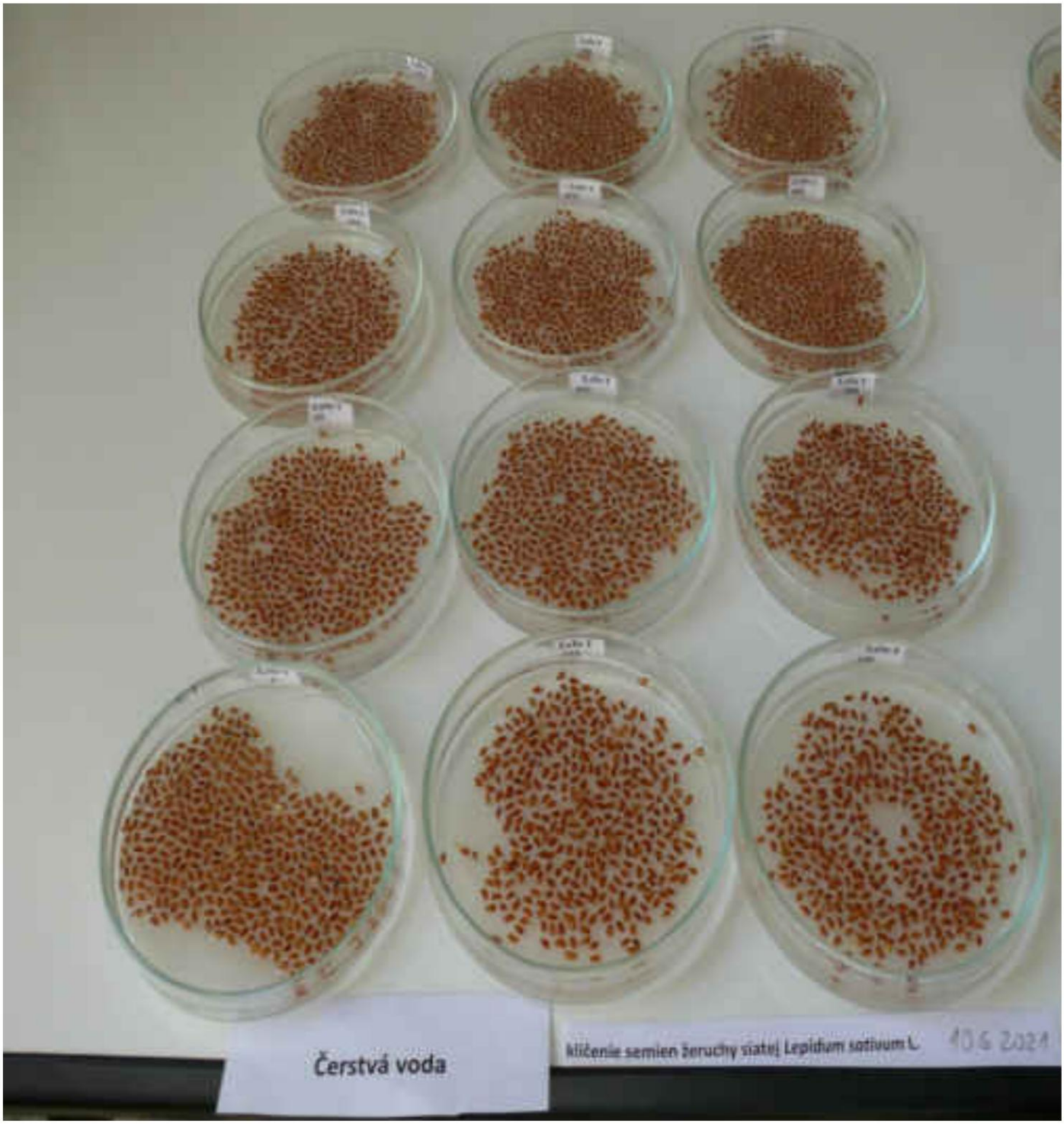

Figure 1 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 24 hours from the start of the experiment (J. Šimková, 2021)

24 hours	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	+	+	+	+	+	+	+	+	+	+	+	+

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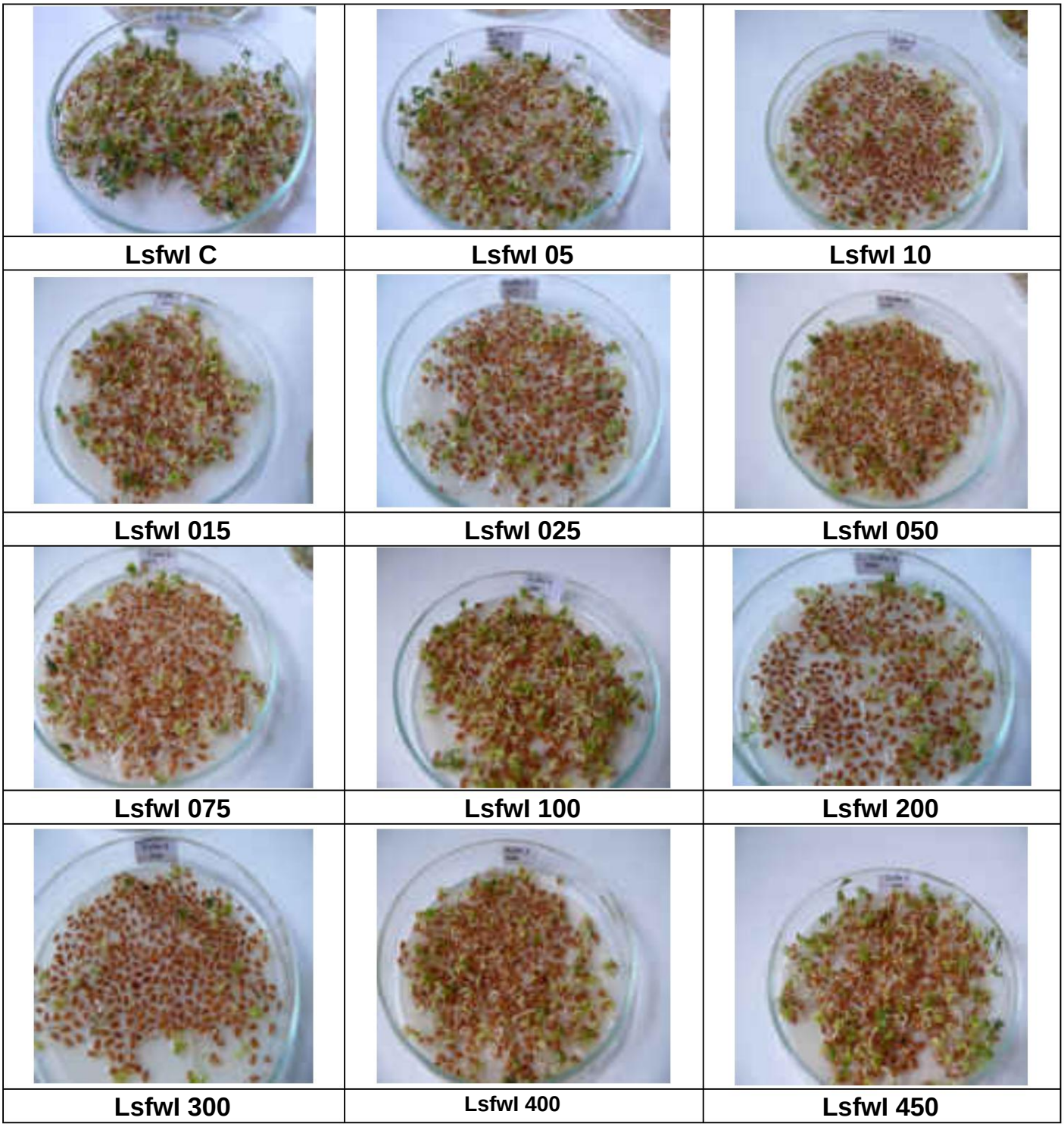

Figure 2 Comparison of tested variants with activated fresh water at different pressures for germination and **emergence of cress seeds l** *Lepidium sativum* **L. after 3 days from the start of the experiment (J. Šimková 20**

3 days	**LSfwc**	**LSfw5**	**LSfw10**	**LSfw15**	**LSfw25**	**LSfw50**	**LSfw75**	**LSfw100**	**LSfw200**	**LSfw300**	**LSfw400**	**LSfw450**
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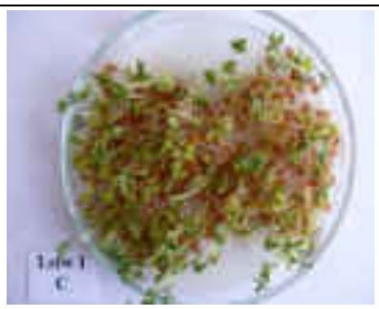		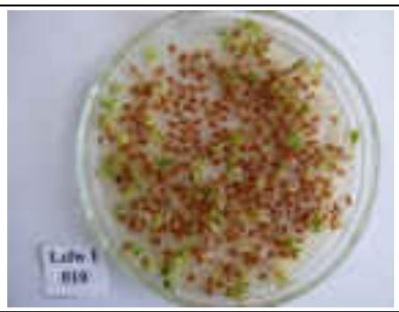
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	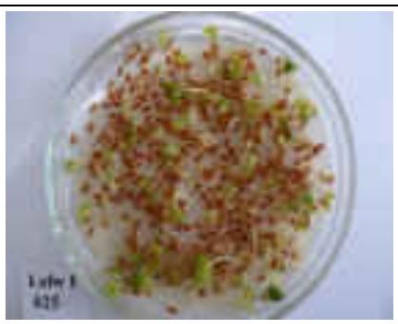	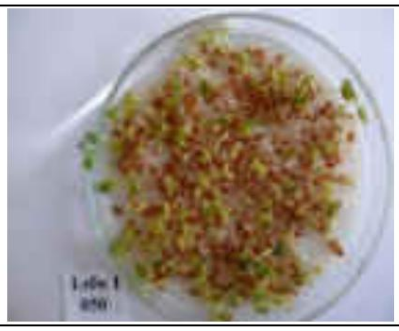
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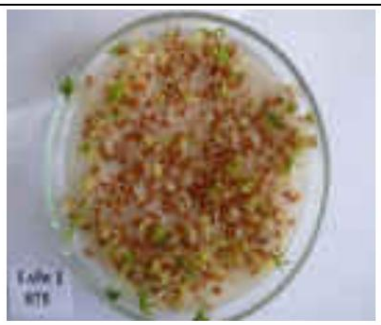	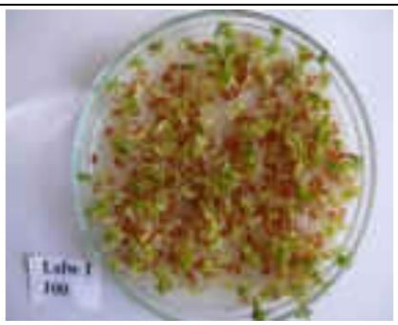	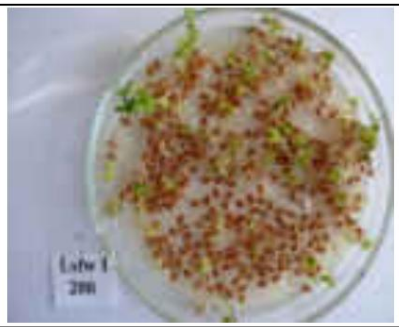
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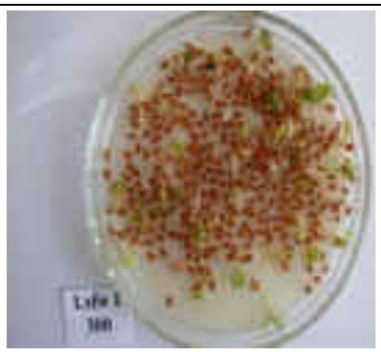	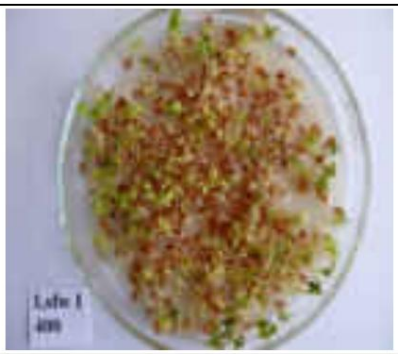	
Lsfwl 300	Lsfwl 400	Lsfwl 450

Figure 3 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds I Lepidium sativum L. after 4 days from the start of the experiment (J. Šimková 2021)

4 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450		
	+++	+++	+	++	++	++	+	++	+	+	++	+++		

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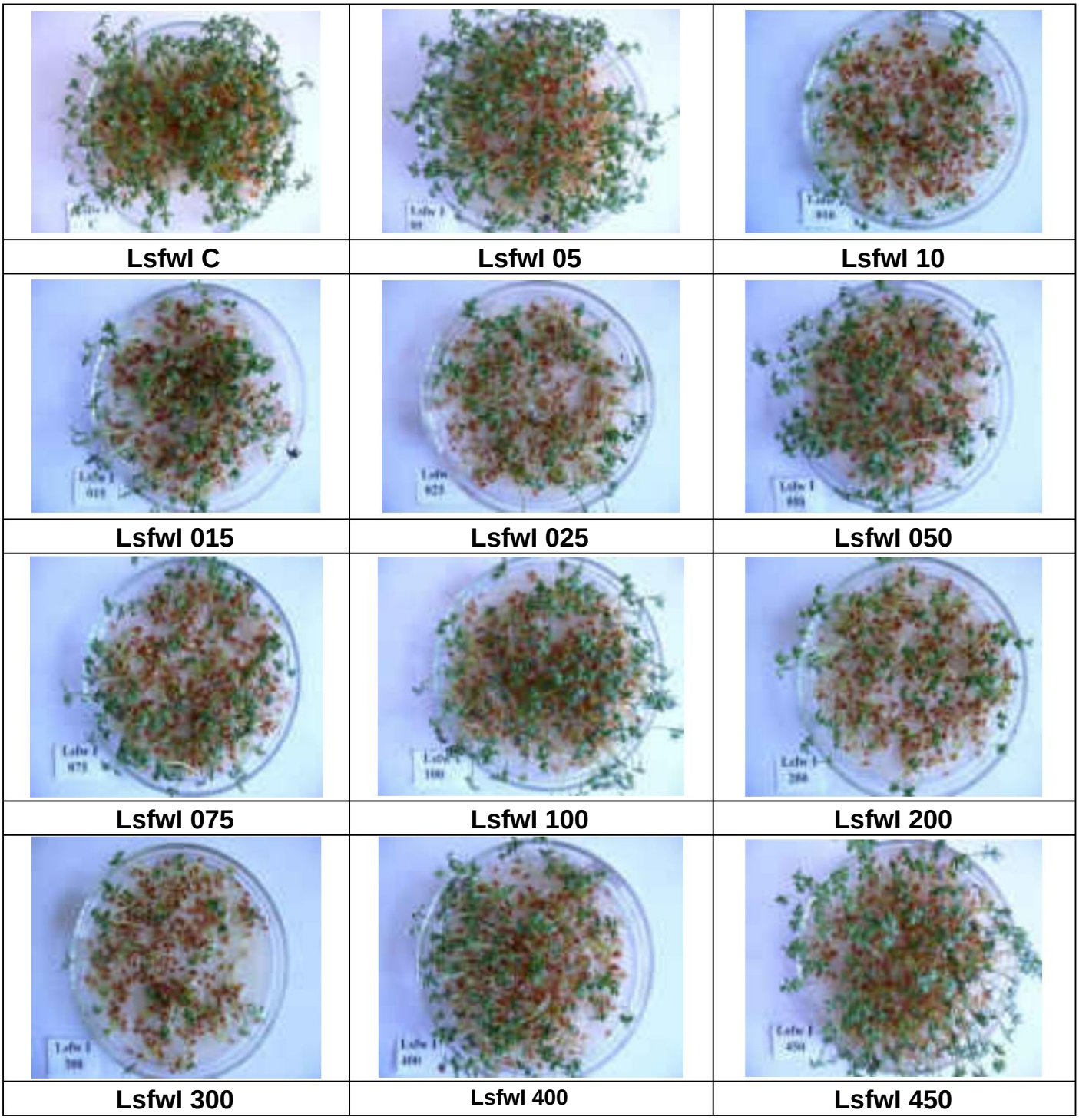

Figure 4 Comparison of tested variants with activated fresh water at different pressures for germination and **emergence of cress seeds l** *Lepidium sativum* L. after 5 **days from the start of the experiment (J. Šimková 202**

5 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	+++	+++	+	++	+	++	++	++	++	+	++	+++

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		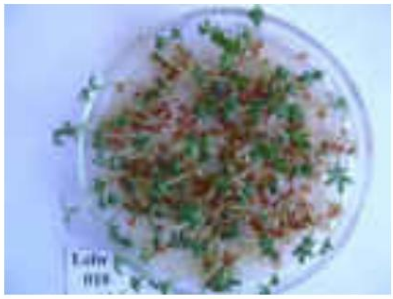
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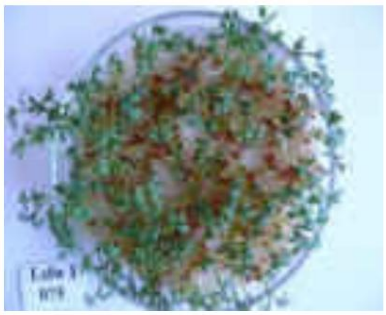
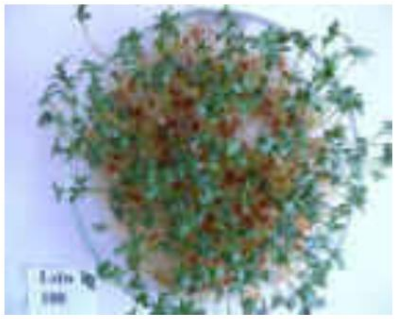
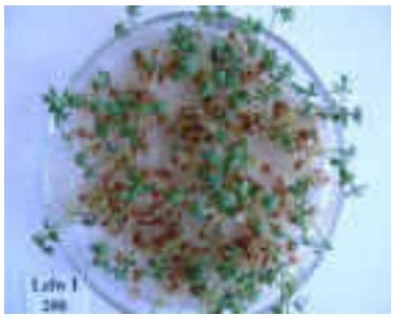
Lsfwl 015	Lsfwl 025	Lsfwl 050
		
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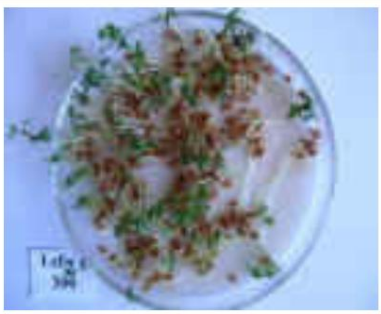	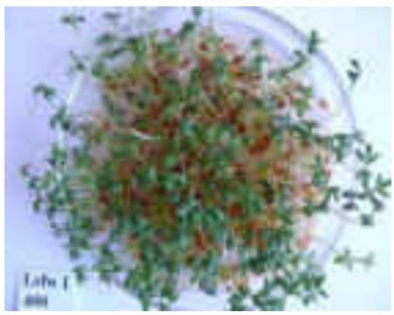	
Lsfwl 300	Lsfwl 400	Lsfwl 450

Figure 5 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress I Lepidium sativum L. seeds after 6 days from the start of the experiment (J. Šimková 2021)

6 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	+++	+++	+	++	++	++	++	++	+	+	++	+++

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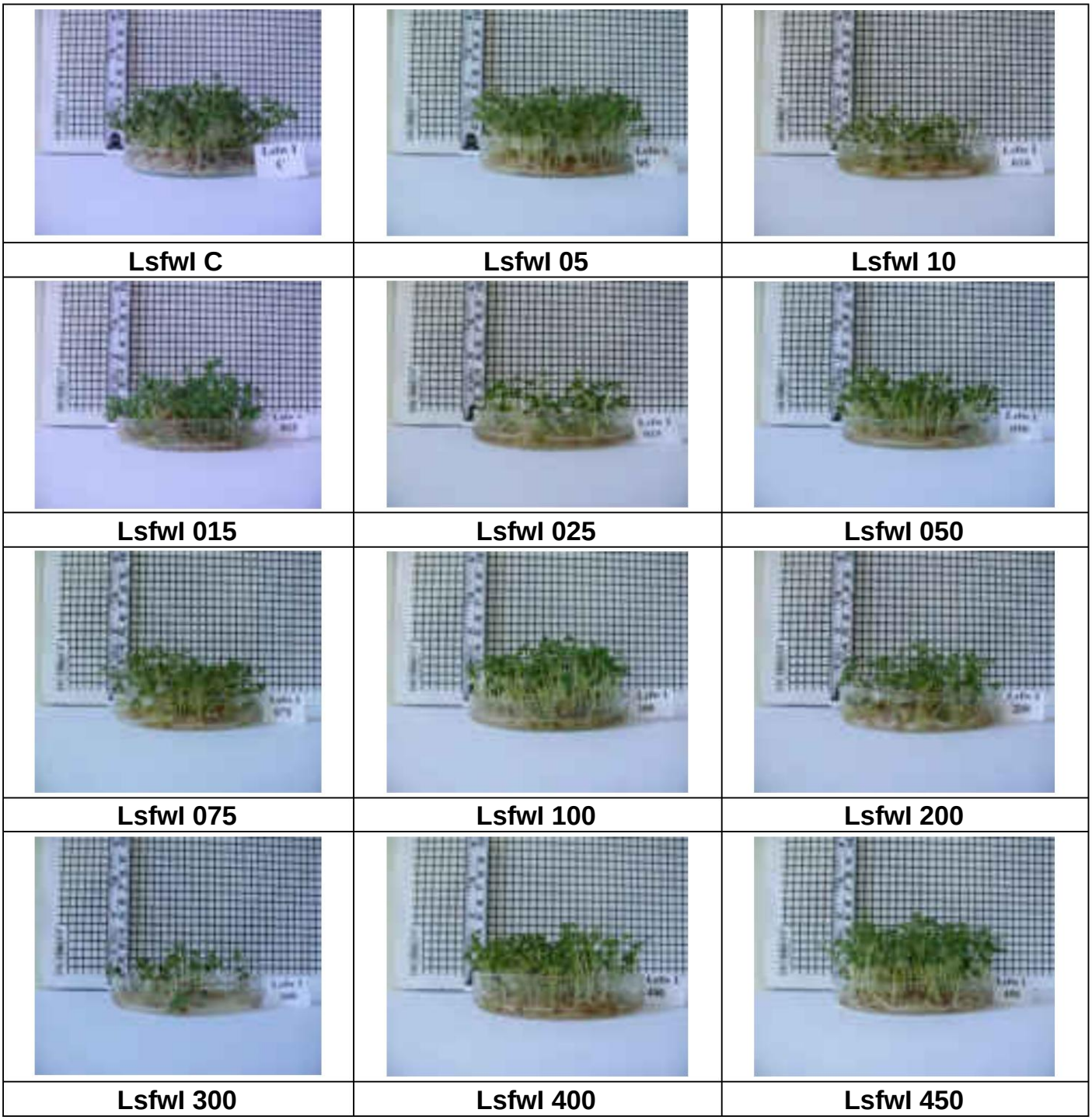

Figure 6 Comparison of the tested variants with activated fresh water at different pressures for the germination and **emergence of cress l** *Lepidium sativum* L. seeds after 6 **days from the start of the experiment, the end of the experiment** (J. **Šimková 2021)**

6 days	**LSfwc**	**LSfw5**	**LSfw10**	**LSfw15**	**LSfw25**	**LSfw50**	**LSfw75**	**LSfw100**	**LSfw200**	**LSfw300**	**LSfw400**	**LSfw450**
	+++	+++	+	++	++	++	++	++	+++	++	+	++	+++

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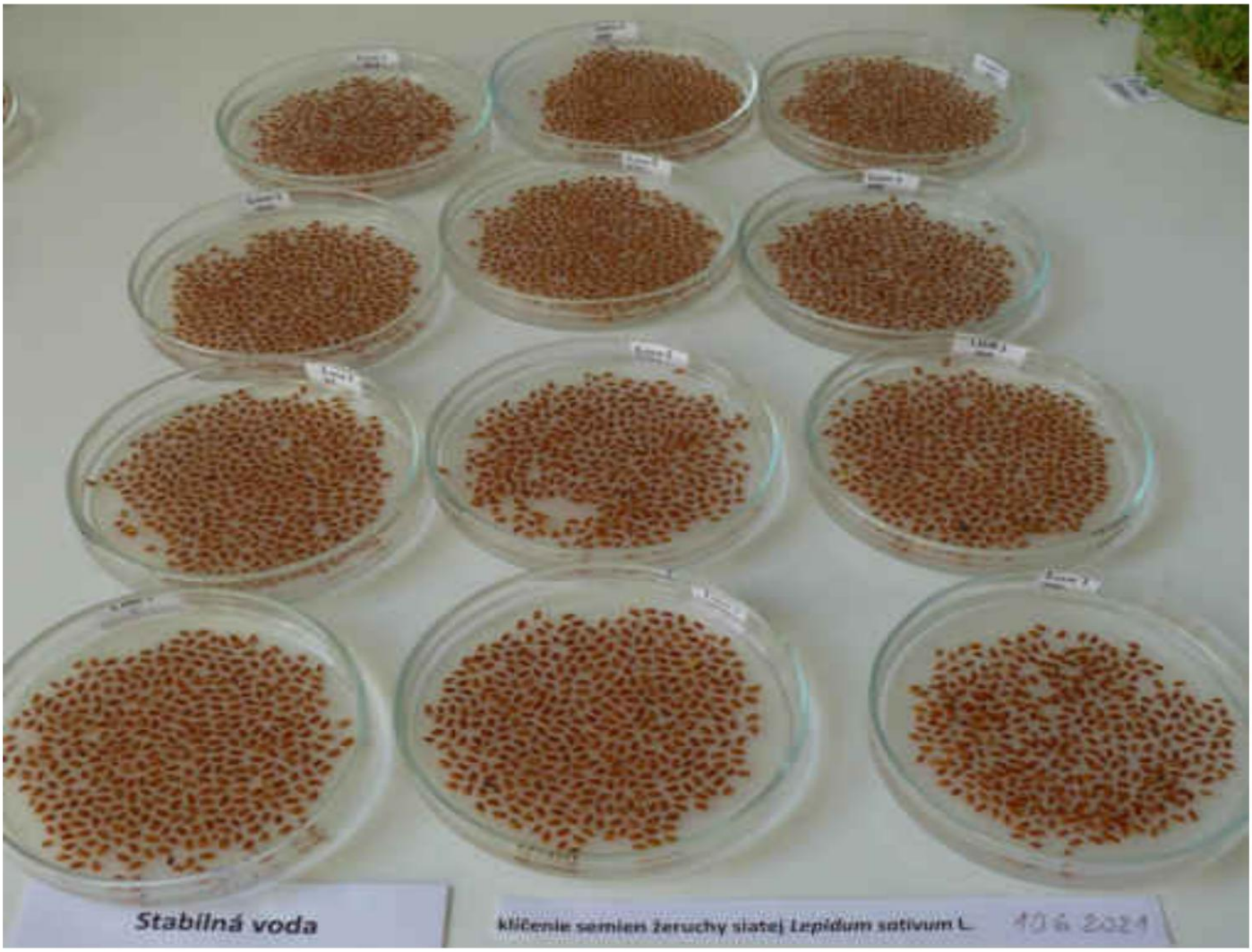
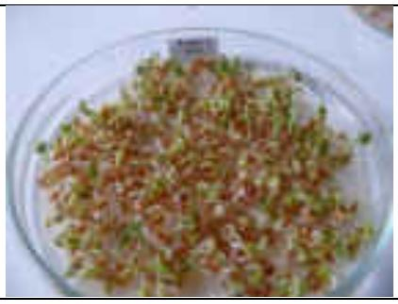
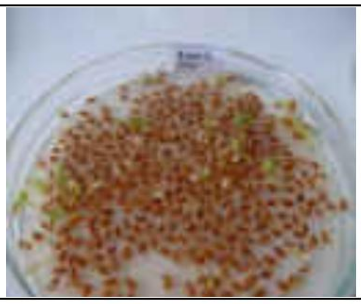


Figure 7 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 24 hours from the start of the experiment (J. Šimková 2021)

24 hours	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450
	+	+	+	+	+	+	+	+	+	+	+	+

Machine Translated by Google

		
Lsswl C	Lsswl 05	Lsswl 10
		
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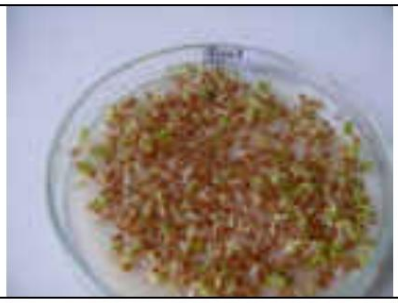		
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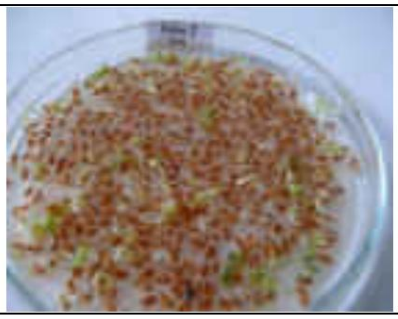	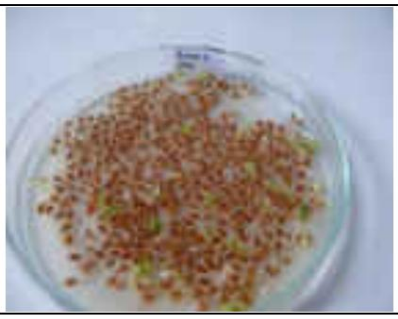	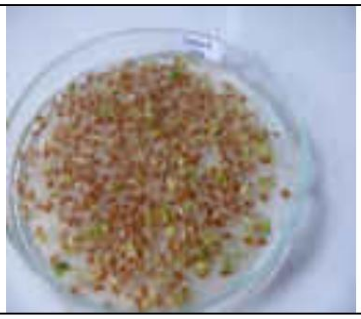
Lsswl 300	Lsswl 400	Lsswl 450

Figure 8 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 3 days from the start of the experiment (J. Šimková 2021)

3 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+	++	++	+	+++	+	+++	++	+	++	+	++		

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	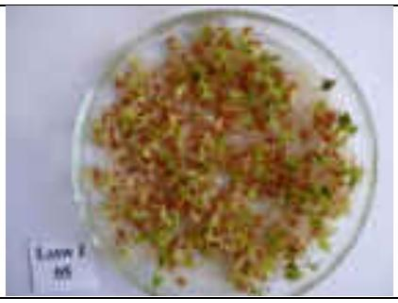	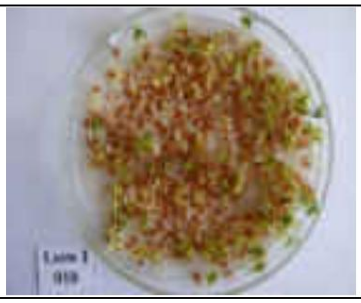
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		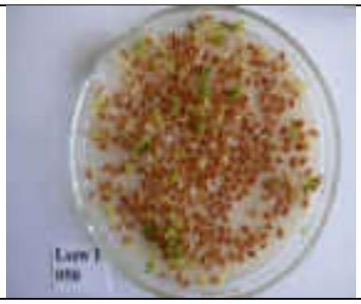
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	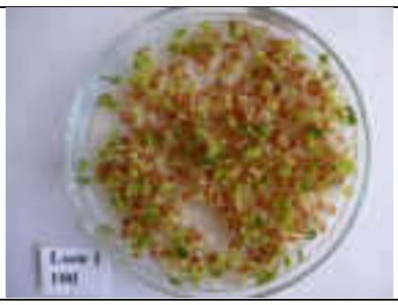	
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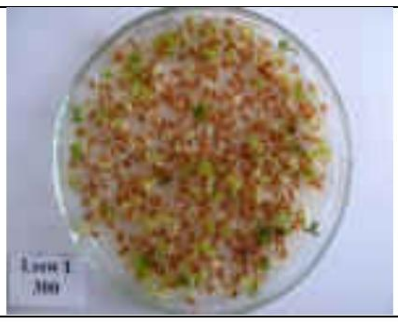	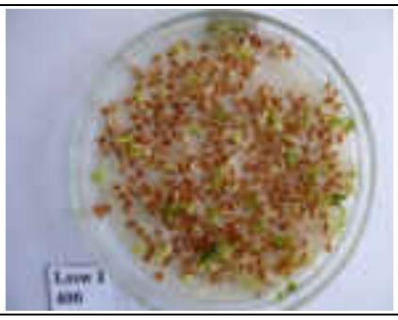	
Lsswl 300	Lsswl 400	Lsswl 450

Figure 9 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 4 days from the start of the experiment (J. Šimková 2021)

4 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	++	++	++	+	+++	+	++	++	+	++	++	++		

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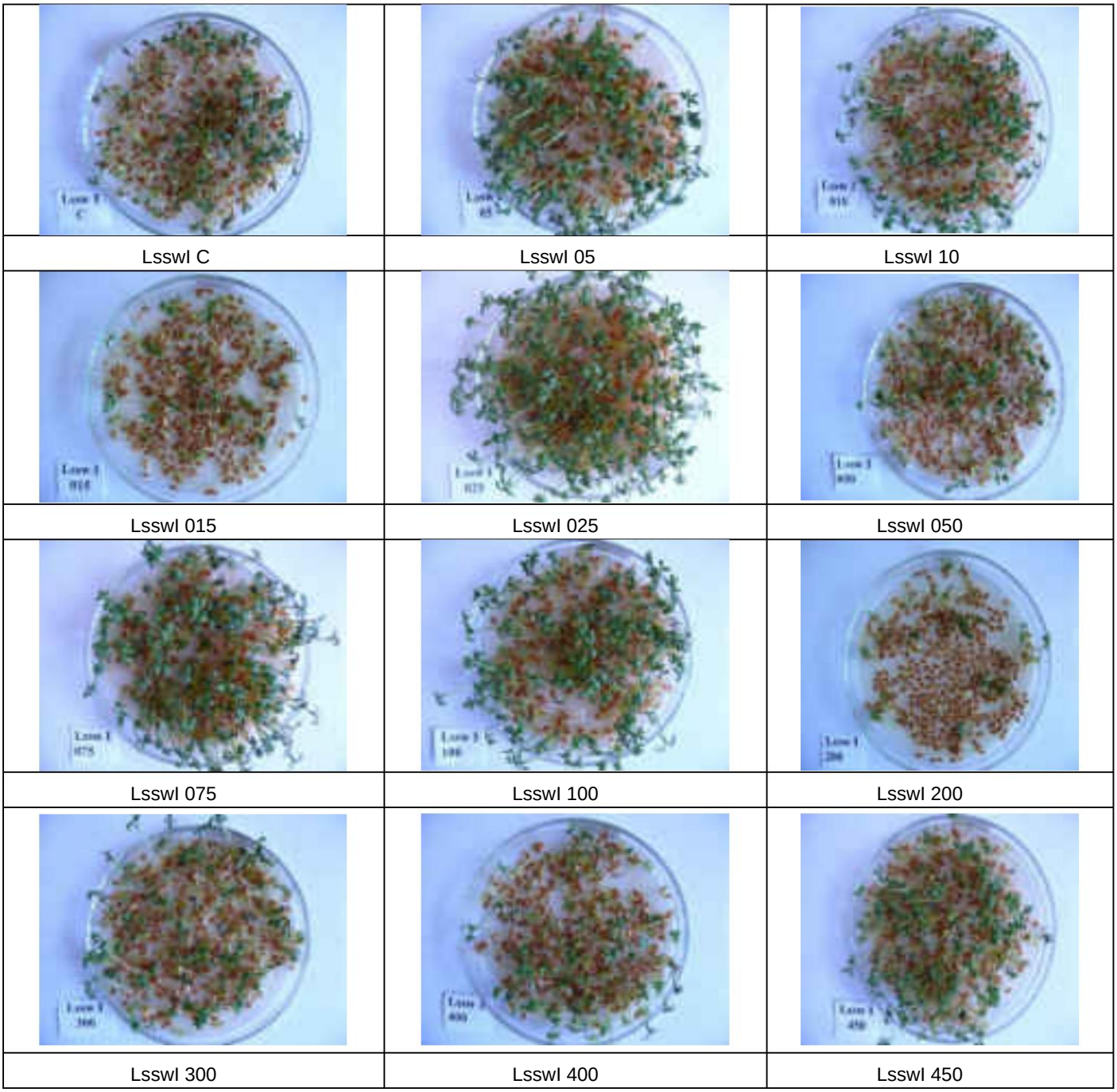

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Lsswl 015	Lsswl 025	Lsswl 050
Lsswl 075	Lsswl 100	Lsswl 200
Lsswl 300	Lsswl 400	Lsswl 450

Figure 10 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 5 days from the start of the experiment (J. Šimková 2021)

5 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	++	+++	++	+	+++	++	+++	+++	+	++	++	++		

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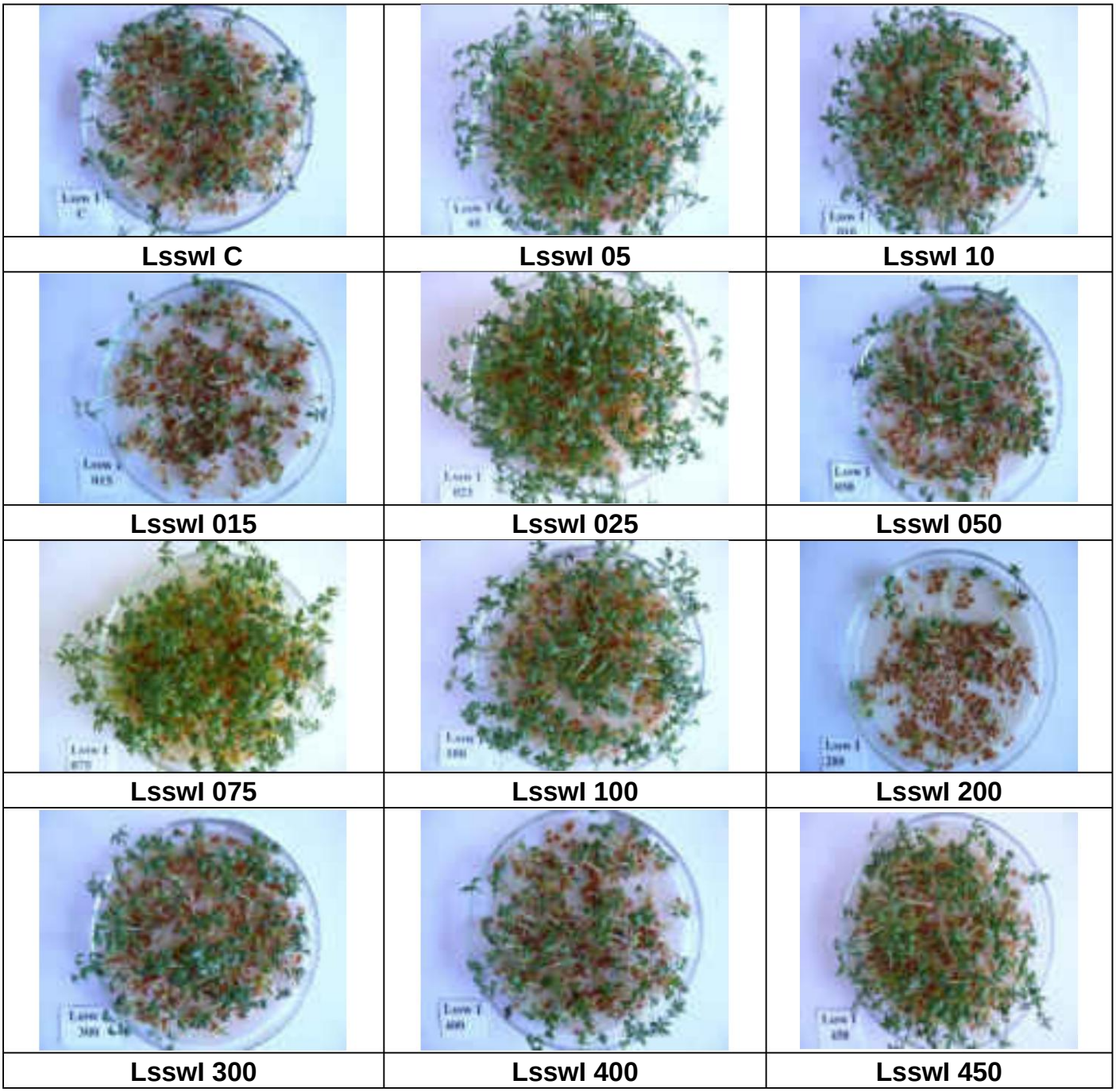

Figure 11 Comparison of tested variants with activated stable water at different pressures for germination and **emergence of cress seeds** *Lepidium sativum* L. after **6 days from the start of the experiment (J. Šimková 2021**

6 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450
	++	+++	++	+	+++	+	+++	+++	+	++	++	++

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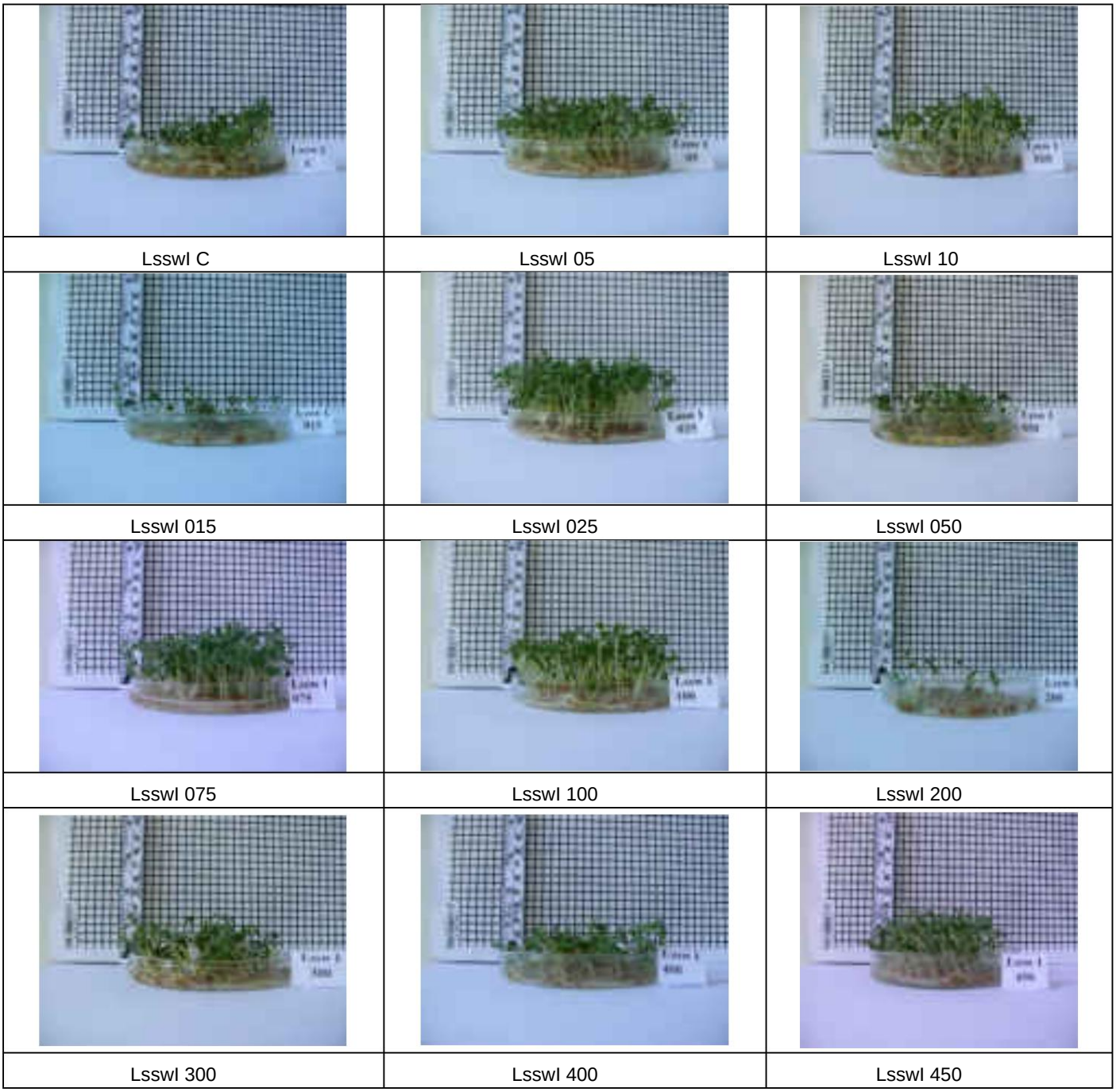

Figure 12 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidum sativum L. after 6 days from the start of the experiment (J. Šimková 2021)

6 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	++	++	++	+	+++	+	+++	+++	+	++	++	++		

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C. Conclusions

Plant species	Applied water	The beginning of the experiment	Ending experiment	Experiment
Sown watercress (Ls) fresh - activated-fw 10.6.2021			16.6.2021	AQIPS-02-E04b
Day [9] Lsfwc Lsfw5 Lsfw10 Lsfw15 Lsfw25 Lsfw50 Lsfw75 Lsfw100 Lsfw200 Lsfw300 Lsfw400 Lsfw450				
24 hours + +	+ + + + + + + + + + + +			
3 +++ ++ 4 +++ +++	+ ++ ++ ++ + ++ + + ++ +++			
	+ ++ ++ ++ + ++ + + ++ +++			
5 +++ +++	+ ++ + ++ ++ ++ ++ + ++ +++			
6 +++ +++ 6 +++ ++	+ ++ ++ ++ ++ ++ + + ++ +++			
+ Sown cress (Ls)	+ ++ ++ ++ ++ +++ ++ + ++ +++			
stable-activated-sw 10.6.2021 Day ÿLsswc Lscw5 Lssw10 Lssw15			16.6.2021	AQIPS-02-E04b
Lssw25 Lssw50 Lssw75 Lssw100 Lssw200 Lssw300 Lssw400 Lssw450				
24 hours. + +	+ + + + + + + + + + + +			
3 + ++	++ + +++ + +++ ++ + ++ + ++			
4 ++ ++	++ + +++ + ++ ++ + ++ ++ ++			
5 ++ +++	++ + +++ ++ +++ +++ + ++ ++ ++			
6 ++ +++	++ + +++ + +++ +++ + ++ ++ ++			
6 ++ ++	++ + +++ + +++ +++ + ++ ++ ++			

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Effect of activated water by the IPS system on the germination and growth of watercress (*Lepidium sativum* L.) AQIPS-02-E04c

Contents

A. Methodology of the experiment

1. Aim of the experiment: Determination of the effect of activated water by the IPS system on the germination and growth of plant species

2. Plant species: Cress siata *Lepidium sativum* L. (Ls – designation of the species)

3. Designation of the plant species in the experiments: Ls

4. Date of establishment of the experiment: 29.6.2021

5. End date of the experiment: 12/07/2021

6. Method of growing plants: Petri dishes, sand substrate, laboratory conditions

7. Evaluation of the experiment: Image analysis

8. Experimental variants

Activated fresh tap water (fw) Direct use of fresh activated water in experiments with an IPS device Control sample without activation		Stable activated water (sw) Use of activated water in the experiment after 24 hours of activation by the IPS device Control sample without activation	
Designation variant	Description of Lsfw-c Tap water - control Created	Designation	Variant description Lssw-c Tap water is stagnant - check
Lsfw05	water at a pressure of 05Pa Created	Lssw05	Created water at a pressure of 05Pa
Lsfw10	water at a pressure of 10Pa Created	Lssw10	Created water at a pressure of 10Pa
Lsfw15	water at a pressure of 15Pa Created	Lssw15	Created water at a pressure of 15Pa
Lsfw25	water at a pressure of 25Pa Created	Lssw25	Created water at a pressure of 25Pa
Lsfw50	water at a pressure of 50Pa Created	Lssw50	Created water at a pressure of 50Pa
Lsfw75	water at a pressure of 75Pa Created	Lssw75	Created water at a pressure of 75Pa
Lsfw100	water at a pressure of 100Pa Created	Lssw100	Created water at a pressure of 100Pa
Lsfw200	water at a pressure 200Pa Created	Lssw200	Created water at a pressure of 200Pa
Lsfw300	water at a pressure of 300Pa Created	Lssw300	Created water at a pressure of 300Pa
Lsfw400	water at a pressure of 400Pa Created	Lssw400	Created water at a pressure of 400Pa
Lsfw450	water at a pressure of 450Pa	Lssw450	Created water at a pressure of 450Pa

9. Methodology for evaluating the effects of activated water

9.1. Effects on seed germination

Designation		Characteristics of samples
NK	-	Seeds without germination
ZK	+	Beginning of germination
PK	++	Full germination
PL	+++	First leaves

9.2. Effects on growth - plant height when observed

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Eva Chovancová, Alexej Oravec

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B. Image documentation

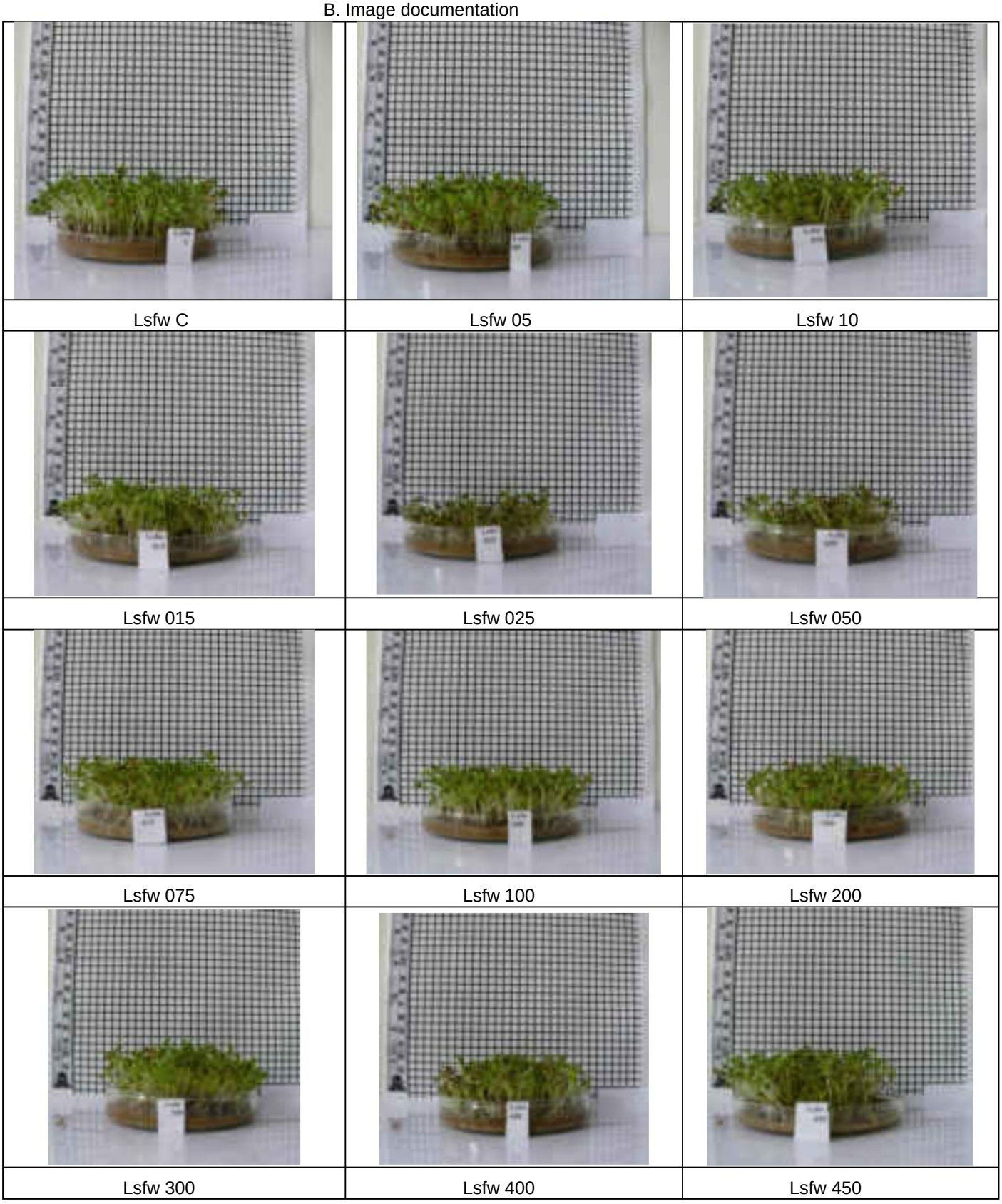

Figure 1 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 3 days from the start of the experiment (J. Šimková 2021)

3 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	++	+++	++	++	+	+	+++	++	++	+++	++	+++

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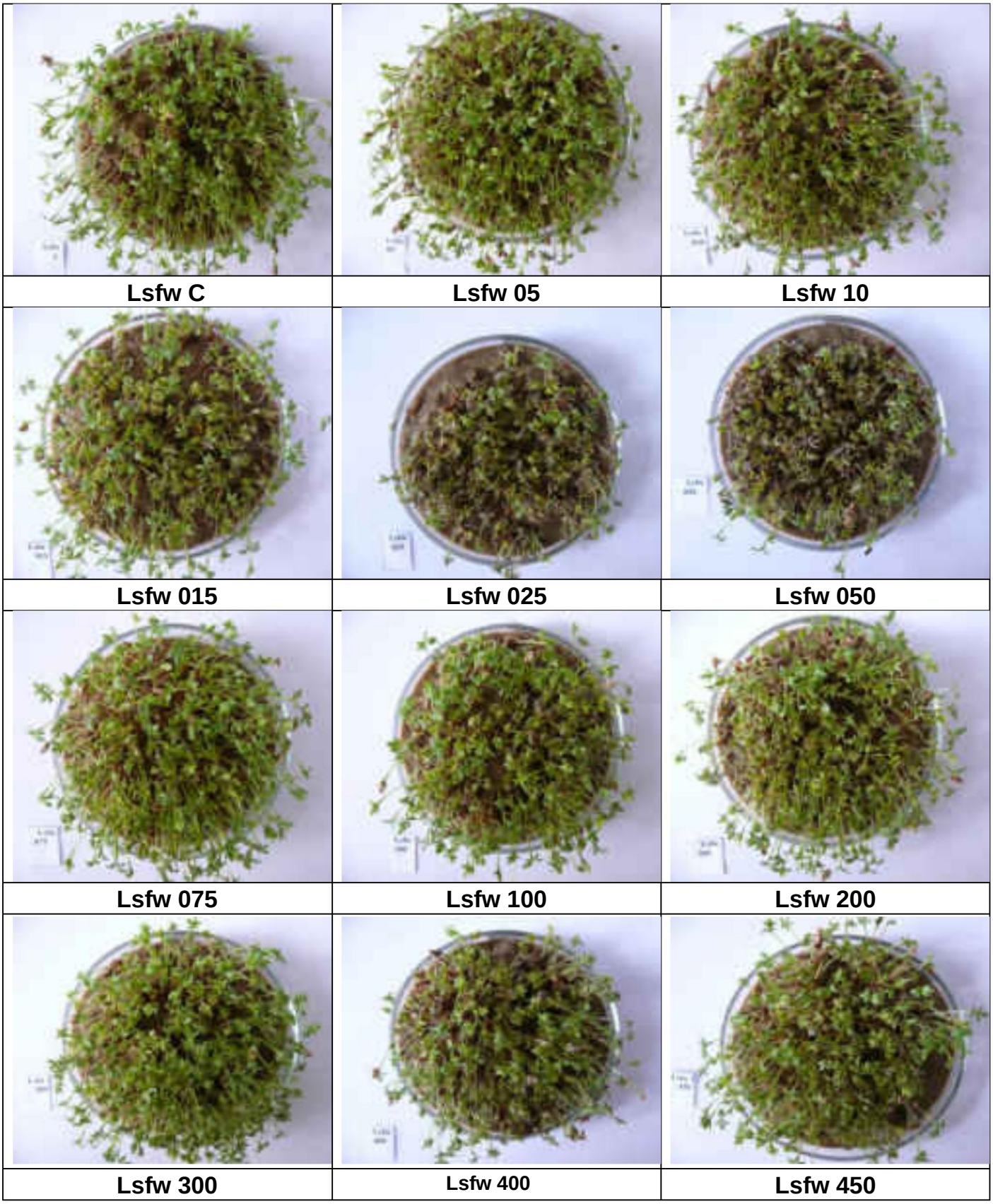

Figure 2 Comparison of tested variants with activated **fresh water at different pressures for germination** and **emergence of cress seeds** *Lepidium sativum* L. after **3 days from the start of the experiment (J. Šimková 2021**

3 days	**LSfwc**	**LSfw5**	**LSfw10**	**LSfw15**	**LSfw25**	**LSfw50**	**LSfw75**	**LSfw100**	**LSfw200**	**LSfw300**	**LSfw400**	**LSfw450**
	++	+++	++	++	+	+	+++	++	++	+++	++	+++

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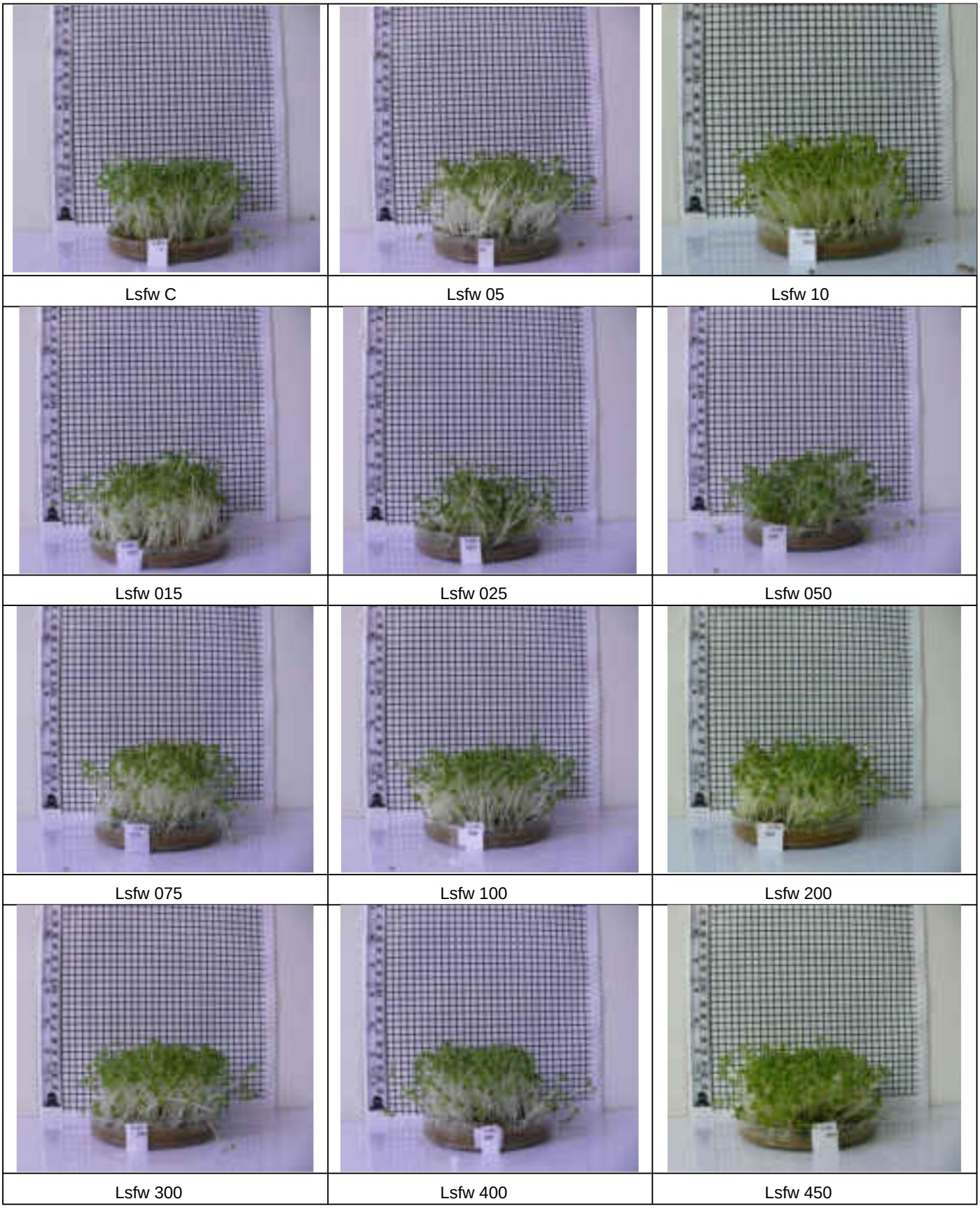

Figure 3 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 9 days from the start of the experiment (J. Šimková 2021)

	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450		
9 days	++	+++	+++	++	+	+	+++	++	++	+++	+++	+++		

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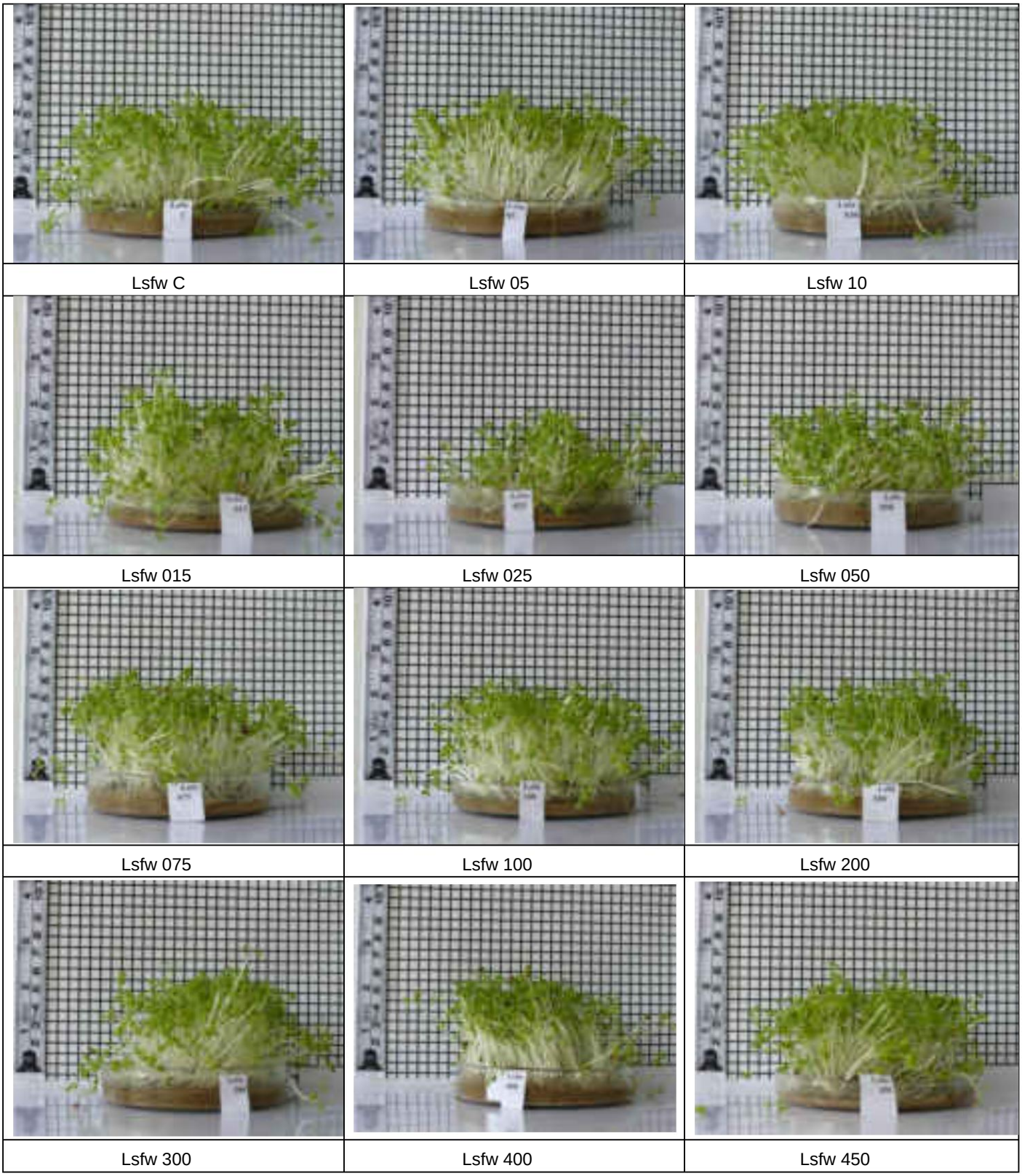

Figure 4 Comparison of tested variants with activated fresh water at different pressures for germination and emergence of watercress seeds sown Lepidium sativum L. after 13 days from the start of the experiment (J. Šimková 2021)

13 days	LSfwc	LSfw5	LSfw10	LSfw15	LSfw25	LSfw50	LSfw75	LSfw100	LSfw200	LSfw300	LSfw400	LSfw450
	++	+++	+++	++	+	++	+++	++	++	+++	+++	+++

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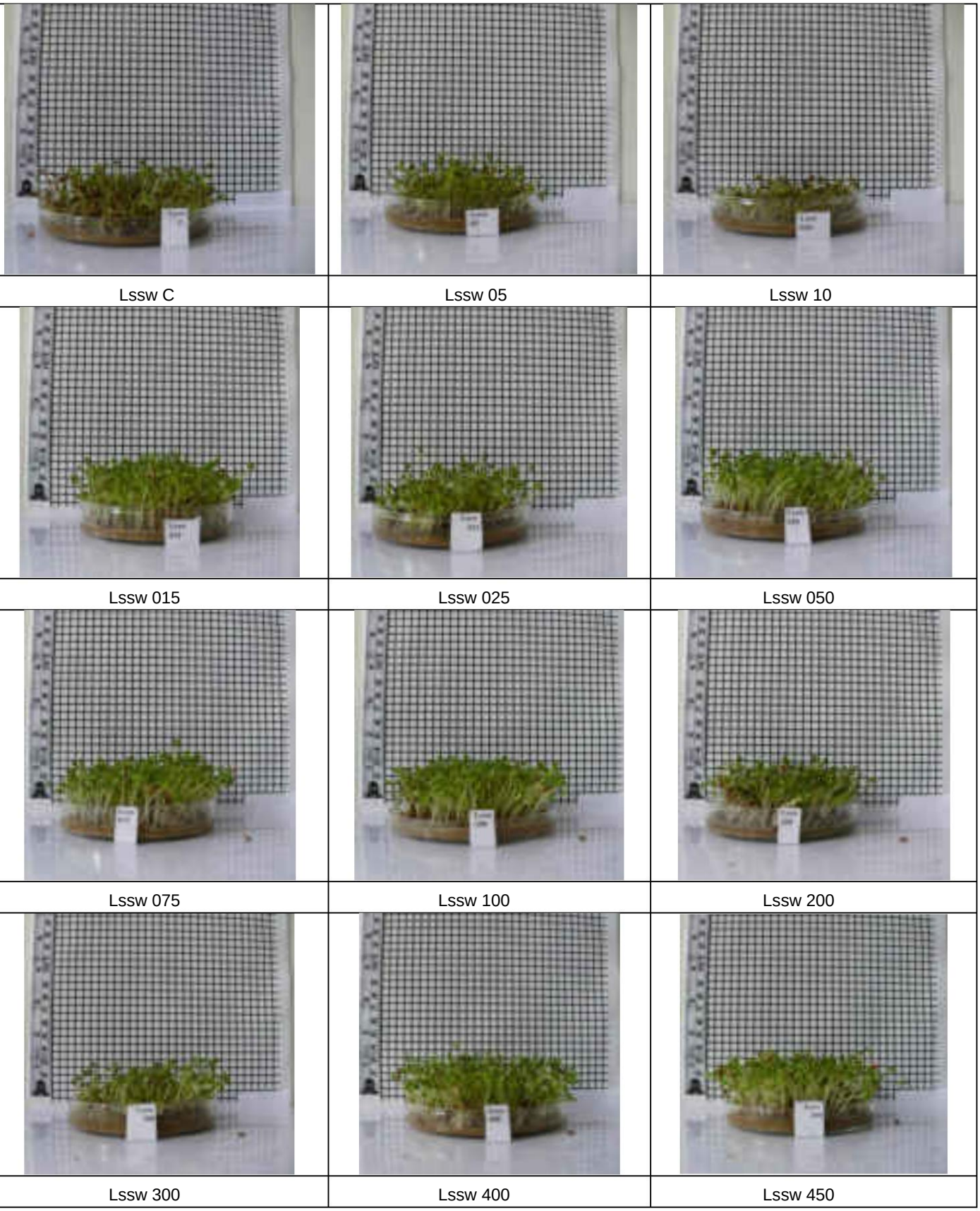

Figure 5 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 3 days from the start of the experiment (J. Šimková 2021)

3 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450				
	+	+	+	+++	++	+++	+++	+++	++	++	+++	+++				

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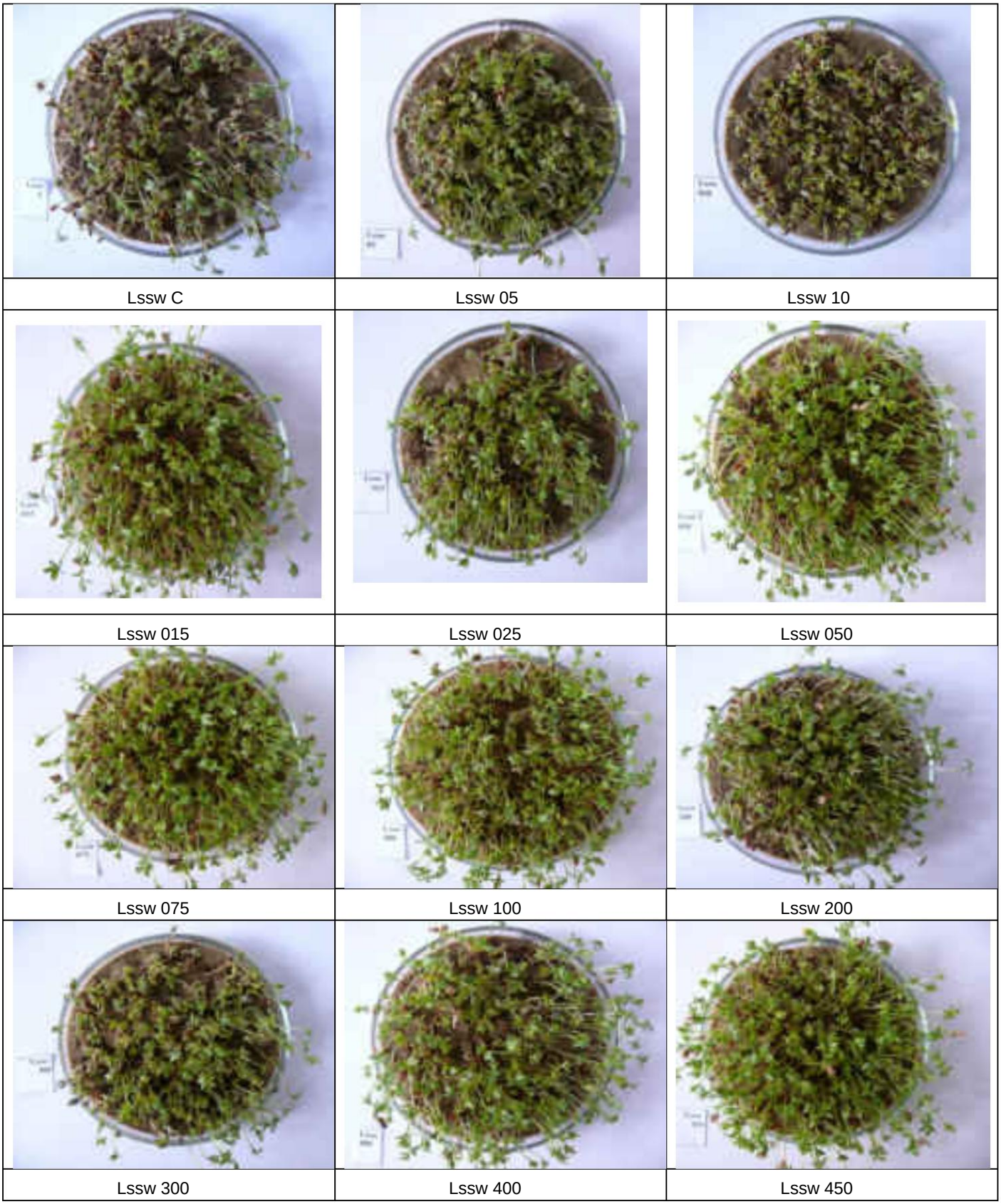

Figure 6 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds sown Lepidium sativum L. after 3 days from the start of the experiment (J. Šimková 2021)

3 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+	+	+	++	++	+++	+++	+++	++	++	+++	+++		

Machine Translated by Google

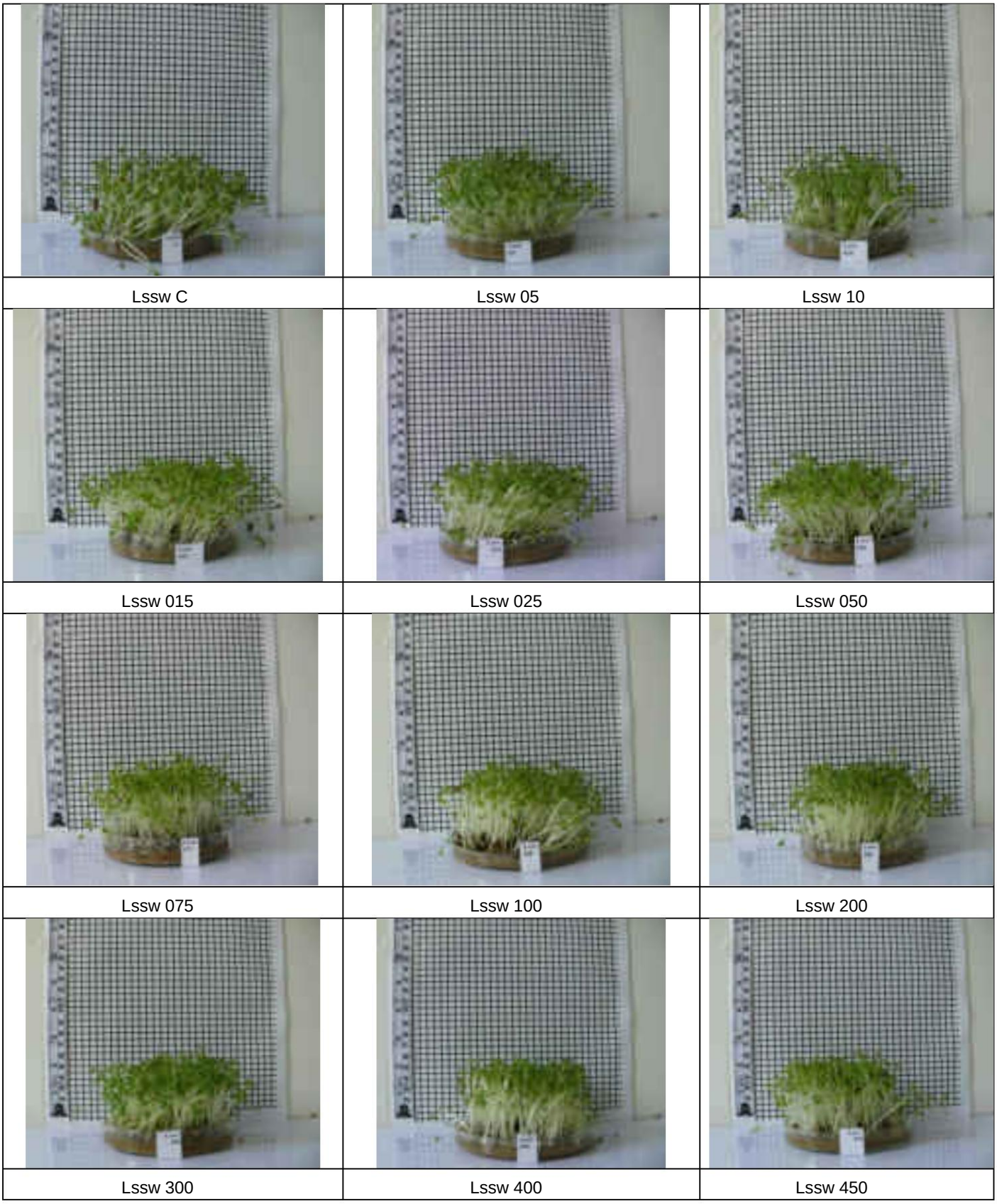

Figure 7 Comparison of tested variants with activated stable water at different pressures for germination and emergence of cress seeds Lepidium sativum L. after 9 days from the start of the experiment (J. Šimková 2021)

9 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450		
	+	++	+	++	++	++	+++	+++	++	+++	+++	+++		

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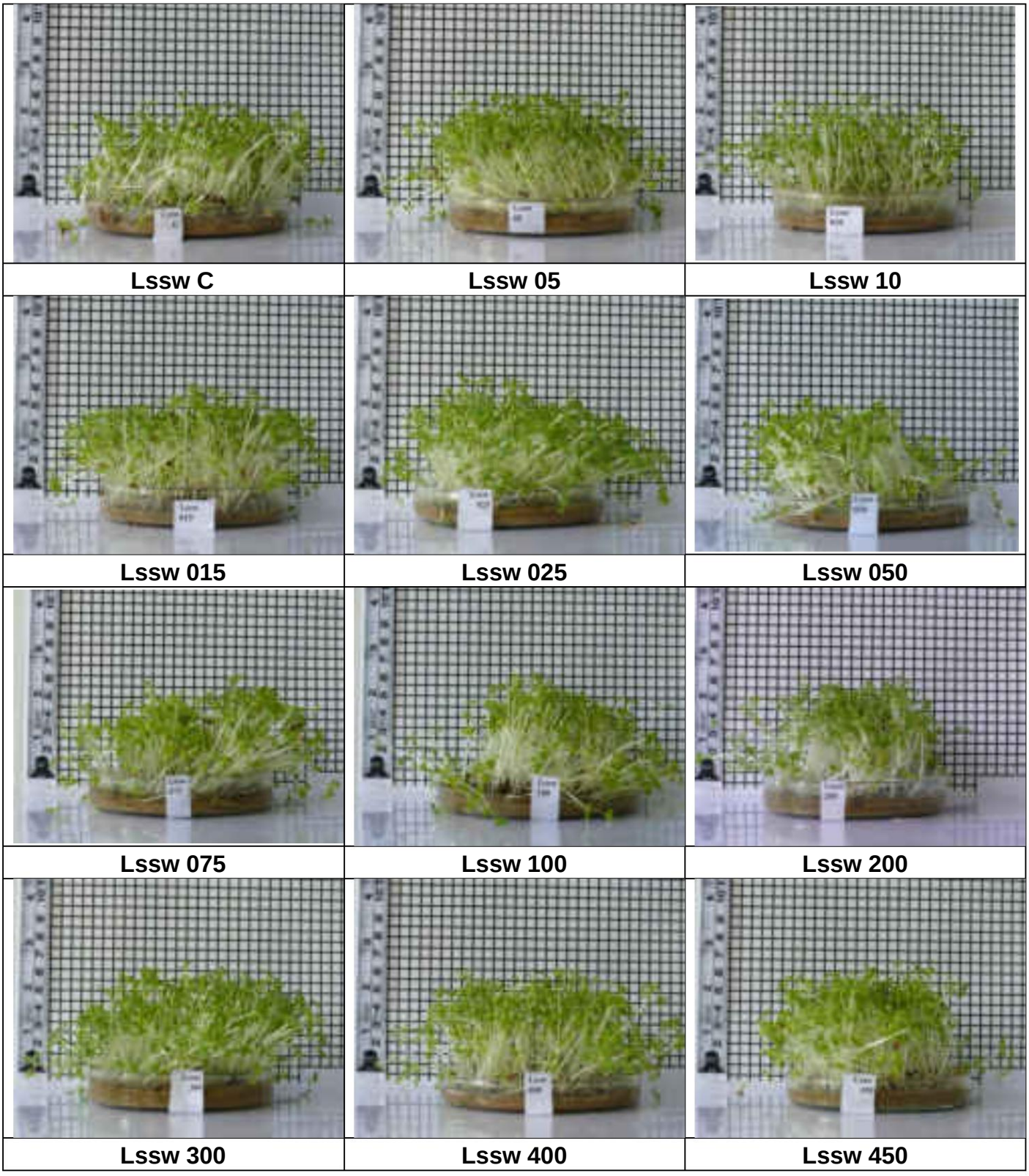

Figure 8 Comparison of tested variants with activated stable **water at different pressures for germination** and **emergence of cress seeds** *Lepidium sativum* L. after **13 days from the start of the experiment (J. Šimková 202**

13 days	LSswc	LSsw5	LSsw10	LSsw15	LSsw25	LSsw50	LSsw75	LSsw100	LSsw200	LSsw300	LSsw400	LSsw450			
	+	+++	+	++	+++	++	++	+++	++	+++	+++	+++			

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C. Conclusions

Plant species	Applied water	The beginning of the experiment	Ending experiment	Experiment
Sown watercress (Ls) fresh - activated-fw 6/29/2021			12.7.2021	AQIPS-02-E04c

Day ÿ	Lsfwc	Lsfw5	Lsfw10	Lsfw15	Lsfw25	Lsfw50	Lsfw75	Lsfw100	Lsfw200	Lsfw300	Lsfw400	Lsfw450				
3	++	+++		++	++	+	+	+++	++	++	+++		++	+++		
3	++	+++		++	++	+	+	+++	++	++	+++		++	+++		
9	++	+++	+++		++	+	+	+++	++	++	+++		+++	+++		
13	++	+++	+++	Cress sown	++	+	++	+++	++	++	+++		+++	+++		

(Ls) stable-activated-sw 29.6.2021 Day ÿ	Lsswc	Lscw5	Lssw10							12.7.2021		AQIPS-02-E04c	
Lssw15	Lssw25	Lssw50	Lssw75	Lssw100	Lssw200	Lssw300	Lssw400	Lssw450					
3	+	+	+	+++	++	+++	+++	+++		++	++	+++	+++
3	+	+	+	+++	++	+++	+++	+++		++	++	+++	+++
9	+	++	+	++	++	++	+++	+++		++	+++	+++	+++
13	+	+++	+	++	+++	++	++	+++		++	+++	+++	+++

Marking		Plant growth intensity
BR	-	No growth
PR	+	Slow plant growth - Blockage of growth
No.	++	Normal plant growth - Plant growth
AND	+++	Intensive plant growth
IS	++++	Extremely intensive growth

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AQIPS 03

Effect of activated water by the IPS system with the application of alginite on biological and production processes of plant species - experiments in the Nitra greenhouse

AQIPS-03-E01 The effect of activated water with the IPS system with the application of alginite on the biological and production processes of hemp *(Cannabis sativa)* - winter period - 24.1.2021-9.3.2021 AQIPS-03-E02 The effect of the activated water with the IPS system with the application of alginite on the biological and production processes of hemp *(Cannabis sativa)* - 17.3.2021 - 19.4.2021 AQIPS-03-E03 The effect of activated water by the IPS system with the application of alginite on the biological and production processes of hemp *(Cannabis sativa)* - 3.9.2021 - 7.12.2021

The effect of activated water by the IPS system at different pressures on germination, growth and development of hemp *(Cannabis sativa* L.) 24.1.2021 – 9.3.2021

AQIPS-03-E01

Contents

A. Methodology of the experiment

Objective: To determine the effect of activated water with the IPS system at different pressures on germination and growth and the development of hemp *(Cannabis sativa* L.)

Location	**Greenhouse KGŠR**	**Form of experiments**	**Containers**
Nitra **Establishment of the experiment** 24.1.2021		**Termination of the experiment**	9.3.2021

Applied equipment: IPS system Applied

alginite products: Alginite spray on alginite sheet and substrate

Number of trial variants: 32

Methodology: Type of experiment **– container experiment (plastic containers volume 45 liters, growing substrate** Klassman TS **– 3), 40 containers, 4 containers per variant.**

Material:

1. **Tested variants of Alginite products: V1**
Standard fertilized control, tap water. **4 variants of irrigation**
and spray water, variants of activated **untreated, 50, 100, 150.* 3 variants of ultrasonically treated alginite UZA**
(10, 20 grams/container and 30 grams/container, applied by mixing into Klassman TS3 substrate). **3 variants of ultrasonically treated UZA alginite (10,** 20 grams/liter and 30 grams/
liter **applied**
in suspension form by spraying on the leaf).
2. **Spraying treatment carried out before flowering.**
3. **Tested variety: Finola (experiment based on seeds of plants showing a higher mass fraction of flower chaff/leaves per plant in a field microexperiment in** 2020).
4. **Evaluated characters during vegetation: establishment of the experiment (date of sowing seeds), beginning of flowering (date), technological maturity (date of collection of inflorescences/seeds).**

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5. Evaluated characters at the level of mature plants:

length of the stem, length of the flower part of the stem, number of flower whorls on the stem, weight of the plant, weight of the flower chaff from the plant, weight of seeds from the plant, number of seeds from the plant, weight of a thousand seeds.

6. Evaluation of the results of the experiment: measures of variability - descriptive statistics, yield potential of economically important parts of the plants, ANOVA and testing of evidence between the averages of characters - parametric tests.

Experimental variants

Marking	Variant description

K – control	A8	B8	C8	D8	
10g	A7	B7	C7	D7	
20g	A6	B6	C6	D6	
30g	A5	B5	C5	D5	
10g/liter	A4	B4	C4	D4	
20g/liter	A3	B3	C3	D3	
30g/liter	A2	B2	C2	D2	
K – control	A1	B1	C1	D1	
Variants	A	B	C	D	
Water treatment	water supply	50 Pa	100 Pa	150 Pa	

Pressures in pascals

Substrate Klassman TS 3

Fertilizer

Nutrient requirements low Medium high

Plants in a pot 2-3 g/l 3-4 g/l 4-5 g/l 3.5 * 40 liters = 140 grams / container

AKVV	Control variant tap water
B50	B variant water treatment with IPS system pressure 50
C100	C variant water treatment with IPS system pressure 100
D150	D variant water treatment with IPS system pressure 150
Graded characters	plant height (mm); number of leaves (mm), stem weight (g), leaf weight
The investigative team	Ing. Marián Miko, CSc., Ing. Ján Gažo, PhD., doc. Ján Brindza, CSc., Ing. Jana Šimková; Ing. Vladimíra Horÿinová Sedláÿková, PhD., Mgr. Olga Grygorieva, PhD., Ing. Štefan Hajdu, Eva Chovancová; Alexej Oravec, Gabriela Szabóová, E. Kovárová, Ing. B. Kováÿová

Basic designation of the evaluated variants in the experiment after the application of activated water by the IPS system at different pressures for the germination growth and development of hemp (CS - Cannabis sativa L.) after 29 days from the start of the experiment

Basic variants Water treatment Pressures in pascals (Pa)	A Regular tap water	B 50 Well	C 100 Well	D 150 Pa	
K – kontrola	CSNA 8 n1	CSNB 8 n1	CSNC 8 n1	CSND 8 n1	
10g	CSNA 7 n1	CSNB 7 n1	CSNC 7 n1	CSND 7 n1	
20g	CSNA 6 n1	CSNB 6 n1	CSNC 6 n1	CSND 6 n1	
30g	CSNA 5 n1	CSNB 5 n1	CSNC 5 n1	CSND 5 n1	
10g/liter	CSNA 4 n1	CSNB 4 n1	CSNC 4 n1	CSND 4 n1	
20g/liter	CSNA 3 n1	CSNB 3 n1	CSNC 3 n1	CSND 3 n1	
30g/liter	CSNA 2 n1	CSNB 2 n1	CSNC 2 n1	CSND 2 n1	
K – control	CSNA 1 n1	CSNB 1 n1	CSNC 1 n1	CSND 1 n1	

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B. Image documentation from experiments

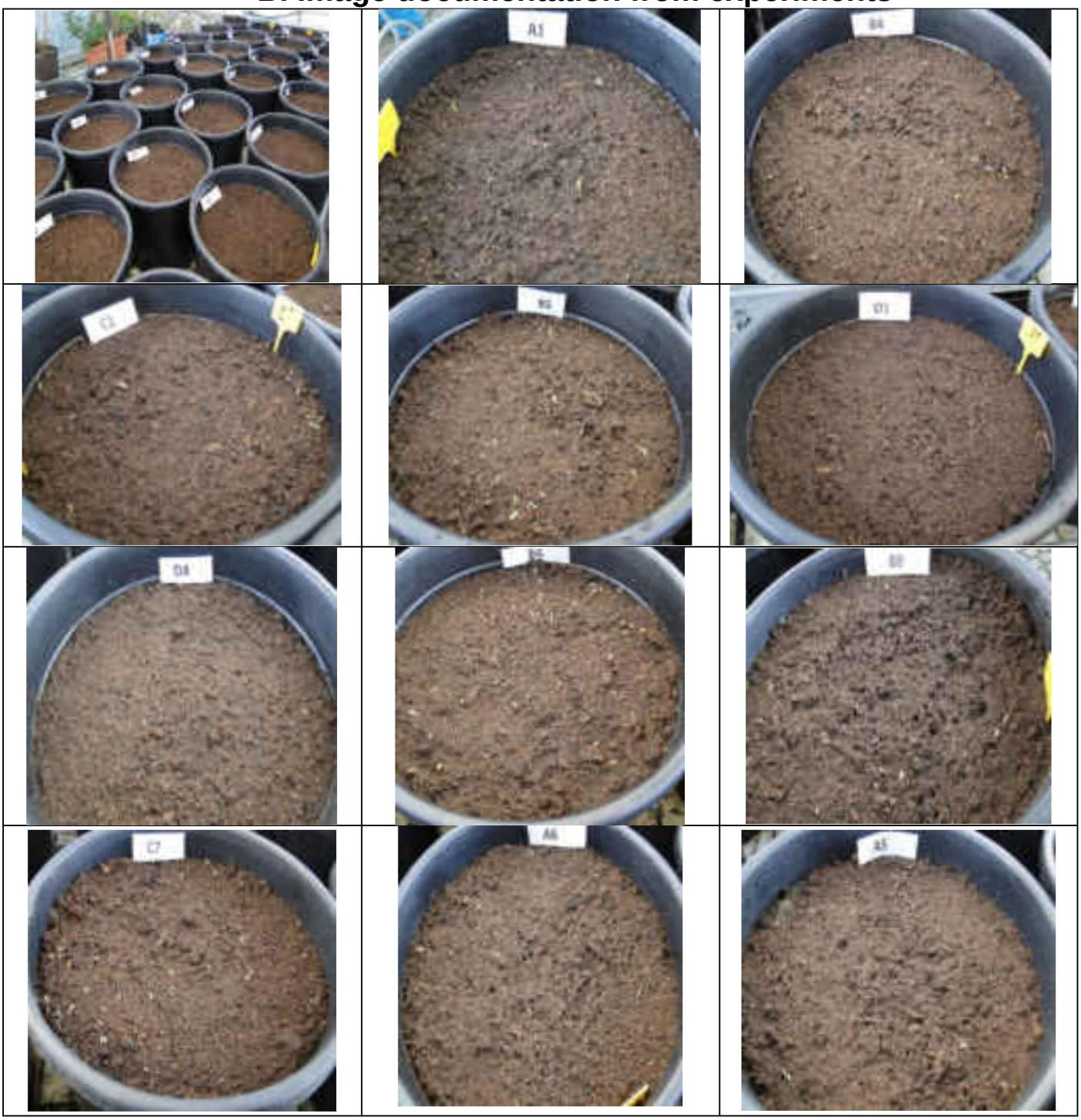

Figure 1 Comparison of variants after the application of activated water by the IPS system at different pressures for germination growth and **development of hemp** *(Cannabis sativa* L.) after 2 **days from the start of the experiment** (Photo: A. Oravec,

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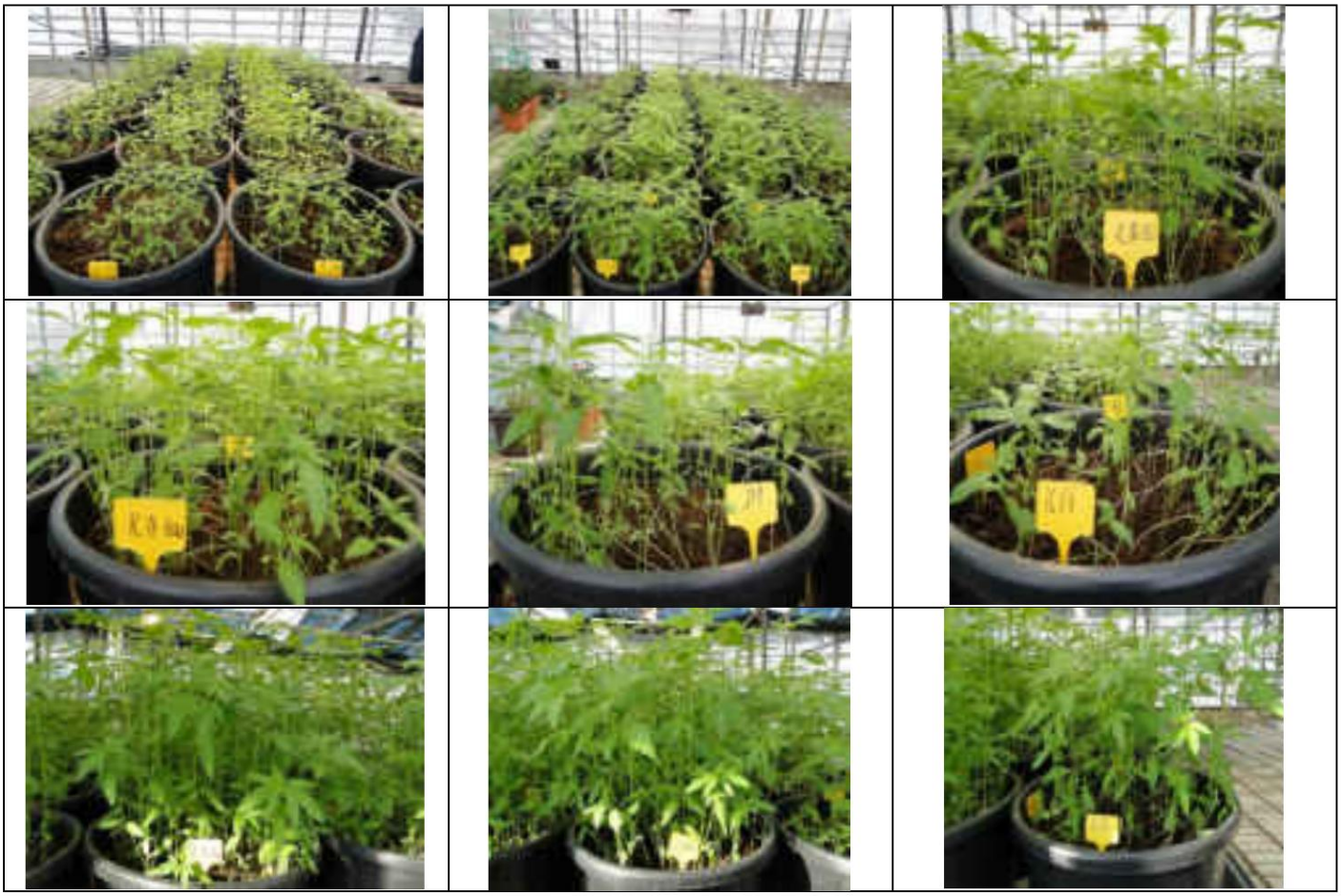

Figure 2 Comparison of variants after the application of activated water by the IPS system at different pressures for germination growth and **development of hemp** *(Cannabis sativa* L.) **after 29 days from the start of the experiment** (Photo: A. Oravec

Figure 3 Evaluation of varieties of hemp *(Cannabis sativa* L.) (Photo: A. Oravec, 2021).
The pictorial documentation clearly documents the significant differences in hemp plants sown between **the tested variants.**

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C. Results

Table 1 Average values of evaluated morphometric features of hemp plants determined in experimental variants with the application of activated water and alginite products in greenhouse conditions (Nitra) 26.1.–9.3.2021

Variants	Plant height (cm)	Number of leaves	Weight of stems (g)	Leaf weight (g)
CSNA1n1	35,10	6,60	0,97	0,68
CSNA2n1	45,06	5,93	1,98	1,00
CSNA3n1	46,17	5,97	2,08	1,11
CSNA4n1	38,57	5,90	1,25	0,72
CSNA5n1	34,40	6,30	1,02	0,64
CSNA6n1	41,33	6,47	1,50	0,93
CSNA7n1	39,35	6,03	1,39	0,83
CSNA8n1	30,16	6,30	0,79	0,56
CSNB1n1	54,78	6,50	1,40	0,87
CSNB2n1	60,82	6,90	3,28	1,55
CSNB3n1	57,08	6,80	3,19	1,54
CSNB4n1	40,67	6,50	1,42	0,77
CSNB5n1	41,83	5,83	1,30	1,77
CSNB6n1	43,80	5,80	1,51	0,81
CSNB7n1	47,80	6,27	1,90	0,92
CSNB8n1	35,52	5,70	1,02	0,57
CSNC1n1	50,10	5,53	1,91	1,03
CSNC2n1	80,63	5,83	2,92	1,54
CSNC3n1	56,03	6,27	2,66	1,38
CSNC4n1	46,43	5,30	1,78	0,84
CSNC5n1	49,67	6,27	1,91	1,06
CSNC6n1	52,50	6,13	2,26	1,16
CSNC7n1	57,77	6,50	2,94	1,27
CSNC8n1	41,90	5,30	1,38	0,79
CSND1n1	40,72	6,00	1,35	0,81
CSND2n1	48,40	6,90	2,16	1,26
CSND3n1	42,57	5,47	1,73	0,94
CSND4n1	41,67	6,37	1,52	0,89
CSND5n1	36,57	5,57	1,26	0,71
CSND6n1	37,13	6,03	1,35	0,76
CSND7n1	42,88	6,10	1,92	1,08
CSND8n1	33,02	5,07	0,93	0,83
n	32	32	32	32
min	30,16	5,07	0,79	0,56
max	80,63	6,90	3,28	1,77
x	45,33	6,08	1,75	0,99
s	9,90	0,46	0,65	0,30
sx	1,75	0,08	0,12	0,05
IN %	21,83	7,53	37,37	30,64

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Table 2 Comparison of the values of correlation coefficients between the assessed traits of hemp *(Cannabis sativa* L.) **by the Pearson method**

Tested characters	Plant length (cm)	Number of leaves	Stem weight (g)	Leaf weight (g)
Plant length (cm)	1,			
Number of leaves	0,26			
0.38 Stem weight	0,87	1		
(g) 0.29 Leaf weight (g)	0,74		1 0,79	1

Between **the length of the plants and the weight of the stem, the weight of the leaves, we determined a moderately strong correlation dependence**

We determined a low degree of correlation dependence between the number of leaves and stem weight, leaf weight and plant length.

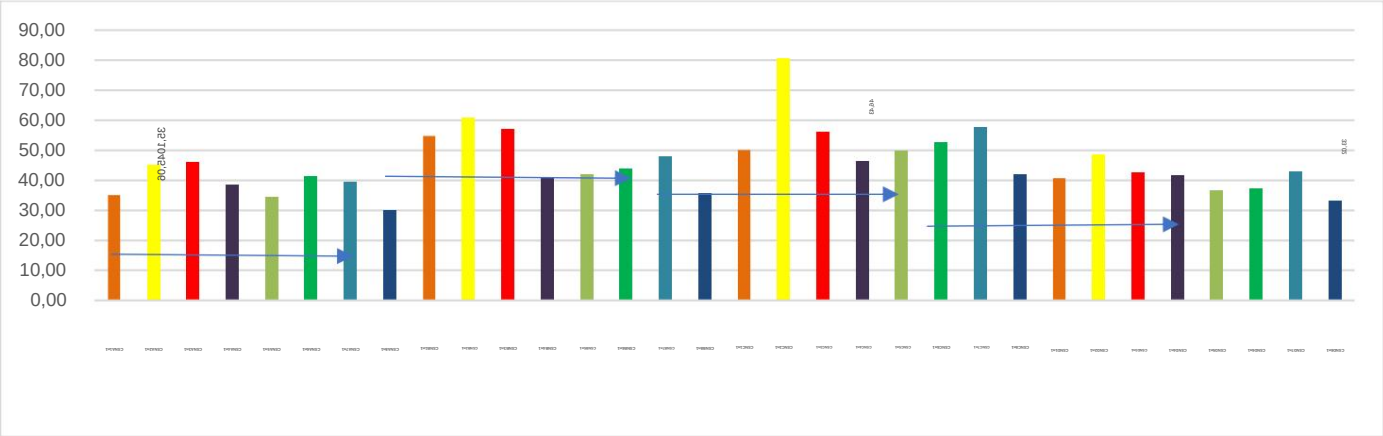

Figure 5 Comparison of the effect of activated water in **combination with applied alginite products on the length of hemp plants (cm)**

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the length of hemp plants increased significantly after the application of activated water with **the application of** 30g/l alginite spray **(2-yellow** color) and with **the application of** 20g/l alginite spray **(3-red** color) and **the application of 10g substrate** (7-light **blue color).**

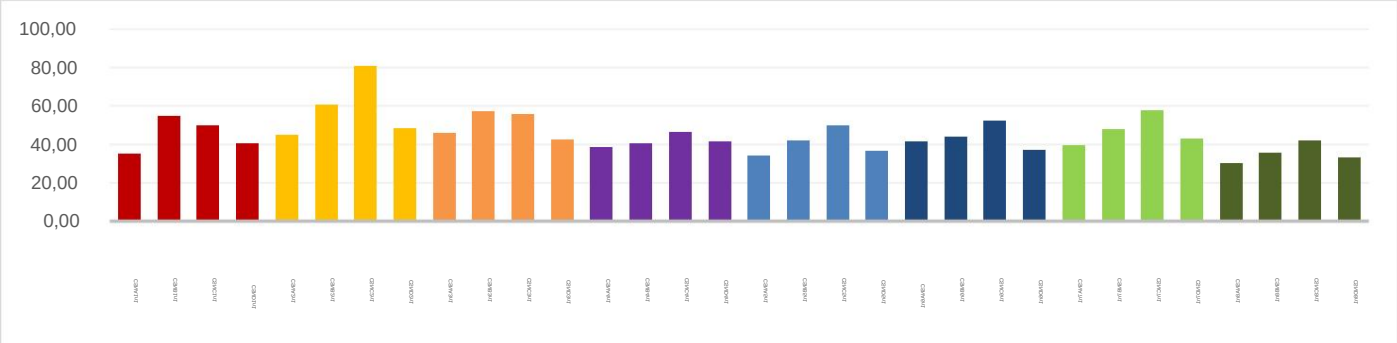

Figure 6 Comparison of the effect of activated water in **combination** with **applied alginite products on the length of hemp plants (cm)**

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the length of hemp plants was generally conditioned by activated water at 50 Pa in **combination with the application of** 20g/l spray (CSNB3n1) and **activated water at 100 Pa** with **the application of** 30g/l spray (CSNC2n1), 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) **alginite substrate** compared **to** controls.

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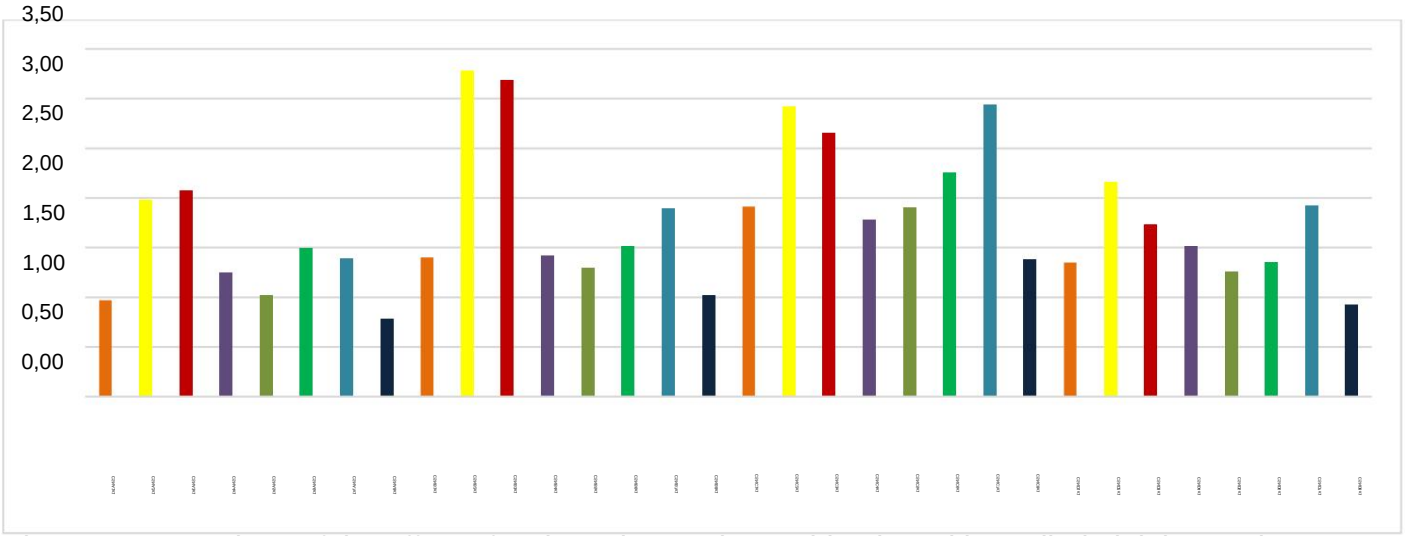

Figure 7 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp stem (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of the hemp stem significantly increased after the application of activated water with the application of 30g/l alginite spray (2-yellow color) and with the application of 20g/l alginite spray (3-red color) and the application of 10g substrate (7-light blue color).

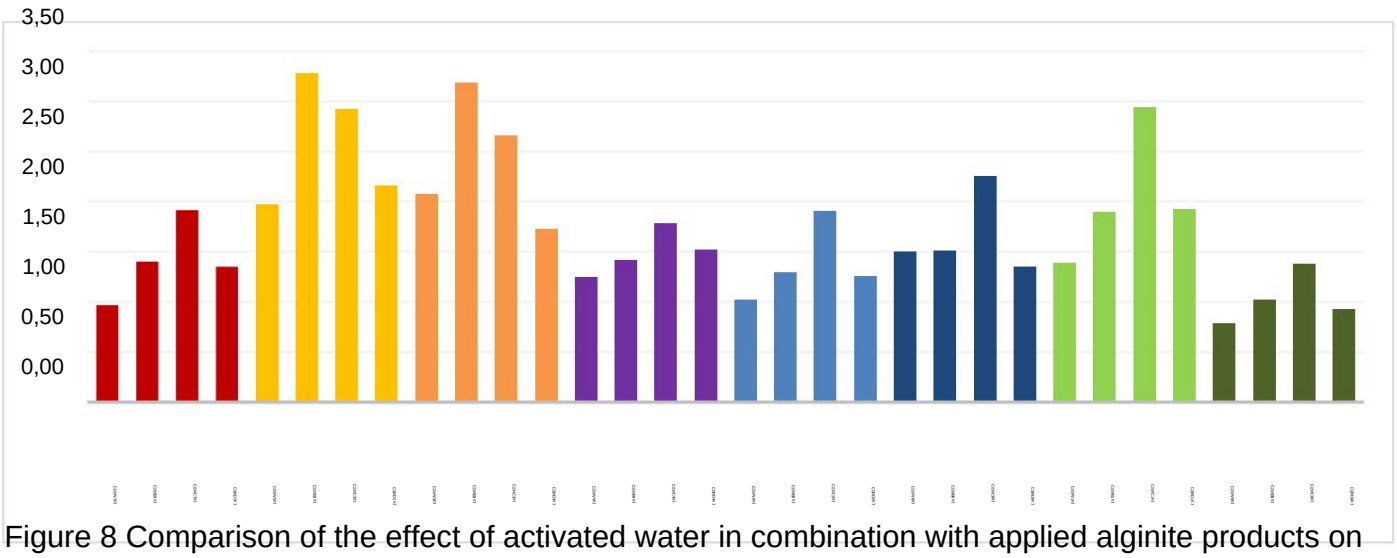

Figure 8 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp stem (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in stem weight on hemp plants was generally caused by activated water at 50 Pa in combination with the application of sprays of 30g/l (CSNB2n1) and 20g/l (CSNB3n1) and water at 100 Pa with the application of 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) alginite substrate compared to controls.

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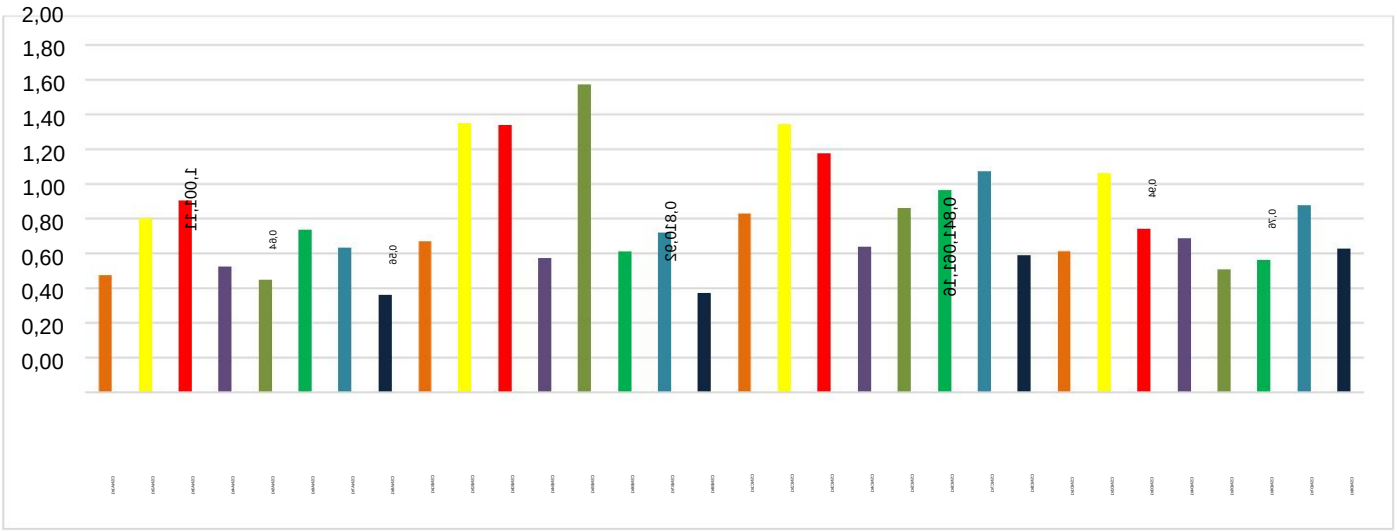

Figure 9 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp leaves (cm)

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of hemp leaves significantly increased after the application of activated water with the application of 30g/l alginite spray (2-yellow color) and with the application of 20g/l alginite spray (3-red color) and the application of 10g substrate (7-light blue color).

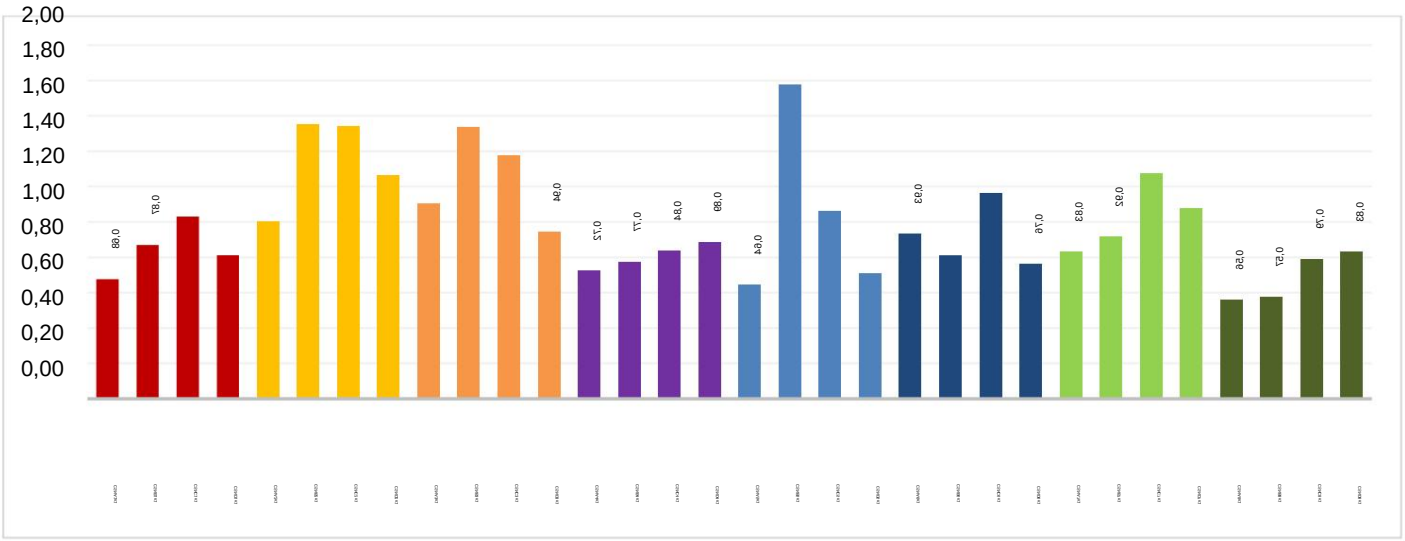

Figure 10 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp leaves (cm)

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the weight of the leaves on hemp plants was generally conditioned by activated water at 50, 100 Pa in combination with the application of sprays of 30g/l and 20g/l of water at 50 Pa (CSNB2n1, CSNC2n1, CSNB3n1, CSNC3n1) with the application of 30 g of substrate alginite (CSNB5n1) and water 100 Pa with the application of alginite substrate 20g (CSN6n1) and 10g (CSN7n1) compared to controls.

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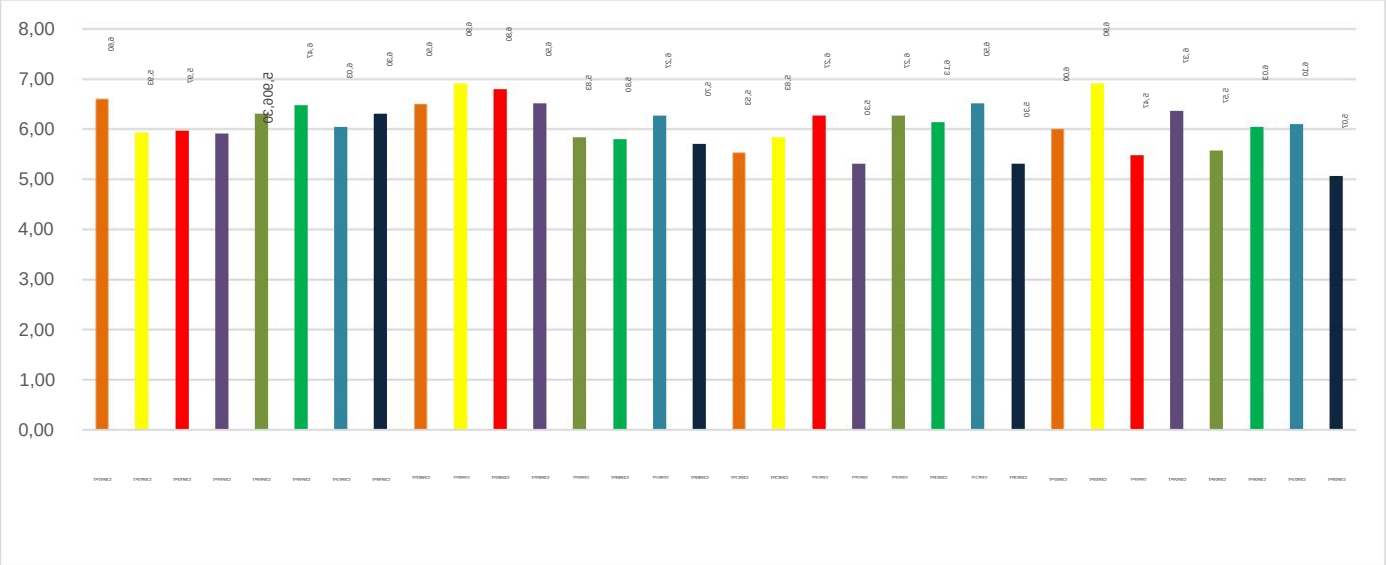

Figure 11 Comparison of the effect of activated water in **combination with applied alginite products on the number of pairs** of hemp leaves (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the number of hemp leaves increased after the application of activated water with the application of 30 g/l alginite spray **(2-yellow color) and 10 g of substrate** (7-light **blue color).**

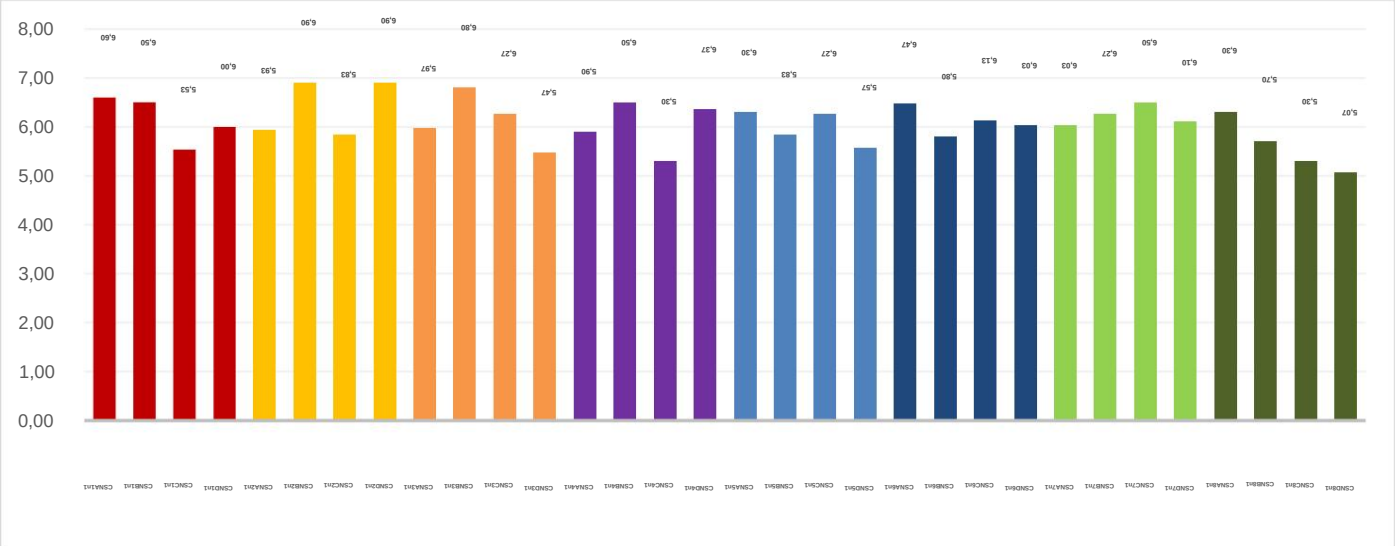

Figure 12 Comparison of the effect of activated water in **combination with applied alginite products on the number of pairs** of hemp leaves (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the number of leaves on hemp plants was generally conditioned by activated water at 50, 150 Pa in **combination with the application of sprays of 30g/l and** 10g/l of water at 100 Pa with **the application of** 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) **of alginite substrate** compared **to** controls.

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D. Conclusions

a) **The length of hemp plants significantly increased after the application of activated water with the application of 30g/l** alginite spray **(2-yellow color)** and with **the application of 20g/l alginite spray (3-red color) and the application of 10g substrate (7-light blue color).**

b) **The increase in the length of hemp plants was generally conditioned by activated water at 50 Pa** in **combination with the application of 20g/l spray (CSNB3n1) and activated water at 100 Pa with the application of 30g/l** spray (CSNC2n1), 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g **(CSNC7n1) alginite substrate compared to** controls.

c) **The weight of the hemp stem increased significantly after the application of activated** water with **the application of 30g/l** alginite spray **(2-yellow color) and** with **the application of 20g/l alginite spray (3-red color) and the application of 10g substrate (7-light blue color).**

d) **The increase in stem weight on hemp plants was generally conditioned by activated water** at 50 Pa in **combination with the application of sprays of 30g/l (CSNB2n1) and** 20g/l (CSNB3n1) and water at 100 Pa with the **application of 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) alginite substrate compared to** controls.

e) **The weight of** hemp leaves **significantly increased after the application of activated water with the application of 30g/l** alginite spray **(2-yellow color) and** with **the application of 20g/l alginite spray (3-red color) and the application of 10g substrate (7-light blue color).**

f) **The increase** in the weight of the leaves on **hemp plants was generally conditioned by activated water at** 50, 100 Pa in **combination with the application of sprays of 30g/l and** 20g/l of water at 50 Pa (CSNB2n1, CSNC2n1, CSNB3n1, CSNC3n1) with **the application of 30 g of alginite substrate (CSNB5n1) and** water 100 Pa with **the application of alginite substrate 20g (CSN6n1) and** 10g (CSN7n1)

compared to controls. g) **The number of hemp leaves increased after the application of activated water with the applic (2–yellow color) and 10 g of substrate (7–light blue color).**

h) **The increase in the number of leaves on sown hemp plants was generally determined by activated water at 50,** 150 Pa in **combination with the application of sprays of 30g/l and** 10g/l water at 100 Pa with **the application of 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) alginite substrate compared to** controls.

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The effect of activated water by the IPS system at different pressures on germination, growth and development of hemp *(Cannabis sativa* L.) 17.3.2021 – 19.4.2021 AQIPS-03-E02

Contents

A. Methodology of the experiment

Objective: To determine the effect of activated water by the IPS system under different pressures on the germination, growth and development of cannabis *(Cannabis sativa* L.).

KGŠR Location Form of experiments Nitra **Greenhouse**			**Containers**
Establishment of the experiment	17.3.2021	**Termination of the experiment**	19.4.2021

Applied equipment: IPS system; Alginite

products applied: Number of

experimental variants: 40 Methodology:

Type of experiment **– container experiment (plastic containers volume 45 liters, growing substrate** Klassman TS **– 3), 40 containers, 4 containers per variant.**

Material:

1. **Tested variants of Alginite products: V1**
   Standard fertilized control, tap water. 4 variants of **irrigation and spraying** water, variants of activated **untreated, 50, 100, 150 and 200.*** 3 **variants of ultrasonically treated alginite UZA** (10, 20 **grams/container** and 30 **grams/container, applied by mixing into the** Klassman TS3 substrate). 3 **variants of ultrasonically modified alginite UZA** (10, 20 grams/liter and 30 grams/liter **applied in suspension form by spraying on the leaf).**
2. Spraying **treatment carried out before flowering.**
3. **Tested** variety: Finola **(experiment based on seeds of plants showing a higher mass proportion of flower chaff/ leaves per plant in a field microexperiment in** 2020).
4. **Evaluated characters during the vegetation: establishment of the experiment (date of sowing seeds), beginning of flowering (date), technological maturity (date of collection of inflorescences/seeds).**
5. **Evaluated characters at the level of mature plants:**
   length of the stem, length of the flower part of the stem, number of flower whorls on the stem, weight of the plant, weight of the flower chaff from the plant, **weight of seeds from the plant, number of seeds from** the plant, **weight of a thousand seeds.**
6. **Evaluation of the results of the experiment:** measures of variability **- descriptive** statistics, **yield potential of economically important parts of the plants,** ANOVA and testing of evidence between character means - **parametric** tests.

Solvers: Ing. Marián Miko, CSc., Ing. Ján Gažo, PhD., doc. Ján Brindza, CSc., Ing. Jana Šimková; Ing. Vladimíra Horÿinová Sedláÿková, PhD., **Mgr. Olga Grygorieva, PhD., Ing. Štefan Hajdu,** Eva **Chovancová; Alexej Oravec, Gabriela Szabóová, E. Kovárová, Ing. B. Kováÿová**

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Experimental variants	
Designation	Variant description
AKVV	Control variant tap water
B50	B variant water treatment with IPS system pressure 50 Pa
C100	C variant water treatment with IPS system pressure 100 Pa
D150	D variant water treatment with IPS system pressure 150 Pa
E200	E variant water treatment with IPS system pressure 200 Pa
Rated plant characters	height (mm); fresh plant weight (g); number of flower whorls, length of flower stem (mm), weight of the chaff part (g), number of seeds

Plan of vessel experiment with technical hemp

K	A8	B8	C8	D8	E8	
10g	A7	B7	C7	D7	E7	
20g	A6	B6	C6	D6	E6	
30g	A5	B5	C5	D5	E5	
10g/liter A4 20g/		B4	C4	D4	E4	
liter A3 30g/liter A2		B3	C3	D3	E3	
		B2	C2	D2	E2	
K	A1	B1	C1	D1	E1	

Variants	A	B	C	D	AND
Water treatment	water supply	50	100	150	200

Substrate: Klassman TS 3

Fertilizer: ICL Osmocote Pro 5-6M 25kg 19-9-10+2MgO+TE

Nutrient requirements: low Medium tall

Plants in a pot: 2 – 3 g/l 3 – 4 g/l 4 – 5 g/l

3.5 * 40 liters = 140 grams / container

Basic designation of the evaluated variants in the experiment after the application of activated water by the IPS system at different pressures for the germination growth and development of hemp (CS - Cannabis sativa L.) after 29 days from the start of the experiment

Basic variants Water treatment Pressures in pascals (Pa)	A Regular tap water	B 50 Well	C 100 Well	D 150 Pa	
K – control	CSNA 8 n1	CSNB 8 n1	CSNC 8 n1	CSND 8 n1	
10g	CSNA 7 n1	CSNB 7 n1	CSNC 7 n1	CSND 7 n1	
20g	CSNA 6 n1	CSNB 6 n1	CSNC 6 n1	CSND 6 n1	
30g	CSNA 5 n1	CSNB 5 n1	CSNC 5 n1	CSND 5 n1	
10g/liter	CSNA 4 n1	CSNB 4 n1	CSNC 4 n1	CSND 4 n1	
20g/liter	CSNA 3 n1	CSNB 3 n1	CSNC 3 n1	CSND 3 n1	
30g/liter	CSNA 2 n1	CSNB 2 n1	CSNC 2 n1	CSND 2 n1	
K – control	CSNA 1 n1	CSNB 1 n1	CSNC 1 n1	CSND 1 n1	

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B. Image documentation from the experiment

Deadline for photo documentation: 22.3. 2021		
		
Deadline for photo documentation: 24.3.2021		
		
Deadline for photo documentation: 31.3.2021		
		
Deadline for photo documentation: April 7, 2021		
		

Figure 1 Comparison of variants after the application of activated water by the IPS system at different pressures for germination growth and **development of hemp** *(Cannabis sativa* L.) after 5, 7 and 14 **days from the start of the experiment** Photo: A. O

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Figure 2 Comparison of variants after the application of activated water by the IPS system at different pressures for germination growth and development of hemp (Cannabis sativa L.) after 5 days from the start of the experiment (Photo: A. Oravec, 2021)

Figure 3 Comparison of variants after application of activated water by the IPS system at different pressures for germination growth and development of hemp (Cannabis sativa L.) after 7 days from the start of the experiment (Photo: A. Oravec, 2021)

Figure 4 Comparison of variants after application of activated water by the IPS system at different pressures for germination growth and development of hemp (Cannabis sativa L.) after 14 days from the start of the experiment (Photo: A. Oravec, 2021)

Figure 5 Comparison of variants after application of activated water by the IPS system at different pressures for germination growth and development of hemp (Cannabis sativa L.) after 14 days from the start of the experiment (Photo: A. Oravec, 2021)

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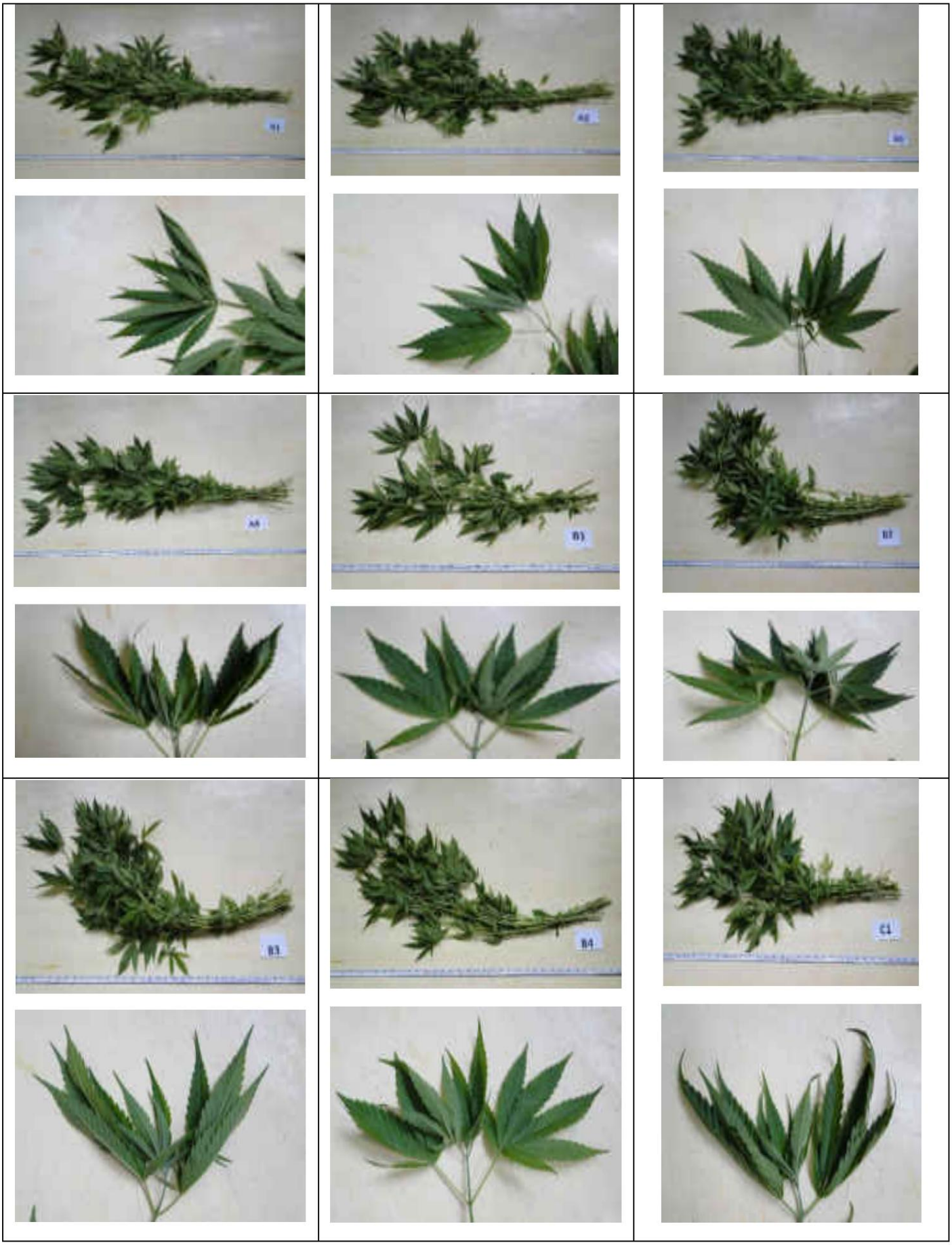

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Figure 6 Comparison of the shape of the compound leaves of hemp sown in variants A, B, C and D (Photo: A. Oravec, 2021)

The pictorial documentation clearly documents the significant differences in hemp plants sown between the tested variants.

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C. Results

Table 1 Average values of evaluated morphometric features of hemp plants determined in **experimental variants with the application of activated water and** alginite products in **greenhouse conditions** (Nitra) 17.3. – 19.4.2021

Variants	Plant height (cm) 56.44	Number of	Stem weight (g) 3.78 3.84	Sheet weight (g) 1.90
CSNA1n2	58.21		4.70	1.47
CSNA2n2	69.97		2.83	1.76
CSNA3n2	55.20		3.66	1.21
CSNA4n2	72.08		2.70	1.93
CSNA5n2	55.67		2.17	1.35
CSNA6n2	54.40		1.35	0.93
CSNA7n2	40.46		1.96	0.87
CSNA8n2	39.85		3.66	1.31
CSNB1n2	60.10		3.07	1.50
CSNB2n2	57.60		3.21	1.20
CSNB3n2	55.58		2.72	1.48
CSNB4n2	55.23		2.75	1.30
CSNB5n2	59.85		3.38	1.20
CSNB6n2	67.67		2.17	1.68
CSNB7n2	52.50		2.45	1.21
CSNB8n2	42.08		3.46	1.42
CSNC1n2	56.47		2.82	1.34
CSNC2n2	57.83		2.82	1.37
CSNC3n2	57.29		2.18	1.26
CSNC4n2	51.10		3.54	1.10
CSNC5n2	57.27		3.93	1.39
CSNC6n2	76.27		3.43	1.44
CSNC7n2	66.53		1.39	1.74
CSNC8n2	33.35		2.56	0.94
CSND1n2	48.83		2.96	1.34
CSND2n2	55.40		2.43	1.43
CSND3n2	56.58		2.27	1.37
CSND4n2	53.22		2.19	1.07
CSND5n2	51.57		2.97	1.15
CSND6n2	61.27		3, 70	1.18
CSND7n2	60 67		5.08	1, 99
CSND8n2	73.20		5.96	2.57
CSNE1n2	83.67		4.48	2.76
CSNE2n2	70.28		3.35	2.24
CSNE3n2	69.13		3.18	1.47
CSNE4n2	64.63		3.94	1.51
CSNE5n2	66.00		3.75	1.87
CSNE6n2	68.93		2.70	1.76
CSNE7n2	56.43		**40**	1.20
CSNE8n2	40		**1.35**	40
n				
min	**33.35**		**5.96**	**0.87**
max	**83.67**		**3.14**	**2.76**
x	**58.72**		**0.15**	**1.48**
sx	**1.59**		**29.53**	**0.06**
IN %	**17.07**			

sheets 5.93 4.79 5.20 5.37 6.37 5.50 4.63 5.86 5.46 5.53 5.13 4.83 **27.28** 5.13 6.17 6.40 5.81 5.17 5

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Table 2 Comparison of the values of correlation coefficients between the assessed traits of hemp (Cannabis sativa L.) by the Pearson method

	Plant length	Number of leaves	Stem weight	Leaf weight
Plant length	1			
Number of leaves	0,47	1		
Stem weight	0,87	0,48	1	
Leaf weight	0,74	0,75	0,89	1

The values of the correlation coefficients between the length of the plants as well as the weight of the stem and the weight of the leaves in the tested plants grown in individual variants after the application of activated water directly document a high degree of linear dependence.

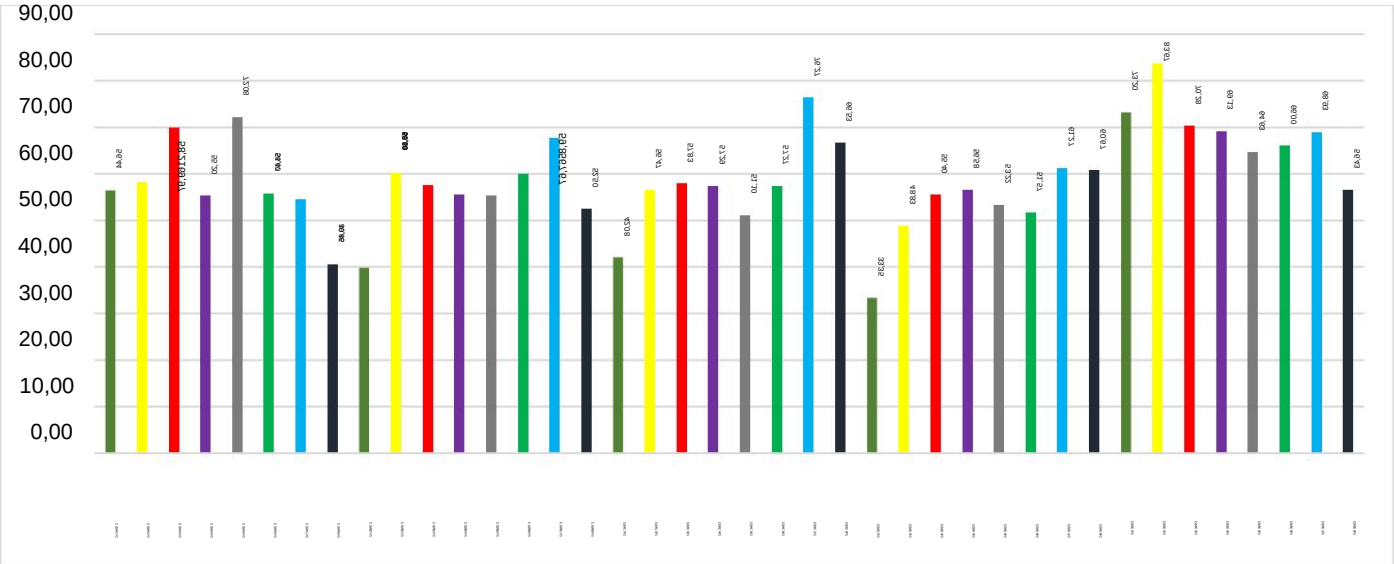

Figure 7 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the length of hemp plants significantly increased after the application of activated water with the application of 30g/l alginite spray (2-yellow color) and 20g/l alginite spray (3-red color) and the application of 10g alginite substrate (7-light blue color).

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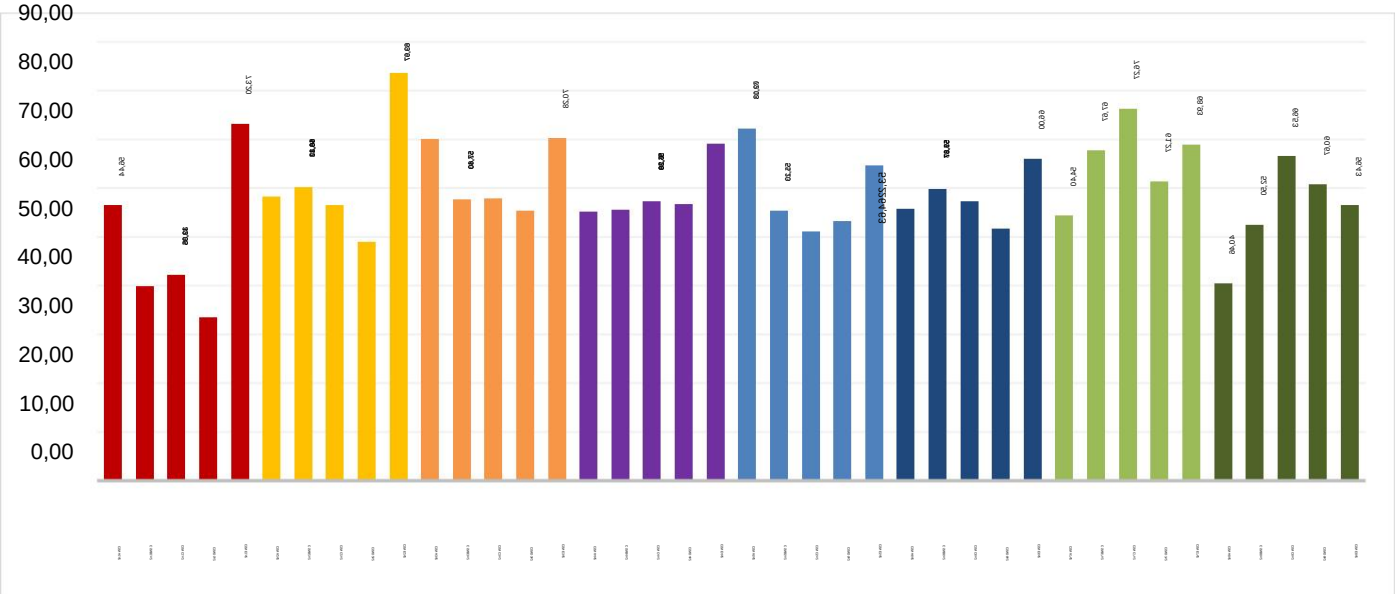

Figure 8 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure of 150 Pa and E - at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control The results document that the increase in the length of hemp plants was generally conditioned by activated water at 200 Pa in combination with the application of sprays 30g/l (CSNE2n1), 20g/l (CSNE3n1), 10g/l (CSNE4n1), 30g (CSNE5n1), 20g (CSNE6n1), 10g (CSNE7n1) substrate and activated water at 100 Pa with application of 10g substrate (CSNC7n1) alginite compared to controls.

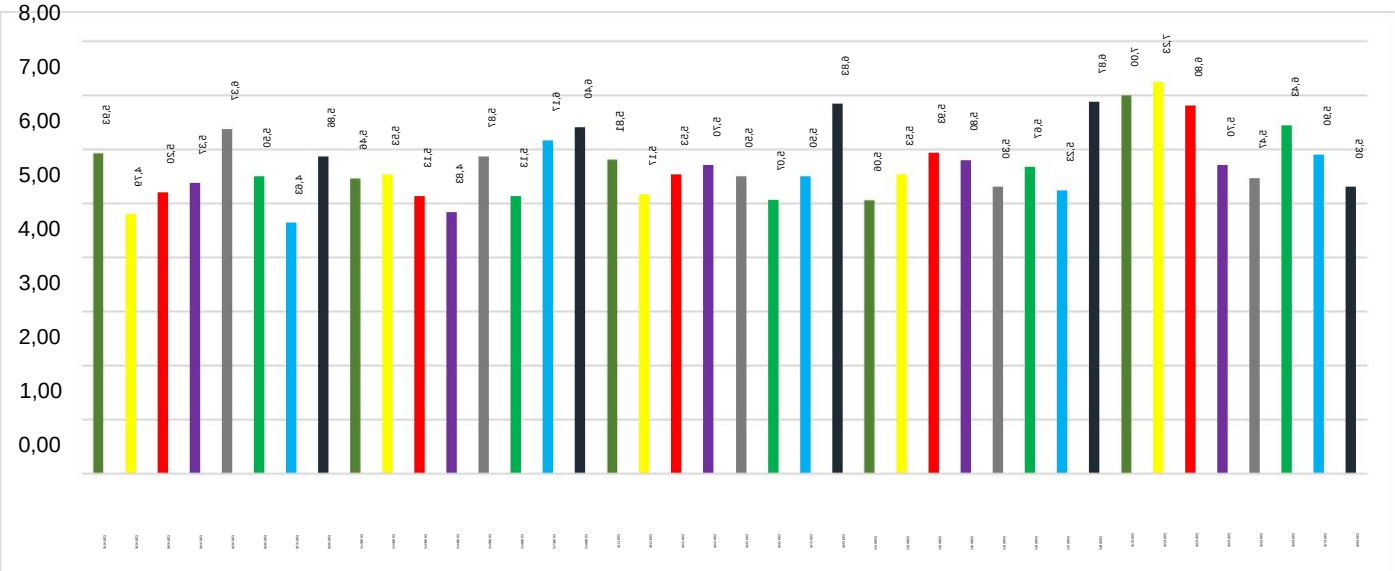

Figure 9 Comparison of the effect of activated water in combination with applied alginite products on the number of pairs of hemp leaves (cm)

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the number of leaf pairs on hemp plants did not increase significantly after the application of activated water in any of the variants compared to both controls 1 and 8.

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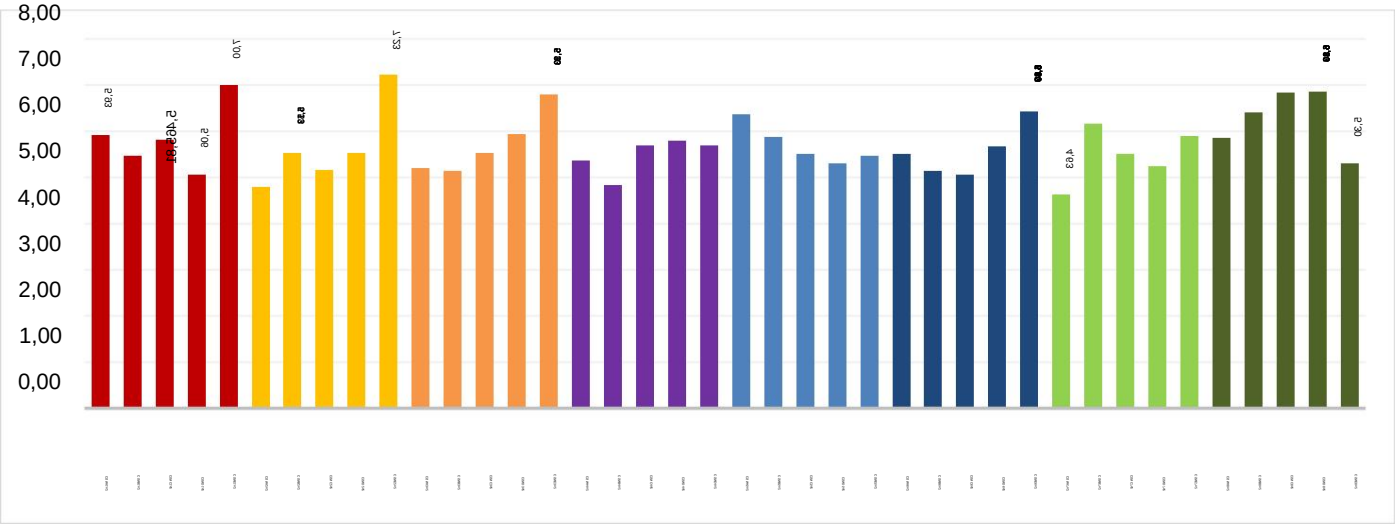

Figure 10 Comparison of the effect of activated water in combination with applied alginite products on the number of pairs of hemp leaves (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the number of leaves of hemp plants was generally conditioned by activated water at 200 Pa in combination with the application of sprays of 30g/l (CSNE2n2), 20g/l (CSNE3n2) and 20g (CSNE6n2), 10g (CSNE7n1) of alginite substrate in comparison with controls.

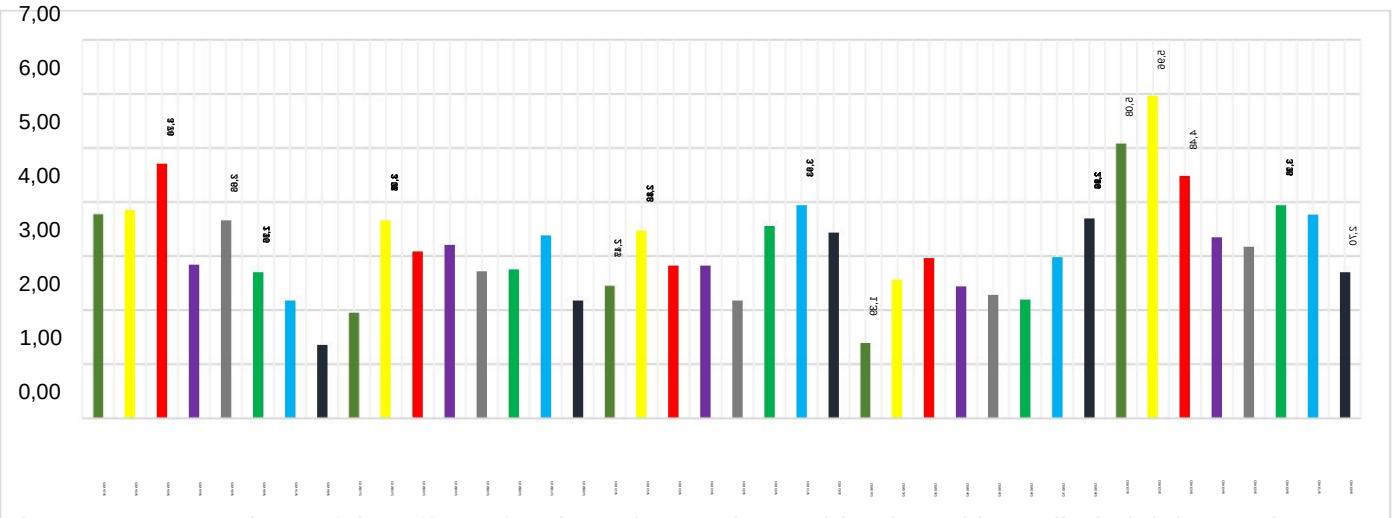

Figure 11 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp stem (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of the stem on hemp plants increased significantly after the application of activated water with the application of 30g/l alginite spray (2-yellow color) and with the application of 10g of alginite substrate (7- light blue color).

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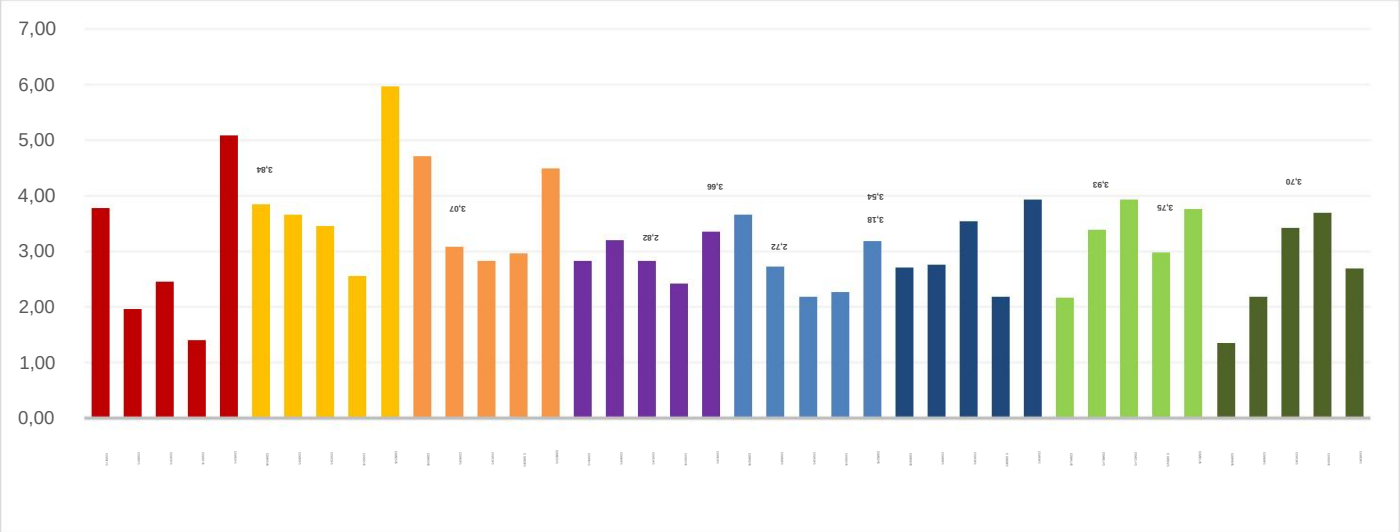

Figure 12 Comparison of the effect of activated water in **combination with applied alginite products on the weight of** hemp stem (cm)
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the weight of the hemp plant stem was generally conditioned by **activated water at** 200 Pa in **combination with the application of sprays of** 30g/l (CSNE2n2), 20g/l **(CSNE3n2), 10g/l (CSNE4n2), 30g (CSNE5n2), 20g (CSNE6n2), 10g (CSNE7n2) substrate** and **activated** water at 100 Pa with **application of** 20g (CSNC6n2) and 10g **substrate** (CSNC7n2) alginite **compared to** controls.

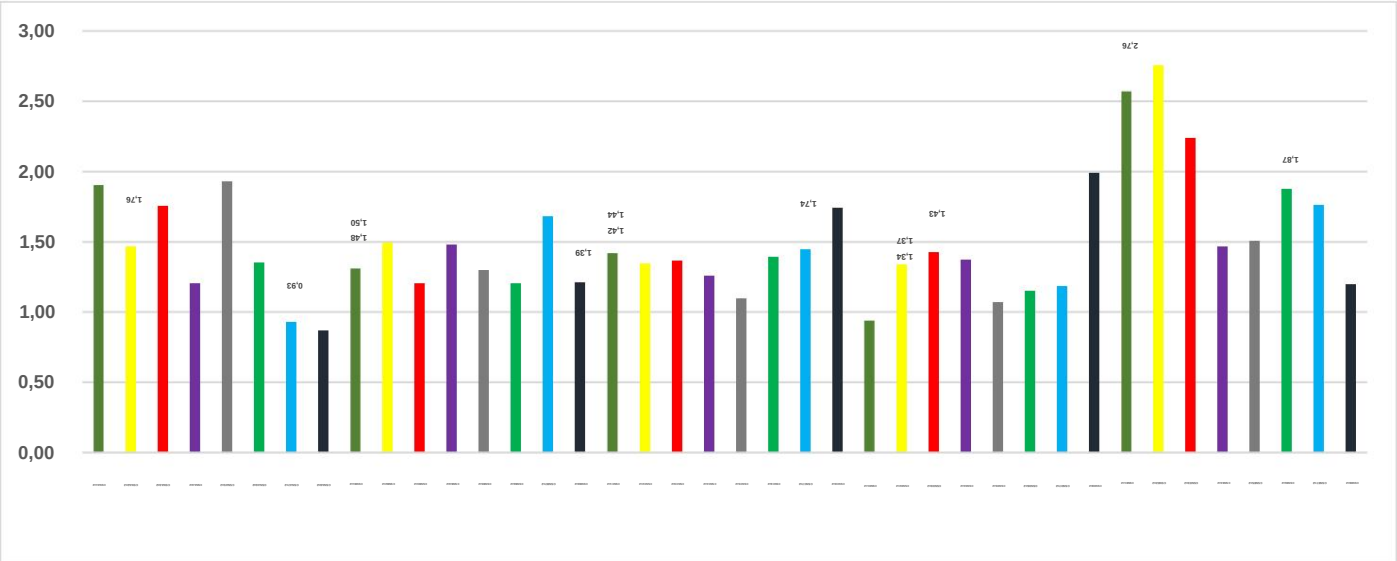

Figure 13 Comparison of the effect of activated water in **combination with applied alginite products on the weight of hemp leaves (cm)**
A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa,
D - at a pressure of 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray / 5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of leaves on hemp plants increased after the application of activated water with **the application of 30g/l alginite spray (2-yellow color).**

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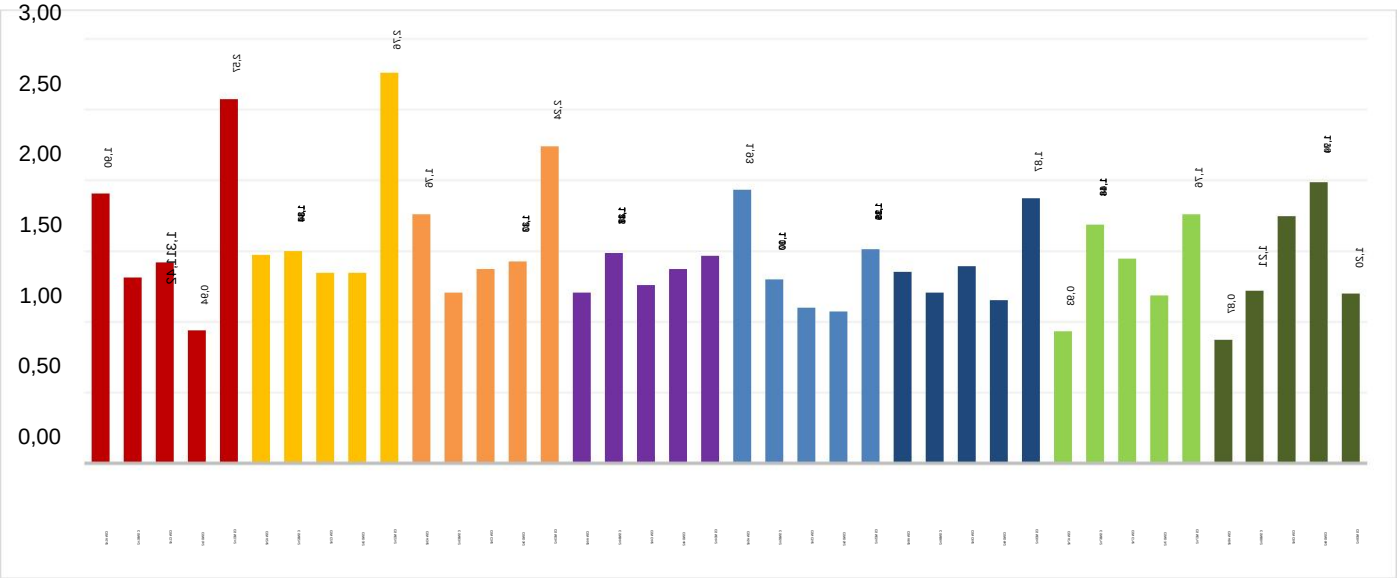

Figure 14 Comparison of the effect of activated water in combination with applied alginite products on the weight of hemp leaves (cm)

A - tap water, B - activated water obtained at a pressure of 50 Pa, C - at a pressure of 100 Pa, D - at a pressure 150 Pa and E - at a pressure of 200 Pa - 2-3-4 alginite spray /5-6-7 alginite substrate, 1 and 8 control

The results document that the increase in the weight of the hemp plant leaves was generally conditioned by activated water at 200 Pa in combination with the application of sprays of 30g/l (CSNE2n2), 20g/l (CSNE3n2), 30g (CSNE5n2), 20g (CSNE6n2), 10g (CSNE7n2) of alginite substrate compared to controls.

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D. Conclusions

a) The length of hemp plants significantly increased after the application of activated water with the application of 30g/l of alginite spray (2–yellow color) and 20g/l of alginite spray (3–red color) and the application of 10g of alginite substrate (7–light blue color). b)

The length of the sown hemp plants was generally conditioned by activated water at 200 Pa in combination with the application of sprays 30g/l (CSNE2n1), 20g/l (CSNE3n1), 10g/l (CSNE4n1), 30g (CSNE5n1), 20g (CSNE6n1), 10g (CSNE7n1) substrate and activated water at 100 Pa with application of 10g substrate (CSNC7n1) alginite compared to controls.

c) The number of pairs of leaves on hemp plants did not increase significantly after the application of activated water in none of the variants compared to both controls 1 and 8.

d) The increase in the number of leaves of hemp plants was generally conditioned by activated water at 200 Pa in combination with the application of sprays of 30g/l (CSNE2n2), 20g/l (CSNE3n2) and 20g (CSNE6n2), 10g (CSNE7n1) of alginite substrate compared to controls .

e) The weight of the stem on hemp plants increased significantly after the application of activated water with the application of 30g/l of alginite spray (2-yellow color) and with the application of 10g of alginite substrate (7-light blue color).

f) The increase in the weight of the hemp plant stem was mostly conditioned by activated water at 200 Pa in combination with the application of sprays 30g/l (CSNE2n2), 20g/l (CSNE3n2), 10g/l (CSNE4n2), 30g (CSNE5n2), 20g (CSNE6n2), 10g (CSNE7n2) substrate and activated water at 100 Pa with application of 20g (CSNC6n2) and 10g substrate (CSNC7n2) alginite compared to controls.

g) The weight of leaves on hemp plants increased after the application of activated water with the application of 30g/l alginite spray (2–yellow color).

h) The increase in the weight of the leaves of hemp plants was mostly conditioned by activated water at 200 Pa in combination with the application of sprays 30g/l (CSNE2n2), 20g/l (CSNE3n2), 30g (CSNE5n2), 20g (CSNE6n2), 10g (CSNE7n2) alginite substrate compared to controls.

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The effect of activated water by IPS system with alginite application on biological and production processes of hemp (Cannabis sativa)

3.9.2021 – 7.12.2021

AQIPS-03-E03

Contents

A. Methodology of the experiment Aim: To determine

the effect of activated water with the IPS system at different pressures on germination and growth and the development of hemp (Cannabis sativa L.)			
Location	Greenhouse KGŠR Nitra Form of experiments		Containers
Establishment of the	30.9.2021	End of the experiment 12/7/2021	
experiment Applied equipment: IPS system			
Applied alginite products: Number of			
experimental variants: 40 Methodology:			

Type of experiment - container experiment (plastic containers volume 45 liters, growing substrate Klassman TS - 3), 40 containers, 4 containers per variant.

Material:

1. Tested variants of Alginit products: V1 Standard fertilized control, tap water. 4 variants of irrigation and spray water, variants of activated untreated, 50, 100, 150 and 200.* 3 variants of ultrasonically treated alginite UZA (10, 20 grams/container and 30 grams/container, applied by mixing into Klassman TS3 substrate). 3 variants of ultrasonically treated UZA alginite (10, 20 grams/liter and 30 grams/liter applied in suspension form by spraying on the leaf).
2. Spraying treatment carried out before flowering.
3. Tested variety: Finola (experiment based on seeds of plants showing a higher mass fraction of flower chaff/leaves per plant in a field microexperiment in 2020).
4. Evaluated characters during vegetation: establishment of the experiment (date of sowing seeds), beginning of flowering (date), technological maturity (date of collection of inflorescences/seeds).
5. Evaluated characters at the level of mature plants: length of the stem, length of the flower part of the stem, number of flower whorls on the stem, weight of the plant, weight of the flower chaff from the plant, weight of seeds from the plant, number of seeds from the plant, weight of a thousand seeds.
6. Evaluation of the results of the experiment: measures of variability - descriptive statistics, yield potential of economically important parts of the plants, ANOVA and testing of evidence between character means - parametric tests.

Solvers: Ing. Marián Miko, CSc., Ing. Ján Gažo, PhD., doc. Ján Brindza, CSc., Ing. Jana Šimková; Ing. Vladimíra Horÿinová Sedláÿková, PhD., Mgr. Olga Grygorieva, PhD., Ing. Štefan Hajdu, Eva Chovancová; Alexej Oravec, Gabriela Szabóová, E. Kovárová, Ing. B. Kováÿová

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<table>
<tr><td colspan="2">Experimental variants</td></tr>
<tr><td>Marking</td><td>Variant description
Plan of vessel experiment with technical hemp
<table>
<tr><td>K – control A8</td><td></td><td>B8</td><td>C8</td><td>D8</td><td>E8</td></tr>
<tr><td>10g</td><td>A7</td><td>B7</td><td>C7</td><td>D7</td><td>E7</td></tr>
<tr><td>20g</td><td>A6</td><td>B6</td><td>C6</td><td>D6</td><td>E6</td></tr>
<tr><td>30g</td><td>A5</td><td>B5</td><td>C5</td><td>D5</td><td>E5</td></tr>
<tr><td>10g/liter</td><td>A4</td><td>B4</td><td>C4</td><td>D4</td><td>E4</td></tr>
<tr><td>20g/liter</td><td>A3</td><td>B3</td><td>C3</td><td>D3</td><td>E3</td></tr>
<tr><td>30g/liter</td><td>A2</td><td>B2</td><td>C2</td><td>D2</td><td>E2</td></tr>
<tr><td>K - control A1</td><td></td><td>B1</td><td>C1</td><td>D1</td><td>E1</td></tr>
</table>
<table>
<tr><td>Variants</td><td>A</td><td>B</td><td>C</td><td>D</td><td>AND</td></tr>
<tr><td>Water treatment
Pressures in pascals
Well</td><td>water supply 50 Pa</td><td></td><td>100 Well</td><td>150 Pa 200 Pa</td><td></td></tr>
</table>
Substrate Klassman TS 3
Fertilizer ICL Osmocote Pro 5-6M 25kg 19-9-10+2MgO+TE
Nutrient requirements low Medium tall
Plants in a pot 2 – 3 g/l 3 – 4 g/l 4 – 5 g/l
3.5 * 40 liters = 140 grams / container</td></tr>
<tr><td>AKVV</td><td>Control variant tap water</td></tr>
<tr><td>B50</td><td>B variant water treatment with IPS system pressure 50 Pa</td></tr>
<tr><td>C100</td><td>C variant water treatment with IPS system pressure 100 Pa</td></tr>
<tr><td>D150</td><td>D variant water treatment with IPS system pressure 150 Pa</td></tr>
<tr><td>E200</td><td>E variant water treatment with IPS system pressure 200 Pa</td></tr>
<tr><td>Graded characters</td><td>plant height (mm); fresh plant weight (g); number of flower whorls, length of flower stem (mm), weight of the chaff part (g), number of seeds</td></tr>
</table>

Basic designation of the evaluated variants in the experiment after the application of activated water by the IPS system at different pressures for the germination growth and development of hemp (CS - Cannabis sativa L.) after 29 days from the start of the experiment

Basic variants Water treatment Pressures in pascals (Pa)	A Regular tap water	B 50 Well	C 100 Well	D 150 Pa
K – control	CSNA 8 n1	CSNB 8 n1	CSNC 8 n1	CSND 8 n1
10g	CSNA 7 n1	CSNB 7 n1	CSNC 7 n1	CSND 7 n1
20g	CSNA 6 n1	CSNB 6 n1	CSNC 6 n1	CSND 6 n1
30g	CSNA 5 n1	CSNB 5 n1	CSNC 5 n1	CSND 5 n1
10g/liter	CSNA 4 n1	CSNB 4 n1	CSNC 4 n1	CSND 4 n1
20g/liter	CSNA 3 n1	CSNB 3 n1	CSNC 3 n1	CSND 3 n1
30g/liter	CSNA 2 n1	CSNB 2 n1	CSNC 2 n1	CSND 2 n1
K – control	CSNA 1 n1	CSNB 1 n1	CSNC 1 n1	CSND 1 n1

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B. Image documentation from the experiment

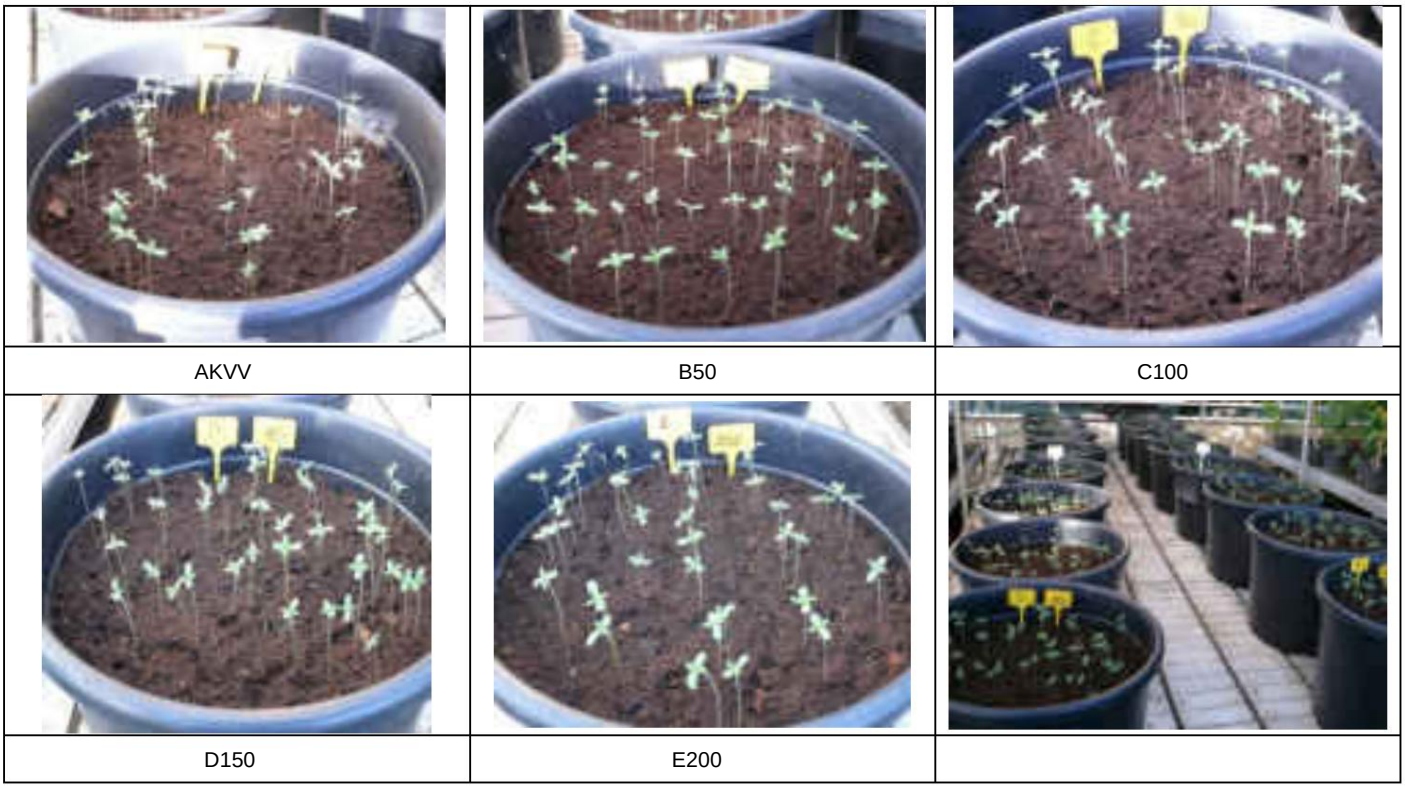

Figure 1 Comparison of variants after the application of activated water by the IPS system at different pressures for the germination, growth and development of hemp *(Cannabis sativa* **L.) 8 days after the start of the experiment (Oravec 2021)**

Figure 2 Comparison of variants after the application of activated water by the IPS system under different pressures on the growth and **development of hemp** *(Cannabis sativa* L.) after **25 days from the start of the experiment** (Oravec 2021)

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Figure 3 Comparison of variants after the application of activated water by the IPS system under different pressures on the growth and development of hemp (Cannabis sativa L.) after 61 days from the start of the experiment (Oravec 2021)

Figure 4 Sown hemp plants of variant E 7 (Cannabis sativa L.) (Oravec 2021)

The pictorial documentation clearly documents the significant differences in hemp plants sown between the tested variants.

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C. Results

Table 1 Average values of evaluated morphometric features of hemp plants determined in experimental variants with the application of activated water and alginite products in greenhouse conditions (Nitra) 30.9.-7.12.2021 1.1. Comparison of all variants

Experimentally variants	Plant with maximum height Plant with minimum height Height (cm)	Number pairs of leaves	Weight (g)	Height (cm)	Number pairs of leaves	Weight (g)	Cumulative Plant length (cm)	Number pairs of leaves	Weight plants (g)
CSNA1n4	107 9 9,7	53 5 134	8 24,8 67 6 107 9 12,5 51 5	86 8 8,9 56 7 88 8		2,1	66,31 6,15 73,3	84,46 7,77 130,6	90,00
CSNA2n4	8,8 48 5	128 8 11,4	65 7 145 10 31,8 58 4 98 8	12,2 43 6 128 9 22,4		4	7,77 123		
CSNA3n4	52 7 135	10 16,2	70 7 108 10 20,5 49 7 110 9	21,9 55 7 102 8 18,4		1,5			
CSNA4n4	60 6 130	8 14,8	56 4 144 10 39,6 65 7 94 7 12,4	50,5 6 100 9 24 53		2,9	73,00 7,23 74,7	65,62 6,92 61,8	86,92
CSNA5n4	6 113 9 22,4	52 8	120 9 21,4 62 7 105 8 16 59	7 90 7 7,4 50 5 120 9		1,5	7,46 139		
CSNA6n4	16,6 56 7	122 8	16,6 52 7 100 9 15,9 51 6 140	10 38,2 65 7 94 8 7,4		4,7			
CSNA7n4	42 6 127	10 19,7	64 7 103 9 15,8 57 6 85 9 8	51 6 134 9 24,2 50 7		1,4	92,64 7,55 141		
CSNA8n4	135 11 36,3	60 7	110 8 24,5 36 4 138 8 44,2	64 7 92 7 8,9 40 6 140		1,8	64,92 7,00 71		
CSNB1n4	10 37,9 51	7 88 7	8,6 53 7 91 9 8,1 53 7 110 9	14,9 52 6 135 10 63,0		2,2	75,08 7,62 113,6	98,29 8,64 187,4	87,46
CSNB2n4	52 6 88 9	12,5 46 6	40 40 40 40 40 85 7 7,4 36	4 145 11 63 70 8		5,1	7,62 141		
CSNB3n4	113,10 8,75	19,97	54,24 6,28 18,98 0,98 12,01	7,51 0,96 3,00 0,16		4,6			
CSNB4n4	1,90 1,19	0,15	16,78 11,21 60,16 13,84 15,31			3,3	71,36 7,14 94,5	73,08 7,31 89,7	80,23
CSNB5n4						2,4	6,77 131,8	98,46 8,54 222	
CSNB6n4						1,8			
CSNB7n4						3,3			
CSNB8n4						2,5	64,38 7,31 73,2	74,54 7,46 105	
CSNC1n4						1,2			
CSNC2n4						4,4	85,00 8,23 139,8	88,08 7,69 161,19	
CSNC3n4						4,4	83,77 7,54 100,3	69,85 7,31 63,6	88,69
CSNC4n4						4	7,54 150,2	89,31 7,77 143,3	71,46 7,08
CSNC5n4							76,1 92,00 8,23 194,6	57,62 6,54 53	
CSNC6n4						2			
CSNC7n4						2,1			
CSNC8n4						3,9			
CSND1n4						1,5			
CSND2n4						3,8			
CSND3n4						1,7	103,38 8,00	164,4 81,92 7,15	103
CSND4n4						2,8			
CSND5n4						2,6	64,08 6,77 56,6	78,00 7,46 129,4	96,62
CSND6n4						2,3	7,92 182		
CSND7n4						4,4			
CSND8n4						3,3	60,31 6,00 90,2	98,00 7,54 236	
CSNE1n4						0,6			
CSNE2n4						5,5	60,92 6,77 65		
CSNE3n4						2,3	88,46 7,69 158,1	69,15 7,15 76,7	69,85
CSNE4n4						2,2	7,46 73,9 74,77	7,08 90,5 81,08	6,77
CSNE5n4						2,9	221		
CSNE6n4						3,2			
CSNE7n4						1,2			
CSNE8n4						3,1	67,08 6,62 105,8	40 40 40	
n						1,9			
min						40	57,62 6,00 53		
max						0,6	103,38 8,64 236		
x						5,5	79,15 7,36 120,18	12,25 0,57 49,07	1,94
s						2,81	0,09 7,76 15,48	7,80 40,83	
sx						1,21			
IN%						0,19 43,16			

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Numerical values of the tested characters determined in minimum and maximum values clearly document the significant influence of activated water on all tested morphometric characters in hemp plants

1.2. Comparison of variants for all combinations of tested factors:

A block - tap water - controls: 2-3-4 alginite spray / 5-6-7 alginite substrate, 1-8 control

Experimentally variants	Plant with maximum height Cumulative(s) Height (cm)	Number pairs of leaves	Weight (g)	A plant with a minimum height Height (cm)	Number pairs of leaves	Weight (g)	Plant length	Number	Weight plants (g)
CSNA1n4	107 9 9,7 66,31	6,15 73,3	134 8 24,8 84,46	7,77		2,1			
CSNA2n4				7 48 5 65 7 58 4					
CSNA3n4				43 6 8 8 43 4 67		4			
CSNA4n4	86 8 8,9 73,00	7,23 74,7	88 8 8,8 65,62	6,92 61,8		1,5			
CSNA5n4				1,06 2,89 0,38		2,9			
CSNA6n4				14,82 18,86		1,5			
CSNA7n4	145 10 31,8 92,64	7,55 141				4,7			
CSNA8n4	98 8 12,2 64,92	7,00 71				1,4			
n	8 8 8 8 8 8 86 8 8,8 64,92	6,15 61,8	145 10 31,8 92,64	7,77 141					
min						1,8			
max						8			
x	111.63 8.50 15.01 77.98	7.23 101.80	21.80 0.76	8.53 11.75	0.54 34.42	7.71 0.27 3.42	4.15 0.	19 12.17 19.53	8.39 56.80 15.06 7.46 33.81
s	The results document a significant influence of tap water (50 Pa) in combination with spray (30 and 20 g/l) and substrate (10 and 20 g) to					4,7			
sx	shape the weight and length of hemp plants					2,49			
IN%						1,26 0,45 50,64			

1.3. Comparison of variants for all combinations of tested factors:

B block – applied water pressure 50 Pa: 2-3-4 alginite spray /5-6-7 alginite substrate, 1-8 control

CSNB1n4 9 7 75,08	128,6	CSNB2n4 10 7 98,29	187,4	CSNB3n4 10 7	97,46 141	2,2		7,62	
	135		16,2	70		5,1		8,64	
	108		20,5	49		4,6		7,62	
CSNB4n4 9 7 71,36	94,5	CSNB5n4 8 6 73,08	89,7	CSNB6n4 8 4 80,25	131,8	CSNB7n4 10 7 98,46	222	7,14	
	102		18,4	60		2,4		7,31	
	130		14,8	56		1,8		6,77	
	144		39,6	65		3,3		8,54	
CSNB8n4 7 6 64,38	94	2 8 8 8 8 7 4 64,38	73,2	10 7 98,46	222	50,5		2,5	7,31
n									
min	8		8	8		8		8	
max	94		12,4	49		1,8		6,77	
x	144	8.88 6.38 81.04	39,65	1.13 1.06	70	12.61 51.05 0.40 0.38 4.46	18.05	12.69 16.64 15.56 38.77	The results document significant
s	118,88	effect of activated water (50 Pa) in combination with spraying (30 and 20 g/l) and substrate (10 and 20 g) on the formation of			57,09		3,15		2,02
sx	17,72	the weight and length of hemp plants	6,87		7,85		1,17		0,66
IN%	6,27 14,91		2,96 40,30	2,60 12,85			0,42 37,29		0,23 8,65

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1.4. Comparison of variants for all combinations of tested factors:

C block – applied water pressure 100 Pa: 2-3-4 alginite spray /5-6-7 alginite substrate, 1-8 control

CSNC1n4	100	9 6 74,54 105	24	53		1,2		7,46	
CSNC2n4	113	9 8 85.00 139.8	9.7	88.08 161.19	52	7 83.77 100.3	7 5 69.85 63.6	4.7	88.69 150.2 8 7 89.31 143.3 9 6 87.24 76.1 8 8 8 8 7 5
CSNC3n4	120	69.85 63.6 9 8 89.31 161.19	21,4	8.506	62	63 81.34	117.44 0.76 0.92 8.04	4	46.28 0.27 0.32 2.86 12.83 8.89 17.69 9.95 30.89 The
CSNC4n4	105	results document the significant influence of	16		59	activated water (100 Pa) in combination with spraying (30 and 10 g/l) and			7,24
CSNC5n4	90	substrate (10 and 20 g) to shape the weight and	7,4		50	length of hemp plants			7,31
CSNC6n4	120		16,6		56		2		7,54
CSNC7n4	122		16,6		52		2,1		7,77
CSNC8n4	100		15,9		51		3,9		7,08
n									
min	8		8		8		1,5		8
max	90		7,4		50		8		7,08
x	122		24		62		1,2		8,23
s	108,75		17,54		54,38		4,4		7,58
sx	11,74		5,21		4,24		2,94		0,34
IN%	4,15 10,80		1,84 29,70		1,50 7,80		1,36 0,48 46,39		0,12 4,51

1.5. Comparison of variants for all combinations of tested factors:

D block – applied water pressure 150 Pa: 2-3-4 alginite spray /5-6-7 alginite substrate, 1-8 control

CSND1n4 10 7 92,00 140	140,6	CSND2n4 8 6 57,62 53	38,2	65		3,8		8,23	
	94		7,4	42		1,7		6,54	
CSND3n4 10 7 103,38 127	164,4	CSND4n4 9 6 81,92 103	19,7	64		2,8		8,00	
	103		15,8	57		2,6		7,15	
CSND5n4 9 6 64,08 56,5	65	CSND6n4 9 7 78,00 129,4		CSND7n4 11 7 96,52 182		2,3		6,77	
	134		8	50		4,4		7,46	
	135		24,2	60		3,3		7,92	
CSND8n4 8 4 60,31 91,2	112	8 8 8 8 4 57,62 53	36,3	36		0,6		6,00	
n									
min	8			8		8		8	
max	85	11 7 103.38 194,6	24,2	5.25 6.25 79.24	61	21.65 1.04	1.04 17.37 54.95 0.37	0.37 6.14 19.43 11.19 16.56 21.69	45.17 The results
x	140	document a significant effect of activated water (150 Pa) in combination with spray (30 and 20 g/l) and substrate (10 and 20 g)	8,24		65				8,23
s	116,00	on the formation of the weight and length of hemp plants	38,2		53,13		2,69		7,26
sx	20,81		21,76		10,37		1,20		0,79
IN%	7,36 17,94		11,53 4,08 52,98		8,67 19,52		0,42 44,58		0,28 10,83

1.6. Comparison of variants for all combinations of tested factors:

E block – applied water pressure 200 Pa: 2-3-4 alginite spray /5-6-7 alginite substrate, 1-8 control

CSNE1n4	138	8 98,00 236	44,2	64	7	5,5		7,54	
CSNE2n4	92	7 60,92 65	8,9	40	6	2,3		6,77	
CSNE3n4	140	10 88,46 158,1	36,9	15 76,7 9 69,85	51	73,9 9 74,77	90,5 10 81,08 22,2	12	7,69
CSNE4n4	88		8,6	53	7	2,9		7,15	
CSNE5n4	91		8,1	53	7	3,2		7,46	
CSNE6n4	110		14,9	52	6	1,2		7,08	
CSNE7n4	135		63	52	6	3,1		6,77	
CSNE8n4	88	9 67,08 105,8	8,2	57 60,92 65	46	6	1,9		6,62
n									
min	8		8		8	8	8		8
max	88	10 98,00 236			40	6	1,2		6,62
x	140	8.63 76.16 128.38	1.69	12.29	68.29	0.42 4.35 24.76	14.13	3.77 16.14 53.5	7.69 The results document the significant influence of activated
s	110,25	water (200 Pa) in combination with spraying (30 and 20 g/l) and substrate (10 and 20 g) to shape the weight and length of hemp	24,76		51,38	0,63	2,79		7,18
sx	23,79	plants	20,88		6,80	0,19	1,28		0,40
IN%	8,41 21,58		7,38 84,30		2,40 13,24	8,22	0,45 46,04		0,14 5,61

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Table 2 Average values of evaluated morphometric features of hemp plants determined in experimental variants with the application of activated water and alginite products in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A- tap water, B- activated water obtained

at a pressure of 50 Pa, C-at a pressure of 100 Pa, D-at a pressure of 150 Pa and D-at a pressure of 200 Pa.

Experimentally variants	Plant with maximum height Cumulative(s) Height (cm)	Number of pairs of pairs of leaves	Weight (g)	A plant with minimal height Height (cm)	Number pairs of leaves	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA1n4	107	9	9,7	53	5	2,1	66,31		73,3
CSNB1n4	128	9	22,4	52	7	2,2	75,08		113,6
CSNC1n4	100	9	24	53	6	1,2	74,54		105
CSND1n4	140	10	38,2	65	7	3,8	92,00		194,6
CSNE1n4	138	8	44,2	64	7	5,5	98,00 5		236
n	5	5	5	5	5	5			5
min	100	8	9,7	52	5	1,2	66,31	6,15	73,3
max	140	10	44,2	65	7	5,5	98,00	8,23	236
x	122,60	9,00	27,70	57,40	6,40 81,18 144,50	2,98	13,25 67,95 0,40 5,93 30,39 13,98		16,32 47,02
s	18,19	0,71	13,68	6,50		1,70		0,76	
sx	8,13	0,32	6,12	2,91		0,76		0,34	
IN%	14,84	7,86	49,38	11,33		57,46		10,27	

The results document a significant influence of activated water (50 and 100 Pa) but especially activated water (150 and 200 Pa) on the formation of the weight and length of hemp plants.

Table 3 Average values of evaluated morphometric features of hemp plants determined in experimental variants (2) with the application of activated water and a dose of 30 g alginite/l spray in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa.

Experimentally variants	Plant with maximum height Cumulative(s) Height (cm)	Number pairs of pairs of leaves	Weight (g)	A plant with minimal height Height (cm)	Number pairs of leaves	Weight (g)	Length plants (cm)	Number	Weight plants (g)
CSNA2n4	134	8 6 84,46 10 7 98,29 9 8 85,00 8 6	24,8	57,62 7 6 60,92	5 5 5 7 6 57,62 10 8 98,29		8,40 6,60	7,77	130,6
CSNB2n4	135	77,26 1,14 0,89 17,37 0,51 0,40 77,07	16,2	13,57 13,55	22,48	5,1		8,64	187,4
CSNC2n4	113		22,4	52		4,4		8,23	139,8
CSND2n4	94		7,4	42		1,7		6,54	53
CSNE2n4	92		8,9	40		2,3		6,77	65
n									
min	5		5	5		5		5	5 53
max	92		7,4	40		1,7		6,54	187,4
x	135		24,8	70		5,1		8,64	115,16
s	113,60		15,94	54,20		3,50		7,59	55,78
sx	20,77		7,79	13,86		1,44		0,91	24,94
IN%	9,29 18,28		3,48 48,88	6,20 25,58		0,64 41,16		0,41 12,02	48,43

The results document a significant effect of activated water (50, 100 and 150 Pa) on increasing the weight and length formation of hemp plants; after the application of activated water 200 Pa, the effect was the opposite.

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Table 4 Average values of evaluated morphometric features of hemp plants determined in experimental variants (3) with the application of activated water and a dose of 20 g alginite/l spray in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

	Plant with maximum height Cumulative(s)			A plant with minimal height					
Experimentally variants	Height (cm)	Number of pairs of pairs of leaves of leaves 7 Height 7.12 7.69 8.01 pairs of leaves	Weight (g)	Height (cm)	Number of pairs of leaves	Weight (g)	Plant length (cm)	Number	Plant weight (g)
CSNA3n4	107	9	12,5	51	5	1,5	90,00		123
CSNB3n4	108	10	20,5	49	7	4,6	87,46		141
CSNC3n4	120	9	21,4	62	7	4,4	88,08		161,19
CSND3n4	127	10	19,7	64	7	2,8	103,38		164,4
CSNE3n4	140	10	37,9	51	7	2,2	88,46		158,1
n	5	5	5	5	5	5	5		5
min	107	9	12,5	49	5	1,5	87,46	7,62	123
max	140	10	37,9	64	7	4,6	103,38 164,4 6,60 8,08 149,54 0,89 6,72		
x	120,40	9,60	22,40	55,40	17,37 0,40 3,01 7,71	3,10	13,55 7,35 11,62	7,75	
s	13,79	0,55	9,36	7,02		1,36		0,15	
sx	6,17	0,24	4,18	3,14		0,61		0,07	
IN%	11,46	5,71	41,77	12,67		43,88		1,91	

The results document the significant influence of activated water (50, 100, 150 and 200 Pa) on increasing the weight formation of hemp plants;

Table 5 Average values of evaluated morphometric features of hemp plants determined in experimental variants (4) with the application of activated water and a dose of 10 g alginite/l spray in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

	Plant with maximum height Cumulative(s)			A plant with minimal height					
Experimentally variants	Height (cm)	Number of pairs of pairs of leaves of leaves 8 Height 7.14 8 7.54 pairs of leaves 7.15 5	Weight (g)	Height (cm)	Number of pairs of leaves	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA4n4	86		8,9	56	7	2,9	73,00		74,7
CSNB4n4	110		21,9	55	7	3,3	71,36		94,5
CSNC4n4	105		16	59	7	4	83,77		100,3
CSND4n4	103		15,8	57	6	2,6	81,92		103
CSNE4n4	88	7	8,6	53	7	2,9	69,15		76,7
n	5	5	5	5	5	5	5		5
min	86	7	8,6	53	6	2,6	69,15	7,14	74,7
max	110	9 83,77 8,20 6,82 7,75	21,9	59	7	4		7,54	103
x	98,40		14,24	56,00	5,84 0,84 0,45 6,57 0,37 0,20 2,94 10,20 6,58 8,66	3,14		7,24	89,84
s	10,74		5,58	2,24		0,54		0,17	13,29
sx	4,80		2,50	1,00		0,24		0,08	5,94
IN%	10,91		39,18	3,99		17,24		2,32	14,79

The results document a significant effect of activated water (50, 100 and 150 Pa) on increasing the weight and length formation of hemp plants; after the application of activated water 200 Pa, the effect was the opposite.

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Table 6 Average values of evaluated morphometric features of hemp plants determined in experimental variants (5) with the application of activated water and a dose of 30 g of alginite substrate in containers in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

Experimentally variants	Plant with maximum height Cumulative(s) Height (cm)	Number of pairs of pairs of leaves	Weight (g)	A plant with minimal height Height (cm)	Number of pairs of leaves	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA5n4	88	8	8,8	48	5	1,5	65,62		61,8
CSNB5n4	102	8	18,4	60	6	2,4	73,08		89,7
CSNC5n4	90	7	7,4	50	5	2	69,85		63,6
CSND5n4	85	9	8	51	6	2,3	64,08		56,6
CSNE5n4	91	9	8,1	53	7	3,2	69,85 5		73,9
n	5	5	5	5	5	5			5
min	85	7	7,4	48	5	1,5	64,08 56,6 73,08 89,7 5,80 68,49 69,12		
max	102	9	18,4	60	7	3,2	0,84 3,62 13,11 0,37 4,62 5,86 14,43 5,29		
x	91,20	8,20	10,14	52,40	18,96	2,28		7,15	
s	6,46	0,84	4,64	4,62		0,62		0,29	
sx	2,89	0,37	2,08	2,06		0,28		0,13	
IN%	7,08	10,20	45,80	8,81		27,28		4,09	

The results document a significant effect of activated water (50, 100, 150 and 200 Pa) on reducing shaping the weight and length of hemp plants;

Table 7 Average values of evaluated morphometric features of hemp plants determined in experimental variants (6) with the application of activated water and a dose of 20 g of alginite substrate in containers in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

Experimentally variants	Plant with maximum height Plant with minimum height Cumulative(s) Height (cm)	Number of pairs of pairs of pairs of leaves	Weight (g)	Height (cm)	Number	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA6n4	128		11,4	65	7	4,7	86,92		139
CSNB6n4	130		14,8	56	4	1,8	80,23		131,8
CSNC6n4	120		16,6	56	7	2,1	88,69		150,2
CSND6n4	134		24,2	50	7	4,4	78,00		129,4
CSNE6n4	110		14,9	52	6	1,2	74,77 5		90,5
n	5	5	5	5	5	5			5
min	110	8 74,77 9 88,69 81,72 0,55 5,92 0,24 2,65 6,37 7,24		50	4	1,2		6,77	90,5
max	134		24,2	65	7	4,7		7,54	150,2
x	124,40		16,38	55,80	6,20	2,84		7,26	128,18
s	9,53		4,76	5,76	1,30	1,60		0,33	22,56
sx	4,26		2,13	2,58	0,58	0,71		0,15	10,09
IN%	7,66		29,07	10,33	21,03	56,26		4,53	17,60

The results document a significant effect of activated water (50, 100 and 150 Pa) on increasing the weight formation of hemp plants;

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Table 8 Average values of evaluated morphometric features of hemp plants determined in experimental variants (7) with the application of activated water and a dose of 10 g of alginite substrate in containers in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

	Plant with maximum height Cumulative(s)			A plant with minimal height					
Experimentally variants	Height (cm)	Number of pairs of pairs of leaves of leaves 7 Height 54 7.77 7.92 Number of pairs of leaves	Weight (g)	Height (cm)	Number of pairs of leaves	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA7n4	145	10	31,8	58	4	1,4	92,64		141
CSNB7n4	144	10	39,6	65	7	3,3	98,46		222
CSNC7n4	122	8	16,6	52	7	3,9	89,31		143,3
CSND7n4	135	11	36,3	60	7	3,3	96,62		182
CSNE7n4	135	10	63	52	6	3,1	81,08		221
n	5	5	5	5	5	5	5		5
min	122	8	16,6	52	4	1,4	81,08	6,77	141
max	145	11	63	65	7	3,9	98,46	8,54	222
x	136,20	9,80 6,20 91,62 13	30,46	30 6,88 0,49	57,40	3,08 11,18 21,03 7,51	3,00	7,71	181,86
s	9,26		16,77	5,55		0,94		0,64	39,68
sx	4,14		7,50	2,48		0,42		0,29	17,75
IN%	6,80		44,78	9,67		31,45		8,32	21,82

The results document a significant effect of activated water (50, 100 and 150 Pa) on the enormous increase in the formation of weight and length of hemp plants;

Table 9 Average values of evaluated morphometric features of hemp plants determined in experimental variants (8) with the application of activated water and a dose of 10 g of alginite substrate in containers in greenhouse conditions (Nitra) 30.9.-7.12.2021: control variants for the application of activated water A - tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and D- at a pressure of 200 Pa.

	Plant with maximum height Cumulative(s)			A plant with minimal height					
Experimentally variants	Height (cm)	Number of pairs of pairs of leaves of leaves 8 Height 31 7.08 6.08 Number of pairs of leaves	Weight (g)	Height (cm)	Number of pairs of leaves	Weight (g)	Length plants (cm)	Number	Plant weight (g)
CSNA8n4	98		12,2	43	6	1,8	64,92		71
CSNB8n4	94	7	12,4	50,5	6	2,5	64,38		73,2
CSNC8n4	100	9	15,9	51	6	1,5	71,46		76,1
CSND8n4	110	8	24,5	36	4	0,6	60,31		90,2
CSNE8n4	88	9	12,5	46	6	1,9	67,08 5		105,8
n	5	5	5	5	5	5			5
min	88	7	12,2	36	4	60,31 9,6 71,46 08,20 5,60 65,63 0,84		6,00	71
max	110	0,89 4,08 0,37 0,40 1,82 10,20 15,97 6,21	24,5			2,5		7,31	105,8
x	98,00		15,50	45,30		1,66		6,80	83,26
s	8,12		5,26	6,16		0,69		0,51	14,65
sx	3,63		2,35	2,75		0,31		0,23	6,55
IN%	8,29		33,93	13,60		41,87		7,53	17,60

The results document the significant effect of activated water (50, 100 and 150 Pa) on the enormous reduction shaping the weight and length of hemp plants;

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Table 10 Correlation analysis of the dependence between the evaluated characteristics by the Pearson method

Correlation coefficients 1

Variants of experiments	Plant length (cm)		Plant weight (g)
	Plant weight (g) 0.96	Number of leaf pairs	Number of leaf pairs
A	0.97	0.81	0,75
B	0.92	0.80	0,80
C	0.90	0.68	0,70
D	0.87	0.92	0,88
AND		0.64	0,23

The values of the correlation coefficients between the length of the plants as well as the number of pairs of leaves in the tested plants grown in variants after the application of activated water obtained at a pressure of 50 Pa (B) and 150 Pa (D) document directly - a high degree of linear dependence. After the application of activated water obtained at a pressure of 200 Pa, we generally noted a significant effect on plant metabolism, which was also reflected in the values of correlation coefficients (D).

Table 11 Correlation analysis of the dependence between the evaluated characteristics by the Pearson method

Correlation coefficients 2

Variants of experiments	Plant length (cm)		Plant weight (g)
	Plant weight (g) 0.99	Number of leaf pairs	Number of leaf pairs
ABCDE1	0.99	0.70	0,65
ABCDE2	0.40	0.99	0,99
ABCDE3	0.78	0.97	0,31
ABCDE4	0.89	0.65	0,31
ABCDE5	0.86	0.87	0,67
ABCDE6	-0.08	0.54	0,46
ABCDE7	-0.10	0.93	0,01
ABCDE8		0.58	-0,64

The values of the correlation coefficients between the length of the plants as well as the number of pairs of leaves in the tested plants grown in variants after the application of activated water by the IPS device in combination with the application of alginite at a dose of 30 g/l spray (ABCDE2) document a direct - linear dependence. After the application of activated water with the application of alginite in the substrate, we noticed a significant effect on plant metabolism, which was also reflected in the values of the correlation coefficients ABCDE7-ABCDE8).

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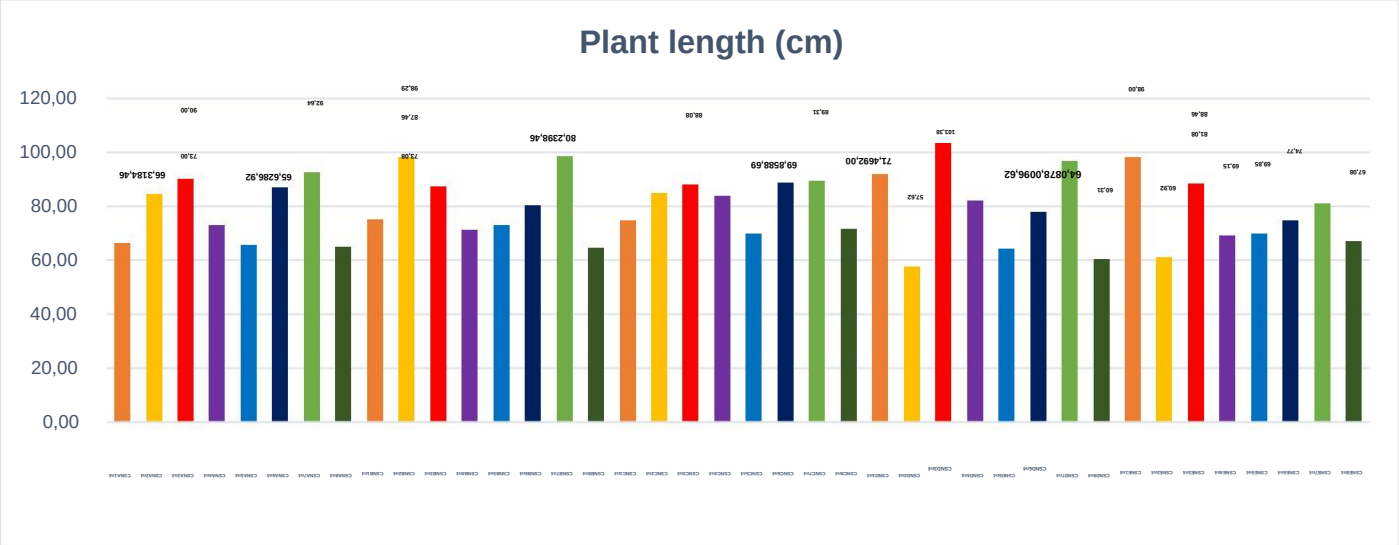

Figure 5 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)

A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the length of hemp plants significantly increased after the application of activated water with **the application of 20g/l alginite spray** (3 **– red color)** and with the application of 10 g of alginite **substrate (7-green color)** and **by applying 20 g of substrate** (6- **dark blue color).**

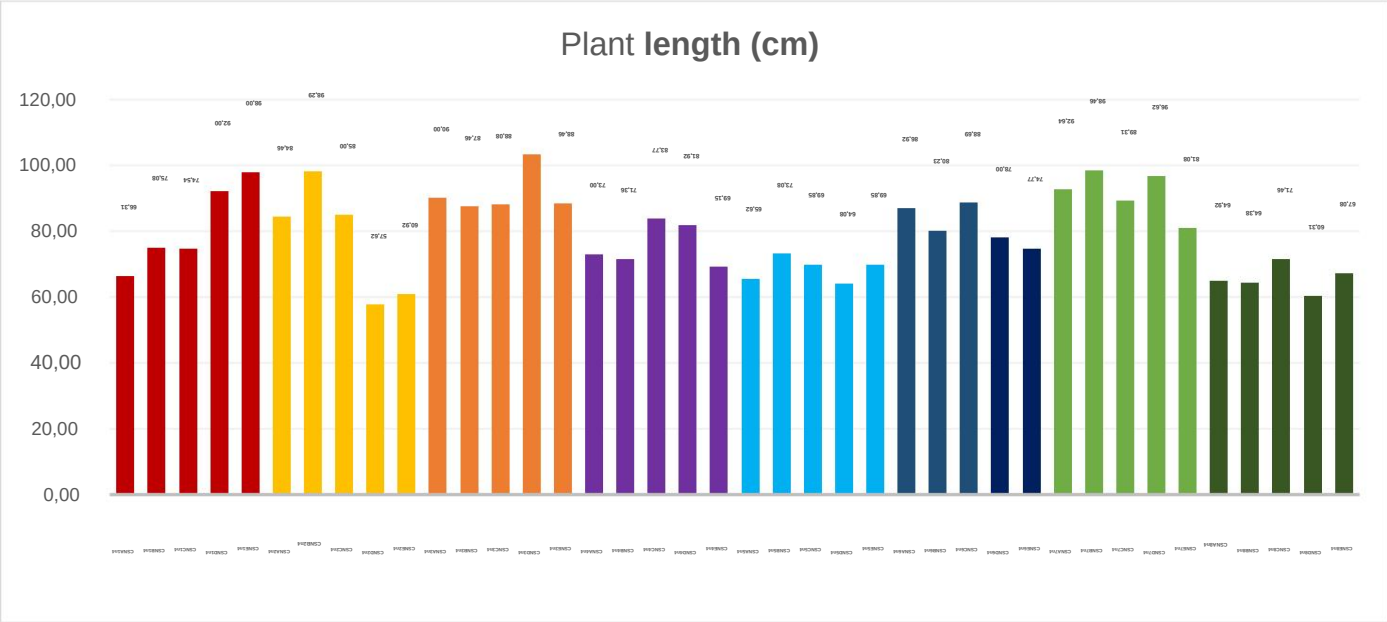

Figure 6 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)

A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the length of hemp plants increased significantly after the application of activated water with **the application of 20g/l alginite spray (3 – ocher** color) and with **the application of 10 g of alginite substrate (7-green color).**
The application of activated water with **the application of 30 g of substrate was manifested by a decrease in plant length.**

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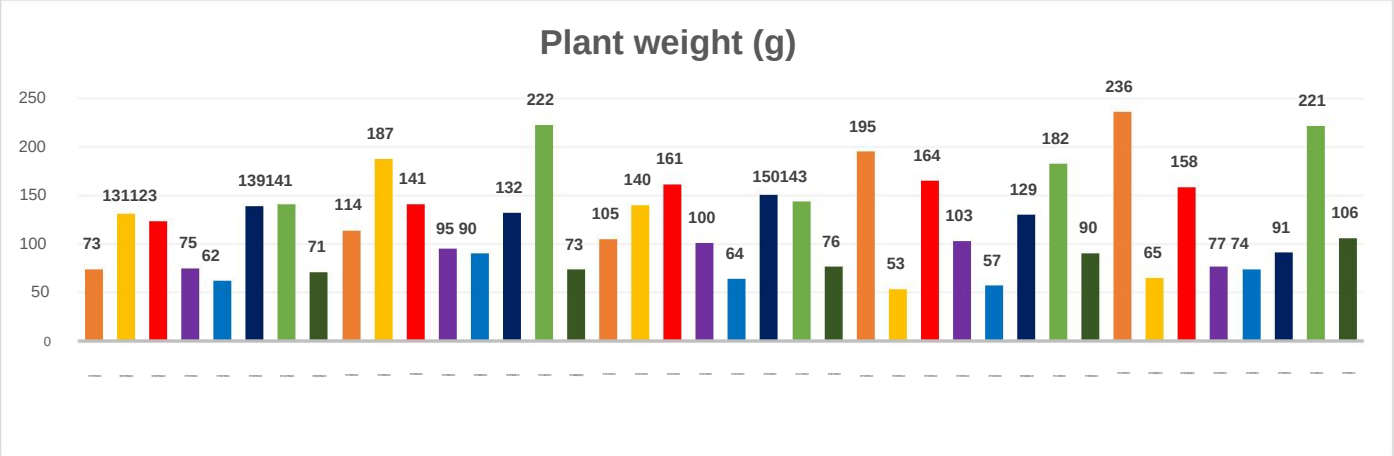

Figure 7 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)
A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of hemp plants significantly increased after the application of activated water with **the application of 20g/l** alginite spray (3 **– red** color) and with **the application of 10 g of alginite substrate (7-greer**

Figure 8 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)
A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the weight of hemp plants increased significantly after the application of activated water with **the application of 20g/l alginite spray (3 – orange** color) and with **the application of 10 g of alginite substrate (7-g**

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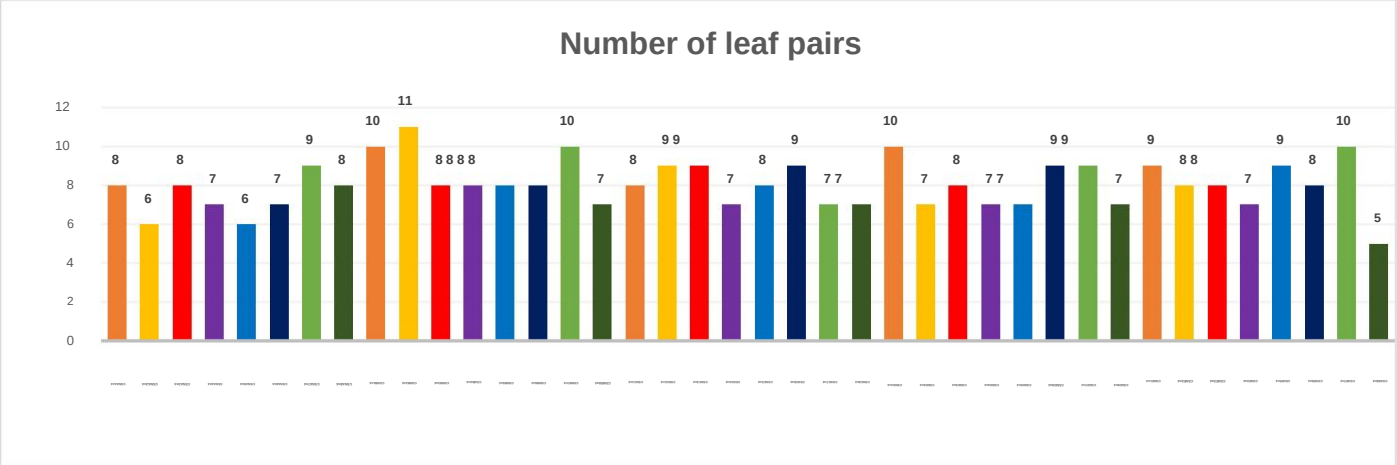

Figure 9 Figure 5 comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)
A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the number of leaf pairs on **hemp plants significantly increased after the application of** activated water with **the application of 10 g of alginite substrate (7-green color).**

Figure 10 Comparison of the effect of activated water in combination with applied alginite products on the length of hemp plants (cm)
A- tap water, B- activated water obtained at a pressure of 50 Pa, C- at a pressure of 100 Pa, D- at a pressure of 150 Pa and E- at a pressure of 200 Pa - 2-3-4 spray of alginite /5-6-7 alginite substrate, 1 and 8 control

The results document that the number of leaf pairs on hemp plants significantly increased after the application of activated water with **the application of 10 g of alginite substrate (7-green color).**

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D. Conclusions

a) The values of the correlation coefficients between the length of the plants as well as the number of pairs of leaves in the tested plants grown in variants after the application of activated water obtained at a pressure of 50 Pa (B) and 150 Pa (D) document directly – a high degree of linear dependence. After the application of activated water obtained at a pressure of 200 Pa, we generally noted a significant effect on plant metabolism, which was also reflected in the values of correlation coefficients (D).

b) The values of the correlation coefficients between the length of the plants as well as the number of pairs of leaves for the tested plants grown in variants after the application of activated water by the IPS device in combination with the application of alginite at a dose of 30 g/l spray (ABCDE2) document a direct - linear dependence. After the application of activated water with the application of alginite in the substrate, we noticed a significant effect on plant metabolism, which was also reflected in the values of the correlation coefficients ABCDE7-ABCDE8). c) The length of hemp plants

increased significantly after the application of activated water with the application of 20g/l alginite spray (3 – red color) and with the application of 10 g of alginite substrate (7-green color) and the application of 20 g of substrate (6- dark blue color)

d) The length of hemp plants significantly increased after the application of activated water with the application of 20g/l alginite spray (3 – ocher color) and with the application of 10 g of alginite substrate (7-green color). The application of activated water with the application of 30 g of substrate was manifested by a decrease in plant length.

e) The weight of hemp plants increased significantly after the application of activated water with the application of 20g/l alginite spray (3 – red color) and with the application of 10 g of alginite substrate (7-green color) f) The

weight of hemp plants significantly increased after the application of activated of water with the application of 20g/l of alginite spray (3 – orange color) and with the application of 10 g of alginite substrate (7-green color)

g) The number of pairs of leaves on hemp plants significantly increased after the application of activated water with the application of 10 g of alginite substrate (7-green color)

h) The number of pairs of leaves on hemp plants significantly increased after the application of activated water with the application of 10 g of alginite substrate (7-green color)

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AQIPS 04

The effect of activated water by the IPS system with the application of alginite on the biological and production processes of plant species

Effect of activated water by IPS system with alginite application on biological and production processes of hemp (Cannabis sativa L.)

AQIPS-04-E01

Contents

A.Methodology of the experiment Institute

Research workplace	of Plant and Environmental Sciences
Responsible solver	Ing. Marián Miko, CSc.
The investigative team	Ing. Ján Gažo, PhD. Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Alex Oravec, Eva Chovancová, Mária Vailingová, Ing. Beáta Kováÿová, Elena Kovárová
Plant species(s)	Cannabis sativa (Cannabis sativa L.) - technique
Tested varieties	Finola
The goal of the experiment	To determine the effect of alginate preparations on grain yield and the formation of production characteristics of hemp.
Form of experiment	Container experiment - substrate Klassman TS 3 + ICL Osmocote Pro 5-6M, 19-9-10+2MgO+TE KGŠR -
Company name-location	FAPZ - SPU Nitra

Experimental variants - applied alginite preparations - method of application and deadlines

Location: Trenÿianske Jastrabie -TA –

variants without water pressure; B variants with pressurized water V1

v2

V3

V4

V5 – variants

Evaluated plant parts: K – inflorescence; L – leaves; S- stem; Variant TA

variant without pressurized water TB variant with pressurized water Plant V11 V12 V13 V14 V15 V11 V12 V13 V14 V15

Total consumption of alginite preparations in the experiment:

Area size of the variant (5 x 4+4 containers) Total number of sown seeds in the container (50 pcs.)

Vegetation records Sowing date	/ treatment date - dates of basic phenophases - harvest
Sampling during growing season Not implemented Yes -	
Photo documentation	as needed

Morphometric analysis of individual plants: plant height (mm), whole plant weight (g), number of male plants (pcs), number of female plants (pcs), weight of seeds per plant (g), weight of leaves (g), weight of flower bracts (g).

Number of analyzed plants from one variant: 40
Total number of analyzed plants: 40 x 40 variants (1,600 plants)

Biochemical analyses: risk elements – number of samples: substrate 35, stems 35, leaves 35, seed 35, flower chaff 35.

Experiment notes:

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B. Results

Table 1 Statistical characteristics of the variability of the weight of the branches (g) in the fresh state from selected hemp plants (Cannabis sativa L.) in the variant CSTAV1 and CSTBV1 CSTAV1 Variants without pressurized water CSTBV1 Variants with

	pressurized water sx V % Growth. n min max x sx V % 21 18.90 146.60 57.67 33.54 7.32 58.15 22 23.80 154.90														
Chance.	n min max x				s	63.48 39.89 8.51 62.84			23 19.60 241 .40 56.08 59.15 12.33 105.49 22 30.60 146.90				s		
1	22 22 10 101,40 51,01 18,86 4,02 36,97 25 14,40 147,60								65.36 28.36 6 05 43.38 25 16.00 118.30 66.88 24.78 4.96						
2	64,17 37,40 7,48 58,27 21 21 15,90 165,20 41,70 36,37								37 .05 file 89.00 8.90 165.20 49.15 30.62 3.25 62.30 file 113						
3		1 2 8,90 72,40 36,77 15,66 3,42 42,60 3 4							16.00 241.40 62.01 38.57 3.63 62.20						
4	7,94 87,24														
5								5							

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V1) resulted in an increase in the weight of the branches on the plants compared to the control variant (variant A).

Table 2 Statistical characteristics of the variability of the weight of branches (g) in the fresh state from selected hemp plants (Cannabis sativa L.) in the variant CSTAV2 and CSTBV2

	CSTAV2 Variants without pressurized water CSTBV2 Variants with pressurized water sx V % Growth. n min max x															
Break. n min max				x	s								s	sx V % 24		
1	19.10 153.30 64.60 32.95 6.73 51.04 23 10.20 79.70						45.00 20	94 4.37	46.54 24	11.40 151.70 61. 70 31.27 6.38 50.65				25 8.80 64.50		
2	42.20 17.10 3.40 40.50 20 27.20 185.50 68.90 46.47 10.39 67						49 24	21	.90 125.40 57.10 24.67 5.04 43.18 25 23.20 135.20 62.40							
3	30.40 6.10 48.70 25 21.60 209.20 69.00 47.20 9 .40 68.30 24						15.40	9	183.20 61.10 40.19 8.20 65.83 24 18.30 156.10 68.30 35.28 7.20							
4	51.66 file 117 11.40 185, 50 63.40 35.78 3.31 56.41 file 121 8.80 20						09.20		56.4 32.68 2.97 57.93							
5								5								

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V2) resulted in a general decrease in the weight of branches on the plants compared to the control variant (variant A).

Table 3 Statistical characteristics of the variability of the weight of branches (g) in the fresh state from selected hemp plants (Cannabis sativa L.) in the variant CSTAV3 and CSTBV3 CSTAV3 Variants without pressurized water Growth. n min max x 20

	16.10 156.20 77.60 42.67 9.54 54.98 25								CSTBV3 Variants with pressurized water							
13.00 112.20 46.00 25.50 5.10 55.40					s		sx V % Growth. n min max x sx V % 25 22.20 134.10 69.10 28.80							s	5.80 41.70 24 4.90		
1	23 16.70 196.70 61 .20 44.39 9.26 72.54 23 10.80 95.00							1	148.20 41.30 32.70 6.70 79.10 25 11.80 69 .80 25.60 13.60							
2	35.30 18.31 3.82 51.84							2	2.70 53.20 26 8.20 88.30 39.40 24.50 4.80 62.20 21 10.00							
3								3	156.20 46.90 33.60 7.30 71 .80 68.75							
4								4								
5								5								
file 91 10.8			196.7 53.5 36.56 3.83 68.39 file 121 4.90 15					6.20 44.40	30.50 2.77							

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V3) resulted in a general decrease in the weight of branches on the plants compared to the control variant (variant A).

Table 4 Statistical characteristics of the variability of the weight of branches (g) in the fresh state from selected hemp plants (Cannabis sativa L.) in the variant CSTAV4 and CSTBV4

	CSTAV4 Variants without pressurized water								CSTBV4 Variants with pressurized water							
Growth. n min max x sx V % Growth n min max x 25 14.50 94.80 53.30 26.58									5.32 49.90 1 24 9.20 81.20				s	sx	In %	
1	37.00 20.69 4.22 55.91 2 31 4.60 112, 40 43.80 27.00 4.80								22 17.70 128.40 43.52 24.25 5.17 20 16.90						55.72	
2	61.60 3 25 28.10 115.00 58.20 22.22 4.44 38.16 4 24 12.10								160.60 55.10 34.66 7.75 24 12.00 139.10						62.93	
3	184.20 77.10 51.73 10.56 67.10 5								52.30 32.26 6.59 21 10 .10 112.70 38.38 33.04						61.68	
4									7.21 22 16.80 132.50 50.01 28.51 6.08 file 129						86.09	
5									4.60 184.20 53.40 33.7 2.97 63.15 file 109						57.02	
10.10 160.6 48.4 30.87 2.96															63.74	

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Application of activated water by the IPS system (variant B) with simultaneous application of activated alginite of products (V4) was manifested in general by a decrease in the weights of branches on plants compared to **the control variant (variant A).**

Table 5 Statistical characteristics of the variability of the weight of the branches (g) in the fresh state from selected hemp plants *(Cannabis sativa L.)* in the control variant CSTKV

	Control variant CSTKV						
Chance.	**n**	**min**	**max**	**x**	**s**	**sx**	**In %**
1	18	18,30	111,60	56,40	26,30	6,20	46.60
2	21	13,10	144,20	53,00	31,22	6,81	58.92
3	23	8,20	93,20	30,40	20,25	4,22	66.68
4	23	13,30	253,20	72,00	61,46	12,82	85.39
5	25	21,50	206,80	66,60	43,00	8,60	64.60
file	110	8,20	253,20	55,87	41,93	4,00	75.06

If we compare **the samples after the application of activated water by the IPS system (variant B) in all** variants (V1 **–** V5) with **the control variant (KV), the increase in the weight of the branches was manifested in variants V1 (62.01 g) and** V2 (56.40 g).

Table 6 Statistical characteristics of the variability of the weight of branches V (g) in the fresh state from selected cannabis plants *(Cannabis sativa* L.) in individual variants

	Variants without pressurized water								Variants with pressurized water							
Variants n min max x sx V % Variants n min max x sx V %						**s**								**s**		
CSTAV1v 89 8,9			165,2 49,15 30,62 3,25 62,30 **CSTBV1v** 113 16,00 241,40 62,01 38,57 3,63 62,20													
CSTAV2v 117 11,40 185,50 63,40 35,78 3,31 56,41 **CSTBV2v** 121 8,80 209,20 56,4 32,68 2,97 57,93																
CSTAV3v 91 10,8 196,7 53,5 36,56 3,83 68,39 **CSTBV3v** 121 4,90 156,20 44,40 30,50 2,77 68,75																
CSTAV4v 129 4,60 184,20 53,40 33,7 2,97 63,15 **CSTBV4v** 109 10,10 160,6 48,4 30,87 2,96 63,74																
CSTKVv 110 8,20 253,20 55,87 41,93 4,00 75,06																

If we compare all the variants in the weight of the branches, the most pronounced increase was in variant V1 (62.01g) after the application of activated water (variant B) compared **to the control variant (55.87g).**

Table 7 Statistical characteristics of the variability of the weight of stalks S (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.)

	Variants without pressurized water Variants with pressurized water Variants n min max x sx V % Variants n min max x sx V %																	
CSTAV1S 4 39.94 68.53 54.71 11.79 5.89 21.55 **CSTBV1S** 5 65.34 74 .09 69.48 3.16 1.41 4.55 **CSTAV2S** 5 57.06 80.06 67.70 9.40 4.21 13.89 **CSTBV2S** 5 43.64 74.08 61.73 11.94 5. 34																		
19.34 **CSTAV3S** 4 36.72 72.68 59.19 15.57 7.79 26.31 **CSTBV3S** 5 36.65 74.00 56.11 13.32 5.96 23.74 **CSTAV4S** 5 45.04 91 .73 64.49 19.62 8.77 30.42 **CSTBV4S** 5 40.00 67.39 52.94 12.12																		
5.42 22.89 **CSTKVS** 5 35.31 70.70 49.89 14.80 6. 62 29.67																		

In the summary overview of the weights of the stems of all variants, the increase was most pronounced in variant V1 (69.48 g) after the application of activated water by the IPS system (variant B) compared to variant V1 without pressurized water (54.71 g). In **other variants B, we noticed a reduction compared to variants A** without pressurized water.

Table 8 Statistical characteristics of the variability of inflorescence weight (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.) in the control variant CSTKVK

	Control variant CSTKVK						
Chance.	**n**	**min**	**max**	**x**	**s**	**sx**	**In %**
1	5	0,22	1,25	0,63	0,41	0,18	64.77
2	5	0,65	1,05	0,83	0,18	0,08	22.16
3	5	0,54	0,86	0,71	0,12	0,05	16.68
4	5	0,50	1,48	0,82	0,39	0,17	47.24
5	5	1,06	1,52	1,29	0,19	0,09	15.11
the file	25	0,22	1,52	0,86	0,35	0,07	40.75

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If **we compare the samples after the application of activated water by the IPS system (variant B) in all variants (V1 –** V5) with **the control variant (KV), the increase in the weight of inflorescences was manifested in variants V1 (0.96 g) and** V3 (0.95 g).

Table 9 Statistical characteristics of the variability of the weight of the inflorescence K (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.) in the variant CSTAV1K and CSTBV1K

	CSTAV1K Variants without pressurized water min max x 0.87 2.62								CSTBV1K Variants with pressurized water sx							
Chance.	n	1.24 2.40 1.33 2.24 0.67 1.31			s	sx V % Rast. n min max x 1,82 0,68 0,31 37,57 1,83 0,50 0,22 27,22 1,69 0,41								s	V % 0.80 0.34 0.15 42.25		
1	5			0,18 24,17 0,87 0,26 0,12 29,75				1	5	0.44 1.34 0.43				0.69 0.18 0.08 25.78 0.75			
2	5							2	5	0.88 0.36 1.27				0.40 0.18 54.11 1.13 0.40			
3	5							3	5	0.76 1.75 1.06				0.18 35.15 1.44 0.43 0.19			
4	5							4	5	2.02 **file** 25 0.36				30.00 0, 96 0.44 0.09			
5								5	5	2.02				45.59			
file	20	0,67	2,62	1,55	0,61	0,14 39,12											

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V1) resulted in a general decrease in the mass of inflorescences on plants compared to the control **variant (variant A).**

Table 10 Statistical characteristics of the variability of the weight of the inflorescence K (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.) in the variant CSTAV2K and CSTBV2K CSTBV2K

	CSTAV2K Variants without pressurized water min max x								Variants with pressurized water sx							
Chance.	n				s	sx V % Growth n min max x 0.27 0.12 29.59 0.75 1.18 18.85 0.54 0.87 51.65								s	V % 0.95		
1	5	0,54	1,23	0,91	0.27 0.69 29.61 0.35 1.31 41.58 0 .43 1.33 35.35 **file** 25 0.27 1.33									0.17 0.08 17.76 0.72 0.14			
2	5	0,81	1,33	1,08 0,20 0,09 1,16 0,60 0,27				2	5					0.06 19.24 0.50 0.15 0.07			
3	5	0,65	2,06	1,01 0,30 0,13 1,16 0,48 0,21				3	5					30.66 0.9 0.35 0.16 39.32			
4	5	0,61	1,43	1,06 0,38 0,08				4	5					0.84 0.38 0.17 44.60 0,			
5	5	0,47	1,67					5	5					78 0.29 0.06 36.93			
file	25	0,47	2,06														

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V2) resulted in a general decrease in the mass of inflorescences on plants compared to the control **variant (variant A).**

Table 11 Statistical characteristics of the variability of the weight of the inflorescence K (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.) in the variant CSTAV3K and CSTBV3K CSTBV3K

	CSTAV3K Variants without pressurized water min max x								Variants with pressurized water sx							
Chance.	n				s	sx V % Rast. n min max x 1,95 0,44 0,20 22,75 1,37 0,68 0,30 49,56 1,90 0,53								s	V % 0.86		
1	5	1,25	2,40	0,24 27,74 1,59 0,59 0,26 36,96				1	5	0.15 1.92 0.73				0.76 0.34 87.54 1.29 0.40			
2	5	0,89	2,57					2	5	1.80 0.32 0.80				0.18 31.29 0.53 0.21 0.09			
3	5	1,32	2,39					3	5	0.51 1.24 0.33				38.90 0.97 0.31 0.14			
4	5	0,90	2,44					4	5	2.18 33.65 **file** 25				31.52 1.07 0.71 0.32			
5								5	5	0.15 2.18				65.81 0, 95 0.54 0.11			
file	20	0,89	2,57	1,70 0,57 0,13										57.35			

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V3) resulted in a general decrease in the mass of inflorescences on plants compared to the control **variant (variant A).**

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Table 12 Statistical characteristics of the variability of inflorescence weight K (g) in the fresh state from selected hemp plants *(Cannabis sativa* L.) in the variant CSTAV4K and CSTBV4K

	CSTAV4K Variants without pressurized water							CSTBV4K Variants with pressurized water sx V							
	n	min max x 1.14 1.73			s	% Growth. n min max x sx V % 1.36 0.25 0.11 18.50 0.51 0.87 0.60 0.15 0.07 25.76 1.26							
	5	0.89 1.89		0.40 0.18 31.50 0 .26 0.50 0.37 0.11				0.05 3	1.26 1.02 2 0.47 0.21 45.58 0.24 1.60 0.85 0.64 0.29 75.03 1.41 0.66							
	5	0.58 1.57 0.58		0.30 47.05 0.67 1.03 0.80 0.14 0.06				16.932	1.46 0.29 5 0.13 20.08 0.24 0.39 0.31 0, 06 0.03 19.47 1.30 0.43 0.09							
	5	2.39 1.07 1.88		31.01 file 25 0.24 1.60 0.59 0.36 0.07				61.05	5							
	5	0.58 2.39						4	5							
	5							5	5							
Growth. 1 2 3 4 5 file																

The application of activated water by the IPS system (variant B) with the simultaneous application of activated alginite products (V4) resulted in a general decrease in the mass of inflorescences on plants compared to the control **variant (variant A).**

Table 13 Statistical characteristics of the variability of inflorescence weight (g) in the fresh state from selected cannabis plants *(Cannabis sativa L.)* for individual variants

	Variants without pressurized								Variants with pressurized water							
Variants	water n min max x				s	sx V %	Variants n min max x sx V %									
CSTKVK 25 0.22			1,52 0,86 0,35 0,07 40,75													
CSTAV1K 20 0.67 2.62			1,55 0,61 0,14 39,12 **CSTBV1K** 25 0 36								2,02 0,96 0,44 0,09 45,59					
CSTAV2K 25 0,47 2,06			1,06 0,38 0,08 35,35 **CSTBV2K** 25 0 27								1,33 0,78 0,29 0,06 36,93					
CSTAV3K 20 0,89 2,57			1,70 0,57 0,13 33,65 **CSTBV3K** 25 0 15								2,18 0,95 0,54 0,11 57,35					
CSTAV4K 25 0,58 2,39			1,30 0,43 0,09 31,01 **CSTBV4K** 25 0 24								1,60 0,59 0,36 0,07 61,05					

In the summary overview of the weights of the inflorescences of all variants, the reduction was most pronounced in variant V3 (0.95 **g) after the application of activated water by the IPS system (variant B) compared to** variant V3 without pressurized water (1.70 g). **In all B variants, we noticed a reduction compared to A variants** without pressurized water.

Table 14 Statistical characteristics of the variability of stem thickness (mm) from the apical (a) and basal (b) parts of plants from samples of selected hemp plants *(Cannabis sativa* L.) in the fresh state

	Variants without pressurized water							Variants with pressurized water							
Variants n min max sx V % Variants n min max				x	s							x	s	sx V %	
CSTAV1Sa 4 6.05 6.99				6,50	0,41 0,20 6,26 **CSTBV1Sa** 5 7,03 8,21 7,51							7,45 0,56 0,25			
CSTAV1Sb 4 18,12 23,48 20,82 2,25 1,12 10,80 **CSTBV1Sb** 5 22,13 27,17 25,23 1,93 0,86 7,65															
CSTAV2Sa 5 7.66	6,77			7,13	0,46 0,21		6,45 **CSTBV2Sa** 5 7,68 6,44 0,87 0,55 13,47								
CSTAV2Sb 5 21,33 27,50 24,91 2,70 1,21 10,85 **CSTBV2Sb** 5 19,54 27,95 24,62 3,51 1,57 14,27															
CSTAV3Sa 4 5.93 7.38				6,79	0,62 0,31		9,08 **CSTBV3Sa** 5 7,66 6,61 0,66 0,29 9,92								
CSTAV3Sb 4 16,83 24,66 21,13 3,27 1,64 15,49 **CSTBV3Sb** 5 19,63 25,80 22,80 2,44 1,09 10,69															
CSTAV4Sa 5 6,50	8,12 7,29	8,71	0,32 9,91	6,30	0,20 0,09 3,23 **CSTBV4Sa** 5			6,18							
CSTAV4Sb 5 19,53 27,78 22,05 3,49 1,56 15,82 **CSTBV4Sb** 5 18,94 26,30 22,85 2,88 1,29 12,59															
CSTKVSa 5 7.95	0.59 0.26	2.82		7,54											
CSTKVSb 5 15,60 24,36 19,14 3,70 1,66 19,34															

In a summary overview, an increase in stem thickness occurred after the application of activated water by the IPS system (variant B) in variants V1 and V4 in **both the apical and basal parts compared to the control variants V1 and** V4. For **the other B variants, the values were lower compared to** the A variants.

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Table 15 Statistical characteristics of the variability of selected hemp plants (Cannabis sativa L.) in individual variants in all evaluated morphological characters (weight of branches (g), length of branches (mm), weight of stems (g), weight of inflorescences (g), thickness of stems in the basal and apical parts (mm), height of the whole plant (mm), length of the vegetative top (mm)

	CSTKV	CSTAV1	CSTAV2	CSTAV3	CSTAV4	CSTBV1	CSTBV2	CSTBV3	CSTBV4			
	WEIGHT OF BRANCHES (g)											
min	8,2	max	8,9	11,4	10,8	4,6	196,7	184,2	16	8,8	4,9	10,1
253,2	55,87	41,93	165,2	185,5	53,46	53,37	36,56	33,70	241,4	209,2	156,2	160,6
x	4,00		49,15	63,43	3,83	2,97	68,39	63,15	62,01	56,41	44,36	48,43
s			30,62	35,78					38,57	32,68	30,50	30,87
sx			3,25	3,31					3,63	2,97	2,77	2,96
In %	75,06		62,30	56,41					62,20	57,93	68,75	63,74
	LENGTH OF BRANCHES											
min			13	15	12	18	14	70	75	76	38,70	41,88	40,28	23	17	16
max	9		90	72	12,55	13,92	15,52	1,35	1,36	1,50	79	85	76	
x	102		38,61	41,37	32,44	33,24	38,53				42,77	41,66	40,13	
s	38,15		13,95	12,58							11,08	15,63	14,42	
sx	18,48	1,76	1,51	1,23							1,09	1,55	1,36	
In %	48,43		36,14	30,42							25,92	37,50	35,93	
	WEIGHT OF STEMS (g)											
min	35,31		39,94	57,06	36,72	45,04	65,34	72,68	91,73	74,09	43,64	36,65	40	
max	70,7		68,53	80,06	59,19	64,49	69,48	15,57	19,62	3,16	7,79	74,08	74	67,39
x	49,89		54,71	67,70	8,77	1,41	26,31	30,42	4,55			61,73	56,11	52,94
s	14,80		11,79	9,40								11,94	13,32	12,12
sx	6,62		5,89	4,21								5,34	5,96	5,42
In %	29,67		21,55	13,89								19,34	23,74	22,89
	FLOWER WEIGHT (g)											
min	0,22		0,67	0,47	0,89	0,58	0,36	0,27	2,06	2,57	2,39	2,02	1,33	1,06	1,70	1,30	0,96	0,15	0,24
max	1,52		2,62	0,78	0,38	0,57	0,43	0,44	0,29	0,08	0,13	0,09	0,09	0,06	35,35	33,65	33,01	2,18	1,60
x	0,86		1,55	45,59	36,93													0,95	0,59
s	0,35		0,61															0,54	0,36
sx	0,07		0,14															0,11	0,07
In %	40,75		39,12															57,35	61,05
	THICKNESS OF STEMS IN THE BASAL PART											
min	15,6	max	18,12	21,33	16,83	19,53	22,13	19,54	27,5	24,66	27,78	27,17	27,95	24,91	21,13	19,63	18,94		
24,36	19,14	3,70	23,48	22,05	25,23	24,62	2,70	3,27	3,49	1,93	3,51	1,21	1,64	1,56	0,86	1,57	10,85	25,8	26,3		
x	1,66		20,82	15,49	15,82	7,65	14,27											22,80	22,85		
s			2,25															2,44	2,88		
sx			1,12															1,09	1,29		
In %	19,34		10,80															10,69	12,59		
	THICKNESS OF STEMS IN THE APICAL PART											
min	6,52		6,05	6,77	5,93	5,98	7,03	5,58	7,33	6,5	8,21	7,68	6,79	6,3	7,454	5,97	6,18		
max	7,95		6,99	7,66	6,442	0,62	0,20	0,56	0,87	0,31	0,09	0,25	0,39	9,08	3,23	7,66	8,12		
x	7,54		6,495	7,132	7,51	13,47										6,608	7,198		
s	0,59		0,41	0,46												0,66	0,71		
sx	0,26		0,20	0,21												0,29	0,32		
In %	7,82		6,26	6,45												9,92	9,91		
	WHOLE PLANT HEIGHT (CM)											
min			112	116	116	118	115	134	130	120	121	103		
max			128	146	125	126,4	122,2	6,58		135	142	139		
x			119,75	131,2	121,75	6,50	2,94	2,91	5,21	5,32	127,6	130	126,4		
s			7,50	12,05	4,27					6,23	7,65	13,81		
sx			3,75	5,39	2,14					2,79	3,42	6,18		
IN %			6,26	9,18	3,51					4,88	5,88	10,93		
	LENGTH OF VEGETATION TOP											
min			32	46	34	44	45	43	45	48				
max			50	60	43	56	59	59	60	62				
x			41,75	52,2	38,75	49	50,6	50,8	51,2	52				
s			7,93	5,26	3,77	5,20	5,50	6,65	6,94	5,70				
sx			3,97	2,35	1,89	2,32	2,46	2,97	3,10	2,55				
IN %			19,00	10,08	9,74	10,60	10,88	13,09	13,56	10,96				

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C. Conclusions

Activated water created by the IPS system in combination with alginite products significantly increased or decreased the tested production characteristics, which also has significant practical application.

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AQIPS 05

Effect of activated water by IPS system with alginite application on biochemical changes of biologically active components in selected parts of plants

AQIPS-05-E01 Effect of activated water by the IPS system on the content of cannabinoids in selected parts of cannabis plants (Cannabis sativa)
AQIPS-05-E02 Effect of activated water by the IPS system on the content of polyphenols in selected parts of cannabis plants (Cannabis sativa)
AQIPS-05-E03 Effect of activated water by the IPS system on the antioxidant activity of selected parts of cannabis plants (Cannabis sativa)

The effect of activated water with the IPS system on the content of cannabinoids in selected parts of cannabis plants (Cannabis sativa)

AQIPS-05-E01

Contents

A. Methodology of the experiment

Objective: To determine the effect of activated water by the IPS system under different pressures on the germination, growth and development of cannabis (Cannabis sativa L.).	
Research workplace	Institute of Plant and Environmental Sciences
Responsible	Ing. Marián Miko, CSc.
researcher Research team	Ing. Ján Gažo, PhD. Ing. Jana Šimková, Ing. Vladimíra Horÿinová Sedláÿková, PhD., Alex Oravec, Eva Chovancová, Mária Vailingová, Ing. Beáta Kováÿová, Elena Kovárová
Plant species(s)	Cannabis sativa (Cannabis sativa L.) - technique
Tested varieties	Finola
The goal of the experiment	To determine the effect of alginate preparations on grain yield and the formation of production characteristics of hemp.
Form of experiment	Container trial – substrate Klassman TS 3 + ICL Osmocote Pro 5-6M, 19-9-10+2MgO+TE
Company name-location	KGŠR – FAPZ – SPU Nitra
Experimental variants - applied alginite preparations - method of application and deadlines	
Location: Trenÿianske Jastrabie -T A – variants without water pressure; B variants with pressurized water V1 v2 V3 V4 V5 – variant	

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Evaluated plant parts: K – inflorescence; L – leaves; S- stem;

Variant TA variant without pressurized water TB variant with pressurized water

Plant V11 V12 V13 V14 V15 V11 V12 V13 V14 V15

Piešÿany - description of variants and their designation:

Control - Plants fertilized as standard by the farmer / without application of preparations

V1 - Plants treated twice with a suspension solution of 20g/liter by spraying on the leaf

V2 - Plants treated twice with a suspension solution of 30g/liter by spraying on the leaf

V3 - Plants treated twice with a suspension solution of 60g/liter by spraying on the leaf

Total consumption of alginite preparations in the experiment:	
Area size of the variant (5 x 4+4 containers)	Total number of sown seeds in the container (50 pcs.)
Vegetation records Sowing date / treatment date - dates of basic phenophases - harvest	
Sampling during vegetation	Not
Photo documentation	implemented Yes - as needed
Morphometric analysis of individual plants: plant height (mm), whole plant weight (g), number of male plants (pcs), number of female plants (pcs), weight of seeds per plant (g), weight of leaves (g) , mass of flower bracts (g).	
Number of analyzed plants from one variant: 40 Total number of analyzed plants: 40 x 40 variants (1,600 plants)	
Biochemical analyses: risk elements – number of samples: substrate 35, stems 35, leaves 35, seed 35, flower chaff 35.	
Experiment notes:	

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B. Literary knowledge

While male plants produce small amounts of cannabinoids, in the cultivation of hemp, the primary products are female flowers grouped in inflorescences (Ohlsson et al., 1971). Pedicellate glandular trichomes are primarily concentrated on calyxes and bracts (Spitzer-Rimon et al., 2019; Leme et al., 2020) with populations extending to the “sugar leaves” in the inflorescence; they are places of accumulation of excreted metabolic products. These valuable secretions include tetrahydrocannabinolic acid (THCA), cannabidiol acid (CBDA), terpenes and flavonoids (ElSohly and Slade, 2005; Flores-Sanchez and Verpoorte, 2008).

Cannabis plant morphology and cannabinoid profiles are influenced by genetics and cultivation environment, highlighting the importance of controlled conditions for cannabis cultivation (Maagnini et al., 2018; Danziger and Bernstein, 2021a,b). With the gradual worldwide increase in social and legal acceptance of hemp, there is considerable interest in the production of this important raw material. Furthermore, as the medical use of cannabinoids is supported by peer-reviewed research and clinical trials, global demand for medical cannabis products will continue to increase. This will put additional pressure on growers to improve control over the concentration of specific hemp metabolites and related hemp genotypes. However, the genotypes and environmental conditions required to obtain this level of precision remain poorly characterized. Ultimately, these elusive methods must center around trichomes as "factory" plants. Current efforts have focused on the effects of cultivar breeding and selection and industrial growing conditions (Vanhove et al., 2011).

Trichomes in the plant kingdom

Trichomes are found throughout the plant kingdom and display an astonishing variety of shapes and properties. Glandular trichomes, which arise from the epidermis on vegetative and reproductive organs, can be broadly divided into secretory and non-secretory types, the former being able to secrete substances (Tian et al., 2017). Both morphologies and metabolic secretions of trichomes are consistent within a plant species, and some species have different trichome morphotypes on the same plant organ (Muravnik, 2020). Excreted compounds, including THCA (Sirikantaramas et al., 2005), can be toxic to plant cells; therefore, storage of metabolites in the cavity of the gland head provides protection to the plant (Sirikantaramas et al., 2008). While different glandular trichome morphs induce different deposition strategies, the architecture of the morph and the position of the cavity relative to the secretory cells determine the direction of secretion (Tissier et al., 2017).

Key metabolites of hemp

Decades of stigma surrounding cannabis have led to various misconceptions about the plant and its products when it comes to cannabinoid biosynthesis. While THCA and CBDA are the main cannabinoids produced by the plant, their degradation products, THC and CBD, are of great interest for their psychoactive and therapeutic effects. Other cannabinoids are gradually gaining interest as their effects on the human body begin to be understood (ElSohly and Slade, 2005). Metabolites, including cannabinoids, terpenes, and flavonoids, are formed in secretory disc cells that line the base of the glandular trichome head and are stored in the subcutaneous cavity (Figure 1B,C; Kim and Mahlberg, 1991, 1997). In recent years, a large number of cannabinoids have been identified, increasing the total known number to just over 110, which can be divided into 11 subclasses (Hanuš et al., 2016; Berman et al., 2018).

To date, more than 120 terpenes have been identified in hemp, which are generally classified as monoterpenes and sesquiterpenes based on differences in their carbon skeletons (ElSohly and Slade, 2005; Degenhardt et al., 2009). Terpenes have a biosynthetic pathway similar to cannabinoids and this process has been extensively reviewed (Booth et al., 2017). Terpenes impart floral aroma and flavor, making them important components for plant product applications such as essential oils from many plant species. Terpene profiles differ between hemp cultivars (Booth et al., 2017) and hemp oils containing more monoterpenes perform better in olfactory evaluations than oils containing more sesquiterpenes.

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while an oil containing a mixture of both scored highest in odor tests (Mediavilla and Steinemann, 1997).

Flavonoids are another major phytochemical group in hemp; however, this group of compounds has received less research focus compared to cannabinoids and terpenes. Similar to terpenes, i
flavonoids are found in a wide variety of plant genera with a wide variety of roles and benefits for the plant (Panche et al., 2016). There are over 20 identified hemp flavonoids with three relatively unique compounds known as cannflavin A, B and C (Bautista et al., 2021). The potential pharmaceutical use of flavonoids, from anti-inflammatory to anti-cancer therapies, is increasing interest in these compounds, especially as the concomitant effects provided by hemp metabolite profiles are better understood (Tomko et al., 2020; Bautista et al., 2021). Since flavonoids are produced primarily in the leaves of hemp, not in the inflorescences (Jin et al., 2020).

Three types of glandular trichomes on hemp flowers—referred to as capitate-sedsile, capitate-pedunculate, and bulbous—were previously described based on structural evaluations using scanning
electron microscopy (Hammond and Mahlberg, 1973). Trichomes were distinguished based on their morphology, where bulbous trichomes were small and low, sessile trichomes consisted of a globular head on a very short stalk, and stalked trichomes had a larger globular head on a long stalk; of the three types of trichomes, stalked trichomes produce the greatest amount of cannabinoids (Hammond and Mahlberg, 1973; Mahlberg and Kim, 2004; Livingston et al., 2020). Unfortunately, this non-specific differentiation between trichome types has led to misidentification of trichomes due to the similar appearance of sessile and stalked morphs (Dayanandan and Kaufman, 1976; Livingston et al., 2020).

The reasons for the variable metabolite profiles found between cultivars/genotypes and plant organs are genetic and environmental. For example, flowers taken from the upper region of the plant produce significantly greater amounts of cannabinoids and terpenes than lower locations; light source and plant maturity are considered important factors affecting concentration and/or amount (Namdar et al., 2018; Eichhorn Bilodeau et al., 2019). Abiotic factors that affect the growth of hemp are the same as those that affect other plant species, such as temperature, fertilization, photoperiod and light intensity (Taschwer and Schmid, 2015). However, knowledge of how these factors influence trichome growth and formation is limited, with much work needed to establish scientific evidence to support links between metabolite production and environmental factors (Taghinasab and Jabaji, 2020). Cannabis research is at an early stage, and future work is needed to explore the signaling pathways that mediate the effect of external factors on metabolite production.

Potential benefits of trichomes for hemp plants

The exact contribution of cannabinoids and terpenes to the plant has not yet been discovered, but several findings point to defensive functions. This is consistent with the common role of trichomes in many plant species (Levin, 1973). Early studies also hypothesized that THC protects against ultraviolet (UV) radiation because hemp plants produce significantly increased levels of THC when exposed to higher levels of UVB radiation, which may lead to the development of geographic chemotypes (Pate, 1983). A recent study found that CBD could be a potential sunscreen because its application to human keratinocyte and melanocyte cells resulted in improved cell viability after exposure to UVB radiation, suggesting that cannabinoids protect cells from this type of potentially DNA-damaging radiation and supporting the geographic hypothesis chemotype (Gohad et al., 2020). These findings suggest that cannabinoids may be secreted and concentrated around flowers to protect reproductive organs—and thus the next generation—from the effects of sun damage; genotypes that come from closer to the equator will produce higher levels of cannabinoids due to the higher incidence of UVB radiation in that area.

Terpenes may act as deterrents against herbivory, as the monoterpenes ÿ-pinene and limonene repel insects at higher concentrations in flowers, while sesquiterpenes, which are bitter to mammals, have higher concentrations in lower leaves (Potter, 2009; Nerio et al. , 2010; Russo, 2011). This apparent organ- and location-dependent range of terpene profiles is consistent with the likely causes

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damage, as insects would be more likely to damage the flowers and herbivorous mammals would likely target the larger fan leaves. Additionally, cannabinoids and terpenes can complement each other to provide plants with a complex defense mechanism against insects. The ratio of monoterpenes to sesquiterpenes determines the viscosity of cannabis resin, while CBGA and THCA are toxic to insects. Altering the ratio of terpene types to increase viscosity can trap insects, while CBGA and THCA induce apoptosis as shown in cultured insect cell lines, thus protecting the plant and critical tissues such as flowers as they develop (Sirikantaramas et al., 2005 ; Russo, 2011). Terpenes and cannabinoids also interact after animal ingestion, as terpenes have been shown to contribute to the affinity of THC for cannabinoid receptor 1 receptors in humans, among other effects (Russo and McPartland, 2001; Andre et al., 2016). Interactions between terpenes and cannabinoids are thus the subject of ongoing research, not only to gain insight into the role of terpenes for plants, but also for potential therapeutic benefits that could be exploited by the medical cannabis sector.

The role of cannabinoids in biotic stress tolerance is consistent with their increased concentration in flowers where trichome densities are highest. In addition to reducing the risk of damage caused by pests, cannabinoids also have antimicrobial properties. Five key compounds [THC, CBD, cannabichromene (CBC), cannabigerol (CBG) and cannabinol (CBN)] and their acidic precursor forms have significant antibacterial activity against several methicillin-resistant Staphylococcus aureus strains through targeting the bacterial membrane (van Klingeren and ten Ham, 1976; Appendino et al., 2008; Farha et al., 2020). This suggests that cannabinoids, including those typically secreted in low concentrations, have a wide range of benefits, acting both within and outside the plant, particularly with regard to cannabinoid production in flowers compared to the rest of the plant (Farha et al., 2020). Although the defensive properties of the main metabolic products produced by cannabis plants are increasingly understood, attention must also be paid to lesser-known compounds. As more than 200 cannabinoid and terpene compounds have been identified together, the cost of producing this vast array of secondary metabolites must be explored to elucidate their individual benefits and roles in plant function. Transcriptomic studies of these lesser-known compounds and their expression in response to common stressors could provide an important start to answering these

questions.

Taken together, the range of potential benefits of these secondary metabolites strongly suggests that they play a key role in the general health and survival of hemp plants and their progeny through a combination of factors. To confirm this, genomics, transcriptomics, and metabolomics studies must be performed to confirm the putative characteristics associated with different trichome morphs, their developmental patterns in different tissues, and their inconsistent metabolite secretions. Evidence is required that these compounds are not simply by-products of other biological processes, but actually have a primary role in defense mechanisms. For these studies to be meaningful, they should not only include hemp cultivars that are the result of centuries of breeding, but also naturally occurring types that are not the product of human selection, even if they are rarely available. Recently, 110 whole genomes of hemp cultivars, from wild plants and historic varieties to modern hybrids, have been sequenced and analyzed, focusing on the Asian sources that account for the likely origin of domestication, to provide an invaluable genetic framework for the history of the plant. The resulting information can be used to investigate secondary metabolites (Ren et al., 2021). In time, the validity of these hypotheses will surely be determined by this new genomic information, along with valuable insight into the impressive complexity seen within them.

Prospects for the future

Hemp has lagged behind the agricultural research boom of the past century due to its illegal status in most jurisdictions. While many advances in plant science for a wide variety of other species are applicable to cannabis, several species-specific traits require specialized research to gain fundamental knowledge and provide evidence-based data to the growing industry. Since the practices of industrial agriculture became established worldwide and genomic studies became possible in the 20th century, researchers have been able to elucidate new agricultural applications derived from understanding at the molecular level, while hemp applications remain focused on breeding and conditions

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environment; culture protocols were largely based on anecdotal rather than scientific evidence. For example, the soybean genome has been sequenced to identify genetic markers associated with nematode resistance and this has been used to support precision breeding strategies (Kim et al., 2016); meanwhile, the simple taxonomy of hemp remains controversial (Koren et al., 2020). The field of hemp research is slowly reaching the level of scrutiny seen in other valuable crop species, with one example being a recent study demonstrating a high-throughput assay using genetic markers to identify the gender and chemotype of hemp germplasm (Toth et al., 2020). . However, this study primarily focused on THC:CBD ratios for chemotype determination, and only THC, CBD, CBG, and CBC were included when modeling “total cannabinoid potential,” highlighting the limits of current genetic studies (Toth et al., 2020). Regardless of their limitations, these studies signal the beginning of true hemp seed entry into 21st century agricultural research.

Trichomes and essential oils in other plant species have been well characterized in recent decades and it is important that our understanding of cannabis trichomes reaches a similar level of understanding. The increasingly widespread legalization and public acceptance of seeded hemp suddenly places the once shunned plant in a position of intense interest and high demand at a time of exceptional experimental standards, raising expectations that questions surrounding it will be answered much more quickly than in the case of previous crops. Simple breeding and agricultural production techniques to influence metabolite profiles are neither precise nor always consistent, leading to a number of potential complications for both producer and consumer. An example of this complication is the growing medical and recreational consumer demand for products with higher levels of THC (Swider, 2021; Zoorob, 2021). The resulting lack of reliability in identification can potentially lead to health complications and mistrust by those who use the plant parts of cannabis seeds for pain relief and as an appetite stimulant/antiemetic. These problems point to the need not only for a more reliable and ethical approach to the quality of hemp products, but also for methods to reliably match the production of metabolites in the trichome source. New approaches such as phytomicrobiome manipulation and exploitation present interesting possibilities, as root inoculum has shown similar effects on THC and CBD content as nitrogen application (Pagnani et al., 2018; Lyu et al., 2019). If methods could be developed to consistently replicate specific concentrations and combinations of metabolites on a small scale between cannabis plants at the trichome level, and if these methods became standard across the industry, the benefits to producers, practitioners and consumers would be great. .

From a scientific point of view, several interesting questions are associated with glandular trichomes. Primarily, these questions focus on differences related to genotype and growing conditions. How changes in soil composition, light, nutrients, water levels, and other environmental factors affect trichome density remains largely unknown for seeded hemp. Our knowledge of how metabolite profiles themselves differ between varieties is limited and primarily based on poor reports from growers that are incomplete beyond the major cannabinoids and terpenes, leaving 100 metabolites unknown. Our lack of knowledge in these areas of hemp metabolism and composition makes it difficult to directly hypothesize exactly where and how the differences occur, emphasizing the need for strict uniform standards to allow objective and scientifically based data comparisons. The more we understand about trichomes, the better our knowledge of this plant will be applicable to those in the chain of production and consumption.

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C. Results

1. CBG content in leaf samples

Table 1 Analysis of variance for the assessment of CBG (cannabigerol) content in hemp leaf samples - Trenÿianske Jastrabie experiment

Univariate significance test for CBG					
Effects	Sum of squares	Degrees of freedom	Root mean square	F	P
Abs.	6449712 1 733764 8 227326 18		6449712	510,6971 0,000000	
			91721	7,2626 0,000249	
			12629		

member Listy Chyba Table 2 Statistical evidence between the content of CBG (cannabigerol) in leaf samples obtained from different experimental variants at the level of significance ÿ = 0.05 - Trenÿianske Jastrabie experiment

Tested variants	LSD test; variable CBG, Homogeneous Groups, alpha = .05000 Error: intermediate group. Pÿ = 12629, sv = 18,000					
	Variants CSTAV2L	Average CBG content	1	2	3	4
3	CSTBV2L	182.4720				****
7	CSTBV1L	390.2569	****			
6	CSTAV3L	410.9539	****			
4	CSTAV4L	430.3240	****			
5	CSTBV3L	431.6816	****			
8	CSTAV1L	540.2762	**** ****			
2	CSTKVL	541.8380	**** ****			
1	CSTBV4L	711.6860		**** ****		
9		759.2767			****	

Explanations: L – leaves; K – control variant; A – variant with activated water; B – variant without activated water Table

3 Statistical evidence between the content of CBG (cannabigerol) in leaf samples obtained from different experimental variants at the significance level ÿ = 0.01

Tested variants	LSD test; variable CBG Homogeneous groups, alpha = .01000 Error: between-group. PC = 12629,, sv = 18,000				
	Leaves Average CBG content CSTAV2L		1	2	3
3	182.4720 CSTBV2L 390.2569 CSTBV1L			****	
7	410.9539 CSTAV3L 430.3240 CSTA4VL		**** ****		
6	431.6816 CSTBV3L 540.2762 CSTAV1L		**** ****		
4	541.8380 711.6860 759.2767		**** ****		
5			**** ****		
8			****		****
2			****		****
	CSTKVL				****
1 0	CSTBV4L				****

Explanations: L – leaves, KV – control variant; A – variant with activated water; B – variant without activated water

The application of activated water by the IPS system with an alginite product statistically significantly increased the content of CBG (9) in hemp leaves compared to the control variant (1), which is documented by the data in Tables 2 and 3.

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2. CBG content in inflorescence samples

Table 4 Analysis of variance for the assessment of CBG (cannabigerol) content in hemp inflorescence samples - Trenÿianske Jastrabie experiment

Effect	Univariate **significance tests for** CBG Sigma-constrained **parameterization; Decomposition of the effective hypothesis**				
	Sum of squares	**Degrees of freedom**	**Average square**	**F**	**P**
Abs.	3,569679E+09 1		3,569679E+09	3497,412 0,000000 2,757	
member	2,251352E+07 8		2,814190E+06	0,035217	
of Kvety Chyba	1,837194E+07 18		1,020663E+06		

Table 5 Statistical evidence between the content of CBG (cannabigerol) in inflorescence samples obtained from different experimental variants at the level of significance ÿ = 0.05 - experiment Trenÿianske Jastrabie

Tested variants	LSD test; variable **CBG** **Homogeneous groups, alpha = .05000** Error: **between-group. PC = 1021E3, sv = 18,000**					
	Flowers	**Average CBG content**	1	2	3	4
1	CSTKVK	10024.02	****			
7	CSTBV2K	10857.26	**** ****			
6	CSTBV1K	10883.17	**** **** ****			
9	CSTBV4K	10884.00	**** **** ****			
3	CSTAV2K	11341.90	**** **** ****	****		
2	CSTAV1K	11555.37	**** **** ****	****		
5	CSTAV4K	12363.20		**** **** ****		
8	CSTBV3K	12610.27			**** ****	
4	CSTAV3K	12965.30				****

Explanations: K **– inflorescences;** KV **– control variant;** A **–** variant with activated water; B **–** variant without activated water

Table 6 Statistical evidence between the content of CBG (cannabigerol) in inflorescence samples obtained from different experimental variants at the level of significance ÿ = 0.01

Tested variants	**LSD test; variable CBG** **Homogeneous groups, alpha = .01000;** Error: intermediate group. **PC = 1021E3, sv = 18,000**			
	Flowers	**Average CBG content**	1	2
1	CSTKVK	10024.02		****
7	CSTBV2K	10857.26	****	****
6	CSTBV1K	10883.17	****	****
9	CSTBV4K	10884.00	****	****
3	CSTAV2K	11341.90	****	****
2	CSTAV1K	11555.37	****	****
5	CSTAV4K	12363.20	****	****
8	CSTBV3K	12610.27	****	
4	CSTAV3K	12965.30	****	

Explanations: K **– inflorescences;** KV **– control variant; A –** variant with activated water; B **–** variant without activated water

The application of activated water by the IPS system with **an alginite product statistically significantly increased** the content of CBG **in all variants** in **the inflorescences** of hemp **compared to the control variant (1), which is documented by the data of Tables** 5 and 6.

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3. CBD content in chaff samples

Table 7 Analysis of dispersion for the assessment of CBD (cannabinoids) content in hemp chaff samples - Piešÿany experiment

Effect	Univariate significance tests for CBD Decomposition of the efficient hypothesis				
	Sum of squares	Degrees of freedom	Mean square	F	P
Abs. member	1952423 1 2986185 2 2432415		1952423	4,816013 0,070631	
of Plevy	6		1493092	3,682988 0,090459	
Chyba			405402		

Table 8 Statistical evidence between the content of CBD (cannabinoids) in chaff samples obtained from different experimental variants at the significance level ÿ = 0.05 - Piešÿany experiment

Tested variants	Homogeneous groups, alpha = .05000 Error: between group. PC = 4054E2, sv = 6.0000		
	Chaff Average CBD content CSPV2PL 14.568		1
3	CSPV1PL 103.982 1278.741		****
2			****
1	CSPKVPL		****

Explanations: PL – chaff; K – control variant

The results from Table 8 document that we did not observe statistically significant differences in the CBD content of chaff samples on hemp plants between the control variant (1) and the chaff samples after the application of alginite products (2, 3) at 95% probability (ÿ = 0.05).

Table 9 Statistical evidence between the content of CBD (cannabidoids) in samples of inflorescences and chaff obtained from different experimental variants at the level of significance ÿ = 0.05 - experiment Piešÿany

Tested variants	Homogeneous groups, alpha = .05000 Error: between group. Pÿ = 95191, sv =				
	19,000 Chaff Average CBD content		1	2	3
	CSPKVPL 2485.639 CSPVKPL 2699.784		****		
1 2	2882.773 3190.754 3295.119		****		
3	CSPV1PL		**** ****		
5	CSPV3PL			**** ****	
4	CSPV2PL				****

Explanations: PL – chaff; KPL – inflorescences + chaff; KV – control variant

The results from Table 9 document that after the application of alginate products (3, 4, 5) the CBD content in the chaff samples on the sown hemp plants was statistically significantly increased compared to the control variant (1) and to the inflorescence and chaff variant (2) at 95 % probability (ÿ = 0.05).

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Table 10 Statistical evidence between the content of CBD (cannabidoids) in samples of inflorescences and chaff obtained from different experimental variants at the level of significance ÿ = 0.01 - experiment Piešÿany

Tested variants	Homogeneous groups, alpha = .01000 Error: between group. Pÿ = 95191, sv = 19.000 Chaff CSPKVPL			
		Average CBD content	1	2
1	CSPVKPL	2485.639		****
2	CSPV1PL	2699.784	****	****
3	CSPV3PL	2882.773	****	****
5	CSPV2PL	3190.754	****	
4		3295.119	****	

Explanations: PL – chaff; KPL **– inflorescences + chaff;** KV **– control variant**

The results from Table 10 document that after the application of alginite products (4, 5) the content of CBD in chaff samples on hemp plants was statistically significantly increased compared to the control variant (1) at 99% probability (ÿ = 0.01).

4. CBD content in leaf samples

Table 11 Analysis of variance for the assessment of CBD (cannabinoids) content in hemp leaf samples - Piešÿany experiment

Effect	Univariate significance tests for CBD Decomposition of the effective hypothesis				
	Sum of squares	Degrees of freedom	Root mean square	F	P
Abs.	8843669 1 183589	3 110443 8	8843669	640,5944 0,000000 4,4328	
			61196	0,040933	
Member of Error Sheets			13805		

Table 12 Statistical evidence between the content of CBD (cannabinoids) in leaf samples obtained from different experimental variants at the significance level ÿ = 0.05 - Piešÿany experiment

Tested variants	Homogeneous groups, alpha = .05000 Error: between group. PC = 13805,, sv = 8.0000			
	Leaves	Average CBD content	1	2
2	CSPV1L	711.797 CSPV2L 797.123 CSPV3L	****	
3	877.974	CSPKVL 1046.989 Explanations: L –	****	
4	leaves; KV	**– control variant**	****	****
1				****

The results from Table 12 document that after the application of alginite products (2, 3) the CBD content in leaf samples on hemp plants was statistically significantly reduced **compared to the control** variant (1) **at 95% probability (ÿ = 0.05).**

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Table 13 Statistical evidence between the content of CBD (cannabinoids) in leaf samples obtained from different experimental variants at the significance level ÿ = 0.01 - Piešÿany experiment

Tested variants	Homogeneous groups, alpha = .01000 Error: intermediate group. PC = 13805, sv = 8.0000			
	Leaves **Average CBD content** CSPV1L 711.797		1	2
2	CSPV2L 797.123 CSPV3L 877.974 CSPKVL		****	
3	1046.989 Explanations: L – leaves; KV – **control**		****	****
4	**variant**		****	****
1				****

The results from Table 13 document that after the application of alginite products (2), the CBD content in the leaf samples of the hemp plants was significantly reduced compared to the control variant (1) at 99% probability (ÿ = 0.01).

5. CBD content in leaf, inflorescence and chaff samples

Table 14 Analysis of dispersion for the assessment of CBD (cannabinoids) content in samples of leaves, inflorescences and chaff of hemp - the Piešÿany experiment

Effect	Univariate significance tests for CBD Decomposition of the efficient hypothesis				
	Sum of squares	**Degrees of freedom**	**Root mean square**	**F**	**P**
Abs.	187095871		187095871	8505,462 0,00	164,562
member Total	39818834	1 11	3619894	0,00	
CBD Error	527931	24	21997		

Table 15 Statistical evidence between the content of CBD (cannabinoids) in samples of leaves, inflorescences and chaff of hemp obtained from different experimental variants at the level of significance ÿ = 0.05 - Piešÿany experiment

Tested variants	LSD test; variable **CBD;, Homogeneous groups, alpha = .05000** Error: **betweengroup. PC = 21997, sv = 24,000**								
	Total CBD **Average CBD content** 1 CSPV1L 711.797		2	3	4	5	6	7	
6	CSPV2L 797.123 CSPV3L 877.974		****						
7	1046.989 2485.639 2699.784		**** ****						
8	2749.832 2835.160 3015.714		**** ****						
5	CSPKVL	3139.551		****					
1	CSPKVPL	3241.957					****		
12	CSPKVK	3755 ,079			****		****		
9	CSPV1K				****				
3	CSPV2PL				****			****	
2	CSPV1PL					****		****	
4	CSPV3PL					****			
11	CSPV3K					****			
10	CSPV2K								****

Explanations: K **– inflorescences; L –** leaves; PL **–** chaff; KV **– control variant**

The results from Table 15 document that after the application of alginate products (6, 7, 8) the CBD content in leaf samples on hemp plants was statistically significantly reduced compared to the control **variant (5), the CBD content in inflorescence samples was** statistically significantly increased (9, **10, 11) compared to the control** variant (12) and **statistically significantly increased in the phlegm samples (2, 3, 4) compared** to **the control variant (1) at 95% probability (ÿ = 0.05).**

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Table 16 Statistical evidence between the content of CBD (cannabinoids) in samples of leaves, inflorescences and chaff of hemp obtained from different experimental variants at the level of significance ÿ = 0.01 - Piešÿany experiment

Tested variants	LSD test; variable **CBD** **Homogeneous groups, alpha = .01000** Error: **intergroup. PC = 21997, sv = 24,000**						
	Total CBD **Average CBD content** 1 CSPV1L		2	3	4	5	6
6	711.797 797.123 877.974	****					
7	CSPV2L	1046.989	****					
8	CSPV3L	2485.639	****					
5	CSPKVL	2699.784	****					
1	CSPKVPL	2749.832			****			
12	CSPKVK	2835.160		**** ****				
9	CSPV1K	3015.714		**** ****				
3	CSPV2PL	3139.551		****		****		
2	CSPV1PL	3241.957		****		**** ****		
4	CSPV3PL	3755.079				**** ****		
11	CSPV3K						****	
10	CSPV2K							****

Explanations: K **– inflorescences; L –** leaves; PL **–** chaff; KV **– control variant**

The results from Table 16 document that after the application of alginite products, the CBD content in the inflorescence samples (10, 11) increased statistically significantly compared to the control variant (12) and increased statistically significantly in the chaff samples (2, 3, 4) in compared to the control variant (1) at 99% probability **(ÿ = 0.01).**

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D. Conclusions

Application of activated water as such in separate experiments as well as in combination with alginite products.

E. Used literature

Aizpurua-Olaizola O., Soydaner U., Öztürk E., Schibano D., Simsir Y., Navarro P. et al. . (2016). Development of cannabinoid and terpene content during growth of Cannabis sativa plants from different chemotypes. J. Nat. Prod. , 95 207-217. doi: 10.1021/acs.jnatprod.5b00949

Aliferis KA, Bernard-Perron D. (2020). Cannabinomics: the application of metabolomics in cannabis (Cannabis sativa L.) Research and developmentFront. Plant Sci. 11:554. doi: 10.3389/fpls.2020.00554 Andre

CM, Hausman JF, Guerriero G. (2016). Cannabis sativa: the plant of a thousand and one molecules. Front. Plant Sci. 7:19. doi: 10.3389/fpls.2016.00019

Appendino G, Gibbons S, Giana A, Pagani A, Grassi G, Stavri M, et al. . (2008). Antibacterial cannabinoids from Cannabis sativa: A structure-activity study. J. Nat. Prod. 71 1427-1430. doi: 10.1021/np8002673 Bautista JL, Yu S., Tian L. (2021).

Flavonoids in Cannabis sativa: biosynthesis, bioactivities and biotechnology. ACS Omega 6 5119-5123. doi: 10.1021/acsomega.1c00318 ,

Berman P, Futoran K, Lewitus GM, Mukha D, Benami M, Shlomi T, et al. . (2018). A novel ESI LC/MS approach for comprehensive metabolic profiling of phytocannabinoids in cannabis. Sci. Rep. 8:14280. doi: 10.1038/s41598-018-32651-4

Bernstein N., Gorelick J., Zerahia R., Koch S. (2019). Effect of N, P, K and humic acid supplementation on the chemical profile of medicinal hemp (Cannabis sativa L.). Front. Plant Sci. 10:736. doi: 10.3389/fpls.2019.00736

Booth JK, Page JE, Bohlmann J. (2017). Terpene synthases from Cannabis sativa. PLoS One 12 :e073911. doi: 10.1371/journal.pone.0173911

Braich S, Baillie RC, Jewell LS, Spangenberg GC, Cogan NOI (2019). Building a comprehensive atlas of transcriptomes and transcriptome dynamics in medicinal cannabis. Sci. Rep. 9:16583. doi: 10.1038/s41598-019-53023-6

Burgel L., Hartung J., Pflugfelder A., Graeff-Hönninger S. (2020). Effect of growth stage and biomass fractions on cannabinoid content and yields of different genotypes of hemp (Cannabis sativa L.). Agronomy 10 :372. doi: 10.3390/agronomy10030372

Campiglia E., Radicetti E., Mancinelli R. (2017). Plant density and nitrogen fertilization affect the agronomic performance of industrial hemp (Cannabis sativa L.) in a Mediterranean environment. In. Crop. Prod. 100 246-254. doi: 10.1016/j.indcrop.2017.02.022

Conant RT, Walsh RP, Walsh M, Bell CW, Wallenstein MD (2017). Effects of the microbial biostimulant, mammoth PTM, on the bud yield of Cannabis sativa. J. Hortic. 4:191. doi: 10.4172/2376-0354.1000191

Conneely LJ, Mauleon R, Mieog J, Barkla BJ, Kretzschmar T (2021). Characterization of the Cannabis sativa glandular trichome proteome. PLoS One 16 :e0242633. doi: 10.1371/journal.pone.0242633

Danziger N., Bernstein N. (2021a). Light matters: the influence of light spectra on the cannabinoid profile and plant development of medicinal cannabis (Cannabis sativa L.) . Ind. Crop. Prod. 164 :113351. doi: 10.1016/j.indcrop.2021.113351

Machine Translated by Google

Danziger N., Bernstein N. (2021b). **Manipulation of plant architecture increases cannabinoid standardization in 'drug-type' medicinal cannabis .** *Ind. Crop. Prod.* 167 :113528. doi: 10.1016/j.indcrop.2021.113528

Dayanandan P., Kaufman PB (1976). **Trichómy Cannabis sativa L. (Cannabaceae) .** *Am. J. Bot.* 63 578-591. doi: 10.1002/j.1537-2197.1976.tb11846.x

Degenhardt J., Köllner TG, Gershenzon J. (2009). Monoterpene and sesquiterpene synthases and the origin of terpene backbone diversity in plants . *Phytochemistry* 70 1621-1637. doi: 10.1016/j.phytochem.2009.07.030

Desaulniers Brousseau V., Wu BS., MacPherson S., Morello V., Lefsrud M. (2021). **Cannabinoids and terpenes: how photoprotector production can be manipulated to enhance** *Cannabis sativa* L. Phytochemistry . ***Front.*** *Plant Sci.* 12:620021. doi: 10.3389/fpls.2021.620021

Eichhorn Bilodeau S., Wu BS, Rufyikiri AS, MacPherson S., Lefsrud M. (2019). **An update on plant photobiology and implications for hemp production .** ***Front.*** *Plant Sci.* 10 296. doi: 10.3389/fpls.2019.00296

ElSohly MA, Gul W. (2014). **"Constituents** *of cannabis sativa* **in** ***the Handbook of Cannabis."*** ed. Pertwee R. (Oxford: Oxford University Press;), 3.–22. doi: 10.1093/acprof:oso/9780199662685.003.0001

ElSohly MA, Slade D. (2005). **Chemical components of marijuana: a complex mixture of natural cannabinoids .** *Life Sci.* 78 539-548. doi: 10.1016/j.lfs.2005.09.011

Fairbairn JW (1972). **Trichomes and glands** of Cannabis sativa L ***BULL.*** *STUPEF* 24 29–33.

Farha MA, **El-Halfawy OM, Gale RT, Macnair CR, Carfrae LA, Zhang** X. et al. . (2020). **Uncovering the hidden antibiotic potential of hemp .** *ACS Infect. Dis.* 6 338-346. doi: 10.1021/acsinfecdis.9b00419

Flores-Sanchez IJ, Verpoorte R. (2008). **Secondary metabolism in cannabis .** *Phytochem. Rev.* 7 639. doi: 10.1007/s11101-008-9094-4 615-

Gohad P, McCoy J, Wambier C, Kovacevic M, Situm M, Stanimirovic A, et al. . (2020). **The new cannabidiol sunscreen protects keratinocytes and melanocytes from ultraviolet B radiation .** *J. Cosmet. Dermatol.* 20 1350-1352. two: 10.1111/jocd.13693

Gülck T., Møller BL (2020). Phytocannabinoids: origin and biosynthesis . *Trends Plant Sci.* 25 985-1004. doi: 10.1016/j.tplants.2020.05.005

Hammond CT, Mahlberg PG (1973). **The morphology of glandular hairs** *of Cannabis sativa* from scanning **electron** microscopy. *Am. J. Bot.* 60 524-528. doi: 10.1002/j.1537-2197.1973.tb05953.x

Hanuš LO, Meyer SM, Muñoz E., Taglialatela-Scafati O., Appendino G. (2016). **Phytocannabinoids: a unified critical inventory .** *Nat. Prod. Rep.* 33 1357-1392. two: 10.1039/C6NP00074F

Hare JD, Elle E., Van Dam NM (2003). **Cost of glandular trichomes in Datura wrightii: a three-year study .** ***Evolution*** 57 793–805. doi: 10.1111/j.0014-3820.2003.tb00291.x

Hawley D., Graham T., Stasiak M., Dixon M. (2018). **Improving the quality and yield of hemp buds using lighting under the canopy .** *HortScience* 53 1593–1599. doi: 10.21273/HORTSCI13173-18

Janatová A., Fraÿková A., Tlustoš P., Hamouz K., Božik M., Klouÿek P. (2018). Yield and content of cannabinoids in different genotypes of hemp (Cannabis *sativa* **L.) for medical use.** *Indian _ Crops Prod.* 112 363-367. doi: 10.1016/j.indcrop.2017.12.006

Jin D., Dai K., Xie Z., Chen J. (2020). **Secondary metabolites profiled in inflorescences, leaves, stem barks and roots of medicinal cannabis .** *Sci. Rep.* 10:3309. doi: 10.1038/s41598-020-60172-6

Kim ES, Mahlberg PG (1991). **Development of the secretory cavity in the glandular trichomes** *of Cannabis sativa* L. (Cannabaceae) . *Am. J. Bot.* 78 220-229. doi: 10.1002/j.1537-2197.1991.tb15749.x

Machine Translated by Google

Kim ES, Mahlberg PG (1997). **Immunochemical localization of tetrahydrocannabinol (THC) in cryofixed glandular trichomes of hemp (Cannabaceae) .** *Am. J. Bot.* 84 336-342. doi: 10.2307/2446007 **Kim** KS,

Vuong TD, Qiu D, Robbins RT, Grover Shannon J, Li Z, et al. . (2016). **Advances in breeding, genetics and genomics for resistance to three nematode species in soybean .** *theor. Appl. Genet.* 129 2295-2311. doi: 10.1007/s00122-016-2816-x

Koren A., Sikora V., Kiprovski B., **Brdar-Jokanoviÿ M., Aÿimoviÿ M., Konstantinoviÿ B., et** al. . (2020). **The controversial taxonomy of cannabis .** *Genetics* 52 **Leme FM, Schönenberger J., Staedler YM,** . 1–13. doi: 10.2298/GENSR2001001K

Teixeira SP (2020). **Comparative floral evolution reveals new aspects of floral structure and diversity in Cannabaceae .** 64-83. doi: *Bot. J. Linn. Soc.* 193 10.1093/botlinnean/boaa004

Levin DA (1973). **The role of trichomes in plant defense .** *Q. Rev. Biol.* 48 . 3-15. doi: 10.1086/407484

Liu Y, Zhu P, Cai S, Haughn G, Page JE (2021). **Three new transcription factors involved in biosynthesis** of cannabinoids in Cannabis *sativa* L. *Plant Mol. Biol.* 106 . 49-65. doi: 10.1007/s11103-021-01129-9

Livingston SJ, Quilichini TD, Booth JK, Wong DCJ, Rensing KH, Laflamme-Yonkman J, et al. . (2020). **Cannabis glandular trichomes change morphology and content during flower maturation** 37-56. doi: 10.1111/tpj.14516 metabolites. *Plant J.* 101

Lyu D, Backer R, Robinson WG, Smith DL (2019). **Plant growth-promoting rhizobacteria for hemp production: yield, cannabinoid profile and disease resistance .** ***Front.*** *Microbiol.* 10:1761. doi: 10.3389/ fmicb.2019.01761

Magagnini G., Grassi G., Kotiranta S. (2018). **The influence of the light spectrum on the morphology and content of cannabinoids** in *Cannabis sativa* L . *Med. Cannabis Cannabinoids* 1 . 19–27. doi: 10.1159/000489030

Mahlberg PG, Kim ES (2004). **Accumulation of cannabinoids in glandular trichomes of hemp (Cannabaceae) .** *J. In. Konope* 9 . 15-36. doi: 10.1300/J237v09n01_04

Marks MD, Tian L, Wenger JP, Omburo SN, Soto-Fuentes W, He J, et al. . (2009). **Identification of candidate genes affecting** A9-tetrahydrocannabinol biosynthesis in *Cannabis sativa . J. Exp. Bot.* 60 . 3715-3726. doi: 10.1093/jxb/erp210

Matoušek J., Kocábek T., Patzak J., Bÿíza J., Siglova K., Mishra AK, et al. . (2016). **A "putative" role of transcription factors of the HlWRKY family in the regulation of the final steps of prenylflavonoid and bitter acid biosynthesis** in hops (Humulus *lupulus* L.) . *Plant Mol. Biologicals* 92 263-277. doi: 10.1007/s11103-016-0510-7

Mediavilla V., Steinemann S. (1997). **Essential oil from the stems of** *Cannabis sativa* L. *J. Ind. Hemp* 4 . 80-82.

Mishra AK, Kocábek T., Nath VS, Awasthi P., Shrestha A., Killi UK, et al. . (2020). Dissection of the dynamic **transcriptome landscape of the leaf, leaf and lupulin gland in hops (Humulus** *lupulus* L.) . *Int. J. Mol. Sci.* 21 :233. doi: 10.3390/ijms21010233

Mudge EM, Brown PN, Murch SJ (2019). **Cannabis** terroir : terpene metabolomics as a tool for understanding *Cannabis sativa Planta Med.* 85 **Bricklayer** LE (2020). " **Structural peculiarities of leaf** . 781-796. doi: 10.1055/a-0915-2550, PMID:

glandular trichomes: a review ," in *Plant Cell and Tissue Differentiation and Secondary Metabolites.* ***Reference series in phytochemistry.*** ed. Ramawat K., Ekiert H., Goyal S. (Cham: Springer;), 1.–35.

Namdar D., Mazuz M., Ion A., Koltai H. (2018). **Variations in cannabinoid and terpenoid composition in** *Cannabis sativa* **inferred from inflorescence position along the stem and extraction methods .** *Ind. Crop. Prod.* 113 376-382. doi: 10.1016/j.indcrop.2018.01.060 **Nerio** LS,

Olivero-Verbel J., Stashenko E. (2010). **Repellent activity of essential oils: A review .** *Bioresour. Technol.* 101 372-378. doi: 10.1016/j.biortech.2009.07.048

Machine Translated by Google

Ohlsson A., Abou-Chaar CI, Agurell S., Nilsson IM, Olofsson K., Sandberg F. (1971). Cannabinoid constituents of male and female Cannabis sativa. Taurus Narc. 23 29 – 32.

Pagnani G., Pellegrini M., Galieni A., D'Egidio S., Matteucci F., Ricci A. et al. . (2018). Plant Growth Promoting Rhizobacteria (PGPR) in Cannabis sativa 'Finola' Cultivation: An Alternative Fertilization Strategy to Improve Plant Growth and Quality Characteristics. Ind. Crop. Prod. 123 75-83. doi: 10.1016/j.indcrop.2018.06.033

Panche AN, Diwan AD, Chandra SR (2016). Flavonoids: An Overview. J. Nutr. Sci. 5:e47. doi: 10.1017/jns.2016.41

Pate DW (1983). Possible role of ultraviolet radiation in the development of hemp chemotypes. Econ. Bot. 37 , 396-405. doi: 10.1007/BF02904200

Potter DJ (2009). Promotion, characterization and optimization of Cannabis sativa L. as phytopharmaceuticals. Doctoral thesis. London, England: King's College London.

Ren G, Zhang X, Li Y, Ridout K, Serrano-Serrano ML, Yang Y, et al. . (2021). Large-scale whole-genome resequencing reveals domestications of Cannabis sativa. Sci. Adv. 7 :eabg2286. doi: 10.1126/sciadv.abg2286 history

Russo EB (2011). Taming THC: potential synergism of hemp and concomitant effects of phytocannabinoids and terpenoids. Bro. J. Pharmacol. , 1344–1364. doi: 10.1111/j.1476-5381.2011.01238.x

163 Russo EB, McPartland JM (2001). Hemp and hemp extracts: greater than the sum of their parts? J. Cannabis Ther. 1 , 103-132.

Saloner A., Bernstein N. (2021). Nitrogen supply affects the cannabinoid and terpenoid profile in medicinal cannabis (Cannabis sativa L.). Ind. Crop. Prod. 167 :113516. doi: 10.1016/j.indcrop.2021.113516

Sangwan NS, Farooqi AHA, Shabih F, Sangwan RS (2001). Regulation of essential oil production in plants. Regulation of plant growth. 34 , 3-21. two: 10.1023/A:1013386921596

Sirikantaramas S., Taura F., Tanaka Y., Ishikawa Y., Morimoto S., Shoyama Y. (2005). Tetrahydrocannabinolic acid synthase, the enzyme controlling the psychoactivity of marijuana, is secreted into the storage cavity of glandular trichomes. Plant Cell Physiol. 46 , 1578-1582. doi: 10.1093/pcp/pci166

Sirikantaramas S., Yamazaki M., Saito K. (2008). Mechanisms of resistance to self-produced toxic secondary metabolites in plants. Phytochem. 7:467. doi: 10.1007/s11101-007-9080-2 Spitzer-Rimon B., Duchin S.,

Bernstein N., Kamenetsky R. (2019). Architecture and florogenesis in female plants of Cannabis sativa · Front. Plant Sci. 10:350. doi: 10.3389/fpls.2019.00350

Swider J.. (2021). Lab shopping: Emphasizing the need for checks and balances in cannabis. Available at: https://cannabisindustryjournal.com/column/lab-shopping-highlighting-the-need-for-checks-and-balances-in-cannabis/ (accessed 6 May 2021).

Taghinasab M., Jabaji S. (2020). The hemp microbiome and the role of endophytes in modulating the production of secondary metabolites: a review . Microorganisms 8:355. doi: 10.3390/microorganisms8030355

Tanney CAS, Backer R, Geitmann A, Smith DL. Cannabis Glandular Trichomes: A Cellular Metabolite Factory. Front Plant Sci. 2021 Sep 20;12:721986. doi: 10.3389/fpls.2021.721986. PMID: 34616415; PMCID: PMC8488169.

Tang K, Struik PC, Yin X, Calzolari D, Musio S, Thouminot C, et al. . (2017). A comprehensive study of planting density and the effect of nitrogen fertilization on the cultivation of dual purpose hemp (Cannabis sativa L.). In. Crop. Prod. 107 427-438. doi: 10.1016/j.indcrop.2017.06.033

Taschwer M., Schmid MG. (2015). Determination of the relative percentage distribution of THCA and ÿ9-THC in plant cannabis seized in Austria - Effect of different storage temperatures on stability. Forensic Sci. Int. 254 , 167-171. doi: 10.1016/j.forsciint.2015.07.019

Machine Translated by Google

Tian N., Liu F., Wang P., Zhang X., Li X., Wu G. (2017). **Molecular basis of glandular trichome development and secondary metabolism in plants .** ***Plant Gene*** 12 **Tissier** A., Morgan JA, . 1–12. doi: 10.1016/j.plgene.2017.05.010

Dudareva N. (2017). **Plant volatiles: they enter the trichome cavities "in", but not "out" .** *Trends Plant Sci.* 22 . 930-938. doi: 10.1016/j.tplants.2017.09.001

Tomko AM, Whynot EG, Ellis LD, Dupré DJ (2020). Anticancer potential of cannabinoids, terpenes and flavonoids present in cannabis . *Cancers* 12:1985. doi: 10.3390/cancers12071985

Toth JA, Stack GM, Cala AR, Carlson CH, Wilk RL, Crawford JL, et al. . (2020). **Development and validation of genetic markers for sex and cannabinoid chemotype in** Cannabis *sativa* L. *GCB Bioenergy* 12 213-222. doi: 10.1111/gcbb.12667

van Klingeren B., ten Ham M. (1976). **Antibacterial activity of** A9-tetrahydrocannabinol and cannabidiol. *Antonie Van Leeuwenhoek* 42 . 9.–12. two: 10.1007/BF00399444

Vanhove W., Van Damme P., Meert N. (2011). **Factors determining the yield and quality of illicit indoor hemp (cannabis spp.) production .** *Forensic Sci. Int.* 212 . 158-163. doi: 10.1016/j.forsciint.2011.06.006

Grand View Research (2020). **Essential Oils Market Size, Share and Trend Analysis Report by Application (Food & Beverage, Spa & Relax), by Product (Orange, Peppermint), by Sales Channel Forecasts 2020-2027 .** *San Francisco, CA.* **Segments available** at: https://www.grandviewresearch.com/industry-analysis/essential-oils-market#:~:text=The%20global%20essential%20oils%20market%20size%20was%20estimated%20at%20USD,USD%**2018.6%20billion20in202020.&text=%20global%20essential%20oil%20market%20is%20expected%20 to%20grow%20at,USD%2033.3%20billion20to 202027 (accessed June 21, 2027**

Wagner GJ (1991). **Secretion of glandular trichomes: more than just hairs .** *Plant Physiol.* 96 . 675-679. doi: 10.1104/pp.96.3.675

Yamauchi T., Shoyama Y., Aramaki H., Azuma T., Nishioka I. (1967). Tetrahydrocannabinolic acid , **the true substance of tetrahydrocannabinol .** *Chem. Pharm. Bull.* 15 . 1076-1079. doi: 10.1248/cpb.15.1075

Zager JJ, Lange I, Srividya N, Smith A, Markus Lange B (2019). **Gene networks underlying cannabinoid and terpenoid accumulation in** cannabis. *Plant Physiol.* 180 1877–1897. doi: 10.1104/pp.18.01506

Zoorob MJ (2021). **The frequency distribution of reported THC concentrations in legal cannabis flower products steadily increases around the 20% THC threshold in Nevada and Washington .** *J. Cannabis Res.* 3:6. doi: 10.1186/s42238-021-00064-2

Machine Translated by Google

The effect of activated water with the IPS system on the biochemical composition of selected parts of cannabis plants (Cannabis sativa)

AQIPS-05-E02

Contents

A. Methodology of the experiment

1. Objective of the experiment: Determination of changes in the content of selected biologically active components in selected parts of the hemp plant sown after the application of activated water and innovative alginite products
2. Research workplace: Institute of Plant and Environmental Technologies, Faculty of Agrobiology and Food Resources, SPU Nitra

3. Research team: doc. Ing. Ján Brindza, CSc., Ing. Vladimíra Horÿinová Sedláÿková, PhD., Mgr. Olga Grygorieva, PhD., doc. Svetla Motyleva, PhD., Ing. Jana Šimková

4. Tested variants
Designation of hemp samples sown 2020
KONV1KSTO- Hemp, variant control, stalks KONV1KPL-
Hemp, variant control, chaff KONV2PL- Hemp,
variant V2, chaff KONV3PL- Hemp, variant
V3, chaff KONV4PL- Hemp, variant V4, chaff
KONV5PL - Hemp, variant V5, chaff
KONV6PL- Hemp, variant V6, chaff
KONV6STO- Hemp, variant V6, stems

5. Applied analytical methods

Determination of cannabinoids

Extraction

The process of extracting cannabinoids varies depending on the material used from which the cannabinoids are extracted. The main goal is reproducibility, high yield and selectivity. The quality of the extraction is a basic prerequisite for a correct analysis. The first step is a rough extraction, which can be done in two ways: liquid-liquid component or solid component. For both, a suitable solvent is used: immiscible with the other (liquid-liquid extraction, LLE) or absorption into the solid phase (solid phase
extraction, SPE) (Raharjo and Verpoorte 2004). The advantage of SPE is high reproducibility with the possibility of automation, as well as a significant reduction in solvent volume compared to LLE (Scheidweiler et al. 2013).
Extraction from urine or serum is possible directly using SPE without prior treatment.

When extracting from plant material, the best choice is LLE, or solid-liquid extraction (solid-liquid extraction, SLE). The greatest demand for extraction and detection is for THC, CBD, CBN and their precursor acids.
Several types of solvents are used, from polar ones such as methanol and ethanol (Chang et al. 1997; Bacigalupo et al. 1999) to less polar ones such as benzene (Yotoriyama et al. 2005) and petroleum ether (Tsatsakis et al. 2000).
Petroleum ether is used in many procedures, for its ability to extract not only neutral cannabinoids,

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but also their acids (Ndjoko et al. 1998). Solvent combinations such as methanol:chloroform (1:1) are used to develop the cannabinoid profile of the plant, for its ability to extract almost all cannabinoids (Lehmann and Brenneisen 1995). The most widespread combination of solvents is n-hexane:ethyl acetate (9:1), which has a yield >90% (Jurado et al. 1996). Preserving the original ratio and amount of cannabinoids in the material is difficult and the temperature limits of the extraction must be taken into account. At 37°C and 60°C and the ratio of neutral cannabinoids differed considerably (Turner and Mahlberg 1984).

Detection

During detection, it is necessary to take into account the temperature and possible treatment of the sample. A common procedure for gas chromatography (gas chromatography, GC) involves gasifying the sample before by injection, which causes decarboxylation of cannabinoid acids and thus only decarboxylated forms can be detected. In the body, cannabinoids are metabolized into more polar compounds with a high boiling point, which causes the substance to break down before gasification and is therefore unsuitable for direct GC. An option is to derivatize the sample, in order to increase stability and fluidity, as well as preparation for identification by mass spectrometry (MS). Pentafluoro-1-propanol (PFPA) and 2,2,3,3,3-

pentafluoro-1-propanol (PFPOH) (Segura et al. 1998). For plant samples, trimethyl silylation using trimethylhalosilanes, trimethylsilyl-(TMS)-amines, (TMS)-esters and (TMS)-amides is the most widely used.

A combination of reagents is possible, namely BSTFA with 1% TMCS. Other options are alkylation trimethylanilinium hydroxide (TMAH) and tetrabutylammonium hydroxide (TBH) (Raharjo and Verpoorte 2004). Besides GC, derivatization can also be used to improve detection in HPLC and thin layer chromatography (TLC) by introducing fluorescent groups (Szabady et al. 2002).

Thin-layer chromatography Thin-layer

analysis of cannabinoids can be performed on silica gel impregnated with silver nitrate in toluene, silica gel G-60 alone, and using 3-methyl-2-benzothiazolinone hydrazone (MBTH) as a visualization reagent (Lavanya and Baggi 1990; Yotoriyama et al. 2005). Despite the good selectivity and sensitivity of TLC, this method is significantly worse compared to other methods. Scale up

selectivity can be achieved by using the so-called over-pressure chromatography on an F254s plate impregnated with silicone rubber (Szabady et al. 2002). Fluorescent derivatization (as described above) increases the sensitivity of TLC to form dansyl derivatives, which are subsequently separated on silica gel with a mixture of isooctane: ethyl acetate: acetic acid (30:20:1). After injection with Triton-X100:chloroform:n-hexane (1:20:80) it is quantitatively measured at 340 nm. This method was applied to a plasma sample (Alemany et al. 1993).

Gas chromatography

Gas chromatography is the most widely used technique for analyzing cannabinoids. However, it is not possible to detect all types with it, as several are thermally unstable, as is the case with acids that quickly decarboxylate to their neutral forms at elevated temperatures (CBDA to CBD, THCA to THC and others). Non-polar silica columns such as HP-1 and HP-5 as well as DB-1 and DB-5 are most commonly used as stationary phases.
Mass spectroscopy is mostly used to detect separated cannabinoids (Chang et al. 1997).
Determination of the cannabinoid profile is possible after derivatization of the sample, but most procedures omit this step due to the focus on neutral forms as quantification targets, regardless of their acidic precursors (Lercker et al. 1992). Internal standards such as 5ÿ cholestane (Matsunaga et al. 1990), docosane (Ferioli et al. 2000) and tetracosane (Stefanidou et al. 2000) were successfully used for the quantification itself, which is often used in conjunction with flame ionization for its thermal stability. In some newer procedures, deuterated cannabinoids are used as internal standards for detection using a mass detector.

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High performance liquid chromatography

The main advantage of HPLC is the possibility of determining acidic cannabinoids without the need for complex sample preparation. The plant material can be used directly after extraction to determine the phenotype of the plant (Rustichelli et al. 1998). The most commonly used is the reverse arrangement with the octadecyl type. A protective pre-column with the same stationary phase is recommended. Methanol:water (8:2) is use separation of CBDA, CBD, THC and CBN. After adding a weak acid to the aqueous component of the mobile phase, it is also possible to distinguish THCA (Lehmann and Brenneisen 1992). Another option for the mobile phase is acetonitrile:water (1:1), where it is also possible to add an acidic component such as formic or acetic acid, chloroacetic acid or sulfuric acid (buffered with NaOH or KOH). With isocratic elution, it is possible to separate CBD, THC, CBN and their acid forms. Lehmann and Brenneisen successfully separated and detected 13 **major cannabinoids from plant material using gradient elution with a** water:acetonitrile mobile phase **containing 8.64 g/L phosphoric acid in the aqueous component. The gradient started at 47% acetonitrile increasing linearly to 60% in 38 min and further to** 70% in 10 **min, followed by a decrease to 47% in 2 min and held isocratically for another 10 min (Lehmann and Brenneisen 1995). A photodiode detector is used for detection , primarily at 220nm, which shows lower LOD values than GC. For high sensitivity, it is also possible to use thermospray-MS, but there are variations in the results due to the instability of the spray (Ndjoko et** al. 1998).

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B. RESULTS

Table 1 Comparison of detected biochemical components in tested hemp samples

	Retention time (min)	Component	Peak area (%)							
			A	I	B	C	D	AND	F	G
			KOV1 KST	KOV6 ST	KOV1 PCS	KOV2 PL	KOV3 PL	KOV4 PL	KOV5 PL	KOV6 PL
1	9:41	Ritalinic acid		0,54						
2	10:04	Clycerol	25,05	22,7	85,36	73,20	63,64	86,45	62,8	84,21
3	10:29 4	Butanedioic acid	9,83	12,24	0,70	0,97	1,07		1,01	0,56
	10,39 5	Myo-Inositol								
	10:49 6	Glyceric acid	1,52	1,35	0,96	1,9	1,17	0,75	1,18	0,83
	11:06 7	Pipecolic acid	6,45	3,78	0,90	1,95	1,49	1,10	2,07	1,40
	11:11 8	Adenine		0,92						
	11:40 9	Methylsuccinic acid	3,50	7,56	2,13	2,41	2,08	1,58	1,87	1,33
	11:44 10	Propanedioic acid		0,48						
	12:09 11	Butanoic acid			0,60	0,62	0,77			
	12:14 12	3-Hydroxy-2,3 dihydromaltol				0,73	0,97			0,50
	12:42 13	2-Hexenoic acid	1,05	4,85		0,45	1,0		0,79	0,44
	12:51	Malic acid	0	30,28	0 0	6,37	5,78		4,79	1,54
14	13:06	L-5-Oxoproline	3,23	4,55	3,45	3,70	4,52	2,30	3,96	2,39
15	13:10	L-Threitol	1,09	1,09	2,40	1,45	1,91	1,30	1,77	1,42
16	13:21	Acrylic acid		0,34		0,49	0,76		0,54	0,41
17	13:36	2,3,4-Trihydroxybutiric acid	0	0,99	1,08	2,9	3,42		2,29	1,21
18	13:40	Propanetritol		0,36	0	0,98	0,88	0,96	1,00	0,60
19	13:49	Tartronic acid	1,09	2,06		0,77			0,84	0,49
20	14:02 21	Xylose	0	5,62	1,43 0,99 0 7,30		3,36	5,9	15,13	6,48
	14:30 22	Benzoic acid	1,97	0,06						
	15:21 23	Ribitol	2,61	0,55	2,00		1,63	2,5	1,80	1,90
	15:38 24	L-(-)-Arabitol	0,08	0,24	7,96	8,60	7,51	9,84	7,98	8,11
	15:49 25	Vanillic acid		0,12						
	15:57 26	Uridine		0,06		0,82	0,65		0,51	
	16:04 27	D-(+)-Ribono-1,4-lactone	0,24	0,22		1,07	0,82		1,57	0,76
	16:17 28	Ribonic acid	0,19	0,47	0 0 0,39	0,39	0,47		0,43	0,33
	16:26 29	Methyl-a-D-glucofuranoside	0 0	1,72						
	16:32 30	D-Psychofuranose	0,30 0,61 5,44 0	19,91	7,35	5,60	7,49	4,75	4,73	5,89
	16:37 31	D-(-)-Tagatofuranos	26381 21,60 0,21		14,37	13,41	16,27	9,96	9,33	11,17
	16:46	1,2-Benzenedicarboxylic acid	0,24 9,29 3,33		1,44	0,52	0,42	1,18	0,49	0,50
32	16:55	Arabinofuranose	1,02 4,25 3,43							
33	16:57 34	D-(+)-Talofuranose	18,80 0,16 0,42				1,8			
	17:07 35	D-Pinitol	13,14 13,89 1,67		0	40,21	44,13	50,67	36,82	51,71
	17:17 36	Erythro-Pentonic acid	0,97 4,11 4,43		40,49	0,67	0,34	0,41	0,50	0,36
	17:25 37	D-(+)- Galactopyranose	0,16 0,22 0 0,28 0		0,62	1,34	2,33		0,42	0,55
	17:34 38	4-Coumaric acid	0,98		2,59	0,57		1,61		
	17:39 39	2-Aminobenzoxazole			1,39	1,28	1,59	0,85	0,85	1,10
	17:48 40	D-Mannitol			1,50	1,75	7,16	9,31	7,21	6,91
	17:52 41	D-Sorbitol			7,93	1,82	1,33	2,33	1,33	2,13
	17:59 42	Scyllo-Inositol			2,19	0,93	1,10	1,36	0,79	0,90
	18:06 43	D-(-)-Ribofuranose			1,05	2,63	1,57	0,60	1,73	0,74
	18:19 44	Glucopyranose a-			1,42	2,38	3,9	1,41	4,61	
	18:22 45	D-(+)-Talopyranose	72,73		2,66	2,50	3,72	2,7	4,73	
	18:34 46	Palmitic acid	4,75	16,83	3,09	6,64	5,06	7,28	13,38	
	19:13 47	D-Trehalose			7,26	2,24	2,96	0,98	1,59	
	19:15 48	Inositol	3,23	16,49	1,18	0,24		1,61		3,04
	19:28	Caffeic acid	0,51	1,22	2,09 0,44	0,57	0,55	0,38	0,47	0,33

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49 19:44 50	3-Methylglutaric acid	0	0,63	0,34	0,37	0,27	0,21	0,39	0,32
19:51 51	Arachidonic acid	0	0,45	2,18	1,69	1,25	2,29	0,45	2,66
19:54 52	9-Dodecyl-1-ol			0,57	0,39	0,29	0,62		0,67
20:00 53	9,12-Octadecanoic acid		9,62						
20:03 54	9,12-Octadecadienoic acid a-	1,50	7,37	31,59	27,52	22,21	33,75	26,68 33,25	
20:06 55	Linolenic acid			16,58	14,89	11,41	17,61	14,38 15,95	
20:13 56	L-Rhamnose		1,73	0,66	0,78	0,98		0,81 0,61 2,01	
20:17 57	Stearic acid	0	4,31	2,34	2,04	1,91	2,14	2,18	
20:36 58	Cannabidoidy	0,86	4,19	21,80	30,32	37,21	23,40	30,97 26,95	
20:41 59	D-Psychofuranose	0,49	3,07						
20:48 60	D-Glucose	1,06 0,80	2,60						
20:52 61	Methylsuccinic acid			0,16	0,16	0,25	0,15	0,17	0,18
20:55 62	Altronic acid	0,30	0,72						
21:06 63	2-Keto-d-gluconic acid		0,54						
21:10 64	Scyllo-inositol	0 0	1,89						
21:12 65	2-Deoxyribofuranose			1,16	1,28	1,74	1,00	1,38	1,42
21:15 66	Ethyl-a-D-glucopyranoside	0	1,35						
21:20	D-Xylopyranose			0,15		0,20			0,14
67 21:29 DELTA 9-Tetrahydrocannabinol 0 68 21:30			1,46						
	DELTA, 8-Tetrahydrocannabiol 69 21:43			2,35	1,79	3,29	1,28	3,57	1,71
	Methyl galactoside 70			0,24	0,21	0,15	0,31	0,21	0,25
21:49 a-D-Glucopyranuronic acid 71 21:50		0,29	6,33						
	Deoxyglucose 72			0,93	0,91	0,71	0,86	0,89	0,84
21:55	Arachidic acid 73	0,11	1,24	1,01	0,94	0,89	1,01	1,01	1,14
22:04	D-Psychopyranose			0,74	0,67	0,74	0,66	0,70	0,66
74 22:09	Cannabinol	0	0,59	0,43	0,36	0,90	0,27	0,70	0,41
75 22:17	Levoglucosan 76	0	1,53	0,30	0,39	0,67		0,33	0,45
22:32	2-Methoxyestradiol 77			0,64	0,41	0,88	0,17	0,87	0,73
22:56	78 millibioses			3,30	3,13	3,83	4,37	1,50	1,23
23:05	Sucrose	11,02		6,77	11,10	9,12	5,68	4,88	
79 23:11 D (+)-Cellobiose 80 23:17		0,49			0,85	0,84	0,36	0,59 0,20	
	Lactose				2,90	4,24		1,56 0,91	
81 23:28	Behenic acid 82			0,99	0,79	0,68	1,19	0,65 1,16	
23:35 b-Sitosterol		0,88		2,17	5,12	4,62		3,99 1,03 69,34	
83 24:06:00 D- Fructose		66,5		86,13	73,89	63,89	86,17	93,5 2,65 2,44	
84 25:21:00 Benzenepropanoic acid					1,31	1,83	1,64		
85 35:20:00 Dihydroartemisinin		69,62	91,3	22,80	27,32	31,51	19,79	31,16 23,5	48,62
86 37:41:00 Scopolin 87			8,71	60,31	51,02	49,56	64,53	59,9 20,22	16,6
37:52:00 3-a-Mannobiose				16,89	21,26	18,94	15,69		

C. Conclusions

The results document that the application of alginite products significantly influenced the increase many biologically active components.

In the case of cannabidoids, compared to the control variants (0.49 - 21.80), we recorded an increase in all variants after the application of the innovative alginite products in the range from 23.40 - 37.21 (peak area).

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The effect of activated water with the IPS system on the content of polyphenols in selected parts of cannabis plants (Cannabis sativa)

AQIPS-05-E03

Contents

A. Methodology of experiments

1. Objective of the experiment: Determination of changes in the content of selected biologically active components in selected parts of the hemp plant sown after the application of activated water and innovative alginite products

2. Research workplace: Institute of Plant and Environmental Technologies, Faculty of Agrobiology and Food Resources, SPU Nitra

3. Research team: doc. Ing. Ján Brindza, CSc., Ing. Vladimíra Horÿinová Sedláÿková, PhD., Mgr. Olga Grygorieva, PhD., Mgr. Olena Vergun, PhD.

4. Experiments - variant

a) Experiments – Trenÿín (T)

Evaluated plant parts: K – inflorescence; L – leaves; S- stem;
Variant TA variant without pressurized water TB variant with pressurized water
Plant V11 V12 V13 V14 V15 V11 V12 V13 V14 V15

b) Piešÿany experiments

Control - Plants fertilized as standard by the farmer / without application of preparations
V1 - Plants treated twice with a suspension solution of 20g/liter by spraying on the leaf
V2 - Plants treated twice with a suspension solution of 30g/liter by spraying on the leaf
V3 - Plants treated twice with a suspension solution of 60g/liter by spraying on the leaf

5. Methods of determination of tested components

Polyphenol content, mg GAE/g The
total polyphenol content of the extracts was measured by the method of Singleton and Rossi (1965) using Folin Chiocalteu's reagent. 0.1 ml of each sample extract was mixed with 0.1 ml of Folin-Chiocalteu reagent, 1 ml of 20% (w/v) sodium carbonate and 8.8 ml of distilled water. After 30 min. absorbance at 700 nm was measured in the dark using a Jenway spectrophotometer (6405 UV/Vis, England). Gallic acid (25–250 mg/l, R2=0.996) was used as standard and results were expressed in mg/g gallic acid equivalents.

Content of phenolic acids, mg CAE/g
Determination of the total content of phenolic acids in the extracts was carried out by the method of Farmakopeia Polska (1999). 0.5 ml of the sample extract was mixed with 0.5 ml of 0.5 M hydrochloric acid, 0.5 ml of Arno's reagent, 0.5 ml of 1 M sodium hydroxide (w/v) and 0.5 ml of distilled water. Absorbance at 490 nm was measured using

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spectrophotometer Jenway (6405 UV/Vis, **England). Caffeic acid** (1–200 mg/l, R2=0.999) **and results were expressed in mg/g caffeic acid equivalents.**

Flavonoid content, mg QE/g Total
flavonoid content (TFC) Determination of total flavonoid content was performed according to the procedure described by Shafii et al. (2017). 0.5 mL of sample extract was mixed with 0.1 mL of 10% (w/v) ethanolic aluminum chloride solution, 0.1 mL of 1 M sodium acetate, and 4.3 mL of distilled water. After 30 min. absorbance at 415 nm **was measured in the dark** using a **Jenway spectrophotometer (6405 UV/Vis, England). Quercetin (0.01–0.5** mg/L; R2 **= 0.997) and results were expressed in mg/g quercetin equivalents.**

Antioxidant activity determined by the DPPH method

Antiradical activity of plant biomass was determined in ethanol extracts. Samples of 1 g in 25 ml of 96% ethanol were stirred for 12 hours, and after filtering the samples, the antiradical activity was determined. As part of the antiradical activity (ability to eliminate free radicals), the ability of plants to remove DPPH• radicals (2,2-diphenyl-1-picrylhydrazyl) was tested by the methods of Brand-Williams et al. (1995). The absorbance at 515 nm was **recorded at regular time intervals until the reaction equilibrium was reached -** using a GENESYS 20 Vis spectrophotometer (Thermo Fisher Scientific Inc., USA). First, the absorbance **of DPPH• (Sigma Aldrich, USA) without antioxidant (control)** was measured . **Inhibition of DPPH• radicals was calculated as a percentage of free DPPH• radicals in the samples using the method of Von Gadow et al. (1997):**

$$\% Inh = (A0 - A1)/A0 \cdot 100$$

where: A0 **is the absorbance of the control at time t = 0 min (DPPH•**
solution), A1 **is the absorbance of the antioxidant at time t (min), the results are in % inhibition of DPPH radicals.**

Antioxidant activity determined by the TE/g method

DPPH radical scavenging assay (DPPH) The radical scavenging activity of the samples was measured using 2,2-
of diphenyl-1-picrylhydrazyl (DPPH) (Sánchéz-Moreno et al., 1998). The extracts (0.5 mL) were mixed with 3.6 mL of radical solution (0.025 g DPPH in 100 mL ethanol). The absorbance of the sample extract was determined using a Jenway spectrophotometer (6405 UV/Vis, England) **at 515 nm.** Trolox (6-hydroxy 2,5,7,8-tetramethylchroman-2-carboxylic **acid) (10–100** mg/L; R2 = 0.988) **was used as a standard, and results were expressed in** mg/g Trolox equivalents.

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B. Results

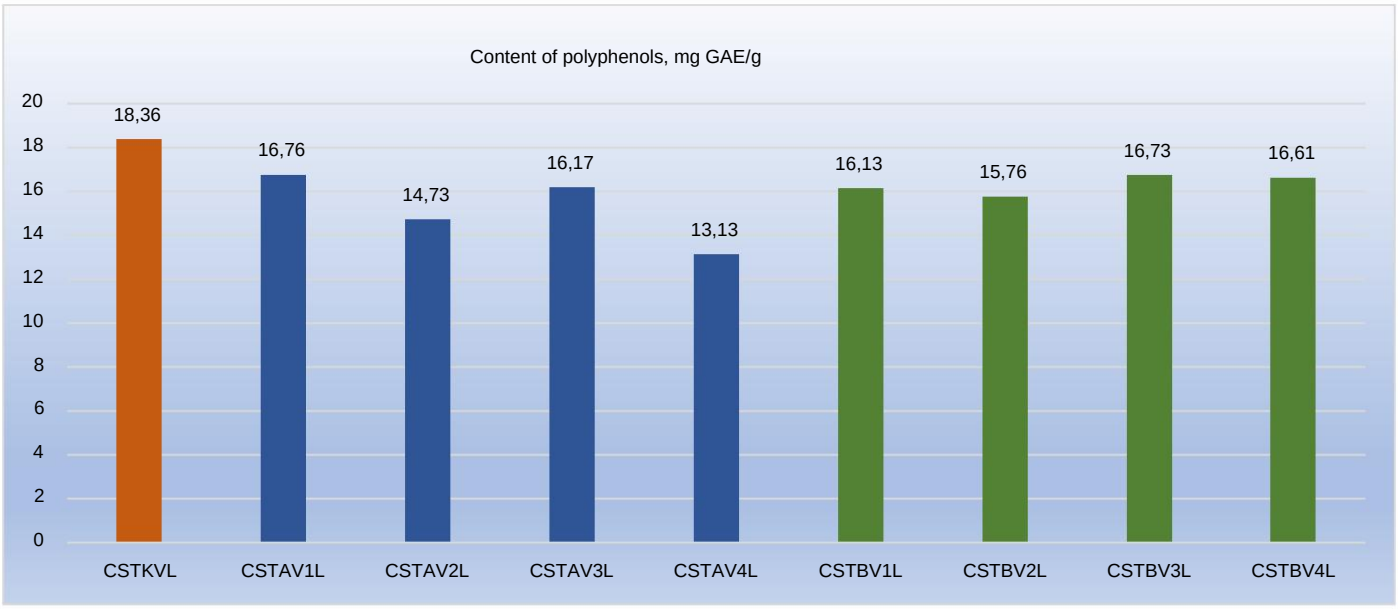

Figure 1 Comparison of the application of alginite products (V1 – V4) with the application of activated water by the IPS system (B variant) on the biosynthesis of the total content of polyphenols (mg GAE/g dry matter) in cannabis leaves (Cannabis sativa) compared to the control variant (A variant)) at the Trenÿianske Jastrabie site (2021)

The results show that in the tested leaf samples we recorded a lower content of polyphenols compared to the control variant (Figure 1).

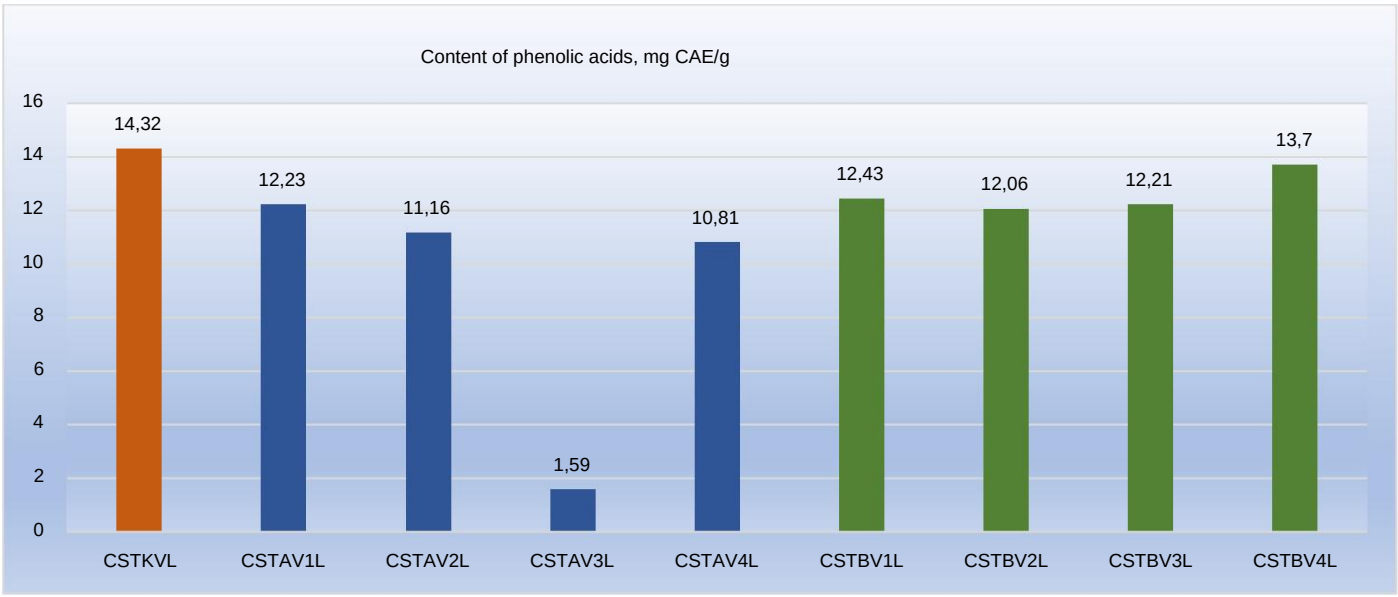

Figure 2 Comparison of the application of alginite products (V1 – V4) with the application of activated water by the IPS system (B variant) on the biosynthesis of the total content of phenolic acids (mg CAE/g dry matter) in cannabis leaves (Cannabis sativa) compared to the control variant (A) variant) at the Trenÿianske Jastrabie station (2021)

The results show that we recorded a lower content of phenolic acids in the tested leaf samples compared to the control variant (Figure 2).

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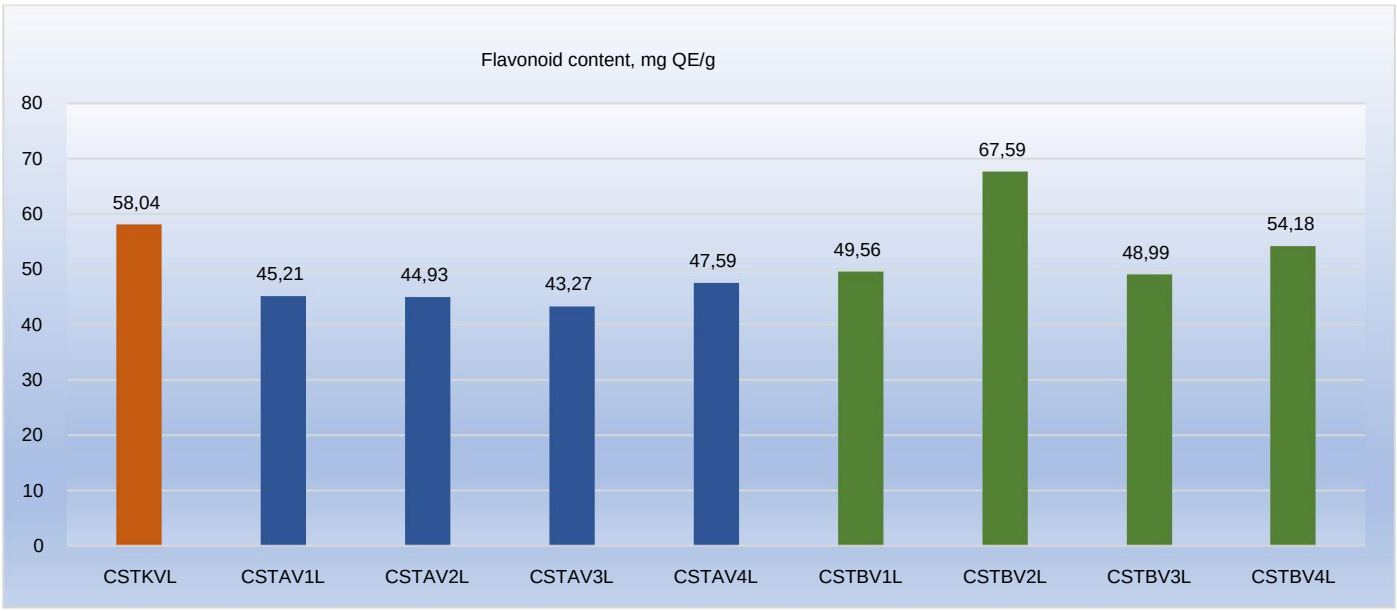

Figure 3 Comparison of the application of alginite products (V1 – V4) with the application of activated water by the IPS system (B variant) on the biosynthesis of the total flavonoid content (mg QE/g dry matter) in the leaves of hemp (Cannabis sativa) compared to the control variant (A variant) at the Trenÿianske Jastrabie site (2021)

The results show that in the tested leaf samples we recorded a lower content of flavonoids compared to the control variant (Figure 3), except for the variant after the application of activated water and alginite products (BV2).

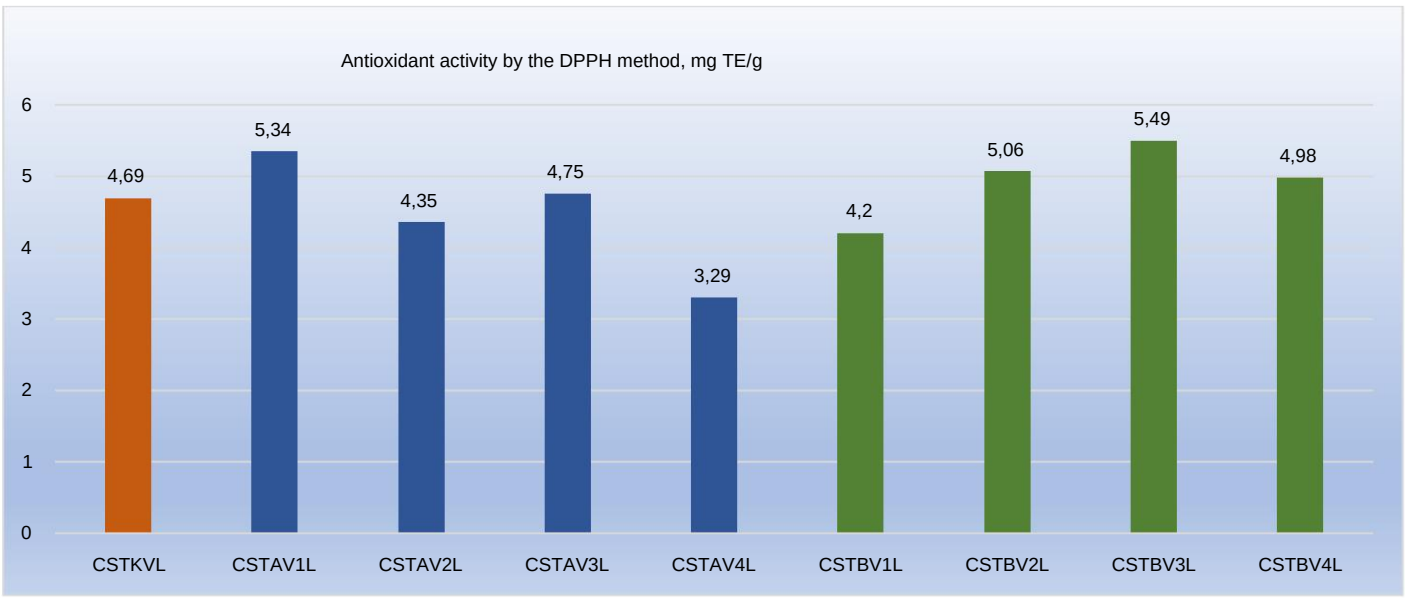

Figure 4 Comparison of the application of alginite products (V1 - V4) with the application of activated water by the IPS system (B variant) on the antioxidant activity (by the DPPH method in mg TE/g) TE/g dry matter) in hemp leaves (Cannabis sativa) compared to control variant (A variant) at the Trenÿianske Jastrabie station (2021)

The results show that we recorded a higher antioxidant activity in the tested leaf samples
compared to the control variant (Figure 4) mainly in variants after application of activated water and alginite products (BV2, BV3 and BV4) and in variant V1 without activated water.

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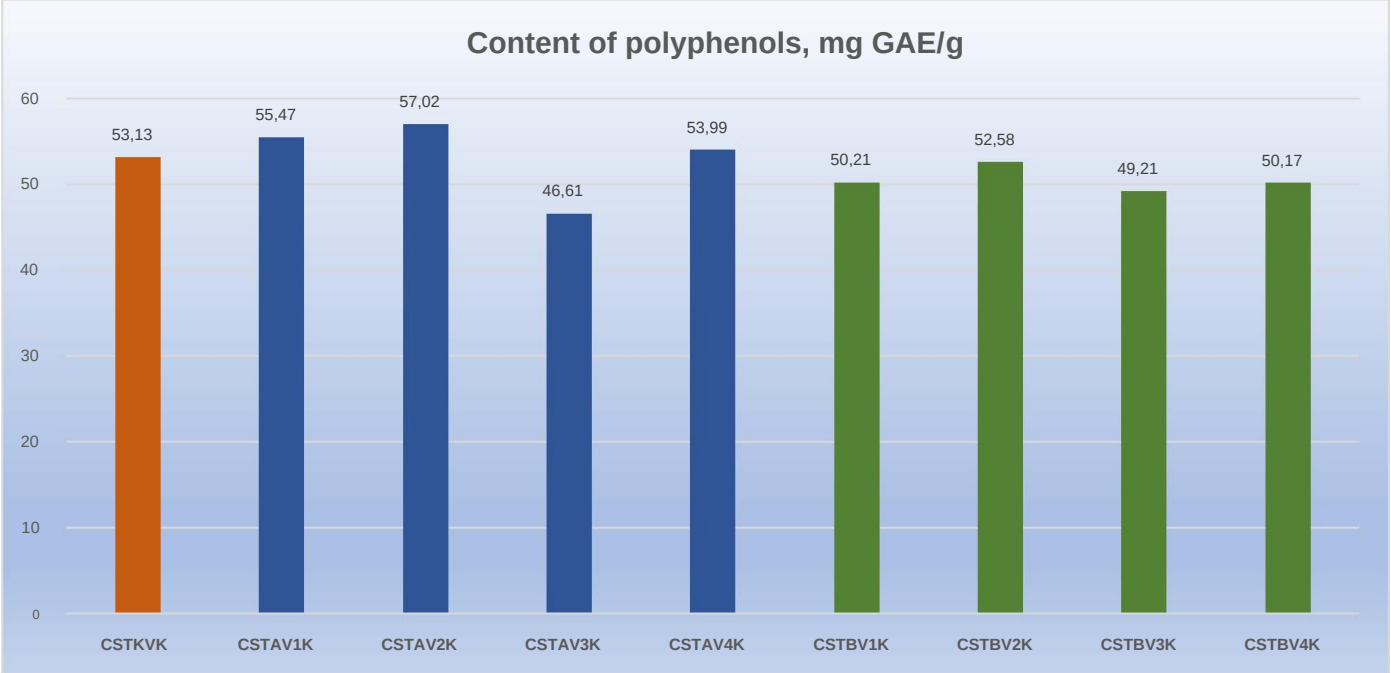

Figure 5 Comparison of the application of alginite products (V1 – V4) with **the application of activated water by the IPS system (B variant) on the biosynthesis of the total content of polyphenols (mg GAE/g dry matter) in the inflorescences of cannabis** *(Cannabis sativa)* compared **to the control variant (A variant)) at the Trenÿianske Jastrabie station (2021)**

The results show that in the tested inflorescence samples we recorded a higher content of polyphenols compared to the control variant (Figure 5) in the variants without the application of activated water and alginite products (AV1, AV2 and AV4).

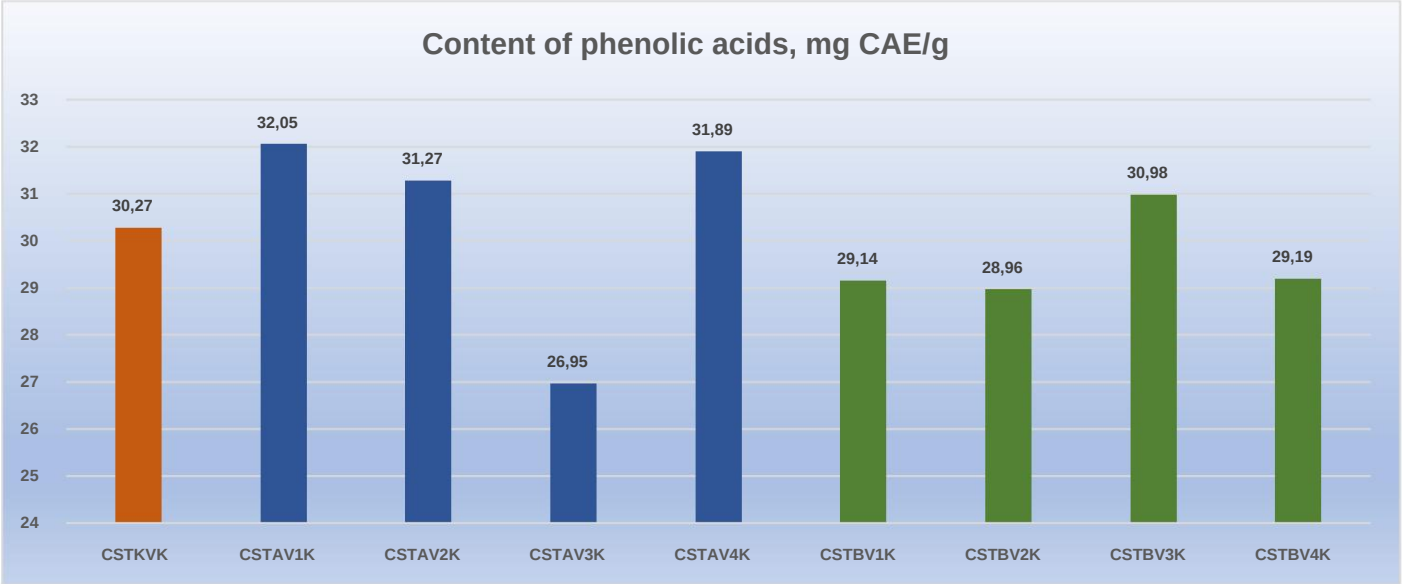

Figure 6 Comparison **of the application of alginite products (V1 –** V4) with **the application of activated water by the IPS system (B variant) on the biosynthesis of the total content of phenolic acids (mg CAE/g dry matter) in the inflorescences of cannabis** *(Cannabis sativa)* compared **to the control variant (A variant) at the Trenÿianske Jastrabie site (2021)**

The results show that in the tested inflorescence samples we recorded a higher content of phenolic acids compared to the control variant (Figure 6) in the variants without the application of activated water and alginite products (AV1, AV2 and AV4).

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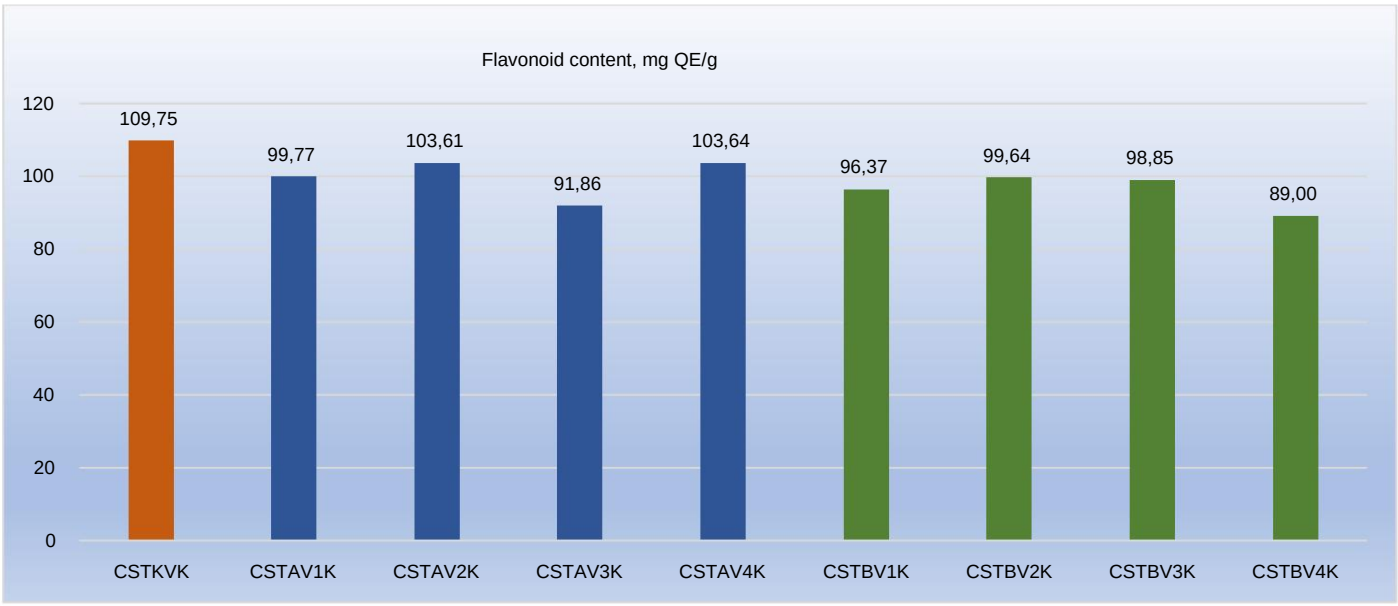

Figure 7 Comparison of the application of alginite products (V1 – V4) with the application of activated water by the IPS system (B variant) on the biosynthesis of the total flavonoid content (mg QE/g dry matter) in the inflorescences of cannabis (Cannabis sativa) compared to the control variant (A variant)) at the Trenÿianske Jastrabie station (2021)

The results show that we recorded a lower content of flavonoids in the tested inflorescence samples compared to the control variant (Figure 7).

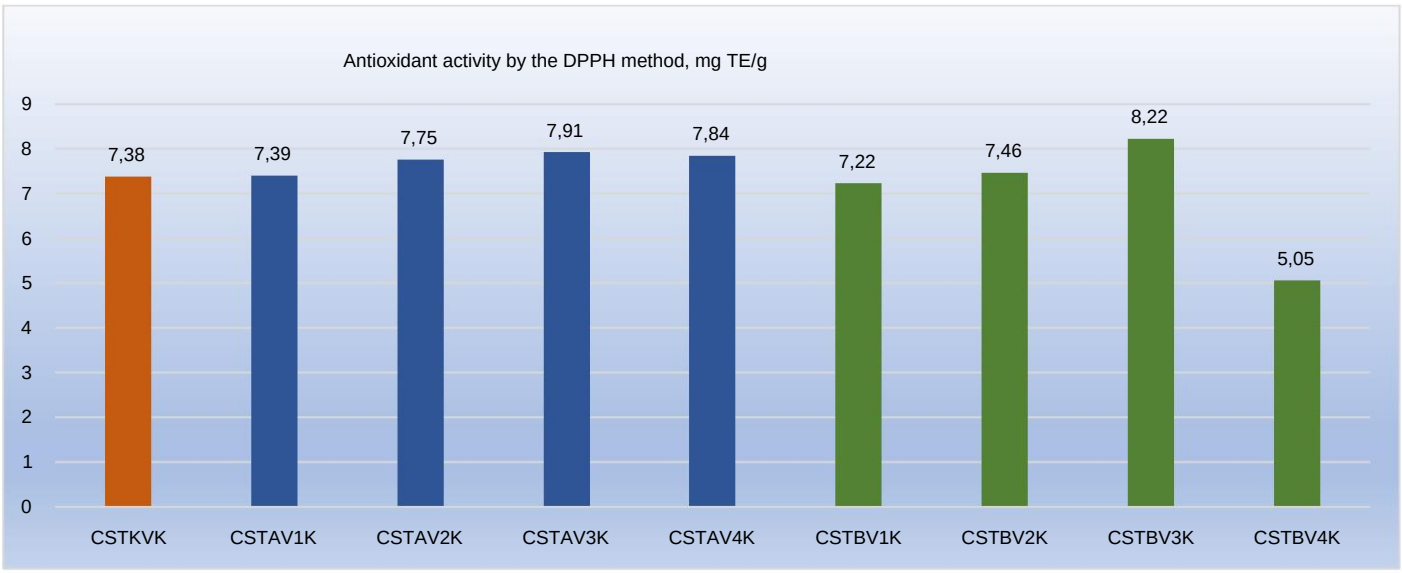

Figure 8 Comparison of the application of alginite products (V1 - V4) with the application of activated water by the IPS system (B variant) on the antioxidant activity (by the DPPH method in mg TE/g) TE/g dry matter) in the inflorescences of hemp (Cannabis sativa) compared to control variant (A variant) at the Trenÿianske Jastrabie station (2021)

The results show that in the tested samples of inflorescences we recorded a higher antioxidant activity compared to the control variant (Figure 8) in all variants without the application of activated water and in the variants with the application of activated water and alginite products (BV2 and BV3).

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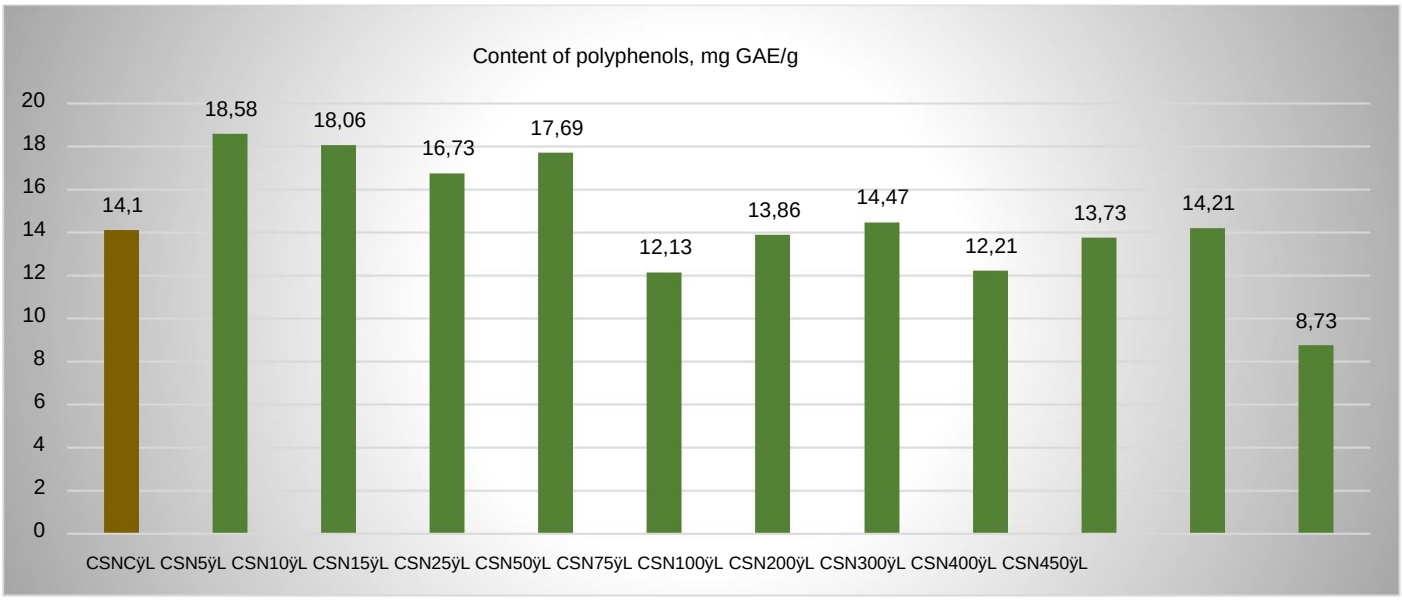

Figure 9 Comparison of hemp variants grown in pots watered at different pressures of activated water by the IPS system for the biosynthesis of total polyphenol content (mg GAE/g dry matter) in hemp leaves
(Cannabis sativa) at the Nitra site (2021)

The results show that in the tested leaf samples we recorded a higher content of polyphenols compared to the control variant (Figure 9) when applying activated water at a pressure of 5Pa, 10Pa, 15Pa, 25Pa.

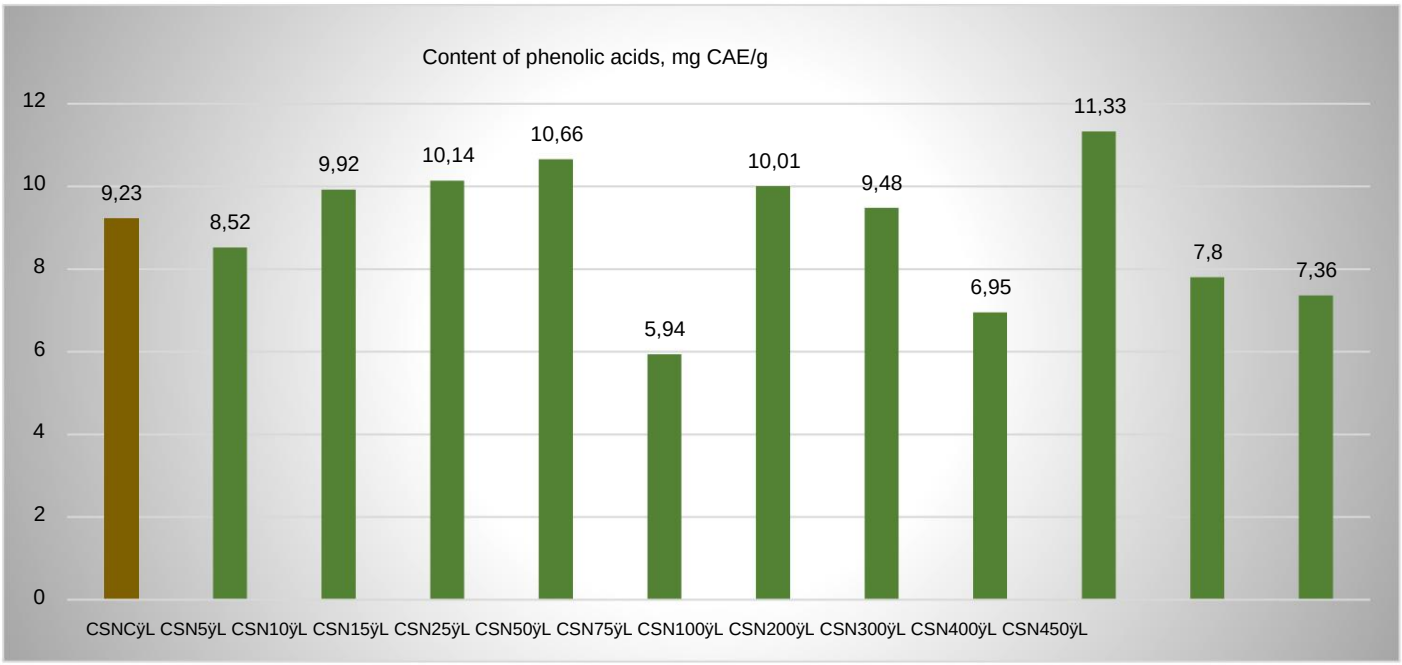

Figure 10 Comparison of varieties of hemp grown in pots watered at different pressures of activated water by the IPS system for the biosynthesis of the total content of phenolic acids (mg CAE/g dry matter) in the leaves of hemp (Cannabis sativa) at the Nitra site (2021)

The results show that in the tested leaf samples we recorded a higher content of phenolic acids compared to the control variant (Figure 10) when activated water was applied at a pressure of 10Pa, 15Pa, 25Pa, 75Pa and 300Pa.

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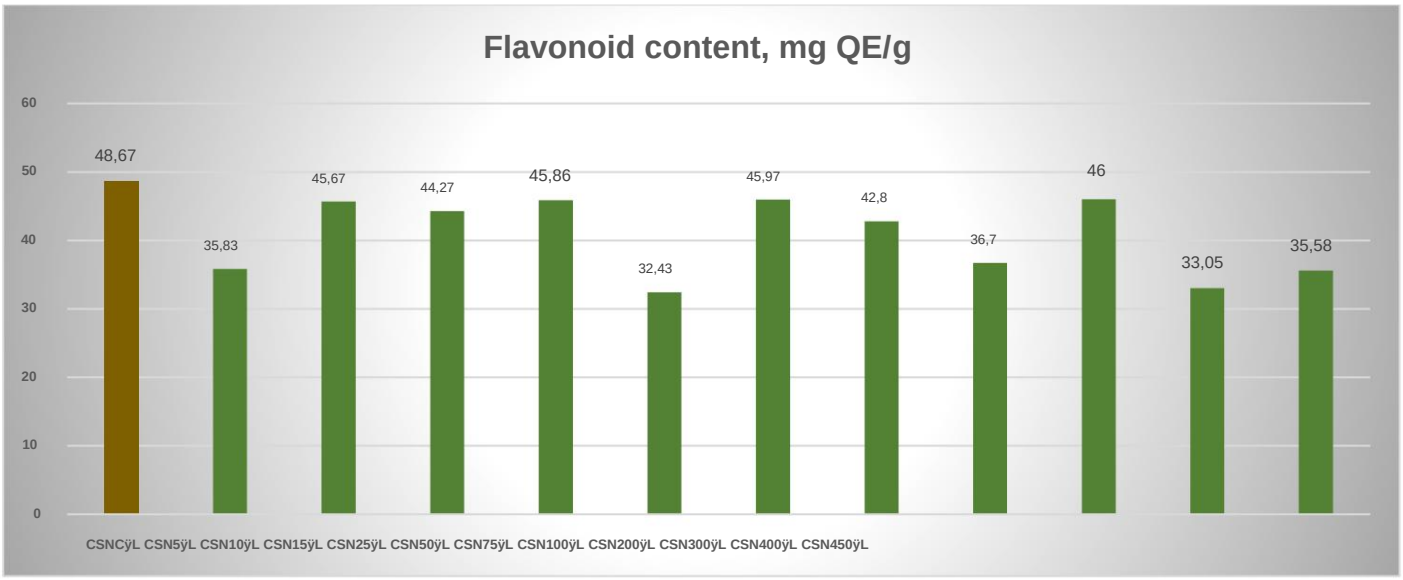

Figure 11 Comparison of hemp variants grown in **pots watered at different pressures of activated water by the IPS system for the biosynthesis of total flavonoid content (mg QE/g dry** matter) in hemp leaves *(Cannabis sativa)* **at the Nitra station (2021)**

The results show that in the tested leaf samples we recorded a lower content of flavonoids after the application of different pressures of activated water compared to the control variant (Figure

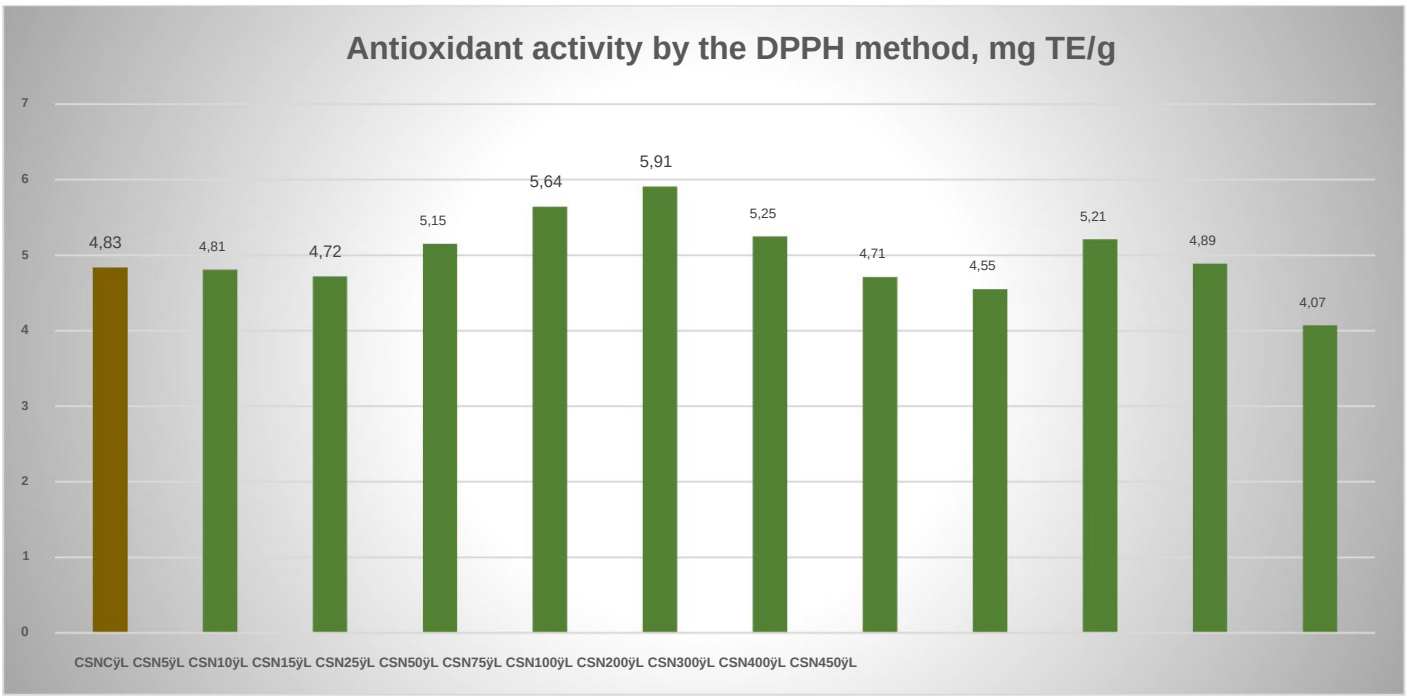

Figure 12 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water with the IPS system for antioxidant activity by the DPPH method** (mg TE/g dry matter) in leaves of hemp *(Cannabis sativa)* **at the Nitra site (2021)**

The results show that in the tested leaf samples we recorded a higher antioxidant activity compared to the control variant (Figure 12) when applying activated water at a pressure of 15Pa, 25Pa, 50Pa, 75Pa and 300Pa.

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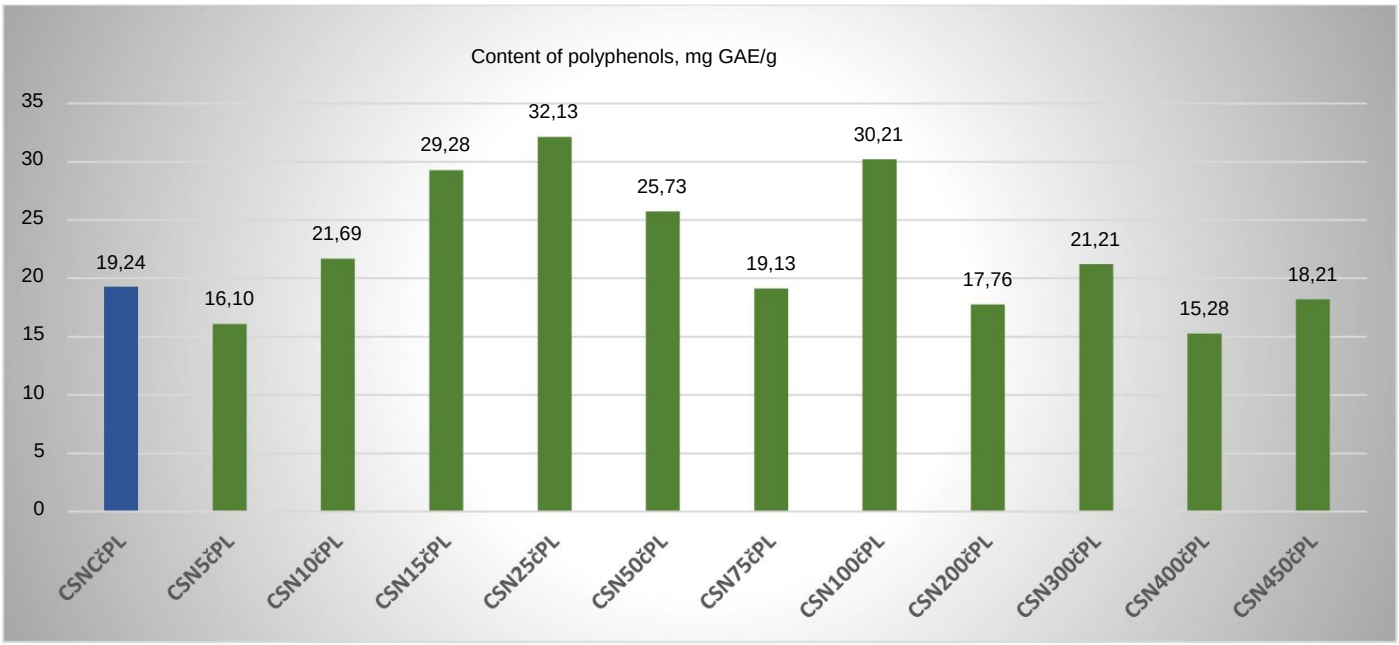

Figure 13 Comparison of hemp variants grown in pots watered at different pressures of activated water by the IPS system for the biosynthesis of the total content of polyphenols (mg GAE/g dry matter) in hemp husks
(Cannabis sativa) at the Nitra site (2021)

The results show that in the tested chaff samples we recorded a higher content of polyphenols compared to the control variant (Figure 13) when activated water was applied at a pressure of 10Pa, 15Pa, 25Pa, 50Pa, 100Pa and 300Pa.

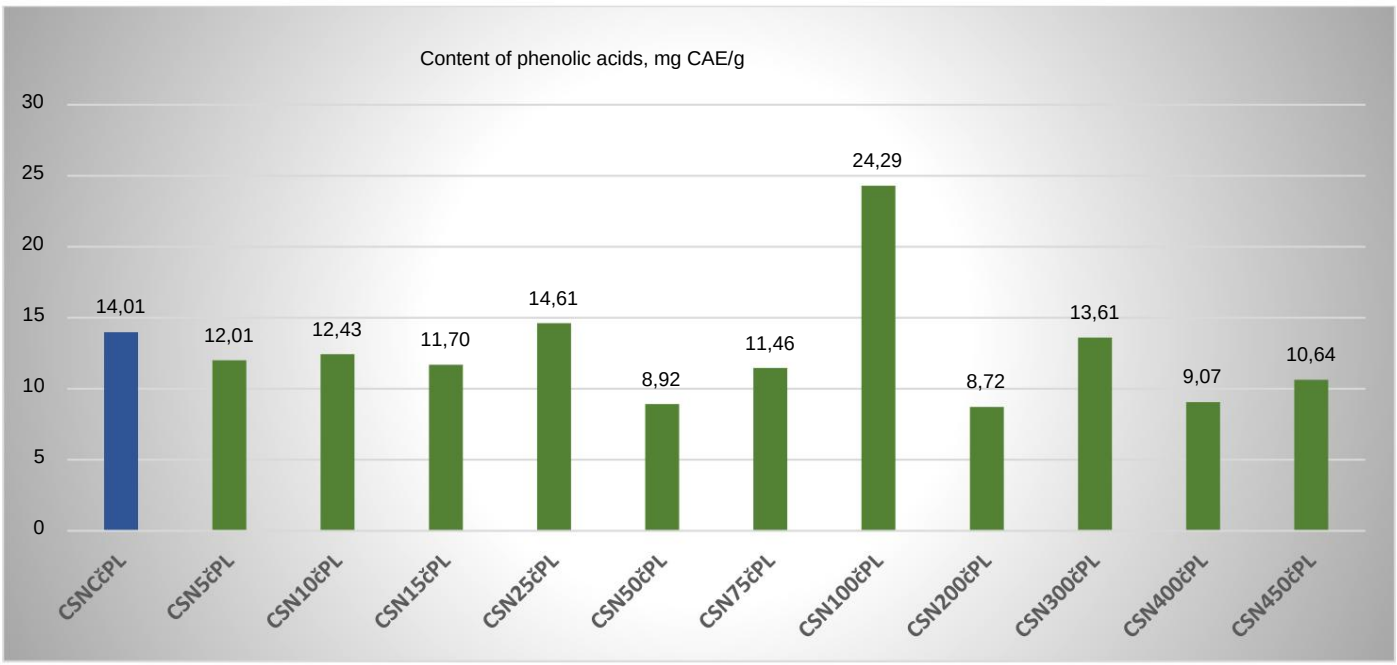

Figure 14 Comparison of varieties of hemp grown in pots watered at different pressures of activated water by the IPS system for the biosynthesis of the total content of phenolic acids (mg CAE/g dry matter) in chaff of hemp (Cannabis sativa) at the Nitra site (2021)

The results show that in the tested chaff samples we recorded a significantly higher content of phenolic acids compared to the control variant (Figure 14) when activated water was applied at a pressure of 100Pa.

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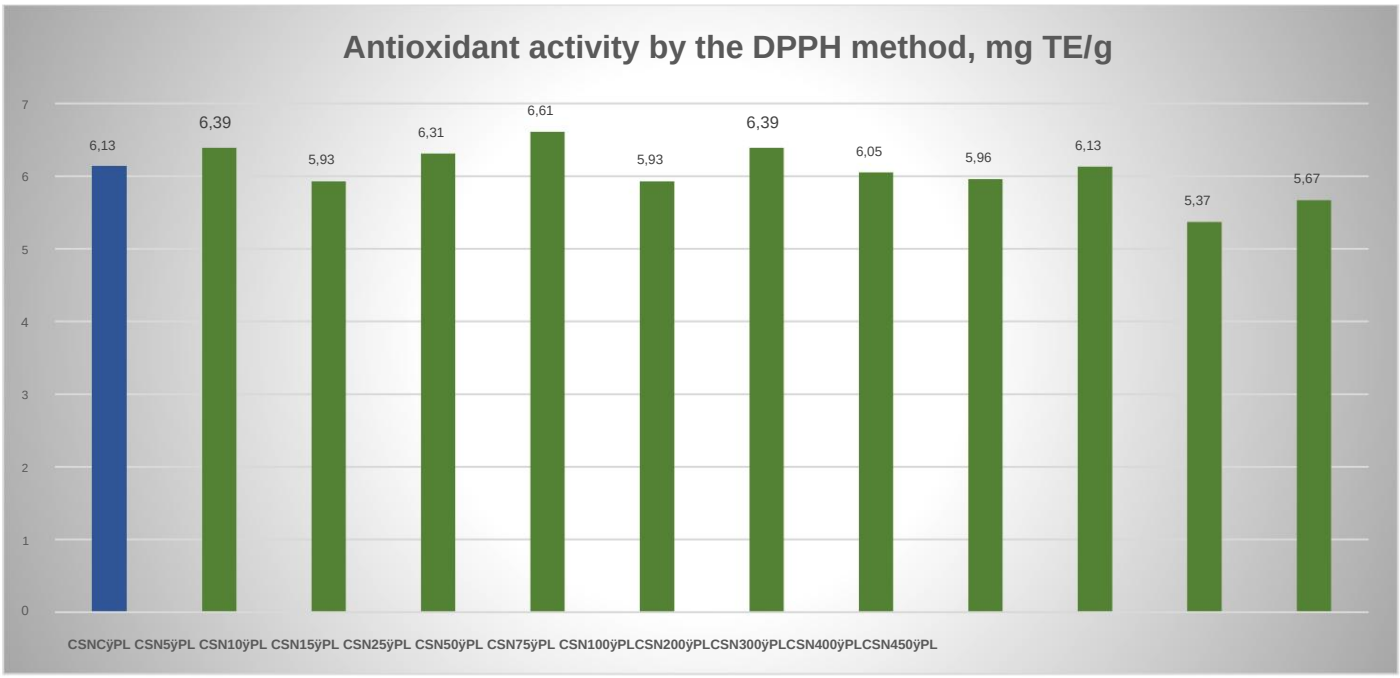

Figure 15 Comparison of varieties of hemp grown in **pots watered at different pressures of activated water by the IPS system for antioxidant activity by the DPPH method** (mg TE/g dry matter) in **chaff** of hemp *(Cannabis sativa)* **at the Nitra site (2021)**

The results show that in the tested chaff samples we recorded a higher antioxidant activity compared to the control variant (Figure 15) when applying activated water at a pressure of 5Pa, 15Pa, 25Pa and 75Pa.

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C. Conclusions

1. We noted a lower content of polyphenols in the tested leaf samples compared to the control variant.
2. We noted a lower content of polyphenolic acids in the tested leaf samples compared to the control variant, except for the variant after the application of activated water and alginite products (BV2).
3. In the tested leaf samples, we recorded a higher content of flavonoids compared to the control variant mainly in the variants after the application of activated water and alginite products (BV2, BV3 and BV4) and in the variant V1 without activated water.
4. In the tested samples of inflorescences, we recorded a higher antioxidant activity compared to the control variant in the variants without the application of activated water and alginite products (AV1, AV2 and AV4).
5. In the tested samples of inflorescences, we noted a higher content of phenolic acids compared to the control variant in the variants without the application of activated water and alginite products (AV1, AV2 and AV4).
6. In the tested inflorescence samples, we recorded a lower flavonoid content in comparison with control variant.
7. In the tested samples of inflorescences, we recorded a higher antioxidant activity compared to the control variant in all variants without the application of activated water and in the variants with the application of activated water and alginite products (BV2 and BV3).
8. We noted a higher content of polyphenols in the tested leaf samples compared to the control variant when activated water was applied at a pressure of 5Pa, 10Pa, 15Pa, 25Pa.
9. In the tested leaf samples, we recorded a higher content of phenolic acids compared to the control variant when activated water was applied at a pressure of 10Pa, 15Pa, 25Pa, 75Pa and 300Pa.
10. In the tested leaf samples, we noted a lower content of flavonoids after the application of different pressures of activated water compared to the control variant.
11. In the tested leaf samples, we recorded a higher antioxidant activity compared to the control variant when activated water was applied at a pressure of 15Pa, 25Pa, 50Pa, 75Pa and 300Pa.
12. We noted a higher content of polyphenols in the tested chaff samples compared to the control variant when activated water was applied at a pressure of 10Pa, 15Pa, 25Pa, 50Pa, 100Pa and 300Pa.
13. In the tested chaff samples, we noticed a significantly higher content of phenolic acids in comparison with a control variant with the application of activated water at a pressure of 100Pa.
14. In the tested chaff samples, we recorded a higher antioxidant activity compared to the control variant when activated water was applied at a pressure of 5Pa, 15Pa, 25Pa and 75Pa.

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AQIPS-06

The influence of the application of created alginite products on the production processes of hemp *(Cannabis sativa)* in field conditions

The influence of the application of the created alginite products on the biological and production processes of hemp *(Cannabis sativa)*

AQIPS-06-E01

Contents

A. Methodology of the experiment

1. Objective:

2. Location: Piešťany 3.

Form of experiments: field

4. Establishment of the experiment End of the experiment: 19.4.2021 **5. Applied alginite products:** UZA 20g/liter, UZA 30g/liter and UZA 60 g/liter)

6. Number of trial variants: 4 (K + 3 treatment variants in three repetitions)

7. Methodology: Type of experiment **- micro-plot experiment - randomly selected plots in the production stand (2** rows **- length 4 meters) for each tested variant in 3 repetitions.**

8. Treatments carried out 2 times during the vegetation period - **after connecting the growth (plant height approx. 50 cm) and after flowering of plants).**

9. Evaluated characteristics during vegetation (on the stand): emergence (date), beginning of flowering (date), technological maturity (date), number of plants per unit area at harvest, number of female plants in the stand .

10. Tested variety: Finola, **11.**

Description of variants and their designation:

Control - **Plants fertilized as standard by the farmer / without application of preparations**

V1 - **Plants treated twice with a suspension solution of 20g/liter by spraying on the leaf**

V2 - Plants treated twice with a suspension solution of 30g/liter by spraying on the leaf

V3 - **Plants treated twice with a suspension solution of 60g/liter by spraying on the leaf**

12. Solvers: Ing. Marián Miko, CSc., Ing. Jana Šimková; Ing. Vladimíra Horťinová Sedláťková, PhD., Ing. **ťubomír Pastucha, Eva Chovancová; Alexej Oravec, Gabriela Szabóová, E. Kovárová, Ing. B. Kováťová**

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B. Results

Table 1 Statistical characteristics of evaluated plant parts from hemp (Cannabis sativa) of the Finola variety grown in field conditions at the Piešÿany location in 2021 after the application of innovative alginite products - Control variant

Control	Weight flowering whorls (g) 26	Plant height (cm) 26	Number of whorls 15.04 45.73	Flower stem length (cm) 26.81	Number of seeds 7.02	The weight of the chaff part (g)
n		26	26	26	26	26
min	1.38	26	15	26	26	3,67
max	26.19	136	28	80	1641	10,63
x - diameter		109,62	20,38	58,69	995,92	5,48
s		11,13	3,68	12,02	311,03	1,68
sx		2,18	0,72	2,36	61,00	0,33
IN%		10,15	18,04	20,48	31,23	30,58

Table 2 Correlation analysis of the dependence between the evaluated characteristics of plant parts of hemp (Cannabis sativa) by the Pearson method - Control variant

Statistical indicators Weight	Number of flower whorls per plant	Plant height (g) (cm)		Flower stem length (cm)	Number of seeds	The weight of the chaff part (g)
Plant weight (g)	1					
Plant height (cm)	0,68	1				
Number of flower whorls	0,54	0,63	1			
Flower stem length (cm)	0,52	0,52	0,58	1		
Number of seeds	0,49	0,13	0,37	-0,07	1	
Weight of the chaff part (g)	0,62	0,32	0,43	-0,01	0,73	1
Seed weight (g)	0,40	-0,07	0,31	-0,10	0,93	0,74

Table 3 Statistical characteristics of evaluated plant parts from hemp (Cannabis sativa) of the Finola variety grown in field conditions at the Piešÿany location in 2021 after the application of innovative alginite products – Variant 1

Statistical indicators	Plant weight (g) 26	Height flowering plants 26	Number of whorls (cm)	Flower stem length (cm)	Number of seeds	The weight of the chaff part (g)
n			26	26	26	26
min	13,55	26	14	26	26	2,26
max	52,44	156	48	110	1500	10,45
x - diameter	26,07	117,81	22,77	58,65	847,85	5,23
s	10,54	14,55	9,10	20,37	306,52	2,39
sx	2,07	2,85	1,78	3,99	60,11	0,47
IN%	40,42	12,35	39,97	34,73	36,15	45,74

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Table 4 Correlation analysis of the dependence between the evaluated characteristics of the plant parts of hemp *(Cannabis sativa)* by the Pearson method – Variant 1

Variant 1	Weight	Plant height of the plant	Number of flower whorls	Flower stem length	Number of seeds	The weight of the chaff part
Plant weight (g)	1					
Plant height (cm)	0,73	1				
Number of flower whorls	0,41	0,56	1			
Flower stem length (cm)	0,64	0,48	0,32	1		
Number of seeds	0,64	0,35	0,41	0,35	1	
Weight of the chaff part (g)	0,43	0,32	0,49	0,14	0,79	1
Seed weight (g)	0,73	0,49	0,48	0,32	0,96	0,80

Table 5 Statistical characteristics of the evaluated plant parts from hemp *(Cannabis sativa)* of the Finola variety grown in field conditions at the Piešťany location in 2021 after the application of innovative alginite products – Variant 2

Variant 2	Plant weight	Plant height	Number of flower whorls 26	Flower stem length	Number of seeds	The weight of the chaff part
n	26	26		26	26	26
min	18,12	26	15	26	26	3,02
max	57,89	150	38	98	1848	8,75
x - diameter	**28,64**	**124,46**	**24,46**	**63,73**	**909,73**	**4,98**
s	9,00	12,26	6,35	17,44	324,27	1,33
sx	1,77	2,40	1,25	3,42	63,59	0,26
IN%	31,43	9,85	25,96	27,37	35,64	26,73

Table 6 Correlation analysis of the dependence between the evaluated characteristics of plant parts of hemp *(Cannabis sativa)* by the Pearson method – Variant 2

Variant 2	Weight	Plant height of the plant	Number of flower whorls	Flower stem length	Number of seeds	The weight of the chaff part
Plant weight (g)	1					
Plant height (cm)	0,73	1				
Number of flower whorls	0,41	0,56	1			
Flower stem length (cm)	0,64	0,48	0,32			
Number of seeds	0,64	0,35	0,41	1		
Weight of the chaff part (g)	0,43	0,32	0,49	0,35	1	1
Seed weight (g)	0,73	0,49	0,48	0,14 0,32	0,79 0,96	0,80

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Table 7 Statistical characteristics of the evaluated plant parts from hemp (Cannabis sativa) of the Finola variety grown in field conditions at the Piešÿany location in 2021 after the application of innovative alginite products – Variant 3

Variant 3	Plant weight	Plant height	Number of flower whorls 26	Flower stem length	Number of seeds	The weight of the chaff part
n	26	26		26	26	26
min	13,12	26	10	26	26	1
max	79,95	170	38	133	2210	10,65
x - diameter	32,78	125,00	24,62	66,00	1112,23	5,36
s	18,09	19,90	7,98	22,84	586,16	2,87
sx	3,55	3,90	1,57	4,48	114,96	0,56
IN%	55,19	15,92	32,42	34,61	52,70	53,56

Table 8 Correlation analysis of the dependence between the evaluated characteristics of plant parts of hemp (Cannabis sativa) by the Pearson method – Variant 3

Variant 3	Weight height of the plant	Plant	Number of flower whorls	Flower stem length	Number of seeds	The weight of the chaff part
Plant weight (g)	1					
Plant height (cm)	0,88	1				
Number of flower whorls	0,73	0,81	1			
Flower stem length (cm)	0,71	0,76	0,77	1		
Number of seeds	0,84	0,72	0,65	0,68	1	
Weight of the chaff part (g)	0,81	0,70	0,69	0,76	0,92	1
Seed weight (g)	0,95	0,81	0,71	0,70	0,95	0,90

Table 9 Statistical characteristics of evaluated plant parts from hemp (Cannabis sativa) of the Finola variety grown in field conditions at the Piešÿany location in 2021 after the application of innovative alginite products - for all variants

Variant	Plant weight	plant height	number of whorls 20.38 22.77	flower stem length	number of seeds	weight of the chaff part	seed weight
Control	26,81	109,62	24.46	58.69	995,92	5,48	9,96
Variant 1	26,07	117,81	24.62	58.65	847,85	5,23	8,97
Variant 2	28,64	124,46	104	63.73	909,73	4,98	9,28
Variant 3	32,78	125,00		66.00	1112,23	5,36	11,46
n	104	104		104	104	104	104
min	26,07	109,62	20,38	58,65	847,85	4,98	8,97
max	32,78	125,00	24,62	66,00	1112,23	5,48	11,46
x - diameter	28,58	119,22	23,06	61,77	966,43	5,26	9,92
s	3,01	7,19	1,97	3,69	114,61	0,21	1,11
sx	1,50	3,60	0,98	1,85	57,30	0,11	0,56
IN%	10,52	6,03	8,54	5,98	11,86	4,04	11,20

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Table 10 Correlation analysis of the dependence between the evaluated characteristics of plant parts of hemp *(Cannabis sativa)* by the Pearson method - for all variants

Tested characters on plants	Plant weight 1	Plant height	Number of flower whorls	Flower stem length	Number of seeds	The weight of the chaff part
Plant weight (g)						
Plant height (cm)	0,70	1				
Number of flower whorls	0,68	1,00	1			
Flower stem length (cm)	0,94	0,86	0,85	1		
Number of seeds	0,83	0,17	0,15	0,62	1	
Weight of the chaff part (g)	0,05	-0,64	-0,64	-0,29	0,55	1
Seed weight (g)	0,88	0,27	0,25	0,66	0,98	0,52

Table 11 Analysis of dispersion for the determination of the applied effects of innovative alginite products on the weight of cannabis plants *(Cannabis sativa* L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Effect Sum

	square	Grades Average driveability	square	F	p Variants Average Variant 1		1	2
					25.66 Abs. member 1		****	
85108.70	599.70 0.0	85108.70			**Control 26.80 Variants** 3 256.32 1.8061 0.1508 **Variant 2 28.64 Error** 101 141.92		**** ****	
Variant 3 32.78 LSD test, H		748.95	**omogeneous groups for alpha = 0 ... _ _ compared to the control variant**				**** ****	
(without alginite application). In plants treated with 2x suspension solution 20g/liter by spraying on the		14233.77						****

leaf (Variant 1), the weight of the plants decreased compared to the control variant (Table 11, Figure 1).

Table 12 Analysis of dispersion to determine the applied effects of innovative alginite products on plant height (cm) of hemp *(Cannabis sativa* L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Average

The Degrees of Freedom effect	Sum (squares		square	F	p	Variants Average 1		2
						Control 109.61		****
Abs. member	1490229	1	1490229	6809,516	0,000000	**Variant 1 117,51**	**** ****	
Variants	4059 **Error LSD**	3	1353	6,182	0.000671	**Variant 2 124,46**	****	
test,	22103	101	219			**Variant 3 125,00**	****	

Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 218.85, sv = 101.00

Conclusions: Hemp plants treated twice with a suspension solution of 20g/liter (variant 1), 30g/liter (variant 2) and 60g/liter (variant 3) sprayed on the leaves statistically significantly increased the height of the plants (cm) compared to the control variant (without applications of alginite), which is documented by the results of Table 12 and Figure 2.

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Table 13 Analysis of variance for the determination of the applied effects of innovative alginite products on the number of flower whorls of hemp *(Cannabis sativa* L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Effect Sum

	square	Grades Average driveability	square	F	p	Variants Average 1			2
						Check 20.38462			****
Abs. member 55372.08			55372,08	1096,307	0,000000	**Variant 1** 22,40741		**** ****	
Variants 310.56 **Error**		1	103,52	2,050	0,111701	**Variant 2** 24,46154		****	
5101.29 **LSD test,**		3 101	50,51			**Variant 3** 24,61538		****	

Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 50.508, sv = 101.00

Conclusions: Hemp plants treated twice with a suspension solution of 20g/liter (variant 1), 30g/liter (variant 2) and 60g/liter (variant 3) by spraying on the leaf showed a statistically significant increase in the number of flower whorls compared to the control variant (without alginite application), which is documented by the results of Table 13 and Figure 3.

Table 14 Analysis of variance for determining the applied effects of innovative alginite products on the length of the flower stalk (cm) of hemp *(Cannabis sativa* L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Total

Effect	square	Degrees of freedom	Average square	F	p	Variants Avg		1
						Variant 1 57,51852		****
Abs.	396841,7		396841.7	1127.728	0.000000	**Control** 58.69231		****
member	1288,6	1	429,5	1,221	0,306193	**Variant 2** 63,73077		****
Variants	35541,4	3 101	351,9			**Variant 3** 66,00000		****

Error LSD test, Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 351.89, sv = 101.00

Conclusions: Cannabis plants treated twice with suspension solution 30g/liter (Variant 2) and 60g/liter (Variant 3) by spraying on the leaf statistically significantly increased the length of flower stalks (cm) compared to the control variant (without alginite application). In plants treated with 2x suspension solution 20g/liter by spraying on the leaf (Variant 1), the length of the flower stalks (cm) was shortened compared to the control variant (Table 14, Figure 4).

Table 15 Analysis of variance for the determination of the applied effects of innovative alginite products on the number of hemp seeds *(Cannabis sativa* L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Effect Degree Average

	Sum square		square	F	p	Variants Average 1 freedom			2
						Variant 1 840,519 1		****	
Abs. member 97671653			97671653	615,6521	0,000000	**Variant 2** 909,731 3 362001		2,2818 **** ****	
Variants 1086003 **Error**			0,083714	**Kontrola** 995,923 101 158647		**Variant 3** 1112,231		**** ****	
16023394 **LSD test,**									****

Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 1586.102 sv = 101,00

Conclusions: Hemp plants treated twice with a suspension solution of 60g/liter (Variant 3) by spraying on the leaves statistically significantly increased the number of seeds on the plants compared to the control variant (without alginite application). In plants treated twice with a suspension solution of 20g/liter spraying per leaf (Variant 1) and 30g/liter spraying per leaf (Variant 2), the number of seeds on the plants decreased compared to the control variant (Table 15, Figure 5).

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Table 16 Analysis of dispersion for the determination of the applied effects of innovative alginite products on the weight of the chaff part of hemp (Cannabis sativa L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Effect Average

	Sum square	Degrees of freedom	square	F	p	Variants Average 1 Variant 2 4.98		
						Abs. member 2886.178		****
622.8440	0.000000	2886,178	1	5.15 Variants	0.2731	0.844646 Variant 3 5.36 Error 5.47 Control LSD test,		****
Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 4.6339, sv = 101.00		3,797	1		1,266			****
		468,021	3 101		4,634			****

Conclusions: After the application of alginite products, the weight of the chaff parts on the sown hemp plants in all variants decreased when compared to the control variant, which is documented by the results of Table 16 and Figure 6.

Table 17 Analysis of variance for the determination of the applied effects of innovative alginite products on the weight of hemp seeds (Cannabis sativa L.) - variety Finola grown in field conditions at the Piešťany location in 2021 Effect Degree Average

	Sum square	driveability	square	F	p	Variants Average 1			2
						Variant 1 8,84333		****	
Abs. member	10260.87	1	10260,87	540,1841	0,000000	Variant 2 9,28000		**** ****	
Variants 103.70 Error			34,57	1.8198	0.148326	Control 9.96077		**** ****	
1918.51 LSD test,		3 101	19,00			Variant 3 11,46308			****

Homogeneous groups for alpha = 0.0500, Error: between-group mean square = 18.995, sv = 101.00

Conclusions: Hemp plants treated twice with a suspension solution of 60g/liter (Variant 3) by spraying on the leaves statistically significantly increased the weight of the seeds on the plants compared to the control variant (without alginite application). In plants treated twice with a suspension solution of 20g/liter by spraying on a leaf (Variant 1) and 30g/liter by spraying on a leaf (Variant 2), the weight of seeds on the plants decreased compared to the control variant (Table 15, Figure 5).

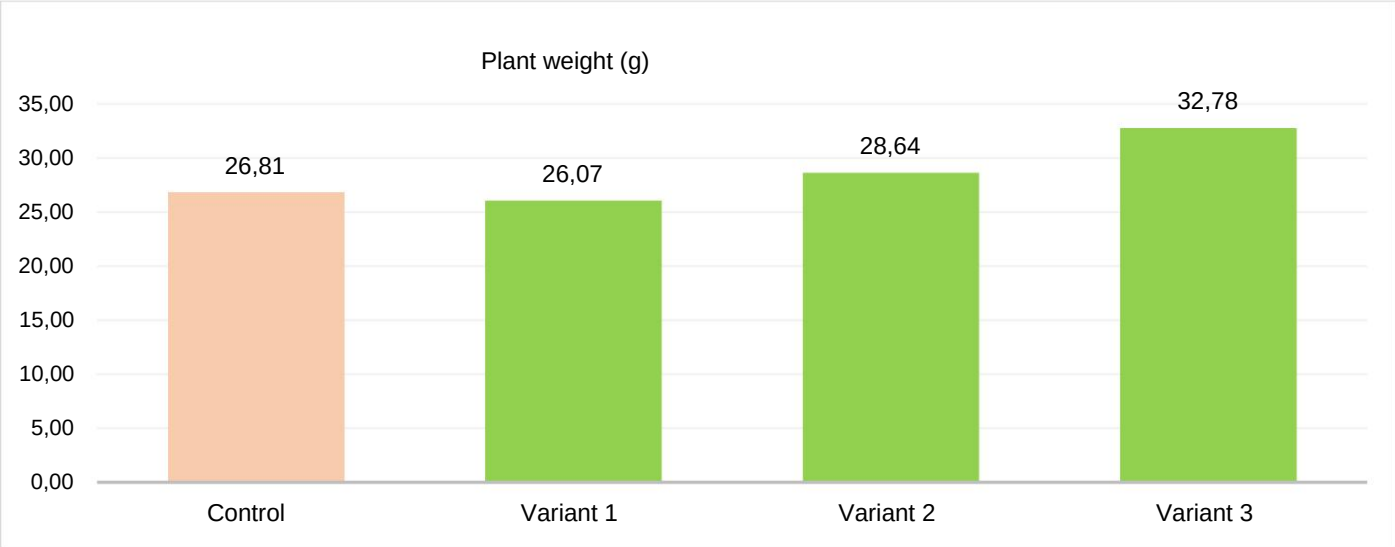

Figure 1 Comparison of tested experimental variants after application of alginite products on plant weight (g) of hemp (Cannabis sativa L.)

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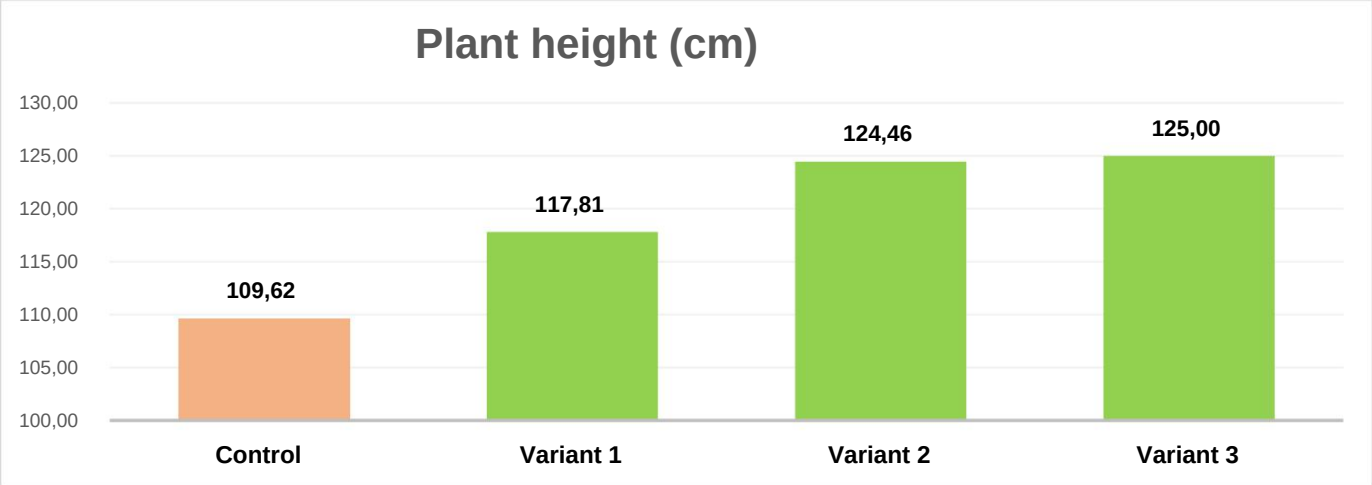

Figure 2 Comparison of the tested experimental variants after the application of alginite products on the height of cannabis **plants** *(Cannabis sativa* L.)

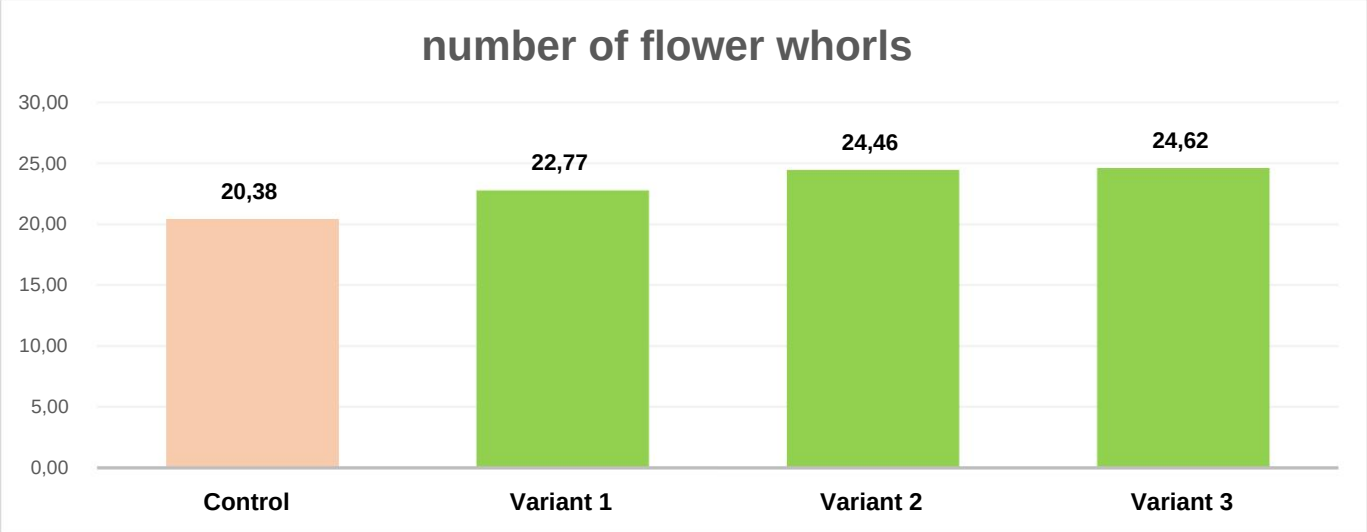

Figure 3 Comparison of tested experimental variants after application of alginite products on the number of flower whorls on hemp **plants** *(Cannabis sativa* L.)

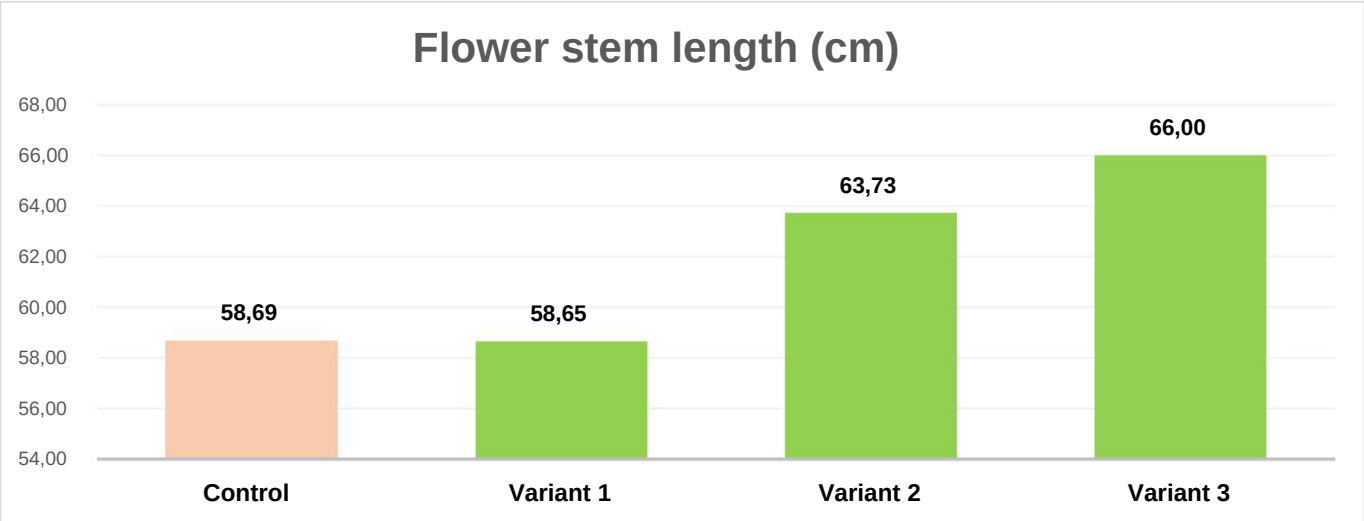

Figure 4 Comparison of the tested experimental variants after the application of alginite products on **the length of the flowering stem of plants (cm) of hemp** *(Cannabis sativa* L.)

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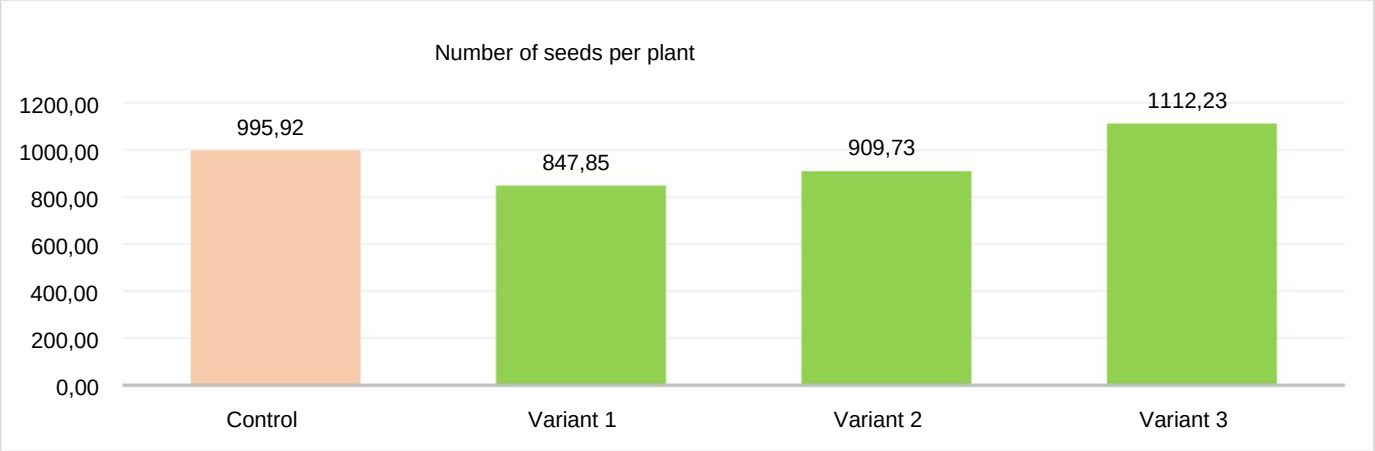

Figure 5 Comparison of the tested experimental variants after the application of alginite products on the number of seeds of cannabis plants (Cannabis sativa L.)

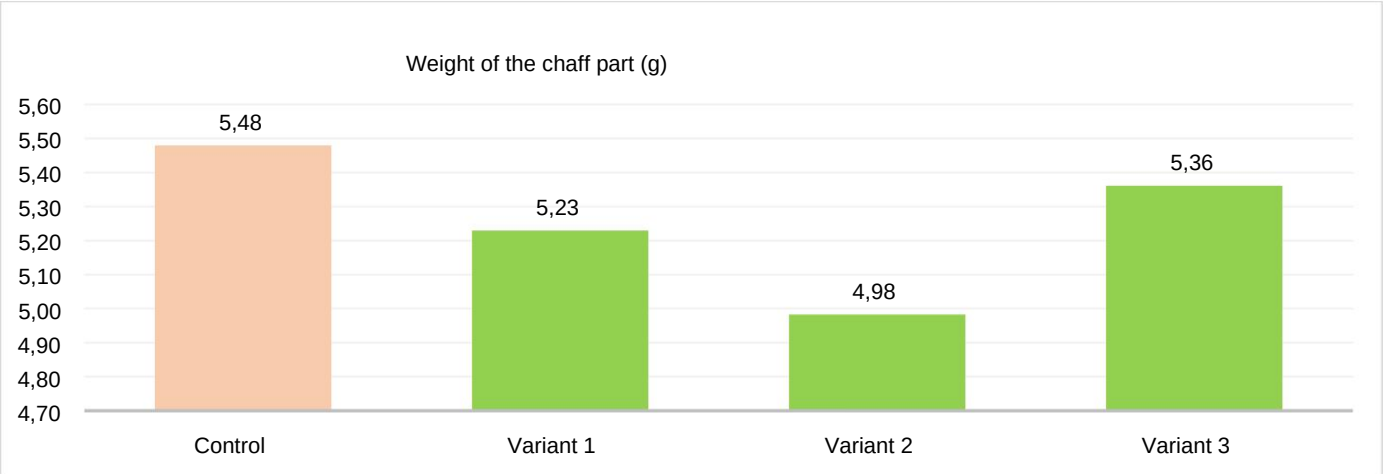

Figure 6 Comparison of tested experimental variants after application of alginite products on the weight of the chaff part of hemp plants (Cannabis sativa L.)

Figure 7 Assessed parts of hemp plants Cannabis sativa L.) Oravec (2021)

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C. Conclusions

1. Sown hemp plants treated twice with a suspension solution of 30g/liter (Variant 2) and 60g/liter (Variant 3) sprayed on the leaves statistically significantly increased the weight of the plants compared to the control variant (without alginite application). In plants treated with 2x suspension solution 20g/liter by spraying on the leaf (Variant 1), plant weight decreased compared to control variant 2. Hemp plants treated with 2x
suspension solution 20g/liter (variant 1), 30g/liter (Variant 2) and 60g/liter (Variant 3) sprayed on the leaves statistically significantly increased the height of the plants (cm) compared to the control variant (without alginite application).

3. Sown hemp plants treated twice with a suspension solution of 20g/liter (variant 1), 30g/liter (variant 2) and 60g/liter (variant 3) by spraying on the leaf showed a statistically significant increase in the number of flower whorls compared to the control variant (without alginite application).
4. Sown hemp plants treated twice with a suspension solution of 30g/liter (Variant 2) and 60g/liter (Variant 3) sprayed on the leaf statistically significantly increased the length of flower stalks (cm) compared to the control variant (without alginite application). In plants treated with 2x suspension solution 20g/liter by spraying on the leaf (Variant 1), the length of flower stalks (cm) was shortened compared to the control variant.

5. Sown hemp plants treated twice with a 60g/liter suspension solution (Variant 3) by spraying on the leaves statistically significantly increased the number of seeds on the plants compared to the control variant (without alginite application). In plants treated twice with a suspension solution of 20g/liter sprayed on a leaf (Variant 1) and 30g/liter sprayed on a leaf (Variant 2), the number of seeds on the plants decreased compared to the control variant.

6. After the application of alginite products, the weight of the chaff parts on the hemp plants sown in all variants decreased when compared to the control variant
7. Sown hemp plants treated twice with a suspension solution of 60g/liter (Variant 3) by spraying on the leaves statistically significantly increased the weight of the seeds on the plants compared to the control variant (without the application of alginite). In plants treated twice with a suspension solution of 20g/liter sprayed on a leaf (Variant 1) and 30g/liter sprayed on a leaf (Variant 2), the weight of the seeds on the plants decreased compared to the control variant.

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AQIPS-07

Determination of trichomes on plant parts of Felina and Finola varieties of hemp grown in the SPU greenhouse in Nitra and Piešťany after application of activated water created at different pressures

Determination of trichomes on plant parts of the Finola hemp variety grown in the SPU greenhouse in Nitra after application of activated water

AQIPS-07-E01

Contents

A. Methodology of the experiment

1. The aim of the experiment: determination of the formation of trichomes on the leaves and **inflorescences of the sown hemp after the application of activated water by the IPS system created after different flow pressures** in the range f 450 Pa

2. Plant species: Sown hemp *Cannabis sativa* L **3.**

Designation of the plant species in the experiments: Cs, **location: Nitra N, pot no.**

4. Date of starting the experiment: 24.8.2021

5. Date of ending the experiment: 13.10.2021 **6.**

Method of growing plants: pots, laboratory conditions, 7. **Variety:**

Felina 32 - 16 pcs of seeds in **each pot**

8. Evaluated characters: leaves and **inflorescences of hemp**

9. Equipment for preparing photo documentation: Macroscope. brand Zeiss

10. Place of assessment: Department of Agrobiodiversity

Experimental variants

Activated water used: stable (sw)	
Marking	Variant description
Cssw-c	Tap water is **stagnant -** check
Cssw05	**Created water at a pressure of 05Pa**
Cssw10	**Created water at a pressure of 10Pa**
Cssw15	**Created water at a pressure of 15Pa**
Cssw25	**Created water at a pressure of 25Pa**
Cssw50	**Created water at a pressure of 50Pa**
Cssw75	**Created water at a pressure of 75Pa**
Cssw100	**Created water at a pressure of 100Pa**
Cssw200	**Created water at a pressure of 200Pa**
Cssw300	**Created water at a pressure of 300Pa**
Cssw400	**Created water at a pressure of 400Pa**
Cssw450	**Created water at a pressure of 450Pa**

10. Research team: doc. Ing. Ján Brindza, CSc., Ing. Vladimíra Horťinová Sedláťková, PhD., Ing. Jana Šimková

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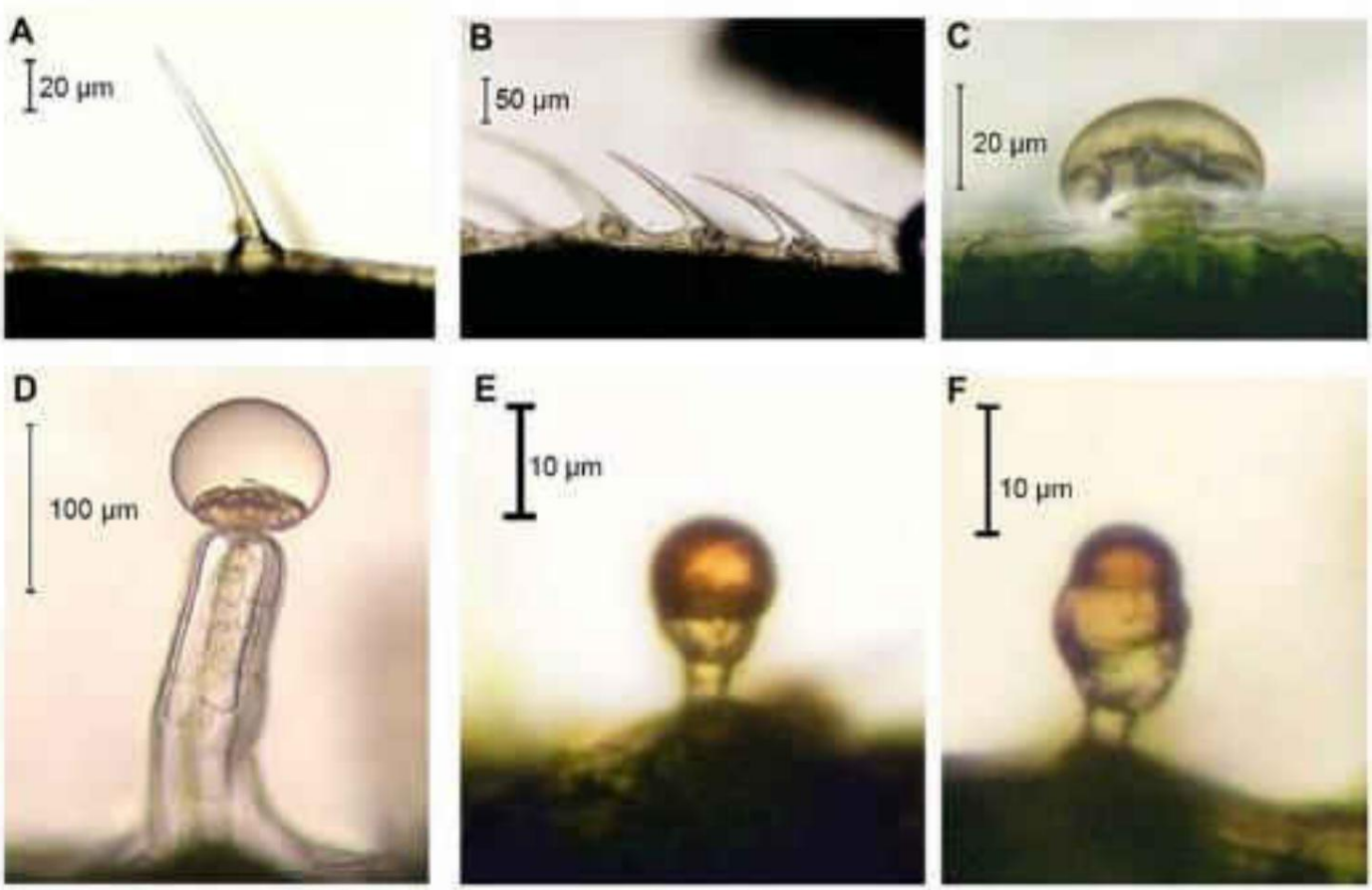
B. Literary knowledge

Trichomes are small hair-like growths found on cannabis plants (including cannabis) as well as lichens, algae, and other protist organisms. A protist organism is one that has cells with nuclei, but is neither an animal nor a plant nor a fungus. Examples of protist organisms include protozoa ("animal" organisms), as well as certain fungi and plant-like protophytes.

Hemp trichomes have a mushroom-like shape. The stem supports a bulbous spherical head. They are also small, around 50-100 microns wide (1 mm = 1000 microns). Although trichomes are thought to have evolved with different functions, cannabis appears to use them as part of a defense system.

Types of hemp trichomes Bulbous

trichomes are the smallest type of trichome. Sometimes they are only 10 microns wide, which is a fraction of the size of the largest bones. Bulbous trichomes can be found all over the surface of the plant, but because they are made up of only a small number of cells, they are difficult to see and identify.



Hemp trichome types. **(A)** Unicellular non-glandular trichome; **(B)** cystolythic trichomes; **(C)** capitate sessile trichome; **(D)** capitate-stalked trichome; **(E)** simple bulbous trichome; **(F)** complex bulbous trichome.

Images by Dr.David J. Potter (GW Pharmaceuticals)

Capped sessile trichomes are larger than bulbous trichomes, with enough cells to form a trichome head and a very short base. But at around 20-30 microns wide, they are not as large as the final category of trichomes, nor are they easily visible.

Capitate stalked trichomes are the largest trichomes. These trichomes provide most of the resin, THC and other cannabinoids. The width of the stalked trichomes is around 50-100 microns. They can be 200-300 microns (0.2-0.3 mm) high. They can also be seen with the naked eye. Female cannabis plants in particular have a large number of stalked trichomes.

Stalked trichomes have a stalk that is made up of cells known as epidermal and hypodermal cells. At the top of the stem is the head of a resin gland. The ball-shaped head of the resin gland has wax

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the outer layer of the cuticle, which acts as "skin". Inside the resin head are cannabinoids and terpenes. These are produced by specialized cells between the apex of the trichome stalk and the globular resin head. As the plant ages, the resin glands may change color. They slowly change from clear and colorless to milky and eventually amber/red.

Simple unicellular trichomes are not glandular. These trichomes are thought to provide basic plant protection. They cause insects and pests to damage the plant. They can also provide some protection from wind and light. Unicellular trichomes can be found on both the upper and lower sides of leaves.
Cystolytic trichomes are also a type of non-glandular trichomes, they do not have a resin head and are similar to unicellular unicellular trichomes. Cystolytic trichomes often have the shape of thin curved hairs. The curved nature of these trichomes resembles the curved shape of a bear's claws if you see several cystolitic trichomes in a row.

Anterial sessile trichomes are not as large as stalked head trichomes. Their width is around 80 microns. They are glandular trichomes, meaning the resin head sits on top of the stem.
Like stalked trichomes, anterial trichomes have a basal tissue beneath a disc of secretory cells (which produce terpenes and cannabinoids) and a "head" where the terpenes and cannabinoids are stored.

Trichome production and the life cycle of cannabis plants.
Hemp trichomes are a source of rare medicinal compounds. But for hemp plants, trichomes offer valuable defensive properties that help them survive long enough to produce seeds for the next generation. Trichome production is vital to the life cycle of cannabis. The sticky trichome coating acts as a physical barrier to deter pests and predators. The resinous trichome coating also protects the delicate growth of linen tissues from the harmful effects of UV sunlight. Cannabinoids found in the trichome layer are believed to have a chemical deterrent effect on insects and predators.

https://dutch-passion.com/en/blog/what-are-cannabis-trichomes-and-how-do-they-affect-your-smoke-n986

However, a recent study on trichome anatomy revealed that sessile trichomes on vegetative leaves consistently have exactly eight secretory disc cells, whereas stalked glandular trichomes on mature flowers have 12–16; these numbers were consistent across cannabis and drug varieties (Livingston et al., 2020). Because sessile trichomes on immature cannabis flowers can contain more than eight disc cells and emit fluorescence at mid-wavelengths, which true sessile trichomes cannot, sessile trichomes are now thought to be a precursor to the immature stalked trichome developmental stage (Livingston et al. 2020). These discoveries allow for better accuracy in classifying trichomes during plant development, can provide more accurate estimates of plant maturity, and enable the identification of optimal metabolite production points. This understanding further allows for greater accuracy in assessing the density of stalked glandular trichomes and the ability to predict the densities of mature floral trichomes.

Trichomes form on the surface of plants in a variety of taxonomically distinct species that provide various functions and benefits to the plant. These may involve simple tasks such as influencing leaf temperature and photosynthesis, or more complicated functions such as repelling pests through their physical structures or the production of compounds (Wagner, 1991; Hare et al., 2003). Glandular trichomes are of particular commercial interest because they are one of the key plant structures that produce essential oils—an industry worth $18.62 billion in 2020 (Grand View Research, 2020). Other structures in oil-producing plants are internal glands and other types of trichomes, some of which are capable of producing resinous secretions. Trichome morphology is highly variable between plant species and within the plant itself (Sangwan et al., 2001). In hemp, stalked glandular trichomes are a trichome morph that produces substances of economic value (Sirikantaramas et al., 2005). These trichomes form a secretory cavity between the secretory disc cells and the cuticle where secondary metabolites, including cana binoids and terpenes, are stored and deposited (Kim and Mahlberg, 1991).

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8488169/

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Figure 1 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after application of activated water 5 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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Image 2 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 10 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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Figure 3 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 15 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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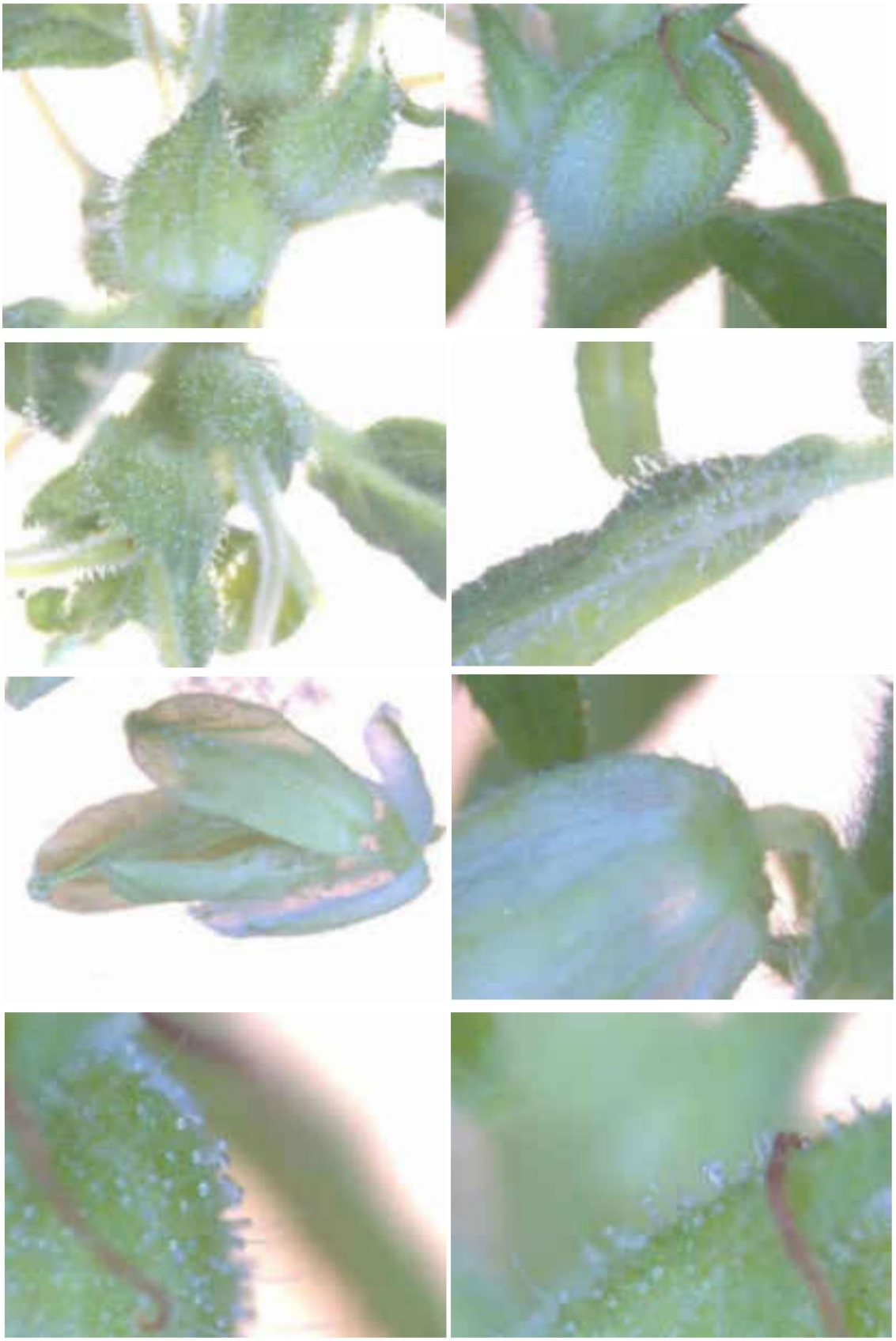

Figure 4 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 25 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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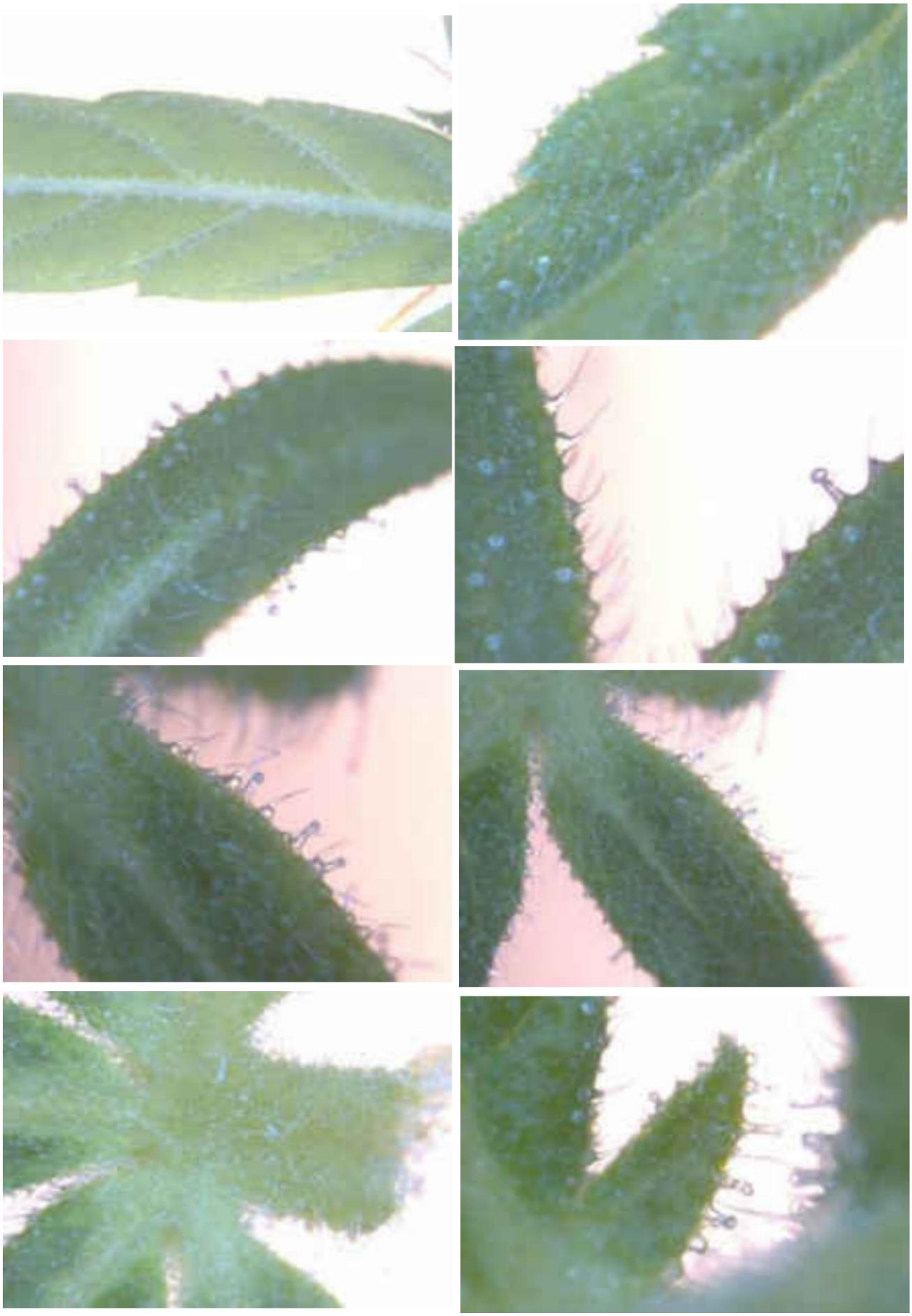

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Figure 5 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 50 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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Figure 6 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 75 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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Figure 7 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 100 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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Figure 8 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 200 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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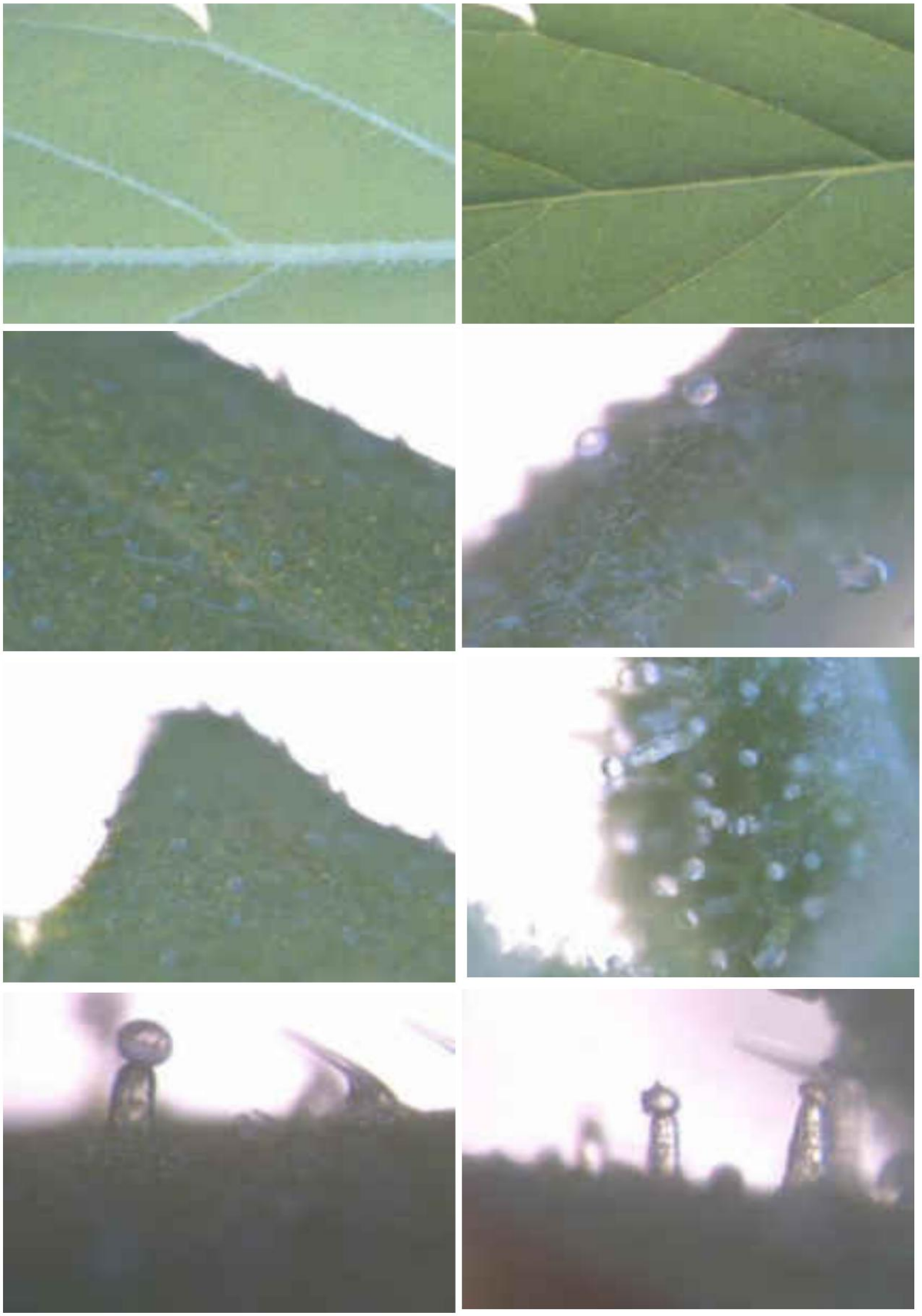

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Figure 9 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 300 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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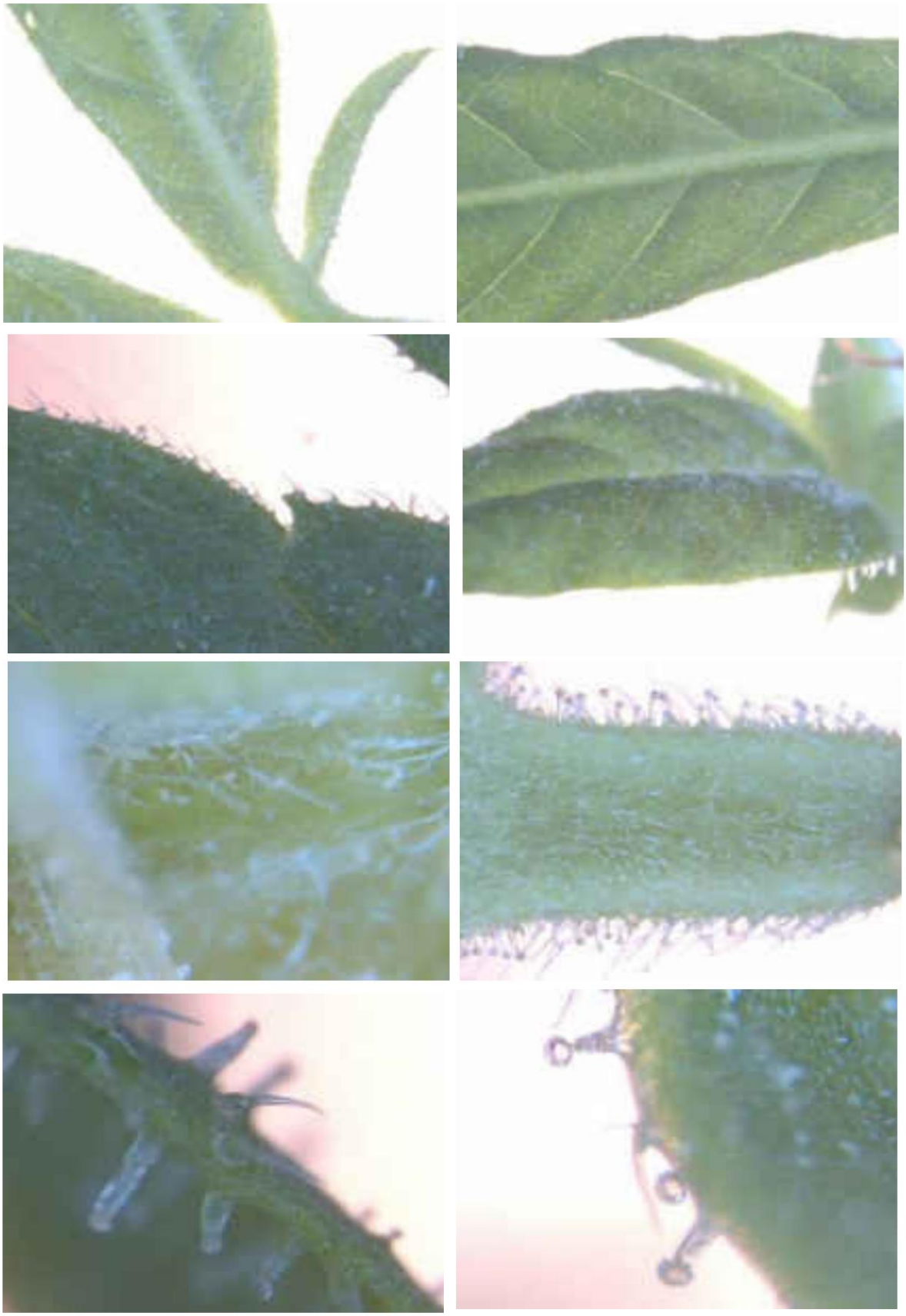

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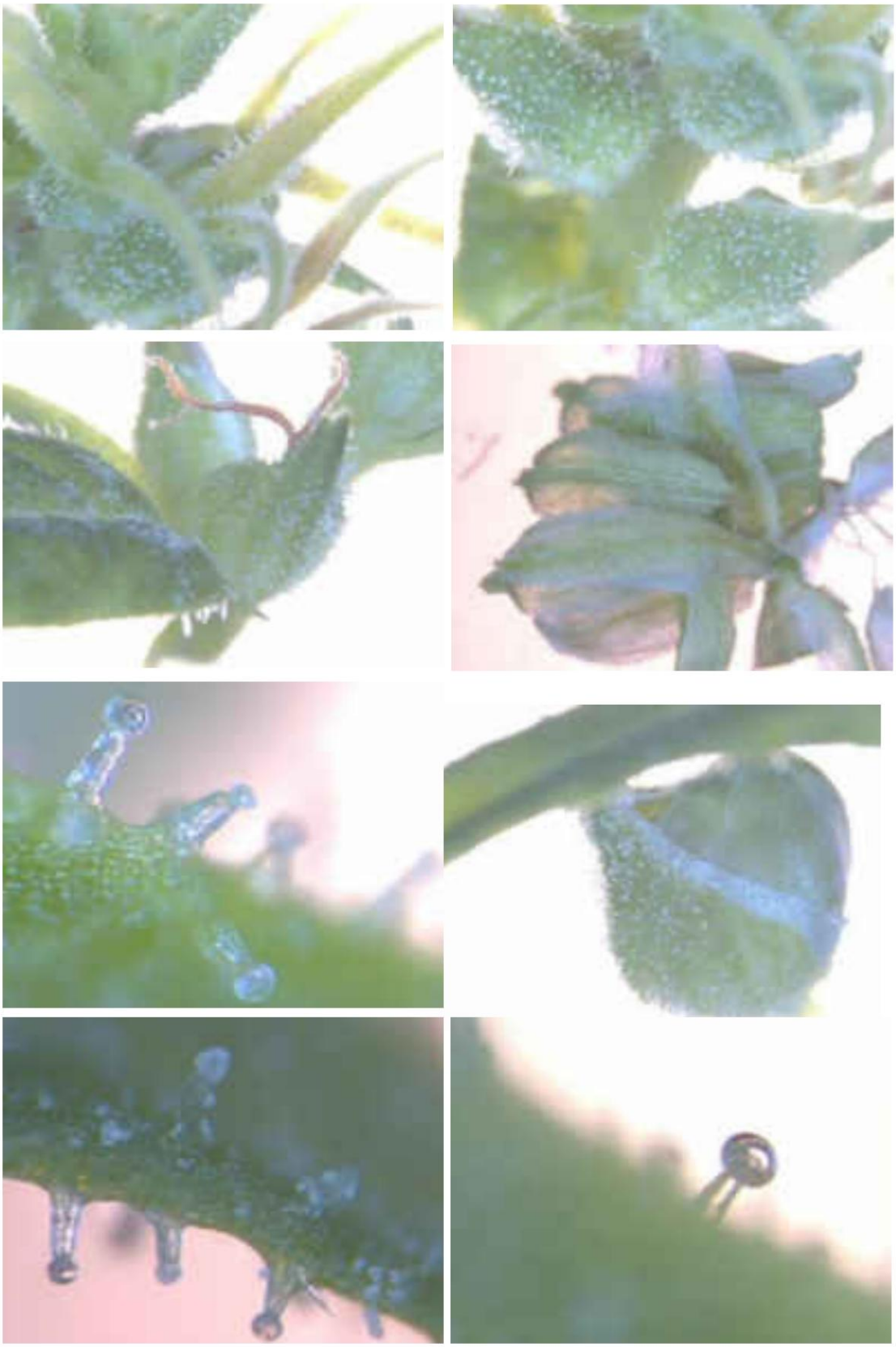

Figure 10 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 400 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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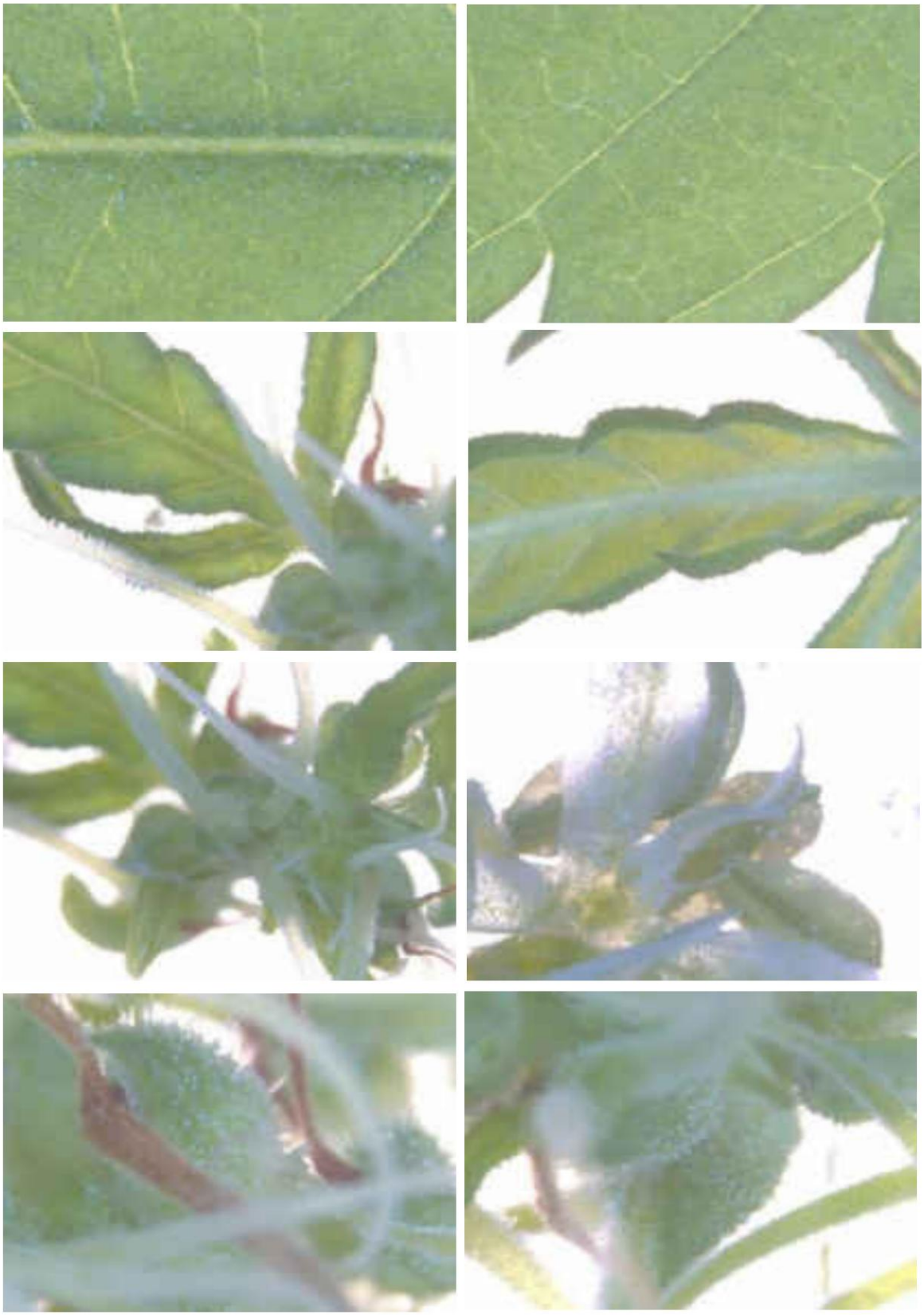

Figure 11 Trichomes on plant parts of hemp - variety Finola grown in the greenhouse of the Slovak University of Agriculture in Nitra as part of the experiment AQIPS-02-E03c in 2021 after the application of activated water 450 Pa (Photo: V. Horÿinová Sedláÿková, 2021)

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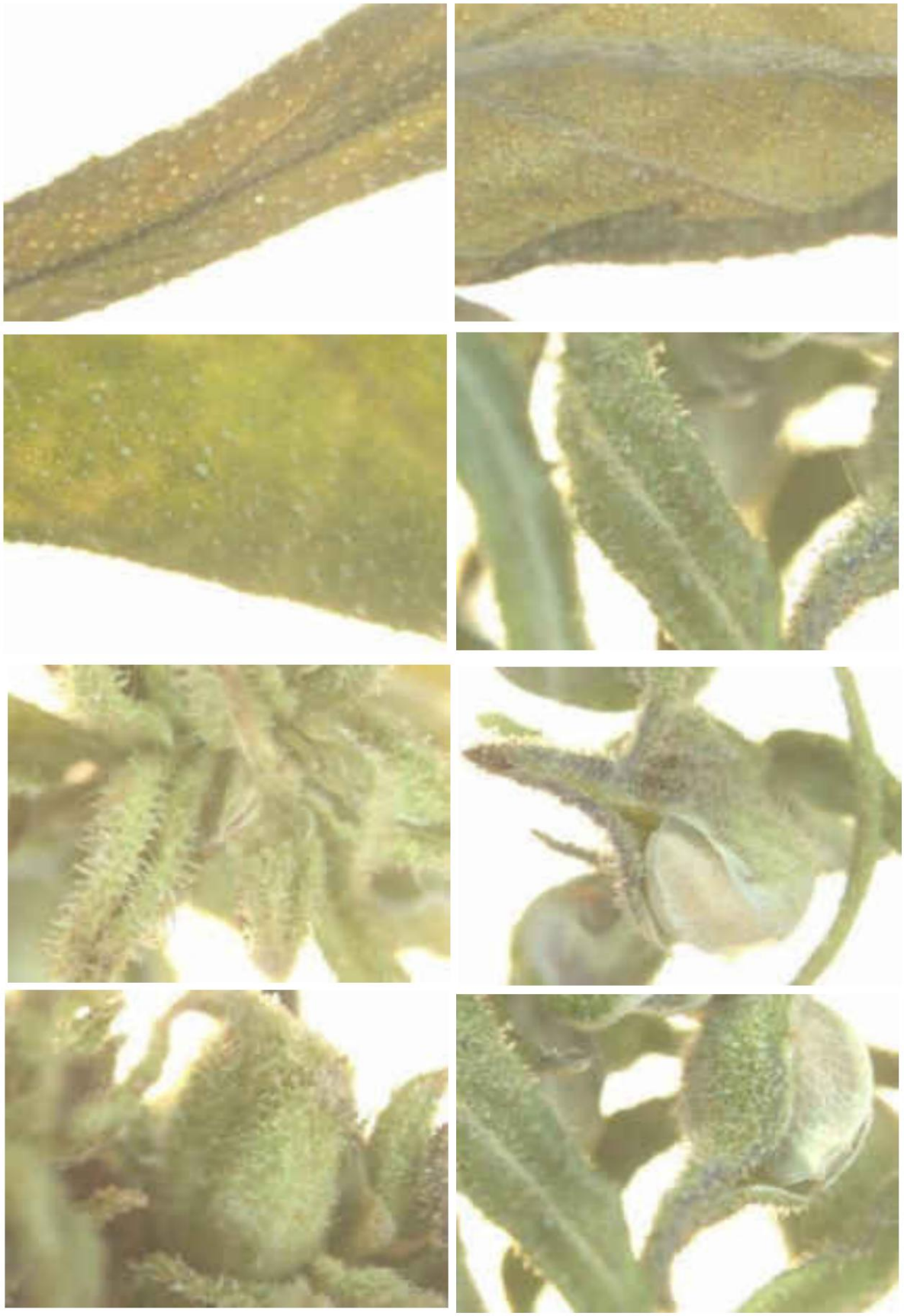

Image 12 Trichomes on plant parts of hemp - variety Finola grown in a greenhouse in Piešťany as part of the experiment AQIPS-02-E03c in 2021 control (Photo: V. Horťinová Sedláťková, 2021)

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Image 13 Trichomes on plant parts of hemp - variety Finola grown in a greenhouse in Piešťany as part of the experiment AQIPS-02-E03c in 2021 V1 variant (Photo: V. Horťinová Sedláťková, 2021)

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Figure 14 Trichomes on plant parts of hemp - variety Finola grown in a greenhouse in Piešťany as part of the experiment AQIPS-02-E03c in 2021 V2 variant (Photo: V. Horťinová Sedláťková, 2021)

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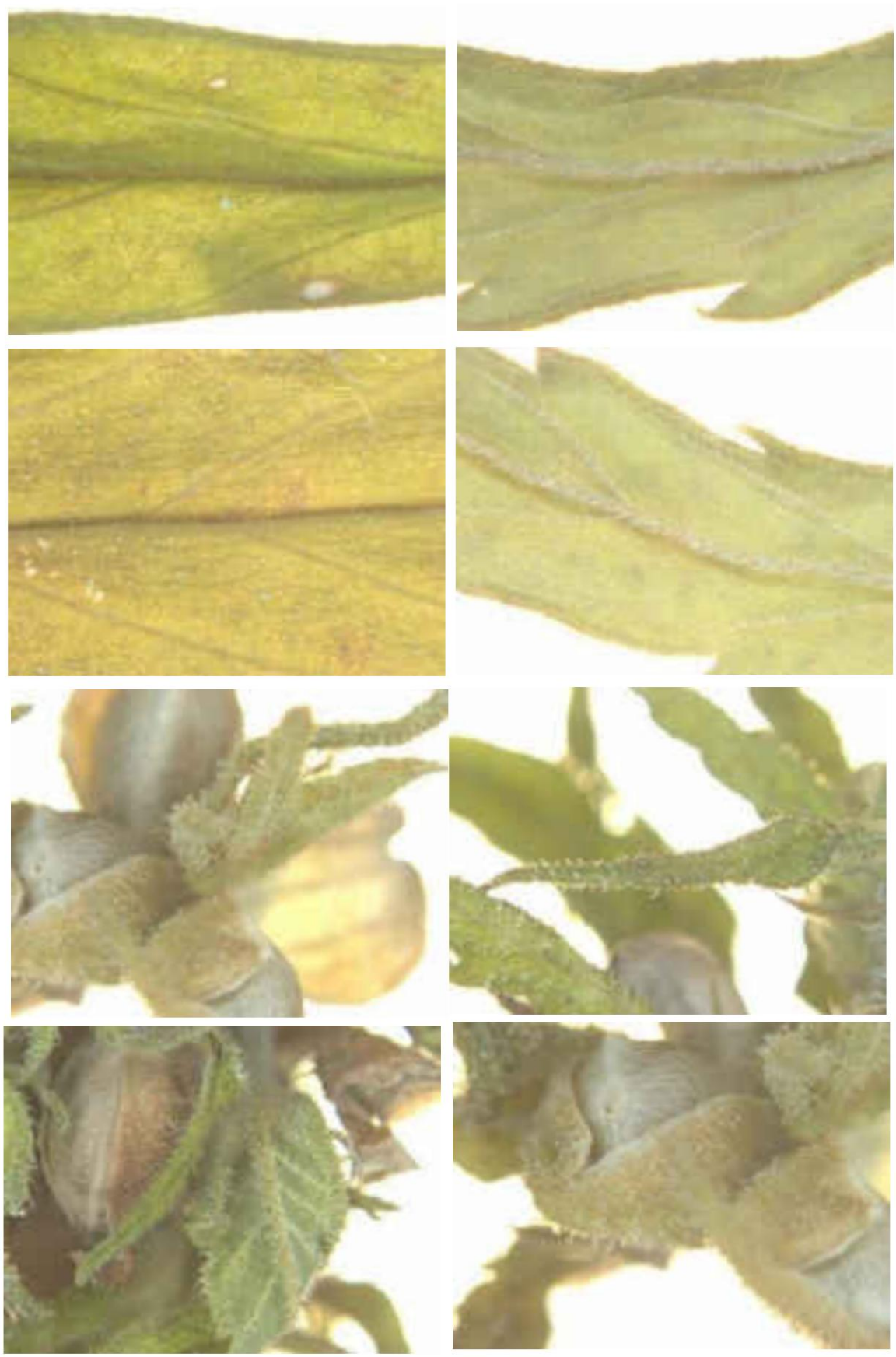

Figure 15 Trichomes on plant parts of hemp - variety Finola grown in a greenhouse in Piešťany as part of the experiment AQIPS-02-E03c in 2021 V3 variant (Photo: V. Horťinová Sedláťková, 2021)

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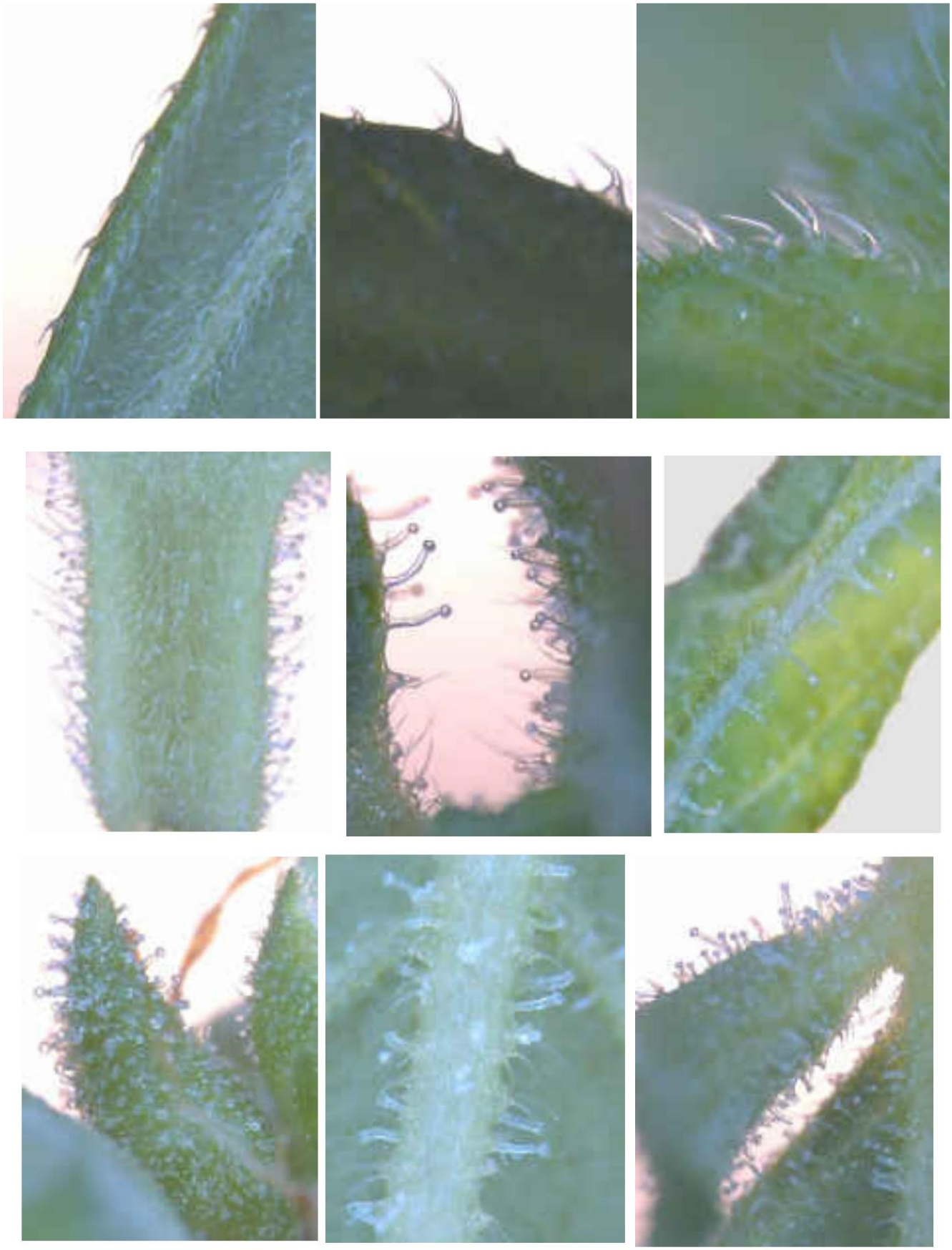

Figure 16 The most frequently occurring forms of trichomes on the assessed plant parts of hemp (Photo: V. Horÿinová Sedláÿková, 2021)

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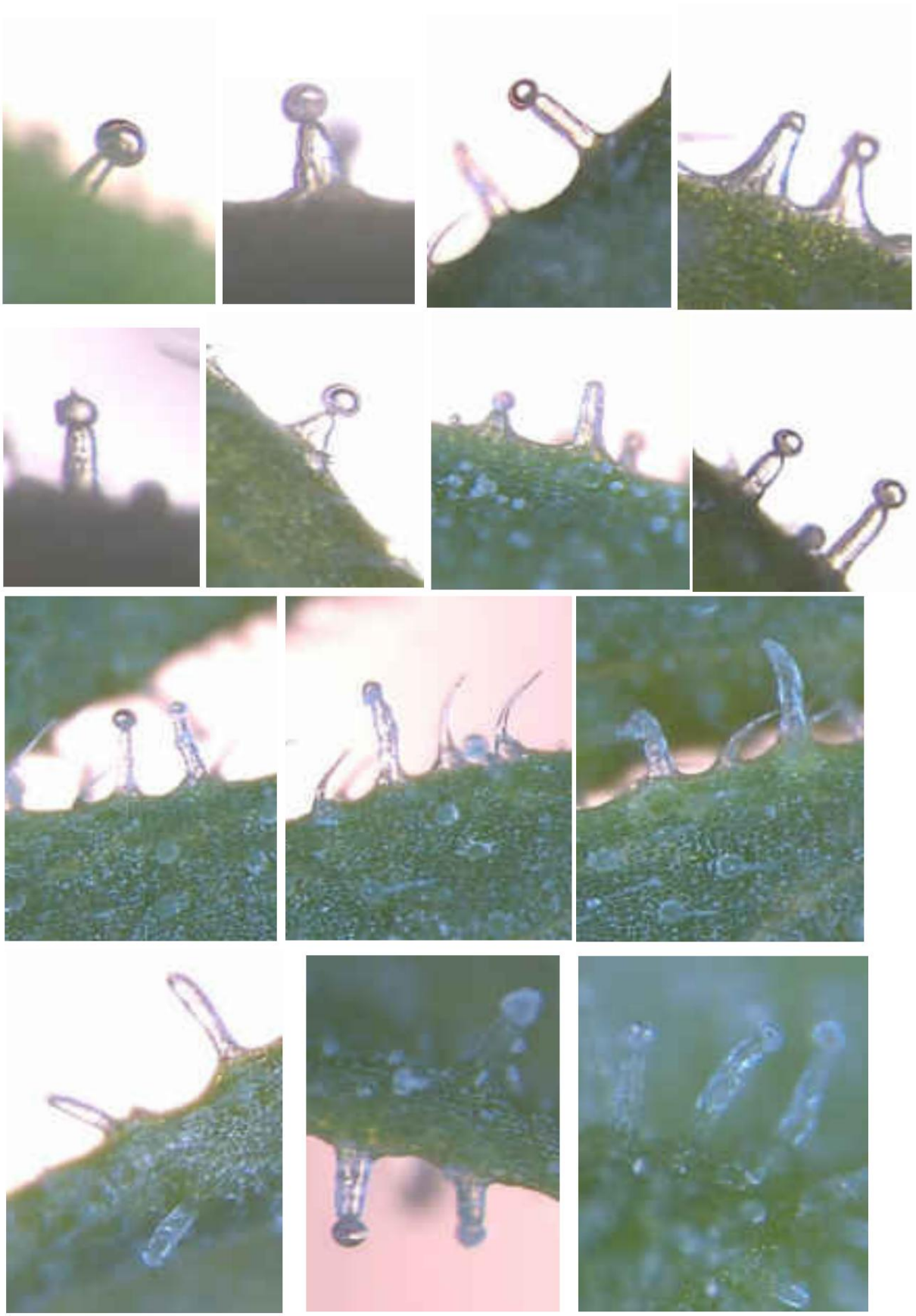

Figure 17 The most frequently occurring forms of trichomes on the assessed plant parts of hemp (Photo: V. Horÿinová Sedláÿková, 2021)

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Figure 18 The most frequently occurring forms of trichomes on the assessed plant parts of hemp (Photo: V. Horÿinová Sedláÿková, 2021)

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D. Conclusion

The presented photo-documentation from the plant parts of sown hemp unequivocally prove that trichomes, which are the source of rare medicinal compounds, are also formed on the evaluated plants of the Felina and Finola varieties, **which are classified as technical forms of hemp.**

In **the laboratory experiments, the aim was to determine the effect of activated water created by the IPS device at different flow pressures on plant growth, which was proven in** the experiments in the AQIPS-03 block. At the same time, we observed **a significant presence of trichomes of various types on leaves, inflorescences, chaff and other parts of plants (Figure 1-17) .** Determining the influence of activated water created **at different flow pressures on the number of trichomes created per unit area is very difficult, but it is not essential It is more important to confirm the effect of the application of activated water created at different flow pressures on the biosynthesis** of cannabinoids in **the given plant parts, which was also confirmed** in the AQIPS **–** 05 experiments.

Based on the knowledge gained and the results of the experiments carried out, it is realistic and possible to increase the production of cannabinoids even **in technical hemp plants with** a suitable **combination of the application of activated** water with **alginite or other industrial fertilizers. There are other possibilities for influencing plant growth** and **development in relation to the biosynthesis of cannabinoid content. All the mentioned options need to be verified experimentally.**

E. Used literature

1. **Aizpurua-Olaizola O., Soydaner U., Öztürk E., Schibano D., Simsir Y., Navarro P. et al. .** (2016). **Development of cannabinoid and terpene content during growth of** *Cannabis sativa* plants **from different chemotypes .** *J. Nat. Prod.* 95 207-217. doi: 10.1021/acs.jnatprod.5b00949

2. **Aliferis** KA, Bernard-Perron D. (2020). **Cannabinomics: the application of metabolomics in cannabis (Cannabis** *sativa* **L.) Research and development*Front.*** *Plant Sci.* 11:554. doi: 10.3389/fpls.2020.00554

3. **Andre** CM, Hausman JF, Guerriero G. (2016). *Cannabis sativa :* **the plant of a thousand and one moths** balls. ***Front.*** *Plant Sci.* 7:19. doi: 10.3389/fpls.2016.00019

4. **Appendino** G., Gibbons S., Giana A., Pagani A., Grassi G., Stavri M. et al. . (2008). **Antibacterial** cannabinoids from *Cannabis sativa :* **A structure-activity study .** *J. Nat. Prod.* 71 1427-1430. doi: 10.1021/np8002673

5. **Bautista** JL, Yu S., Tian L. (2021). Flavonoidy v *Cannabis sativa :* **biosyntéza, bioaktivity a biotechno logic .** *ACS Omega* 6 5119-5123. doi: 10.1021/acsomega.1c00318

6. **Berman** P, Futoran K, Lewitus GM, Mukha D, Benami M, Shlomi T, et al. . (2018). **A novel ESI-LC/MS approach for comprehensive metabolic profiling of phytocannabinoids in cannabis .** *Sci. Rep.* 8:14280. doi: 10.1038/s41598-018-32651-4.

7. **Bernstein** N., Gorelick J., Zerahia R., Koch S. (2019). **Effect of N, P, K and humic acid supplementation on the chemical profile of medicinal hemp (Cannabis** *sativa* L). ***Front.*** *Plant Sci.* 10:736. doi: 10.3389/fpls.2019.00736

8. **Booth** JK, Page JE, Bohlmann J. (2017). **Terpene synthases from** *Cannabis sativa . PLoS One* 12 :e073911. doi: 10.1371/journal.pone.0173911

9. **Braich** S, Baillie RC, Jewell LS, Spangenberg GC, Cogan NOI (2019). **Building a comprehensive atlas of transcriptomes and transcriptome dynamics in medicinal cannabis .** *Sci. Rep.* 9:16583. doi: 10.1038/s41598-019-53023-6

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10. **Burgel** L., Hartung J., Pflugfelder A., **Graeff-Hönninger S. (2020). The influence of growth stage and biomass fractions on the content of cannabinoids and yields of different genotypes of hemp (Cannabis** *sativa* L.). ***Agronó*** *mia* 10:372. doi: 10.3390/agronomy10030372

11. **Campiglia** E., Radicetti E., Mancinelli R. (2017). **Plant density and nitrogen fertilization influence the agronomic performance of industrial hemp (Cannabis** *sativa* **L.) in a Mediterranean environment .** *In. Crop. Prod.* 100 . 246-254. doi: 10.1016/j.indcrop.2017.02.022

12. **Conant** RT, Walsh RP, Walsh M, Bell CW, Wallenstein MD (2017). **Effects of microbial biostim** lantu, a mammoth PTM, for yielding *Cannabis sativa* **buds .** *J. Hortic.* 4:191. doi: 10.4172/2376-0354.1000191

13. **Conneely** LJ, Mauleon R, Mieog J, Barkla BJ, Kretzschmar T (2021). **Characterization of the glandular trichome of** *Cannabis sativa* proteome . *PLoS One* 16 :e0242633. doi: 10.1371/journal.pone.0242633

14. **Danziger** N., Bernstein N. (2021a). **Light matters: the influence of light spectra on the cannabinoid profile and plant development of medicinal cannabis (Cannabis** *sativa* L.) . *Ind. Crop. Prod.* 164 :113351. doi: 10.1016/j.indcrop.2021.113351

15. **Danziger** N., Bernstein N. (2021b). **Manipulation of plant architecture increases cannabinoid standardization in 'drug-type' medicinal cannabis .** *Ind. Crop. Prod.* 167 :113528. doi: 10.1016/j.indcrop.2021.113528

16. **Dayanandan** P., Kaufman PB (1976). **Trichómy Cannabis sativa L. (Cannabaceae) .** *Am. J. Bot.* 63 . 578-591. doi: 10.1002/j.1537-2197.1976.tb11846.x

17. **Degenhardt J., Köllner TG, Gershenzon J. (2009). Monoterpene and sesquiterpene synthases and the origin of terpene backbone diversity in plants .** *Phytochemistry* 70 1621-1637. doi: 10.1016/j.phyto chem.2009.07.030

18. **Desaulniers Brousseau** V., Wu BS, MacPherson S., Morello V., Lefsrud M. (2021). Cannabinoids and **terpenes: how photoprotectant production can be manipulated to enhance** *Cannabis sativa* L. Phytochemistry . ***Front.*** *Plant Sci.* 12:620021. doi: 10.3389/fpls.2021.620021

19. **Eichhorn** Bilodeau S., Wu BS, Rufyikiri AS, MacPherson S., Lefsrud M. (2019). **An update on plant photobiology and implications for cannabis production .** ***Front.*** *Plant Sci.* 10 296. doi: 10.3389/fpls.2019.00296

20. **ElSohly** MA, Gul W. (2014). **"Constituents of** *Cannabis sativa* **in *the Handbook of Cannabis.*** ed. Pertwee R. (Oxford: Oxford University Press;), 3.-22. doi: 10.1093/acprof:oso/9780199662685.003.0001

21. **ElSohly** MA, Slade D. (2005). **Chemical constituents of marijuana: a complex mixture of natural cannabinoids** dov . *Life Sci.* 78 . 539-548. doi: 10.1016/j.lfs.2005.09.011

22. **Fairbairn** JW (1972). **Trichomes and glands of Cannabis sativa L** . ***BULL.*** *STUPEF* 24 . 29–33.

23. **Farha** MA, **El-Halfawy OM, Gale RT, Macnair CR, Carfrae LA, Zhang X. et al. .** (2020). Revelation 338-346. doi: 10.1021/ **the hidden antibiotic potential of cannabis .** *ACS Infect. Dis.* 6 fecdis.9b00419 . acsin

24. **Flores-Sanchez** IJ, Verpoorte R. (2008). **Secondary metabolism in cannabis .** *Phytochem. Rev.* 7 615-639. doi: 10.1007/s11101-008-9094-4

25. **Gohad** P., McCoy J., Wambier C., Kovacevic M., Situm M., Stanimirovic A. et al. . (2020). **The new kana bidiol sunscreen protects keratinocytes and melanocytes from ultraviolet B radiation .** *J. Cosmet. Dermatol.* 20, 1350-1352. doi: 10.1111/jocd.13693

26. **Grand View Research** (2020). **Essential Oils Market Size, Share and Trend Analysis Report by Application (Food & Beverage, Spa & Relax), by Product (Orange, Peppermint), by Marketing Channel and Segment Forecasts, 2020-2027 .** *San Francisco, CA.* **Available**

Machine Translated by Google

at: https://www.grandviewresearch.com/industry-analysis/essential-oils-market#:~:text=The%20global%20essential%20oils%20market%20size%20was%20estimated%20at%20USD,USD%

2018.6%20billion20in202020.&text=%20global%20essential%20oil%20market%20is%20expected%20to%20grow%20at,USD%

27. **Gülck T., Møller BL (2020). Phytocannabinoids: origin and biosynthesis .** *Trends Plant Sci.* 25 985-1004. doi: 10.1016/j.tplants.2020.05.005 28.

Hammond CT, Mahlberg PG (1973). **Morphology of glandular hairs** *of Cannabis sativa* from scanning **electron microscopy .** *Am. J. Bot.* 60 524-528. doi: 10.1002/j.1537-2197.1973.tb05953.x

29. **Hanuš LO, Meyer SM, Muñoz E.,** Taglialatela-Scafati O., Appendino G. (2016). Phytocannabinoids: a **critical critical inventory .** *Nat. Prod. Rep.* 33 1357-1392. two: 10.1039/C6NP00074F

30. **Hare** JD, Elle E., Van Dam NM (2003). **Cost of glandular trichomes in Datura wrightii: a three-year study** is. ***Evolution*** 57 793–805. doi: 10.1111/j.0014-3820.2003.tb00291.x

31. **Hawley** D., Graham T., Stasiak M., Dixon M. (2018). **Improving the quality and yield of hemp buds pomo** 1593–1599. **cou lighting under the shelter .** *HortScience* 53 doi: 10.21273/HORTSCI13173-18

32. **Janatová A., Fraÿková A., Tlustoš P., Hamouz K., Božik M., Klouÿek P. (2018). Yield and content of cannabinoids in different genotypes of cannabis (Cannabis** *sativa* **L.) for medical use.** *Indian _ Crops Prod.* 112 363-367. doi: 10.1016/j.indcrop.2017.12.006 33. **Jin**

D., Dai K., Xie Z., Chen J. (2020). **Secondary metabolites profiled in inflorescences, leaves, stem barks and roots of medicinal cannabis .** *Sci. Rep.* 10:3309. doi: 10.1038/s41598-020-60172-6

34. **Kim** ES, Mahlberg PG (1991). **Development of the secretory cavity in the glandular trichomes** *of Cannabis sativa* L. (Can nabaceae) . *Am. J. Bot.* 78 220-229. doi: 10.1002/j.1537-2197.1991.tb15749.x

35. **Kim** ES, Mahlberg PG (1997). **Immunochemical localization of tetrahydrocannabinol** (THC) in cryofix 336-342. doi: **glandular trichomes of cannabis (Cannabaceae) .** *Am. J. Bot.* 84 10.2307/2

36. **Kim** KS, Vuong TD, Qiu D, Robbins RT, Grover Shannon J, Li Z, et al. . (2016). **Advances in Breeding,** 2295- **genetics and genomics for resistance to three nematode species in soybeans .** *theor. Appl. Genet.* 129 2311. doi: 10.1007/s00122-016-2816-x

37. **Koren** A., Sikora V., Kiprovski B., **Brdar-Jokanoviÿ M., Aÿimoviÿ M., Konstantinoviÿ B., et** al. . (2020). **The controversial taxonomy of cannabis .** *Genetics* 52 1–13. doi: 10.2298/GENSR2001001K

38. **Leme FM, Schönenberger J., Staedler YM, Teixeira SP (2020). Comparative floral evolution reveals new aspects of floral structure and diversity in Cannabaceae .** *Bot. J. Linn. Soc.* 193 64-83. two: 10.1093/botlinen/book004

39. **Levin** DA (1973). **The role of trichomes in plant defense .** *Q. Rev. Biol.* 48 3-15. doi: 10.1086/407484

40. **Liu** Y., Zhu P., Cai S., Haughn G., Page JE (2021). **Three new transcription factors involved in the biosynthesis** of of cannabinoids in Cannabis *sativa* L. *Plant Mol. Biol.* 106 49-65. doi: 10.1007/s11103-021-01129-9

41. **Livingston** SJ, Quilichini TD, Booth JK, Wong DCJ, Rensing KH, Laflamme-Yonkman J, et al. . (2020). **Cannabis glandular trichomes change morphology and metabolite content during flower maturation** 37-56. doi: 10.1111/tpj.14516 tov . *Plant J.* 101

42. **Lyu** D, Backer R, Robinson WG, Smith DL (2019). **Growth-promoting rhizobacteria in** cannabis- producing plants : **yield, cannabinoid profile and disease resistance .** ***Front.*** *Microbiol.* 10:1761. doi: 10.3389/fmicb.2019.01761

43. **Magagnini** G., Grassi G., Kotiranta S. (2018). **The influence of the light spectrum on the morphology and content of cannabis** noidov v *Cannabis sativa* L *Med. Cannabis Cannabinoids* 1 19–27. doi: 10.1159/000489030

Machine Translated by Google

44. Mahlberg PG, Kim ES (2004). Accumulation of cannabinoids in glandular trichomes of hemp (Canna baceae). J. Ind. Konope 9 , 15-36. doi: 10.1300/J237v09n01_04

45. Marks MD, Tian L, Wenger JP, Omburo SN, Soto-Fuentes W, He J, et al. . (2009). Identification of candidate genes affecting A9-tetrahydrocannabinol biosynthesis in Cannabis sativa. J. Exp. Bot. 60 3715-3726. doi: 10.1093/jxb/erp210

46. Matoušek J., Kocábek T., Patzak J., Bríza J., Siglova K., Mishra AK, et al. . (2016). A "putative" role of transcription factors from the HlWRKY family in the regulation of the final steps of the biosynthesis of prenylflavonoids and bitter acids in hops (Humulus lupulus L.). Plant Mol. Biologicals 92 263-277. doi: 10.1007/s11103-016-0510-7

47. Mediavilla V., Steinemann S. (1997). Essential oil from the strains of Cannabis sativa LJ Ind. Hemp 4 , 80-82.

48. Mishra AK, Kocábek T., Nath VS, Awasthi P., Shrestha A., Killi UK, et al. . (2020). Dissection of the dynamic transcriptome landscape of the leaf, leaf and lupulin gland in hops (Humulus lupulus L.) . Int. J. Mol. Sci. 21 :233. doi: 10.3390/ijms21010233

49. Mudge EM, Brown PN, Murch SJ (2019). The terroir of cannabis: terpene metabolomics as a tool for po taking Cannabis sativa selections . Plant Med. 85 , 781-796. two: 10.1055/a-0915-2550

50. Muravník LE (2020). “ Structural peculiarities of leaf glandular trichomes: a review ,” in Plant Cell and Tissue Differentiation and Secondary Metabolites. Reference series in phytochemistry. ed. Ramawat K., Ekiert H., Goyal S. (Cham: Springer;), 1.–35.

51. Namdar D., Mazuz M., Ion A., Koltai H. (2018). Variations in cannabinoid and terpenoid composition in Can nabis sativa inferred from inflorescence position along the stem and extraction methods. Indian Crop. Prod. 113 , 376-382. doi: 10.1016/j.indcrop.2018.01.060 52.

Nerio LS, Olivero-Verbel J., Stashenko E. (2010). Repellent activity of essential oils: A review. Bi oresour. Technol. 101 , 372-378. doi: 10.1016/j.biortech.2009.07.048

53. Ohlsson A., Abou-Chaar CI, Agurell S., Nilsson IM, Olofsson K., Sandberg F. (1971). Cannabinoid deficiency components of male and female Cannabis sativa. Taurus Narc. 23 , 29 – 32.

54. Pagnani G., Pellegrini M., Galieni A., D'Egidio S., Matteucci F., Ricci A. et al. . (2018). Plant Growth Promoting Rhizobacteria (PGPR) in Cannabis sativa 'Finola' Cultivation: An Alternative Fertilization Strategy to Improve Plant Growth and Quality Characteristics. Ind. Crop. Prod. 123 75-83. doi: 10.1016/j.indcrop.2018.06.033

55. Panche AN, Diwan AD, Chandra SR (2016). Flavonoids: An Overview. J. Nutr. Sci. 5:e47. doi: 10.1017/jns.2016.41

56. Pate DW (1983). A possible role of ultraviolet radiation in the development of cannabis chemotypes. Econ. Bot. 37 , 396-405. doi: 10.1007/BF02904200

57. Potter DJ (2009). Promotion, characterization and optimization of Cannabis sativa L. as a phytopharmaceutical. Doc Torandian work. London, England: King's College London.

58. Ren G, Zhang X, Li Y, Ridout K, Serrano-Serrano ML, Yang Y, et al. . (2021). Large-scale whole-genome resequencing reveals the domestication history of Cannabis sativa. Sci. Adv. 7 :eabg2286. doi: 10.1126/sciadv.abg2286

59. Russo EB (2011). THC taming: potential synergy of cannabis and concomitant effects of phytocannabinoids 1344– a terpenoidov . Br. J. Pharmacol. 163 , 1364. doi: 10.1111/j.1476-5381.2011.01238.x

60. Russo EB, McPartland JM (2001). Hemp and hemp extracts: greater than the sum of their parts? J. Cannabis Ther. 1 , 103-132.

Machine Translated by Google

61. Saloner A., Bernstein N. (2021). Nitrogen supply affects the cannabinoid and terpenoid profile in medicinal cannabis (Cannabis sativa L.). Ind. Crop. Prod. 167 :113516. doi: 10.1016/j.indcrop.2021.113516

62. Sangwan NS, Farooqi AHA, Shabih F, Sangwan RS (2001). Regulation of essential oil production in plants. Re gulation of plant growth. 34 , 3-21. two: 10.1023/A:1013386921596

63. Sirikantaramas S., Taura F., Tanaka Y., Ishikawa Y., Morimoto S., Shoyama Y. (2005). Tetrahydrocannabinolic acid synthase, the enzyme controlling the psychoactivity of marijuana, is secreted into the storage cavity of glandular trichomes. Plant Cell Physiol. 46 1578-1582. doi: 10.1093/pcp/pci166 64.

Sirikantaramas S., Yamazaki M., Saito K. (2008). Mechanisms of resistance to self-produced toxic secondary metabolites in plants. Phytochem. 7:467. doi: 10.1007/s11101-007-9080-2

65. Spitzer-Rimon B., Duchin S., Bernstein N., Kamenetsky R. (2019). Architecture and florogenesis in sa Predné. cannabis sativa cannabis plants · Plant Sci. 10:350. doi: 10.3389/fpls.2019.00350

66. Swider J. (2021). Lab shopping: Emphasizing the need for checks and balances in cannabis. To degree at: https://cannabisindustryjournal.com/column/lab-shopping-highlighting-the-need-for-checks and-balances-in-cannabis/

67. Taghinasab M., Jabaji S. (2020). The cannabis microbiome and the role of endophytes in modulating the production of secondary metabolites: a review . Microorganisms 8:355. doi: 10.3390/microorganisms8030355

68. Tang K, Struik PC, Yin X, Calzolari D, Musio S, Thouminot C, et al. . (2017). A comprehensive study of planting density and the effect of nitrogen fertilization on the cultivation of dual-purpose hemp (Cannabis sa tiva L.). Ind. Crop. Prod. 107 , 427-438. doi: 10.1016/j.indcrop.2017.06.033

69. Taschwer M., Schmid MG. (2015). Determination of the relative percentage distribution of THCA and ÿ9-THC in plant cannabis seized in Austria - Effect of different storage temperatures on stability. Forensic Sci. Int. 254 167-171. doi: 10.1016/j.forsciint.2015.07.019

70. Tian N., Liu F., Wang P., Zhang X., Li X., Wu G. (2017). Molecular basis of glandular trichome development and secondary metabolism in plants. Plant gene 12 , 1–12. doi: 10.1016/j.plgene.2017.05.010

71. Tissier A., Morgan JA, Dudareva N. (2017). Volatile substances of plants: they enter from the cavities of the trichome never “from” . Trends Plant Sci. 22 , "in", but 930-938. doi: 10.1016/j.tplants.2017.09.001

72. Tomko AM, Whynot EG, Ellis LD, Dupré DJ (2020). Anticancer potential of cannabinoids, terpenes and flavonoids present in cannabis. Cancers 12:1985. doi: 10.3390/cancers12071985

73. Toth JA, Stack GM, Cala AR, Carlson CH, Wilk RL, Crawford JL, et al. . (2020). Development and validation of genetic markers for sex and cannabinoid chemotype in Cannabis sativa L. GCB Bioenergy 12 213-222. doi: , 10.1111/gcbb.12667

74. van Klingeren B., ten Ham M. (1976). Antibacterial activity of A9-tetrahydrocannabinol and cannabidi volume. Antonie Van Leeuwenhoek 42 , 9.–12. two: 10.1007/BF00399444

75. Vanhove W., Van Damme P., Meert N. (2011). Factors determining the yield and quality of illicit indoor production of cannabis (Cannabis spp.) . Forensic Sci. Int. 212 158-163. doi: 10.1016/j.forsci int.2011.06.006

76. Wagner GJ (1991). Secretion of glandular trichomes: more than just hairs. Plant Physiol. 96 , 675-679. doi: 10.1104/pp.96.3.675

77. Yamauchi, T., Shoyama, Y., Aramaki, H., Azuma, T., Nishioka, I. (1967). Kyseline tetrahydrocannabinol, the true substance tetrahydrocannabinol. Chem. Pharm. Bull. 15 , 1076-1079. doi: 10.1248/cpb.15.1075

78. Zager JJ, Lange I, Srividya N, Smith A, Markus Lange B (2019). Gene networks underlying cannabinoid and terpenoid accumulation in cannabis. Plant Physiol. 180 1877–1897. doi: 10.1104/ pp.18.01506

Machine Translated by Google

79. Zoorob MJ (2021). The frequency distribution of reported THC concentrations in legal cannabis flower products increases steadily around the 20% THC threshold in Nevada and Washington. J. Cannabis Res. 3:6. doi: 10.1186/s42238-021-00064-2

80. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8488169/

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Report on an experiment with water crystals

AQIPS 08

AQIPS-08-E01 Evaluation of Activated Water Samples Using the Water Crystal Method - Masaru Emoto, LLC

Water is one of the most essential substances for human life. Let's think about the water in our body. It is generally said that 90% or more of the embryonic body is water. As for an infant, about 80% of his body is made up of water, and 70% of an adult's. As we age, the percentage of water in our body decreases.

It is not enough to take the necessary amount of water into the body, but we should take into account the quality of the water. For example, a neighborhood with many long-lived people is blessed with high-quality water from natural sources. In other words, it is clear that there are many connections between health and the quality of the water we drink every day.
Today, even if the water we drink or use does not contain any harmful component, the quality of the water is not always satisfactory. It turns out that water crystal formation reflects water quality. I would like you to deepen your knowledge and interest in water after seeing the photos presented here.

Office Masaru Emoto, LLC

Hypothesis about the growth mechanism of water crystals In
each of the 50 Petri dishes, we put about 0.5 ml of water sample and put it in the freezer.
When the Petri dish is removed from the freezer, a very small lump of ice or "water crystal seed" is thought to begin growing on top of the ice drop. The water crystal can be observed in a free refrigerator set at -5 °C. But the temperature rises around 0 degrees C due to the heat from the observer's body. After removing the Petri dish from the freezer, the resulting drop of ice begins to melt. At the same time, when the vapor forming the ice drop and the moisture in the air are cooled by the ice, it freezes and sticks to the crystal. In other words, the ice is melting and growing at the same time.

What does the crystal tell us?
While the snow crystal has a beautiful hexagonal shape, highly symmetrical, many of the water crystals obtained in this experiment have a collapsed form. And the pattern of the collapsed form varies depending on the water.
Tap water that has gone through a chlorine sterilization process is likely to change our collapsed crystals and features like natural pure water. This can be partially explained by the effect of residual chlorine.

Some scientists point out that there is a connection between water crystal formation and the degree of water pollution, and it can be one of the indicators of water quality in terms of the degree of pollution. In recent research it has been shown that Hado, information or energy such as music, sound or words can influence the formation of a water crystal. Thus, the formation of a water crystal reflects not only the physical, but also the hadoic, informational or energetic aspect of water.

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Observation report

Tested water samples
Sample 1 - tap water from the Oberwesel laboratory - control - reference sample
Sample 2 – activated water with the IPS Premium-Active device Date of photo documentation

The first test was conducted on June 17-19, 2022
The second test was conducted on June 27-July 2
The third test was done on the 13th -16th. July

Conditions of photo documentation
Freezing temperature: ÿ25 °C ±2 °C
Freezing time: min. 4 hours
Observation temperature: ÿ7 °C ±5 °C
Observation device: Olympus Optical Microscope (magnification: ×200).

We first analyzed the control water (from the tap water from the Oberwesel laboratory).
I did not observe any crystals from this tap water.

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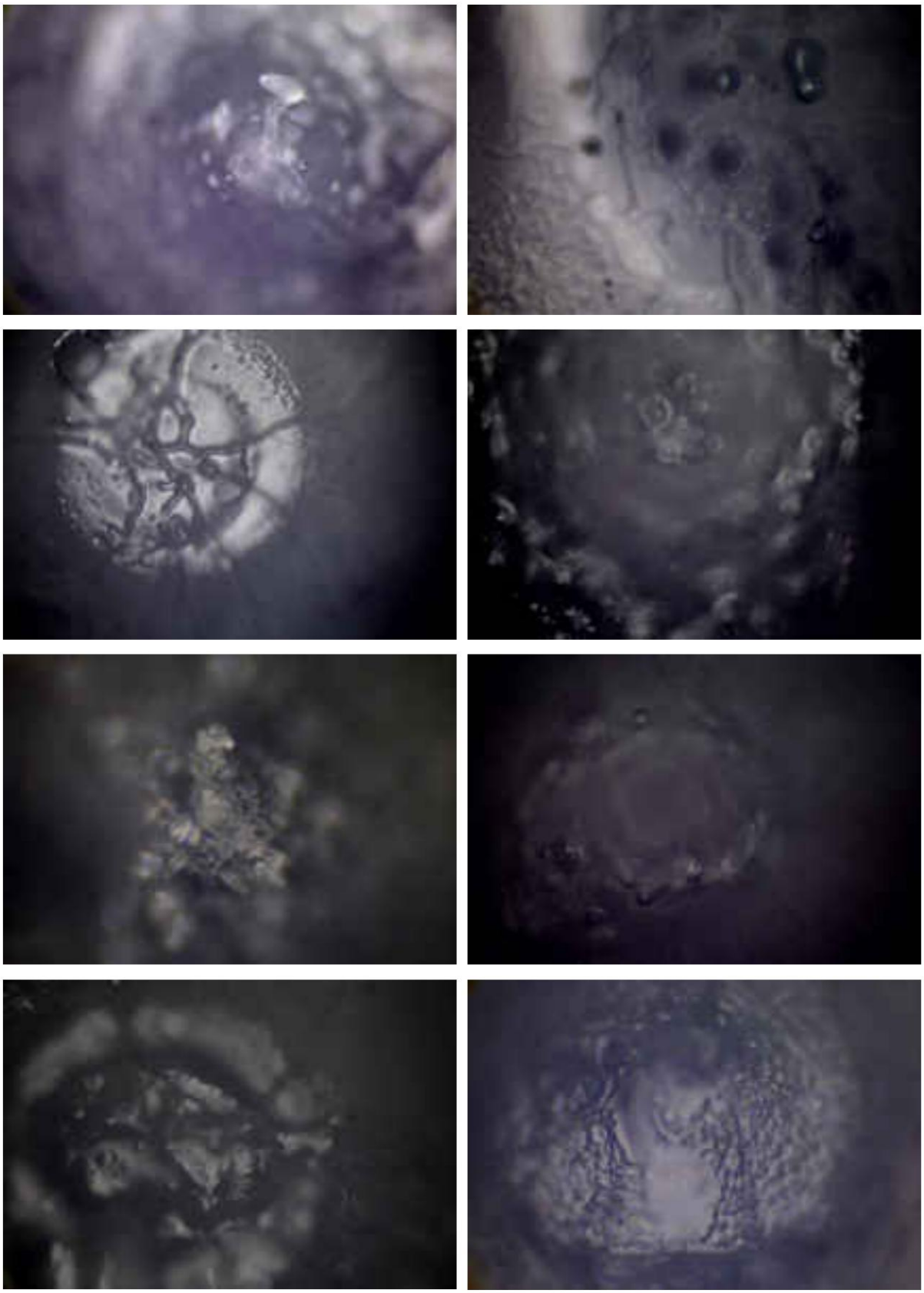
Results from the experiment
Water crystals of the control water sample

4. Tap water / control water / representative results



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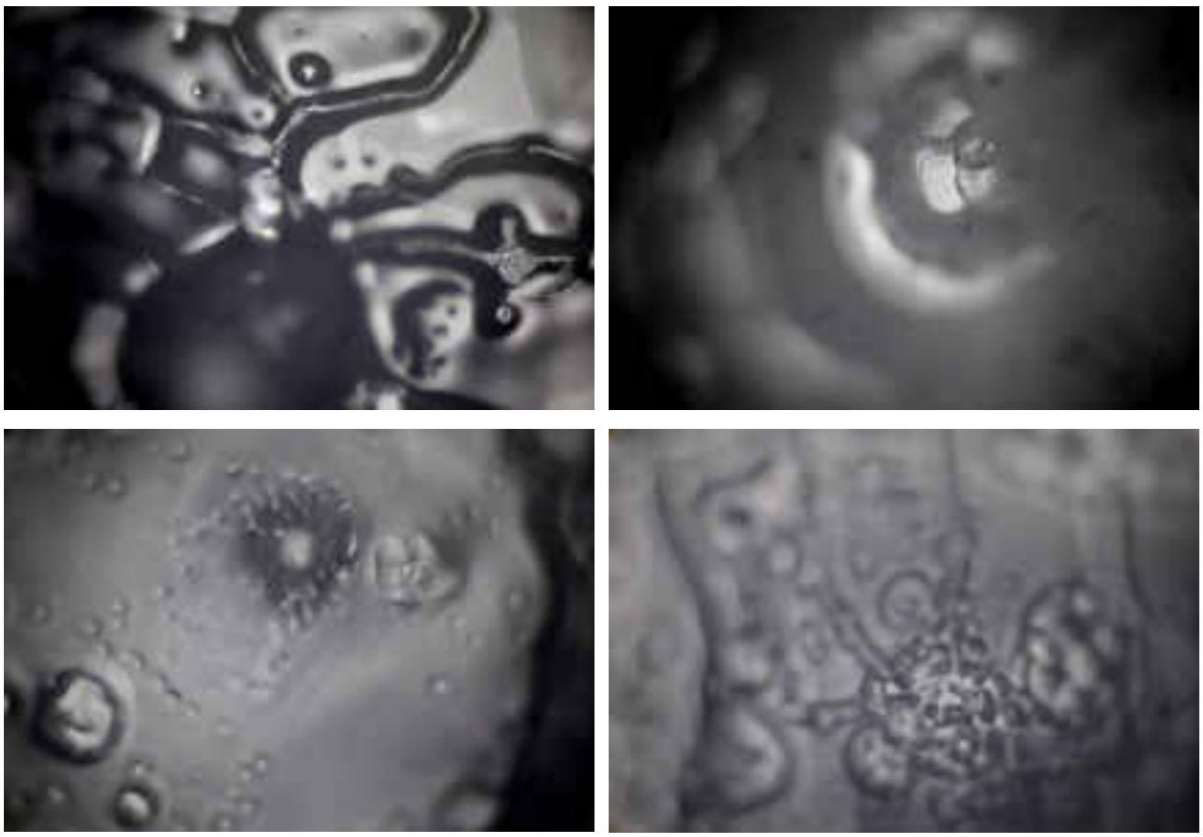

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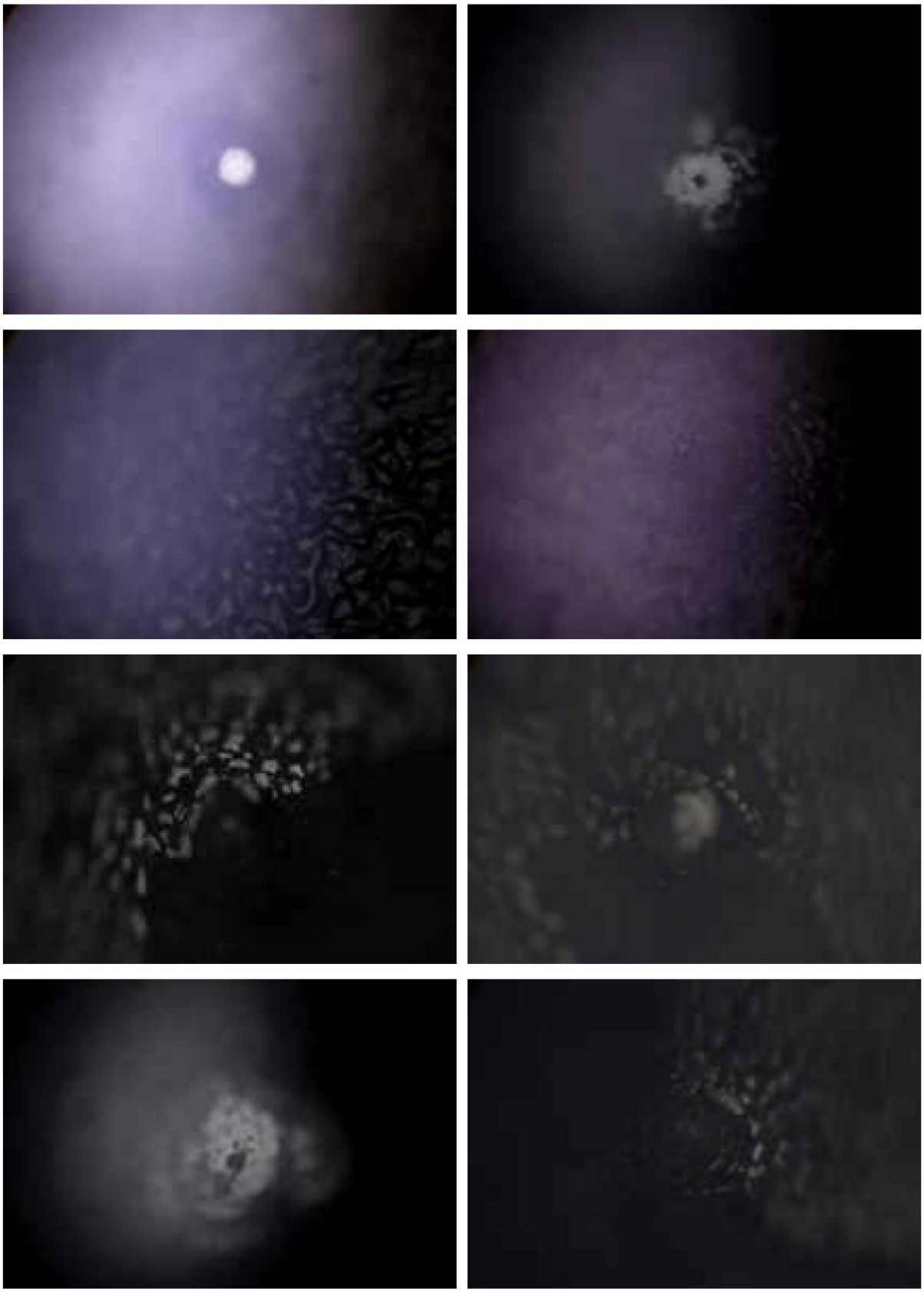
Water crystals from a water sample activated by the device
IPS Premium_Active
A sample of water labeled O



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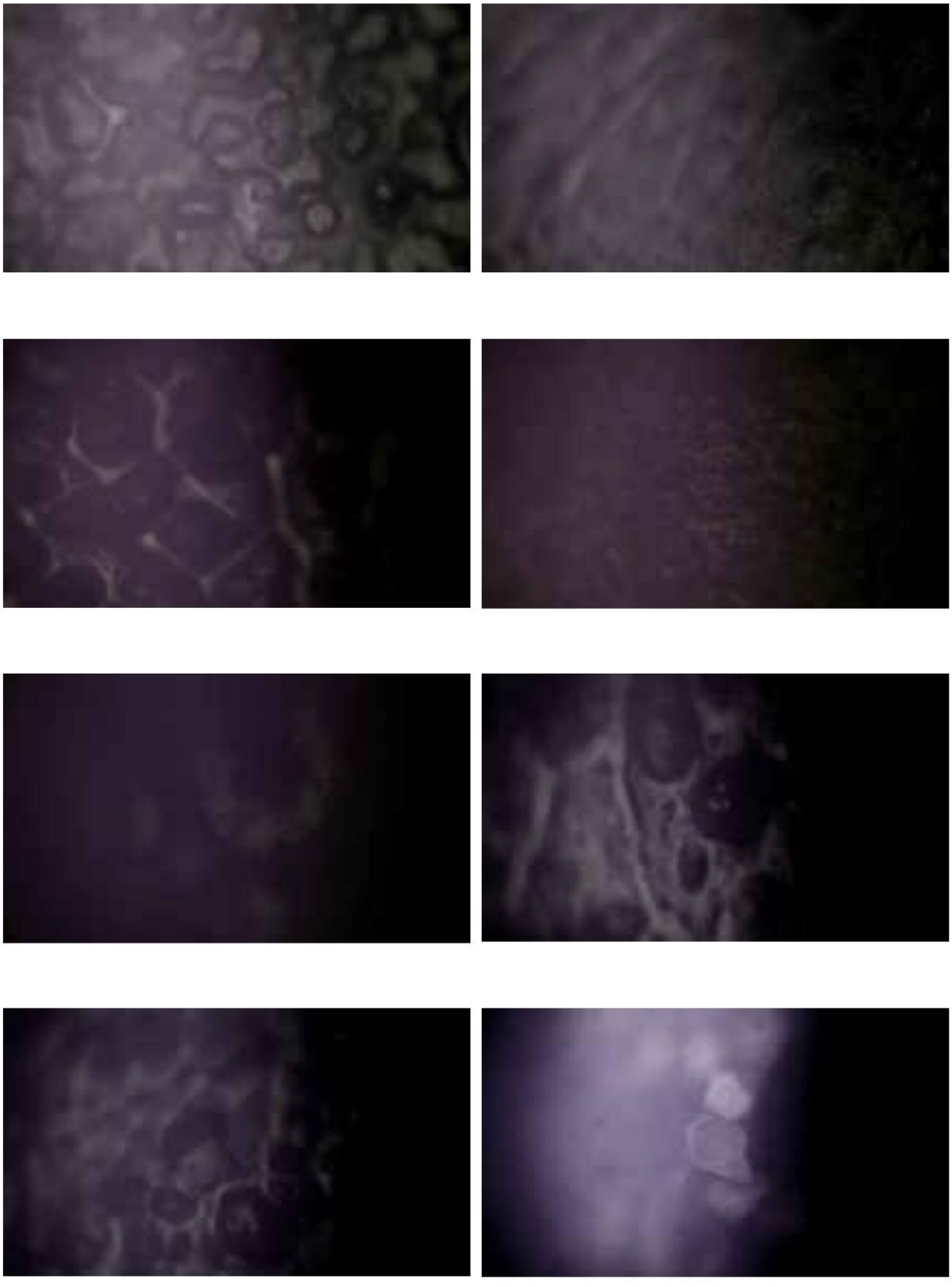

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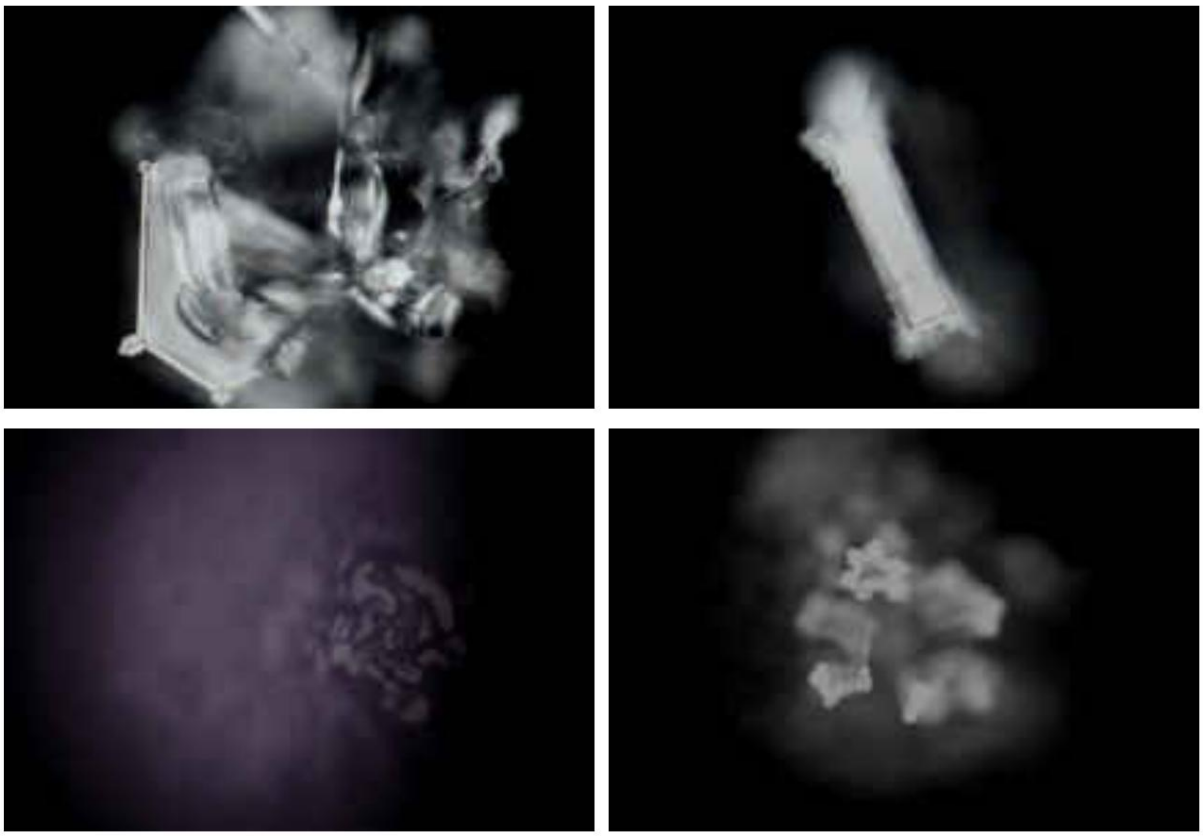

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II. Significant results from the solution of the research project

Research activities and experiments

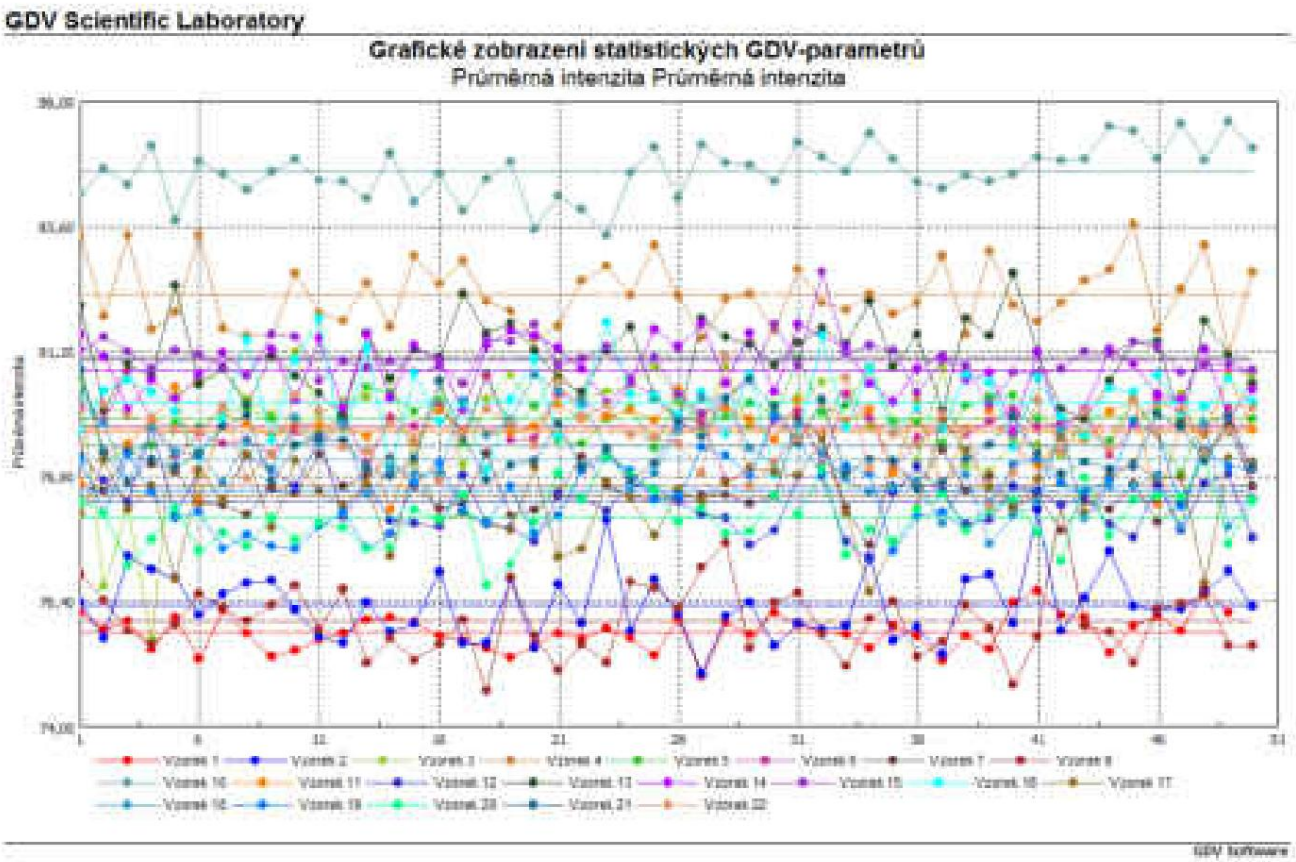
AQIPS-01 Characterization of activated water by IPS device with GDV camera

AQIPS-01-E01 Development of a test device for controlling the flow pressure of water

The research team developed an original prototype and model of a device for regulating the flow pressure of tap water in order to test the activation of water by the IPS device at different flow pressures and its effects on plants. A similar device is not known in the world. Activated water obtained by the given device with the application of the IPS system was used in all conducted experiments in field and laboratory conditions. The device is needed for both experimental and practical purposes. It is not known from the literature how the pressure of the water in the pipe affects the physical and chemical properties of the water. The device still needs to be tested for some physical parameters

AQIPS-01-E02 Characterization of the energetics of activated water by the IPS system with the parameters of the GDV camera.

Measuring the properties of activated water with commonly used measuring devices is not possible, because not a single device is capable of measuring the parameters of the energy-informational field of water. The mentioned parameters can currently only be measured with a GDV camera, which we do not have at the workplace, and therefore the first water samples were tested at a specialized workplace in Prague. Testing of the first water samples pointed to the acquisition of significant and even unique properties of activated water with the IPS system. We found significant differences between the IPS system activated water samples obtained at different pressures. The results of the testing of activated water with the IPS system are not known in the world. In order to verify the effects of activated water with the IPS system on plants, it is necessary to provide another series of experiments. This issue is little known and elaborated in the world.



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AQIPS 02 Effect of activated water by the IPS system on seed germination and growth of plant species

AQIPS-02-E01a Effect of activated water by the IPS system on germination and growth of wheat (Triticum aestivum L.)

The results of the experiment clearly showed the influence of activated water by the IPS system on the germination and initial growth of the given species. The effects of activated water obtained at individual pressures were manifested in individual variants by accelerating or slowing down germination as well as increasing or decreasing the height and weight of plants. To determine the causality of the effects, it is necessary to repeat the experiments several times. All established effects have their theoretical and practical justification.

		
Tasw 300	Tasw 400	Tasw 450

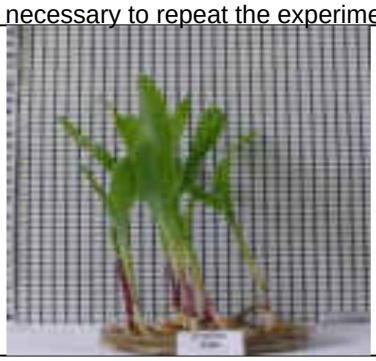
AQIPS-02-E01b Effect of activated water by the IPS system on germination and growth of wheat (Triticum aestivum L.)

In a repeated experiment, the effects of activated water obtained at individual pressures were manifested in individual variants by accelerating or slowing down germination as well as increasing or decreasing the height and weight of plants. The experiments were carried out in laboratory conditions. It would be interesting to know the effect of the IPS system on plant stands with the application of irrigation, which requires specific experiments.

		
Tasw C	Tasw 05	Tasw 10

AQIPS-02-E02a Effect of activated water by the IPS system on germination and growth of maize (Zea mays L.)

The results of the experiment clearly showed the influence of activated water by the IPS system on the germination of the given species. The effects of activated water were manifested in individual variants by accelerating or slowing down germination as well as increasing or decreasing the height and weight of plants. To determine the causality of the effects, it is necessary to repeat the experiments several times.

		
Zmfw 300	Zmfw 400	Zmfw 450

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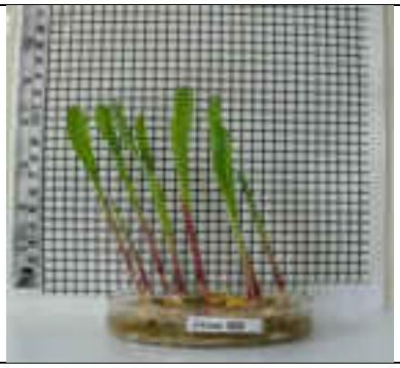
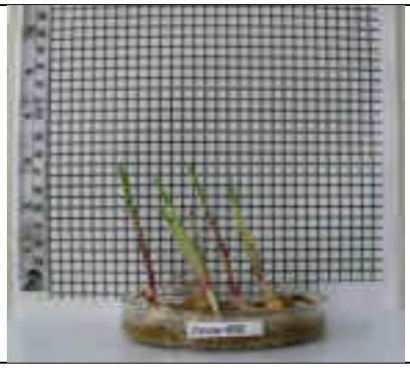
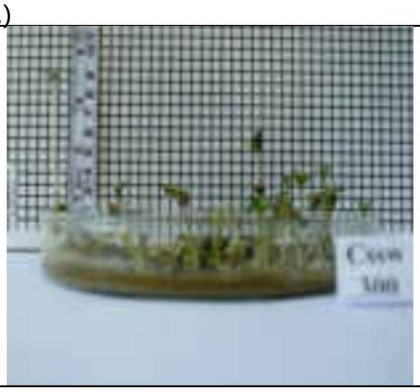
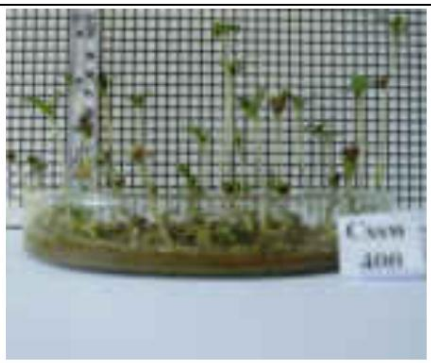
AQIPS-02-E02b Effect of activated water by the IPS system on the germination and growth of corn (Zea mays L.)

		
Zmsw 300	Zmsw 400 In	Zmsw 450

the second experiment, we noted a significant repeatability of the results in the effects of activated water on the germination and growth of sown corn plants. Activated water obtained by the IPS system at pressures above 400 Pa blocked germination and plant growth

AQIPS-02-E03a The effect of activated water with the IPS system on the germination and growth of hemp (Cannabis sativa L.) The results of the experiment clearly pointed to the effect of activated water with the IPS system on the germination, emergence, growth and development of plants of the given species. The effects of activated water were manifested in the individual variants by speeding up or slowing down emergence as well as by increasing or decreasing the height and weight of plants and their branching. To determine the causality of the effects, it is necessary to repeat the experiments several times. All established effects have their practical justification.

AQIPS-02-E03b Effect of activated water by the IPS system on the germination and growth of hemp (Cannabis sativa L.)

		
Cssw 300	Cssw 400 In	Cssw 450

the second experiment, the effect of activated water obtained by the IPS system at different pressures was manifested by a significant reduction or increase in growth and thus the height of the stands. Both effects are significant, but it is important to find out how this is reflected in the content of cannabinoid accumulation in plant parts.

AQIPS-02-E03c Effect of activated water by the IPS system on the germination and growth of cannabis (Cannabis sativa L.)

In another experiment with the application of activated water by the IPS system obtained at different pressures for the germination and growth of hemp, we noted a significant increase in plant length after certain pressures (10, 300, 400, 450 Pa) or staying at the level of the control variant (25, 50 and 75 Pa).

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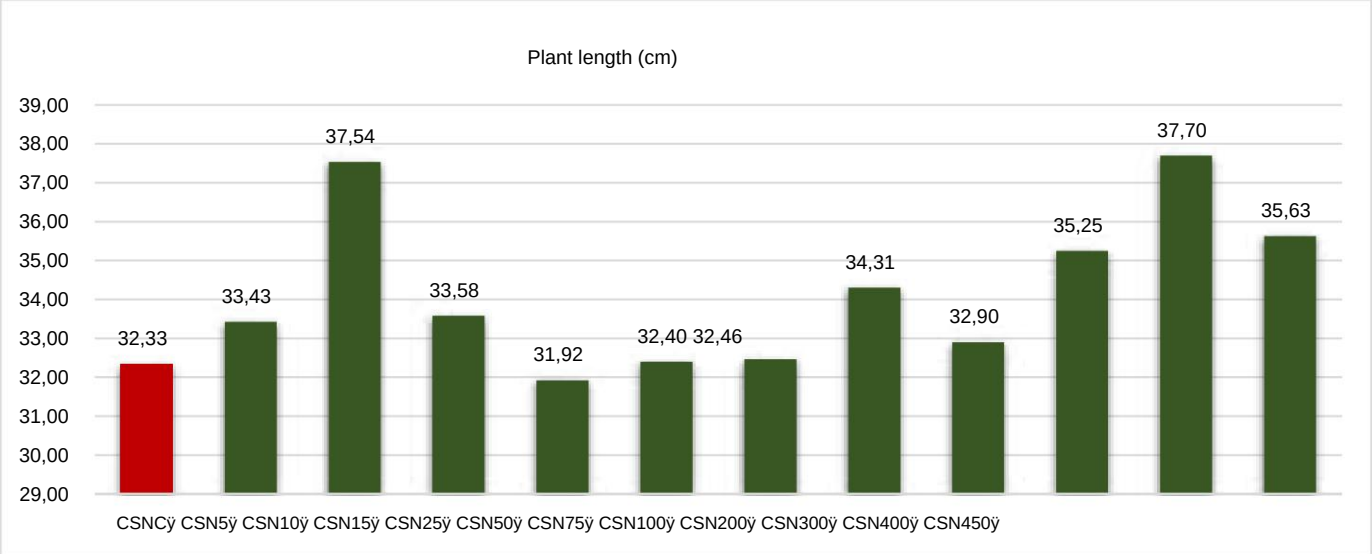
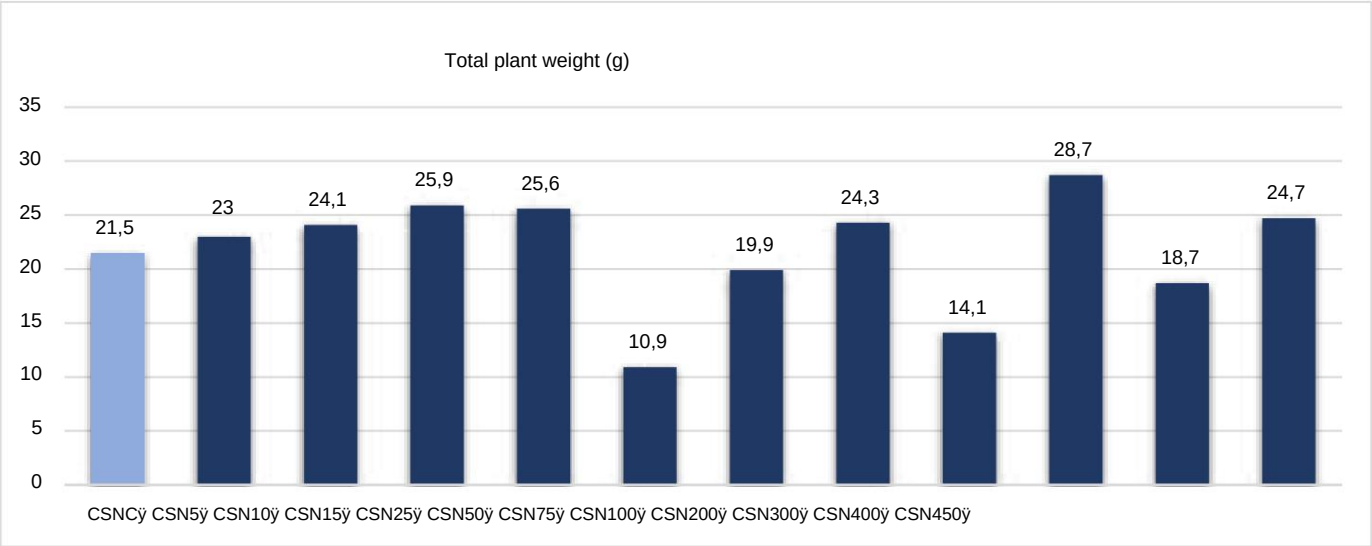
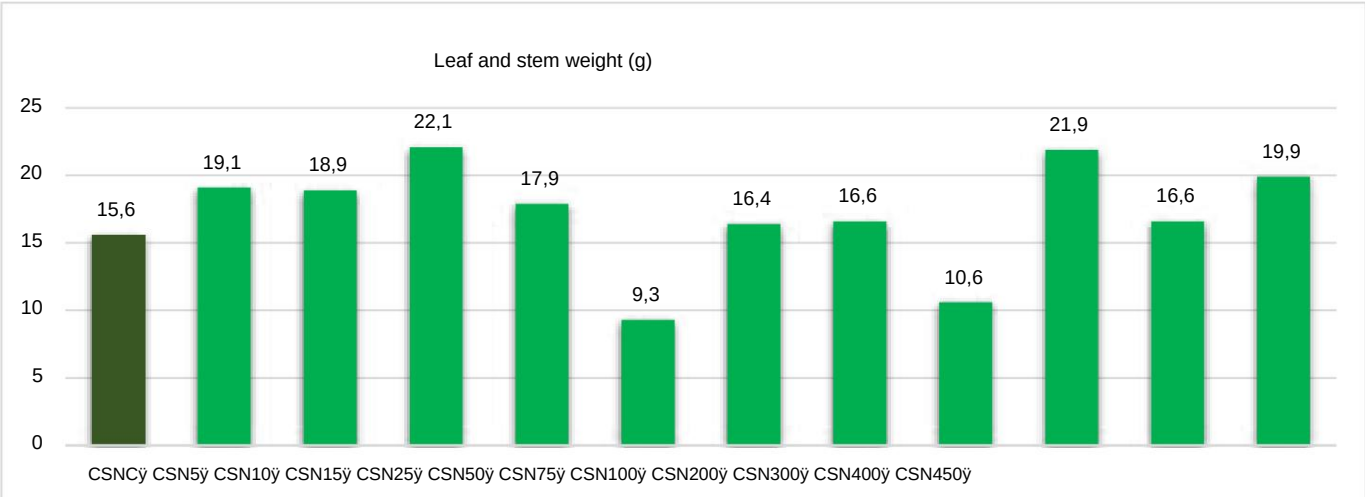




In connection with the increase or decrease in plant length, we also noticed a significant effect of activated water created by the IPS system after different pressures on plant weight as well as on the weight of leaves and stems.



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Cssw 075	Cssw 100 The	Cssw 200

effect of activated water by the IPS system after different pressures was also manifested on the habitus of the plants.

AQIPS-02-E04a,b,c Effect of activated water by the IPS system on the germination and growth of watercress siatej (Lepidium sativum L.)

In another experiment with the application of activated water by the IPS system obtained at different pressures for the germination and growth of watercress, we repeatedly noted a significant increase in plant length after certain pressures or staying at the level of the control variant.

		
Lsfw 300	Lsfw 400	Lsfw 450

		
Lsfw 300	Lsfw 400	Lsfw 450

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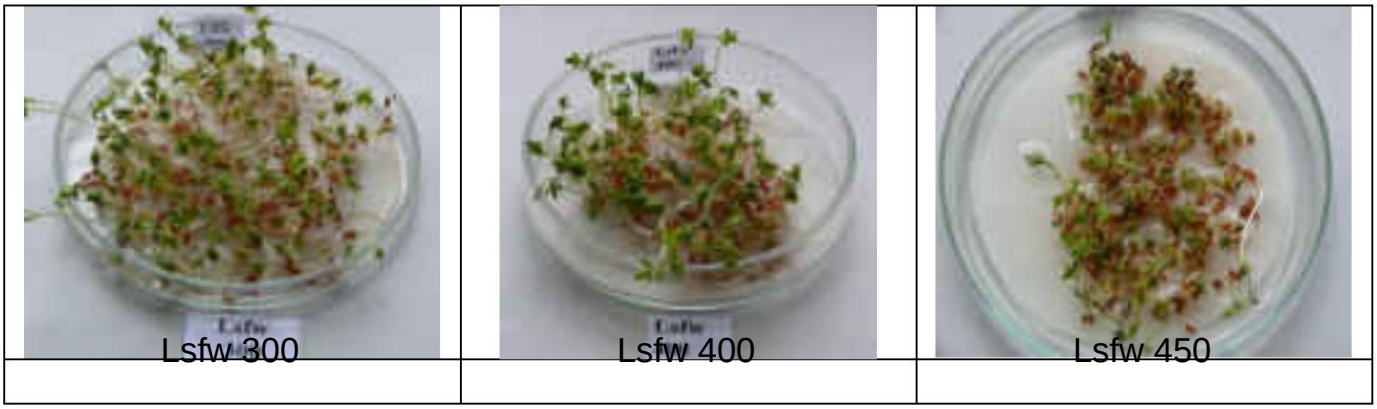
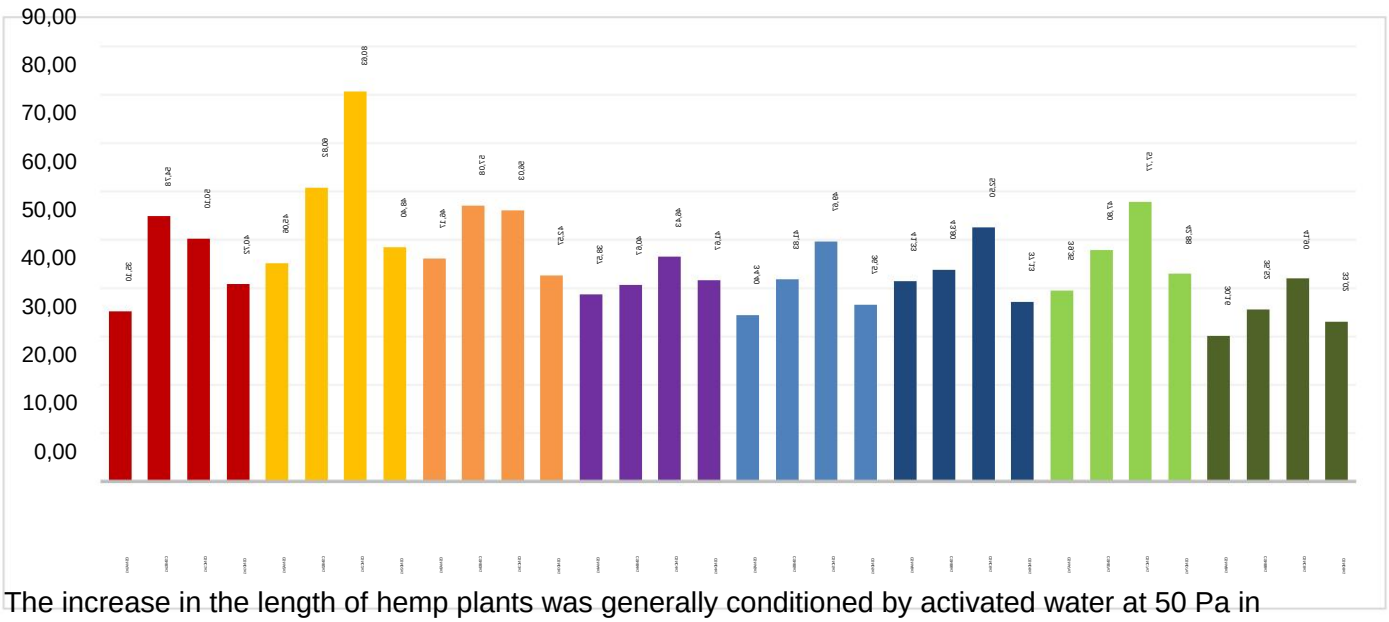


AQIPS 03 The effect of activated water by the IPS system with the application of alginite on the biological and production processes of plant species

AQIPS-03-E01 The effect of the activated water by the IPS system with the application of alginite on the biological and production processes of hemp (Cannabis sativa) - winter period - 24.1.2021-9.3 .2021



The increase in the length of hemp plants was generally conditioned by activated water at 50 Pa in combination with the application of 20g/l spray (CSNB3n1) and activated water at 100 Pa with the application of 30g/l spray (CSNC2n1), 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) alginite substrate compared to controls.

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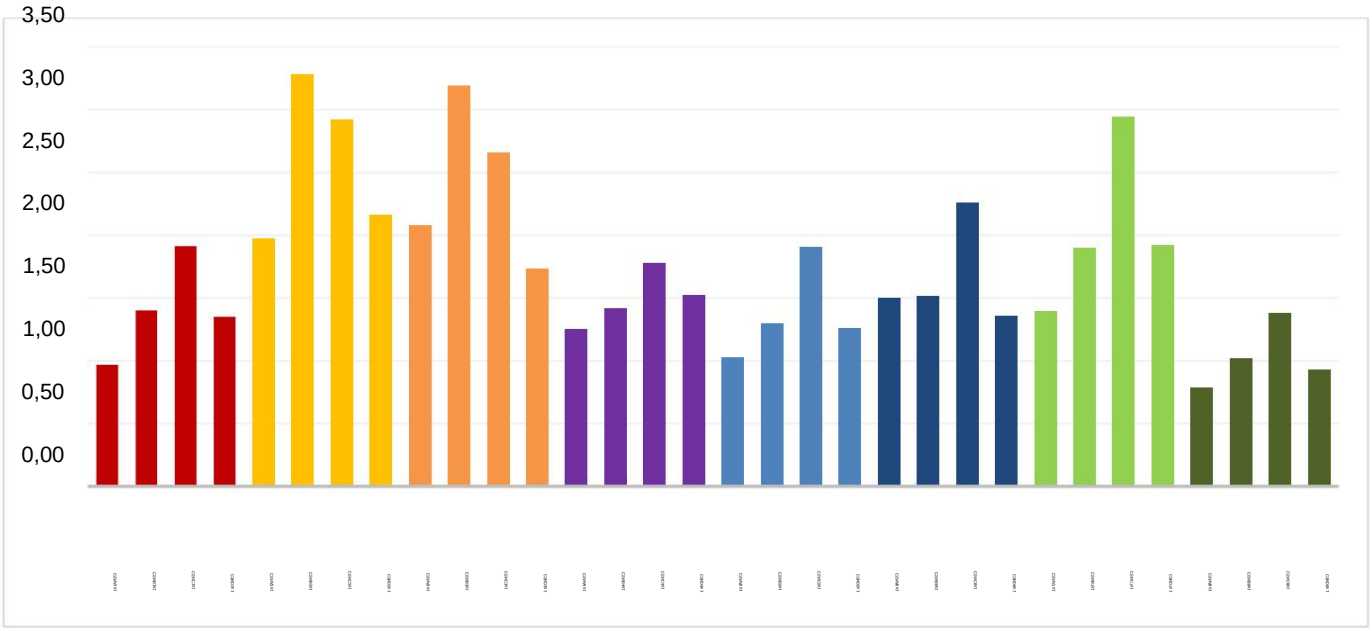
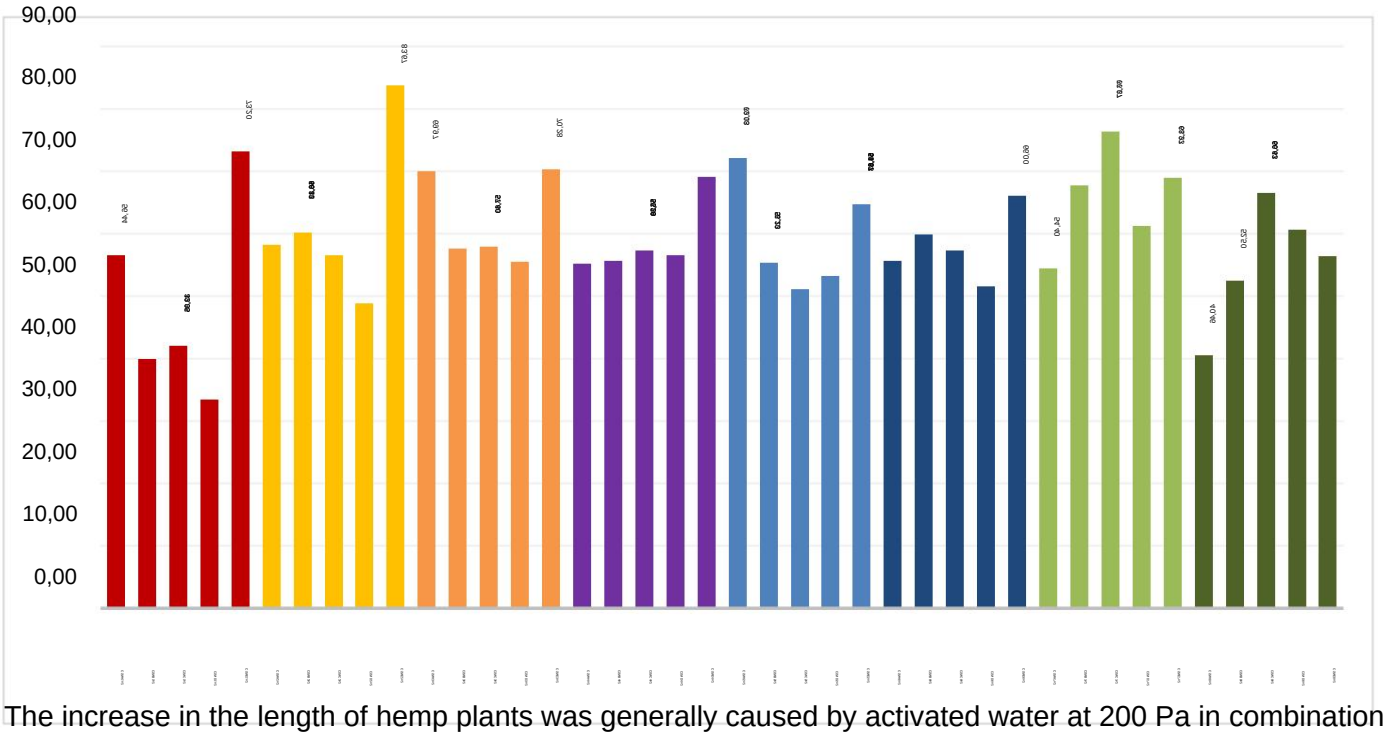


The increase in stem weight on hemp plants was generally conditioned by activated water at 50 Pa in combination with the application of sprays of 30g/l (CSNB2n1) and 20g/l (CSNB3n1) and water at 100 Pa with the application of 10g/l spray (CSNC4n1), 30g (CSNC5n1), 20g (CSNC6n1) and 10g (CSNC7n1) alginite substrate compared to controls.
AQIPS-03-E02 Effect of activated water by IPS system with alginite application on biological and production processes of hemp (Cannabis sativa) - 17.3.2021 - 19.4.2021



The increase in the length of hemp plants was generally caused by activated water at 200 Pa in combination with the application of sprays 30g/l (CSNE2n1), 20g/l (CSNE3n1), 10g/l (CSNE4n1), 30g (CSNE5n1), 20g (CSNE6n1), 10g (CSNE7n1) substrate and activated water at 100 Pa with application of 10g substrate (CSNC7n1) alginite compared to controls

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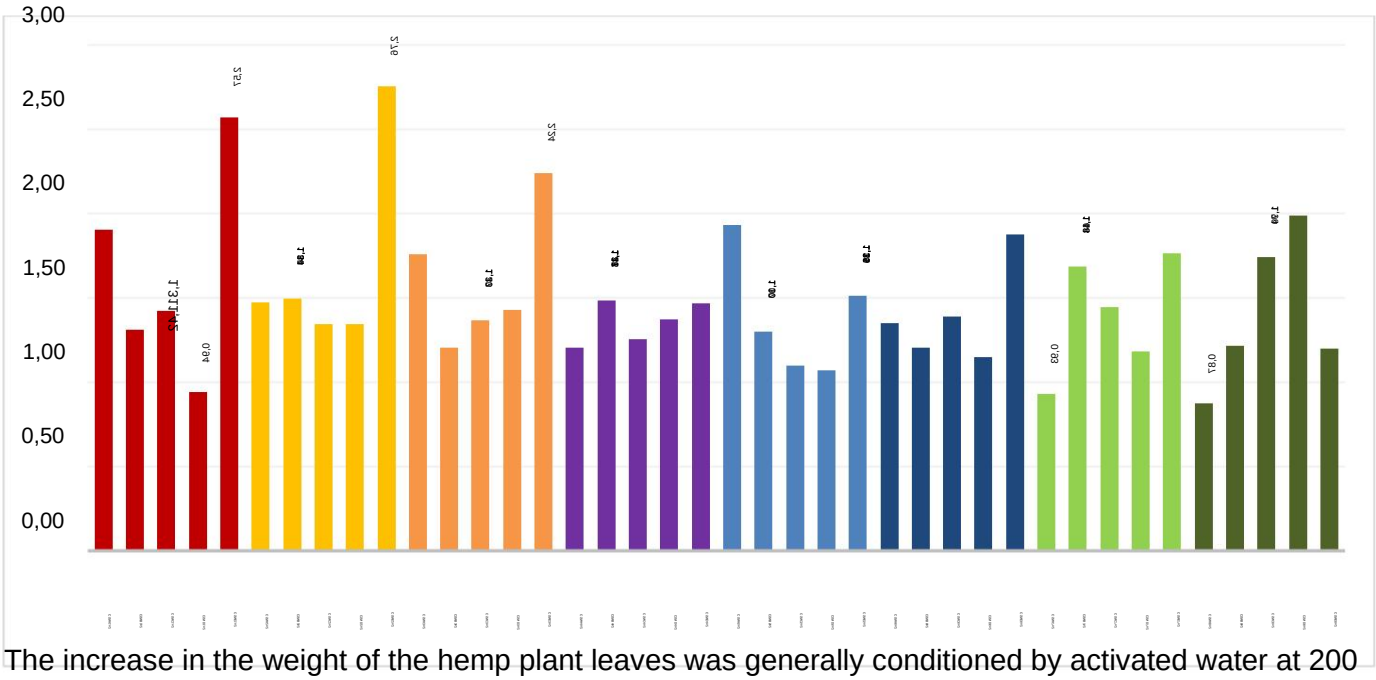
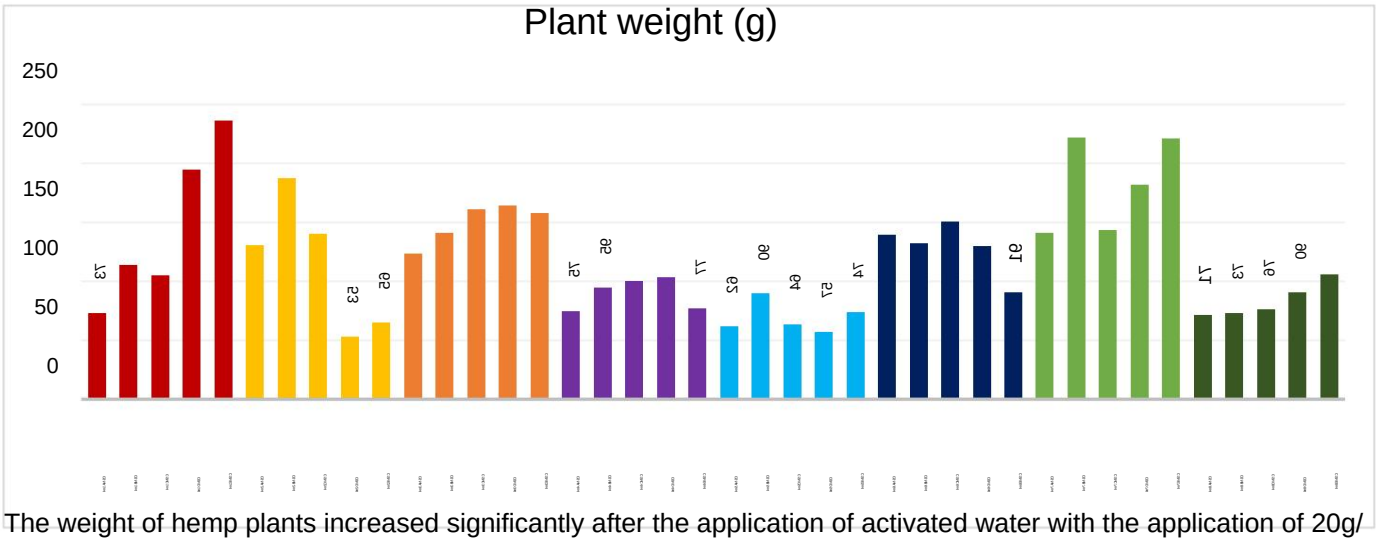


The increase in the weight of the hemp plant leaves was generally conditioned by activated water at 200 Pa in combination with the application of sprays of 30g/l (CSNE2n2), 20g/l (CSNE3n2), 30g (CSNE5n2), 20g (CSNE6n2), 10g (CSNE7n2) alginite substrate compared to controls.

AQIPS-03-E03 The effect of activated water by the IPS system with the application of alginite on the biological and production processes of hemp (Cannabis sativa) - 3.9.2021 - 7.12.2021



The weight of hemp plants increased significantly after the application of activated water with the application of 20g/l alginite spray (3 – orange color) and with the application of 10 g of alginite substrate (7-green color).

AQIPS 04 The effect of activated water by the IPS system with the application of alginite on the biological and production processes of plant species AQIPS-04-
E01 The effect of the activated water by the IPS system with the application of alginite on the biological and production processes of hemp (Cannabis sativa)
Activated water created by the IPS system in combination with alginite products significantly increased or decreased the tested production characteristics in individual variants, which also has significant practical application.

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AQIPS 05 Effect of activated water by the IPS system with the application of alginite on biochemical changes of biologically active components in selected plant parts AQIPS-05-E01 Effect of activated water by the IPS system on the content of cannabinoids in selected parts of cannabis plants (Cannabis sativa)

Tested variants	LSD test; variable CBG Homogeneous groups, alpha = .05000 Error: intermediate group, PC = 1021E3, sv = 18.000					
	Flowers	Average CBG content CSTKVK	1	2	3	4
	10024.02	CSTBV2K 10857.26	****			
1 7	10883.17	10884.00 11341.90	**** ****			
6	CSTBV1K	11555.37	**** **** ****			
9	CSTBV4K	12363.20	**** **** ****			
3	CSTAV2K	12610.27	**** **** **** ****			
2	CSTAV1K	12965.30	**** **** **** ****			
5	CSTAV4K	Application		**** **** ****		
8	CSTBV3K	of			**** ****	
4	CSTAV3K	activated				****

water by the IPS system with an alginite product statistically significantly increased the CBG content in all variants oh in the inflorescences of sown hemp compared to the control variant (1).

Tested variants	Homogeneous groups, alpha = .05000 Error: intermediate group, Postal code = 95191, sv = 19.000				
	Chaff	Average CBD content	1	2	3
	CSPKVPL	2485.639	****		
1 2	CSPVKPL	2699.784	****		
3	CSPV1PL	2882.773	**** ****		
5	CSPV3PL	3190.754		**** ****	
4	CSPV2PL	3295.119			****

After the application of alginate products (3, 4, 5), the CBD content in chaff samples on hemp plants was statistically significantly increased in comparison with the control variant (1) and with the inflorescence and chaff variant (2) at 95% probability (ÿ = 0, 05).

AQIPS-05-E02 Effect of activated water by the IPS system on the biochemical composition of selected parts of cannabis plants (Cannabis sativa)

	Retention time (min)	Component	Peak area (%)							
			A	I	B	C	D	AND	F	G
			KOV1 KST	KOV6 ST	KOV1 PCS	KOV2 PL	KOV3 PL	KOV4 PL	KOV5 PL	KOV6 PL
57	20:36	Cannabinoids	0.49	21.80	30.32	37.41	23.40	30.97	26.95	The

application of activated water to plants had a significant effect, in addition to morphological changes, in the biochemical composition of the evaluated plant parts of the tested plants. By analyzing the samples on a high-pressure gas chromatograph, an increase or even a decrease in their content was determined in several biologically active components compared to the control variant. These changes were also confirmed by determining the antioxidant activity. To determine the causality of the effects, it is necessary to repeat the experiments several times.

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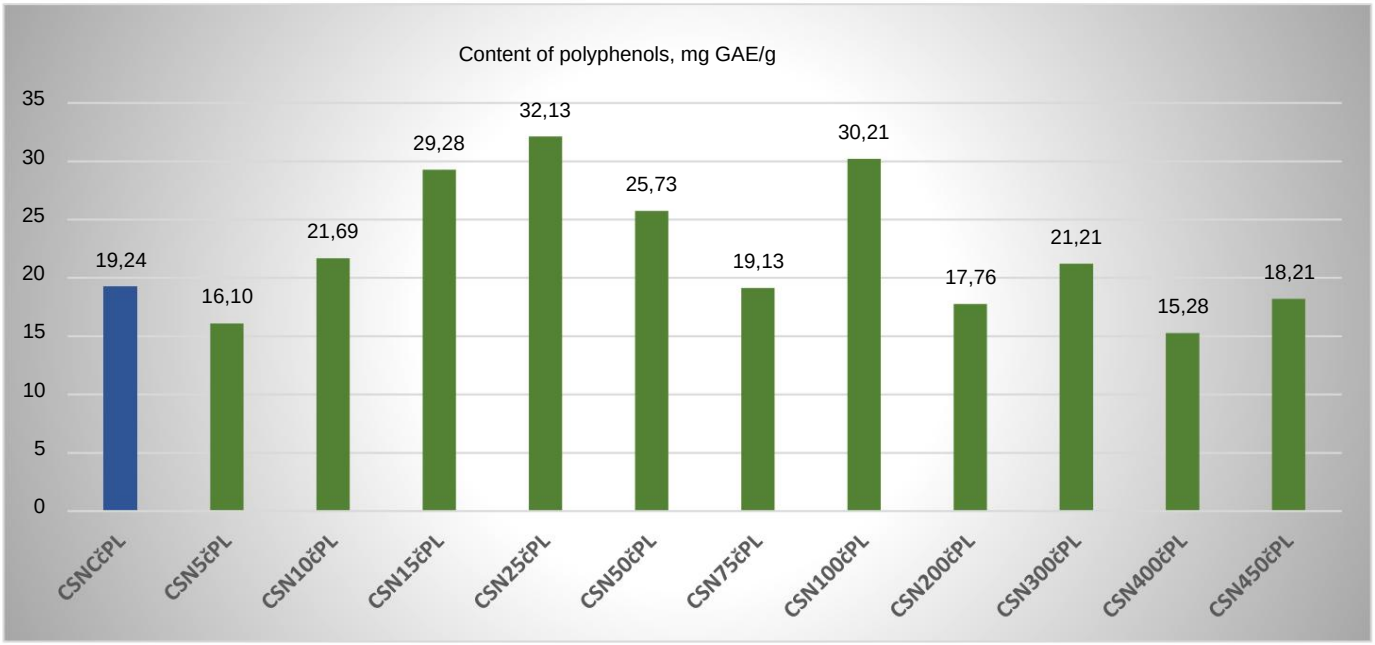
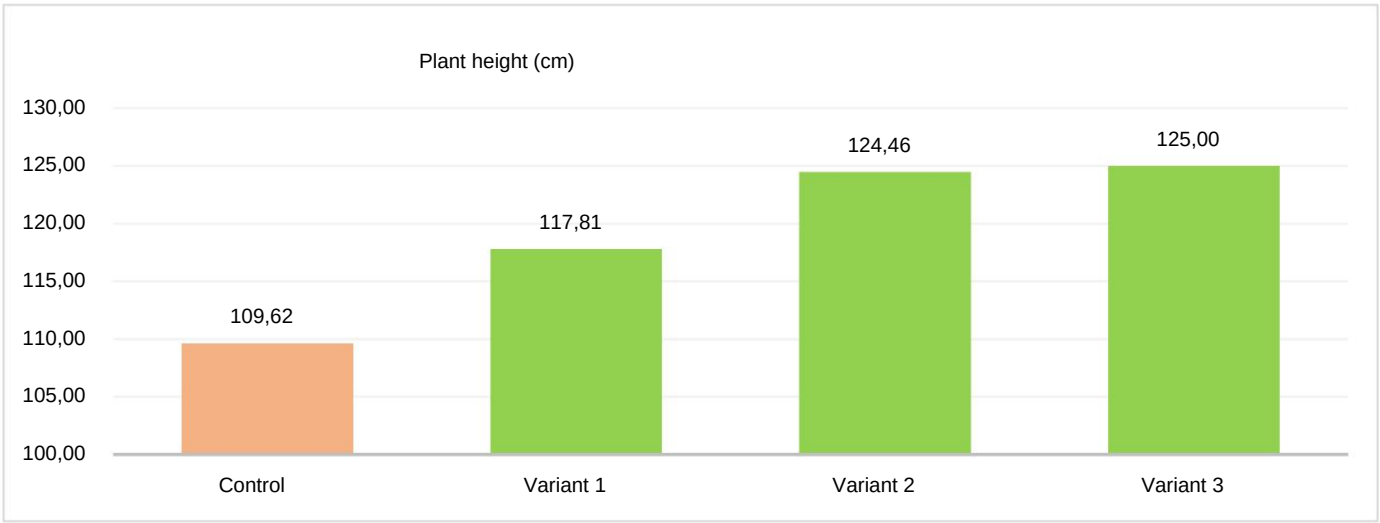
AQIPS-05-E03 Effect of activated water by the IPS system on the content of polyphenols in selected parts of cannabis plants (Cannabis sativa)



In the tested chaff samples, we recorded a higher content of polyphenols compared to the control variant when activated water was applied at a pressure of 10Pa, 15Pa, 25Pa, 50Pa, 100Pa and 300Pa. We also noted significant differences in the content of flavonoids, polyphenolic acids and antioxidant activity.

AQIPS-06 The influence of the application of alginite products on the biological and production processes of hemp (Cannabis sativa) y

AQIPS-06-E01 The influence of the application of created alginite products on the biological and production processes of hemp (Cannabis sativa)



Hemp plants treated twice with a suspension solution of alginite 20g/liter (variant 1), 30g/liter (variant 2) and 60g/liter (variant 3) by spraying on the leaves statistically significantly increased the height of the plants (cm) compared to the control variant (without application alginite).

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AQIPS-07 Determination of trichomes on plant parts of the Finola hemp variety grown in the SPU greenhouse in Nitra after application of activated water

AQIPS-07-E01 Determination of trichomes on plant parts of the Finola hemp variety grown in the SPU greenhouse in Nitra after application of activated water

The application of activated water with the IPS system conditions the formation of trichomes on plant parts of technical hemp. This means that there is a real possibility to increase the cannabinoid content of plants of technical hemp varieties.

Summary

In 2021, the research team from the Slovak University of Agriculture in Nitra ensured several experiments with the application of activated water with the IPS system in laboratory, greenhouse and field conditions.

At the outset, I emphasize that the collective had the opportunity to test the IPS system on plant species for only one year. For this reason, all relatively extensive knowledge from applied experiments is preliminary and provides basic information about the direction of the effects of the IPS system.

The findings from the conducted experiments are presented in separate reports and are at the same time basic knowledge and achieved results presented in a concise form and in the conclusions.

The IPS system is a technically very unique and ingenious water activation device with a wide range of practical uses, and undoubtedly also in the field of agriculture and especially plant production.

However, in experimental plant production, the main principle applies - results and knowledge can be considered justified only on the basis of repeated experiments during 4-6 years in different locations and during different climatic conditions.

Taking into account the fact that the collective carried out experiments in only one year, the results and knowledge can be considered primary and original, but nevertheless with a high informative value, because they indicate many directions and trends that have not been presented to the professional community from a given experimental point of view.

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In the experiments, the research team used and tested several phenomena, namely the activation of water by an original device, the determination of the energy-information fields of several samples of activated water obtained by the IPS device at different pressures, and the application of such activated water to various plant species directly or through a combination of innovative bituminous rock products - alginite to determine the effects of germination, growth, development, formation of the production process of some plant parts and their quality from a biochemical point of view. In order to obtain the presented results and knowledge, it was necessary to sow and analyze thousands of plants, samples, dozens of characters and hundreds of chemical analyses.

Activated water created by the IPS system in combination with alginite products significantly increased or decreased the tested production characteristics in individual variants, which also has significant practical application. Not every increase in morphological features on a plant is appropriate and beneficial for the economics of growing a plant species. Increasing the height of plants often means only increasing the total biomass, while the production of useful biomass is usually reduced. With hemp grown for seed, it is not the height of the plant or other morphological features that is important, but the yield of seeds from the plant or from a unit of area.

And as a rule, if the height of plants increases, seed production decreases. With hemp cultivated for the production of cannabinoids, neither the height nor the weight of the plant as such is important, but the weight of the inflorescence on the plant, which is the basic raw material for the extraction of cannabinoids. When applying activated water to a plant, it is not easy to determine when it is most beneficial for the plant - morning, evening or night? When applying water to plants, the temperature and humidity of the air, plants and water are also decisive. It is also very important to know the form of application - to the roots, spraying on the plant or just misting? Another important factor is the phenophase - in which the most water is needed and in which the least. It is not excluded that a stressful environment is suitable for the production of cannabinoids - that is, an environment created with increased dryness. Although water is crucial in the biology of each plant, it is necessary to combine it with the growing environment, soil preparation, application of nutrition and treatment of stands during the growing season with regard to biotic and abiotic factors. The mentioned and many other factors must be respected in experiments with a specific focus on individual plant species. These facts are emphasized by the research team in order to understand the expected results for practical use. Despite the fact that in such a spirit it was not possible to carry out more extensive experiments in one year, the presented results clearly document the original and unique effects of activated water by the IPS device on the tested plant species.

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III. Conclusions

1. In 2021, the research team from the Slovak University of Agriculture in Nitra provided several experiments with the application of activated water with the IPS system in laboratory, greenhouse and field conditions.
2. IPS Premium-Active is a system technically developed as a very unique and ingenious device for activating water with a wide range of practical uses, and undoubtedly also in the field of agriculture and especially plant production.
3. The collective had the opportunity to test the IPS system on plant species for only one year. For this reason, all relatively extensive knowledge obtained from applied experiments is preliminary and provides basic information about the direction of the effects of the IPS system on plants.
4. In experimental plant production, the main principle applies - results and knowledge can be considered justified only on the basis of repeated experiments during 4-6 years in different locations, during different climatic conditions on different varieties and on different types of plants.
5. Despite the fact that the collective carried out experiments in only one year, the results and knowledge can be considered primary and original with a high informative value, because they indicate many directions and trends that have not yet been experimentally realized from this point of view and therefore are not known either professional community.
6. Experiments with the evaluation of some parameters of the energetics of the GDV camera activated water created by the IPS system at different pressures clearly proved its uniqueness at the level of energy-information fields, which is the basic essence and uniqueness of the IPS device as such - unfortunately, this issue is little known to the scientific community - and the device was tested for the first time on parameters from the given area, therefore the practical reach of the uniqueness of IPS from the given point of view is still th still little known.
7. Based on the conducted experiments with plant species, it is clear confirmed the following effects of IPS:
   - 7.1. Improving (accelerating) or partially blocking (slowing down) seed germination and plant emergence; Both effects also have their practical significance - it depends on the plant species - 700 cultural plant species are used in the world - approx. 270 in Slovakia; some plant species require rapid germination and emergence, some the opposite. The obtained results cannot be generalized to all types of plants.
   - 7.2. Accelerating or slowing down the growth of established plants and the formation of biomass; Both effects also have their practical significance – in the case of plants used for fodder purposes, the formation of a large volume of biomass is required; in the case of potatoes, wheat and other cereals, the formation of a high production of vegetative biomass is totally disadvantageous - a lower production of vegetative biomass (cobs, stems, stalks and leaves) is required, but a higher yield of seeds and tubers; tall plants with a small proportion of inflorescences are not needed for seeded hemp, but rather short plants with massive ones

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by inflorescence - IPS confirmed this effect positively in experiments; The obtained results cannot be generalized to all types of plants.

7.3. An increase or decrease in the content of important biochemical components in various plant parts significantly affects their quality, which, however, needs to be evaluated specifically for individual species - in each plant cell there are approximately 5-10 thousand biochemical components, therefore biochemical studies are expensive; practical understanding of increasing or decreasing - with malting barley, an enormous increase in proteins is disadvantageous, but decreasing them; with wheat, what is interesting is not the enormous increase in storage proteins and non-essential amino acids in the grain proteins, but essential amino acids;

7.4. Increasing the antioxidant activity (AA) of plant parts - increasing AA means an increase but also a decrease in several important biologically active components in plants (vitamins, amino acids, flavonoids, polyphenols, polyphenolic acids and many others) - it is an important comprehensive indicator of the quality of plant products - almost in all experiments confirmed the effect of increasing AA with activated water, which is very significant

7.5. An increase in the content of cannabinoids in plant parts of hemp, mainly in inflorescences and flower petals, after the application of activated water as well as in combination with alginite - these effects were confirmed in experiments after the application of activated water as well as in combination with alginite (CBD, CBG)

7.6. Secondly, it was noted in the experiments that by applying activated water with the IPS system a) improvement of the water regime in plants (increased tolerance against drought), b) increased tolerance against biotic factors (lower presence of diseases), c) shortening of the vegetation period (hemp sown) - from no special experiments were carried out on the issue in question.

7.7. By activating the water with the IPS system, the physico-chemical properties of the water are significantly modified, mainly the stabilization of EC and TDS, which makes the water more acceptable for plants - however, it is necessary to take into account the quality of various water sources, the specific requirements of plants for soil and water pH, the time of irrigation application and technical irrigation equipment - no special experiments were carried out on the issue in question

8. It is possible to consider the results from testing the energy indicators of activated water samples as very valuable and original. The results clearly demonstrated the unusual "dynamic activities" of the individual tested samples.
The explanation of the detected reactions is not simple. The complexity of the interpretation lies in the fact that even the laboratory workers who tested the samples did not encounter such manifestations of the water samples and therefore cannot take a position on the issue themselves. There is also the problem of experimental errors and mistakes. Water manifests itself in a specific form of its "life" and indescribable reactions to all possible known but mainly unknown influences, which in most cases are unrepeatable. This means that it reacts very sensitively to all technical, climatic, human and other unknown factors during sample preparation, transfer

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samples, ambient electrosmog, evaluation of samples and environmental conditions in which the mentioned activities are carried out. These briefly mentioned problems were fully manifested when testing the energetics of the samples themselves, as well as when conducting experiments on the application of water for the germination, growth and development of the tested plants. Therefore, it would be appropriate to repeat the experiments to confirm the causality of the determined effects of activated water.

In Nitra, January 4, 2023 doc. Ing. Ján Brindza, CSc.