



UNIwersytet Rolniczy
im. Hugona Kołłątaja w Krakowie



Incubator of Innovation 2.0

University of Agriculture in Krakow

Centre for Technology Transfer of the University of Agriculture in Krakow

Innovation Centre of the University of Agriculture in Krakow, Ltd.



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We are pleased to present to you a publication in which we present some of the research currently carried out at the University of Agriculture in Krakow. These works are mainly associated with innovations and new technologies that can find their application in broadly understood business. The creation of this material could have occurred thanks to the implementation of the competition „Innovation Grant”, implemented as part of the „Incubator of Innovation 2.0”. This Program contributes to the financing of 9 selected research works, which are presented in this publication. The catalog presented to you covers only a fragment of many activities undertaken under the Program.

The aim of the „Incubator of Innovation 2.0” is to support the process of managing the results of scientific research and development works of employees and research teams of the University of Agriculture in Krakow, in particular in terms of their commercialization. The implementation of the Program contributes to the promotion of scientific achievements, increasing their impact on the development of innovation and strengthening cooperation between the scientific and economic environment.

Promoting the scientific achievements of the creators of individual Grants in order to increase the efficiency of knowledge and technology transfer to the business is one of the main objectives of the Centre for Technology Transfer of the University of Agriculture in Krakow and the Innovation Center of the University of Agriculture in Krakow, Ltd., who are the main contractors of this Program on behalf of the University of Agriculture in Krakow.

The goals of the Centre for Technology Transfer of the University of Agriculture in Krakow activity is to stimulate the University’s innovativeness by enabling the full use of the intellectual potential of the academic staff of the University of Agriculture in Krakow. The tasks of the Centre for Technology Transfer of the University of Agriculture in Krakow includes the commercialization of research results, conducting activities in the field of intellectual property protection, building a cooperation network between the sphere of science and the economy to facilitate and intensify the flow of innovative technologies and knowledge. The Innovation Centre of the University of Agriculture in Krakow, Ltd. deals with the commercialization of the results of scientific and research works created at the University of Agriculture in Krakow through the sale of patents, licenses and the creation of spin-off companies. As authors, responsible for the preparation of this publication, we believe in the great potential of innovations created at the University. We are sure of the positive impact of created innovations on the development of our University, as well as many areas of life in the Lesser Poland Voivodeship and throughout the Poland. This publication is dedicated to innovators, businessmen and entrepreneurs who are looking for support in the implementation of their innovative projects. We also recommend it to scientists of the University of Agriculture in Krakow who are just starting their scientific career or are already at its more advanced stage. It is thanks to their efforts and commitment that this publication could be created, inspiring the next innovators and explorers!

Authors



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DOMAIN: Agriculture and Horticulture

AREA: Plant biostimulation

Grant topic: Making a prototype of the „Growth Stimulator” device for post-emergence plant biostimulation

Introduction: „Growth Stimulator” is an innovative technology of post-emergence plant irradiation, using the combined method (algorithm for irradiating plants with adjustable light beams). It is dedicated to agricultural producers looking for agro-technology dedicated to plants in the juvenile phase, sensitive to potential abiotic and biotic stress factors, including pathogens, water deficit.

Description of the solution: „Growth Stimulator” is dedicated to small- and large-area agricultural producers cultivating arable crops, including vegetables and herbal plants. An element difficult to imitate is the proposed algorithm that can effectively stimulate plants to grow in a safe way for the environment. The technology solves the problem of the length of the vegetation period of plants, e.g. soybeans, which in the case of growing high-oxygen varieties with a prolonged vegetation period is problematic due to the late harvest date, which raises problems with seed drying.

Faculty: Agriculture and Economics at the University of Agriculture in Krakow

Authors of the Grant: manager: Agnieszka Klimek-Kopyra PhD, research team: Bogna Kulig Prof. DSc, Piotr Janas PhD, Piotr Przybyszewski

Grant Supervisor (Innovation Broker): Wojciech Borówka

Solution development phase: Currently, level III TRL, ultimately level IV or V TRL.

Intellectual property rights: The team plans to submit a patent application for an innovative prototype for post-emergence plant biostimulation.

Proposed form of cooperation: The research team plans to set up a spin off company.



DOMAIN: Civil Engineering and Transport, Earth Sciences and the Environment

AREA: TLS, UAV measurements

Grant topic: Measuring instrument for integrating data from TLS and UAV measurements

Introduction: Measuring balls dedicated to the integration of measurement data from TLS and UAV are not produced in the world or in Poland. Until now, manufacturers of scanners and accessories for them have focused on the modification of reference balls for the needs of measurements by ground laser scanning techniques. In commercial sales you can find only a few offers of reference balls for laser scanning in the classic form of the white sphere, but there are no reference balls in the proposed form and functionality.

Description of the solution: As part of the research, several conceptual marker solutions for the integration of data from TLS and UAV measurements were analyzed and tested. A measuring ball with a contrasting marker as a photopoint for photos and a center for measurements using classical geodetic technique and RTK GPS was chosen as the optimal solution and its prototype was tested as part of the research. The appearance of a new product on the market will enrich the narrow offer so far, and the production of the solution on the domestic market will make it competitive in price. The abandonment of classic geodetic tripods, integration of measurements based on common reference points and the possibility of measuring them with classic geodetic techniques are features that increase the comfort of contractors' work, shorten the time needed to perform the contract, while ensuring the maximum precision possible.

Faculty: Environmental Engineering and Land Surveying at the University of Agriculture in Krakow

Authors of the Grant: manager: Bartosz Mitka PhD, research team: Przemysław Kłapa M.Sc., Eng.

Grant Supervisor (Innovation Broker): Wojciech Przywała M.Sc., Eng.

Solution development phase: Currently, level VII TRL, ultimately - level IX TRL.

Intellectual property rights: An application for protection of the industrial design „Reference marker for integration of measurements” was filed at the Patent Office of the Republic of Poland (protection of the industrial design was obtained on 08.05.2018 under the number Wp.26231). On 29.01.2018, an application for a patent for the invention was submitted: „Measuring instrument for the integration of data from terrestrial laser scanning (TLS) and unmanned aerial vehicles (UAV)”, application number P.424402.

Proposed form of cooperation: Cooperation in the production and distribution of the device or acquisition of a license for the production of the device.

DOMAIN: Biological Sciences, Agriculture and Horticulture

AREA: Phytoremediation of industrial wastewater

Grant topic: Optimization of phytoremediation of industrial wastewater containing chromium using callitriche (*Callitriche* sp.) and co-inhabiting organisms

Introduction: The use of living organisms in the removal of impurities (generally bioremediation) is becoming increasingly popular in the world. Previous studies have experimentally confirmed the critical functions of future technology (treatment plant). Callitriche together with accompanying species can be a high-efficiency biological filter enabling purification of water and sewage from chromium compounds present in the environment, i.e. chromium (VI) and chromium (III). The solution obtained under the project may be used in hydrophyte sewage treatment plants containing chromium (and other heavy metal compounds). The area of application of such treatment plants will be mainly areas contaminated with Cr compounds - plants producing or using chromium compounds, as well as post-mining areas.

Description of the solution: Chromium compounds, in particular the Cr(VI) form belong to the so-called priority toxicity compounds. The benefits of using plants are associated with: low costs, no secondary pollution and the elimination of pollution in the area of contamination. Conventional methods used to remove Cr from water involve the reduction of the Cr(VI) form to the Cr(III) form, which is less soluble, less toxic and precipitates from the contaminated solution. The resulting sludge containing Cr (and secondary pollution - other compounds for reduction) is deposited in a hazardous waste landfill. This solution does not eliminate pollution, but only reduces the bioavailability of chromium in the environment. Callitriche not only performs very efficiently the accumulation of Cr, but also its reduction from the Cr(VI) to Cr(III) form (which has been documented in cognitive studies). In the long run, the proposed solution will also aim to recover chromium.

Faculty: Biotechnology and Horticulture at the University of Agriculture in Krakow

Authors of the Grant: manager: Joanna Augustynowicz PhD, research team: Ewa Sitek PhD, Dariusz Latowski PhD

Grant Supervisor (Innovation Broker): Wojciech Borówka

Solution development phase: The transition to level VI TRL is planned.

Intellectual property rights: Patent Application dated 9.05.2016, No. P. 417140.

Suggested form of cooperation: Service - consultation / expertise in the field of phytoremediation of chromium contaminated waters. Patent sale - if obtained.

DOMAIN: Mechanical Engineering

AREA: Sewage distribution

Grant topic: Formeth - technology for direct decomposition of formaldehyde and urotropin wastewater

Introduction: Introduction: It is planned to make a laboratory technology demonstrator that will be adapted to continuous process running together with a measuring stand for quick verification of the obtained process effects. Thanks to this solution, it will be possible to demonstrate the effect of using the technology on potential customers, based on real waste water samples. It is a unique solution on the domestic and international market, which allows to demonstrate to the client how the technology works and the effects of its application after implementation at the plant.

Benefits of using:

- environmental profit by reducing currently incurred costs and emissions of pollutants into the environment,
- the operating cost of conducting the process with the use of peroxone is on average PLN 2.54 · kgChZT-1 (in classical methods the cost is PLN 17 · kgChZT-1),
- the first technology in Poland for the disposal of formaldehyde and urotropin wastewater using peroxone will be created,
- substrates derived from raw materials 100% neutral for the environment,
- the process will be carried out in accordance with the highest standards of safety and environmental protection,
- improving the ecology of waste treatment processes (no additional waste will be generated during processing).

Faculty: Production and Power Engineering at the University of Agriculture in Krakow

Authors of the Grant: manager: Maciej Gliniak PhD, research team: Mateusz Malinowski PhD, Stanisław Famielec PhD, Tomasz Jakubowski DSc, Anna Lis M.Sc., Eng.

Grant Supervisor (Innovation Broker): Adelina Kasprzak M.Sc., Eng.

Solution development phase: Currently level III TRL, planned to reach level VI TRL.

Intellectual property rights: Property rights belongs to Maciej Gliniak PhD.

Proposed form of cooperation: Short-term rental, purchase of devices in the ESCO formula.



DOMAIN: Civil Engineering and Transport

AREA: Reference balls

Grant topic: Innovative solutions for stabilizing reference balls on the surface of the land, as well as balustrades and handrails

Introduction: The subject of R&D works are steel reference balls with devices for their stabilization on the surface of the land in the form of a steel tripod (solution R1) and on balustrades and handrails in the form of steel clamp (solution R2). Terrestrial laser scanning (TLS) is used in many engineering fields, including enables non-contact and automatic measurement of one million points in real time. To uniquely identify common points in the space of scanning stations, among others, reference balls. The balls are placed in the scanner view space and stabilized by means of handles, magnets, etc.

Description of the solution: The essence of research on R1 consists in developing such a reference ball mounting on the surface of the terrain to ensure stability, also when measuring its location with geodetic techniques. The advantage of R1 is simplicity of use and product life. The ball attachment device ensures full stability on the terrain surface and allows it to be measured by geodetic techniques. It is handy, light, easy and cheap to make. The essence of research on R2 is to develop a stable attachment of the reference ball on all types of balustrades or handrails, of any cross-section and building material, with protection for the mounting surface. The advantage of R2 is the stability of mounting the ball on various objects by adjusting the width of the handle to the dimensions of the structure element on which the ball is mounted.

Faculty: Environmental Engineering and Land Surveying at the University of Agriculture in Krakow

Authors of the Grant: manager: Maria Makuch PhD, research team: Pelagia Gawronek PhD

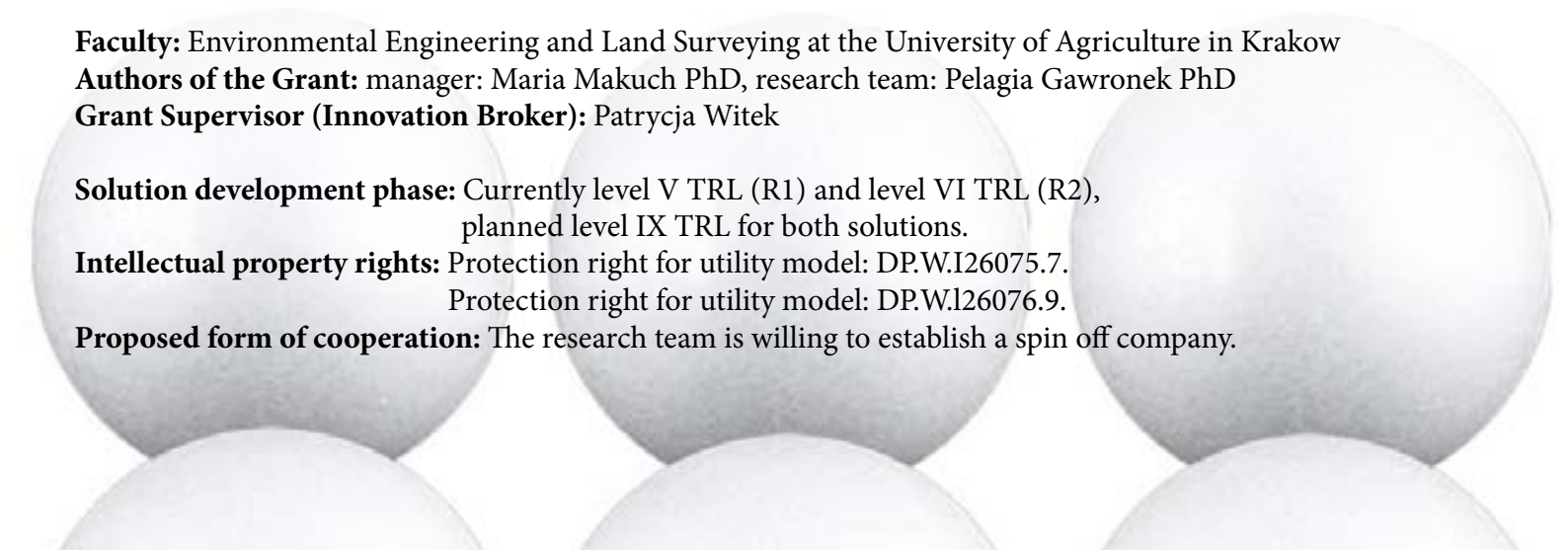
Grant Supervisor (Innovation Broker): Patrycja Witek

Solution development phase: Currently level V TRL (R1) and level VI TRL (R2),
planned level IX TRL for both solutions.

Intellectual property rights: Protection right for utility model: DP.W.I26075.7.

Protection right for utility model: DP.W.I26076.9.

Proposed form of cooperation: The research team is willing to establish a spin off company.





DOMAIN: Food and Nutrition Technology

AREA: Furcelleran foils

Grant topic: The use of furcelleran films for the production of meat preparations

Introduction: As a result of active research on furcelleran-whey films cross-linked with plant extracts, they were found to have antioxidant and bacteriostatic effects. These films are flexible enough to wrap a food product in - they do not break, crumble or break. The films contain bioactive compounds, which significantly affects their performance. Studies have shown the positive effect of furcelleran-whey film on the durability of perishable products and the slowing down of oxidation processes. These films are biodegradable and edible, which is important due to the growing problem of waste management and environmental protection.

Description of the solution: This research is aimed at developing smoked meat production technology using active films. This solution will apply in the meat industry. Many smoked meats can be included in the group of non-shell products. The distribution of such products requires packaging. Recontamination is a problem that arises during preparation for distribution. The use of edible films will avoid the use of plastic packaging and protect the product against recontamination. The presented solution is innovative on a global scale. Currently, edible, biodegradable and active packaging are not used on the market. For packaging meat, plastic bags or sheets are used (most often: polyethylene, polypropylene or polyamide), collagen paper or foil.

Faculty: Food Technology at the University of Agriculture in Krakow

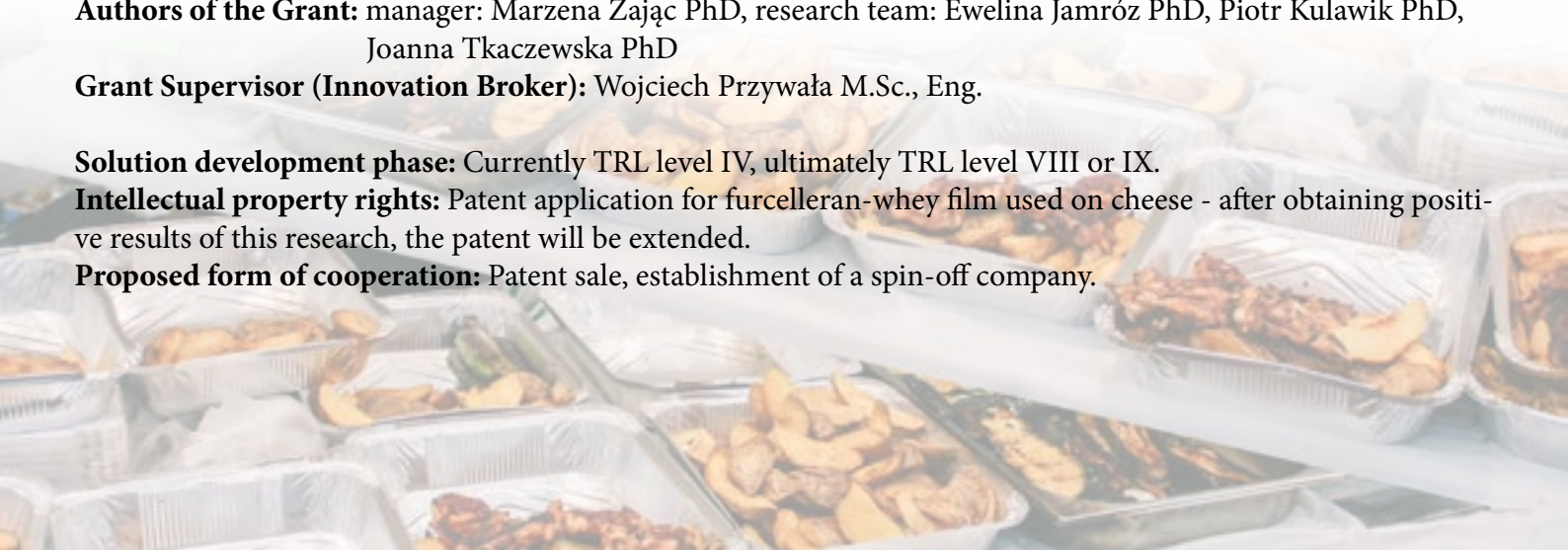
Authors of the Grant: manager: Marzena Zajac PhD, research team: Ewelina Jamróz PhD, Piotr Kulawik PhD, Joanna Tkaczewska PhD

Grant Supervisor (Innovation Broker): Wojciech Przywała M.Sc., Eng.

Solution development phase: Currently TRL level IV, ultimately TRL level VIII or IX.

Intellectual property rights: Patent application for furcelleran-whey film used on cheese - after obtaining positive results of this research, the patent will be extended.

Proposed form of cooperation: Patent sale, establishment of a spin-off company.





DOMAIN: Food and Nutrition Technology

AREA: Hydrolyzate in the form of microcapsules

Grant topic: Carpate gelatin hydrolyzate in the form of microcapsules to extend the shelf life of fish and their products

Introduction: The invisible layer of microcapsules with carp gelatin hydrolyzate and / or peptide, located on the surface of perishable food (e.g. raw fish) will allow the inhibition of oxidation processes, which is one of the reasons for the inadequate quality of stored fish. Therefore, the technology developed for the production of microcapsule solution with hydrolyzed carp gelatin and / or biopeptide can be an effective solution to many environmental as well as food problems.

Description of the solution: As part of the work, a new way of preserving food in the form of an active coating will be developed, with parameters that have not yet been achieved by any other such solutions. The slow release of active substances will extend the effectiveness of the coating over time. Microencapsulation is used in many industries, while the use of hydrolyzate and bioactive peptides as one of the main components of the microcapsule is an innovation on a global scale.

Faculty: Food Technology at the University of Agriculture in Krakow

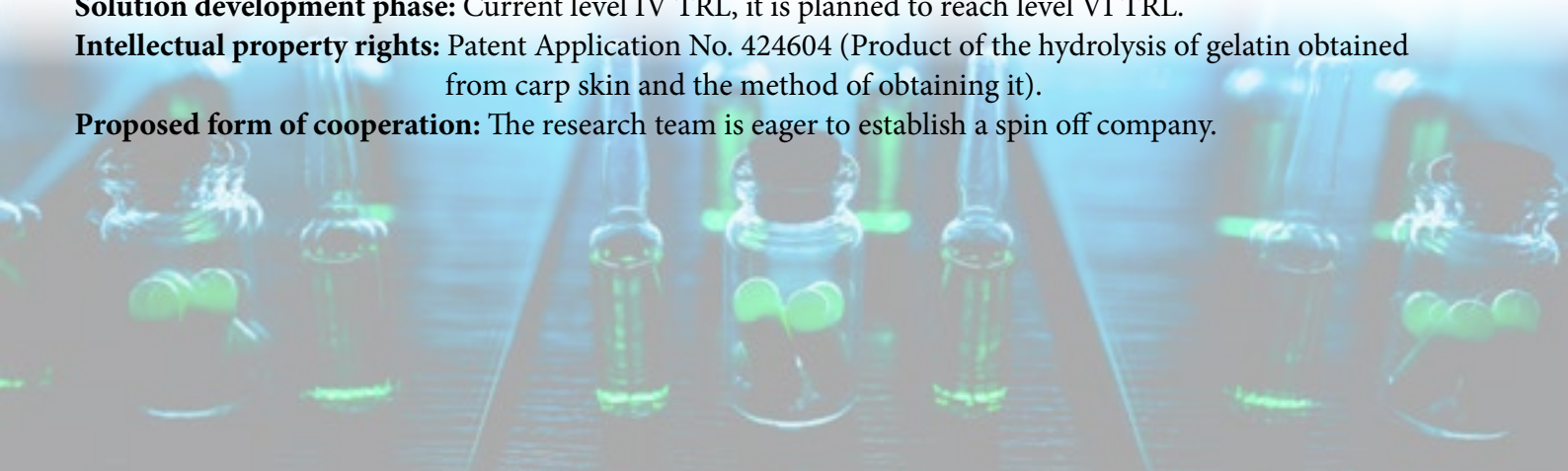
Authors of the Grant: manager: Piotr Kulawik PhD, research team: Ewelina Jamróz PhD,
Marzena Zając PhD, Joanna Tkaczewska PhD

Grant Supervisor (Innovation Broker): Patrycja Witek

Solution development phase: Current level IV TRL, it is planned to reach level VI TRL.

Intellectual property rights: Patent Application No. 424604 (Product of the hydrolysis of gelatin obtained from carp skin and the method of obtaining it).

Proposed form of cooperation: The research team is eager to establish a spin off company.



DOMAIN: Forest Sciences (Urban Forestry)

AREA: Mobile application with data set

Grant topic: Safe Park

Introduction: The project concerns a domain defined in English as Urban Forestry (UF) - i.e. it is directly related to the role of urban greenery (high and low as well as the entire „green infrastructure”) in urban areas. UF issues are extremely important for the inhabitants of urban agglomerations, whose awareness regarding the presence and health status of urban greenery has significantly increased in recent years. Assessment of the health condition of trees can be used in the context of improving the safety and health of urban residents and tourists staying in these places, as well as minimizing the risk of damage to public and private property.

Description of the solution: The project involves developing a prototype of a mobile application presenting data on greenery in selected parks in Krakow in terms of its safety for the health and life of residents and tourists, and protection of property (e.g. valuable infrastructure or cars). Testing the „Safe Park” application among the residents of Krakow will allow it to assess its usefulness for final beneficiaries, such as city offices, emergency services and other groups such as tourists or festival organizers.

Faculty: Forestry at the Agricultural University in Krakow

Authors of the Grant: manager: Piotr Wężyk DSc, Prof. UAK, research team: Karolina Zięba-Kulawik M.Sc., Eng., landscape architect, Ewa Siedlarczyk M.Sc., Eng., Monika Winczek M.Sc., Eng., landscape architect


Grant Supervisor (Innovation Broker): Adelina Kasprzak M.Sc., Eng.

Solution development phase: Level VI TRL. Making demonstrations of technologies similar to reality.

Intellectual property rights: Preparation for the patent application procedure.

Proposed form of cooperation: The research team plans to set up a spin-out company.





DOMAIN: Mechanical Engineering, Environmental Engineering, Mining and Energy

AREA: Optimization of the combine's pneumatic system

Grant topic: Determination of technical and operational parameters of the pneumatic system constituting the equipment of the working head in the combine harvester section for strawberry fruit harvested in rows or beds, field and / or under cover

Introduction: There are no known (in Poland, Europe or in the world) constructions of the strawberry fruit harvester intended for cultivation, carried out in rows or beds, field and / or under cover, neither in the production version, in the form of a finished product, nor in the version prototype. The planned result of pre-implementation works will be the optimization of the construction and operation of the pneumatic system designed to support the work capital collecting strawberry fruit.

Description of the solution: Optimization will be carried out, among others in terms of the quality of harvested fruit, determined by limiting the formation of mechanical damage, limiting the contamination of the harvested fruit crop, parts of the plant or substrate, e.g. broken leaves, unripe fruit, used mulch, soil.

Solving the problem that is the subject of the above proposal will bring the following benefits to the market:

- shortens the waiting time for the use of mechanized strawberry fruit harvest from crops, carried out in rows or beds, field and / or under cover,
- will improve the producers' situation related to the strawberry fruit harvest due to the lack of workforce,
- reduces the burden of the harvesting process,
- will improve the safety of the strawberry fruit product by improving the hygiene of the harvest.

Faculty: Production and Power Engineering at the University of Agriculture in Krakow

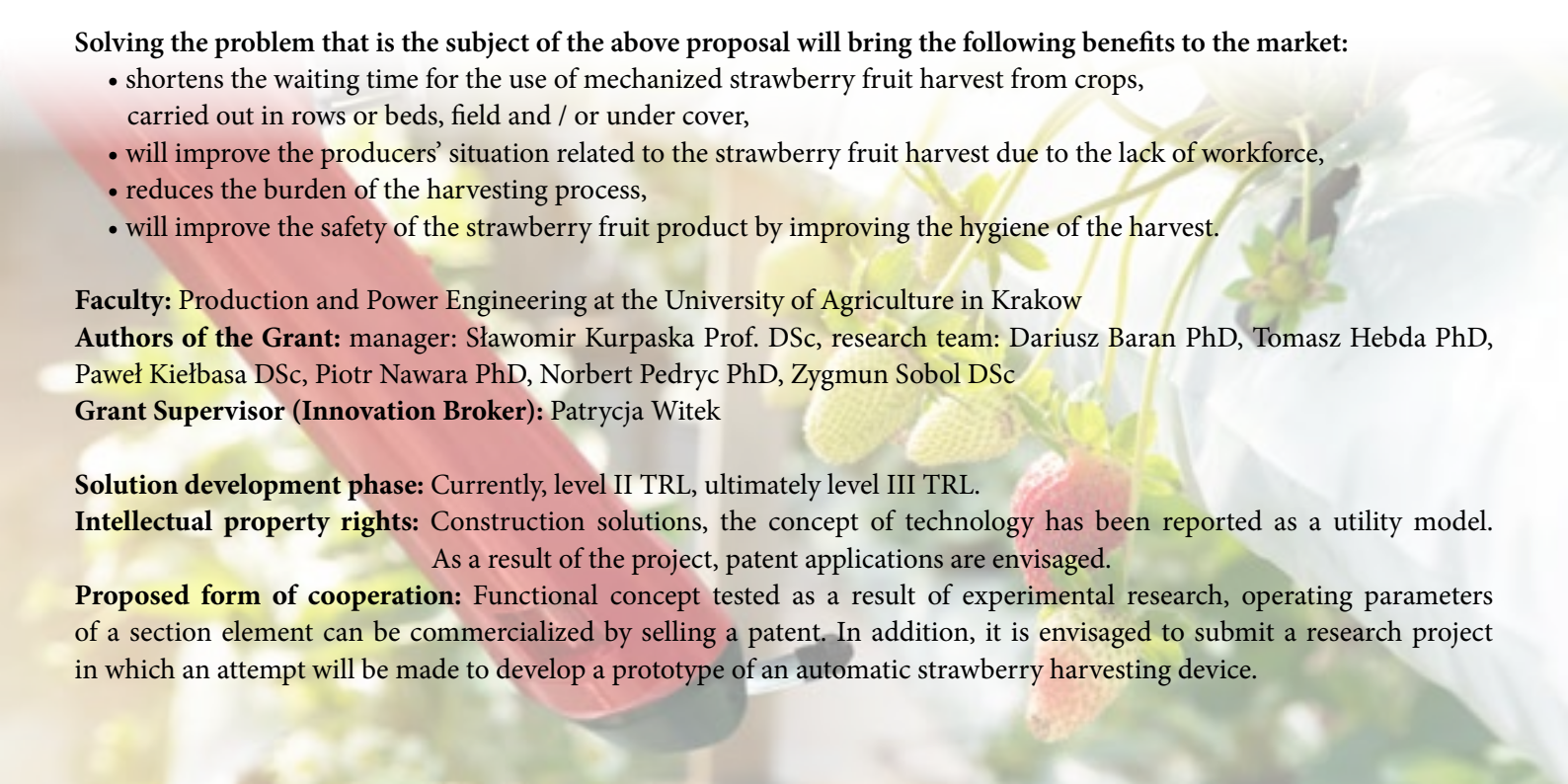
Authors of the Grant: manager: Sławomir Kurpaska Prof. DSc, research team: Dariusz Baran PhD, Tomasz Hebda PhD, Paweł Kielbasa DSc, Piotr Nawara PhD, Norbert Pedryc PhD, Zygmunt Sobol DSc

Grant Supervisor (Innovation Broker): Patrycja Witek

Solution development phase: Currently, level II TRL, ultimately level III TRL.

Intellectual property rights: Construction solutions, the concept of technology has been reported as a utility model.
As a result of the project, patent applications are envisaged.

Proposed form of cooperation: Functional concept tested as a result of experimental research, operating parameters of a section element can be commercialized by selling a patent. In addition, it is envisaged to submit a research project in which an attempt will be made to develop a prototype of an automatic strawberry harvesting device.





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is implemented as part of a non-competition project entitled „Support for management of scientific research and commercialization of results of R&D works in scientific units and enterprises” under the Operational Program Intelligent Development 2014-2020 (Measure 4.4). The total value of the Program is PLN 1 210,000.

The goal of the Program called „Incubator of Innovation” is to support the process of managing the results of scientific research and development works of employees and research teams of the University of Agriculture in Krakow, in particular in terms of their commercialization.

The implementation of the Program contributes to the promotion of scientific achievements, increasing their impact on the development of innovation and strengthening cooperation between the scientific and economic environment.

Program details are available on the website „Incubator of Innovation 2.0”
Inkubator2.urk.edu.pl



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