Biostimulants World Congress

18 - 21 November 2019
Fairmont Rey Juan Carlos I – Palau de Congressos de Catalunya, Barcelona, Spain

DON'T MISS THE WORLD'S LARGEST EVENT ON AGRICULTURAL BIOSTIMULANTS!

The Congress is the world's leading event on agricultural biostimulants, which are increasingly used in crop production. It is an international scientific and technical gathering to review the latest knowledge in this field.

Organised by: New AG International

In Partnership with: EBIC European Biostimulants Industry Consortium

GOLD SPONSORS:

Agrinos, ALGAENERGY, Atlántica Agricultura Natural, Bioiberica, agro tecno logía naturally efficient, ITALPOLLINA HELLO NATURE!, LIDA plant research, seipasa natural technology, SICIT, Stoller, sas, tradecorp nutri-performance, UPL OpenAg™, Valagro Where science serves nature, YARA Knowledge grows

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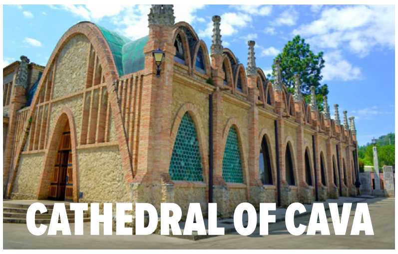
DAY ONE • MONDAY, 18 NOVEMBER 2019 • PRE-CONFERENCE

14.00 *Delegate Registration:* From 14:00 to 17:00

19.00 to 21:00

Opening Evening Reception Hosted by:

Agrinos · ALGAENERGY · Atlántica Agricultura Natural · Bioiberica · agro tecno logía naturally efficient · ITALPOLLINA HELLO NATURE! · LIDA plant research · seipasa natural technology · SICIT · Stoller · sas · tradecorp nutri-performance · UPL OpenAg · Valagro Where science serves nature · YARA Knowledge grows



The Opening Evening Reception takes place in the '**Cathedral of Cava'** – the home of Codorníu, a family wine-making business dating back 460 years and located a short drive to the west of Barcelona.

Delegates will have the opportunity to learn about the venue's grapes and to meet and connect with clients, develop new networks, solidify existing partnerships and be part of the **Biostimulants World Congress Network!** This glamorous evening is presented to you and sponsored by the Congresses Gold Sponsors: **Agrinos, AlgaEnergy, Atlántica Agrícola, Bioiberica, Grupo Agrotecnología, Italpollina, Lida Plant Research, Seipasa, SICIT Group, Stoller, Sustainable Agro Solutions, Tradecorp, UPL, Valagro** and **Yara International.**

Avda Jaume de Codorníu s/n 08770 Sant Sadurní d'Anoia (Barcelona).

IMPORTANT INFO: All delegates MUST register at the Palau de Congressos de Catalunya before getting on the coach for the transfer to the Codorniu. Skip the queues and pick up your delegate pass as early as 14.00 on Monday 18th November. **Coach transfers will leave the Palau de Congressos de Catalunya to the Codorniu from 17:00 to 18:00**. The journey will take approximately 45 minutes depending on traffic. The coaches will leave approximately every 15 mins. **The return transfers from the Codorniu to the Palau de Congressos will commence at 21:15**.
New Ag International staff will be available to answer any questions on site and to direct you to the coach pick up point. Only Registered Delegates will be allowed access to the evening reception. Please make sure you wear your badge at all times.

DAY TWO • TUESDAY, 19 NOVEMBER 2019 • MAIN CONFERENCE

08.00 *Delegate Registration*

08.30 **Opening Remarks**
Dr. Patrick du Jardin, Professor, **University of Liège - Gembloux,** *Belgium*

08.40 **OPENING LECTURE: Yield gaps: understanding the scope to sustainably increase crop production**
Martin K. van Ittersum, Professor, **Wageningen University,** *Netherlands*

Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
Chairperson: Dr. Patrick Brown, Professor of Plant Sciences in the Department of Plant Sciences, University of California, Davis, *USA*	

The use of biostimulants to improve yield and abiotic stress tolerance

09.35 **KEYNOTE: Using desiccation-tolerant microorganisms to safely protect crops from drought**
Desiccation-tolerant microorganisms can survive for extended periods of time in absence of water. These microorganisms produce xeroprotectants such as trehalose to avoid the deleterious damages from water loss. A collection of desiccation-tolerant soil microorganisms was isolated from Nerium oleander's rhizosphere. Those with the highest tolerance were able to protect pepper plants from dourght. Among them, Microbacterium sp. 3J1 is able to tolerate desiccation and improve drought tolerance of pepper plants by altering the metabolic profile of the plant by changing the C and N metabolism. Changes in the plant's glutamine and -ketoglutarate content, result in different production of metabolites for the restoration of the osmotic pressure. These molecules include sugars and amino-acids, antioxidant molecules, phytohormones and substrates for lignin production.
Transcriptomic studies, by RNAseq and qPCR, pointed to the hijacking of the trehalose metabolism of the plant by the microorganism to improve drought tolerance.
An Environmental and Human Safety Index (EHSI) was developed to numerically quantify the biosafety of the different isolates. The benefits of using safe desiccation-tolerant microorganisms will be discussed.
Dr. Maximino Manzanera, University of Granada, *Spain*

10.10 **Biostimulant applications and recalcitrant carbon soil amendments affect soil microbial activity, turfgrass establishment, growth and response to acute drought stress**
Urban areas are replacing traditional production agriculture lands as the global population continues to expand. The perennial crop of choice in these areas is a covering of turfgrass (e.g. Poa pratensis, Lolium perenne, etc.). The public generally perceives that this urban crop is watered and fed in excess of need and receives prophylactic pesticide applications indiscriminately. Professional turf managers who culture lawns, golf and sports turf are constantly seeking ways to manage turf more efficiently and with fewer resources, especially during stress drought and heat stress. Prior research has demonstrated the benefits of incorporating organic amendments prior to planting (Linde and Hepner, 2005) and exogenous applications of various biostimulants under stress conditions (Zhang and Ervin, 2010; Zhang et al. 2008). The possible enhanced plant response of biostimulants on turf grown in soils amended with newer soil recalcitrant carbon sources like biochar is unclear. Seedling turfgrass was grown under controlled environment conditions on a sand rootzone amended with or without biochar and treated with or without various biostimulants containing kelp extract, humate, Bacillus spp.. Substantial increases in soil microbial activity were measured when biostimulants were combined with biochar and some modest improvements in turf establishment and green color retention when subject to acute drought were measured. These studies demonstrate the positive effects of these possible management inputs for further enhancing sustainable turf management practices.
Dr. Cale Bigelow, Professor, Department of Horticulture and Landscape Architecture, **Purdue University,** *USA*

10.35 *Coffee / Tea Break*

Track 1: Biostimulant Science and Technology

Produced by the scientific committee this track is dedicated to technical discussion and ground-breaking scientific advances. Science and technology are the core focus of this track.

The use of biostimulants to improve yield and abiotic stress tolerance

Track 2: Developments and Innovations in Commercial Biostimulants

Chairperson: Mr.Wang Xiaochen,CEO, TBIO Crop Science

Produced due to popular request and demand this track is highly commercial and product focused. Commercial strategy and product innovations are the core focus.

Developing Products with Integrated Crop Management, Modern Agriculture and Sustainability in Mind

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11.15

Track 1: The potential of biostimulants and plant monitoring tools to reduce water and nutrient consumption in horticulture

Bio4safe aims at reducing water and nutrient consumption in horticulture through the use of (seaweed-based) biostimulants in combination with innovative plant sensors. By this, we want to reduce water and fertilizer use by 20 and 10% in the 2 Seas Region, respectively. The project focuses on demonstration trials with various horticultural crops in four countries (NL, FR, UK, BE) for three years. After one trial year, when plants were grown under optimal conditions, first results hint towards a positive effect of the biostimulants to promote plant growth and stress resilience as a better water conservation strategy was observed (leaf clip, LVDT and sap flow sensors, water and nitrogen use efficiency, chlorophyll indices, growth parameters). The trial is repeated in 2019, but the plants are grown under drought stress (reduction of 20% water) and nutrient stress (reduction of 10-20% N). Results of this trial are available by Oct 2019. Data from the trials will be summarized in a general database, completed with data from literature. This will result in a webbased application where growers can search for the most appropriate biostimulant. This project aims further to develop a standardized protocol that accredited laboratories can use to objectively evaluate biostimulants. Project partners: PCS Ornamental Plant Research, Ghent University (BE), NIAB EMR, Dove Associates (UK), Pole Legumes, ISA Lille (FR), Proeftuin Zwaagdijk and North Sea Farm Foundation (NL). This project has received funding from the Interreg 2 Seas programme 2014-2020 co-funded by the European Regional Development Fund under subsidy contract No 2S03-029.

Ellen Dams Proefcentrum voor Sierteelt (BE)

Track 2: Biostimulants: a key input for integrated crop management practices – insight from AlgaEnergy

As agricultural practices advance toward more complete Integrated Crop Management (ICM) programs it is becoming increasingly evident that robust plant-based natural inputs in the form of biostimulants can complement other ICM inputs to create a synergistic and positive impact on the yield and quality of harvests. While biostimulants are often used as an input to optimize crop performance under certain conditions, such as abiotic stress, AlgaEnergy is demonstrating that products derived from different strains of microalgae can provide valuable tools to optimize crop performance throughout all stages of plant growth and development. Unlike commonly used seaweeds, microalgae represent a very large diversity within the plant kingdom and naturally produce the full complement of all amino acids, oils and sugars and other active compounds that provide the ability to create unique nutritional biostimulants and biopesticides. The production of microalgae can be accomplished in highly controlled closed systems using simple inputs and recycling CO2 as a carbon source, thus allowing for the consistent production of very high-quality products from a plant source, not an animal or bacterial source, for use in agriculture. AlgaEnery has perfected the commercial-scale production of novel biostimulant products from unique combinations of microalgae strains using our proprietary UPT® process. The company has designed an 'Integral Biostimulation®' program, a holistic approach to ICM, that enables us to offer to the farmer a biostimulant solution that can be easily integrated into the normal practices of the grower.

Dr. Ry Wagner, President of International Agribusiness, **AlgaEnergy**

11.40

Track 1: Biostimulants effect on yield and drought tolerance - a functional physiological study

Biostimulants are widely implemented to improve crop productivity under normal and stress conditions. However, studies have not been conclusive regarding their efficacy. A new functional physiological phenotyping approach that was used to test and analyze the response of Capsicum sp. to two different commercial biostimulants ('ICL-SW' and 'ICL-NewFo1') under different irrigation regimes revealed that the plant's transpiration rate under well-irrigated condition and ICL-SW supplement was significantly higher than for ICL-NewFo1 supplement and no-surfactant supplement. The differences in transpiration rate are related to the higher plant biomass gain for the ICL-SW supplement. On the other hand, under water-deprived conditions, the transpiration-rate for the ICL-SW supplement was significantly lower than for the ICL-NewFo1 treated and untreated plants. This led to 52% and 18% increase in fruit number for ICL-SW and ICL-NewFo1 supplement treatments, respectively, compared to the untreated plants under well-irrigation condition. Yet, under drought condition, the transpiration rate for the ICL-SW supplement was reduced by 44%, and ICL-NewFo1 supplement was reduced by 16% during compared to their respective transpiration rate well-irrigated condition. Thus, the "physiological-boost" mechanism of ICL-SW supplement was beneficial under well-irrigated conditions, but injurious at drought conditions, while ICL-NewFo1 supplement revealed "physiological-protective" mechanism which did not improve the plant productivity under normal conditions but prevented the injurious effect of the drought. It was also found that both biostimulants improved the plant resilience (recovery rate after the drought), yet, the ICL-NewFo1 improved the resilience, better than ICL-SW did, in particular due to improvement in maintaining a higher relative water content.

Rony Wallach, Professor, **Hebrew University of Jerusalem**

Track 2: Biostimulants key role in sustainable agriculture and food chain – feedback from Intermag

The principle of agricultural sustainability is that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable agriculture frequently encompasses a wide range of production practices, including conventional and organic farming. An integrated system of plant production practices are designed to produce long-term effects such as:-Production of sufficient human food, feed and fiber,-Sustain the economic viability of farm -Protection of the environment Enhancing crop quantity and quality by providing an additional boost to crop outputs. There are many trials proving crop quantity and quality enhancement when biostimulants based on organic form of titanium, vanadium and on bioavailable silicon were used. Trials results from many countries (i.e. Poland, Italy, Great Britain) shows yield increase up to 30%. Increasing crop quality by biostimulants (content of ascorbic acid, lycopene, sugar, mycotoxins reduction, firmness, uniformity of tubers or fruits) were reported in trials on many crops. Improve plant tolerance to stress and help crop assimilate nutrients. Biostimulants based on microorganisms as well as bioavailable silicon are limiting factors for many pests and pathogens, therefore use of pesticides and traditional fertilizers can be lower than in conventional agriculture (Horticulture Institute 2014, Plant Protection Institute). Biostimulants support the development of beneficial soil microorganisms which improves soil health. Biostimulants help plants to more effective nutrients uptake to ensure a higher return on investment for farmers and fewer unintended impacts on the environment.

Dr. Wieslaw Ciecierski, Marketing Director, **INTERMAG sp. z o. o.**

12.05

Track 1: Effect of different biostimulant products in heat stress response: transcriptomic profile evaluation

Three different biostimulant products (Phylgreen™, Phylgreen Wave™ and Delfan Plus™) were applied to Arabidopsis thaliana plants 12 hours prior to heat stress exposure and were compared to positive and negative controls plants. Based on the results obtained it is possible to conclude that the preventive application of biostimulants 12 hours prior to the stressful event had a positive effect showing specific responses at a molecular level. It is important to notice that the transcriptional profiles studied in this trial represent a â€œpictureâ€ of a particular stage of plants recorded immediately after the stress. Thus, the genes induced by the treatments could have a primary or secondary role also in different phases of stress response. The mode of action of these biostimulants seem to be correlated with the regulation of the HSP gene family.

Antonio Ferrante, Associate Professor, **University Milan,** *Italy*

Track 2: Sustainability in agriculture and the use of seaweed extract

As a new type of fertilizer as well as biostimulant, seaweed fertilizer utilizes marine seaweeds as its precursor and is made with advanced processing technologies that break the seaweed biomass into its essential ingredients, which contain the rich inorganic and organic components of seaweeds such as calcium, potassium, magnesium, zinc and more than 40 types of minerals and vitamins, in addition to many types of polysaccharides, poly-unsaturated fatty acids and bio-stimulants such as abscisic acid, indole acetic acid, jasmonate, etc. The many types of seaweed fertilizers are engineered to suit different types of plants in their different stages of growth, and can be used to promote plant growth and maintain a balance between plant and soil, thereby playing an important role in modern agriculture. After several decades of development, the many varieties of purpose made seaweed fertilizers are now widely accepted by farmers all over the world, making them one of the excellent types of modern fertilizers. Our research has shown that the practical benefits of seaweed fertilizers include: promote rhizobacteria, suppress soil borne disease and nematodes, promote healthy root growth, improve germination rates, improve nodulation, minimize effect of heat and frost, strengthen cell walls against insect and fungal attack, promote budding and flowering, improve root crop quality, increase quality, size, taste and yield, etc. Key words: seaweeds; seaweed fertilizer; active ingredients; modern agriculture; biostimulant

Yimin Qin, Director State Key Laboratory of Bioactive Seaweed Substances, China, **Qingdao Bright Moon Seaweed Group Co., Ltd**

	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
	The use of biostimulants to improve yield and abiotic stress tolerance	**Developments and innovations in commercial biostimulants**
12.30	**Increased crop productivity using agrinos technology based arbuscular mycorrhizal fungi (AMF) formulation** In the recent times, bacteria and fungi based bio-fertilizers are gaining greater importance in global agriculture. Among the bio-fertilizers, Arbuscular Mycorrhizal Fungi (AMF) plays a major role in the cultivation of many important crops where Glomus sp. was found to be widely used for the abiotic stress management and crop productivity. Present paper summarizes the scientifically designed replicated field studies to enlighten the potential use of Agrinos AMF for promoting growth and yield benefits in different crops being cultivated in Indian subcontinent. Agrinos AMF developed through in-house technology where more than 90 % endomycorrhizal spores of Glomus sp. loaded in the product to establish root-symbionts which obtain their nutrients from the plant and provide mineral elements like N, P, K, Ca, S and Zn to the host plant through absorption. In this association, the fungus takes over the role of the plant's root hairs and acts as an extension of the root system. The significance of AMF in augmenting crop production has been clearly established through extensive field experimental data. Yield differences between AMF treated and untreated fields were significantly high (($P < 0.05$) with fitting cost benefit ratio. The results on different crop experiments (Rice, Vegetables, Sugarcane and fruit crops) showed that the right dose, window and method of application is important for obtaining maximum benefits of the product which has ultimately enabled to develop specific application protocols to support commercial approaches for delivering vast benefits to the farmers. Studies further revealed the capabilities of AMF on improving soil health (aggregation, organic matter, water relation), better withstand of annual/perineal crops during drought and quality enhancement of end produce which has given way for future investigation in Mycorrhizal Technology. **Dr. Selvasundaram Rajagopal,** Regional Technology Director - Eastern Europe & Asia Pacific, **Agrinos India Pvt Ltd.**	**Insight from FBSciences**
12.55	*Lunch and Poster Session*	
	Track 1: The use of biostimulants to improve plant nutrition, development and quality	**Track 2: Formulation, composition and novel products for commercialization**
	The use of biostimulants to improve plant nutrition, development and quality *Chairperson:* **José María García-Mina Freire ,** Professor of Agricultural Chemistry, **University of Navarra**	**Formulation, composition and novel products for commercialization**
14.25	**KEYNOTE: Ammonium uptake by roots and its impact on hormonal regulation and plant development** Ammonium is a major inorganic nitrogen source for root uptake by crops. While it strongly promotes plant growth at low concentrations, ammonium may cause toxicity symptoms at elevated concentrations. This wide range of beneficial and adverse actions is a consequence of the interference of ammonium with multiple plant processes, such as pH changes in the rhizosphere, cation-anion balance during nutrient uptake, primary metabolism and in particular phytohormone transport and regulation. Besides these physiological processes, ammonium also re-shapes root system architecture and shoot development. Thereby, ammonium cannot be regarded alone, since its impact strongly depends on the overall plant nutritional status and the presence of nitrate. Using examples from model plants and crops exposed to different nitrogen forms, the present talk will highlight how ammonium uptake by roots is regulated, how ammonium provokes physiological and morphological responses and how ammonium nutrition can be deployed to influence agronomical relevant crop traits. **Nicolaus von Wirén,** Professor at Dept. Physiology & Cell Biology, **Leibniz-Institute of Plant Genetics & Crop Plant Research,** *Germany*	**A case study from SEIPASA: developing and commercializing new biostimulant technologies** SEIPASA has been working in order to create new formulations for a more rational, sustainable and technology based agriculture, with direct implications in the design and development of plant biostimulant products. Based on the synergistic effects among different types of raw materials (microbial, a sulfonated random polymer of three aromatic alcohol and reducing sugars), together with independent research partners, SEIPASA generated data and empirical pieces of evidence to support these claim justifications. Through radicular and/or foliar stimulation and the establishment of microbial with a high colonization power, it has been possible to demonstrate interaction between culture and microorganism in various crops. High levels of genetic overexpression were reached in tomato culture. In concerning pepper, the use of the formulated product involved the formation of a biofilm and significant precocity levels, while olive and citrus trees were able to significantly improve the productivity and harvest quality levels. **Javier Nacher,** Chief Technical Officer**, Seipasa**

	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
15.00	**Do Biostimulants have common mode of action on a molecular level? Comprehensive analysis of diverse types of biostimulants and their effects on gene expression of critical metabolic processes.** Biostimulants promote root and shoot growth, flowering, fruit set, yield and quality of crops. These beneficial effects can be attributed to enhanced nutrient use efficiency and increased tolerance to abiotic stress, triggered by physical and chemical challenges including foliar nutrient application. In this study we investigated the effect of five categories of commercially available biostimulants including seaweed extracts (SE), protein hydrolysates (PH), synthetic formula containing antioxidant properties (SF), plant growth regulators (PGR) and fermentation metabolite-based (FM) products. Each class of biostimulants was evaluated either alone or in combination with nutrients. Treatments were applied twice to the foliage of six-week-old Arabidopsis thaliana plants. Leaf tissue was collected 24 hours after the second application. Specific metabolic pathways were identified using microarray and gene expression was confirmed with qPCR. In this study we evaluated upregulation of genes involved in these pathways. Compared to control, all tested biostimulants showed different degrees of gene upregulation in stress response, nutrient transport and homeostasis, reactive oxygen species control and signaling. The strongest response was observed with the FM biostimulant followed by SE, while PGR, PH and SB showed lower or no gene upregulation. Application of biostimulants with nutrients generally enhanced gene upregulation over biostimulants alone, while nutrient treatment on its own resulted in low or no gene upregulation. In summary, we detected similarities in biostimulant effects on these metabolic pathways with unique differences in efficiencies of their performance and propose a common mode of action on a molecular level. **Dr. Adam Blaszczak,** R&D Director / Molecular Biology and Microbiology, **Cytozyme Laboratories**	**Acadian plant health: identifying and differentiating the composition and consistency of algal-based biostimulant products available in the global marketplace.** Biostimulants are a diverse group of agricultural inputs that, when applied to plants or growing media, promote natural plant processes beyond the value of their nutrient content. They are commonly used with the goal of improving nutrient use efficiency, abiotic stress tolerance, and crop quality and yield. Biostimulants are most often derived from natural materials, and include algal extracts, humic acids, protein hydrolysates, and microbial products. Marine algal extracts, particularly those derived from Ascophyllum nodosum, have been used in commercial agriculture for over a half-century. One of the challenges in global regulatory environments is identifying the components of a complex marine algal extract to demonstrate and support its composition and authenticity. In this study, we outline work that has been conducted to characterize Acadian Seaplants' Ascophyllum nodosum-based biostimulants using natural products isolation techniques along with modern analytical tools and NMR metabolomic analysis. Focusing on the natural compounds that are known to be present in this alga (such as mannitol, alginic acid and laminarin), we have developed HPLC-based analytical methods for the detection and quantification of these key marker compounds in both fresh Ascophyllum nodosum and various aqueous extracts manufactured from it, with NMR-based metabolomic profiling also used to confirm their presence. Using these tools, we have demonstrated the consistency of Acadian Seaplants' biostimulants and established the levels of select marker compounds in these products, as well as shown differences with other experimental and commercial algal-based biostimulants available in the global marketplace. **David Hiltz,** Director of Analytical Services, **Acadian Plant Health**
15:25	**Pseudomonas simiae and a nonpathogenic strain of Fusarium oxysporum improve the induction of iron deficiency responses in cucumber and tomato plants** In calcareous soils, high pH contributes to the low solubility of Fe (iron) and, consequently, to the poor availability of this element. To solve this problem, dicot plants induce physiological and morphological responses in their roots aimed to facilitate Fe mobilization and uptake. Some key genes related to these responses are FRO, encoding a ferric reductase that reduces $Fe3+$ to $Fe2+$; IRT1, encoding a Fe transporter that transports $Fe2+$ into the root cells; and HA, encoding a $H+$-ATPase that releases protons to the rhizosphere. Several hormones and signaling substances, like ethylene and nitric oxide, participate in the regulation of these Fe acquisition genes. ISR (Induced Systemic Resistance), triggered by beneficial rhizosphere microorganisms, is also regulated by similar hormones and signaling substances, in such a way that ISR-eliciting microorganisms can promote the induction of Fe acquisition genes (Romera et al. 2019). The objective of this work was to study the capacity of Pseudomonas simiae and of a nonpathogenic strain of Fusarium oxysporum (both elicit ISR) to induce Fe deficiency responses, to improve the growth of plants and to alleviate the effects of high pH caused by bicarbonate in cucumber (Cucumis sativus L.) and tomato (Solanum lycopersicon Mill.) plants. The results obtained showed a greater induction of the Fe acquisition genes FRO, IRT1 and HA, and enhanced growth, a higher capacity to acidify the medium in presence of bicarbonate, and an enhancement of the ferric reductase activity some days after inoculation, in cucumber and/or tomato plants inoculated with these microorganisms. **Dr. Francisco Javier Romera,** Professor, **Universidad de Cordoba**	**A case study from Bioiberica: developing quality biostimulant products** During the past two decades the presence of amino acid based biostimulants in the market has shown a steep growth. Many products have become available but, for many of them, a through analytical characterization of their composition has remained elusive. The obtention method as well as the source of protein are key factors for the quality of the finished product. For instance, while an enzymatic hydrolysis process leads towards a preservation of the biologically active forms, L-form of amino acids, chemical hydrolysis tends to leave residues as sodium, sulphates and chlorides and produce racemization. Both, residues and D-amino acids, can have undesired side effects for crops. Method of obtention and protein origin are independent factors although often chemical hydrolysis and animal origin as well as enzymatic hydrolysis and vegetal origin have been wrongly associated. Four globally present amino acid-based products claimed as vegetal in the biostimulant market have been characterized through HPLC-UV, PCR and EC-MS/MS to determine their amino acidic profile, molecular weight distribution and chiral purity and thus identify its origin and, tentatively, their obtention method. These results were compared to Terra-Sorb® Foliar, an animal based commercial product obtained through enzymatic hydrolysis. Furthermore, to assess their efficacy, agronomic as well as physiological assays were performed for the five products **Nuria Sierras,** Head of Research and Early development, **Bioiberica, S.A.U**
15.50	*Coffee / Tea Break*	

3rd Biostimulants World Congress Delegates:

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	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
	The use of biostimulants to improve plant nutrition, development and quality *(continued)*	**Technological innovation showcase & product promotion**
16.20	**Postharvest fruit quality as a new target for biostimulants: challenges, opportunities and some case studies** Upon harvest, fruit are commonly stored at low temperatures and modified atmospheres with or without additional postharvest treatments aiming to slow down ripening and extend the produce life. Nonetheless, such conditions are known to be stressful and can induce the accumulation of oxidative damage as well as trigger an array of metabolic shifts/reactions within the fruit leading to the appearance of numerous physiological disorders. Thus said, the application of both targeted and untargeted transcriptomic or metabolomics studies has allowed to elucidate, to some extent, the etiology of many physiological disorders. Changes in specific metabolites levels as well as a disruption of the fruit redox homeostasis or an alteration of the fruit ripening-related machinery are common denominators for most of the relevant physiological disorders affecting fruit during storage. Consequently, the question now arises on whether the application of certain substances pre-harvest, such as biostimulants, can be employed to tackle postharvest physiological disorders. Research done over the past three years with a commercially available phospholipid enriched food-grade formulate that supplements the cuticle of the plant, has shown that pre-harvest treated peaches retained better firmness and owned increased shelf-life showing lower incidence of chilling injury disorders upon storage. Investigations on the putative mode of action of this product, have revealed that such positive effects were associated to changes in the fruit ethylene metabolism as well as by favouring the accumulation and utilization of sugars (sucrose) and acids (citrate), respectively, within the fruit yet without affecting the fruit maturity or quality at the time of commercial harvest. Overall, the results from this research are discussed on the context of developing new biostimulant products especially targeted to improve postharvest fruit quality and shelf-life. **Dr. Jordi Gine-Bordonaba,** Researcher, **IRTA**	**Discovering innovative biostimulant products developed by Atlantica Agricola** Abiotic stresses such as soil salinity, drought and high temperatures severely affects crops establishment, growth and yield, leading to substantial economic losses. Biostimulants of Atlantica Agricola are formulated with different components such as seaweed extracts, amino acids, macro and microelements with the aim to improves plant growth and development and cope with the negative effects of abiotic stresses. The aim of this work was to evaluate soil and foliar applications of different formulations of biostimulants and their effects on tolerance to salt stresses of different crops. Photosynthesis (rate of net CO2 assimilation ACO2 and stomatal conductance gs), vegetative growth, organic solutes (proline and reducing sugars), and oxidative damage (MDA) were quantified. Additionally, the expression patterns of different genes involved in photosynthesis, oxidation-reduction processes, and several transcription factors were evaluated and confirmed by qRT-PCR. With this data it was concluded that application of biostimulants increased salt tolerance of tomato and Arabidopsis plants. These plants had a larger vegetative growth due to a better functioning of physiological processes, and enhancing of antioxidant stress. qRT-PCR study reports that Biostimulant application regulated genes expression related with salt tolerance in plants, and this regulation was only observed in salinized plants receiving biostimulant application. **Dr. Ernesto Alejandro Zavala,** Head Researcher, **Atlantica Agricola**
16:45	**How can a biostimulant influence next year's harvest?** In grapes, bud cluster formation takes place over two consecutive years. In the first year, inflorescences start to form (inflorescence primordia or IP) in the bud. This phase determines the potential fertility of the latent buds. Thus, the quality of the inflorescences formed in the first year is a crucial factor in the final yield of the following year. Regulation of the bud formation stages as defined by ISVV involves a set of genes which regulate the phases of cell proliferation, differentiation of vegetative meristems into floral meristems and acquisition of definitive characteristics. Biochemical and genetic analyses highlight the importance of hormones for promoting communication between cells and tissues ensuring harmonious and defined bud development. ISVV and UPL collaborated on a study to evaluate the effects of Vivaflor®, containing GA142, Ascophyllum nodosum filtrate on latent bud fertility. The multidisciplinary approach highlighted the positive effect of Vivaflor® (GoActiv) on the expression of the genes involved in these mechanisms, and also on the hormonal regulation mechanisms and metabolism of sugars favouring the formation of IP in the latent buds of vines. Acting at three complementary levels, it promotes IP branching stages by stimulating cellular differentiation and carbohydrate metabolism. Lastly, Vivaflor® triggered an increase in ABA content at the start of dormancy onset leading to a greater accumulation of sucrose and starch for improved storage of insoluble sugars. This led to better distribution and use of soluble sugars the following spring, with a cumulative effect. **Steven Parker,** Global Development Lead, Bio-stimulants, **UPL**	**Heat-induced male sterility in flowers is reversed by cytokinin, mediated by expression of sugar transporter AtSweet 7** In controlled environment tests, we found that exogenous application of cytokinins, as well as of sucrose, substantially improved floral fertilization and fruit set ($P<0.05$) under high temperatures in Arabidopsis thaliana. Further, in multiple trials of bean and maize under high flowering temperatures in the field, reproductive success and yield were also increased ($P<0.05$) by cytokinin application. As a mechanism, we propose that cytokinin promotes sugar movement and accumulation in flowers through maintenance of sugar transporter gene expression important for reproductive success. Consistent with this, cytokinin application rescued heat-induced repression of the sugar transporters AtSweet 7 and AtSweet 6 in Arabidopsis, and an AtSweet 7 knockdown line showed impaired recovery of heat fertility by cytokinin treatment. Taken together, our data indicate that exogenous application of cytokinin can improve reproductive success and yield under hot conditions. **Dr. Ron Salzman,** Director of Research, **Stoller**

"Exposure to the wide number of biostimulant companies on hand at the Exhibit area - very eye-opening. I have tested about 30 products during past 20 years but now realize that is a very small percentage of the products on the market."

– 3rd Biostimulants World Congress Delegate

Track 1: Biostimulant Science and Technology

Track 2: Developments and Innovations in Commercial Biostimulants

17.10

Track 1: Biostimulants for producing high-quality fruits and vegetables

The world's agricultural systems face a great balancing act between two needs: (1) rise the supply of food produced on the available farmland since the global population will increase to over 9.3 billion by 2050, and (2) reduce agriculture's impact on the environment and human health. Meeting these two targets present a major sustainability challenge to scientists and producers, which might be fostered by using natural products known as plant biostimulants. Plant biostimulants, when applied to seeds, leaves, or the soil, can enhance nutrient uptake and assimilation, photosynthesis and crop tolerance to environmental stresses. Vegetal-derived biostimulants and endophytic fungi Rhizoglomus irregulare BEG72, Funneliformis mosseae BEG 234, and Trichoderma atroviride MUCL 45632 are gaining a lot of interest due to the high agronomic effectiveness and the lack of limitations in their use in organic farming systems. Several agronomic trials showed that vegetal-derived biostimulants and endophytic fungi differently modulate quality of fruits and vegetables. Vegetal-derived protein hydrolysate enhanced fruit size, mineral profile, nutritional and functional quality of several product (e.g. tomato, kiwi, cherry) while tropical-plant extract reduced nitrate content in leafy vegetables (e.g. spinach). Moreover, application of endophytic fungi enhanced soluble solids, phytochemical and especially mineral content of several product (e.g.cucumber, zucchini) Biostimulant activity have been associated with changes of endogenous hormonal balance, increase of nutrient uptake, activation of antioxidant defense system, and stimulation of primary and secondary metabolism. Several examples will be presented and discussed to show the potential benefits of using plant biostimulants in horticultural crops.

Mariateresa Cardarelli, Researcher, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, **Centro di ricerca Orticoltura e Florovivaismo,** *Italy*

Track 2: Microbiome innovation from Grupo Agrotecnología: Understanding how microbial-based biostimulants affect the microbiome of different agricultural soil types

Microbial-based biostimulants constitute a new group of products with high potential in agriculture, however, not much data about their impact in agricultural ecosystems or their mechanisms of action are available. In the efforts to elucidate the mechanism of action of Agrotecnología's products, the main objective of this study was to understand how one of our microbial-based biostimulants affects rhizospheric soil microbiome. The effects of the biostimulant were studied in four different soil typologies (acidic, basic, sandy and clay). Microbiome soil evolution was assessed from the last treatment with the product until harvesting points. Metagenomic studies were performed by analyzing the prokaryotic 16S ribosomal RNA gene. The product effects on bacterial biodiversity resulted soil type dependent, however, in none of the cases treatments showed negative effects on bacterial biodiversity. In acidic and clay soils, a short-term significant accelerated colonization of rhizospheric soil by bacterial species, previously described as plant growth promoter rhizobacterias (PGPRs), Arthrobacter and Hyphomicrobium respectively, was observed due to the biostimulant action. Similarly, a significant increase in another PGPR belonging to Sphingomonas genus was found at medium-term in the basic soil. Nevertheless, Bacillus subtilis, the microbial species included in the product, was not detected as majoritarian in any of the studied soils. This study gives the first insight into the impact of the microbial-based biostimulant in rizhospheric soil microbiome. Additionally, the results give a possible mechanism of action of the product. Thus, the ability of the biostimulant to recruit certain PGPR species may contribute to the successful performance of the product in the field.

Noemi Herrero, R&D Manager, **Grupo Agrotecnología,** *Spain*

17.35

Track 1: Harpin αβ for improved citrus quality - the importance of cell wall calcium

Harpin αβ peptides are produced by gram-negative bacteria. When applied as a foliar spray, Harpin αβ binds to plant receptors, initiating jasmonic acid and ethylene dependent pathways. The harpin- induced response is characterised by elevated levels of reactive oxygen species, potassium efflux and calcium influx. The extent to which Harpin αβ (ProAct®) influences calcium influx and how this affects fruit quality has received significant attention in recent years, including a 4-year study on citrus at the Instituto Valenciano de Investigaciones Agrarias (IVIA), Spain. IVIA reported an increase in calcium pectate (cell wall calcium) and firmer fruits following application of Harpin αβ. Across the 4 years, the level of 'creasing' in Harpin αβ treatments was reduced by an average of 47% (range 20-75%), with application timing having a significant effect.

The IVIA results mirror that achieved in 46 grower trials (2015-2018), where Harpin αβ increased cell wall calcium by 21%. Yield increase across a range of citrus varieties and cultivars was 15%. The benefits of Harpin αβ can thus be broadly categorised as: improvements to fruit quality, increased yield, and better market opportunities, for example where harvesting of later varieties (e.g. Queen Mandarin) can be delayed. Assuming baseline yields of 50 MT/Ha, the yield improvement delivered by ProAct® equates to 10-15 times ROI (over $2,500 per Ha). Where the product is applied to late harvesting varieties returns are even higher, as growers can charge a premium of at least 10% if harvest is delayed by just two weeks.

Dr. Aoife Dillon, Technical Director, **EMEA, Plant Health Care Espana, S.A.**

Track 2: Synergistic biostimulatory effect of codasil® by NOBA technology platform from sustainable agro solutions: enhancing crop resilience to abiotic stress

Abiotic stress has become an emerging threat to global food security due to the constant changes of climate conditions and deterioration of environment as a result of human activities. Plants are continuously exposed to multiple abiotic stresses during their life cycle and their management is one of the biggest challenges facing agriculture. codasil® is a biostimulant composed of potentially bioactive form of silicon, oligo/polypeptides and free amino acids powered by SAS NOBA technology platform. Silicon is considered a 'quasi-essential' nutrient due to its role in providing benefits to the plant on growth, quality and yield, particularly under abiotic and/or biotic stress conditions. Oligo/polypeptides and amino acids have similar biostimulatory effects. This research project aimed to design a robust formulation and unravel the role of synergistic effects among silicon, oligo/polypeptides and amino acids contained in codasil® in improving plant resilience to abiotic stress at physiological, biochemical and molecular level. Several trials were carried out to evaluate the impact of soil-applied codasil® on different cultivars under drought, salinity and metal/metalloid toxicity. Our results revealed silicon-fortified plants achieving high nutrient use efficiency and high crop yield. Data suggested that the beneficial effects of codasil® on improving abiotic stress tolerance were attributed to an increase of photosynthetic activity, an enhanced water use efficiency, a contribution to osmotic adjustment, a reduction of metal/metalloid uptake and translocation, a protection against oxidative damage, an improvement of structural stability and a regulation of silicon transporter genes. Hence, codasil® represents a sustainable solution to improve crop abiotic stress tolerance.

Dr. Gemma Arjo, Researcher, **Sustainable Agro Solutions (SAS), S.A.**

18:00 - 19:30

Poster Session

08.30 *Delegate Registration*

REGULATORY FRAMEWORK OF PLANT BIOSTIMULANTS

Chair: **Dr. Patrick du Jardin,** Professor, **University of Liège - Gembloux,** *Belgium*

09:00 **KEYNOTE: Plant biostimulants under the new fertilising products regulation in Europe**

Dr. Theodora Nikolakopoulou, European Commission, **DG GROW**

09:35 **How the standardization can support the global market of biostimulants?**

During the last years, the word "biostimulant" or its cousins ("beneficial substances", "biofertilizers"…) have been commonly used by scientists, journalists, sales forces… But without a clear definition of these concepts, nuances appearing and creating some confusions for regulators and the end-users. In the same time, different National or Regional Authorities have started to develop regulatory framework to cover the access on the market for biostimulants. Even if there is no global definition, that will not slow the use of this innovative agricultural input. To check the compliance with these regulations, standards will be required to check the claims, the safety parameters or to define how to label products or ingredients. The lack of harmonized definitions and analytical methods could create barriers at global exchanges level! The European Technical Committee (CEN/TC 455) on Plant Biostimulants has started to work based on the future draft standardization request in support to the new EU Regulation on fertilizing products. In parallel, on the request of the European members, the International Technical Committee (ISO/TC 134) on Fertilizers, Soil Conditioners and Beneficial Substances has created an ad'hoc group to collect information and evaluate the possibility to develop a set of standards for this category of products. In this paper, the authors will: • Provide an overview of the current definitions of biostimulants and related words; • Give an update on the status of Biostimulants in Europe, USA and China; • Explain the link between regulatory framework and standards in Europe, USA and China; • Outline the consensual multi-stakeholder process for elaborating European and International standards and benefits for businesses; • Inform on how to be involved in this process

Benoit Planques, Global Regulatory Management, **Italpollina**

09:55 **Justifying plant biostimulants claims: boundaries and credibility**

There is an emerging global consensus around a definition of plant biostimulants that focuses on the key functions they provide: improving nutrient use efficiency, plant tolerance to abiotic stress and crop quality. Biostimulants are not the only agricultural inputs that affect these characteristics, and biostimulants may share some ingredients with products with different functions, such as fertilizers or plant protection products. Separating the effect of biostimulants out from other inputs is complicated by the fact that the mode of action of biostimulant products is not always fully understood or may be difficult to isolate when a product is complex and contains many ingredients. How then, can we distinguish biostimulant effects from those of other agricultural inputs? This paper bridges between research and regulation by providing an overview of EBIC's guidelines on demonstrating the proof-of-concept for biostimulant products in the context of the forthcoming EU Fertilising Products Regulation, which specifies that a plant biostimulant "shall have the effects that are claimed on the label for the plants specified thereon". Consequently, the justification of the agronomic claim of a given plant biostimulant will be an important element to allow it to be placed on the European market once this new regulation is applied. EBIC's guidelines for justifying claims include topics such as adapting trial protocols to differentiate biostimulant effects from nutrient or plant protection functions and how use cases can help define boundaries between product categories when it is not possible to rely on a specific, isolated active ingredient to simplify categorization.

Manuele Ricci, Chair, **EBIC**

10:15 **Regulatory Q&A with the audience.** During this session you will be given the opportunity to ask questions and gain clarification relating to biostimulant regulation.

10:40 *Coffee / Tea Break*

Track 1: Biostimulant Science and Technology

Market trends and good practices

Chairperson: **Jean-Pierre Leymonie**

11:20 **Climate change: is it part of your marketing plan?**

Is Climate Change too political to be in your marketing plans? If it is growing more extreme, what strategies will be needed and will your tactics change? Do you have a vision for this future? Data from field trials and growth chamber studies conducted at Universities in North Carolina and Florida in the U.S. and at Rothamsted Centre for Research & Enterprise in the UK identified enhanced assisted migration of maize and cotton seed using Biostimulants. Surveys and interviews conducted in 2018 and 2019 with specific grower/producer segments in these regions yielded surprising data supporting a growing acceptance of Climate Change and a concern for information on input management necessary to combat what may become extreme environmental stresses.

Scott Gibson, Executive Director, **JAKL, Inc**

Track 2: Developments and Innovations in Commercial Biostimulants

Product development – insight from industry

11:20 **The Van Iperen approach on biostimulants and our developments**

Nutrient Use Efficiency with breakthrough innovations

Agriculture is rapidly changing. Due to the growing world population, more extreme weather conditions and the increasing restrictions to fertilizers, we need to look for alternative ways to ensure sustainable crop nutrition for the future. Smarter use of land, use of nutrients by crops and an improved tolerance to stress conditions are important factors. Biostimulants can offer important opportunities in many areas: nutrient use efficiency, improved abiotic stress tolerance and greater crop quality. IPE® Technology to improve phosphate and micro nutrient use efficiency and Foliastim® seaweed range are already well-known. Recent new innovations to highlight are Wake-up® Liquid increasing fruit quality by enhancing water use efficiency and drought tolerance. And Foliastim® Calcium, a suspended formulation of Calcium and Seaweed with improved Ca uptake, providing higher firmness and better shelf life in top fruit and reducing cherry cracking. Most of today's biostimulants have their limitations. These are often waste products from other industrial chains and for this reason hard to control from sink-to-source. Moreover they often have a broad definition and generic claims. That is why in R&D we need to go to the next innovation. Van Iperen International received end of August approval for EU Life subsidies for the P4P® project. It is a joint project from R&D partner Landlab and Van Iperen group, with scientific partners such as the University of Padua, Italy, the James Hutton Institute in Scotland. P4P® stands for Plants for Plants. In this research project, plants from organically grown food crops are studied on their various physiological processes to search for biostimulation mode of actions. Extracts with different targeted characteristics could well been identified. The extracts (compounds) coming from the harvest of Organic Farm grown crops are carefully processed and formulated into ready-to-use nutrients. All under controlled conditions in order to safeguard a consistent, high level of activity: the so called "SMP: Standardized Metabolites Phytocomplex". Therefore having a "green soul". In the P4P® life project so far, 3 prototypes are developed: a fertigation product enhancing the Nutrient Use Efficiency (NUE), a foliar product focus on Water Use Efficiency (WUE) and a crop fortification product reducing the sensitivity to diseases. The EU life grant supports several important activities which still need to be carried out until the launch in 2022: Optimization of the final extraction method and formulation, building a pilot plant, product development in all various crops, registrations as biostimulant and organizing scientific and demonstration trials throughout EU. As these biostimulants are produced from organically grown food crops they are free from any chemical residue and very safe for human consumption and the environment. Offering solutions which are more efficient, use less resources and are better equipped against adverse climatic conditions. The P4P® project gives birth to a new generation of biostimulants for a more sustainable agriculture.

Marc Van Oers, Director of Innovations, **Van Iperen International**

	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
11.45	**The market potential of seaweed biostimulants: a roadmap towards success** The Bio4safe project aims to develop a solution to reduce water and nutrient consumption of the agricultural sector through the use of, primarily seaweed-based, biostimulants. These seaweed-based biostimulants increase the nutrient and water use efficiency, increase the tolerance against abiotic stress and/or the quality of crops and flowers. By combining the application of these biostimulants with innovative plant sensors the project aims to demonstrate to farmers that this approach works and the results of water and fertilizer reduction by 20% and 10% respectively are being achieved. addition, the project will make a market study on the potential of biostimulants based on local seaweed, in order to create economic opportunities for seaweed producers in the 2 Seas Region. For successful collaboration a roadmap will be developed in close collaboration with a variety of stakeholders. The preliminary results of the roadmap will be presented to showcase the ongoing social & technical challenges and opportunities in the (seaweed) biostimulant industry. Further, the project focuses on demonstration trials with various horticultural crops in four countries (NL, FR, UK, BE). A database with all relevant information about biostimulants in horticulture. This database will further result in a webbased application for growers to choose the most suitable biostimulant for their crop. At last, this project aims to develop a standardized protocol that accredited laboratories can use to objectively evaluate biostimulants. By 2020 the EU will develop a common European framework for the marketing of biostimulants, but it remains unclear how positive effects of biostimulants on nutrient and water use can be quantified. This project has received funding from the Interreg 2 Seas programme 2014-2020 co-funded by the European Regional Development Fund under subsidy contract No 2S03-029. **Marlies Draisma,** Markets & Applications Manager, **North Sea Farm Foundation**	**Biostimulant product development – insight from Yara** Yara's motivation for a global agronomy program on biostimulants is to sustain farmers profitability beyond conventional plant nutrition and improve plant health and quality by alleviating crop stress and to use biostimulants as a tool to adapt to climate change. The objective of the current research program is to understand the influence of Ascophyllum based seaweeds on yield in different crop groups; cereals, pulses, oilseeds, fibre crops and vegetables. We evaluated YaraVita BIOTRAC and F3580 at different rates and frequency of applications for their effect on crop yield in collaboration with various institutions in 2018 cropping season. F3580 application in soybeans at V2 growth stage and 13 days later @ 3 l ha-1 resulted in 12% significant higher bean yield than untreated control. Similarly, in cotton, Biotrac and F3580 applications resulted in 14 and 11 % higher seed cotton yield respectively over untreated control across two tested locations over different rates and timing of applications. In cabbage, Biotrac application @ 3 l ha-1, thrice (21, 33 & 45 DAP) resulted in 16% significant higher yield than untreated control. In potato, Biotrac application resulted in 7% numerical yield advantage at tested rates. Results confirmed the beneficial effect of biostimulants for yield especially in soybeans, cotton, potato and cabbage. Further evaluation of various biostimulants through rate response studies across different crops and agroecological climate zones is necessary for further understanding of biostimulant' s crop performance. **Dr. Kiran Pavuluri,** Research & Development Manager, **Yara UK Ltd.**
12.10	**Phenotypic variation of microbial biostimulants for consideration to improve product efficacy** Microbial biostimulant products are emerging as an environmentally sustainable alternative to traditional fertilizers in many agricultural industries. Most of these products consist of concentrated fungi or spore forming bacteria that can survive the unfavorable supply chain. Decades of research has identified many non-spore forming bacteria that may be equally or more beneficial to crop health; however, limited commercialization of these beneficial non-spore forming bacteria has occurred due to the inability of these microbes to survive the supply chain. Furthermore, phenotypic variation is observed in non-spore forming bacteria as a result of sporadic mutation during storage which can reduce biostimulant activities and lead to inconsistent field results. One solution to these problems is to ferment a fresh population of beneficial microbes on-site by combining a stabilized dried inoculum with growth media in a closed system, and allowing the population of microbes to increase exponentially until a viable concentration is reached. Since these microbial biostimulants are dynamic living products, the industry must shift expectations for these products to ensure the microbial strain that is applied in the field is unchanged from the strain that is formulated into the product. Adoption of the use of these products is limited due to inconsistent field results, and phenotypic variation may explain some of these inconsistencies. Incorporation of functional assays and education of growers and distributors could assist with the commercialization and use of these products. **Rebecca Williams-Wagner,** Principal Scientist, **3Bar Biologics, Inc**	**Developing biostimulants at SICIT: Exploring methodological approaches to study the mechanism of action of different components of protein hydrolysates produced by SICIT2000** Protein hydrolysates exert biostimulant effects on crops either adding to the soil or using as foliar spray. Protein hydrolysates are produced by chemical or enzymatic hydrolysis of animal- or plant-derived organic matter and normally consist of a mixture of free amino acids and peptides of different length. To optimize the efficacy of these products, we deemed important to investigate their mechanisms of action and dissect the effects of distinct components (free amino acids and different class of peptides). Indeed, single peptides and amino acids can have specific signaling activity on plant metabolism. We have applied several methodological approaches to study the mechanism of action of different components of a protein hydrolysates produced by SICIT2000. In our experimental model, we tested the effects of the biostimulant on roots of plants grown in diluted nutrient solution supplied with the protein hydrolyzate or fractions of the hydrolysate. The phenotypical analysis was associated with ionomic and transcriptomic studies that enabled us to focus on specific effects of the product on the plant response to drought and hypoxic stress. In parallel, we exploited various methods to separate different classes of peptides on the basis of their molecular weight and to identify the most abundant peptides in the mixture in order to test the biostimulant efficacy of individual components **Dr. Tiziana Pandolfini,** Associate Professor, **University of Verona**
12:35	*Lunch and poster session*	
	Mechanisms of biostimulation and structure-function relationships *Chairperson:* **Dr. Patrick Brown,** Professor of Plant Sciences in the Department of Plant Sciences, **University of California, Davis**	**Strategies for Success**
14.10	**KEYNOTE: It takes two to tango: dissecting the genetic basis of plant-microbe interactions in the rhizosphere** My group uses barley (Hordeum vulgare) as a model to gain novel insights into the functional significance of plant-microbiota interactions in the rhizosphere and devise novel strategies to enhance sustainable crop production. We previously demonstrated that Elite varieties and wild barley ancestors host distinct microbiotas, possibly representing a footprint of plant domestication on the microbial communities inhabiting the rhizosphere. We recently extended these lines of investigation by characterising the microbiota of a bi-parental population between an elite variety and a wild barley ancestor. By combining 16S rRNA gene sequencing profiles, as 'quantitative traits', with thousands of SNPs in the barley genome we compiled a map of the plant loci shaping the rhizosphere microbiota. Strikingly, we did not observe a linear relationship between number of loci and bacteria putatively controlled by them. Rather, our data suggest that microbial community assembly in the barley rhizosphere is controlled by a few major alleles with a major effect. In particular, we identified a single locus on barley chromosome 3H significantly associated with the recruitment of several, phylogenetically unrelated, bacteria. We produced isogenic barley lines harbouring contrasting alleles at the locus of interest and we demonstrated that the introgression of wild barley genes into a modern variety on chromosome 3H is sufficient to shape, at least in part, the rhizosphere microbiota. Here I will discuss the experiments that led us to these discoveries and their implications for basic science and translational agriculture. **Davide Bulgarelli, University of Dundee,** *UK*	**Using innovative technologies to understand mode of action and guide product development strategies for current, new and combination biostimulant products** The adverse environmental conditions due to climate change, combined with declining soil fertility, threatens global food security alarmingly. This calls, imperatively, for innovative strategies to improve crop growth under these constraints whilst conserving resources. Innovative and efficient methodologies such as the use of biostimulants are instrumental in improving water and nutrient use efficiency and tolerance to abiotic stresses. Although biostimulants such as seaweed extract, humic substances and plant growth promoting rhizobacteria (PGPR) have been shown to improve plant growth and tolerance to abiotic stresses, there are still gaps in detailed understanding of the role and combinatory effects of biostimulants on plant growth under ever-changing environment. This is a handicap to a knowledge-driven product design and development approach, and thereby to downstream agri-business strategies. In developing innovative biostimulant products, there is a necessity to understand the underlying mechanisms governing the interactions between plants and biostimulants. In not being able to understand or quantify these fundamental processes, products of a biostimulant nature may not yield the projected results and often lose credibility. The onus is therefore upon subject matter experts alike to further reinforce the biostimulant market by generating knowledge and understanding the functional mechanisms of biostimulants. **Venessa Moodley,** Manager, **Omnia Fertilizer,** *South Africa*

	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
	Mechanisms of biostimulation and structure-function relationships *(continued)* *Chairperson:* **Dr. Patrick Brown,** Professor of Plant Sciences in the Department of Plant Sciences, **University of California, Davis**	**Strategies for Success** *(continued)*
14.45	**VDAL, a new biostimulant in Agriculture** Biostimulants are emerging as an interesting research topic for not only industry but also the academics. Plant biostimulants are diverse substances or microbes that can stimulate natural processes to enhance/benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, and crop quality and yield. However, novelty in term of molecular mechanisms underlying the beneficial effects of biostimulants is generally unclear, despite that understanding the precise mechanisms is key to practical management. Verticillium dahliae is a soilborne phytopathogenic fungus that causes extensive losses in a wide variety of crop plants. Here we isolated a VDAL (Verticillium dahliae secreted Asp f2-like protein) form Verticillium dahliae. VDAL is a zinc ion binding protein secreted by Verticillium dahliae that usually causes the wilt disease in many plants. VDAL can cause cotton leaf wilting when applying on cutting leaves. We expressed VDAL in Escherichia coli, and tested its possible functions in different crops, vegetables and fruits. We found that applying this new protein on leaf surface of different crops by spraying solution and soaking or coating seeds can significantly promote plant growth and development, and greatly increase yield of various crops, and largely improve the Vitamin C and sugar contents of various fruits and melons. This protein is very stable in dried powder and the usage amount is very low. VDAL is a new biostimulant that can be widely used in Agriculture, but its molecular mechanism needs further explored, especially when applying on plants in vitro. **Prof. Zhizhong Gong,** State Key Laboratory of Plant Physiology and Biochemistry, College of Biological Sciences, **China Agricultural University**	**CROMALIV® promotes anthocyanin and carotenoid accumulation in fruits with no side-effects** Fruit colour development is a complex physiological process that involves deep anatomical, physiological and biochemical rearrangements. In most red-purple fruits, colour development involves the accumulation of red-to-purple anthocyanins and orange-yellow carotenoids, along with the degradation of green chlorophylls. This process has a strong impact on the economic value of many fruit crops since delayed, incomplete or uneven colour development may delay harvest time, devaluate the yield, or increase crop exposure to pathogen attacks or environmental insults. Unusual weather patterns, inadequate pruning, mineral deficiencies, imbalanced crop load, and inappropriate land uses are common causes of impaired colour development in fruit crops. In order to provide farmers with tools to promote and homogenize colour development in fruits, Futureco Bioscience has developed CROMALIV®. This biostimulant aims at the jasmonate signalling pathway, which controls anthocyanin accumulation. Field and greenhouse trials on sweet cherries, table grapes, blueberries and strawberries have shown that anthocyanin accumulation is enhanced in plants treated with CROMALIV®, to a greater extent than other commercial products for the same purpose. In addition, greenhouse trials on pepper show that CROMALIV® promotes carotenoid accumulation as well. On the other hand, CROMALIV® did not affect any of the other fruit ripening indicators studied. . **Carolina Fernández,** Director of Research**, Development & Innovation at Futureco Bioscience,** *Spain*
15:10	**Evaluation of agronomically relevant methods to assess salt stress tolerance provided by plant biostimulants** Salinity is one of the major environmental stresses affecting crop production. Most vegetable crops are salt sensitive, as a consequence they grow poorly in salinized soils due to the osmotic stress and accumulation of toxic ions [1]. A meaningful approach to increase crop yield and counteract the effects of yield loss due to salt stress would be the use of plant biostimulants, which are gaining interest worldwide [2]. Our approach consisted in evaluating the ability of next generation biostimulants based on marine carbohydrates to stimulate salt stress tolerance processes and increase crop yield under agronomically sound conditions. Salt stress is first perceived at the root zone level, consequently, the initial screening of biostimulant activity was carried out using the model plant Arabidopsis thaliana in a high-throughput root microphenotyping system [3]. The plant biostimulants were assessed then in tomato plants subjected to controlled salinity conditions to evaluate its effect on phenotypical, physiological, biochemical and molecular markers associated with salt stress. Our data showed that the plant biostimulants were able to deliver varying degrees of salt stress tolerance by modulating the expression of a number of the genes involved in small molecules, phosphorous, carbohydrate and lipid metabolic processes, maintaining a favourable ionic homeostasis and increasing fruit yield. These findings present a significant opportunity for solving specific plant productivity challenges on salt affected lands through the targeted application of specialized plant biostimulants. **Dr. Oscar Goñi,** Scientific Supervisor, **Brandon Bioscience**	**PLB: Towards a new concept of phosphorus biosolubilization and availability for plants** Phosphorus is a very insoluble and immobile element in the soil. This is due to the formation of salts such as calcium, ferric or magnesium phosphates. Its high insolubility implies that the use of phosphorus as fertilizer by plants is highly inefficient. Its high insolubility affect its use efficiency by plants. To date, phosphoric rock has been treated with different acids to extract and produce soluble phosphorus salts such as MAP or DAP and subsequently use it to formulate fertilizers. Other strategies have also been used generating monocalcium phosphate (TSP based fertilizers) by the acidification of phosphoric rock using phosphoric acid. All these strategies are effective for a very limited period of time since the phosphorus in soil will quickly return to its equilibrium; the vast majority of the applied phosphorus will be insolubilized. Today a totally different strategy is proposed. The new fertilizers are based on the application of directly insoluble phosphorus (phosphoric rock, struvite, etc). This phosphorus is accompanied by carbon and a set of biostimulant substances that enhance the solubilization of the applied phosphorus in soil. Studying the type plants reaction and its interaction with the soil in case of phosphorus shortage, helped a lot to define and optimize the new strategy. With this concept, new phosphorus granulated fertilizers are born with a much lower carbon footprint associated with their production and with h9igher agronomic efficiency due to the new biostimulant based technology. **Dr. Ignasi Salaet,** Deputy Director in R & D Department, **Tervalis**
15.35	*Coffee / Tea Break*	
16.05	**Towards the development of more effective protein hydrolysate biostimulants: an approach combining molecular fractionation and metabolomics** The biostimulant activity of protein hydrolysates has been traditionally related to different compounds, that can be grouped into small molecules (including secondary metabolites and amino acids) and peptides. In this work, a protein hydrolysate was fractionated using dialysis membranes having different molecular weight cut-off, and fractions separately tested for hormone-like activity using in vitro bioassays.The most promising fractions, together with the non-fractionated protein hydrolysate, were then applied either basally or via spraying onto leaves, using tomato as model crop and indole-3-butyric acid as positive control. Growth and morphological parameters were recorded. Thereafter, leaf samples were harvested at 7 days after treatment and then analyzed through an UHPLC-ESI/QTOF-MS metabolomic approach to shed light onto the molecular bases of biostimulant activity. With this regard, pathways and biological processes modulation was inferred using the pathway tool of Plant Metabolic Network.Interestingly, hierarchical clustering allowed highlighting distinct metabolomic signatures as a function of the combination between the mode of application and the fraction considered. The supervised OPLS-DA multivariate analysis pointed out that the smaller fraction, when applied foliarly, modulated metabolic changes in a way very close to indole-3-butyric acid, thus strengthening the outcome of hormone-like activity bioassays. The processes involved included the biosynthesis of secondary metabolites, amines and amino acids, cofactors as well as the tuning of phytohormone profile.Our results suggest that the approach used might be useful to properly design biostimulants, starting from manufacturing process up to the definition of the best application strategies in the field. **Luigi Lucini,** Professor, **Universita Cattolica del Sacro Cuore**	**Insight from BioAtlantis: A biostimulant based molecular priming strategy to combat abiotic stress and to improve crop performance** 70% of the potential yields on crops such as corn, wheat, sorghum, soybean, oat and barley worldwide are lost due to abiotic stress. During this phenomenon, harmful accumulation of reactive oxygen species (ROS) will take place inside the plant, causing growth retardation and reduce yield in case of crops. Even, well managed crops only achieve ~75% of their genetic potential. In this study we demonstrate that SuperFifty®, can protect crops from abitoic stress induced damages and increase their ability to achieve their genetic yield potential. Strategy: Growers should prime and protect their crops using Super Fifty®, by applying 3-5 days before anticipated stress or at the critical stages of plant growth. This will prevent crop damage during stress and improve crop performance. **Dr. Tsanko Gechev,** Associate Professor and Director, Center of Plant Systems Biology and Biotechnology, **Bulgaria** – representing **BioAtlantis**

	Track 1: Biostimulant Science and Technology	Track 2: Developments and Innovations in Commercial Biostimulants
	Mechanisms of biostimulation and structure-function relationships *(continued)*	**Strategies for Success** *(continued)*
16:30	**Advanced characterization of humic-based biostimulants using size-exclusion chromatography with simultaneous UV and fluorescence detection** Global market of biostimulants is rapidly growing by ~10% annually with humic-based products occupying ~50% share. However, wider use of biostimulants is often inhibited by limited knowledge of the mechanisms of their action and lack of standardized integrative characterization, which makes it difficult to compare efficacy and functionality of commercial products. These factors may cause exaggerated claims, unrealistic expectations and restrain credibility and, thereby, slow down implementation of beneficial biostimulants.We report on application of a systematic analytical approach based on size-exclusion chromatography (SEC) to characterize humic-based biostimulants of peat origin and comparable products. Using SEC humic substances were separated according to apparent molecular weight into fractions, which were simultaneously characterized by UV and fluorescence detectors. The SEC analysis allowed rapid fractionation and fingerprinting of individual humic and fulvic products. We analysed applicability and benefits of the method to optimize the manufacturing processes, to conduct quality control, and to assess shelf-life of the biostimulants. In parallel, conventional methods were used to evaluate the humic-based biostimulants regarding their antioxidant, reactivity, and chelating properties, which are essential to reduce abiotic stress of plants and to enhance availability and transport of nutrients. Results of the chemical analyses were correlated with the results of growing tests performed under controlled conditions.This ongoing project is aimed to develop a harmonized comprehensive approach to characterize and, potentially, predict essential properties of humic-based biostimulants of different origin using robust, rapid, and economically feasible chemical and non-chemical methods. **Dr. Alexey Ignatev,** Postdoctoral Researcher, **University of Jyvaskyla**	**A strategy for soil improvement: Marine polysaccharide-microorganism combination technology for soil biological improvement and remediation** In this study, marine polysaccharide-microorganism combination technology for soil biological improvement and remediation was used to improve and repair citrus soil, improve physical and chemical environment of soil, which make algae polysaccharide, microbe and plants form a benign mutual promotion relationship, balance crop nutrient absorption and enhance the photosynthesis and stress resistance of plants, and finally improved the yield and quality of citrus. **Sally Zhao,** Director of Leili Overseas Business, **Leili Group**
16.55	**Humic acids extracts as plant growth biostimulants: use of Arabidopsis mutants affected in hormone signalling to go insight the mechanism of action** The use of plant mutants with altered hormones pathway is used as an interesting tool to support a proposed mechanism of action of different biostimulants. The plant growth promoting effect of some organic compounds as humic acids is well known. In this study the phenotypic effect of these compounds at a certain dose applied and plant stage is detected. Once the effect is expressed in wild type arabidopsis, it is compared, in the same conditions, with mutants treated with the biostimulant. If the observed effect in the wild type plants is not maintained, it can be concluded that the paths of the hormones affected in the mutants tested play a role in the mechanism of action of the biostimulants applied. The selected mutants keep the growth increase in shoot of the wild type plants treated with the humic acid, whereas presented a similar pattern of root decrease. In the same way, the significant increases in auxins, cytokinins, jasmonic acid and salicylic acids root content with the humic acid in wild type plants are kept with the mutants. The general pattern of cytokinins and salicylic shoot content in wild type plants are also followed in the mutants. Therefore, the cytokinin, jasmonic acid and auxins signalling pathways affected in these mutants do not seem to be essential in the action of humic acid extract in aerial part. **Dr. Javier Erro,** Researcher, **Universidad de Navarra**	End of Track 2 -please join Track 1
17.20	**A Brassinosteroid-based biostimulant improves plant growth, soil health, and tolerance to glyphosate stress** Biostimulants with multi-functional are effective management tools to enhance plant growth and improve soil health for optimum crop productivity while maintaining sustainable agroecosystems. Research indicating effects of biostimulants on soil health or on their ability to suppress glyphosate herbicide effects on crop and soil health is lacking. A biostimulant consisting of multiple brassinosteroids, 1-tricontanol, and B vitamins offers several modes of action to enhance crop growth. Field trials conducted during 2014-2017 on the biostimulant effects on key soil health indicators and response of glyphosate-resistant maize and soybean to glyphosate. Soil health indicators - soil microbial biomass, diversity and biological activity - improved under both crops receiving biostimulant. Beneficial fluorescent pseudomonads, Mn-reducing and indole acetic acid (auxin) producing rhizobacteria, and root biomass in glyphosate-treated maize and soybean were significantly increased ($P<0.05$). Root infection by Fusarium was significantly reduced while mycorrhizae were increased on soybean suggesting the biostimulant overcame suppressive effects of glyphosate. The biostimulant may offset glyphosate soil residual concentrations (≥1000 μg/kg soil), increasing microbial activity compared with soils without biostimulant. Results suggest the biostimulant reduces glyphosate stress on rhizosphere biological function due to brassinosteroids ability to reduce pesticide absorption and metabolism by plants, affecting glyphosate release into the rhizosphere. Increased photosynthesis by tricontanol likely results in more carbon released into the rhizosphere to sustain beneficial microbial function and diversity. Biostimulants serve a fundamental role in mediating stress in transgenic crops by overcoming detrimental effects of glyphosate used in crop production systems while enhancing beneficial microbial activity and soil health. **Dr. Manjula Nathan,** Extension Associate Professor, **University of Missouri**	End of Track 2 -please join Track 1
17.45	*Poster Session*	

Track 1: Biostimulant Science and Technology

Developing new biostimulants: new sources and screening tools

Chair: **Dr. Patrick du Jardin,** Professor, **University of Liège - Gembloux,** *Belgium*

08.30	*Coffee and Registration*
09.00	**KEYNOTE: Advances in root functional phenotyping** Over the last ten years, an increasing number of studies have demonstrated that the modulation of root system architecture can bring significant improvement of crop performance under water limitations. These studies have essentially focused on constitutive traits, including root angle, root growth and root anatomy through their effect on root depth and the volume of soil explored. The soil-plant system, however, harbours a much wider array of features, of which some have been well described in artificial conditions, whose ecological and agronomical significance have yet to be uncovered. The morphological, anatomical and physiological plasticity of roots, the many differences between root types and the hydraulics of the soil-root system are good examples of such features. We believe that these bear additional levers to improve water capture by crops, but that this may require novel approaches to integrate different scales and disciplines to analyse the hydraulic domain of the soil-plant system, as well as to address the many dimensions of the yet-to-be-defined root efficiency. In this talk, we shall, through examples, illustrate how recent progress in plant biology, phenotyping and modelling pave the way to formulate new questions that will help the soil-plant community broaden the scope of features to be exploited in breeding, management and biostimulants research to further improve crop performance under water limitations. **Xavier Draye,** Professor at the Faculty of Bioengineering, **UCLouvain,** *Belgium*
09.35	**High-throughput automated phenotyping as a shortcut to more effective biostimulants: from seeds to crops** Development of highly effective biostimulants requires an accurate evaluation of the effects of candidate products on morpho-physiological traits of selected crops during different developmental stages and environmental conditions. As conventional screening methods are time consuming, destructive and labour intensive, high-throughput plant phenotyping procedures were recently proposed as effective and high-precision tools for novel product screening.In this work, we evaluated the effects of newly-formulated and commercial plant-derived protein hydrolysates (PHs) as growth promotors and/or stress alleviators on plants subjected to abiotic stresses (drought and salinity) at different phenological stages. Using PlantScreen™ ,automated high-throughput phenotyping systems developed by PSI (Photon Systems Instruments, Czechia), we were able to monitor the mode of action of the selected PHs, applied either via seed coating, foliar spray or soil drenching, on seedling emergence rate of wheat, rosette growth-related traits in Arabidopsis and morpho-physiological traits in lettuce and tomato plants, respectively. The PHs biostimulant mode of action was characterised by applying integrative multi-trait phenotyping approach based on quantitative analysis of photosynthetic performance, growth performance and dynamics, and colour analysis. A complex pipeline using complementary phenotyping methodologies in different plant species will be presented and case example of growth improving PHs and stress alleviating PHs will be discussed. Finally, we show that integrative high-throughput phenotyping approach represents powerful tool for biostimulant research, novel development and mode of action characterisation **Mirella Sorrentino,** PhD Student, **PSI (Photon Systems Instruments)**
10.00	**Development of new biostimulant formulations for row crops by means of transcriptomics and high efficiency plant phenotyping** Row/industrial crops such as soybean, corn, wheat, rice, rapeseed, sunflower, and cotton represent the most important crops in terms of global cultivated area. Row-crops agriculture is generally an intensive system of farming used to obtain high yields by employing elevated quantities of organic and mineral fertilizers. This is inconsistent with a vision of eco-compatible agricultural activity. Considering this, and the decrease in area of arable land, it becomes crucial to ensure high yield and quality using alternative strategies, such as the use of plant biostimulants (PBS). This study highlights the use of high-throughput/efficiency plant phenotyping (phenomics) together with Next Generation Sequencing (NGS) to investigate the effectiveness and mechanism of action of new biostimulant formulations specifically conceived as foliar applications to increase yield of row crops. Phenomic-based measurements of digital biovolume, Greener Area, and Stress Index allowed us to select the most effective prototype among the ones tested. Subsequently, we used NGS for a deep characterization of the molecular mechanisms by which the selected biostimulant exerts its positive effect. In conclusion, the results showed in this work support the integration of multiple "omics" as robust and objective tools in the discovery, evaluation, and development of innovative, sustainable, and targeted solutions to meet the emerging needs of row-crops agriculture. **Dr. Giovanni Povero,** Plant Science Manager, **Valagro SpA**
10.25	*Coffee / Tea Break*
11.00	**In planta selection of rhizosphere competent biostimulant microorganisms through an automated plant phenomics platform** Driven by ecological awareness on excessive use of chemical fertilizers, research and industry are aiming to develop biostimulant inoculants harboring plant growth-promoting bacteria (PGPR). However, most adopted selection procedures for PGPR consist of the initial exclusive in vitro isolation and selection of bacterial strains, which are only subsequently assayed in the host plant rhizosphere. As rhizospheric competence and activity are not accounted for in the initial in vitro selection, promising candidates often fail to perform in planta. In order to obtain superior candidates for biostimulant products, we developed an in planta enrichment platform with simultaneous selection for the biostimulant trait and rhizosphere competence. The platform was implemented to select for phosphate solubilizing bacteria (PSB) on maize (Zea mays L.). As maize exhibits phosphorous deficiency through the accumulation of anthocyanin, a phenotyping platform encompassing a multispectral camera was used to capture anthocyanin accumulation to monitor the plant's phosphorous status in a nondestructive manner. Through a cyclic approach in which plants were consecutively exposed to insoluble phosphorous, we succeeded to enrich the rhizosphere for a PSB consortium by the third enrichment cycle. Inoculated maize grown under phosphorous limitation showed a significant improvement over non-inoculated maize and harbored comparable phenotypes and phosphorous contents to maize grown on full nutrient solution. This platform has shown the potential to generate efficient in planta consortia, from which now individual strains could be isolated for further assessment. Furthermore, the platform can be implemented for other plant growth promoting traits such as nitrogen use efficiency and iron uptake. **Dr. Noemie De Zutter,** PhD Researcher, **Ghent University**
11.25	**Assessment of biostimulant effects under natural in-field conditions** Biostimulants are used in agriculture either as seed coating, foliar or soil application to enhance/benefit nutrient uptake and efficiency, abiotic stress tolerance and crop quality. The effects of biostimulants are often studied in controlled laboratory conditions during the screening phase to isolate and test for specific parameters/effects. Testing biostimulants in the field under natural conditions is challenging as the effect is dependent on the natural - in field - conditions. How can biostimulants be tested in field under natural conditions to achieve valid and reliable data on the effects of the biostimulants? Field trials have shown that standard small plot field testing does not fully account for the complexity of natural conditions, which impact the usefulness of the efficacy data on the biostimulants. New technologies are needed to fully investigate the effect and potential of biostimulants under natural conditions. The OnFarmPlus trial concept have shown to provide useful and valid data is large scale field plots in combination with a selection of georeferenced sensor data and specialized measurements such as root development. This method provides several layers of data with high resolution and can be customized to test for a specific effect or parameter under natural conditions. Furthermore, OnFarmPlus trials provide a better to understanding of the interaction between biostimulants, crops and natural environments. **Mette Walter,** Head of Projects, **Danish Technological Institute**
11.50	**Bio2Bio: from organic agro waste streams to biostimulants** Many biostimulants are sourced from renewable resources or even waste products. In the framework of circular economy, the Ghent university initiated an ambitious project to develop new biostimulants and biopesticides from agro-food waste products. The project, entitled Bio2Bio is a close collaboration between the research institutes Ghent University, VITO, ILVO and KULeuven and the industry.In the project 10 organic waste streams and by-products from food and agricultural industries are being investigated. Different extracts were prepared and tested for their bioactivity in a screeningsplatform containing 54 different bioassays ranging from in vitro tests, to greenhouse and even field tests. The project has created a unique library of extracts with specific bioactivity from organic waste streams. Upon evaluation of the screening results, determination of bioactive ingredients and biostimulant mode of action studies will be carried out. The project will have an impact on the discovery of new bioactive compounds of natural origins which conforms with circular economy. By linking academia with industry, it will provide valuable leads for biostimulant product development which is suitable for market needs. **Maaike Perneel,** Business Developer, **CropFit - Ghent University**
12.15	**Field screening approaches for monitoring whole-plant response modulated by biostimulants** Biostimulants are the most rapidly growing segment of the Agricultural Chemicals industry, nevertheless, considerable uncertainty exists with regard to application rates, timings, crop responses, and mode of action. Skepticism among consumers and regulators as to the role of these products in modern agriculture further hampers adoption. To address this issue there is a need to develop university managed, rapid screening protocols that are independent, statistically robust, and low cost. The UC Davis Biostimulant Field Screening Trial is an investigation of physiological parameters related to biomass accumulation and energy balance of Lycopersicon esculentum Mil in order to characterize whole-plant response of biostimulant treated plants to multiple-stressors in commercial fields. This trial utilized the latest in sensing technologies and ground-truth devices to characterize Lycopersicon esculentum Mil phenology and to identify critical periods of biostimulant activity. **Meerae Park,** Graduate Student Researcher, **UC Davis**
12.40	**Poster Award Presentation** Given to the best student's poster by **Prof. Patrick Brown,** Co-chair of the **Scientific Committee**
13:20	**Closing Remarks** **Dr. Patrick du Jardin,** Professor, **University of Liège - Gembloux,** *Belgium*

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