BOOK OF ABSTRACTS

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Training of people with disabilities of daily structures in the working process of the tomato harvest

An inclusive world of work requires the equal participation of people with disabilities, including those in day-to-day structures, in public working life.
According to Article 1 Paragraph 2 of the UN Convention on the Rights of Persons with Disabilities, people with disabilities are persons who have a physical, emotional or mental disability or other sensory impairments. They should be able to participate equally in society through barrier-free education and work, in addition to a self-determined lifestyle.
In the project "Socially sustainable inclusion of people with disabilities in the work processes of horticulture (IRMA)", the aim was to create a training concept for the work process of tomato harvest, which ensures a socially sustainable, especially barrier-free harvest.
Eight experts of the social field were asked about the conception of a training concept. Additionally, it was pursued the socially sustainable integration of disabled persons (DP) into the work processes of horticulture. Based on the criteria determined and taking into account Human Work Design, blended learning training documents and practical training unit for the work process of the tomato harvest were developed. Both were evaluated by 39 of 55 participants (DP, social supervisors, specialists from horticulture and interested project partners), in accordance with green pedagogy.
The interviews documented were descriptively analyzed and described, using the qualitative content analysis according to Mayring with the MAXQDA software and the standardized questionnaires completed by the training participants.
Important measures identified of a theoretical and practical training for the implementation of inter-company cooperation in the completion of work up to an employment relationship were the use of easy language, a practical training unit as well as a training concept based on green pedagogy. Suggestions for improvement for a repeated implementation of training courses are the concentration on essential contents, easily understandable text by using easy language and well-coordinated time frame conditions. The theoretical and practical support as well as barrier-free training documents are essential in order to include disabled persons of daily structures in horticultural companies.

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Hand-arm vibration risk in olive harvesting

In some olive grove areas, the complete mechanisation of olives harvesting can be difficult due to technical and economic factors, such as the farm's location in steeply sloped areas, the small dimensions of the farms, the unsuitable training systems, and the layout of planting. This is the reason of the prevalence of hand-held portable harvesters in southern Italy. They detach the drupes through vibration supplied by electric motor or combustion engines. Portable harvesters have a significant impact on operator safety, since they expose workers to the health risks related to vibrations. Hand-arm vibration exposure (HAV) is one of the main physical risks for workers involved in agriculture, as it is potential cause of specific pathologies such as vibration-induced white finger and carpal tunnel syndrome. Regulations with the aim of protecting the workers towards hand-arm vibration risk are based on referenced dose/response models, and prescribe a maximum operating time as a solution to reduce the dose of vibrations received. Nowadays, the common approach for measuring the vibration dose of workers appears outdated since new technologies to measure and record the vibration dosage experienced by each operator in real time are available at low cost. In our previous work a prototype system has been proposed for estimating in real time the exposure to hand–arm vibration of workers by means of a wearable embedded device involving a tri-axial micro electro-mechanical systems (MEMS) accelerometer and ZigBee wireless communication. The device developed can be attached to the operator waist, and record the vibration dose received, and generate an alert when the threshold is reached. Recently, the initial prototype has been developed into a full operational demonstration system known as safe hand-arm vibration exposure (SHAVE). Vibration levels were determined by means of the SHAVE system, employed as a dosimeter capable of measuring the vibration level transmitted to the hand-arm system, applying the specified frequency weighting, processing the three axes of vibration data, and computing the vibration dose continuously for 8 h. By relating the time spent by the operator using the portable shaker, the quantity of harvested olives and the level of exposure to vibrations, an efficient management strategy for the team of operators was obtained that complied with the safety requirements for the workers involved.

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Precision fertilization in olive growing

Since the beginning of the twenty-first century, there has been an increase in the agricultural area used for olive growing as in Extra Virgin Olive Oil (EVOO) consumption. Precision agriculture has been little applied in olive growing both for the architectural characteristics of the plant and for its limited diffusion on Earth due to its specific pedoclimatic needs. The aim of this study was to apply precision agriculture in olive orchard, in order to identify the pedological and nutritional variability of the plants and build the prescription maps for variable rate fertilizers distribution (VRT). In the field, the plants were georeferenced using the S7-G Stonex GPS with RTK differential correction also recording the parameters related to vigour: trunk circumference, trunk height, number of branches, foliage diameter, etc. Thirty-six soil and leaf samples were taken using the same sampling grid to carry out the main chemical and physical analyses. The following parameters were determined on the soil samples: texture, pH, electrical conductivity, $CaCO_3$ percentage, organic matter and nitrogen concentration. The foliar analyses involved the determination of N, K, Ca, Fe, Mn, Mg, B, Zn, Na, Cu. Sampling data were spatialized using the main interpolation techniques and geo-statistical methodologies. The open-source geographic software QGIS was used for data processing. The main threshold of minimum foliar concentration was used to identify the areas where fertilization would be needed. Finally, the fertilization schedule was determined for each plant by applying the nutrient balance method. It was obtained by interpolating the main base maps, as the crop yield map. The prescription map of nitrogen fertilization ($g*m^{-2}$) was thus obtained to be applied in the field. The prescription map created will be used for variable rate fertilization using a tractor and fertilizer spreader connected by ISOBUS system. The realization of the prescription map allowed to reduce the amount of nitrogen to be distributed in the field by 30% compared to the standard dose, with a concrete improvement of the crop production both in terms of environment and management.

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Implementation of a new system for precision apiculture

The innovative technologies of precision agriculture can be applied today to different productive sectors of agriculture in order to optimize crop production and to improve the quality of the final products. One of these is beekeeping, a very important sector both from an environmental and a production standpoint. The production of honey depends on many factors, some of which are environmental factors such as temperature, relative humidity and wind. The aim of this study was the design of a Precision Apiculture System (PAS) platform for monitoring and controlling the main environmental factors, both inside and outside the hive, in order to assess their influence on the honey daily production. The PAS was designed by the Department of Agricultural, Food and Forest Sciences of the University of Palermo and consists of an Arduino board with Atmel Microcontroller (ATmega2560) with 8 bits. PAS is a platform capable of continuously recording and monitoring the following parameters: temperature (° C) inside and outside the hive, and quantity of honey produced (kg). The tests were carried out in a cultivated field with French honeysuckle plants in full bloom. The results obtained confirm the accuracy of the data recorded by the PAS platform, providing a valid decisional support to the operator (Decision Support System).

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CowEnergy- Challenges and opportunities in a cyber physical system for milk and energy production

Cyber physical systems are playing an increasingly important role in industry under the term Industry 4.0. The individual processes control each other in a demand-oriented manner and enable customer-oriented individual production. The aim of the CowEnergy project is to transfer this approach to milk production. The two main products are milk and energy.
The generation of renewable energy via biogas, photovoltaics, wind and geothermal energy has become widespread in German dairy production in recent years. At the same time, there has been extensive automation with milking robots, feeding robots and cleaning robots. The corresponding prerequisites for the implementation of Industry 4.0 in agriculture are therefore in place.
When it comes to energy production, the dairy farm is a producer, a storage facility and a consumer. Since it can produce more energy than it consumes itself, it can make it available on demand, especially via storage facilities, but also absorb electricity peaks from the energy grid via its own consumption and storage. In milk production, it is possible to record the milk from each cow individually via the milking robots and to market it according to demand, e.g. according to protein content.
What are the challenges for the CowEnergy concept?
Part of the challenge is the difference between agriculture and industry. Industry usually takes place in closed and well-defined units. Agriculture is an open biological system in which the farm animal interacts as a further actor in addition to humans and technology.
The challenge in technology is the networking of the individual partners. Even simple communication between the milking robot and the feeding robot about the adjustment of the feed quantity when the milk yield decreases is not always guaranteed. In energy technology, too, there is no standard for communication between biogas plants and photovoltaic plants, e.g. for storing methane when the weather forecast indicates that more energy is expected from photovoltaics.
The challenge in the marketing of energy is the billing that arises from energy costs and grid fees, which makes it expensive to move energy between farm and region. In milk marketing, dairies currently have a centralised structure, but automated small-scale dairies on the farm would be necessary for individualised production. In addition, transport and marketing for demand-oriented products would have to be redesigned.

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Effects of die size, date inclusion, and die thickness on extrudates mechanical properties

As the cost of fish production is rising globally and the management of agricultural byproducts needs to be addressed. Corresponding efforts to handle the agricultural crop residues have not been satisfactorily sustained. One of the ways to overcome these problems is the production of extruded fish feed with date seed. Therefore, the optimum conditions in a single screw extruder to form extrudates with desirable mechanical properties with date seed at different inclusion rate (0, 5, 10, 15%), die size (4, 6, 8 mm), and die thickness (3, 6, 9 mm) were investigated. Extrusion increased the hardness as the date seed inclusion increases. Extrudates with less than 6 mm die size and greater than 6mm thickness resulted in high hardness. Response surface model developed for the mechanical property described the processing conditions (R^2>0.63). The optimal combination of extrudates size (8mm), date inclusion (19.72%) and die thickness (18.28mm) resulted in optimal hardness of 0.214kN at maximum desirability of 0.79 resulted to 86.9% machine efficiency. The results indicated the significance of die size and interaction of die size-date inclusion on the extrudate properties. This work shows that fish feed extrusion with date seed, enhanced properties of extrudates, and technological advancement.

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Anaerobic digestion of olive mill wastewater for a sustainable recovery

Olive mill wastewater is characterized by a low pH, a high chemical oxygen demand, a high C/N ratio as well as a high content of polyphenolic compounds, which makes difficult its management and disposal without engendering environmental problems unless appropriate treatments are applied. Among these, anaerobic co-digestion seems to be a reliable process for olive mill wastewater sustainable recovery.

The present study reports the results of experimental trials dealing with anaerobic digestion of olive mill wastewater for biogas production. To this purpose, laboratory reactors containing seeding sludge and olive mill wastewater in different proportions were incubated at mesophilic conditions (37 °C) for 30 days. Each of the matrices as well as the tested mixtures were characterized in terms of dry content (DC %), volatile solids (VS %), total phenolic contents (PPs g/L), chemical oxygen demand (COD g/L) and pH. The process was performed in wet, i.e. the reactor dry content was below 10 %, pH ranged between 6.9 and 7.2. The produced biogas was daily quantified according to water displacement method. While its content was determined by performing gas chromatography. Higher amount of biogas (5.80 ± 1.77 $NL.L^{-1}{}_{\text{of substrate}}$) and methane ($4.88 \pm 2.03$ $NL.L^{-1}{}_{\text{of substrate}}$) was obtained when implementing higher content of olive mill wastewater corresponding to one third the whole reactor content.

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An innovative system for monitoring and control the aromatic herb drying process

In the last years, the interest of consumers towards aromatic and medicinal herbs has registered a growing trend. Unfortunately, the biomass has a short life after harvest, from a few hours to a maximum of half a day, so artificial drying is necessary to stabilize them. The principle is to dry the free waters with a forced flow of dry air, passed through the biomass, spread over large surfaces on one or more layers. Hot-air drying, using convective ovens, is a fundamental technology for the postharvest preservation of aromatic and medicinal plants. The aim of this study was to design a low-cost real-time monitoring and control system for the drying process of aromatic herbs. The smart system is based on an Arduino Mega 2560 board, to which nine Siemens 7MH5102-1PD00 load cells and a DHT22 temperature and humidity sensor were added. The data acquired by the sensors were transmitted through Wi-Fi to a ThingSpeak account in order to monitor the drying process in real time. Hot-air drying tests of sage and laurel leaves using the novel control system were carried out in a dryer desiccator cabinet at 40 °C and 25% relative humidity using three biomass densities (3, 4 and 5 kg/m2). The variation in the moisture content of the product and the drying rate were obtained. The three different biomass densities employed did not provide significant differences in the drying process for sage. Statistically significant differences among the three tests were found for laurel in the final part of the process.

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Improvement of mechanical separation of black soldier fly compost: Plant design and development

Several technological solutions have been developed in order to improve composting process. However, the separation of earthworms or insects from the compost at the end of the process still constitutes the bottleneck of the supply chain, as it is performed manually in most of the cases. Indeed, little scientific literature deals with the aspects inherent to mechanized or automatic separation. In this context, the present work describes a new plant designed specifically for mechanical separation of black soldier fly compost. The composting plant is mainly made up of three elements: 1) the composting station consisting in an open container having internal dimensions of 1.13 x 1.13 x 0.3 m and a volume of 0.38 m3, capable therefore to hold more than 190 Kg of substrate. In this container, agro-industrial and livestock by-products are subjected to composting by black soldier fly larvae during approximately 15 days; 2) a vibrating screen which represents the key element of the composting plant as it can separate the compost ready to use for agronomic purpose and Hermetia illucens L. pupae to be used for insect breeding. This unit is composed of a hopper whose function is to convey the material to be separated on the two vibrating sieve structures, having an area of 4.5 m2 each. The presence of two sieve structures is mainly due to the necessity to recover Hermetia illucens L. pupae with different dimensional features, hence, the upper vibrating structure enables pupae fist-step separation thanks to a couple of 10 x10 mm electro-welded meshes, superposed and rotated in a configuration 0/45°, while the lower structure, which is made of a couple of 5 x 5 mm electro-welded meshes, alike the first one, enables to separate the compost and the remaining pupae; 3) a platform ladder to facilitate the manual operations of unloading the containers at the end of the process and loading the vibrating screen hopper for compost and Hermetia illucens L. pupae separation. With such a plant, compost separation rate reached 85 % during preliminary experimental trials.