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SEPTEMBER 2025

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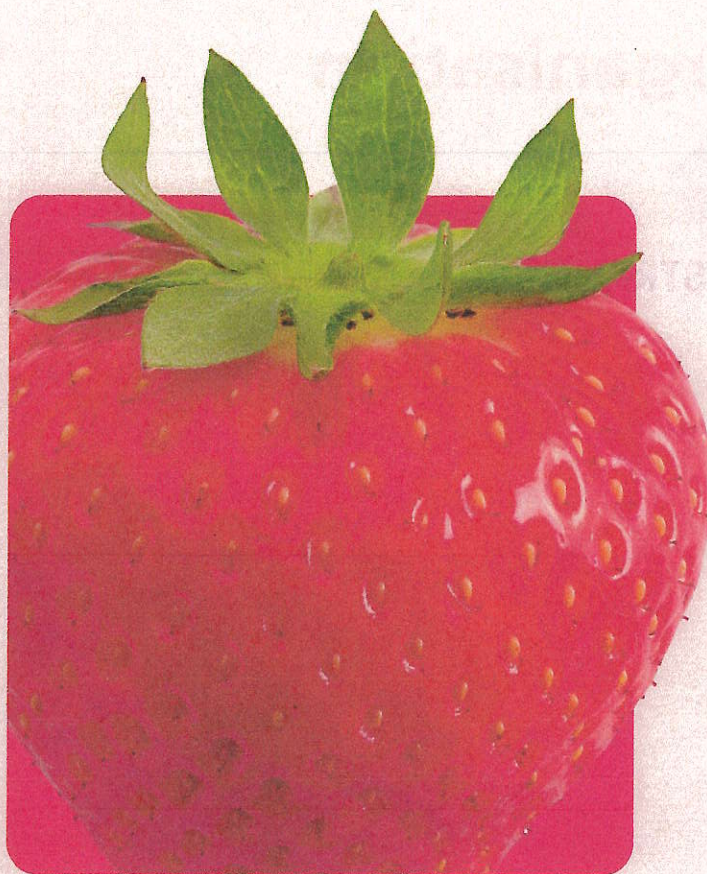


Table of Contents

4	Organisation
6	List of contents
11	Session 1 : Strawberry Breeding & Physiology
25	Session 2 : Integrated Pest Management
41	Session 3 : Innovative Technology & Vertical Farming
51	Session 4 : Sustainability & Fruit Quality
71	Posters
115	Sponsors

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List of contents

Oral presentations

Strawberry Breeding & Physiology

- 12 Scientific Insights and Technological Innovations Shaping the Next-Generation of Strawberry Cultivars

S.J. Knapp, G.S. Cole, M.J. Feldmann, D.D.A. Pincot, M. Bjornson, R.A. Famula, C.M. López, A. Krill-Brown, J.M. Debernardi

- 14 Genome editing of Fra a 1.01 to reduce allergen in strawberry

Yuichi Uno, Kanako Takebe, Hina Hosomi, Tatsuya Nagano, Takeshi Fukumoto, Yuki Kono, Ryohei Koyama, Misaki Ishibashi, and Keiji Nishida

- 17 AI-driven phenotyping for profiling varietal requirements in strawberry breeding programs

Souhaieb Aouayeb, Henri Nicod, Erwan Rouault, Irene Berriet, Felicie Vuittenez, Romain Schmitt

- 20 The application of priming agents as an alleviation strategy to combat salinity stress in strawberry plants: a physiological, biochemical and transcriptomic approach

Egli C. Georgiadou, Sofia Torrado, Anna Maria Taliadorou, Vasileios Fotopoulos, George A. Manganaris

Integrated Pest Management

- 26 Non-chemical means to control strawberry powdery mildew

Arne Stensvand, Belachew Asalf, Arupillai Suthaparan, Rodrigo B. Onofre Natalia A. Peres, David M. Gadoury

- 29 Can bee-vectored bacteria restore the strawberry flower microbiome and enhance disease resistance in greenhouse cultivation?

Jari Temmermans, Marie Legein, Ilaria checchia, Giovanna E. Felis, Wenke Smets, Reet Karise, Barbara De Coninck, Filip Kieken, Sarah Lebeer

- 33 Short wavelength UV and blue lighting in combination with cold storage can minimize postharvest gray mold losses in strawberry

Arupillai Suthaparan, Ganghan Zhou, Pinkuan Zhu

- 37 Sustainable soil fumigation program over 3 years with Nemasol® (metam-sodium 510 g/L) on strawberries in Huelva, Spain

B. De los Santos, D. Ruano-Rosa, L. Miranda, J.A. Gómez-Mora, J.M. Rabasse, E. Medico, A. Bogaert, J.J. Medina, M. Talavera

Innovative Technology & Vertical Farming

- 42 The colourful life of plants in vertical farms

Leo F.M. Marcelis, Jielyu Han, Paul Kusuma, Ying Liu

- 45 Drone-based yield prediction for everbearing strawberries: adapting to scaffold challenges

Yasmin Vanbrabant, Nick Gutkin, Bart Theys, Nicole Gallace, Stephanie Delalieux, Dany Bylemans, Serge Remy

- 48 **VOC-based monitoring for early detection of mechanical damage and fungal infection in strawberries**

Taylor Person, Miaomiao Yao, Maxence Paillart, Thijs Defraeye, R.E. Schouten

Sustainability & Fruit Quality

- 52 **Low chill strawberries: Long picking season with low energy input**

Johanna Bqc-Molenaar, Frank Kempkes, Marcel Raaphorst

- 56 **Energy-saving strategies for early-season strawberry production in North-West European greenhouses**

S. Laurijssen, P. Melis, M. Hofkens, V. Greffe, D. Peeters, T. Van Delm

- 60 **Fruit pigmentation is distinctively associated with anthocyanins and volatile organic compounds in the fruit of contrast strawberry cultivars**

Hyowon Park, Joohyuk Jo, Jiwon Park, Theint Thandar Latt, Si-Eun Byeon, Ho-Yeon Kim, Jinwook Lee

- 64 **Calcium with transport stimulant improves firmness of strawberries**

Jolyon Dodgson, Anna K. Marks, David J. Marks

- 67 **Impact of postharvest LED light treatments on strawberry quality during cold storage**

Farneti Brian, Paucek Ivan, Khomenko Iuliia, Pennisi Giuseppina, Pistillo Alessandro, Pastore Chiara, Gianquinto Giorgio, Biasioli Franco, Orsini Francesco, Spinelli Francesco

Posters

Breeding & Phenotyping

- 72 **Molecular basis of water soaking in strawberry**

Diana Seidler, Henryk Flachowsky, Ofere Francis Emeriewen, Klaus Olbricht, Moritz Knoche

- 73 **BreedingValue: Four years of successful European Berry Breeding Research**

Klaus Olbricht, Bruno Mezzetti, Jahn Davik, Sonia Osorio, Salla Karhu, Björn Usadel, Lena Prochnow, Anne Kopk

Strawberry Physiology

- 76 **Plantalogica 'flower mapping' service: describing strawberry plant architecture**

E.J.J. (Bert) Meurs

- 77 **The impact of chemical priming on the physiology and productivity of strawberries under deficit irrigation**

Sofia Torrado, Egli Georgiadou, Elena Myrtsi, Anna Maria Taliadorou, Vassilis Fotopoulos, George A. Manganaris

Integrated Pest & Disease Management

- 80 **Sticky Traps in Open Tabletop Cultivation: Effective IPM Strategy or Insectageddon?**
N. Gallace, R. Ruiz Vargas, A. Alhmedi
- 81 **New strategy to control *Rhizopus stolonifer* and *Mucor* spp. during the cultivation of strawberry**
An Ceustermans, Michelle Holtappels, Wendy Van Hemelrijck, Maarten Hofkens, Peter Melis, Jane Debode, Dany Bylemans
- 82 **Leveraging strawberry-associated microbes for fungal disease protection**
Katto Macharis, Liese Vlasselaer, Brianne Newman, Wenke Smets, Sarah Lebeer, Barbara De Coninck
- 83 **Dietary requirements of the mycophagous ladybird beetle, *Psyllobora vigintiduopunctata*, a potential biological control agent of powdery mildew on strawberry**
Tham Nguyen, Johanna Bac-Molenaar, Gerben J. Messelink
- 84 **Fungicide sensitivity of two microbial antagonists**
Michel Vincent
- 85 **Effect of fermented organic material on *Verticillium dahliae***
Michel Vincent
- 86 **Influence of application equipment on spray deposition on strawberry grown on tabletop growing systems**
Justine Garnodier, Florence Verpont, Camille Allemann
- 87 **Temperature and steam treatment of strawberry plant material**
Peter Melis, Stef Laurijssen, Maarten Hofkens, Diethe Peeters, Vincent Greffe
- 88 **Efficacy of crop protection agents against strawberry foliar nematodes**
Eva Bangels, Nicole Gallace, Johan Desaegeer, Tim Beliën, Dany Bylemans
- 89 **The strawberry – *Botrytis cinerea* interaction: from flower to fruit**
Yijie Zhao, Maarten Hertog, Bart Nicolai, Barbara De Coninck

Innovative Cultivation Methods

- 92 **Innovation of production systems and the potential of Japanese strawberry varieties brought by F1 seed strawberries**
Yuki Otsuka
- 94 **Micropropagated strawberry mother plants: soilless and open field nursery trials for the evaluation of their stoloniferous potential**
Valentina Morresi, Francesca Balducci, Jacopo Diamanti, Francesca Bottegoni, Franco Capocasa, Bruno Mezzetti

Vertical Farming

- 96 **Optimizing strawberry plant propagation in a controlled environment ecosystem**
Jolien Claerbout, Simon Craeye, Maarten Garmyn, Bert Deruyckl, Maarten Ameye
- 97 **Efficient Strawberry Production in Plant Factories Using Pseudo Short Day Light Treatment**
Sota Kikuchi, Yukiko Tomari, Naoya Mori, Tomohisa Sudo, Ayumi Tanaka, Hiroyuki Watanabe

Robotics & Automation

- 100 **Fruit biochemical and molecular responses after postharvest robotic gripping**
Rafael Tomzas, Aneesh Chauhan, Leo Marcelis, Julian Verdonk, Silvia Langer

Fertilisation, Soil Health & Growing Media

- 102 **Substituting Mineral Nitrogen with Organic Nitrogen Forms Enhances Strawberry Plant Resilience in Substrate Culture**
Nicole Gallace, P. Lieten
- 103 **Organic substrates for soilless strawberry cultivation from derived products: evaluation of peat alternatives available in Trentino**
Paolo Martinatti, Brian Farneti, Gianpiero Ganarin, Paolo Miorelli, Luca Brentari, Tommaso Pantezzi
- 104 **Effect of biochar and compost tea on the yield of strawberries**
Michel Vincent, And r An ay, Louis Sutter
- 105 **An overview of recently tested biostimulants at Research Centre Hoogstraten**
V. Greffe, M. Hofkens, P. Melis, S. Laurijssen, D. Peeters, T. Van Delm
- 106 **Reusing Horticultural Substrates in Strawberry Cultivation: Impacts on Fruit Taste and Root-associated Microbiome**
Xinquan Hu, Jolien Claerbout, Bart Vandecasteele, Simon Craeye, Danny Geelen
- 107 **Tactics for increasing yield of trayplants for June-bearers Opera and Parlando**
Maarten Hofkens, P. Melis, S. Laurijssen, D. Peeters, V. Greffe, T. Van Delm
- 108 **Substrate reuse in modern strawberry cultivation**
Diethe Peeters, Stef Laurijssen, Maarten Hofkens, Peter Melis, Vincent Greffe
- 109 **Screening of peat-free substrate mixtures for hydroponic strawberry cultivation**
Simon Craeye, Hofkens Maarten, Vandecasteele Bart, Claerbout Jolien, Ameye Maarten

112 Fruit Quality & Nutritional Properties

Changes in distribution of soluble carbohydrates and organic acids in strawberry fruit visualized using MALDI-TOF q-MSI during fruit ripening

Takumi Fujiki, Yutaka Jitsuyama, Takashi Suzuki

114 Postharvest Biology & Technology

The efficacy of postharvest application of coatings and priming agents on quality attributes, volatilome fingerprinting and antioxidant potential of strawberry fruits

Egli Georgiadou, Elena Myrtsi, Anna Maria Taliadorou, Sofia Torrado, Vassilis Fotopoulos, George A. Manganaris

Organic substrates for soilless strawberry cultivation from derived products: evaluation of peat alternatives available in Trentino

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Abstract

Soilless strawberry cultivation requires a growing medium with specific physicochemical characteristics, particularly porosity and exchange capacity, which determine the hygroscopic and nutritional conditions suitable for plant development. Sphagnum blonde peat of appropriate granulometry has demonstrated these conditions, becoming the preferred material for this cultivation due to its cost-effectiveness and ease of use.

In recent years, environmental pressures to reduce the use of slowly renewable natural resources on one hand, and geopolitical issues suggesting increased costs and risks for production and transportation of materials on the other, have accelerated the search for viable alternatives.

Simultaneously, these socioeconomic factors have led to the emergence of initiatives aimed at recovering and transforming products or by-products from various sources: domestic, industrial, energy, or agricultural. In Trentino, composting of domestic waste, bio-digestion of livestock effluents, chipping of tree residues for thermal energy use, and chipping of urban green management residues generate large quantities of organic materials with diverse physicochemical characteristics.

The intersection of these two economic-ecological trajectories, one internal and one external to the sector, has led to evaluating their potential applications in soilless cultivation systems. This study aims to utilize these materials to reduce peat usage through total or partial substitution, or by reusing peat for multiple production cycles. Different formulations and management methodologies were determined and tested based on preliminary assessments of the physical-hydraulic and chemical-nutritional behaviours of these materials.

Initial results suggest the potential use of some of these materials as supplements to peat previously used in a first production cycle. For example, mixing used peat with a minority proportion of digestate, combined with specific fertigation management, has enabled its reuse in a biennial production cycle with overwintering a limitation typically insurmountable due to the drastic structural deterioration of reused peat.

Organic substrates for soilless strawberry cultivation from derived products: evaluation of peat alternatives available in Trentino

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Biodigester of Villa Agneda (TN)



Composting Center of Faedo (TN)



Wood chip company of Cimego (TN)



Introduction

The success of soilless strawberry cultivation depends on a growing medium with specific porosity and exchange capacity. For a long time, sphagnum peat has been the preferred choice due to its ideal properties and low cost.

However, increasing environmental and geopolitical pressures have highlighted the need for sustainable alternatives. Concurrently, efforts to recover and transform organic by-products from domestic and agricultural sources have created a new supply of materials. This research evaluates the potential of these materials, specifically those produced in Trentino, to be used as growing media in soilless cultivation systems.

Objectives

The primary goal of this research is to explore the use of organic by-products to reduce or eliminate peat consumption. By analyzing the physical-hydraulic and chemical-nutritional properties of these materials, we developed and tested different formulations and management strategies. Our approach seeks to achieve one of two outcomes: either the total or partial substitution of peat, or the extension of its use through multi-cycle reuse.

Materials

Substrate testing (as is or in a mixture):

BLOND SPHAGNUM PEAT "control test" (from Baltic peat bogs)

LIVESTOCK DIGESTATE (from the nearby biodigester)

URBAN COMPOST (from the provincial composting center)

BY-PRODUCT OF HEATING WOOD CHIPS (from a company of this region)

USED BLOND SPHAGNUM PEAT (from the local farms)

soilless cultivation system with trays in a climate-controlled greenhouse



control and management of the fertigation system (six different types of treatment)



Blond Sphagnum Peat (bulk in commercial bags)



Urban compost (front) Biodigester (behind)



By-product of heating wood chips (available in various diameter calibers)



Used blond sphagnum peat (ready to use bags)

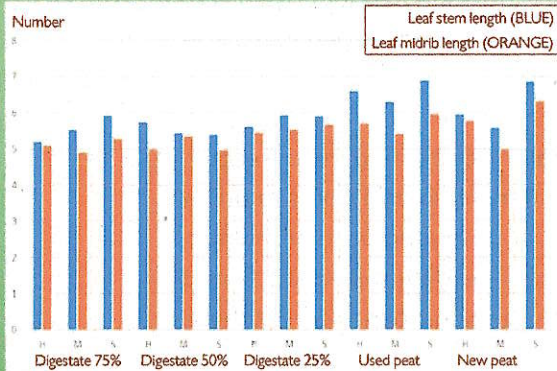


Methods

After verifying the declared values of the chemical components and the main chemical-physical characteristics, the products' behavior was initially tested as such or in equivalent binary mixtures to interpret their responses to water management, fertigation (in terms of pH and conductivity), and management (e.g., any pre-transplant treatments such as flushing, chemical-nutrient additions, etc.). The possible mixtures of the various products and their synergistic percentage ratios were then monitored, both in combination with each other and with peat, both new and reused, with the aim of, if not replacing it, at least reducing annual consumption.

Results

To determine the best way to utilize the materials, we first verified their chemical components and key properties. We then tested their response to water and nutrient management (fertigation), including the effects of pre-transplant treatments. Finally, we monitored different product mixtures, both as standalone media and in combination with new and reused peat, to assess their potential for reducing or replacing peat consumption.

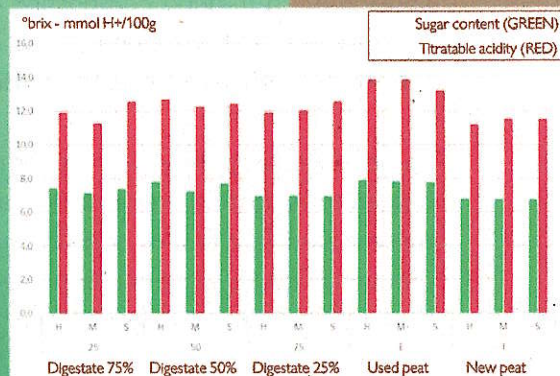


VEGETATIVE DATA (first year, before winter)

LEGEND: (substrates)
T (standard)= new peat
E (treaty)= used peat
25/50/75= % of digestate in peat

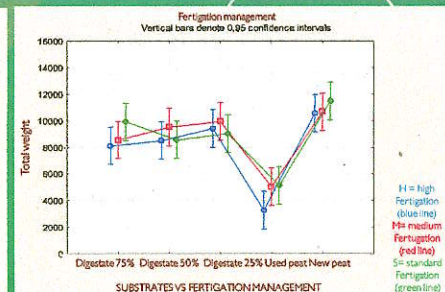
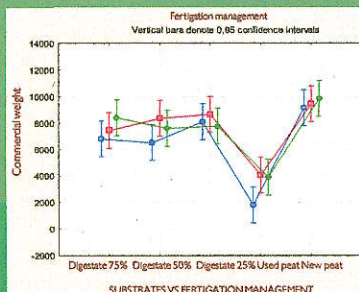
LEGEND: (treatment)
H= high increase fertigation
M= medium increase fertigation
S= standard fertigation management

QUALITATIVE DATA (second year, post winter)

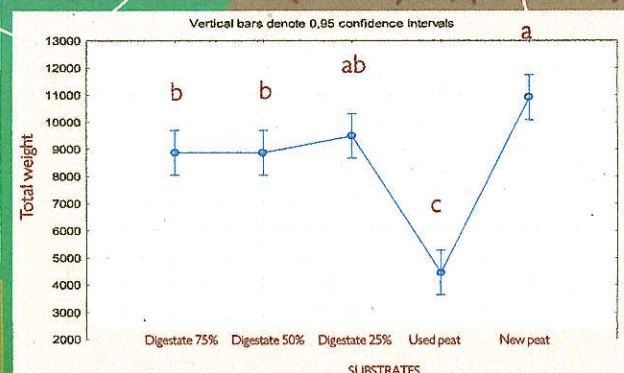


Discussions

Despite peat's superior performance, especially when compared to reused peat after overwintering, our initial findings indicate that some of the tested materials could serve as effective conditioners or partial replacements for previously used peat. Furthermore, our study highlights the importance of precise fertigation management, particularly regarding the quantity and frequency of watering, and monitoring conductivity, for successful cultivation in all types of substrates.



PRODUCTION DATA (second year, post winter)



Conclusions

Our results indicate the potential for using alternative materials to supplement peat. We successfully raised a mixture of used peat and a small proportion of digestate for a two-year production cycle, even with overwintering. This is particularly notable because the structural integrity of reused peat typically degrades to a point where it is unusable after one cycle. These findings highlight a promising strategy for reducing peat consumption.

Acknowledgements

We would like to sincerely thank the following for their support: Evelyn Carlin and Simone Martini of the farm of the Edmund Mach Foundation for the practical support; Daniela Bona and Andrea Cristoforetti of the Bioeconomy Unit of the Research and Innovation Centre of the Edmund Mach Foundation for the scientific support; The Agri Alp Bioenergy farm and the CR3 company for the raw materials.