Fraunhofer UMSICHT
Building integrated food production - inFARMING®

Sustainable indoor horticultural systems of the future | inFARMING®

1st Joint Agrospace-MELiSSA Workshop, Rome, Italy 16.-18. May 2018

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The Fraunhofer-Gesellschaft

- 69 institutes and independent research facilities
- More than €2 bn research funds
  - €2.1 bn contract research
- About 24,500 employees (m/f)
- 40 facilities in Germany
- 13 institutes in North Rhine-Westphalia
- 4 institutes in the Ruhr area
Content

- Introduction
- Plant lighting systems
- Fertilizer production
- Outlook »Altmarktgarten«, 1st inFARMING® project
Local conditions for the cultivation of fresh horticultural products are basically tied up to the availability of light, water, heat and nutrients. These requirements can be provided efficiently within the urban space.

The systems approach inFARMING® is

- local,
- sustainable,
- close to the consumer,
- economically feasible
- by an efficient production and
- closed loops to the greatest possible extent.
Technical approaches for indoor cultivation

inFARMING® applies to:
- Fertilizer production from indoor waste streams
- Energy recovery
- Material development
- Artificial light management
- Sensor development and application
Technical approaches for indoor cultivation

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Technical approaches for indoor cultivation – plant lighting

Plant photoreceptors

– **phytochrome** (660 respectively 730 nm)
  - control of growth processes
  - control of shade protection, flowering induction

– **cryptochrome** (340 respectively 520 nm)
  - continuity of the circadian rhythmic
  - control of photomorphogenesis

– **phototropin** (340 to 520 nm)
  - efficient light use

– **UV-B-photoreceptor** (280 to 350 nm)
  - protective function
Technical approaches for indoor cultivation – phytochemicals

- **Flavonoids**
  - flavan
  - flavanol
  - rutin

- **Anthocyanins**
  - Group of flavonoids
  - cyanidin

- **Chlorophylls**
Technical approaches for indoor cultivation – fertilizer production

Motivation:

- Worldwide use of NPK fertilizers: 104 Mio. t N, 46 Mio. t P$_2$O$_5$ and 33 Mio. t K$_2$O
- High energy demand for Haber-Bosch Synthesis and uncertain P-resources
- Growing number of attempts to recycle or convert fertilizers from wastewater and animal excrements e.g. manure.
- Aquaponics has the same idea.
- No technical processes for safe and efficient urban integrated recovery.
Technical approaches for indoor cultivation – fertilizer production
Technical approaches for indoor cultivation – fertilizer production

Block 6

- Rainwater
- Blackwater
- Greywater
- Flushwater (7 – 8,5 m³/d)

Evaporation infiltration

MBR

Q = 50 PE

Goldwater

Utilitywater

Aquaponics

Hydroponics

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Outlook 2018: inFarming project realization
»Altmarktgarten«

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Thanks to my team, our partners and sponsors and to you for your attention!