



FOTOPONICA

SISTEMI INNOVATIVI PER NUOVE COLTIVAZIONI

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Medicinal plants

In Italy, the production of medicinal herbs does not meet the growing consumer demand for natural remedies. The pharmaceutical industry that depends on plant-derived active ingredients is still heavily reliant on imports from global markets, which may not always adhere to the same standards of supply chain management as those within Italy or Europe.



Cultivation without soil

The literature clearly shows that "soilless" crops, grown in controlled environments without soil, offer several advantages:

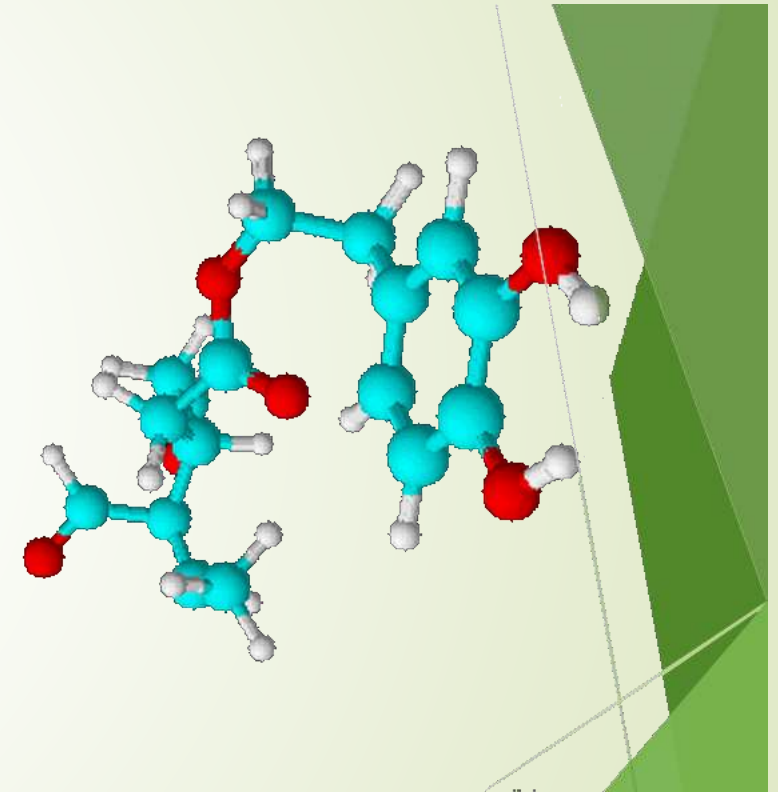
- Enable mono-succession planting;
- Facilitate cultivation in marginal and arid regions;
- Enhance water and mineral nutrition;
- Promote better rooting of plant materials;
- Increase plant density per unit area;
- Streamline crop management processes;
- Remove the need for geo-disinfection measures;
- Lower the risk of plant diseases;
- Utilize substrates free from heavy metals.



Byproducts of secondary metabolism

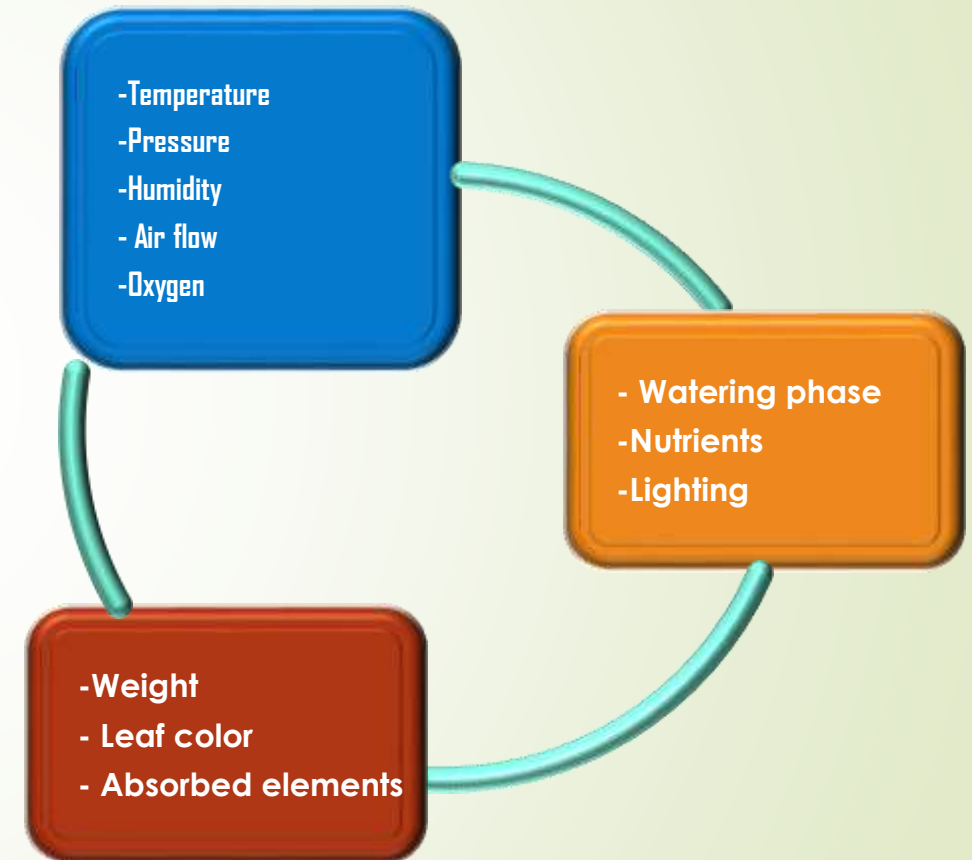
Secondary metabolites are compounds generated by plant cells that do not participate in primary metabolic activities and serve three key purposes:

- They provide defense to the plant against biotic or abiotic stress.
- They attract pollinators or herbivores to facilitate pollination and seed dispersal.
- They help regulate the balance between the plant and its neighboring counterparts.
- **These compounds are highly valued in pharmaceuticals for their antibiotic and antitumor properties.**



The logic

- **Establish environmental conditions**
- **Adjust photoperiod, nutrients, and irrigation**
- **Monitor plant growth criteria**
- **Introducing types of "stress" during different phenological stages**
- **To enhance physiological processes and boost the accumulation of target molecules within plant tissues.**



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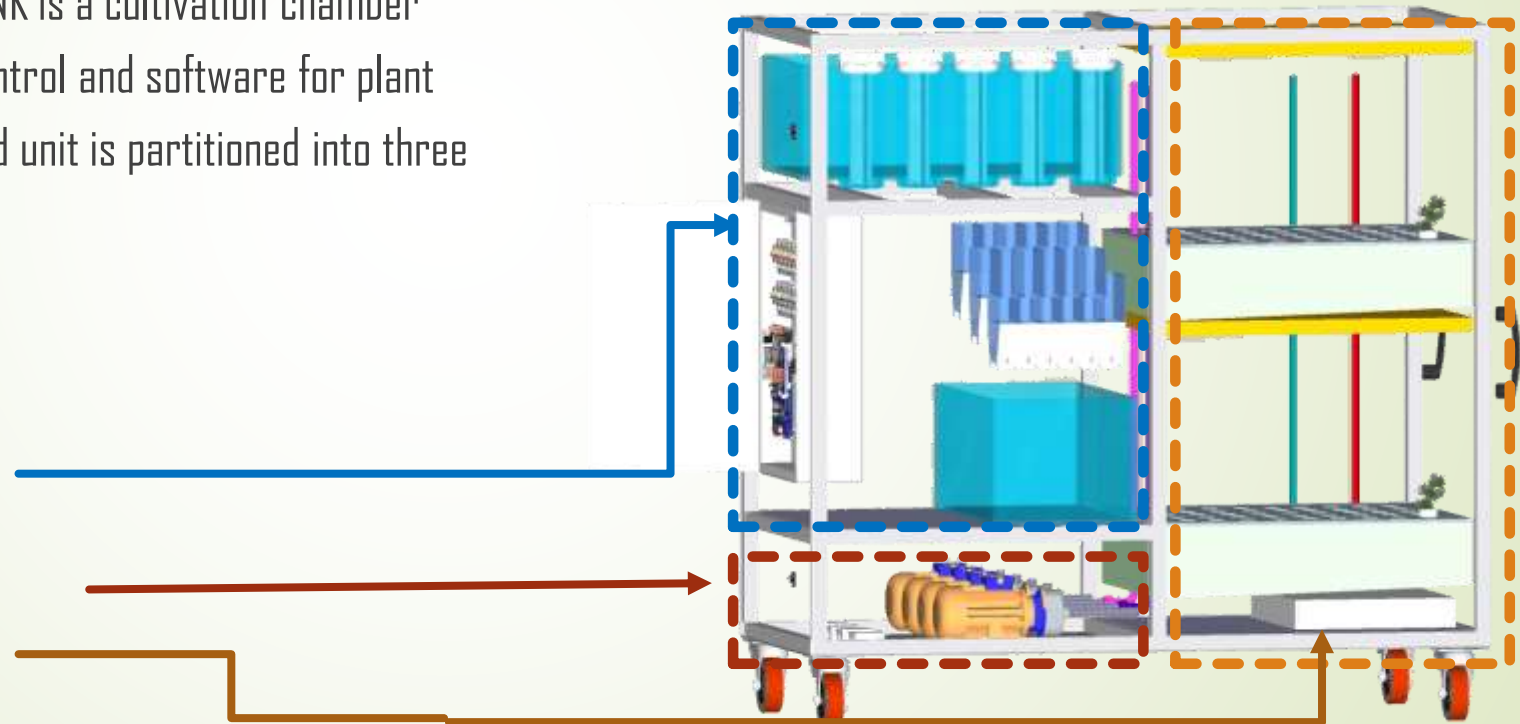
PRESENTS



The grow chamber with environmental control,
and automatic plant growth management system

Created in partnership with the University of Tuscia's Department of Innovation in Biological, Agri-Food, and Forestry Systems (DIBAF) and the University of Siena 1240's Department of Life Sciences, SINK is a cultivation chamber equipped with environmental control and software for plant growth management. This sealed unit is partitioned into three distinct zones:

- Plant Area
- Control Zone
- Cultivation Area



Area of Cultivation

As many as three distinct tanks can be set up in the cultivation zone, designed to support crops without soil and isolated from the external environment. This arrangement allows for complete control over the growth and flowering stages of the plants.

Each tank is equipped with its own lighting system that can produce radiation at various intensities, ranging from 300 nm to 760 nm.



Botanical Zone

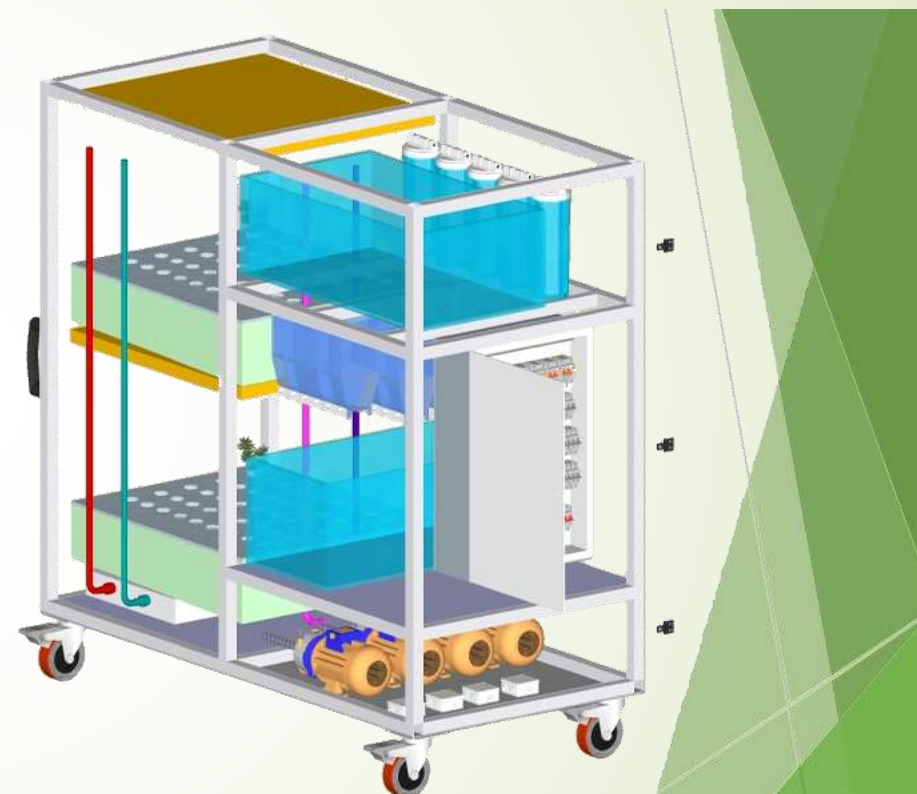
In the plant facility, there is a main tank specifically allocated for the storage of irrigation water, accompanied by three additional tanks that contain different nutrients. Each of these tanks is capable of dispensing a distinct combination of the three nutrients. The irrigation and nutrient distribution system is engineered to efficiently manage both the irrigation schedules and the supply of nutrients.



Regulated Area

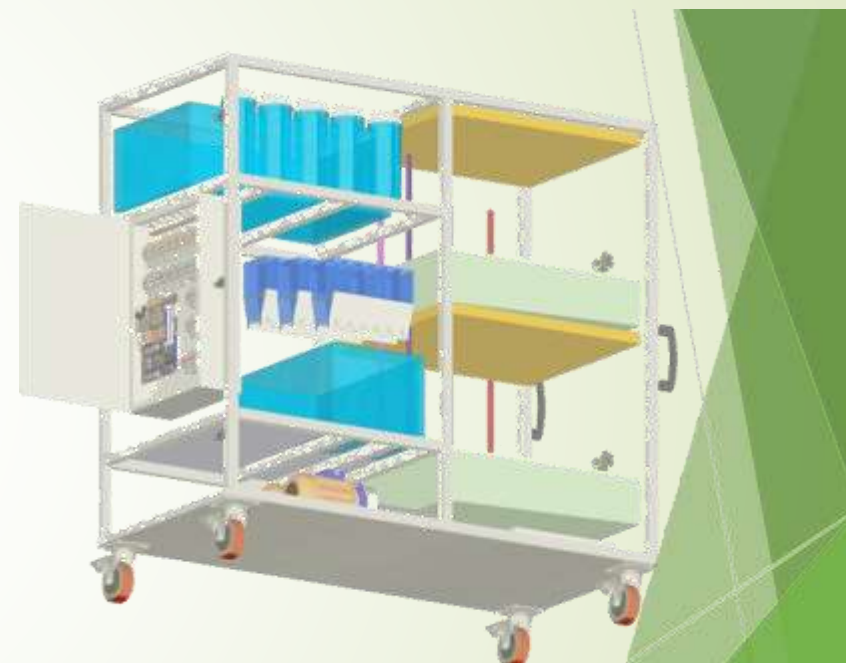
The control zone contains all the systems responsible for establishing and regulating the following conditions within the cultivation area:

- Temperature
- Atmospheric pressure
- Humidity
- Airflow
- Oxygen levels.



Sensors

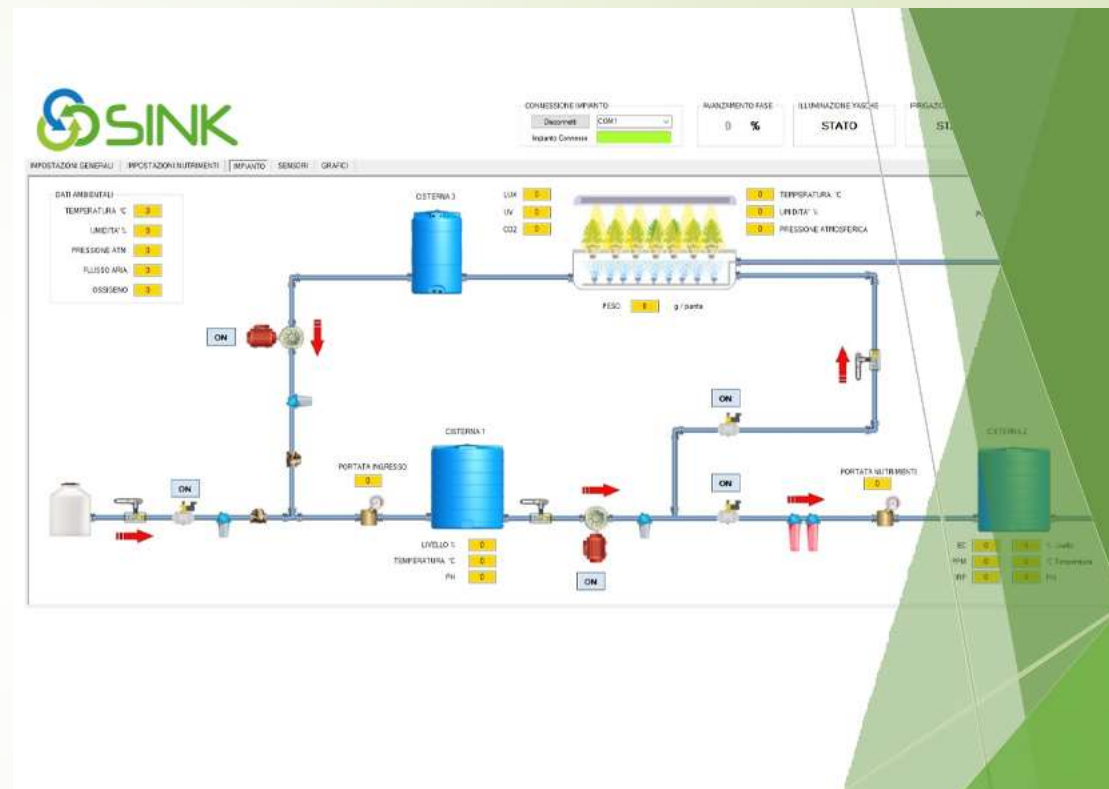
Within the cultivation zone, there exists a sensor system that can assess the weight of each plant, evaluate the color spectrum of the leaves, and analyze the water collected during the tank cleaning process.



The Software

The software takes care of setting and keeping the temperature, atmospheric pressure, humidity, air flow and the amount of oxygen within the growing area constant.

It also manages irrigation, nutrients and lighting (wavelength and power) of each individual tank, according to a pre-set protocol, verifying, through sensors, the correct growth process of the plants and the operation of the system.



The Software

The software is designed for remote control via an internet connection, enabling users to:

- Monitor data collected by the sensors;
 - Ensure the systems are operating correctly;
 - Adjust environmental settings;
 - Modify the watering, nutrient, and lighting schedules for each pool.
- ➔ Additionally, the system features a camera circuit that captures the growth area in time-lapse, which can be accessed remotely, along with an audio broadcasting system for conducting experiments related to the effects of sound waves on cultivation.



Conclusions

SINK can be utilized to:

- Identify the optimal parameters that promote the fastest growth of a plant.
- Discover growth conditions that enhance the production of specific active compounds and secondary metabolites relevant to cosmetics or pharmaceuticals.
- Conduct scientific investigations.
- Examine the optimal environmental settings and the most effective combination of nutrients for cultivating superfoods.

The Group

The group emerged from the collaboration between Michele Antonini and Giuseppe Laghezza Masci, who bring years of entrepreneurial experience and expertise in business organization and internationalization. This is complemented by the technological expertise of Luciano Cudicio and the research acumen represented by Valentina Laghezza Masci, Federico Monteleone, and Riccardo Tartaglia, along with the management and administrative proficiency of Carlo Ferdinando de Nardis.



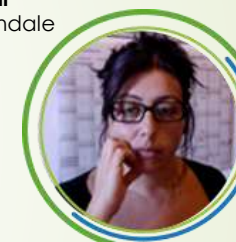
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