

SYSTEM AND METHOD FOR HYDROPONIC PLANT GROWTH

Description

- [0001] The present invention relates generally to the growing of plants in the absence of soil, and finds particular, although not exclusive, utility in a hydroculture growing system.
- [0002] The environment within a greenhouse may be closely monitored and controlled. In particular, the temperature and humidity may be kept within a narrow range to best favour the healthy growth of plants therein. Greenhouses lend themselves in particular to the growing of plants by means of hydroculture in its broadest sense (that is, the growing of plants in the absence of soil), in particular hydroponics, basic-hydroculture/passive-hydroponics, aeroponics, fertigation, aggregate culture and/or aggregation; that is, the growing of plants in the absence of soil. In addition, plants grown within a greenhouse (e.g. having a controlled internal environment) and/or by means of such hydroculture methods may be done so without the use of pesticides (e.g. herbicides, insecticides, fungicides, anti-microbials and/or other forms of pesticides), and in some jurisdictions may be referred to as organic agriculture. Conventional greenhouses are designed not only to hold plants, but also to provide access to the plants by growers. Space within the greenhouse is not utilised efficiently. In addition, while sophisticated systems are often employed to provide feed and water to the plants, they are generally inefficient and result in a significant amount of the feed and water being wasted. Typically greenhouse crop production uses 85% of the floor area for growing crops.
- [0003] According to a first aspect of the present invention, there is provided a soilless plant growing system (e.g. a hydroculture growing system), comprising: a conveyor for moving plants around a closed loop; a clean room in which the conveyor is located, the clean room provided with a filtered air supply and held at a pressure above ambient atmospheric pressure; a plurality of carriages configured to be mounted on the conveyor for movement thereon; at least one tray configured to be received on each of the plurality of carriages, each tray configured for

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growing at least one plant in the absence of soil; and automated tray apparatus for removing and/or inserting a tray from and/or onto the carriages, respectively.

- [0004] In particular, the conveyor may be configured to move a series of carriages around a closed loop. In this way, plants grown in the absence of soil may be moved around a growing room such that each plant receives a more even exposure to light than would be the case if static in the growing room. The growing room may be for instance approximately 50, 100, 115, 150 or 200 meters long, and may be oriented in an approximately East-West direction. The growing room may be for instance approximately 10, 20, 22, 30 or 50m wide.
- [0005] The system may comprise any number of carriages, for instance approximately 10, 20, 50, 100, 200, 500, 600, 650, 1000, 2000 or 5000 carriages. The conveyor may be operable with a maximum number of carriages thereon, the conveyor may be operable with a minimum number of carriages thereon, and/or the conveyor may be operable with an intermediate number of carriages thereon.
- [0006] The closed loop may have a serpentine form. In particular, the closed loop may comprise a series of parallel and/or antiparallel legs. In this way, a maximum and even exposure to natural and artificial lighting for each tray may be achieved.
- [0007] Each leg of the serpentine may be spaced from each other leg by between 0.5m and 2m, in particular between 1m and 1.5m, more particularly approximately 1.2m.
- [0008] The conveyor may comprise a track, and may be arranged such that the track may trace out a closed-loop pathway. The closed-loop pathway may be in two- or three-dimensions, for instance, arranged on a substantially flat floor, on a sloping floor, and/or on a tiered floor. In this way, the conveyor may be shaped to fit within any size and/or shape of building without wasting valuable growing space. In particular, the conveyor may include slopes of up to approximately 45 degrees, in particular up to approximately 30 degrees, more particularly up to approximately 10 degrees.
- [0009] The pathway may be substantially polygonal in form. The pathway may have a form substantially that of a non-convex polygon and/or a concave

[0059] A cleaning station may be provided adjacent to the spur line and/or other form of automated carriage apparatus, for cleaning the carriages.

[0060]

Planting and harvesting may be achieved at a single location, or at least a reduced number of locations, to enable economy of scale. The automated tray apparatus may comprise an automated tray removal apparatus and/or an automated tray insertion apparatus.

[0061] The automated tray apparatus may be located in a loading/unloading room. The loading/unloading room may comprise a clean room in a manner similar to the growing room. Alternatively or additionally, the loading/unloading room may be located in the clean room environment of the growing room. Movement between the loading/unloading room and the growing room may comprise moving through a decontamination region, air curtain and/or airlock, or similar, or alternatively, may comprise moving through a conventional non-airlock type portal, configured such that environmental conditions may be maintained at substantially different levels.

[0062] An automated tray conveyor may be provided for removing trays from the loading/unloading room and/or automated tray apparatus. The tray conveyor may move trays thus unloaded through a decontamination region and/or airlock, or similar.

[0063] The automated carriage apparatus may be configured/arranged to convey carriages from the conveyor to the automated tray apparatus. The automated tray apparatus may be located adjacent to the spur line and/or any other form of automated carriage apparatus. The automated tray apparatus may be located in the growing room.

[0064] A tray cleaning station may be provided adjacent to the automated tray apparatus, for cleaning the carriages.

[0065] In particular, automation minimises the need for persons to enter a clean room, and therefore improves cleanliness and minimises energy use.

[0066] The soilless plant growing system may further comprise at least one

CLAIMS

1. A soilless plant growing system, comprising:
 - a conveyor for moving plants around a closed loop;
 - a clean room in which the conveyor is located, the clean room provided with a filtered
5 air supply and held at a pressure above ambient atmospheric pressure;
 - a plurality of carriages configured to be mounted on the conveyor for movement
thereon;
 - at least one tray configured to be received on each of the plurality of carriages, each tray
configured for growing at least one plant in the absence of soil; and
 - 10 automated tray apparatus for removing and/or inserting a tray from and/or onto the
carriages, respectively.
2. A soilless plant growing system according to Claim 1, in which the conveyor is a floor-
mounted conveyor.
3. A soilless plant growing system according to Claim 1 or 2, in which each carriage may
15 be removably replaceable on the conveyor.
4. A soilless plant growing system according to Claim 1, 2 or 3, in which the plurality of
carriages are arranged in a first order on the conveyor, and in which the plurality of carriages
are re-orderable on the conveyor into a second order.
5. A soilless plant growing system according to any preceding claim, in which the clean
20 room comprises light-transmissible windows composed of polycarbonate.
6. A soilless plant growing system according to any preceding claim, further comprising
lighting disposed adjacent to the conveyor, and configured to be stationary with respect
thereto, such that each carriage passes the lighting as the carriage passes around the closed
loop.
- 25 7. A soilless plant growing system according to any preceding claim, further comprising at
least one watering station configured to irrigate the plants on each carriage as the carriage is
passed adjacent to the watering station.

8. A soilless plant growing system according to Claim 7, in which the watering station is configured to collect water run-off from the plants.
9. A soilless plant growing system according to Claim 8, in which the watering station is configured to purify water run-off collected from the plants.
- 5 10. A soilless plant growing system according to any preceding claim, further comprising automated carriage apparatus for removing and/or inserting a carriage from and/or onto the conveyor, respectively.
11. A soilless plant growing system according to any preceding claim, further comprising at least one sensor configured to determine the maturity of plants present in a tray.
- 10 12. A method of growing a plant in the absence of soil, the method comprising:
 - providing a soilless plant growing system according to any preceding claim;
 - placing a plant on the tray;
 - placing the tray on the carriage;
 - placing the carriage on the conveyor;
 - 15 moving the carriage on the conveyor around the closed loop;
 - providing the clean room with a filtered air supply; and
 - holding the clean room at a pressure above ambient atmospheric pressure.