AIR MOVEMENT CONTROL AND AIR SOURCE DEVICE FOR CULTIVATION

Cross-reference to related applications

This application is a Singapore National Stage entry of PCT Application No: PCT/TH2017/000082 filed November 17, 2017, which claims priority to Thai Patent Application No. 1601007444, filed December 14, 2016, the contents of which are incorporated herein by reference.

Technical field

The present invention relates to agriculture and engineering, plant growing, devices and method, in particular air movement control and air velocity retention device

cultivation.

Background

The air movement is the air moving from one place to another. There are two types of air movement: 1. Wind refers to the movement of air in the horizontal direction. It causes the distribution of air to the locations of the earth. 2. Air current refers to the movement of air in the direction perpendicular formation. For example clouds, rain, drought, etc.

Wind is another important factor for plant growth. In addition to helping to pollinate crops, distribute seeds and also plays an important role in the growth of plants, which helps for caring carbon dioxide for photosynthesis. The movement of water vapor, the other gases and temperature affect the photosynthesis process . The process is faster. By comparison, a plant that grows in areas where the wind blows lightly and plant-growing area of wind blows with speed of 1-5 mph. Found that the plants grow in area with wind speeds 1-5 mph. The rate of growth is better to plant in area with light wind, especially the growth of the stem and roots of plants. At the same time, there are also disadvantages effect, such as when strong wind will cause the crop to blow down, crop losses, destroy soil fertility and obstacle to spray chemical element. Corrosion of nutrients is the indirect effect of cropping.

The patent No. ZA 200803785 **B** announces methods and tools to control the air flow move through the plant at least one tree, which can be applied to crops as a group . And control the airflow through various parts of the plant.

The patent No. CN204513637 announcement of Shanghai Yizhuo Energy Technology Co., Ltd. announced the weather system that includes air purifiers, fan, box and the acreage controlled environment (container type). Its work by fan inflating the airflow pressure into the box through the plant nutrient (culture medium), located at the roots of the plant. To solve the problem of pollution from crop acreage controlled

environment (container type) with an aerator. Low power consumption and use less space as well.

The patent No. JP2011015655 announcement of Dyna Air KK announces the system and methods of air conditioning to controlled temperature of plants growth system and wind. By blowing air from the side of the plant to air through the top. The air flow out perpendicularly direction to the import air. To solve the problem of temperature control of the plant.

From the patent No. JP2012000028 announcement of Shimizu Corp. (Shimizu Corp.) revealed that the carbon dioxide in the air to help plant growing. By installing a two key position fan to assist in controlling the wind, the fan in the ventilation duct adjacent to the root of the plant . And fan in the plant room that help ventilating. To blow up the air back into the incoming tube.

From finding announcement, we only find the winds control for plant growing system. There are no relevant inventions related to the use of air currents in the plant growing system.

Planting under conditions of a controlled wind is another factor that helps plants grow faster, but often presents problems in controlling the wind to stabilize the entire area. And the temperature distribution is stabilize in the entire plant area. So the quality of plants is not equal. The plants near the wind generator grow better than the plants on the tip. Occasionally, plants in some areas are dwarfed or dead. The planters solve the problem by planting the plant only in the stabilized wind. This results in a limited area of growing is less than it should be and less commercial output. Another problem is plants that grow vertically. Plants on the upper floor of the plant rail grow fewer than the plant on the ground floor. Cause due to carbon dioxide, which is the key gas in photosynthesis, move down densely below. The growth of the top and bottom crops in the same row of crops although they provide the same nutrition and light.

Summary of invention

According to aspect of the present invention there is provided the air movement control and air source device for cultivation comprising:

Claims

1. An air mixture and air movement system for plant cultivation, the system comprising:

   A crop rail configured for holding plants;

   An air conditioning system for the cooling of incoming air and producing cooled outgoing air, the outgoing air routed to an air emission point (048);

   A mixing arrangement for introducing stored gases into the incoming air;

   An air movement device for creating a flow of air movement of the outgoing air, further configured to direct the air movement from the air emission point (048) to flow over an area of plants and arranged so that the flow of air movement traverses an essentially linear path from the air emission point (048) to an air intake (049);

   At least one air velocity retention device (AVRD) attached to the crop rail, the AVRD comprising an air intake for drawing in air and an air output for expelling air at a velocity associated with the operation of the AVRD;

   Wherein the path is arranged to traverse surfaces of at least one plant held in the plant rail, and

   Wherein the at least one AVRD is oriented and arranged to assist the air flow on the path from the air emission point (048) to the air intake (049).

2. The system of claim 1 wherein a plurality of AVRDs are attached to the crop rail, the plurality of AVRDs configured in a consecutive sequence so that air expelled from one of the AVRDs is directed towards the air intake of the next AVRD in the consecutive sequence.

3. The system of claim 2 wherein the AVRDs are spatially arranged in a consecutive sequence, and wherein the distance between consecutive AVRDs in the sequence is separated by a distance within a range of 15 to 300 centimeters.

4. The system of claim 2 wherein the crop rail is arranged to be able to hold at least one plant between a consecutive pair of AVRDs.

5. Air movement control and air source device for cultivation in accordance with claim 1, the system configured to implement an air movement control process comprising:

Retrieving at least one gas from a gas storage tank (201), the gas capable of affecting the growth of plants;

Transferring the gas through a nozzle (311) to inject the gas into the airflow of an air inlet (045) to an air conditioner (100), the air conditioner for regulating the air temperature to be suitable for growing plants;

Directing the flow from an air outlet of the air conditioner (046) through the air inlet accelerator (325), wherein the air enters the air collector tube (328) for distribution air into the discharge pipe (047), which releases the moving air though at least one emission point (048) into a spatial volume comprising living plants;

Passing the moving air from the at least one emission point (048) to a first AVRD (110), then through a region configured to comprise at least one plant (001) and into a second AVRD (111), then through a region configured to comprise at least plant (002), the AVRDs configured to maintain directed air movement;

Drawing the flow through the air intake (049) and into the pipe (050) which is conveyed to the collecting pipe (329);

Separating the flow into gas product and liquid product;

Directing the liquid product into a solution tank (354);

Directing the gas product into an air accelerator device (326) and subsequently to an excess moisture trap (320) for removing moisture from the gas product, and is then directed to the air conditioner,

Wherein the liquid product directed the storage tank (354) is available for use in plant nutrient processing.

6. The system of claim 5 wherein the gas storage tank (201) is arranged to comprise at least carbon dioxide gas.

7. The system of claim 1 wherein the concentration of gases that affected plant growth can be measured.

8. The system of claim 5 wherein the solution storage tank (354) is a closed container comprising at least one passage and an outlet.

9. The system of claim 5 wherein the air inlet accelerator (325) comprises at least one of a centrifugal pump or an axial flow fan.

10. The system of claim 5 wherein at least one of the air discharge tube (047), air collector tube (328), air compilation pipe (329), and pipe (050) comprise at least one of aluminum, plastic, stainless steel,foil, or equivalent.

11. The system of claim 5 wherein the surface area of the air collector tube (328) is within a range of 19 to 6360 square centimeters.

12. The system of claim 5 wherein the air compilation pipe (329) can be shaped to suit a specific application area.

13. The system of claim 5 further comprising a crop rail for holding plants, the crop rail (931).

14. The system of claim 1 wherein the crop rail (931) has an exterior surface color comprising a photosynthetic photon flux density (PPFD) within the range of 100 - 1000 microns per square meter per second (micron mol/sqr.m. sec).

15. The system of claim 1 wherein the surface of the crop rail (931) comprises a textured surface.

16. The system of claim 1 wherein the crop rail (931) can be vertically positioned to support a plurality of plants in a vertical stack or horizontally positioned as a shelf to support a plurality of plants in horizontal array.

17. The system of claim 5 wherein the air conditioner (100) is arranged to be able to provide an air temperature within the range 5 to 50 degrees Celsius.

18. The system of claim 5 wherein the excess moisture trap (320) comprises at least one of a desiccant dehumidifier, an air filter, and a humidity control unit.

19. The system of claim 1 wherein add any device that work to remove the air from the air intake (049) and flow through the air collector tube (328), and new device counted as one of the parts of the air acceleration device (326) by setting any side of the system.

20. The system of claim 1 wherein externally-sourced wind can be used to reduce the number of AVRDs.

21. The system of claim 5 wherein the air accelerator device (326) comprises at least one of a centrifugal pump or an axial flow fan.

22. The system of claim 1 wherein the air movement velocity is essentially within a range of 0.1 – 5 meters per second.

23. The system of claim 1 wherein the carbon dioxide concentration in the outgoing air is in a range of 450 to 1600 parts per million (ppm).

24. The system of claim 5 wherein the surface area of the air complication pipe (329) is within a range of 19 to 6360 square centimeters.

25. The system of claim 1 wherein the crop rail (931) comprises at least one of Polyvinyl Chloride, Polyethylene, Polypropylene, 316L stainless steel, 304 stainless steel, 308 stainless steel, or equivalent.