

SUMMARY

To address the needs and deficiencies described above, the various embodiments of the present invention provide for a luminaire system and method for optimizing plant growth and efficient use of artificial light resources in a controlled farming environment. Every type of plant has certain light requirements, wherein these light requirements include a specific light intensity, specific spectrum, and duration of light, to maximize plant growth. These requirements may not always mean "fastest" growth, as light can have psychological effects on plant growth. Plants have secondary metabolites that can be targeted or avoided using specific spectrum; e.g. with some plants, the color of the plant can be altered based upon the amount of UV light exposure to the plant. These light requirements are represented by light requirement information, and may be stored in an internal location or an external location (from the luminaire system) such as a farming environment database or a farming environment website. Once the luminaire obtains the light requirement information, the luminaire determines if adjustments should be made to a light source in the controlled farming environment to correspond to the light requirement information. The luminaire actuates any adjustments, and in one embodiment, updates information in a memory to reflect the current light provided to the plurality of plants in the controlled environment.

Therefore, one ~~aspect~~embodiment of the present invention provides an luminaire system for optimizing plant growth in a controlled environment, the luminaire system comprising: a luminaire controller, wherein said controller has a bidirectional communication link to ~~an~~the internet accessible network location and said luminaire controller is configured to access the internet accessible network location via the bidirectional communication link and retrieve light requirement information from the internet accessible network location; a luminaire light source, wherein the luminaire light source is coupled to one or more luminaires; and, an electrical or a light source interface providing a communication link from the luminaire light source ~~to~~and the luminaire controller. The luminaire controller is configured to receive light requirement information from a farming environment database, a farming environment website, or a third party website (or database) via the bidirectional communication link. The light requirement information may comprise spectrum information, or light quantity information, which may include a specific light measurement value in moles or the amount of light to be provided to a plant in a particular time measurement.

Another ~~aspect~~embodiment of the present invention provides a method of utilizing a luminaire system to optimize plant growth for a plurality of plants in a controlled environment, the method comprising: obtaining~~determining~~ light requirement information for one or more plants via a signal received from an internet accessible network location; ascertaining current light level information in the controlled environment; comparing the current level information and the light requirement information; and,

adjusting the inputs to the controlled environment based on the light requirement information and current-light level information. The step of determining light requirement information may further comprise accessing a farming environment database, a farming environment website, or a third party website (or third party database) via a bi-directional communication link. The step of determining light requirement information may comprise receiving a light quantity requirement, light duration information, or spectrum information. The step of adjusting may comprise scheduling a light source to be inactive during certain times of the day or varying the spectrum and/or intensity of the light provided by the luminaire system in the controlled farming environment.

Yet another embodiment of the present invention provides for an apparatus for optimizing plant growth in a controlled environment, the apparatus comprising: a power source; at least one processor; and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: determine light requirement information for one or more plants; ascertain current light level in the controlled environment; and, adjust the inputs to the controlled environment based on the light requirement information and current light level.

The at least one memory and the computer program code may be further configured to, with the at least one processor, cause the apparatus to: i) access a farming environment database, farming environment website, or third party website (or database) via a bi-directional communication link; ii) in said determining step, receive a light quantity requirement or spectrum information; or iii) in said adjusting step, schedule a light source to be inactive during certain times of the day or vary the spectrum of the light provided by the luminaire light source in the controlled farming environment. The power source may comprise one or more renewable energy sources, and the luminaire light source may comprise, for example, an LED light source.

These and other embodiments will be described in greater detail in the detailed description of the various embodiments of the present invention, wherein those skilled in the art will appreciate that many deviations may be made while maintaining the spirit and scope of the present invention.

THAT WHICH IS CLAIMED:

1. A luminaire system for optimizing plant growth in a controlled environment, the luminaire comprising:

5 a luminaire controller, wherein said luminaire controller has a bidirectional communication link to a network location;

a luminaire light source, wherein the luminaire light source is coupled to one or more luminaries; and,

10 an electrical interface providing a communication link from the luminaire light source and the luminaire controller.

2. The luminaire system of Claim 1, wherein the luminaire controller is configured to receive light requirement information from a network location via the bidirectional communication link.

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3. The luminaire system of Claim 2, wherein the network location may comprise a farming environment database.

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4. The luminaire system of Claim 2, wherein the memory location may comprise a farming environment website.

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5. The luminaire system of Claim 1, wherein the controller is configured to receive light requirement information from the network location via the bidirectional communication link.

6. The luminaire system of Claim 1, wherein the light requirement information may comprise spectrum information.

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7. The luminaire system of Claim 1, wherein the light requirement information may comprise light quantity information which may include a specific light measurement value in moles.

8. The luminaire system of Claim 1, wherein the luminaire controller is configured to detect a change in light requirement information, and generate a signal to effectuate a change in the controlled farming environment based on the change in light requirement information.

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9. A method of utilizing a luminaire system to optimize plant growth for a plurality of plants in a controlled environment, the method comprising:

determining light requirement information for one or more plants via a signal received from a network location;

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ascertaining current level information in the controlled environment;

comparing the current level information and the light requirement information;

and,

adjusting the inputs to the controlled environment based on the light requirement information and current level information.

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10. The method of Claim 9, wherein determining light requirement information further comprises accessing a farming environment database via a bi-directional communication link.

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11. The method of Claim 9, wherein determining light requirement information further comprises accessing a farming environment website via a bi-directional communication link.

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12. The method of Claim 9, wherein determining light requirement information comprises determining a light quantity requirement.

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13. The method of Claim 9, wherein determining light requirement information comprises determining spectrum information by a signal received from the network location.

14. The method of Claim 9, wherein adjusting comprises scheduling a luminere light source to be inactive during certain times of the day.

15. The method of Claim 9, wherein adjusting comprises varying the spectrum of the light provided by the luminaire light source in the controlled farming environment.

16. An apparatus for optimizing plant growth in a controlled environment, the
5 apparatus comprising:

a power source;

at least one processor; and

at least one memory including computer program code, the at least one memory
and the computer program code configured to, with the at least one processor, cause the
10 apparatus at least to:

determine light requirement information for one or more plants via a signal
received from a network location;

ascertain current level information in the controlled environment; and,

adjust the inputs to the controlled environment based on the light requirement
15 information and current level information.

17. The apparatus of Claim 16, wherein the at least one memory and the computer
program code are further configured to, with the at least one processor, cause the
apparatus to access a farming environment database via a bi-directional communication
20 link.

18. The apparatus of Claim 16, wherein the at least one memory and the computer
program code are further configured to, with the at least one processor, cause the
apparatus to access a farming environment website via a bi-directional communication
25 link.

19. The apparatus of Claim 16, wherein the at least one memory and the computer
program code are further configured to, with the at least one processor, cause the
apparatus to, in said determining step, receive a light quantity requirement.

20. The apparatus of Claim 16, wherein the at least one memory and the computer
program code are further configured to, with the at least one processor, cause the
apparatus to, in said determining step, receive spectrum information.

21. The apparatus of Claim 16, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to, in said adjusting step, schedule a light source to be inactive during certain times of the day.

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22. The apparatus of Claim 16, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to, in said adjusting step, vary the spectrum of the light provided by a luminaire light source in the controlled farming environment.

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23. The apparatus of Claim 16, wherein the apparatus comprises a luminaire system.

24. The apparatus of Claim 16, wherein the power source may comprise one or more renewable energy sources.

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THAT WHICH IS CLAIMED:

1. A luminaire system for optimizing plant growth in a controlled
5 environment, the luminaire comprising:
a luminaire controller, wherein said luminaire controller has a
bidirectional communication link to an Internet accessible network location
and said luminaire controller is configured to access the Internet accessible
network location via the bidirectional communication link and retrieve light
10 requirement information from the Internet accessible network location;
a luminaire light source, wherein the luminaire light source is coupled
to one or more luminaries; and,
an electrical interface providing a communication link from the
luminaire light source to the luminaire controller.
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2. The luminaire system of Claim 1, wherein the luminaire controller is
configured to retrieve light requirement information from the Internet
accessible network location via the bidirectional communication link
automatically at certain time periods or upon a user request.
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3. The luminaire system of Claim 1, wherein the Internet accessible
network location comprises a farming environment database or a farming
environment website.
- 25 4. The luminaire system of Claim 2, wherein the light requirement
information comprises spectrum information or light quantity information
which includes a specific light measurement value.
- 30 5. The luminaire system of Claim 1, wherein the luminaire controller is
further configured to detect a change in light requirement information, and
generate a signal to effectuate a change in the controlled environment based
at least in part on the change in light requirement information.

6. A method of utilizing a luminaire system to optimize plant growth for a plurality of plants in a controlled environment, the method comprising:
- obtaining light requirement information for one or more plants via a
 - 5 signal received from an Internet accessible network location;
 - ascertaining current level information in the controlled environment;
 - comparing the current level information and the light requirement information; and,
 - adjusting the inputs to the controlled environment based on the light
 - 10 requirement information and current level information.
7. The method of Claim 6, wherein the step of obtaining light requirement information comprises accessing an Internet accessible farming environment database or an Internet accessible farming environment website via a bi-
- 15 directional communication link and the Internet.
8. The method of Claim 6, wherein the step of obtaining light requirement information comprises obtaining a light quantity requirement or obtaining spectrum information from the Internet accessible network location.
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9. The method of Claim 6, wherein the step of adjusting comprises scheduling a luminaire light source to be inactive during certain times of a day or varying the spectrum of the light provided by the luminaire light source in the controlled environment.
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10. The luminaire system of Claim 1, wherein the luminaire controller comprises:
- a power source;
 - at least one processor; and
 - 30 at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the luminaire controller at least to:

retrieve the light requirement information for one or more plants via a signal received from the Internet accessible network location;

ascertain current level information in the controlled environment; and,

adjust the inputs to the controlled environment based on the light
5 requirement information and current level information.

11. The luminaire system of Claim 10, wherein the at least one memory and the computer program code are further configured to, with the at least one processor, cause the luminaire controller to access a farming
10 environment database or a farming environment website via the bi-directional communication link and the Internet.

12. The luminaire system of Claim 10, wherein the at least one memory and the computer program code are further configured to, with the at least
15 one processor, cause the luminaire controller to receive a light quantity requirement or receive spectrum information from the Internet accessible network location.

13. The luminaire system of Claim 10, wherein the at least one memory and the computer program code are further configured to, with the at least
20 one processor, cause the luminaire controller to schedule the light luminaire source to be inactive during certain times of a day, schedule the luminaire light source to be active during a certain time of a day, or vary the spectrum of the light provided by the luminaire light source in the controlled environment.

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14. The luminaire system of Claim 1, wherein the light requirement information comprises information causing the luminaire light source to activate during periods of time when energy costs are lower and to deactivate during periods of time when energy costs are higher.

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15. The method of Claim 6, wherein the step of adjusting comprises activating a luminaire light source to produce light during a time of the day when the cost of electrical power is lower.

16. The method of Claim 6, wherein the step of adjusting comprises altering the spectrum of light provided by a luminaire light source to cause plants in the controlled environment to have a particular color.