hydroponic and other soilless growing techniques can yield extremely high plant densities, especially in those instances in which either horizontal stacking systems or vertical growth towers are used.

[004] While hydroponic farming techniques offer a number of advantages over conventional farming techniques, in order to achieve large-scale adoption of these techniques it is vital that the cost per plant be competitive with the costs associated with conventional farming techniques. Accordingly, the present invention provides a hydroponic tower that achieves increased planting consistency, increased tower strength, decreased manufacturing time and cost, and simplified maintenance between use cycles.

SUMMARY OF THE INVENTION

[004a] According to an aspect of the present invention, there is provided a multi-piece hydroponic tower, comprising: a tower body, said tower body comprising a rear cavity wall, and first and second cavity side walls extending from opposing edges of the rear cavity wall, thereby defining a first tower cavity, said first tower cavity configured to provide a passageway for a water/nutrient mix; a first tower face plate, wherein an edge portion of said first tower face plate is hingeably coupled to an outer edge of said first cavity wall of said tower body, wherein said first tower face plate is configured to be positioned relative to said tower body in at least a first tower cavity closed position and a first tower cavity open position via said hingeably coupled edge portion, said first tower face plate comprising a first plurality of plant container cut-outs, said first plurality of plant container cut-outs configured to accept a first plurality of plant containers; and a first fastener configured to temporarily latch said first tower face plate to an outer edge of said second cavity wall of said tower body when said first tower face plate is in said first tower cavity closed position.

[005] Embodiments of the present invention provides a multi-piece hydroponic tower comprised of (i) a tower body that defines a first tower cavity, where the first tower cavity is configured to provide a passageway for a water/nutrient mix, and where a first edge portion of the tower body includes a first tower body hinge member; (ii) a first tower face plate, where an edge portion of the first tower face plate includes a first face plate hinge member, where the first tower face plate is hingeably coupled to the tower body via the first tower body hinge member and the first face plate hinge member, where the first tower face plate is positionable relative to the tower body in at least a first tower cavity closed position and a first tower cavity open position, and where the first tower face plate includes a first plurality of plant container

cut-outs configured to accept a first plurality of plant containers; and (iii) a first fastener configured to temporarily latch the first tower face plate to the tower body when the first tower face plate is in the first tower cavity closed position. The first fastener may be comprised of a first plurality of fasteners. The first fastener may be comprised of a first snap-fit fastener. The tower body and the first tower face plate may be fabricated from plastic (e.g., polyethylene, polypropylene, polyvinyl chloride, polytetrafluoroethylene, and acrylonitrile butadiene styrene, etc.) and may be white.

[006] The multi-piece hydroponic tower may be a dual-sided hydroponic tower, where the tower body defines a first tower cavity and a second tower cavity, where the first body hinge member of the first edge portion of the tower body corresponds to the first tower cavity, and where the tower body is further comprised of a second tower body hinge member corresponding to a second edge portion, the second tower body hinge member of the second edge portion of the tower body corresponding to the second tower

Once assembled, the face plate cannot be removed from the body without applying excessive force, thus minimizing the risk of accidental disassembly during planting, harvesting and/or tower maintenance.

[0032] It will be appreciated that the limitation placed on the maximum opening of the hinged face plate is determined by the specific design of the hinged pieces, i.e., face plate end portion 901 and the curved end portion 905A/905B of the tower body. In the illustrated embodiment, the end portion of the face plate includes a second bend at position 909, resulting in face plate surface 911 contacting tower body surface 913 when the face plate is in the fully open position. In the preferred embodiment, this contact point limits hinge movement such that the plane of face plate 101 is approximately perpendicular to rear cavity surface 701 when the face plate is in the fully open position, and more preferably limits hinge movement such that there is an angle of approximately 86 degrees between the plane of the face plate and that of the rear cavity surface 701 when the hinge is fully open.

[0033] Any of a variety of different fastener types can be used to latch face plate 101 to the tower body when the hinge is closed. In the preferred embodiment and as illustrated, fasteners 801 are comprised of snap-fit fasteners. Each snap-fit fastener 801 is comprised of a first portion 703 formed on the face plate at a location distal from face plate end portion 901, and a second portion 705 formed on the edge of the tower body at a location opposite that of hinge end portions 905A/905B. While snap-fit fasteners can utilize a variety of shapes, in the preferred embodiment snap-fit fastener portion 703 is generally cylindrically with body portion 705 having a complimentary shape. Slot 707 in snap-fit portion 703 allows portion 703 to compress more readily during fastening.

[0034] In at least one preferred embodiment, the side walls 713 of each tower cavity are tapered, thus ensuring that the tower face plates can open without the plant plug holders clipping the side walls 713. Preferably the flare out of each side wall 713 is approximately 10 degrees, resulting in an angle 709 of approximately 100 degrees. Note that when the face plate is closed, the side walls 713 are pulled inward such that the angle between the side walls 713 and the rear cavity surface, i.e., angle 711, is approximately 90 degrees (i.e., 90 degrees plus/minus 5 degrees). As a result, when the face plate is closed, the tower cavity 501 has an approximately square or rectangular shape as shown.

[0035] Due to the difference in cross-section between the open (i.e., Fig. 7) and closed (i.e., Fig. 8) configurations, preferably steps are taken to ensure that cavity side

walls 713 do not bow out when the face plates are closed. Preferably and as shown in Fig. 10, the junction 1001 between the rear cavity wall 701 and each side wall 713 has a strain relief feature with a 0.012 inch radius.

[0036] As shown in the figures, preferably the dual-sided tower includes a large "V" shaped groove 803 that runs along the length of the tower, and on either side of the tower as shown. Groove 803 is centered on the side of tower, evenly splitting the two tower cavities. Note that in the single-sided configuration (e.g., Figs. 3 and 4), only half of the groove (e.g., groove 303) is required. In at least one embodiment of the invention utilizing a double-sided configuration (e.g., Figs. 1 and 2), groove 803 has a depth 805 of approximately 0.35 inches (± 0.1 inches). In this embodiment the angle 807 between side wall portions 809 is preferably within the range of 90 to 110 degrees, and more preferably 102 degrees.

[0037] Groove 803, or groove 303 in the single-sided configuration, provides an alignment feature that can be used when coupling planters, harvesters, or other equipment to the tower. This is an especially useful feature in an automated system. An additional benefit of groove 803, or groove 303 in the single-sided configuration, is that it reduces the width of rear cavity surface 701. Since water and nutrients are preferably supplied to the plants within the hydroponic tower by directing the water/nutrient flow along surface 701, reducing the width of this surface increases the likelihood that the water and nutrients flowing down the surface reach the plants contained within the tower.

[0038] The hydroponic towers of the present invention are not limited to a specific water/nutrient delivery system. Thus, for example, a wicking system may be implemented within the disclosed towers. As noted above, however, in the preferred embodiment the water/nutrient mix is directed towards the cavity rear surface 701 where it can then flow downward, feeding the plants contained in the individual plant containers that are fit into each tower cut-out. In order to help control water/nutrient flow along the back wall of the tower cavity, preferably a series of vertical ridges 811 are fabricated onto the rear cavity wall 701 of each cavity 501. In this embodiment, each ridge 811 is 0.0625 inches wide and extends from the wall surface by 0.012 inches. It will be appreciated that other ridge dimensions can be used, and that the ridges do not have to be uniform across the entire surface, i.e., the ridges in the center could be wider and/or deeper than those to either side of the wall center.

CLAIMS

1. A multi-piece hydroponic tower, comprising:

a tower body, said tower body comprising a rear cavity wall, and first and second cavity side walls extending from opposing edges of the rear cavity wall, thereby defining a first tower cavity, said first tower cavity configured to provide a passageway for a water/nutrient mix;

a first tower face plate, wherein an edge portion of said first tower face plate is hingeably coupled to an outer edge of said first cavity wall of said tower body, wherein said first tower face plate is configured to be positioned relative to said tower body in at least a first tower cavity closed position and a first tower cavity open position via said hingeably coupled edge portion, said first tower face plate comprising a first plurality of plant container cut-outs, said first plurality of plant container cut-outs configured to accept a first plurality of plant containers; and

a first fastener configured to temporarily latch said first tower face plate to an outer edge of said second cavity wall of said tower body when said first tower face plate is in said first tower cavity closed position.

2. The multi-piece hydroponic tower of claim 1, wherein said multi piece hydroponic tower is a dual-sided hydroponic tower, wherein said tower body third and fourth cavity walls extending from the opposing edges of the rear cavity wall to define a second tower cavity, said multi-piece hydroponic tower further comprising:

a second tower face plate, wherein an edge portion of said second tower face plate is substantially fixed and hingeably coupled to an outer edge of said third cavity wall of said tower body, wherein said second tower face plate is configured to be positioned relative to said tower body in at least a second tower cavity closed position and a second tower cavity open position via said hingeably coupled edge portion, said second tower face plate comprising a second plurality of plant container cut-outs, said second plurality of plant container cut-outs configured to accept a second plurality of plant containers; and

a second fastener configured to temporarily latch said second tower face plate to an outer edge of said fourth cavity wall of said tower body when said second tower face plate is in said second tower cavity closed position.

3. The multi-piece hydroponic tower of claim 1 or claim 2, said first fastener comprising a first snap-fit fastener.

4. The multi-piece hydroponic tower of claim 2 or claim 3, said second fastener comprising a second snap-fit fastener.

5. The multi-piece hydroponic tower of claim 2, further comprising:

a first plurality of vertical ridges formed on the first rear cavity wall; and

a second plurality of vertical ridges formed on the second rear cavity wall.

6. The multi-piece hydroponic tower of claim 5, said first plurality of vertical ridges of uniform width, and said second plurality of vertical ridges of uniform width.

7. The multi-piece hydroponic tower of claim 2, further comprising:

a first V-shaped groove running along a first side of said tower body, said first V-shaped groove centered between said first tower cavity and said second tower cavity; and

a second V-shaped groove running along a second side of said tower body, said second V-shaped groove centered between said first tower cavity and said second tower cavity.

8. The multi-piece hydroponic tower of claim 7, said first V-shaped groove formed from a first side wall portion corresponding to said first tower cavity and a second side wall portion corresponding to said second tower cavity; and said second V-shaped groove formed from a third side wall portion corresponding to said first tower cavity and a fourth side wall portion corresponding to said second tower cavity.

9. The multi-piece hydroponic tower of claim 2 wherein

said first side wall flares out relative to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity open position, and wherein said second side wall flares out relative to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity open position; and

said third side wall flares out relative to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity open position, and

wherein said fourth side wall flares out relative to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity open position.

10. The multi-piece hydroponic tower of claim 9, wherein said first side wall is at an angle of approximately 100 degrees relative to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity open position, wherein said second side wall is at an angle of approximately 100 degrees relative to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity open position, wherein said third side wall is at an angle of approximately 100 degrees relative to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity open position, and wherein said fourth side wall is at an angle of approximately 100 degrees relative to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity open position.

11. The multi-piece hydroponic tower of claim 9, wherein said first side wall is approximately perpendicular to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity closed position, wherein said second side wall is approximately perpendicular to said first rear cavity wall when said first tower face plate is positioned in said first tower cavity closed position, wherein said third side wall is approximately perpendicular to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity closed position, and wherein said fourth side wall is approximately perpendicular to said second rear cavity wall when said second tower face plate is positioned in said second tower cavity closed position.

12. The multi-piece hydroponic tower of claim 1 wherein

a first edge portion of said tower body includes a first tower body hinge member and

an edge portion of said first tower face plate includes a first face plate hinge member, wherein said first tower face plate is hingeably coupled to said tower body via said first tower body hinge member.

13. The multi-piece hydroponic tower of claim 2 wherein:

a first edge portion of said tower body includes a first tower body hinge member and

an edge portion of said first tower face plate includes a first face plate hinge member, wherein said first tower face plate is hingeably coupled to said tower body via said first tower body hinge member and said first face plate hinge member;

a second edge portion of said tower body includes a second tower body hinge member and

an edge portion of said second tower face plate includes a second face plate hinge member, wherein said second tower face plate is hingeably coupled to said tower body via said second tower body hinge member and said second face plate hinge member.

14. The multi-piece hydroponic tower of claim 1 or any claim dependent thereon, wherein the edge portion of said first tower face place is non-removably hingeably coupled to the other edge of said first cavity side wall of said tower body.

15. The multi-piece hydroponic tower of claim 2 or any claim dependent thereon, wherein the edge portion of said second tower face plate is non-removably hingeably coupled to the outer edge of said third cavity side wall of said tower body.