CLAIMS:

1. A gravity-driven plant cultivation system, comprising:

(a) a frame having a frame upstream end and a frame downstream end spaced horizontally apart from the frame upstream end;

(b) a plurality of vertically stacked conveyor assemblies mounted to the frame, each conveyor assembly including at least one gravity conveyor extending between the frame upstream end and the frame downstream end along a conveyor axis, the conveyor axis sloping downwards relative to a horizontal plane from the frame upstream end to the frame downstream end; and

(c) a plurality of plant cultivation trays rollingly supported on each gravity conveyor and urged to translate along a respective conveyor axis toward the frame downstream end via gravitational force, each tray including:

(i) a tray body having a tray top and a tray bottom vertically opposite the tray top, and the tray body having laterally spaced apart tray underside surfaces bearing against the conveyor, each tray underside surface sloping downwardly relative to the horizontal plane generally parallel with the conveyor axis;

(ii) a plurality of plant cavities in the tray body and open to the tray top, the plant cavities for holding plants; and

(iii) a nutrient chamber internal the tray body and in fluid communication with the plant cavities, the nutrient chamber for holding plant nutrient solution, the tray body including a nutrient chamber bottom wall that is generally parallel with the horizontal plane for maintaining a generally constant depth of the plant nutrient solution across the nutrient chamber bottom wall.

2. The system of claim 1, wherein each gravity conveyor includes a pair of tray supports spaced laterally apart from one another by a conveyor opening, each tray support including a rail extending between the frame downstream end and the frame upstream end generally parallel with a respective conveyor axis, and a plurality of wheels rotatably mounted to the rail and spaced apart from one another along the conveyor axis, the wheels of the pair of tray supports engaging the laterally spaced apart tray underside surfaces of the plant cultivation trays supported on the conveyor.

3. The system of claim 2, wherein the tray body includes a nutrient chamber sidewall extending upwardly from a periphery of the nutrient chamber bottom wall.

4. The system of claim 2, wherein the nutrient chamber is laterally intermediate the pair of tray supports.

5. The system of claim 4, wherein the nutrient chamber extends into the conveyor opening.

6. The system of any one of claims 1 to 5, wherein each tray includes at least one tray vent passing through the tray body, the tray vent extending along a vertical vent axis normal to the horizontal plane between a vent top end open to the tray top and a vent bottom end open to the tray bottom, the tray vent for passing air through the tray body to facilitate delivery of air to the plants from below.

7. The system of claim 6, wherein the tray vent passes through the nutrient chamber, the tray vent having a hollow vent interior in fluid isolation from the nutrient chamber.

8. The system of any one of claims 6 to 7, further comprising an air delivery ductwork for delivering air to the plants, the air delivery ductwork including a plurality of first ports above each plant cultivation tray for discharging air from the air delivery ductwork downwardly to deliver air to the plants from above, and a plurality second ports below each plant cultivation tray for discharging air from the

air delivery ductwork upwardly to deliver air to the plants from below via the tray vents.

9. A plant cultivation tray for a gravity-driven plant cultivation system, comprising:

(a) a tray body having a tray top, a tray bottom vertically opposite the tray top, a tray front, and a tray rear axially opposite the tray front, the tray body including:

(i) a pair of laterally spaced apart tray underside surfaces for engagement with wheels of a gravity conveyor to rollingly support the plant cultivation tray thereon, each underside surface sloping downwards relative to a horizontal plane from the tray rear to the tray front and capable of being supported on the conveyor;

(ii) a nutrient chamber bottom wall lying in a bottom wall plane; and

(iii) a nutrient chamber sidewall extending upwardly from a periphery of the chamber bottom wall, the nutrient chamber bottom wall and the nutrient chamber sidewall enclosing a nutrient chamber internal the tray body for holding plant nutrient solution, wherein the nutrient chamber bottom wall is generally parallel with the horizontal plane for maintaining a generally constant depth of the plant nutrient solution across the nutrient chamber bottom wall; and

(b) a plurality of plant cavities in the tray body for holding plants, the plant cavities open to the tray top and in fluid communication with the nutrient chamber for providing the plant nutrient solution to the plants.

10. The tray of claim 9, wherein the nutrient chamber bottom wall is laterally intermediate and at an elevation below the underside surfaces.

11. The tray of any one of claims 9 to 10, wherein each tray includes at least one tray vent passing through the tray body, the tray vent extending along a vertical vent axis normal to the horizontal plane between a vent top end open to the tray top and a vent bottom end open to the tray bottom, the tray vent for passing air through the tray body to facilitate delivery of air to the plants from below.

12. The tray of claim 11, wherein the tray vent passes through the nutrient chamber.

13. The tray of any one of claims 9 to 12, wherein each plant cavity extends along a vertical cavity axis normal to the horizontal plane between a cavity top end open to the tray top and a cavity bottom end below the cavity top end.

14. The tray of claim 13, wherein the cavity bottom end of each plant cavity lies in a common cavity bottom plane, the cavity bottom plane generally parallel with the horizontal plane when the tray is supported on the conveyor.

15. The tray of any one of claims 13 to 14, wherein the cavity top end of each plant cavity lies in a common cavity top plane, the cavity top plane generally parallel with the horizontal plane when the tray is supported on the conveyor.

16. The tray of claim 9, wherein the tray body includes a tray lower portion and a tray upper portion removably nested in the tray lower portion, and wherein the nutrient chamber is in the tray lower portion, the plant cavities are in the tray upper portion, and the tray further comprises a plurality of tray vents, each tray vent passing through the tray lower portion and the tray upper portion.

17. The tray of claim 16, wherein the tray vent includes a vent projection extending upwardly from the nutrient chamber bottom wall and through the nutrient chamber, the vent projection having: a hollow vent interior in fluid isolation from the nutrient chamber, and a projection port above the nutrient chamber and providing fluid communication between the vent interior and the tray top.

18. The tray of claim 17, wherein the vent projection includes a projection top wall above the nutrient chamber and a projection sidewall extending between the chamber bottom wall and the projection top wall, the projection sidewall horizontally enclosing the vent interior and the projection port in the projection top wall.

19. A method of operating a high-density plant cultivation system, comprising:

(a) rollingly supporting a plurality of plant cultivation trays holding plants on a gravity conveyor, each tray having an underside surface bearing against rolling elements secured to the gravity conveyor, the gravity conveyor extending along a conveyor axis between a frame upstream end and a frame downstream end, the conveyor axis sloping downwardly relative to a horizontal plane from the frame upstream end to the frame downstream end;

(b) delivering air, plant nutrient solution, and light to the plants to facilitate plant growth, wherein delivering the plant nutrient solution includes supplying the plant nutrient solution to a nutrient chamber internal each tray, the nutrient chamber in fluid communication with the plants and enclosed from below by a nutrient chamber bottom wall of the tray, the nutrient chamber bottom wall lying in a bottom wall plane;

(c) rolling the plant cultivation trays supported on the gravity conveyor along the conveyor axis toward the frame downstream end via gravitational force; and

(d) during steps (a) to (c), maintaining the bottom wall plane generally parallel with the horizontal plane for maintaining a generally constant depth of the plant nutrient solution across the nutrient chamber bottom wall.

20. The method of claim 19, wherein said delivering air comprises discharging air upwardly from a plurality of ports in a duct and conducting the air vertically through each tray and to the plants from below via a plurality of tray vents in each tray, each tray vent passing vertically through, and in fluid isolation from, the nutrient chamber.