



AEssenseGrows and Dosing

Does AEssenseGrows offer centralized Dosing?

AEssenseGrows is often asked whether our system offers centralized dosing. Typically, this is a question asked by legacy growers who are used to implementing centralized volumetric dosing. Generally, in a centralized volumetric dosing system the fertigation solution is only used once and then it drains to waste (fig. 1).

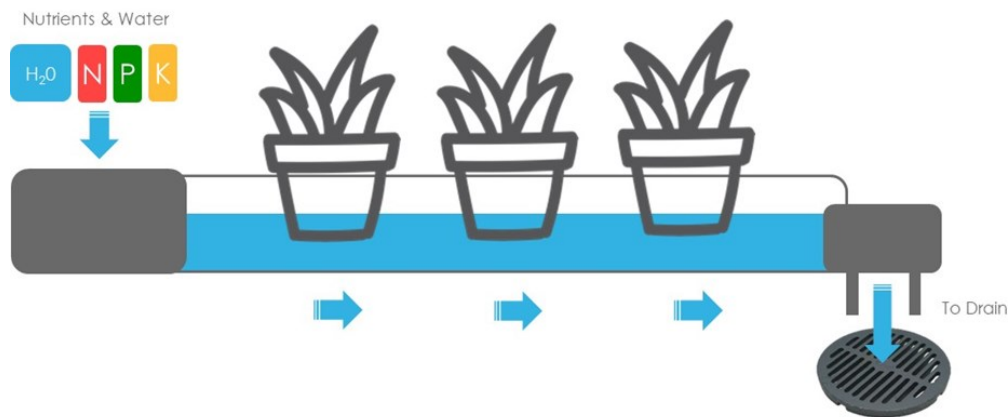


Fig. 1: Typical drain to waste hydroponic system

The beauty of aeroponics is that the water can be recirculated and reused. This can save significant amounts of water and nutrients. But as nutrients are taken up by the plants and water is lost through transpiration the nutrient concentration in the fertigation solution will change. AEssenseGrows has executed on "Dynamic Dosing" using water conductivity, temperature, pH and level sensors to continuously maintain the optimal fertigation solution. As plants use nutrients conductivity will go down and nutrients will be automatically added according to the growth plan (aka grow "recipe") that is run by our Guardian™ Grow Manager (GGM) software. Conductivity could increase as water is lost due to transpiration, but we use an ultrasonic water level sensor so that the GGM can automatically keep water at desired levels when the water filling solenoid is attached to an appropriate water source. This helps to prevent "nutrient burn".

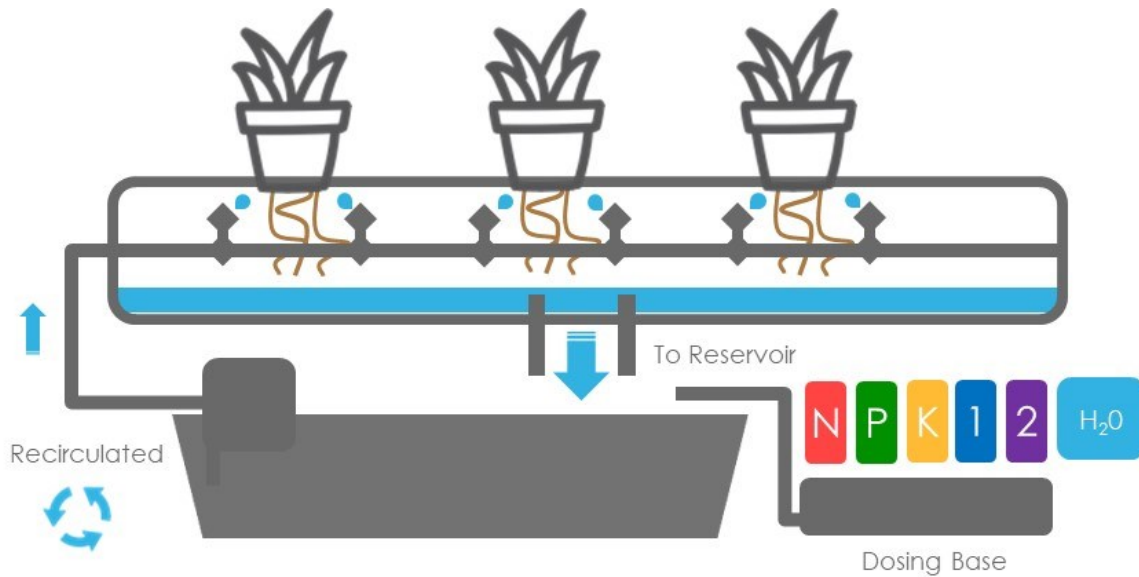


Fig. 2: Rendering of closed loop aeroponic system with dynamic dosing.

Applying centralized dosing to a sensor-driven recirculating aeroponic dosing system (fig. 2) introduces concerns with disinfection, flushing, precision, flexibility and greater potential for failure.

Disinfection

The additional piping required for centralized dosing, including long runs to and from each row of grow tubs, means that there would be a great amount of piping that needs to be disinfected between grows. This will require a lot of water and disinfection solution. In addition, all of the thousands of feet of supply piping must be made of light tight piping to prevent algae growth. In addition, isolation of rows helps in cases of a water-borne pathogen like *Pythium*. Better to lose 1 row with 200 plants in it than 10 rows of 200 plants.

Flushing

In aeroponics it is desirable to flush the nutrient solution periodically. This can be done when there are major changes in the nutrition plan or it can be done periodically. Often it is done every two weeks. Flushing will “reset” nutrients to the desired ratios and it will help to cleanse the entire system. When blooming in an AEtrium-4 the worst-case scenario is using 50 gallons to flush. In a central dosing system, one needs to flush the central reservoir, all of the associated piping linking each row of grow tubs to the reservoir, and ultimately the grow tubs themselves. Instead of using just 50 gallons of water to flush, thousands of gallons may be involved. This water needs to be processed and disposed of properly.

Precision

AEssenseGrows uses sensors to precisely monitor and control the nutrition levels in our reservoir. The following graph from an actual cannabis grow shows that we are controlling our total fertility with EC (Electrical Conductivity) to about 100 ppm (NaCl) over more than 30 hours of fertigation. The graph (fig. 3) shows a cyclic decrease in total nutrition until it reaches its low EC set point of 900 ppm, when it doses the reservoir back up to a target EC of 1000 ppm. Precision is the hallmark of our Guardian™ Grow Manager software and enables excellent repeatability. With 1000's of gallons to measure in a centralized system and 100's of unmeasured gallons trapped in distribution piping it would be impossible to deliver the same degree of precision.



Fig. 3: Guardian™ Grow Manager EC Sensor Data Report

Flexibility

With centralized dosing one cannot easily customize a grow plan to a specific strain. Meaning that every plant on that centralized doser must be at the same stage of growth. One would not want to have every room in a grow facility on the same grow plan and on the same stage of nutrition. One can't have plants ready to harvest in one place and others still in bloom as they have different nutritional needs. For example, using our AEtrium-4 bloom system one can have an 8-week strain and a 9-week strain in adjacent rows in the same bloom room. While the 8-week strain may be flushing the 9-week strain will still be boosting bloom weight by delivering nutrients to the plants. AEssenseGrows typically recommends that facilities build out their bloom rooms in multiples of eight, recognizing that the "average" cannabis strain matures in eight weeks. Were one to implement centralized dosing and were one to have each room be on the same nutrition plan



Fig. 4: AEtrium 4 'Matriarch'

then one would still need centralized dosing for each room. The large dosing tanks would take up valuable floor space that can be dedicated to blooming. In the case of the AEtrium-4 dosing is compact and fully contained under the first grow tub in a row which we call a “Matriarch” (fig. 4).

Greater potential for failure

To create a centralized and recirculating dosing system for aeroponics one needs to pump water from the central reservoir to each row. Then one needs to provide pumps to pressurize each row as it would be logistically very difficult to run pressurized water from a central location because varying lengths of piping runs will affect the pressure when it gets to the fertigation emitters. Then one needs to pump the water to return from each row back to the centralized dosing reservoir. In the AEssenseGrows implementation we have one pressure pump per row. But to implement central dosing one would require two additional pumps, one to pump to each row and one return pump to pump from each row.

The AEtrium System has been designed to be easily implemented with a minimum of custom engineering that would be required for centralized dosing. Built of individual dosing units it can be easily scaled and failures are limited in scope. Metaphorically speaking the AEtrium System is more like a multi-celled organism than an amoeba. Each cell can be separately tuned to allows it to perform a specific task in order to contribute towards the overall function of the organism. In order to compete to survive, the workload needs to be divvied up -- and divvied up well -- by specialists!



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