EXPLORATION OF THE CONNECTION BETWEEN EZ WATER CONCEPT AND AEROPONIC MIST-BASED HYDROPONIC AGRICULTURE

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Aeroponic farming is a soilless method of growing plants where the roots are consistently sprayed with nutrient-rich water. This form of agriculture has become more popular in recent years due to the high savings in water (98%) and fertilizer usage (60%) compared to soil-based agriculture[1]. Generally, these aeroponic farms are housed within environmentally controlled grow rooms which help prevent pathogen contamination, effectively eliminating pesticide usage. Most notable is the increased production yields using aeroponics versus soil-based farming. NASA has studied the application of aeroponics for space-flight food production since the 1960s and discovered that plants grow up to three times faster in aeroponic systems than in soil[1,2].

It is important to note that aeroponics is a subset of various hydroponic, soilless, farming techniques, however, researchers have shown that various crops including Chrysanthemum, cherry tomatoes, and potatoes show comparable better yields than traditional hydroponic methods[3]. Explanations for the improved performance of aeroponics primarily point towards the maximum access to oxygen at the root-zone, as it is misted rather than completely submerged in solution[1,4]. Others suggest that the fine droplet size of the mist are better suited for nutrient delivery to the root filaments[1]. We propose there may be a strong connection between Exclusion Zone (EZ) water and the relatively high performance of aeroponics technology. Pollack has described how the formation and stability of droplets and bubbles may be due to the EZ characteristics at the water/air interface[5].

The droplets formed in aeroponic systems, especially those less than 80 microns in diameter, may be preferred by the plant as they share enough EZ characteristics as with the plant tissue. One may expect that the smaller the droplet, the higher proportion of EZ water to bulk ratio. A direct experiment we plan to pursue to seek a correlation between the EZ concept and the aeroponic droplets involves using UV/Vis spectroscopy to identify the signature UV peak of EZ water from the aeroponically sprayed water. Prior NASA work has suggested that the optimal droplet size lies between 30 to 80 micron in diameter[1,2]. The current methods of facilitating aeroponic mist include low pressure sprinklers (millimeter size droplets), high pressure spray nozzles (>100 psi, 10 to 100 micron size droplets), and ultrasonic fog transducers (<<10 micron). Sprayed water from these three ranges of droplet sizes (mm, micron, and submicron) will be examined for EZ characteristics.

References

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