

Development and characterization of hydroponics solution for bell pepper

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Hydroponics is the practice of growing plants in either a bath or flow of highly oxygenated nutrient enriched water. The major advantage of hydroponics is that it permits controlled supply of all mineral elements. The basic principle behind the process is that of growing plants with their roots in contact with a solution containing all the essential plant nutrients in amounts needed for optimum plant growth.

Commercially available hydroponics formulations are not crop specific. These media either contain excesses or insufficient amounts of nutrients to plants. Further, during the growth of plants in nutrient solutions, pH of the solution changes. As a result, nutrients, especially metals, can be precipitated during the plant growth at higher pH.

Hence, a hydroponics mixture, which contains all nutrients for bell pepper was developed using low cost, available chemicals and the formulation was characterized using computer aided chemical speciation programs. The new medium was developed to provide required chemical species in correct concentrations for bell pepper in the medium at a pH range of 5 – 6. Modeling was done to find out the amounts of compounds that can be added to the solutions to avoid metal precipitation at this pH. Nutrients can be precipitated due to the changes in pH during the crop cycle and hence a chelating agent has to be added to the solution to resemble the bulky groups like humic acids in soil.

Speciation resulted that the best chelating agent that can be added to prevent metal precipitation in the hydroponics solution is EDTA. Within the optimum pH range for bell pepper all the metals are in the solution as either in free form or complexed with EDTA, and they are readily available for the plant. All the nutrients are in completely soluble form within the entire pH range that is needed for bell pepper and the results obtained from the field trials using this nutrient mixture showed that this formulation can be used as a low cost hydroponics mixture for bell pepper.

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