605 E2

Development and characterization of a hydroponic fertilizer mixture for tomato cultivation

The growing of higher plants with their roots in dilute solutions of mineral salts instead of in soil, hydroponics, has led to a vastly increased understanding of plant nutrition. The use of water culture technique for growing plants permits precise control of the supply of nutrients in the root environment.

There are few nutrient mixtures available in the market. Their formulations are expensive and unknown. The main problem is that they are not specific for a one kind of plant. Hence the purpose of this experiment was to develop a low cost nutrient mixture for tomato plant and characterization of that mixture, using computer aided chemical speciation modellingm, with the changing of the medium pH. For modelling work, oxidation state, solubility constants, formation constants, activity coefficients, alkalinity, pH, partial pressure of each component and temperature were considered.

A solution containing all nutrients that are essential for proper plant growth was prepared using chemical reagents by maintaining the pH at 5.6 and the electrical conductivity of 2.83 mS / cm. In this process, precipitation problems may interfere and it must be avoided. Hence the modelling was done to find out the amounts of compounds that can be used in appropriate pH. In this prepared solution, total concentration of all nutrients satisfied the requirement of the plant.

When growing plants in nutrient solutions, the pH of the solution changes, perhaps after a few hours or days iron can be precipitated. EDTA (Ethylenediaminetetra-acetic acid) was added to prevent this effect as resulted form the speciation work. EDTA in this solution resembles the bulky chelating agents, like humic acid, in soil.

Within the optimum pH range for the tomato plant, pH between 5.5 and 6.5, the modeling results show that all nutrients are in the solution and readily available for the plant. Also in the prepared solution, all elements are present in completely soluble form in entire pH range that is used for tomato cultivation and this formulation can be used as a low cost hydroponic mixture for tomato.

Field trials, using this formulation in comparison with other available formulae, have been completed and the results on growth, yield and product quality are very successful.