A SINGLE NUTRIENT SOURCE HYDROPONIC SOLUTION: MANAGING PH WITH A BIOLOGICAL BUFFER

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ABSTRACT

MES (2-[N-morpholino]ethanesulfonic acid) is a biological buffer that can be used to stabilize pH in a hydroponic system. It can, however, be toxic to plants, including soybeans. Hydroponic systems are efficient for studying plant nutrition. It is often desirable to adjust individual nutrients for unique species' needs and/or to create multiple nutrient deficiencies within the same study. However, this is challenging to do with traditional solutions as nutrients are generally added as dual nutrient salts. Such as when using ammonium phosphate as the phosphorus (P) source in a study with varying P concentrations, which would result in an undesirable interaction as the nitrogen (N) concentration would vary as well. This can create unintended consequences with nutrients other than those intended for adjustment. A new hydroponic system has been created to allow for nutrient deficiencies using single nutrient sources, including ammonium nitrate; phosphoric, sulfuric, hydrochloric, and boric acids; potassium, calcium, magnesium, zinc, and copper carbonates; manganese acetate; sodium molybdate; iron EDDHA; and with HEDTA as an additional chelate. However, previous studies have resulted in problems with excessive pH fluctuation. The objective of this study was to evaluate a biological buffer (MES) at various concentrations to evaluate solution pH levels and soybean [*Glycine Max* (L.) Merr] health in an attempt to further refine this new hydroponic solution and investigate its effectiveness in providing a way to introduce single nutrient deficiencies. This new solution proved effective, as soybean was grown to maturity with no signs of nutrient deficiencies. The MES concentrations at or above [BH1] 0.060 M proved to be toxic for soybean and concentrations below 0.060 M showed no significant negative impact on plant health. The MES concentrations were: 0.000, 0.006, 0.008, 0.012, 0.060, and 0.080 M, which resulted in average pH of: 8.5, 7.4, 6.8, 6.2, 5.0, and 4.9, respectively. According to the data, the optimal concentration for MES is 0.008 M if the desired pH is near neutral and 0.012 M or 0.006 M if an acid or alkaline solution is desired, respectively.