Sustainable Spirulina: Lysed Arthrospira platensis Phycocyanin-Rich Biofertilizer (APB) for DWC Hydroponic Applications

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In the United States, 96% of food deserts are in urban areas. Deep Water Culture (DWC) hydroponics increases access to fresh produce in urban communities however economic barriers from initial system construction and long-run nutrient/maintenance costs prevent easy implementation. I combatted long-run cost barriers via an Arthrospira platensis (Spirulina)-derived biofertilizer (APB), which provides a cost-effective, replenishable nutrient source that's ecologically friendly to produce. APB was created by suspending powdered Spirulina in a pre-buffered saline solution combined with EDTA protease inhibitor. Repeated Freeze-Thaw (RFT) lysis was done to induce phycocyanin release to supplement plant photosynthesis on top of nutrient feeding. The solution was separated into cell lysate and liquid biofertilizer. Commercial nutrient solution, APB, and APB + cellular debris concentrate were added to 2 L reservoirs in a DWC system constructed for testing. Lactuca sativa was germinated prior to in-situ growth which occurred for 13 days under 12 hr 400 PPFD light cycles. APB treatments had a 45% higher relative change in height than control. Kruskall Wallis analysis implied a high statistical correlation between biofertilizer and productive success ($p < 0.0006$). Root length within APB treatments was 20% greater than control and cost of APB production was 50% lower. APBs offer a sustainable, competitive, economical option to minimize the long-run operating expenses created by DWC hydroponics.

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