Nitrogen Fixation Efficacy of Trifolium repens with Rhizobia inoculant Treatments

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Global population growth is far outpacing food production, leading to overgrowth of high protein crops and poor soil health. Legumes are often used in crop rotations to replenish nutrients, most commonly nitrogen, in the soil. Fixation of atmospheric nitrogen into soil occurs in legumes through symbiotic relationships with Rhizobium bacteria, in which the bacteria convert nitrogenous gases into ammonia. Farmers often attempt to use cost-effective materials to inoculate legume seeds with Rhizobium, yet studies have not investigated the efficacy or cost effectiveness of these more affordable inoculant treatments. This study compared the efficacy of five different low-cost inoculant treatments: orange juice, cola soda, diluted corn syrup, water, and glue, on Rhizobium inoculation of white clover (Trifolium repens), alongside a positive control of gum Arabic. We predicted that the corn syrup treatment would be the most effective at promoting nitrogen fixation, as it has a high sugar content and a neutral pH. After a growing period of 51 days, the number of nodules on the roots were counted and normalized by the biomass of the roots. Data was analyzed between the treatment and control groups using a unpaired two-tailed t-test. Coca-Cola and gum Arabic resulted in the highest nodulation compared to the respective negative control groups, with p-values of 0.0011 and 0.0234, respectively. Last, a cost analysis was performed of each method to assess the economic feasibility of these treatments, finding Coca-Cola to be the most cost-effective by a factor of forty-five compared to gum Arabic.

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