

Green Watts: Investigating Power Production of a Single Chamber Plant Microbial Fuel Cell in a Modular System Comparing Crop Plants, *Triticum aestivum*, *Saccharum officinarum* and *Zea mays* - A Novel Fifth Year Study

Long, Luke (School: Canterbury School)

Impacts of global warming are causing a need for renewable energy alternatives. Plant-microbial fuel cells (P-MFC's) have emerged in recent years as a promising method that uses bacteria to oxidize organic matter and convert chemical energy into a harvestable electrical current. The goal of this study was to explore the potential of crop plants in P-MFC's comparing photosynthetic C4 plants, *Saccharum officinarum* (sugar cane), and *Zea mays* (maize), to C3 plants, *Triticum aestivum* (wheat). Experiments were conducted with sixteen single-chamber fuel cells, four each of *S. officinarum*, *Z. mays*, and *T. aestivum*; each crop plant was connected in a series of three and compared to its single control counterpart. Additionally, a negative control was set up in the same way. Systems were monitored daily for seventeen days using a multi-meter. Data were analyzed for current, voltage and power density for all cells. It was observed that on average the modular P-MFC's performed 10.9 times greater than their single cell counterparts, with the C4 plants producing 2.58 times more power than the C3 plants. The highest modular P-MFC was the C4 plant, *Z. mays*, which at its peak produced a total of 1.5 watts. Both C4 plants, *S. officinarum*, and *Z. mays* modules were able to light LED's. The C4 plants outperformed the C3 plants in power output in modular and individual systems, indicating a possible correlation between the photosynthetic contribution and energy production. Such comparisons could provide an important application if C4 crops could be used as both a food and power resource.

Awards Won:

Second Award of \$1,500