NC STATE UNIVERSITY

Utilizing Sunlight More Efficiently with Semi-transparent Organic Solar Cell Powered Greenhouses

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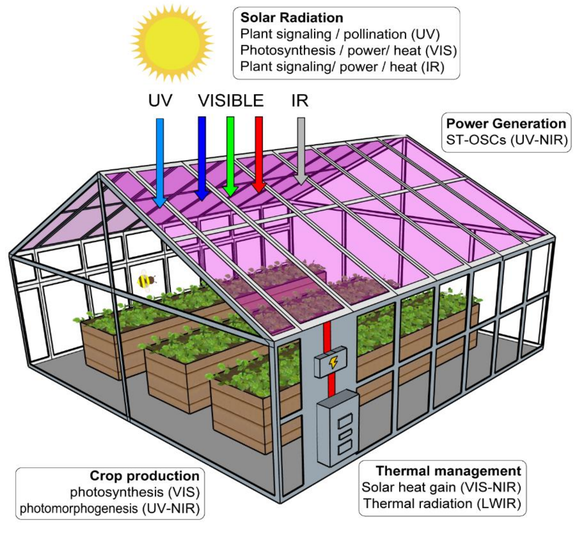
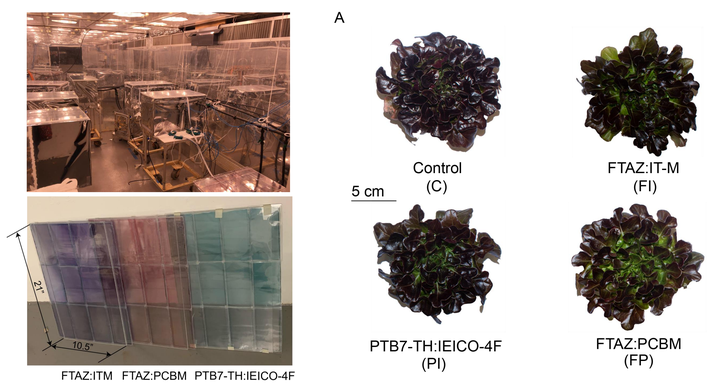
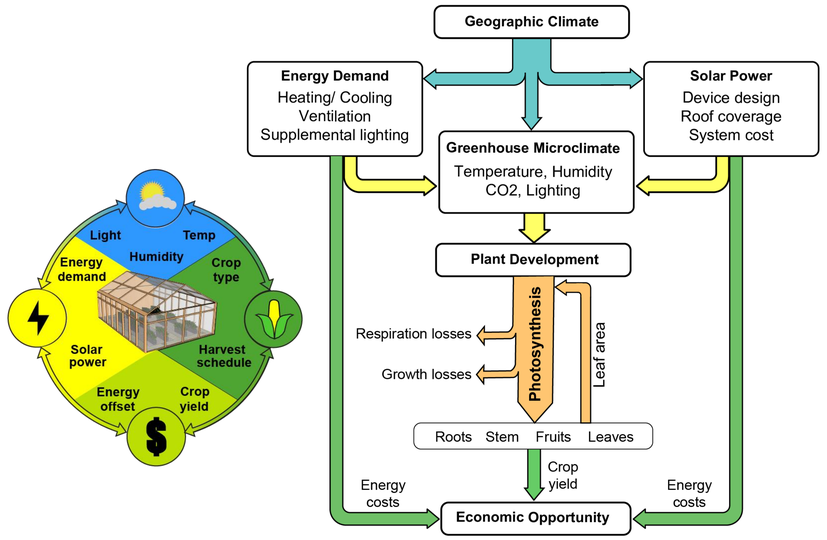
1. Introduction

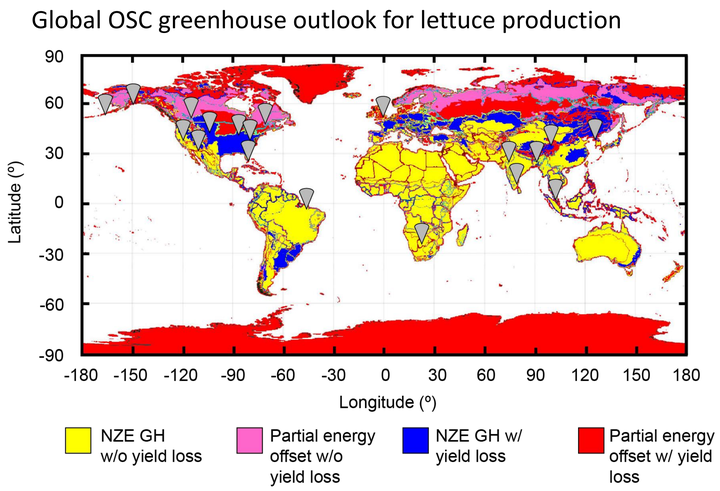




A solar powered greenhouse would utilize sunlight for both plant growth and energy production. **Our purpose is to develop a self-sustaining greenhouse system that utilizes organic solar cells (OSC) to selectively filter certain wavelengths for energy production, while allowing wavelengths critical for plants to pass through.**

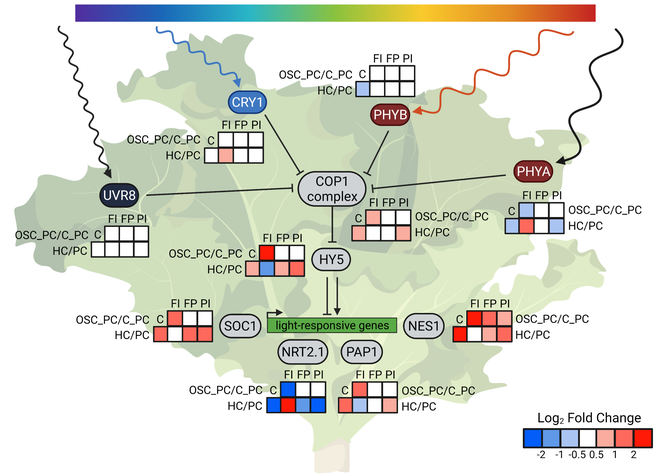
2. Economic and Plant Modeling





Through modeling, the potential to achieve net zero energy greenhouses as well as the impact on the production of lettuce across different climates were analyzed for organic solar powered greenhouses**.**

3. Plant Growth under Filters



Lettuce plants grown under OSC filters had similar growth despite altered gene expression. These genes regulate many aspects of plant growth and development, including flowering (*SOC1*), antioxidant content (*PAP1*), pest defense *(NES1*) and nitrogen use (*NRT2.1*). Selection of different OSCs can modify the expression of these genes to control how crops grow inside the greenhouse.

4. Conclusions

Modeling has demonstrated that these OSC greenhouses can offset total or partial energy demands in many climates. Experiments with lettuce have demonstrated that these plants can grow well under OSC-filtered light. Different OSCs can be selected to optimize energy harvesting and plant growth for different crops in different climates. Further experiments with other species are needed to better understand how plants respond and to make recommendations of the best suited OSCs.

5. Acknowledgements

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