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The effect of plant growth-promoting rhizobacteria (PGPR) on the growth and yield of cucumber (*Cucumis sativus*) in differently colored polyethylene greenhouses

Jung-Hsiu Tsuai[1], Yu-Min Wang[2], Pei-Chun Chang[1*]

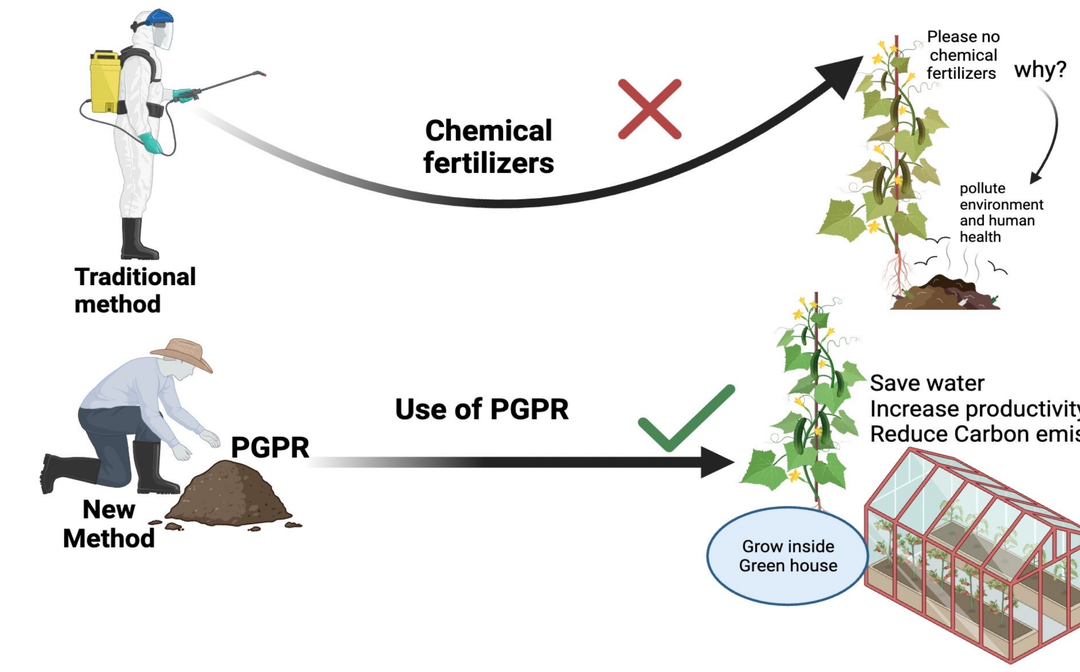
[1] Department of Tropical Agriculture and International Cooperation, National Pingtung University of Science and Technology Taiwan

[2] Professor of General Research Service Center, National Pingtung University of Science and Technology, Taiwan

E-mail: pearlchang@mail.npust.edu.tw *

INTRODUCTION & AIM

Cucumber cultivation in greenhouses is a common practice for effective pest control and the maintenance of optimal growing conditions to ensure consistent productivity. The choice of greenhouse covering material is crucial as it affects both the quality and quantity of light that enters the greenhouse. Biofertilizers such as plant growth-promoting rhizobacteria (PGPR) offer a sustainable alternative to chemical fertilizers by enhancing nutrient uptake, conserving water, reducing pesticide use, and lowering carbon emissions. This study aimed to investigate the spectral characteristics of two types of polyethylene (PE) films used as greenhouse covering materials and their effect, individually or when combined with PGPR, on cucumber vegetative growth and fruit production. The results showed that the application of PGPR strains, particularly *Staphylococcus sciuri* (E2) and *Bacillus* sp. (P1) in purple PE greenhouses significantly boosted yields and fruit quality.



MATERIAL & METHODS

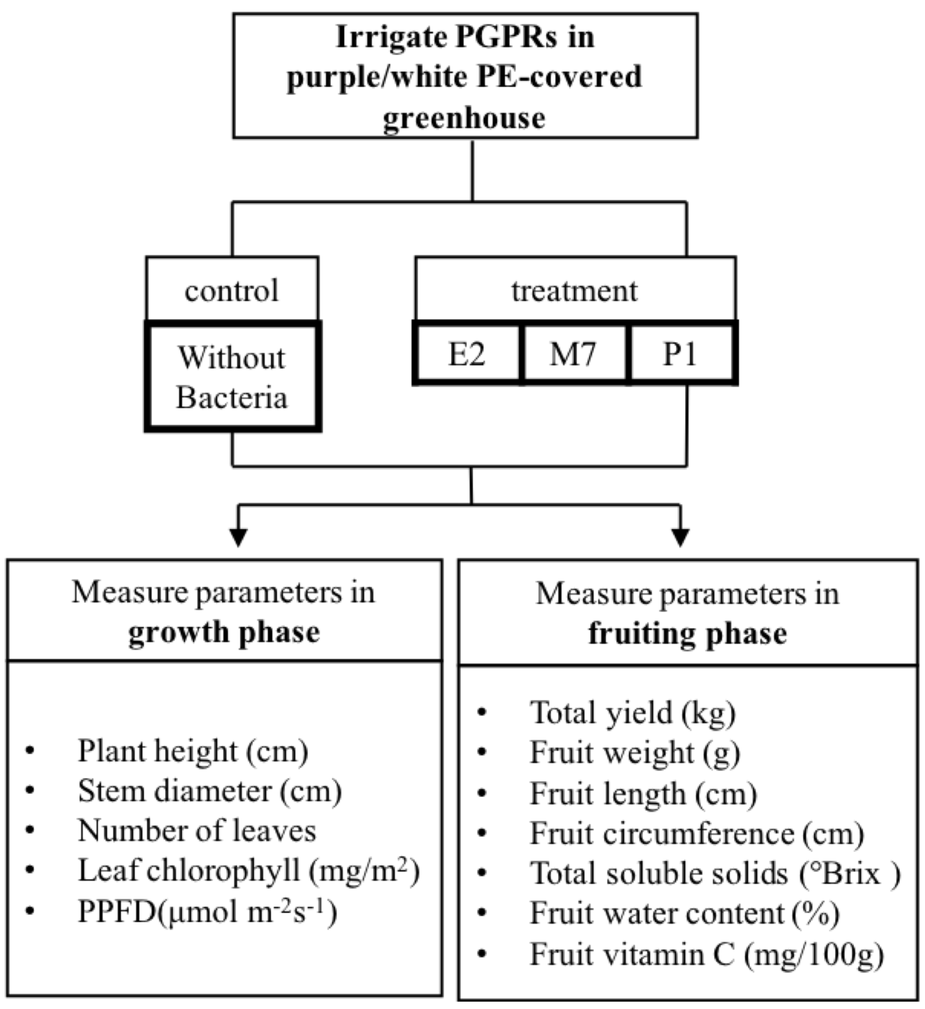


Figure 1. Research Framework.

Three PGPR strains—*Staphylococcus sciuri* (E2), *Bacillus amyloliquefaciens* (M7), and *Bacillus* sp. (P1)—were assessed under two light conditions created by white and purple PE film greenhouses. Each treatment included seven plants (n=7). The PGPRs were applied every two weeks at a concentration exceeding 10^8 CFUg/mL.

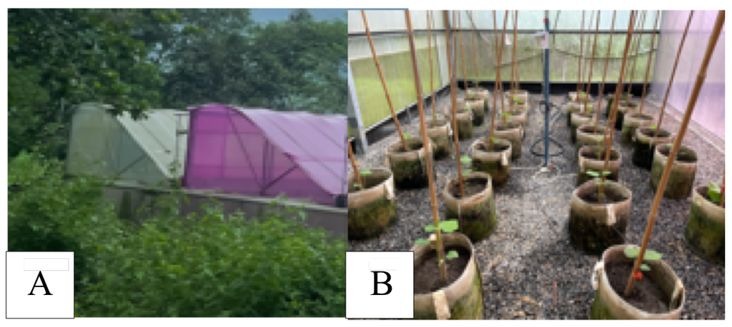


Figure 2. Experiment environment (A) Cucumbers were cultivated under two greenhouses. (B) 2 weeks old seedling were transplanted in 30 x 25 cm polybags. Distance between bags is 30 cm.

RESULTS & DISCUSSION

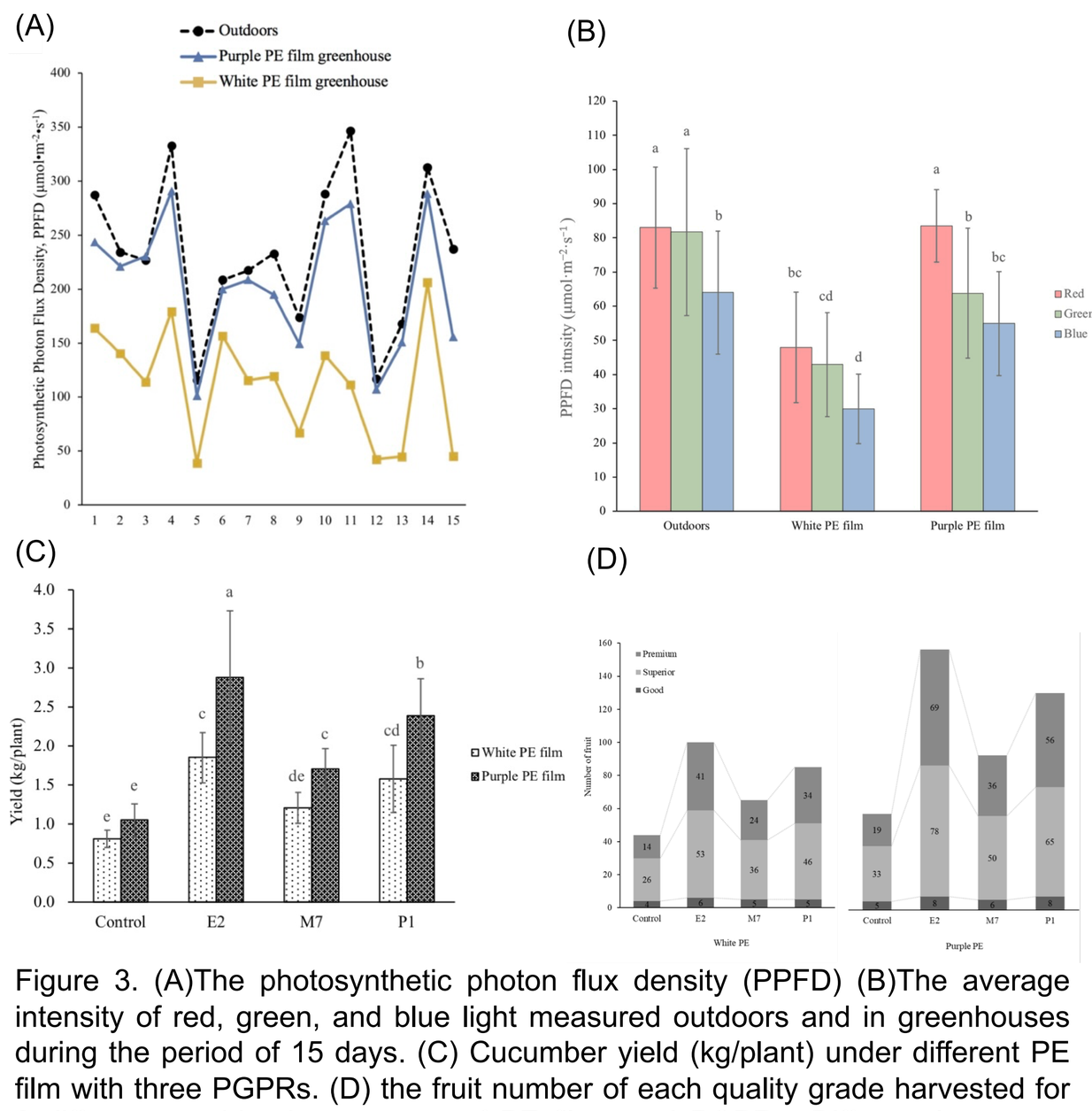


Figure 3. (A)The photosynthetic photon flux density (PPFD) (B)The average intensity of red, green, and blue light measured outdoors and in greenhouses during the period of 15 days. (C) Cucumber yield (kg/plant) under different PE film with three PGPRs. (D) the fruit number of each quality grade harvested for 8 different combined treatments of PE films and PGPRs. Different lowercase letters indicate significant differences among the control and PGPR treatments ($p<0.05$, Tukey's HSD test; SAS 2021), and the error bars represent the standard deviations of the means.

CONCLUSION

The application of PGPR strains in conjunction with purple PE films could further boost cucumber yields and fruit quality. This combined use of microbiology and engineering shed light on an integrated system for sustainable agriculture.