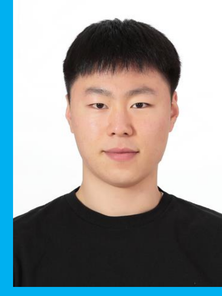
Jeonbuk National University
Plant Cultivation System Laboratory



Analysis of changes in bell pepper's maximum Rubisco carboxylation rate and electron transport rate according to the light diffusive cover application

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INTRODUCTION

- Greenhouse cultivated fruit vegetables that are highly dependent on sunlight have poor light interception properties within crop canopy by the planting density and growth stages
- Recently, the diffusive covering material, which scattered sunlight, is introduced to improve the light interception properties of crop canopy that could penetrate deeper and more uniformly into crops

OBJECTIVE

- To compare and analyze the photosynthetic rate, maximum Rubisco carboxylation rate (V_{cmax}) and electron transport rate (J_{max}) of bell peppers cultivated under the greenhouses with general glass and the diffusive covering material

MATERIALS & METHODS

Experiment settings

- Bell peppers (*Capsicum annuum* L. 'Scirocco')
- Two Venlo-type greenhouses (gangjin 59251, Korea)
- A greenhouse using diffusive covering material and B greenhouse using general glass material
- Planting density : 7 stems/m²

Detail measurements

- Control variables : 500.0 μmol/s flow, 55% relative humidity, 5000 rpm a fan speed and 25.0 °C temperature
- Light response curve : 400 μmol/mol CO_2, 0, 100, 200, 500, 1000, 1200 and 1500 μmol/m²/s light intensity
- A-Ca curve : 1600 μmol/m²/s light intensity, 50, 100, 200, 400, 600, 800, 1200 and 1600 μmol/mol CO_2
- The third leaf below the growth point was measured with the gas analyzer, LI-6800 (LI-COR, Nebraska, USA), in August and October

Used statistics and programs

- R Studio (R Studio, Boston, USA), Sigmaplot (Systat Software Inc, Chicago, USA) and SPSS (IBM SPSS Statistics, Chicago, USA)

Fig. 1. Measurement pictures in a greenhouse

RESULTS & DISCUSSION

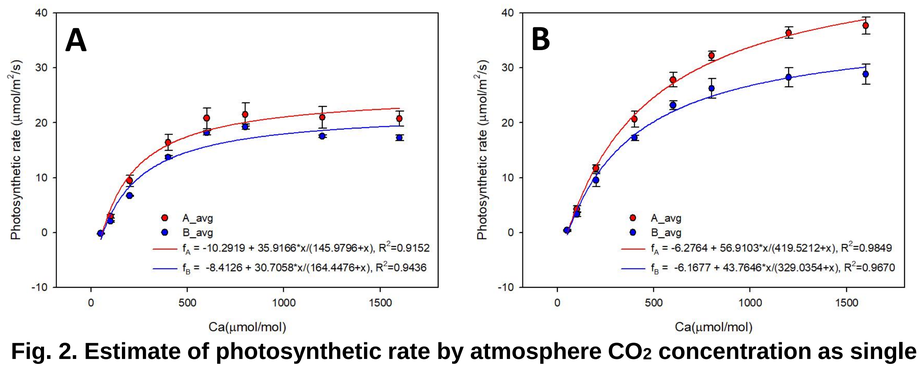

Fig. 2. Estimate of photosynthetic rate by atmosphere CO_2 concentration as single rectangular hyperbolic function. The curves were measured in Aug.(A) and in Oct.(B). Graph represent means ± SE.

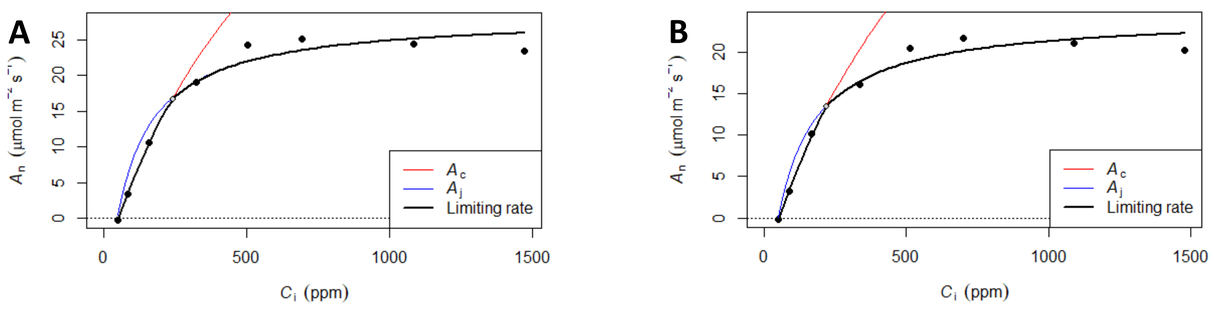

Fig. 3. Estimate of CO_2 Assimilation by intercellular CO_2 concentration using R Studio program(FvCB model). The curves were measured in the greenhouses with light diffusive cover(A) and with general glass(B). Data was measured in August.

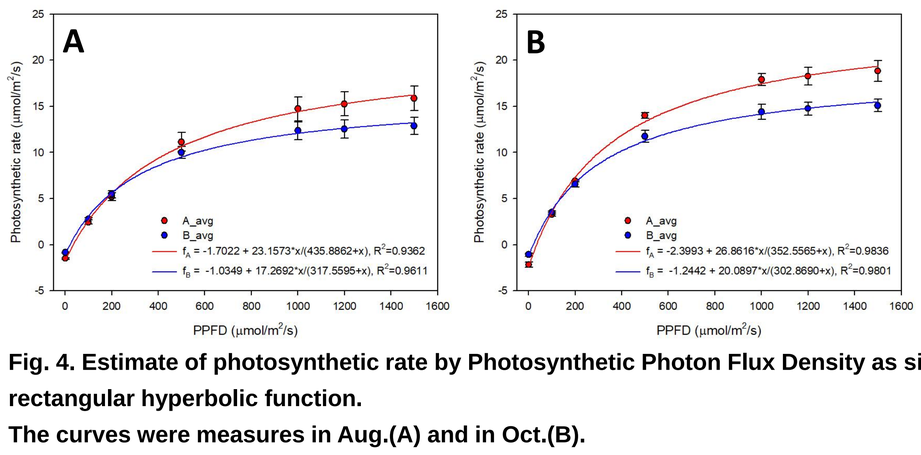

**Fig. 4. Estimate of photosynthetic rate by Photosynthetic Photon Flux Density as single rectangular hyperbolic function.
The curves were measures in Aug.(A) and in Oct.(B).
Graph represent mean ± SE.**

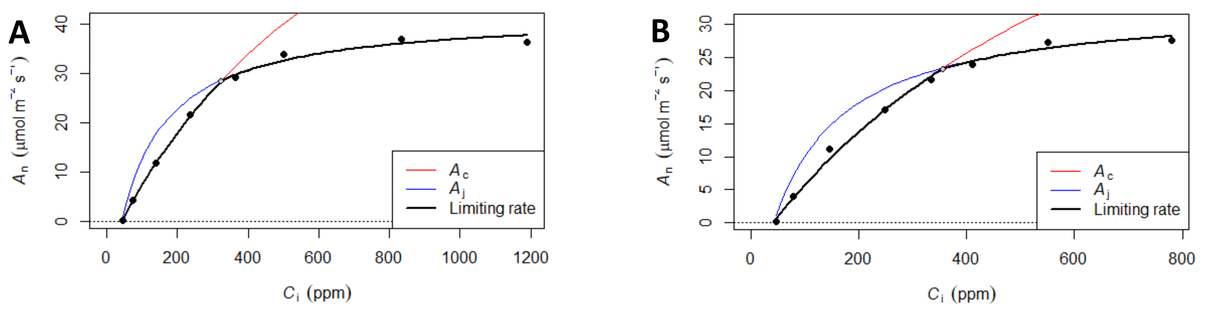

Fig. 5. Estimate of CO_2 Assimilation by intercellular CO_2 concentration using R Studio program(FvCB model). The curves were measured in the greenhouses with light diffusive cover(A) and with general glass(B). Data was measured in October.

	Treatment	August	October
V_{cmax}	Diffusive glass	68.680 ± 13.731	97.411 ± 22.621
	General glass	53.121 ± 1.648	55.305 ± 10.923
	P-value	0.074	0.044*
J_{max}	Diffusive glass	100.768 ± 19.136	198.334 ± 30.159
	General glass	84.161 ± 9.095	135.372 ± 17.749
	P-value	0.150	0.036*

Table. 1 V_{cmax} and J_{max} of bell peppers cultivated in the two greenhouses. Means with an asterisk(*) are significantly different by *t* test at $P \leq 0.05$ (n=4). Data represent mean ± SD.

FUND

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CONCLUSIONS

- The plants cultivated in the greenhouse(A) with light diffusive cover have higher maximum Rubisco carboxylation rate, electron transport rate, and photosynthetic rate compared to the plants cultivated in the greenhouse(B) with general glass
- The light diffusive cover could be used as a major consideration factor for constructing environment in greenhouse with the calculation of production cost against the initial cost

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