

The Effect of Light Quality on the Major Components of Hot Pepper Plant(*Capsicum annuum* L.) Grown in Polyethylene Film House

II. Chlorophyll, Carotenoid and Capsaicin Content

by

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辛味種 고추의 Polyethylene Film House 栽培時 主要成分에 미치는 Light Quality의 영향

II. Chlorophyll, Carotenoid 및 Capsaicin 含量

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Abstract

After growing the hot pepper fruits in polyethylene film(PE) house covered with white or red colored film, the fruits were collected and chlorophyll, carotenoid, and capsaicin content was analyzed.

Although total chlorophyll content was higher in fruit of white PE house(208.9 μ g/g-F.W.) as compared to that of red PE house (153.0 μ g/g-F.W) grown plants, the ratio of chlorophyll a over b were similar, giving 2.15 and 2.13 respectively in white and red PE house. Total carotenoid, β -carotene and the capsaicin content were higher in fruits of red PE house grown plants.

Therefore, it is suggested that red film could be used as a successful covering material for polyethylene film house.

Introduction

In the previous report(Kim *et al.*, 1977) the growth and development of hot pepper plants was studied when the plants were grown in the polyethylene film (PE) house covered with red, blue, green, and white

colored film. It was suggested that red film may be successfully adapted for a covering material. The chlorophyll and carotenoid content are determining factors of pepper fruit along with capsaicin content. Therefore, in this report, we report the changes in chlorophyll and carotenoid content in the fruits from plants grown in white and red PE house.

Materials and Methods

'Saemaeul No. 1' hot pepper plants were grown as described in the previous report (Kim *et al.*, 1977). The fruits were harvested at 32 days after flowering for various analysis.

Chlorophyll Analysis: The pericarp of pepper fruit was extracted with 80% acetone and the filtrate was assayed according to the method of Vernon (1960) measuring the optical density at 649 and 665nm.

Carotenoid and Capsaicin Analysis: Total, β -carotene and capsaicin contents were analyzed by the method of Lee, *et al.*, (1975).

Results and Discussion

Changes in chlorophyll content: The relationship between the chlorophyll content, the ratio of chlorophyll a and chlorophyll b, and light quality has been studied (Haight, 1970; Jahn, 1976; Vaskresenicaya, 1967).

In the after-ripening study of tomato fruits, red light treatment destroyed chlorophyll greatly as compared to blue, white, green, and dark light treatment. In the potato root tissue culture (Bajaj and Mcallan, 1969), chlorophyll content was the highest in white treated tissue followed by blue and red treated tissue. Particularly, chlorophyll a content was high in white and blue light treated tissue, whereas chlorophyll b in red light treated tissue.

As shown in Table 1, total chlorophyll content in the fruit pericarp was 208.9 μ g/g in white PE house as compared to 153.0 μ g/g in red PE house. Chlorophyll a and b contents showed similar response as in total chlorophyll, further showing similar chlorophyll a/b

Table 1. Chlorophyll contents in the hot pepper fruit, 'saemaeul No. 1' harvested from grown in polyethylene film house with different color

	Chlorophyll(μ g/g—F.W.)			
	a	b	a/b	Total
White	142.7	66.2	2.15	208.9
Red	104.1	48.9	2.13	153.0

ratio of 2.15 and 2.13 in white and red PE grown fruits, respectively.

Our results are in contrast with the Bajaj and Mcallan's (1968) results. These differences may be due to the difference in the tissue. Therefore, it will be interesting to examine the chlorophyll content in the leaf from the pepper fruit.

Changes in carotenoid content: Changes in carotenoid content influenced by light quality has received many attentions by many researchers(Jen, 1974a,b; Shewfelt, 1970; Khudairi, 1972; Boe, 1968).

As shown in Table 2, total carotenoid content in fruits from plants grown in red PE house was 1,384.5 μ g%—F.W. which was higher than 410.7 μ g%—F.W. in white PE house. β -carotene, important as a vitamin source, was also higher in red PE house.

However, Jen(1974a) in after-ripening study of tomato fruit reported that blue and red light treatment was the most effective in the carotenoid synthesis. as compared to white, green-light, and dark treatment.

Khudairi and Arboleda (1971) and Thomas and Jen (1975) working with tomato reported the involvement of phytochrome in lycopene content and suggested that far-red absorbing form of phytochrome (Pfr) is involve in the carotenoid synthesis.

Therefore, high content of total carotenoid and β -carotene in hot pepper fruits from red PE house grown plants further implies a usefulness of using red polyethylene film as a covering material.

Table 2. Carotenoid and β -carotene content in the hot pepper fruit, 'Saemaeul No. 1' harvested from grown in polyethylene film house with different color

	(μ g%—F.W.)	
	White	Red
Carotenoid	410.7	1384.5
β -carotene	77.5	490.6

Changes in capsaicin content: capsaicin, one of the major hot spicy constituent in pepper fruits is synthesized through phenylpropanoids pathways regulated by phenylalanine ammonia-lyase(PAL) as a key enzyme.

Zucker(1965) and Scherf and Zenk (1967) already reported the relationship between light quality and

Table 3. Capsaicin content in the hot pepper fruit, 'Saemaeul No. 1' harvested from grown in polyethylene film house with different color

Capsaicin	(mg%-F.W.)	
	White	Red
	9.8	11.8

PAL activity and Lee(1971) also reported the relationship between capsaicin content and PAL activity. White light treatment to germinating *Zea mays L.* seeds increased PAL activity (Duke and Naylor, 1974).

As shown in Table 3, capsaicin content was high in the fruit from red PE house grown plants as compared to that from white PE house grown plants. This response can be related to the more efficient transformation of Pr form to P_{fr} form by red PE film as compared to white PE film.

要 約

고추의 Polyethylene Film House 재배시에 피복 재료로서 White, Blue, Green 및 Red Color의 Film을 사용하여 광질에 따른 실험을 행한 바 있다. White와 Red Film의 처리시에 Chlorophyll, Carotenoid, 및 Capsaicin 함량을 측정 한 결과는 다음과 같다.

1. 總 Chlorophyll의 함량은 White구가 208.9 μ g/g-F.W., Red구가 153.0 μ g/g-F.W.으로서 White구에서 그 함량이 현저히 높았으며, Chlorophyll a,b의 비는 White, Red구가 각각 2.15, 2.13으로 비슷하였다.

2. 總 Carotenoid는 Red구가 White구의 3.4배에 달하였으며, 특히 β -carotene은 Red, White구가 각각 490.6 μ g%, 75.5 μ g%로서 Red구에서 현저히 많았다.

3. Capsaicin의 함량은 Red구가 White구보다 약 20%정도 높았다.

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