

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

I. Growth and Development

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

I. 生育狀態

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SUMMARY

The blue, green, and red colored polyethylene film was used as a covering material for house grown pepper production to compare with the white film.

Plant height was the tallest in red PE house(78.8 cm) followed by white, blue, and green PE house. The leaf weight was 0.40g in white PE house and 0.39g in red PE house which was higher than the weight in blue and green PE house.

Fruiting percentage was 48.0% and 46.1% in white and red PE house, respectively, however no fruit was set in blue and green PE house. The fruit weight was 3.32g and 2.81g, in red and white PE house, respectively.

The K, Ca, Mg, and Fe content in the leaf was the lowest in plants grown in white PE house. The content of K, Ca, Mg, and Fe was the highest in plants grown in green PE house.

INTRODUCTION

The pepper fruit, rich in vitamin, is one of the very important spicy materials. Particular, year round production in the polyethylene film house

(PE house) increases the farm house income.

When growing plant in the PE house, one must consider the light transmittance of PE. In a given thickness, transmittance becomes high as the wavelength increases. However, in a visible

light spectrum, the difference of transmittance among various light quality may be negligible although this small difference influenced plant growth and development (Pfeiffer, 1928).

It is well known that the red and far-red light controll many physiological and chemical aspects of plant growth (Vince, 1964 : Furuya, 1968 : Kasperbauer, 1968 : Elliot, 1975). However, many researches were mainly concerned with the plant pigment changes during maturation and after-ripening period (Halght, 1970 : Paynter and Jen, 1976).

Although various physiochemical studies on the after-ripening of pepper fruit have been performed (Lee, *et al.*, 1973b, 1975 : Kim, *et al.*, 1977), it has not been well investigated how the light quality affects various physiological and chemical characteristics of pepper fruits and plants. Further, we have frequently informed by the growers that the pepper fruit grown in the PE house is not as hot as expected,

Therefore, we initiated this experiment to understand how the light quality influences the growth and development of pepper plants and fruits, when the plants are grown in the PE house covered with various colored PE film.

MATERIALS AND METHODS

Consturction of PE House: PE house was built as a quonset house whose height, width, and length was 2, 4, and 6 m, respectively. These PE houses were covered with a white, blue, green, and red PE of 0.06 mm in thickness(Golden bell vinyl, Korea Plastic Co.). The light

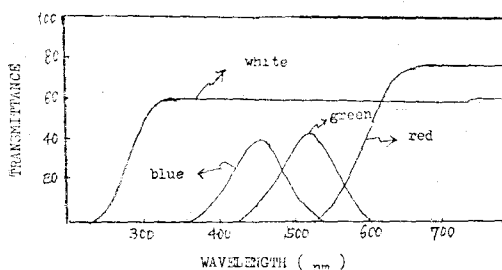


Fig. 1. The Absorption Spectra of the Filtered Light by the Polyethylene Film of Various Color used in the Experiment

transmittance of the PE was measured by AA-2 type Recording Spectrophotometer as shown in figure.

Cultivation: 'Saemaoul No.1' pepper seeds were sown on June 10, 1976 and transplanted to 60cm in intervals when the plant grew about 25—30cm in height. On September 20, when the planted naturally branched for 3 or 4 times, the house was covered with various PE film indicated above. Due to the prevent a sudden changes in growing environment, labelling was started from October and continued till November.

Data Collection: During cultivation period, injury by insects and etiolation was observed. Plant height, leaf weight, fruiting percentage, and fruit weight was also obtained. The 100 leaves of weight determination was collected from the 5th to 7th branches. Fruiting percentage was expressed by the number of harvested fruits over the number of labelled fruits. Leaf tissue analysis was also carried out by Atomic Absorption Spectrophotometer to determine the content of potassium, calcium, magnesium, iron, and manganese.

RESULTS AND DISCUSSION

Reports by Pfeiffer(1928) indicated that the plant growth influenced by the light quality depends on the plant species which acts either promotive or inhibitory(Kluyver, 1911 : Schanz, 1919 : Popp, 1926).

As shown in Table 1, plant height was the tallest when grown in PE house with red film (78.8cm), while it was the shortest in PE house with green film (63.6cm). Similar results were obtained in cucumber, potato, bean, and chrysanthemum by Schanz (1919).

Leaf weight was 0.40g and 0.39g when the plant was grown in white and red PE house, respectively, which was higher than that when grown in blue (0.31g) and green (0.32g) PE house.

Since the flower failed to set fruit immediately after covering the house due to changes in environment conditions, fruiting percentage was based on the flower opened about one week after

Table 1. The Effect of Light Quality Treatment on the Growth and Development of Hot Pepper Plant, 'Saemaedul No. 1' Grown in PE House with Different Color

	White	Blue	Green	Red
Plant Height(cm)	70.9	67.4	63.6	78.8
Leaf Weight(g)	0.40	0.31	0.32	0.39

Table 2. The Effect of Light Quality Treatment on the Growth and Development of Hot Pepper Plant, 'Saemaedul No. 1' Grown in PE House with Different Color

	White	Blue	Green	Red
Fruiting Percentage	4.80	0	0	46.1
Fruit Weight(g)	2.81	—	—	3.32

covering.

However, flowers opened in blue and green PE house failed to set fruit completely. On the contrary, fruiting percentage was 48.0% and 46.1% in the white and red PE house, respectively. Fruit weight was 3.3g and 2.81 from plants grown in red and white PE house, respectively. Although no data were obtained, the insect injury was less in red PE house than white PE house.

Therefore we suggest using red polyethylene film instead of conventional white film.

Plant grown in blue and green PE house showed higher Mg and K content in leaves than red and white PE house. Except in the green PE house grown plants, Ca content among white, blue and red PE house showed similar content. According to Helms and David (1973), white light treated *Phaseolus vulgaris* L. seeds absorbed more Ca than red light treated seeds during germination.

Table 3. Major Element Content of Leaf Influenced by Light Quality in Hot Pepper Plant, 'Saemaedul No. 1' Grown in PE House with Different Color

	White	Blue	Green	Red
K	2.95	4.32	5.21	3.25
Ca	1.36	1.55	2.34	1.75
Mg	3.75	6.00	7.60	5.21

(g%-d.w.)

Table 4. Fe and Mn Content of Leaf Influenced by Light Quality in Hot Pepper Plant, 'Saemaedul No. 1' Grown in PE House with Different Color (mg%-d.w.)

	White	Blue	Green	Red
Fe	35.5	60.9	132.9	65.5
Mn	10.7	21.1	18.3	10.4
Fe/Mn	3.3	2.9	7.6	6.3

The Fe content was the highest (139.19mg) from plants grown in green PE house and the lowest (35.45mg) in white PE house. While the lowest Mn content (10.4mg) was observed in red PE house, Mn content was the highest (21.1 mg) in blue PE house. The ratio of Fe over Mn (Fe/Mn) was 3.3 and 2.9 in white and blue PE house which ratio was lower than that of green (7.6) and red (6.3) PE house.

Somers and Shive (1942) reported a ideal ratio of Fe/Mn of ranging from 1.5 to 2.0 of normal plant growth. Lee, et al., (1973) further reported that the increase in Fe and Mn content coincide with the rise in the spicy substance, capsaicin, in hot pepper fruit.

Although the nutrient elemnet analysis in this study and in the previous report by Lee, et al., (1973*), no definite conclusion could be drawn between the growth and fruiting percentage and the Fe and Mn content.

要 約

辛味種 고추(Saemaedul No. 1)의 polyethylene film house 재배시에 피복재료로써 광질이 다른 white, blue, green 및 red color의 0.06mm polyethylene film을 사용하여 재배시험을 행하고 생육상태를 조사한 결과는 다음과 같다.

1. 초장은 red구가 78.8cm로서 가장 크고 white구가 다음이었으며, blue, green구는 각각 67.4, 63.6cm로 매우 저조하였다. 그리고 5~7단 사이의 잎의 평균중량은 white, red구가 각각 0.40, 0.39g으로써 비슷하였고, blue, green 구에서는 0.31, 0.32g으로써 초장에서와 같이 생장상태가 불량하였다.
2. 착과율은 white.구가 48.0%, red구가 46.1%로써 white구가 다소 높았으며, blue, green구에서는 착과가 되지 않았다. 그리고 과실의 중

량은 red구가 3.32g으로써 white구의 2.81g보다 높았으며, 또 재배중에 유색(blue, green, Red)구, 그중에서도 red구가 white구에서 보다 총해가 적음을 관찰할 수가 있었다.

3. 잎의 무기질 중에서 K, Mg는 생육상태가 불량한 blue, green구에서 white, red구보다 많았고 Fe는 green구에서, 그리고 Mn은 blue구에서 가장 많았으며, white구에서는 Fe, Mn이 다같이 적었다.

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