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INFLUENTA FILMULUI REFLECTIV LA PIERSIC
THE INFLUENCE OF REFLECTIVE FILM IN PEACH

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Abstract

This study was carried out for investigate the effect of reflective material during harvest season. 'Mihwang', 'Soohwang' and 'Kanoiwa Hakuto' cultivars were treated with the porous reflective film and the aluminium reflective film for 15 days and 30 days before harvest. In both groups, the total soluble solids increased with reflective film treated time, but there was no significant difference between the two groups. On the other hand, when processed for more than 15 days, the quality of peaches shows a tendency to deteriorate because of the excessive coloration of fruits. Overall, it is considered that the treatment time of the reflective film should be within 15 days.

Keywords: peach, reflective film, high quality, coat cover

1. Introduction

Peach (*Prunus persica* (L.) Batsch) belongs to the genus of *Prunus* in the rose family, and is a fruit grown in the temperate and subtropical regions. (Scorza & Sherman 1996). Its origin is China and it was reported to be harvested in the area for over 4,000 years (Hesse, 1975). Due to heavy rainfall in summer, Korea is not an ideal place for peach harvest. The peach trees in Korea at this time often suffer from water sprout and over-growth shoots, which deteriorate the photosynthetic radiation condition in the crown of a tree. Thus, such condition adversely affects the fruit quality and flower bud formation.

In order to overcome these problems and produce high quality fruits, a method to cover the bottom part of the tree with the reflective film was suggested and several prior studies have been conducted on the Unshiu orange, pears and apple (E G.J. et al., 2003; Moon et al., 2003; Sagong et al., 2001). However, the coloration characteristics of each cultivar are different thus, 'Mihwang', 'Soohwang', the cultivar from Gyeongbuk and 'Kanoiwa Hakuto' are used in this research.

2. Material and methods

This experiment was conducted at Nectarines Research Institute (Cheongdo Peach Research Institute) for two years from 2016 to 2017. The cultivars used in the experiment are 'MIhwang', 'Soohwang' and 'Kanoiwa Hakuto', and each tree was 10-year-old. The implemented cultivation method was in accordance with the conventional culture except for the reflecting film treatment.

The tested trees were in three groups; control, trees treated with the aluminium reflective film, and trees treated with the porous reflective film. For the trees treated with the reflective films, the treatment time of the reflective film was grouped into 15 and 30 days before harvesting and each group consists of 3 trees. The reflective films were coated on the area between the trees and fixed with fixing pins.

In order to create the ideal growing conditions, illuminometer (PYRARNO-70, RF sensor) was installed at a distance of 100cm from the tree, 50cm and 150cm above the ground, and temperature-humidity data logger (TR-72wf, T&D) was installed at a distance of 100cm above the ground. The measurement interval for illuminometer and temperature-humidity sensor was 10-minute.

Spectrophotometer (SAM-706AC, GMK) was used to measure the Total Soluble Solids (TSS) of the fruit and color-difference meter (CM-700d, KONICA) was used to measure the coloration of the fruit.

3. Results and discussions

The photosynthetic radiation change for each type of reflective film are indicated on Figure 2. Amount of reflected light on the bottom and top part of the trees treated with reflective film was higher than that of control. For the bottom of tree (50cm above ground), reflected light from the porous reflective film was higher than that from the aluminium film. While for the top of tree (150cm above ground), there was no difference between the amount of reflected light from aluminium film and the porous reflective film. Compared to the control group, the amount of reflected light, on the bottom of trees was 2.5 times higher for those treated with the white reflective film and 2.3 times higher for those treated with the porous reflective film (Park, 2010). And this result showed the similar results to this research.

The temperature-humidity variation by each type of reflective film being used is indicated in Figure 3. The air temperature of trees treated with the reflective film was 1-2^{o} higher than that of the control, and there was no difference between the types of reflective films. While the control showed lower air humidity than the trees treated with reflective films. This seems to be the result of blocking the soil's water vapor by coating the reflection film.

By 14, the soil temperature of control was 2^{o} higher than that of trees treated with the porous reflective film. While the soil temperature of trees treated with the aluminium reflective film was 1℃ higher than that of trees treated with the porous reflective film (Figure 4). It was shown that the diurnal variation of the soil temperature tends to be narrower for the trees treated with the reflective films than the control.

Figure 5 shows the maturation ratio of 'Mihwang' according to the reflective film treatment. On June 28, 44-47% of trees treated with the porous reflective film and 22~24% of trees treated with the aluminium film were harvested. But, for the control, there was no fruit at optimum maturity. Harvest maturity of the control was about 2 days slower than the treated trees. There was no significant difference in the harvest maturity in terms of reflective film treatment yet, there was a slight difference made in terms of the type of film used.

Table 1 shows the total soluble solids of the 'Mihwang', 'Soo Hwang' and 'Kaoiwa Hakuto' in terms of the reflective film treatment. For the treated 'Mihwang' trees, the variation of TSS according to the location of fruits was generally low. While, for the control, the TSS of the top and bottom part of tree was 1°Bx. Overall, the 30-day aluminium reflective film coated trees showed the highest TSS of 14.2°Bx and the control showed the lowest TSS of 12.6°Bx.

In case of 'Soohwang', there was no significant difference in the TSS compared to the rest of the treated trees, except for the 15-day aluminium reflective film coated trees and control, as it showed a similarly high level of TSS. It is considered that the overall TSS of 'Soo Hwang' was low due to frequent rainfall and poor photosynthetic radiation condition during its harvest season.

The difference in TSS of 'Kanoiwa Hakuto' depending on the fruit location for the reflective film treated trees was as low as 0.4-1.3°Bx while for the control was 2.2°Bx. The TSS of 30-day aluminium film treated trees and 30-day porous reflective film treated trees showed the highest TSS of 13.6°Bx and 13.4°Bx accordingly. And the control showed the lowest TSS of 11.3°Bx. 15-day reflective film treated trees showed TSS of 12.9°Bx and 12.8°Bx, intermediate between the 30-day reflective film treated trees and control. This result is similar to the result of Yoon et al. (2011), the research on 'Changhowon Hwangdo' which represented the TSS of fruit increasing by 1.7°Bx when the tree was treated with the porous reflective film and removed the film 30 days before the harvest.

Color variation of the fruit by each type of reflective film being used is indicated in CIELAB color space (Figure 4). All three cultivars showed a high value of L, a and b when they are not treated with the reflective film. Thus, control showed the highest brightness and, strong red and yellow color. In case of trees treated with the reflective film showed strong red color due to the excessive coloration which tends to decrease the a and b value and reduce the brightness. In 2017, there was no significant difference between the two groups as the light was not strong during harvest. When the tree is coated with the reflective film for 30 days, the marketability of fruits tends to fall as they are overly exposed to strong light. However, the fruits showed an adequate level of coloration after 15-day reflective film treatment.

The TSS increases as the treatment time with the reflective film increases. However, taking consider of the marketability of fruits, 15-day reflective film treatment will be ideal. However, the treatment time of reflective film shall be decided by taking consideration of the year's amount of light during the harvest time and the characteristic of cultivars.

4. Conclusions

In order to improve the photosynthetic radiation condition of peach cultivation as well as the quality of peach, research on the reflective film treatment took place and its results are summarized as follows. The research was conducted by comparing the control with 'Mihwang', 'Soohwang' and 'Kanoiwa Hakuto' trees which were treated with the porous reflective film and the aluminium reflective film for 15 and 30 days. When the reflective film is coated, the harvest time can be advanced by more than two days. Moreover, the TSS increased with the longer treatment time, and there was no significant difference between the porous reflective film and the aluminium reflective film. However, if the treatment time exceeds 15 days, the coloration of the fruit becomes excessive and, tends to deteriorate the marketability of fruits. In sum, it is considered that the ideal treatment time of the reflective film should be no more than 15 days.

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Tables and Figures

Table. 1. Fruit total soluble solids(50cm above ground) of peach cultivar "Miwhang" and "Soowhang", "Kanoiwa Hakuto" by reflective film type.

Classification	Mishang			Soowhang			Kanoiwa Hakuto		
	Upper*	Lower	All	Upper	Lower	All	Upper	Lower	All
Porous 30	13.9	13.7	13.8b**	10.2	9.5	9.8a	13.8	13.4	13.6a
Porous 15	13.6	13.5	13.5b	10.1	9.7	9.9a	13.2	12.6	12.9b
Aluminium 30	14.6	13.7	14.2a	9.9	9.7	9.8a	13.8	13.0	13.4a
Aluminium 15	14.0	13.1	13.6b	9.6	8.5	9.0b	13.4	12.1	12.8b
Cont.	13.1	12.1	12.6c	9.6	8.8	9.2b	12.4	10.2	11.3c

* Upper: Over 150cm above ground, Lower: Below 150cm above ground
**Duncan's multiple range test($P \leq 0.05$)

Table. 2. Color difference* of peach cultivar "Miwhang" and "Soowhang", "Kanoiwa Hakuto" by reflective film type.

Classification	Mishang			Soowhang			Kanoiwa Hakuto		
	L	a	b	L	a	b	L	a	b
Porous 30	27.5c	9.4b	6.8b	32.9b	13.0bc	7.7b	52.3ab	11.3b	18.7ab
Porous 15	31.2b	9.6b	7.2b	32.2b	12.2c	7.0b	51.8b	12.8a	18.1b
Aluminium 30	30.4b	8.2b	6.9b	35.1ab	14.3abc	8.9ab	51.5bc	12.0b	18.0bc
Aluminium 15	30.3b	9.6b	7.4b	34.0ab	15.7ab	8.4b	49.7c	12.9a	17.1c
Cont.	37.3a	16.7a	11.5a	37.5a	16.0a	10.7a	53.9a	13.2a	19.4a

* CIELAB color space
**Duncan's multiple range test($P \leq 0.05$)

Porous reflective film Aluminium reflective film Control

Fig. 1. Pictures of each treatment by reflective type

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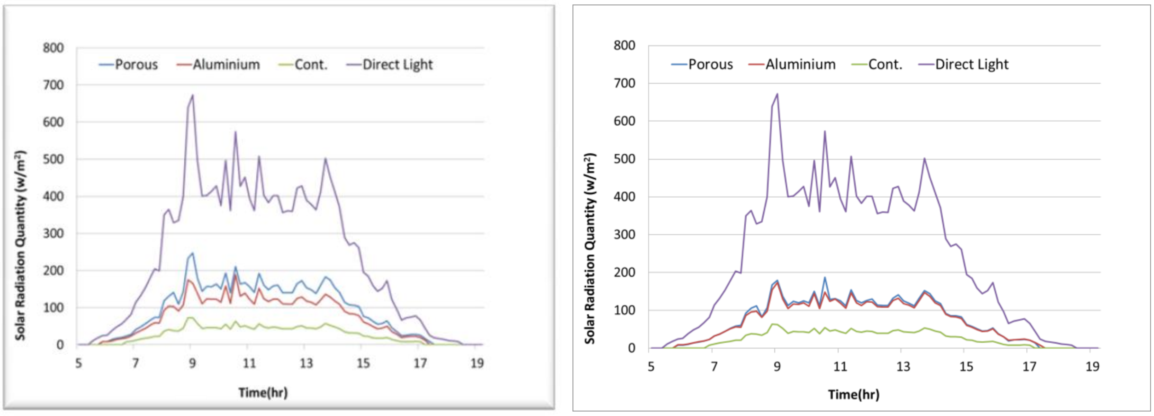
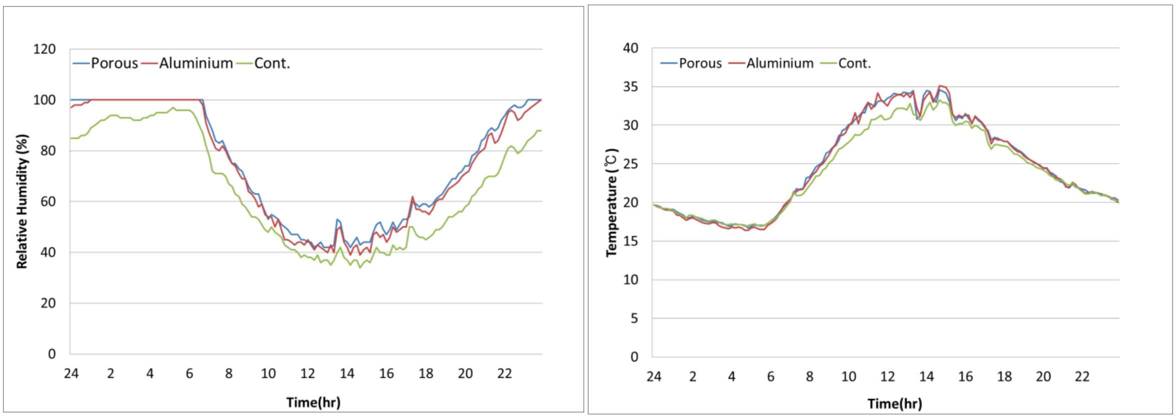


A. 50cm above ground B. 150cm above ground

Fig. 2. Reflected light change by reflective film type at 50cm and150cm above ground in Korea



A. Change of atmospheric temperature B. Change of relative humidity

Fig. 3. Change of atmospheric temperature and relative humidity by reflective film type

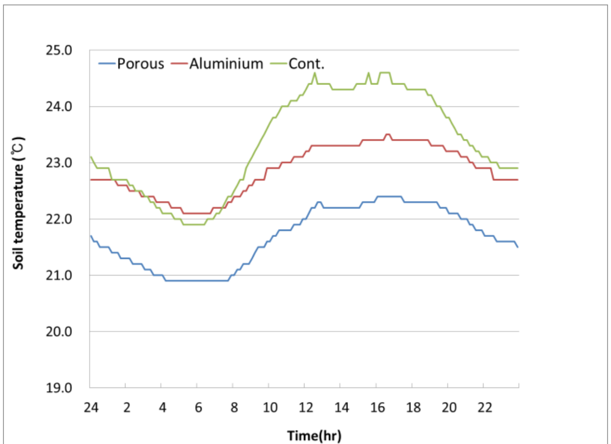


Fig. 4. Change of soil temperature by reflective film type

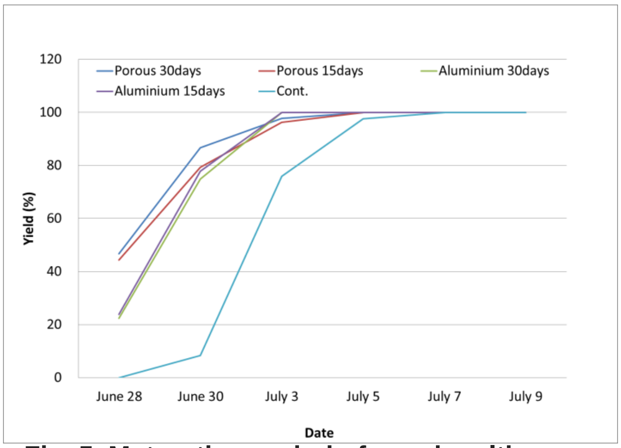


Fig. 5. Maturation period of peach cultivar “Miwhang” by each reflective film type