# CHAPTER 4

# RESULT AND DISCUSSION



## 4.1 Introduction

In this chapter, the results obtained from the properties of the coloured shading nets and performance of plants under the shading nets will be discussed in details. The study were done for 19 weeks to get the data. The entire results were analysed and plotted. This chapter includes two data, which is data obtained from experiment and analysis of variance (ANOVA).

Before conducting the study, the characteristic of the material in terms of its mesh number and thickness of the material were analysed. Then, the light property with regards to light intensity of different coloured shading net was investigated inside the greenhouse under the sunlight. Lastly, the plant performance under coloured shading net concerning of its leave number, height, width and chlorophyll content of the plant were evaluated.

## 4.2 Mesh Number and Thickness of Shading Net

Red, yellow and blue shading net have higher shading factor compared to black shading net. This is due to the thickness and mesh number of the shading net. The thicker the net and dense number of the holes will contribute to higher shading factor. Table 4.1 presents the mesh number and the thickness of the shading net. Yellow, red and blue shading nets have 70% of shading factor. Meanwhile for black shading net, its shading factor was 50%. Red, yellow and blue shading nets were purchased from the same factory,

thus their shading thickness and mesh number is the same which was 0.89 mm and 96 holes per inch squared. However for black shading nets, its mesh number and thickness was much lower with 0.70 mm and 21 holes per inch square. Moreover, red, yellow and blue shading net have weight of 96g/m² and black shading is 60g/m². The more weight per meter square indicates the higher shading factor it have.

**Table 4.1: Mesh Number per inch square and Thickness of Shading Net**

| Colour | Mesh Number (number of holes / 1 inch square) | Thickness of Net (mm) | Weight of Net (g/m²) |
|---|---|---|---|
| Yellow | 96 | 0.89 | 96 |
| Red | 96 | 0.89 | 96 |
| Blue | 96 | 0.89 | 96 |
| Black | 21 | 0.70 | 60 |



## 4.3 Light Intensity under Coloured Shading Net

In order to measure the Light Intensity, Light meter from Extech is used. Referring to Table 4.2 and graph in Figure 4.1, in the morning at 9am yellow shading net gave the highest reading of light penetration which is 23633.33 *lux*. However, in the afternoon at 12 pm and evening at 4 pm, the light intensity without shading gave the highest value of 60383.33 *lux* and 43102.08 *lux*. Meanwhile for black shading net, it had the lowest intensity during 9am and 12pm with 14316.67 lux and 25425.00 lux and blue shading net gave the lowest intensity at 4pm with 19114.58 *lux*.

**Table 4.2: Average Light Intensity *(lux)***

| Time | Control | Yellow | Red | Blue | Black |
|---|---|---|---|---|---|
| **9am** | 18941.67 | 23633.33 | 14425.00 | 15983.33 | 14316.67 |
| **12pm** | 60383.33 | 42183.33 | 42016.67 | 33333.33 | 25425.00 |
| **4pm** | 43102.08 | 29600.00 | 25216.67 | 19114.58 | 20491.67 |

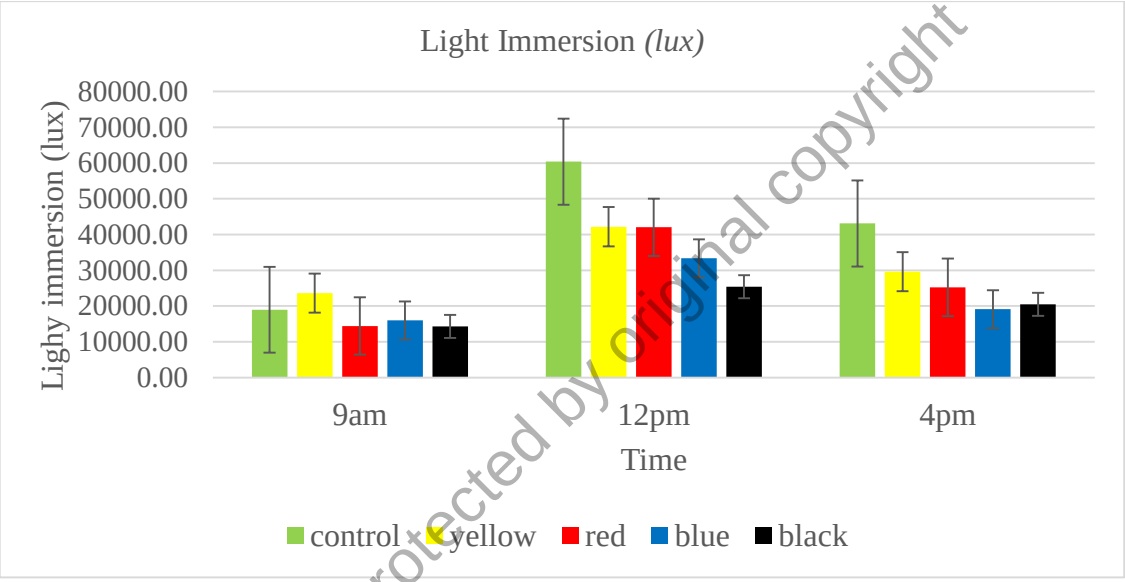




**Figure 4.1: Light Intensity (lux)**

From the statistical analysis of ANOVA with α= 0.05, F value is 5.160132 while F critical is 3.837853. As the F > F critical therefore, the results indicated that there is difference in the treatment using different colour of shading net. The P≤ 0.05 indicated that there is significant difference in light intensity under different colour of shading nets as compared to control. As a conclusion, colour of the shading net had a significant effect on shading capacity, Black shading net is responsible for the highest shade while yellow net was the most permeable for radiation. The data of ANOVA is showed in Appendix A table A1.

The intensity of light was measured by the units *lux* (lx). Lux is the unit of illumination that a surface receives one meter away from a light source. The intensity of light can change with the time of the day, season, geographic location and weather. It gradually increase from sunrise to the middle of the day and then gradually decrease toward sunset. According to Chapman and Carter (1976) the minimum limit for the process of photosynthesis in most plants is between 1076.39 to 2152.78 lux (100 to 200 fc). Likewise, excessive light intensity should be avoided. It can scorch the leaves and reduce yields. According to Edmond et al. (1978), Chlorophyll content is reduced with excessive light intensity. From the study, it is found that at 9 am and 4pm, black and blue shading nets are in range for the minimum light intensity required by the plants. Meanwhile, yellow shading net is out of the minimum range of light intensity required.

## 4.4 Plant Growth and Chlorophyll Content under Coloured Shading Net

There were three replication made in this study and each replication takes 5 weeks to grow. There were 4 parameters that are observed in terms of plant performance and its' growth. Those parameters were compromised of number of yield, number of leaves, plant width, plant height and chlorophyll content in the leaf of the plant.

### 4.4.1 Number of Yield

Table 4.3 and Figure 4.2 indicates the number of yields under each coloured shading net. It can be seen that plants under shading net have more yields as compared to plants under control. Plants under red coloured shading net performs the best by having the highest number of yield. At the end of week 5, blue coloured net shading came as the second best colour and followed by black shading net. Control and yellow coloured shading net have almost the same number of yield throughout the study.

**Table 4.3: Number of Yield**

| Colour of shading net/ Weeks after transplant | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Control** | 4 | 4 | 3 | 3 | 1 |
| **Yellow** | 4 | 3 | 3 | 3 | 3 |
| **Red** | 8 | 8 | 7 | 7 | 7 |
| **Blue** | 7 | 5 | 5 | 5 | 5 |
| **Black** | 8 | 7 | 5 | 5 | 4 |

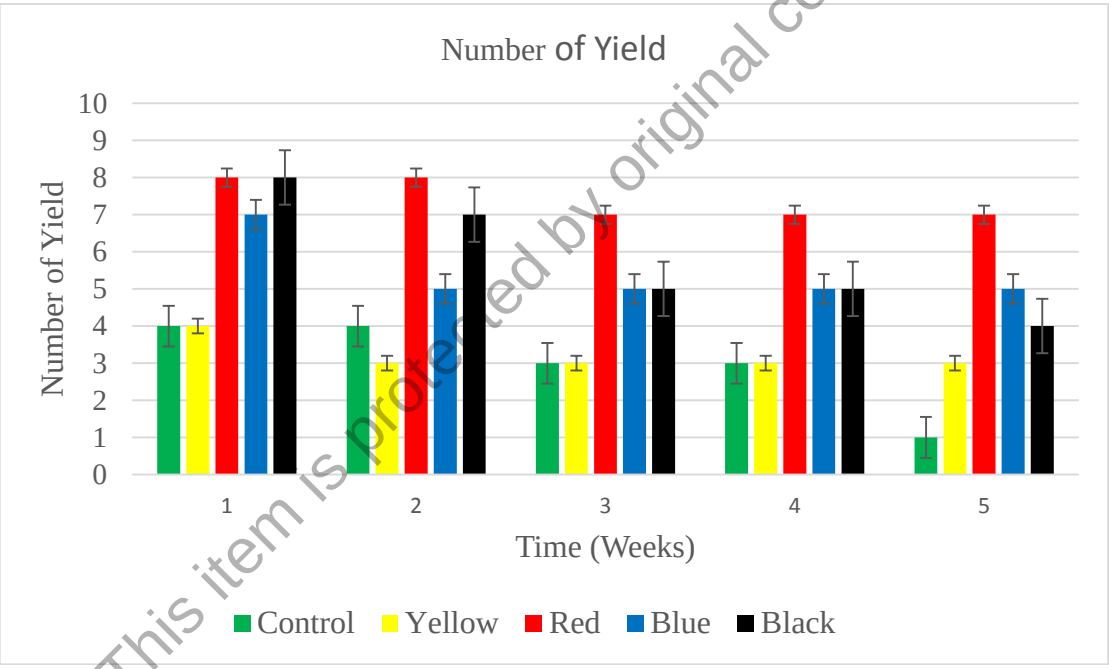




**Figure 4.2: Number of Yields**

From the statistical analysis of ANOVA with α= 0.05, F value is 34.69514 while F critical is 1.87258. As the F > F critical and P≤ 0.05 therefore, the result indicates that there is significant difference in number of yield under different coloured shading nets compared to control system. Table of ANOVA on number of yields is shown in Appendix A table A2.

### 4.4.2 Number of Leaves

Referring to Table 4.4 and Figure 4.3, Plants under control had the highest number of leaves and followed by blue colour of shading net. At the end of the study, plants under red and yellow shading nets had equal number of leaves under them. Same situation undergoes by plants under blue and black shading nets.

**Table 4.4: Number of Leaves**

| Colour of shading net/ weeks after transplant | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Control** | 3 | 5 | 6 | 7 | 7 |
| **Yellow** | 3 | 4 | 5 | 6 | 5 |
| **Red** | 4 | 4 | 5 | 5 | 5 |
| **Blue** | 4 | 5 | 6 | 6 | 6 |
| **Black** | 4 | 4 | 4 | 5 | 6 |



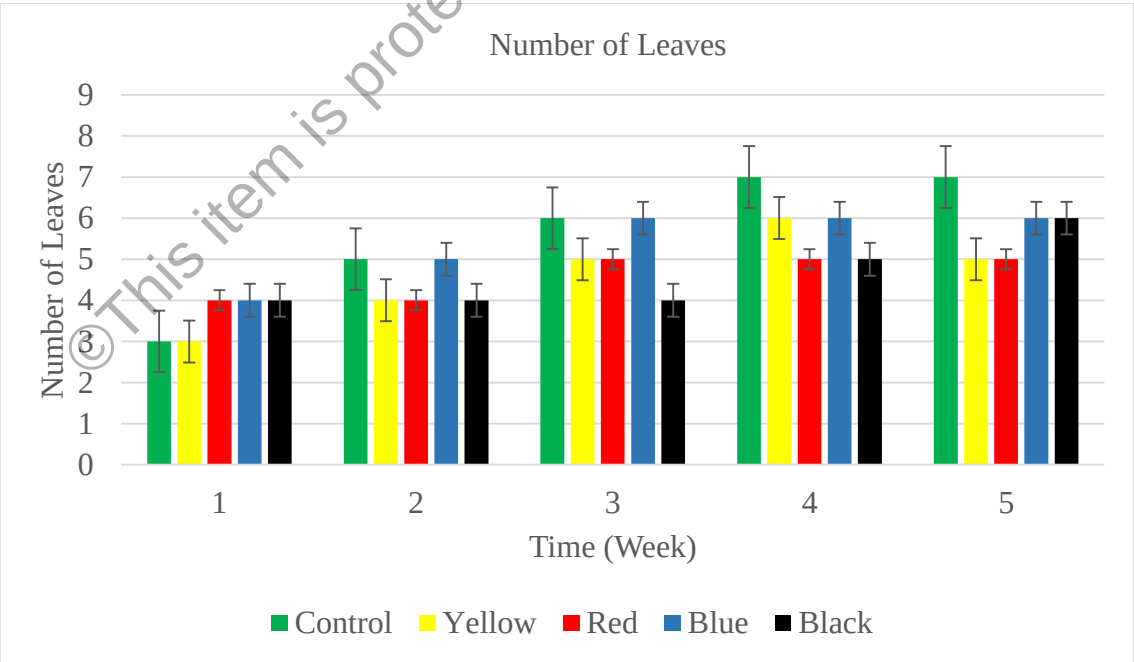


**Figure 4.3: Number of Leaves**

Based on the statistical analysis of ANOVA with α= 0.05, F value is 3.768546 while F critical is 3.006917. As the F > F critical and P value is 0.024113 which is less than 0.05. Therefore, the result indicates that there is a significant difference in number of leaves under the coloured shading nets compared to control system. Table of ANOVA on number of leaves is shown in Appendix A table A3.

### 4.4.3 Width of Plants

The width of plants under each shading for 5 weeks is shown in Table 4.5 and Figure 4.4. From the line graph, it can be seen that the width of the plants increased gradually throughout the weeks. At the end of week 5, plants under blue shading net was the widest in diameter. However, for plants under controlled environment, the width of plants decreased drastically at week 4. Red shading plants had the least width among the other colour of shading net. In week 5, plants under control environment had loss its width due to too high light intensity, thus plants tend to wilt and die.



**Table 4.5: Width of Plants**

| Colour of shading net/ Weeks after transplant | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Control** | 3.95 | 5.54 | 8.25 | 14.42 | 9.09 |
| **Yellow** | 3.51 | 4.85 | 6.79 | 6.31 | 8.79 |
| **Red** | 2.78 | 3.53 | 4.95 | 6.35 | 8.04 |
| **Blue** | 3.90 | 5.38 | 8.00 | 11.67 | 13.69 |
| **Black** | 3.20 | 3.83 | 6.55 | 7.28 | 9.42 |

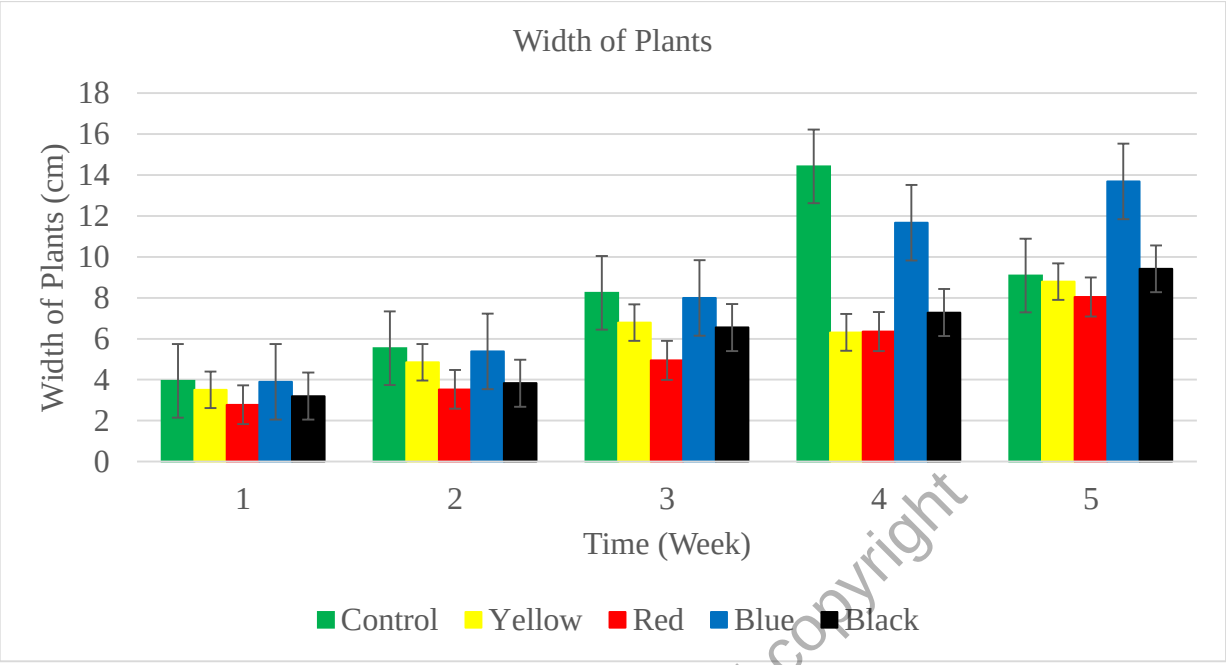


**Figure 4.4: Width of Plants**

Based on the statistical analysis of ANOVA with α= 0.05, F value is 10.11116 while F critical is 3.862548. As the F > F critical and P value is 0.003057 which is less than 0.05. Therefore, the result indicates that there is a significant difference in width of plants under different colour of shading nets as compared to control system. ANOVA table of width of plants can be seen in Appendix A table A4.



### 4.4.4 Height of Plants

Based on Table 4.6 and Figure 4.5, the graph shows that the height of plants under each colour of shading net increases gradually. However, for plants under yellow shading net it faced some loss in height in week 4 with 2.715 cm and the height had increased in week 5 with 3.435 cm in average. Plants under red, blue and black shading net didn't face any loss in height during the study period. At the end of week 5, it shows that plants under red and blue shading net have almost the same height. Meanwhile, plants under black shading net is the tallest among others with 4.467cm height in average.

**Table 4.6: Height of Plants**

| Colour of shading net/ Weeks after transplant | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Control** | 1.950 | 3.015 | 3.875 | 3.665 | 3.835 |
| **Yellow** | 1.680 | 1.675 | 3.465 | 2.715 | 3.435 |
| **Red** | 1.510 | 2.010 | 2.623 | 2.867 | 4.117 |
| **Blue** | 1.870 | 2.000 | 3.025 | 3.850 | 4.095 |
| **Black** | 1.800 | 2.203 | 2.677 | 3.667 | 4.467 |

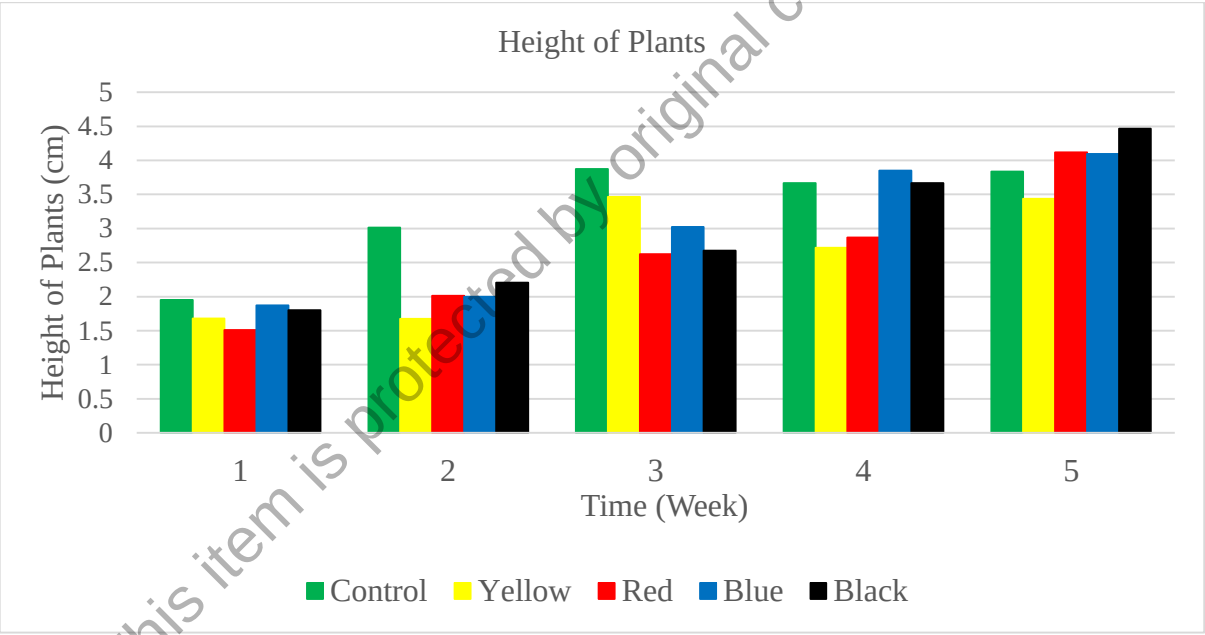




**Figure 4.5: Height of Plants**

Based on the statistical analysis of ANOVA with α= 0.05, F value is 2.611367 while F critical is 3.006917. As the F < F critical and P is more than 0.05. There is no significant difference in plant height under different colour of shading net compared to control. Table of ANOVA on height of plants is showed in Appendix A table A5.

Plants grown under different coloured nets had varying growth due to their spectral effect that influences the plant growth. Number of plants alive were found to be significantly higher under the red shading net over the control. The present study was in agreement to Kawabata et al (2007) who had also reported that crops under red shade net are more compared to other colour for dracaena and blue shade net has been found to be effective for improving plant width.

According to Anem Agro, the standard size of Pak Choy and Cabbage is about 7-20 cm in width and 15-30 cm high. As observed, at the end of week 5, it shows that width plants for all colour and control are within the range of 7-20 cm. However, plants under blue shading net was found to have the widest size compared to other colours.

For the height of plants, even though it doesn't reach the standard height, however plants under black net was seen to be the tallest plants and yellow net was the smallest. This might be due to the attack of caterpillar and insect under the yellow shading net.



### 4.4.5 Chlorophyll Content

From Table 4.7 and Figure 4.6, chlorophyll content was found highest under black shading net with total chlorophyll content of 13.6898 µg/ml followed by blue and control with 11.9201µg/ml and 9.0494 µg/ml. The lowest total chlorophyll content was found under yellow shading net with 4.0769µg.ml.

**Table 4.7: Chlorophyll Content**

| Colour of shading net | chl a (µg/ml) | chl b(µg/ml) | Total chl (µg/ml) |
|---|---|---|---|
| **Control** | 6.2722 | 2.7773 | 9.0494 |
| **Yellow** | 3.2532 | 0.8236 | 4.0769 |
| **Red** | 4.2364 | 2.4472 | 6.6836 |
| **Blue** | 9.1957 | 2.7244 | 11.9201 |
| **Black** | 4.1063 | 9.5835 | 13.6898 |

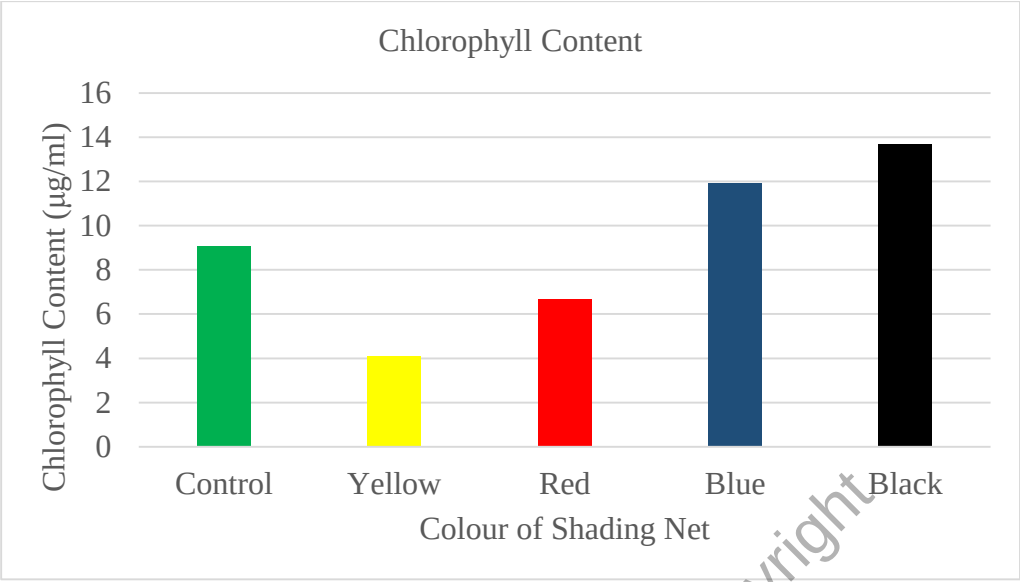


**Figure 4.6: Chlorophyll Content**

Chlorophyll content was found to be greater for plants grown under black shading net and least for plants under yellow shading net. This condition can be explained by the fact that the leaves of shaded plants are thinner and contain larger pigment-rich chloroplasts (Guichard et al., 2001).

Based on the statistical analysis of ANOVA with $\alpha = 0.05$, F value is 2.611367 while F critical is 3.006917. As the F > F critical and P is more than 0.05. There is a significant difference in chlorophyll content under different colour of shading net compared to control. Table of ANOVA on chlorophyll content is showed in Appendix A table A6.