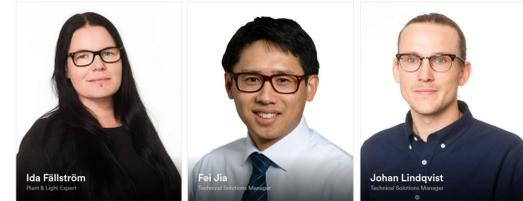


Different lighting strategies for inducing red coloration in lettuce



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Introduction

The anthocyanin content is responsible for the red pigmentation of the red-green lettuce. The concentration of anthocyanins, which gives different gradient of coloration, depends on the growth environment, such as light quality and quantity. A high anthocyanin content may reduce the absorption of light and lead to reduction in plant growth.

Lights designed for high crop production may not achieve desired coloration of red lettuce. Therefore, it is to our interest to compare the overall growth and coloration of LED grow lights with spectrum optimized for plant growth and grow lights optimized for inducing coloration.

Lettuce was first grown under lights with a spectrum focused on stimulating biomass accumulation. This light gives a less red colored lettuce. At the end of biomass production, the plants were treated with 2 lighting strategies to induce the red coloration. One with increased light intensity, the other with blue heavy spectrum.

Conclusions

- The lettuce grown under blue heavy spectrum for longer time had the lowest biomass but increased anthocyanin content.
- Of lettuce with induced coloration; High light treatment had higher biomass and higher anthocyanin content than High blue treated.
- These results indicated that there are several ways to induce coloration of lettuce.
- Growers have the choice to adapt the best method that is suitable to their growing environments and growing style.

Methods

LIGHT SPECTRA:

Three different light treatments were used for growing lettuce, presented in Table 1. All lettuces were grown under the Production treatment for the main part of the growth. At the end of production (EOP) the lettuces were finished with either the High blue treatment for 5 or 11 days, with the High Light Production treatment for 2 days or kept in the Production treatment.

The photoperiod was 18 hours (8:00-2:00).

PLANTS & GROWTH CONDITIONS:

Lettuce, variety Rouxai RZ were seeded one plant per pot and germinated for 5 days. The seeds were sown in pots with soil and vermiculite mix germinated under SIERA light bar propagation light for 24 h per day. After germination, the lettuce were placed in growth units inside the Heliospectra Plant Lab. The growth units are a trolley where each shelf is 125 x 55 cm (0,69 m²), with 3 lightbars per level (cc 20 cm) with different distance of cm lightbar to shelves, to give similar PPFD. All crops were fertilized with PlantProd 20-20-20 Ca+Mg, from day going into units. Set points for the room temperature were 23°C/19°C day/night and relative humidity was set to 60 %.

	Production	High Blue	High Light Production
Blue (of PFD)	13 %	35 %	13 %
Green (of PFD)	13 %	15 %	13 %
Red (of PFD)	67 %	47%	67 %
Far-red (of PFD)	6%	2%	6%
Red:Far-red ratio	11:1	20:1	11:1
Average PPFD (μmol/m ² /s)	223	220	450

Table 1. Spectral distribution (400 – 800 nm) and light intensity for all light treatments.

DATA COLLECTION:

After 25 days 5 pots from each light treatment were collected and measured. The head size (diameter) was measured in cm. Fresh weight was taken in grams. The anthocyanin was measured using a Dualex leafclip sensor (ForceA) as relative absorbance in the range 0 to 1.5

Results

There was visible difference in color between Production and High Blue treated plants. High Light had the darkest red color. The longer the plants had been growing under High blue the more compact plant but the more color. Production was the palest in red color but largest of all the lettuce.

These results indicated that there are several ways to induce coloration of lettuce. The right lighting strategies provides the grower the possibility of higher yield and more coloration of the lettuce.

Averages	Fresh weight (g)	Head Size (cm)	Anthocyanin
Production	112.0 (±1.4)	26.5 (±0.5)	0.38
High Blue EOP 5 days	96.3 (±9.8)	-	0.59
High Blue EOP 11 days	84.3 (±9.9)	23.0 (±0.3)	0.69
High Light EOP 2 days	104.1 (±6.0)	25.4 (±0.4)	0.83

Table 2. Average plant size, weight and anthocyanin content for all crop.

Lettuce : comparing the size and coloration of the light treatments.



Figure 1. Size of lettuce head at end of experiment.



Figure 2. Coloration of lettuce head at end of experiment.

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