

***Brassica rapa* growth affected by different light sources...**

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Background

The various effects of different types of light is interesting when in correlation to plant height, first leaf length, and color.

Three principal characteristics of light affect plant growth: **quantity**, **quality**, and **duration**.

Heat stress disturbs cellular homeostasis and causes visible growth inhibition of shoots and roots, severe stunt in growth and development, and even death.



Objective

In this experiment, *Brassica rapa* was observed when affected by three different types of light: growth lamp, fluorescent, or incandescent, in order to test the **hypothesis** that the growth lamp will produce taller plants, larger first leaves, and a healthier color.



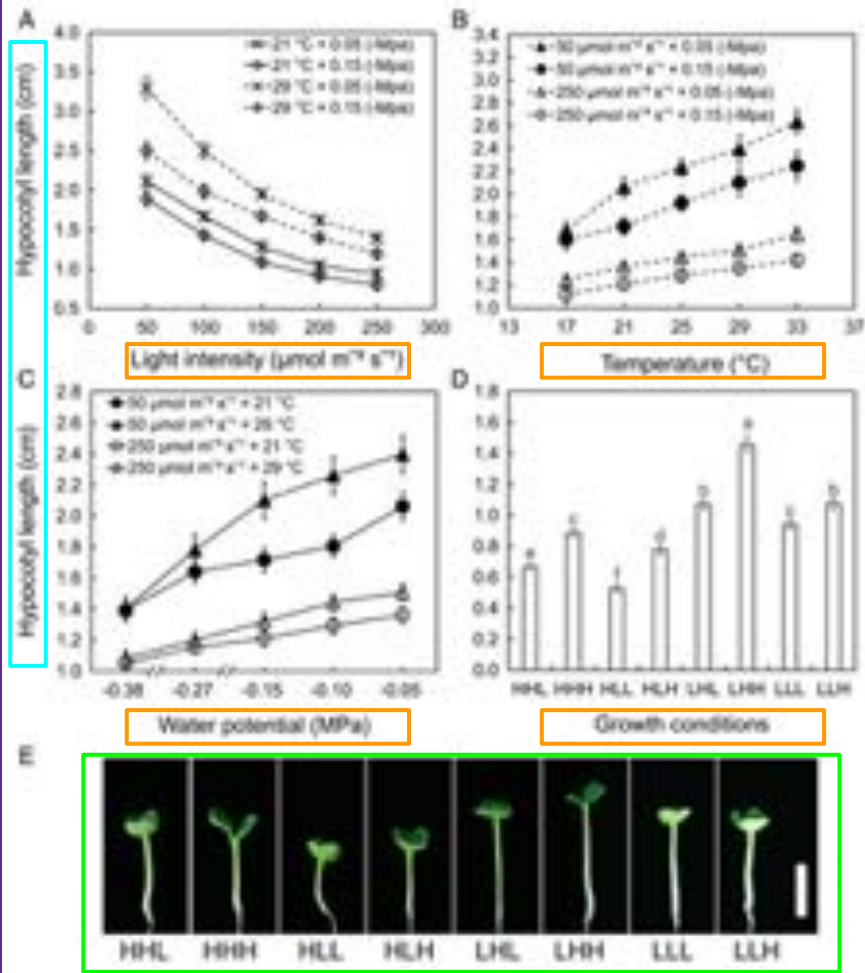


Fig. 2. The influence of light intensity, temperature and water potential on hypocotyl elongation in *B. rapa*. (A) High light represses hypocotyl elongation. (B) Hypocotyl elongates increasingly as the temperature increases. (C) Hypocotyl elongates increasingly as the water potential increases. (D) Hypocotyl length of *B. rapa* seedlings under the combined effects of light intensity, temperature and water potential for 48h. The data in A-D represent the means of three replicates \pm SD. Small letters in D represent significant difference among the seedlings under different conditions ($P < 0.05$). (E) Photograph of *B. rapa* seedlings under the combined effects of light intensity, temperature and water potential for 40h. Scale bar represents 1 cm.

In this study by Hongfei, Wang *Brassica rapa* was used to analyze **hypocotyl length** which is the the part of the stem of an embryo plant beneath the stalks of the seed leaves or cotyledons and directly above the root. They tested **light intensity, temperature, growth conditions, and water potential.**

This study used different types of light such as **fluorescent** and **incandescent** to see how the primordium formation was affected. Primordium formation is the rate that a plant will form new leaves.

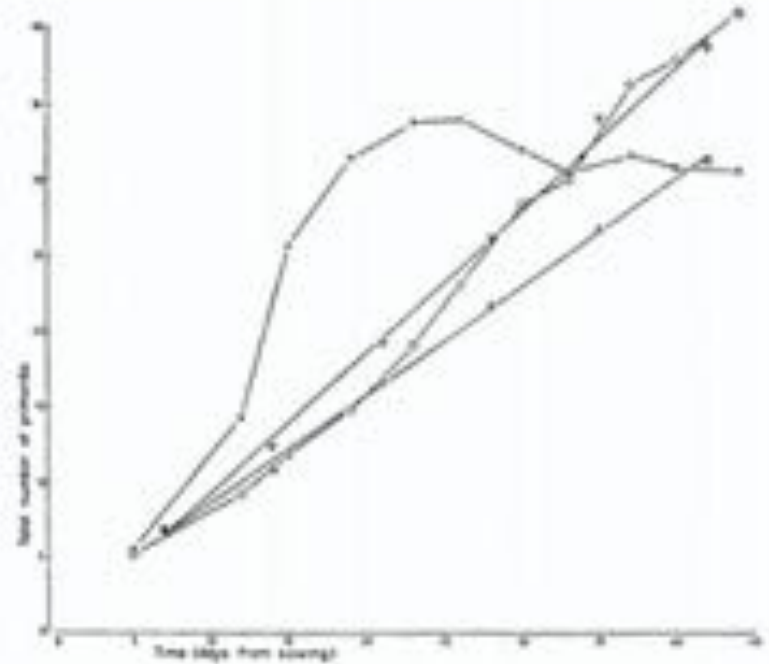


FIG. 1.—Effect of day length and light source on rate of primordium formation on main axis of Pilsener barley. Δ, 10-hr daylength, fluorescent light (1.92 cal/cm²/hr); ○, 10-hr daylength, fluorescent light supplemented with incandescent (22.74 cal/cm²/hr); ▽, 16-hr daylength, fluorescent light; ×, 16-hr daylength, fluorescent light supplemented with incandescent.

Table 1. Effect of light regime and culture on plant height, number of flowers, leaf area, and total dry weight of *Adiantum*.

Culture	Plant ht (cm)			No. flowers			No. axillary shoots			Leaf area (cm ²)			Total dry wt (mg)		
	Light regime														
	F	I	CF	F	I	CF	F	I	CF	F	I	CF	F	I	CF
Flaxweed	9.8	18.7	11.3	7.2	8.8	9.9	1.7	1.3	1.9	124	120	86	108	119	108
Woods	10.2	16.5	12.5	7.1	7.9	8.8	1.1	1.4	0.9	179	256	229	908	1058	1215
Roundleaf	20.0	28.1	21.9	17.8	28.4	20.4	1.8	4.3	1.5	325	342	274	1763	2183	1971
var at P = 0.05		8.9			11.0			1.0			30.1			371	

*Values are means of two temperature regimes and 18 plants per culture.

In this study by J.C. Vlahos they studied the effects of **incandescent light** (I) or **fluorescent compact gas-discharge lamps** (CF) vs. a basic irradiance ($96 \mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$ for 12 h) with **fluorescent** (F) light on various types of plants.

- ★ Plant height
- ★ # of flowers
- ★ # of axillary shoots
- ★ Leaf area
- ★ Total dry weight

Methods

★ The lights were kept on 24/7 for three weeks

1. Set up the lighting systems

- Growth, Fluorescent and Incandescent

2. Three reservoirs were filled with water and three pieces of water mat were cut out



3. The mats were thoroughly saturated

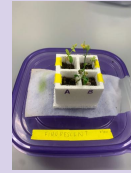
- Half was placed in reservoir



4. Lids snapped on and other half of the water mat was placed on top



Methods continued



5. In a styrofoam container, a wick was placed in each cell

- Wick was pulled halfway through the hole



6. Soil was moistened slightly and placed into each cell about halfway



7. Three fertilizer pellets were added to each cell

- Soil was added on top

8. Shallow depressions were made on top of each cell

- Three seeds were added and more soil was placed on top



9. Cells were watered gently with a pipet



10. Styrofoam containers were placed on top of each reservoir on the wet map

Methods continued

11. Cells were labeled and the reservoirs were placed under different light systems

12. Plants were thinned after 4 to 5 days of growth

- Extra seedlings were transplanted to other cells

13. Each week, 3 variables were measured: height of plants, length of the first leaf and color of leaves



Results

Figure 1. Color of a *Brassica rapa* Plant Leaves After Being Exposed to Different Light Sources.

During the three weeks of growth, the plant under the growth light produced all green leaves. The first week of growth one of the four plants did not grow, and an extra from a different cell was transplanted to the empty cell after one week. The plant under the fluorescent light produced other colors after two weeks of growth such as purple and yellow.

	Growth	Fluorescent	Incandescent
Week 1	3/3 Green	4/4 Green	N/A
Week 2	4/4 Green	3/4 Green, 1/4 Purple	N/A
Week 3	4/4 Green	2/4 Green, 2/4 Yellow/Green	N/A

Results

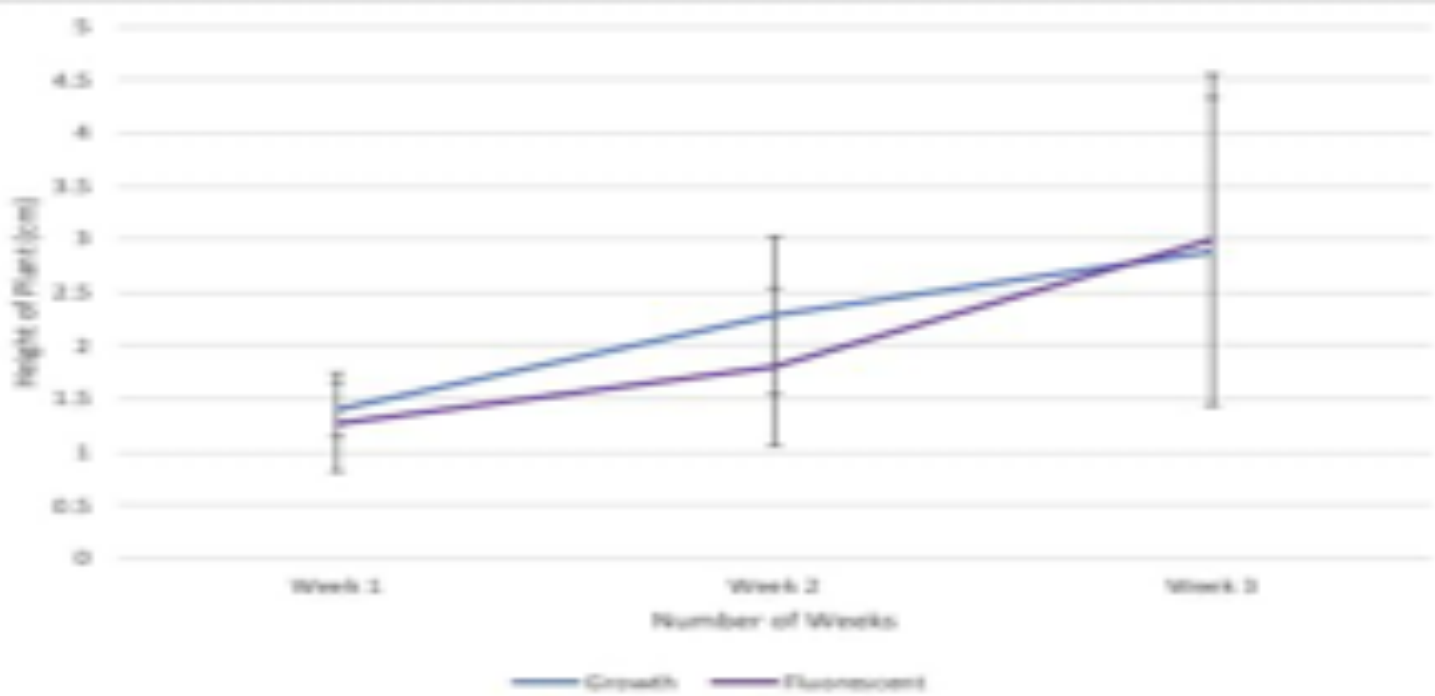


Figure 2. Height of *Brassica rapa* Plant After Being Exposed to Different Light Sources.

The height of the plants was measured from the soil (base of the plant) to where the stem of the plant stopped which was below the first leaf. The plant under the growth light grew faster and was taller than the plant under the fluorescent light. After week three, the plant under the fluorescent light grew taller than the plant under the growth light. The incandescent plant never grew. The error bars represent the high and low of the average.

Results

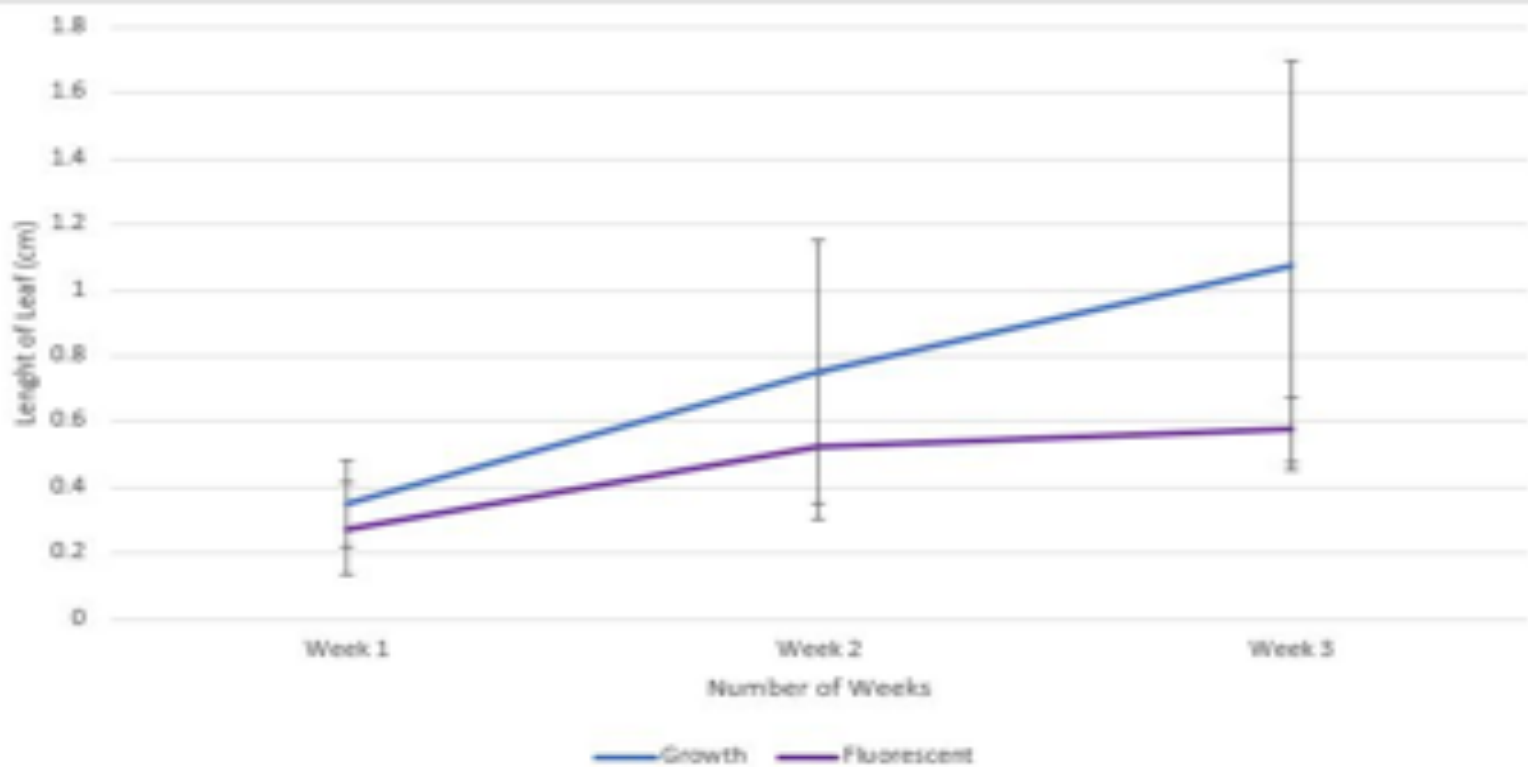


Figure 3. Length of First Leaf of a *Brassica rapa* Plant After Being Exposed to Different Light Sources.

The length of the leaves was measured from the base of the leaf to the tip of the leaf. Throughout the weeks, the growth light caused the leaves to grow faster and longer than the plant under the fluorescent light. The error bars represent the high and the low of the average.

Results



- Color
 - Growth: all green, all weeks
 - Fluorescent: all green week 1, green and one purple week 2, half green and half yellow week 3
- Height
 - Growth: fast growth first two weeks and slows for week 3
 - Fluorescent: slower growth first two weeks and picks up growth rate after week two*
 - *error bars overlap
- Leaf Length
 - Growth: fast and steady growth all three weeks*
 - Fluorescent: fast growth first two weeks and slows after week two
 - *error bars overlap

(Plant under the incandescent light did not grow enough to be measured or observed)

*= higher end result

Discussion

Incandescent light = too hot

Green → Purple (color) =

Photosynthesis decrease

Blue & Red (wavelength) = best for plant growth

Intensity of Light

- quality of light
- amount of light
- duration
- heat



Limitations

- Incandescent : N/A
- 1st week only 3 GL plants
- Determining based on 3 different variables

Hypothesis ✓

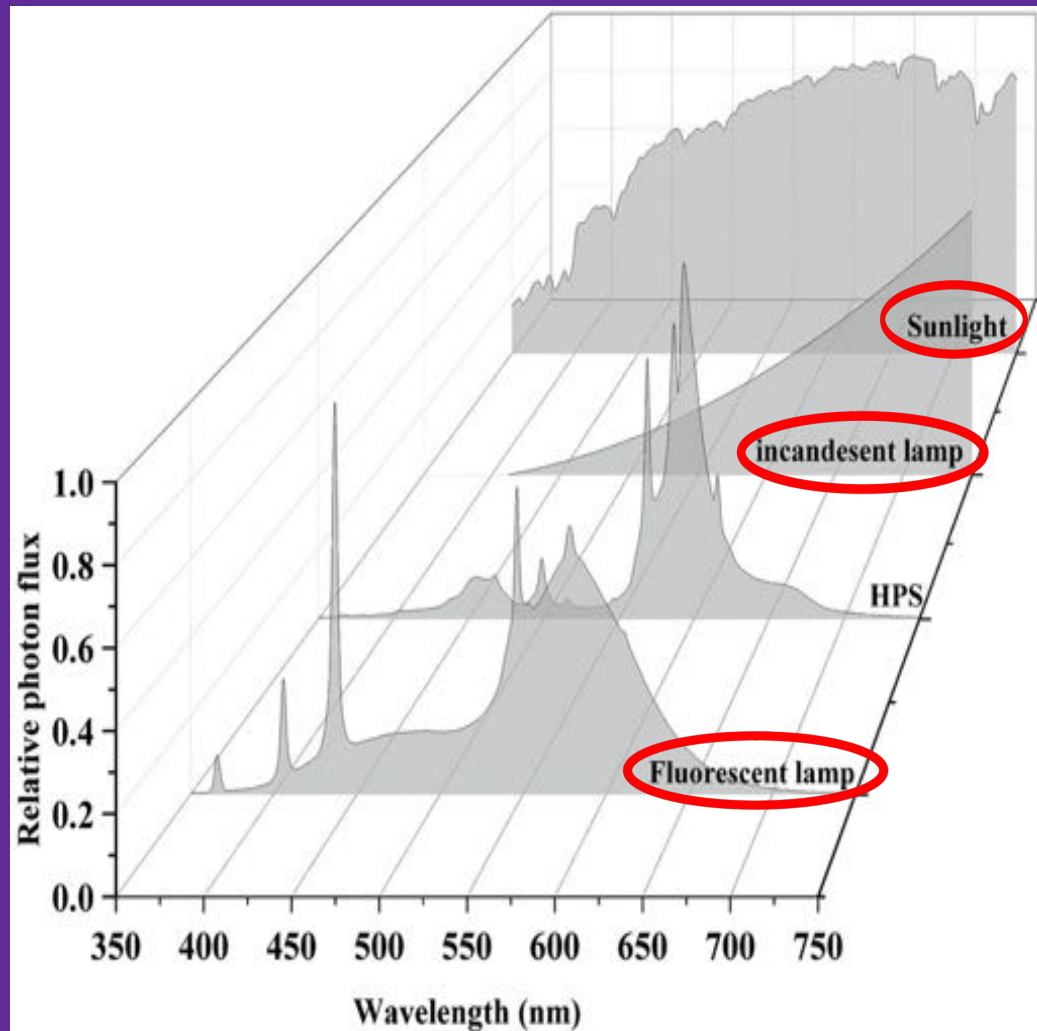
Growth Lamp: Leaf Length & Color

Fluorescent Light: Height

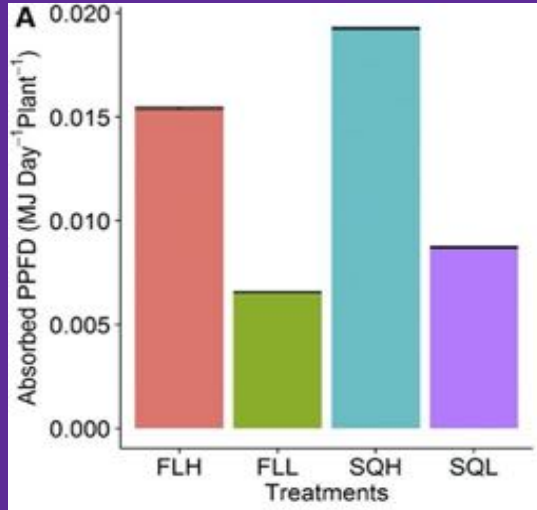
Quality

<400 nm (purple) = limited photosynthesis

Green can be created by absorption close to 400 nm and 800 nm (red and blue).



Quantity



FLH - Fluctuating High Light
FLL - Fluctuating Low Light
SQH - Square High Light
SQL - Square Low Light

Intensity + Exposure = Growth

Violet-Chabrand, Silvere. Et. Al.



TABLE III: AVERAGE
FINAL LENGTH OF
BRASSICA RAPA IN MM

T1: white light

T2: blue light

T3: green light

T4: yellow light

T5: red light

	T1	T2	T3	T4	T5
Plant 1	47	36.5	48	33	35
Plant 2	39	37	42	34	33
Plant 3	42	41	37	37	29
Plant 4	43	40	37.5	42	45
Plant 5	41	36	41	43	29
Total	212	190.5	205.5	189	171
Mean	42.4	38.1	41.1	37.8	34.2

Acero, Liwayway H.

Growth Lamp ~ Sunlight

fluorescent lighting 24 h/d
bud around day 12 (~ 2 weeks)

incandescent light
~5% electrical power → light
remaining → heat

Duration: 24 h/d



Gayral, Bruno
Wendell, Douglas L., Pickard, Dawn

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