

Assessing pH Growth Response of Hydroponic Kale

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Introduction

There is ongoing debate about whether it is necessary to control pH within in hydroponics. While some argue that a pH balanced around 6 is best for overall plant growth and nutrient uptake, others argue that pH might have minimal impacts. There are many efficiency benefits to allowing a larger pH range in plant growth.

Objective: To investigate the effects of controlling pH on hydroponic production of kale

Materials and Methods

Plant Materials:

Kale (*Brassica napus*) 'Red Russian'

Growing Environments:

- = Indoor vertical farm
- = Deep water culture hydroponic system
- = Air temperature: 22 °C
- = Nutrient solution: 150 ppm N
- = Lighting: 24-hour, PPFD of 220 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$

pH treatments:

| Treatment # | pH range |
|-------------|--------------------|
| 1 | Control |
| 2 | pH = 6.0 |
| 3 | pH = 6.0 \pm 0.5 |
| 4 | pH = 6.0 \pm 1.0 |
| 5 | pH = 6.0 \pm 1.5 |
| 6 | pH = 6.0 \pm 2.0 |

Materials and Methods

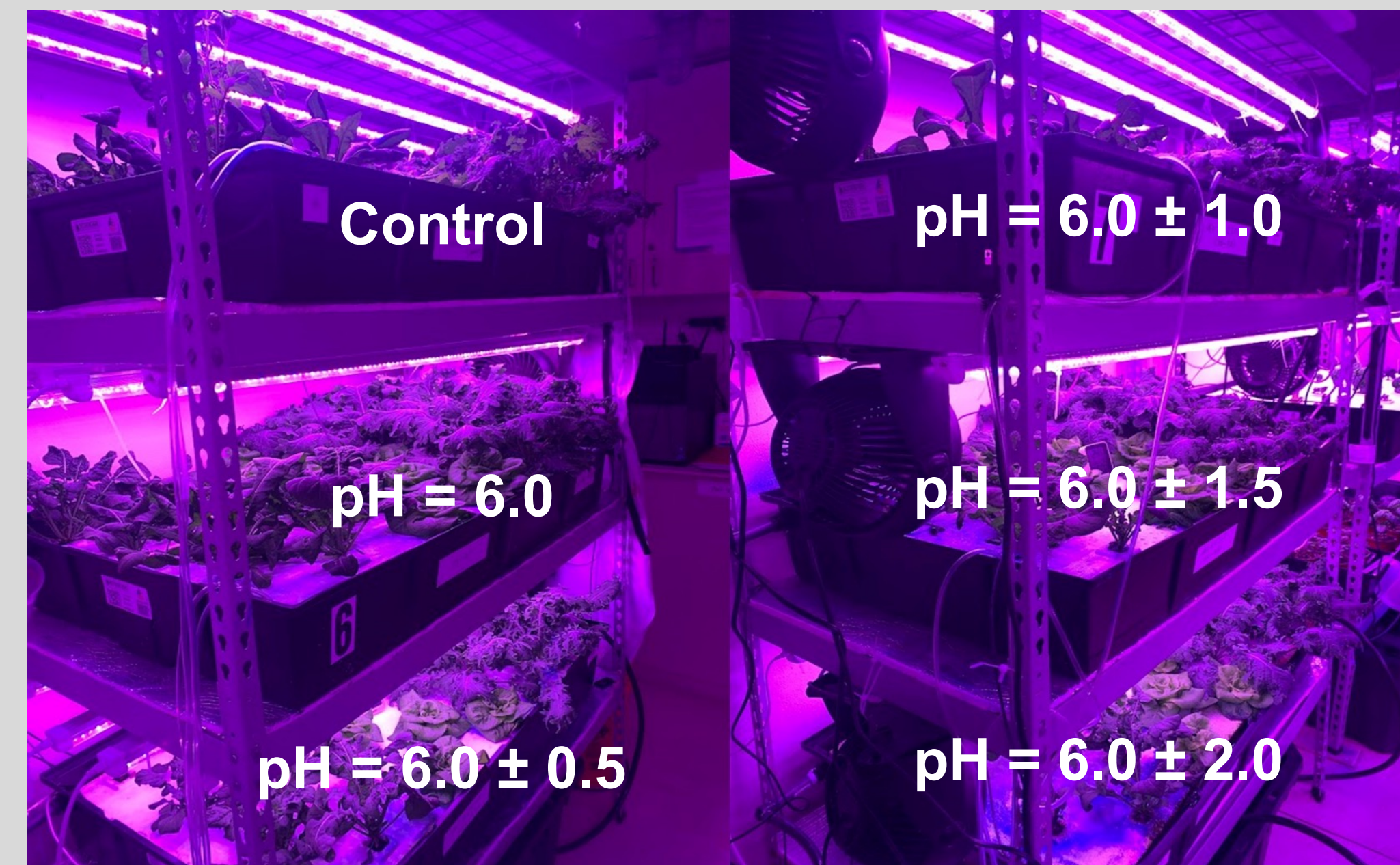


Fig. 1. The experimental set up for six pH treatments. Kale plants were grown in the deep water hydroponic culture systems. Each pH treatment was given in each growing reservoir.

Results

Table 2. The mean and standard deviation of daily monitored pH and electrical conductivity (EC) values of six pH treatments during a 31-day cultivation period after transplanting.

| Treatment # | pH | EC (mS/cm) |
|-------------|---------------|---------------|
| 1 | 7.3 \pm 0.5 | 1.6 \pm 0.1 |
| 2 | 6.0 \pm 0.0 | 1.3 \pm 0.2 |
| 3 | 6.3 \pm 0.2 | 1.4 \pm 0.1 |
| 4 | 6.6 \pm 0.3 | 1.5 \pm 0.1 |
| 5 | 6.9 \pm 0.4 | 1.5 \pm 0.1 |
| 6 | 7.1 \pm 0.4 | 1.6 \pm 0.1 |

Results



Fig. 2. Kale plants grown under six pH treatments for 31 days after transplanting.

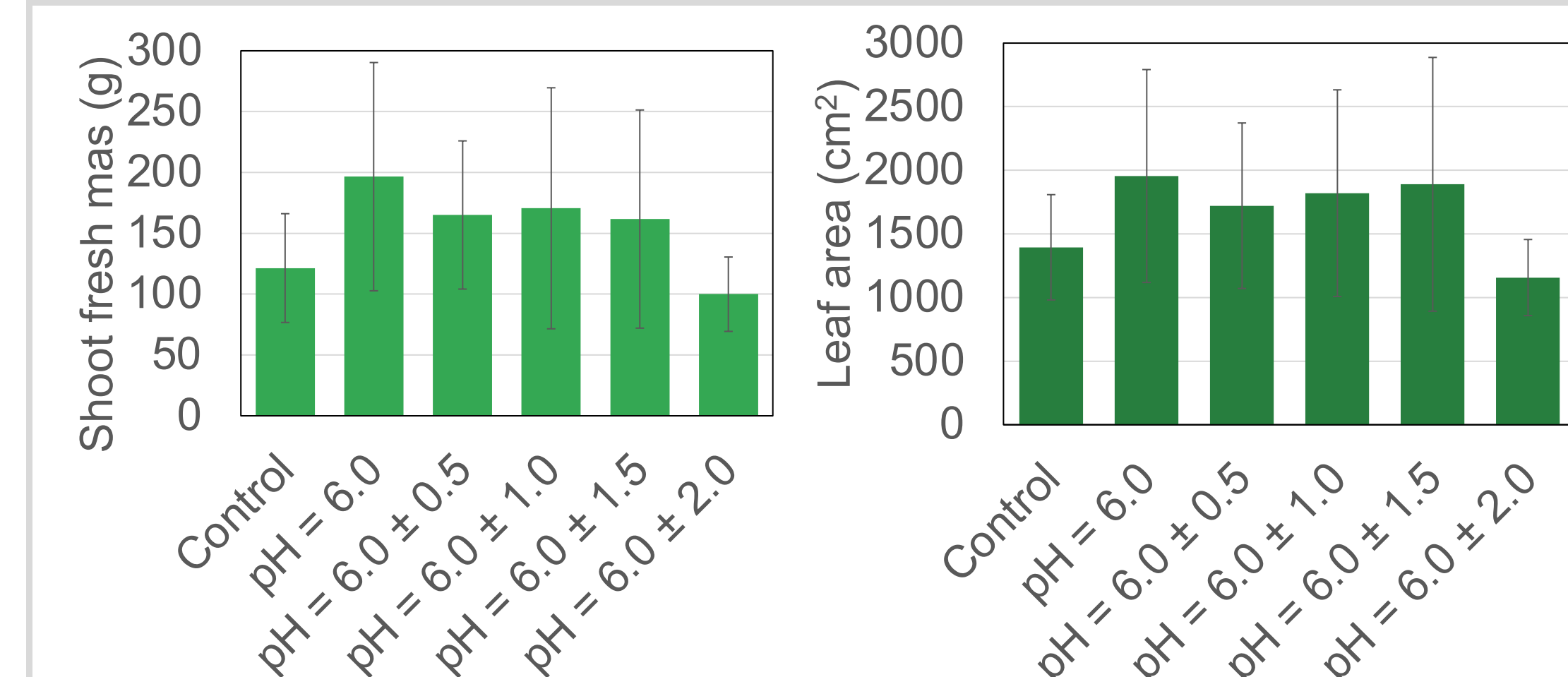


Fig. 3. Shoot fresh mass and leaf area of kale plants grown under six pH treatments for 31 days after transplanting. Data represents the mean and standard deviation of 10 plants per treatment.

Conclusions

- Lower EC was observed when the pH was kept more stable, indicating increased plant nutrient uptake.
- Kale had higher shoot fresh mass and leaf area when the pH was maintained at 6 within a range of \pm 1.5.

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