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Introduction

Strawberries are increasingly being grown in vertical farms using hydroponics, however, there is little information regarding the optimal ratios of nutrients for effective production in these conditions. Besides nitrogen, potassium is often the most used nutrient by plants for growth. Many photosynthetic processes that use nitrogen are limited by the availability of potassium. As a result, finding the optimal ratio between the two can greatly impact plant outcomes.

- **Objective:** To investigate the effects on strawberry growth and development by increasing the ratio of potassium to nitrogen in a hydroponic nutrient solution.
- **Hypothesis:** We postulated that increasing the ratio of potassium to nitrogen up to a certain threshold would improve plant growth and increase fruit size, yield, and quality in strawberry.

Materials and Methods

Plant Materials:

Strawberry (*Fragaria × ananassa*) 'Monterey' and 'San Andreas'

Growth Conditions:

- Indoor vertical farm
- Deep water culture hydroponic system
- Air temperature: 23°C
- Nutrient solution: N = 77 ppm, pH = 5.8

Lighting Conditions:

- Photon flux density (in $\mu\text{mol m}^{-2} \text{s}^{-1}$) from each LED lamp type: 80 $B_{(457 \text{ nm})}$ + 270 $R_{(660 \text{ nm})}$ + 50 $FR_{(732 \text{ nm})}$
- Photoperiod: 18-hour

Materials and Methods

Table 1. Ratio and concentration of potassium and nitrogen in each treatment.

Treatment (K:N Ratio)	Potassium (ppm)	Nitrogen (ppm)
1.5	116	77
2.5	193	77
3.5	270	77
4.5	347	77



Fig. 1. Growing tray and lighting conditions for strawberry plants.

Results

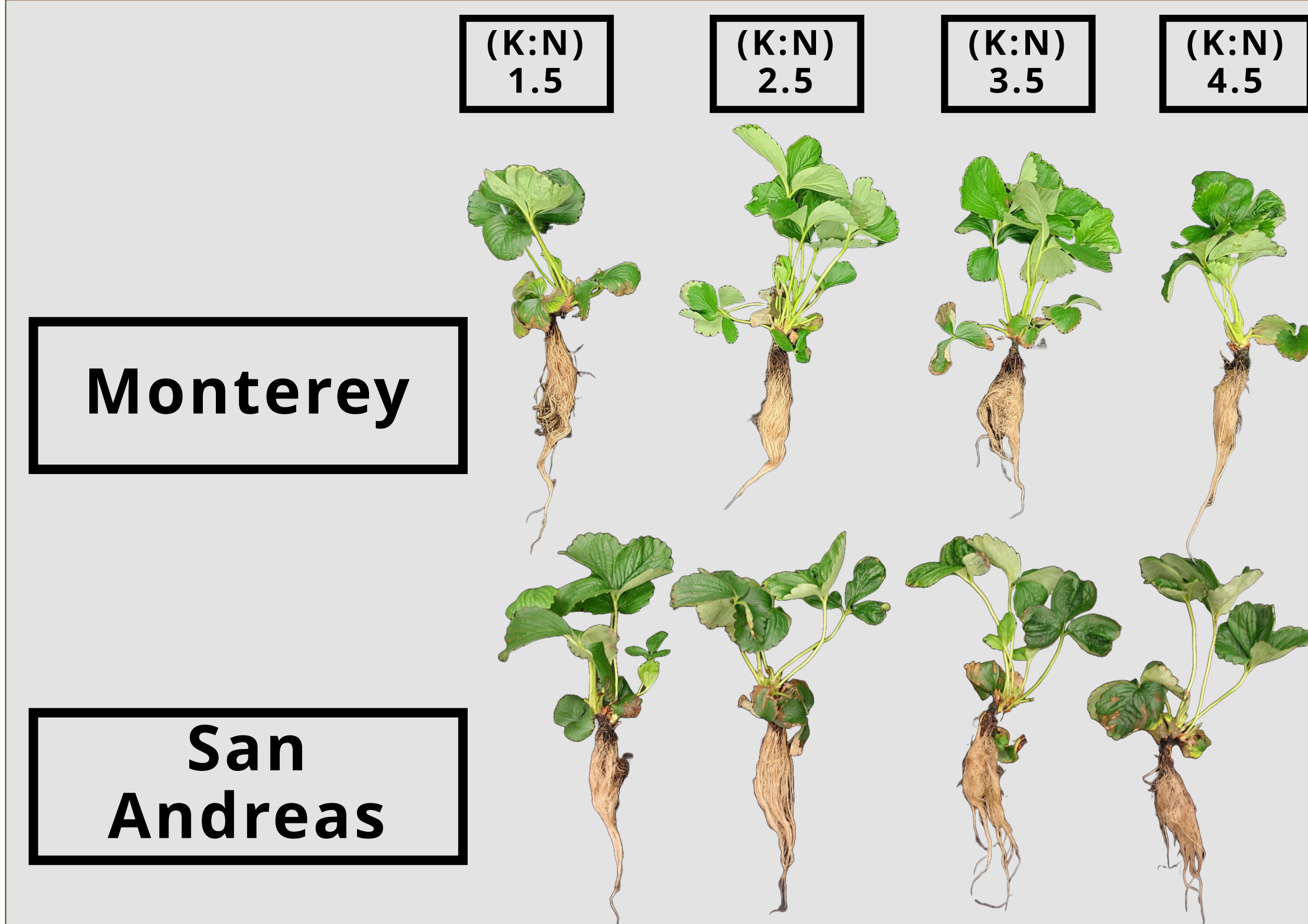


Fig. 2. Strawberry plants under each treatment after 5 weeks of growth.

Results

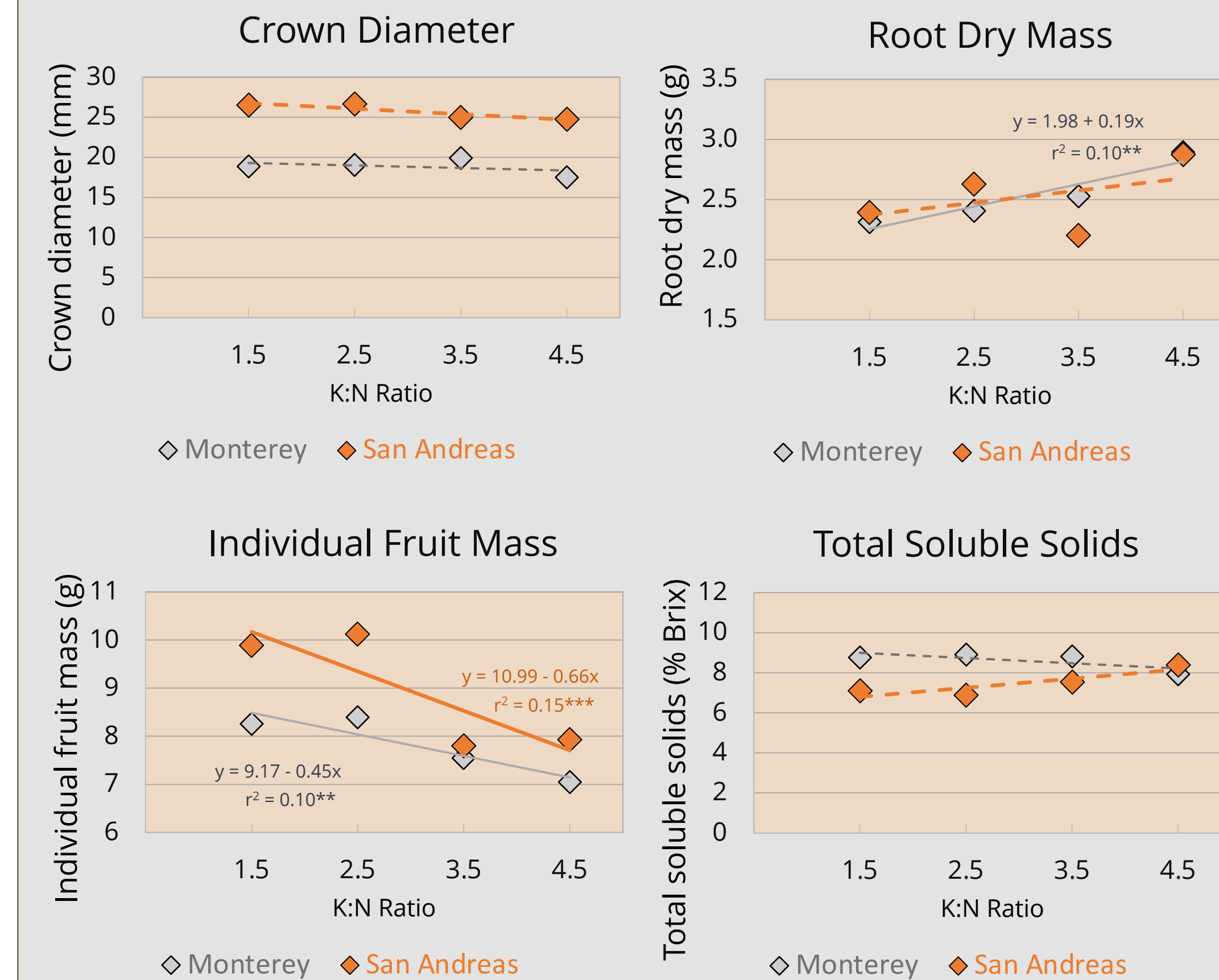


Fig. 3. Growth and fruiting characteristics of strawberries under treatments. Data represents the mean of two replications. Correlation coefficients (r^2) and regression equations are shown as a solid line when statistically significant and a dotted line when not significant. *, **, *** indicate significant at $P < 0.05$, 0.01 or 0.001, respectively.

Conclusions

Increasing the ratio of potassium to nitrogen had little effect on vegetative growth and fruit quality but decreased individual fruit size and mass in strawberry 'Monterey' and 'San Andreas'.

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