Strawberry Nutrient Management: Potassium Rates and AI-Driven Diagnosis

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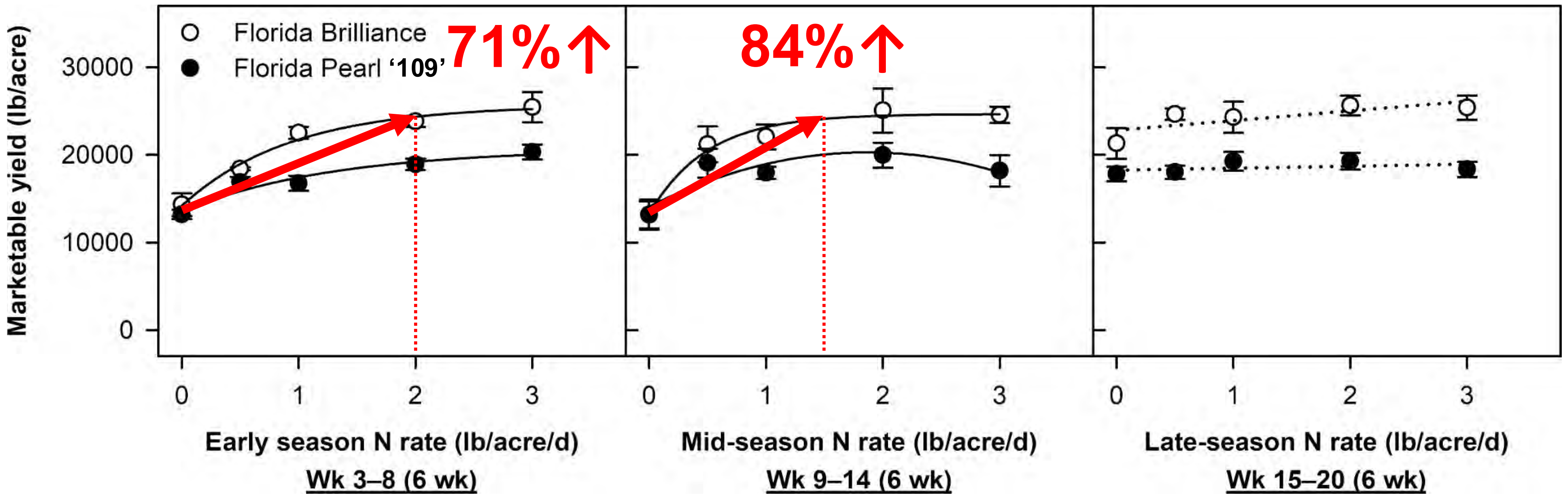
GULF COAST RESEARCH & EDUCATION CENTER

Presentation outline

Potassium rate

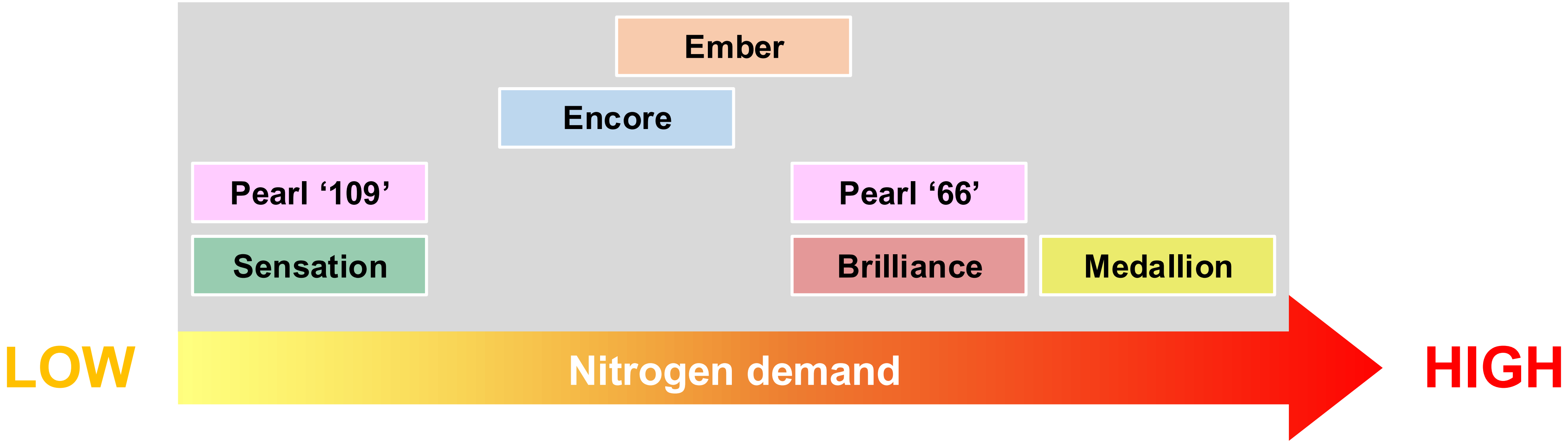
AI-Driven
Plant Diagnosis

Yield responses to N



Nitrogen recommendation

	Preplant	Daily N application rate (lb/acre/d)							Total
	(lb/acre)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	(lb/acre)
Old	0–40	0.6	0.6	0.6	0.6	0.75	0.75	0.6	150
New (2023)	**0**	**1.5–2.0**	**1.0–2.0**	**1.0–1.5**	**0.75–1.0**	**0.5–1.0**	**0.5–0.75**	**0.5–0.75**	**175**



Current potassium recommendation

1. **Preplant soil test**

2. **Determine the recommendation rate based on soil test results**

Mehlich-3 potassium	K_2O recommendation
Low (<35 ppm)	120–150 lb/acre
Medium (35–60 ppm)	100 lb/acre
High (>60 ppm)	0 lb/acre

3. **Determine the daily rate for each month**

If soil test K is low (<35 ppm)…

Preplant	Daily K_2O application rate (lb/acre/d)							Total
(lb/acre)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	(lb/acre)
0	0.6–0.8	0.6–0.8	0.6–0.8	0.6–0.8	0.6–0.8	0.6–0.8	0.6–0.8	150

Functions of potassium in plants

- K is present as K^+ ion in plants.
- Physiological roles
    - Stomatal opening and closure
    - Cell expansion and turgor maintenance
    - Sugar transport from source (leaves) to sink (fruit)
    - Activation of enzymes in sugar metabolism and photosynthesis

Potassium rate trials

Year

- 2024–25
- 2025–26

Cultivar

- Brilliance
- Medallion
- Ember
- Encor

Background soil K

- 19–28 ppm (low)

Trial 1

Early season (6 wk)

<table>
<tr><th rowspan="2">#</th><th colspan="10">Daily K_2O application rate (lb/acre/d)</th><th rowspan="2">Total K_2O (lb/acre)</th></tr>
<tr><th colspan="2">Oct</th><th colspan="2">Nov</th><th colspan="2">Dec</th><th colspan="2">Jan</th><th colspan="2">Feb</th></tr>
<tr><td>1</td><td rowspan="5">Sprinkler</td><td colspan="3">0.0</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td>84</td></tr>
<tr><td>2</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td>126</td></tr>
<tr><td>3</td><td colspan="3">2.0</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td>168</td></tr>
<tr><td>4</td><td colspan="3">3.0</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td>210</td></tr>
<tr><td>5</td><td colspan="3">4.0</td><td colspan="3">1.0</td><td colspan="3">1.0</td><td>252</td></tr>
</table>

Trial 2

Mid-season (6 wk)

<table>
<tr><th rowspan="2">#</th><th colspan="10">Daily K_2O application rate (lb/acre/d)</th><th rowspan="2">Total K_2O (lb/acre)</th></tr>
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</table>

Trial 3

Late season (6 wk)

<table>
<tr><th rowspan="2">#</th><th colspan="10">Daily K_2O application rate (lb/acre/d)</th><th rowspan="2">Total K_2O (lb/acre)</th></tr>
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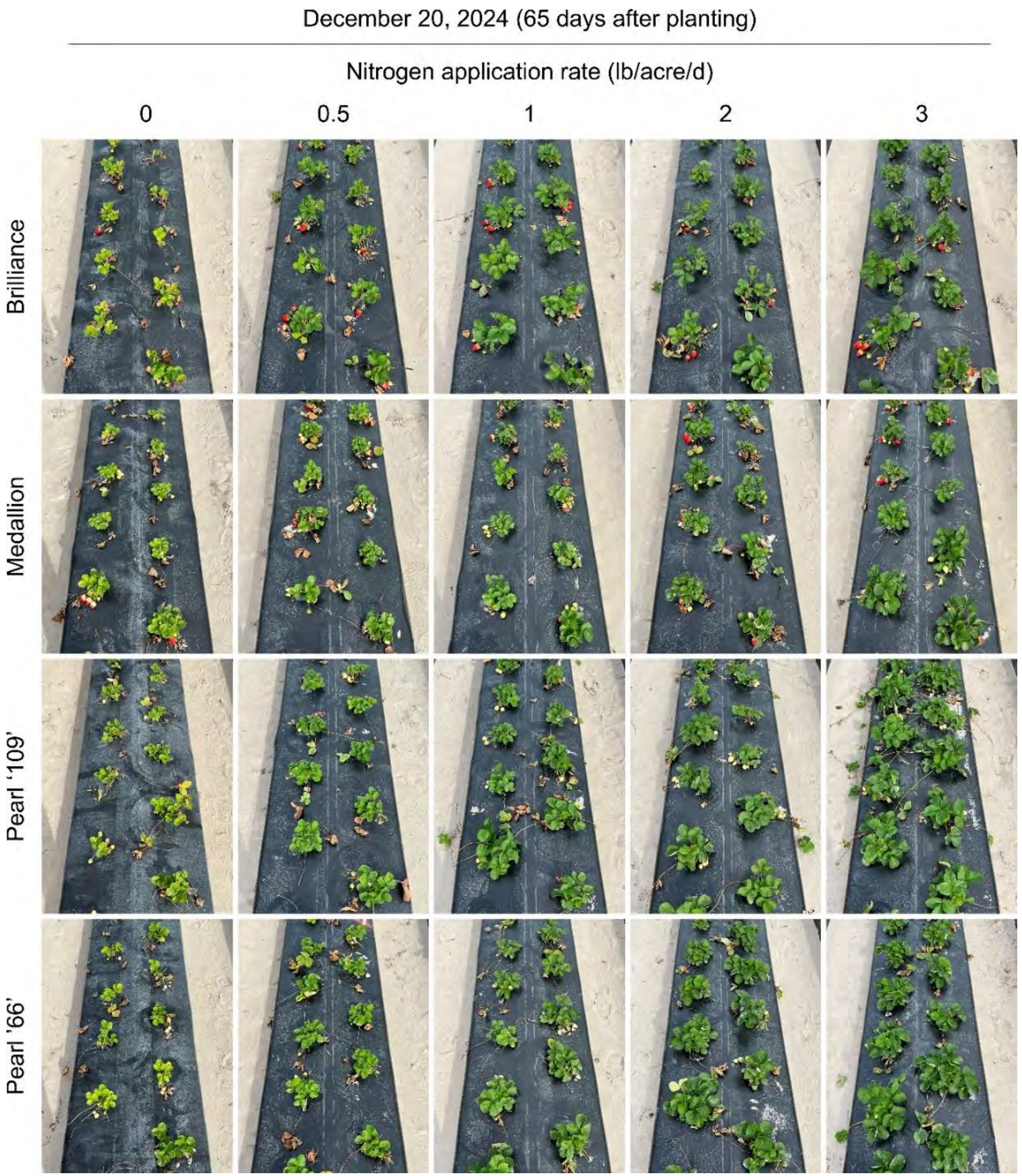
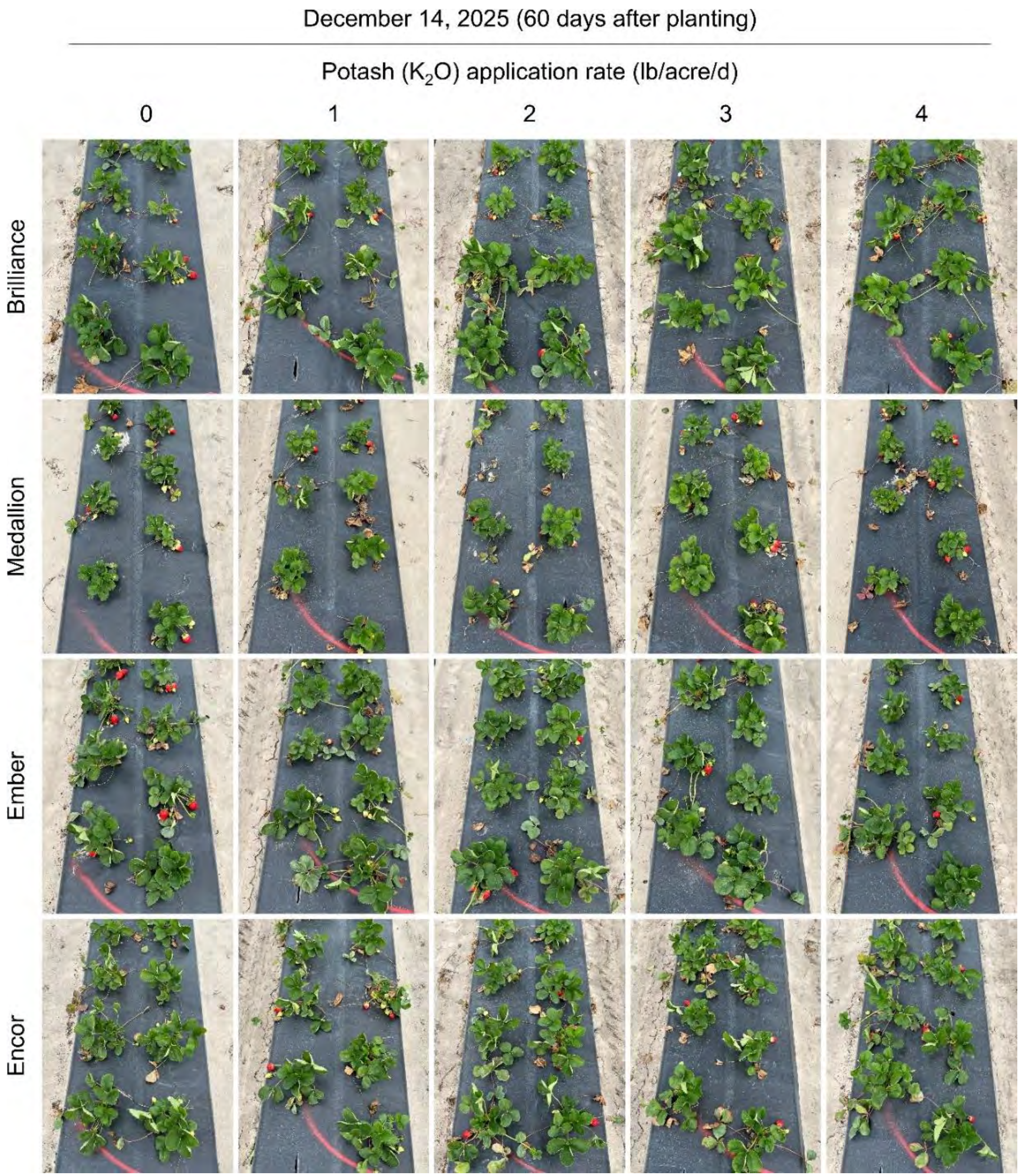
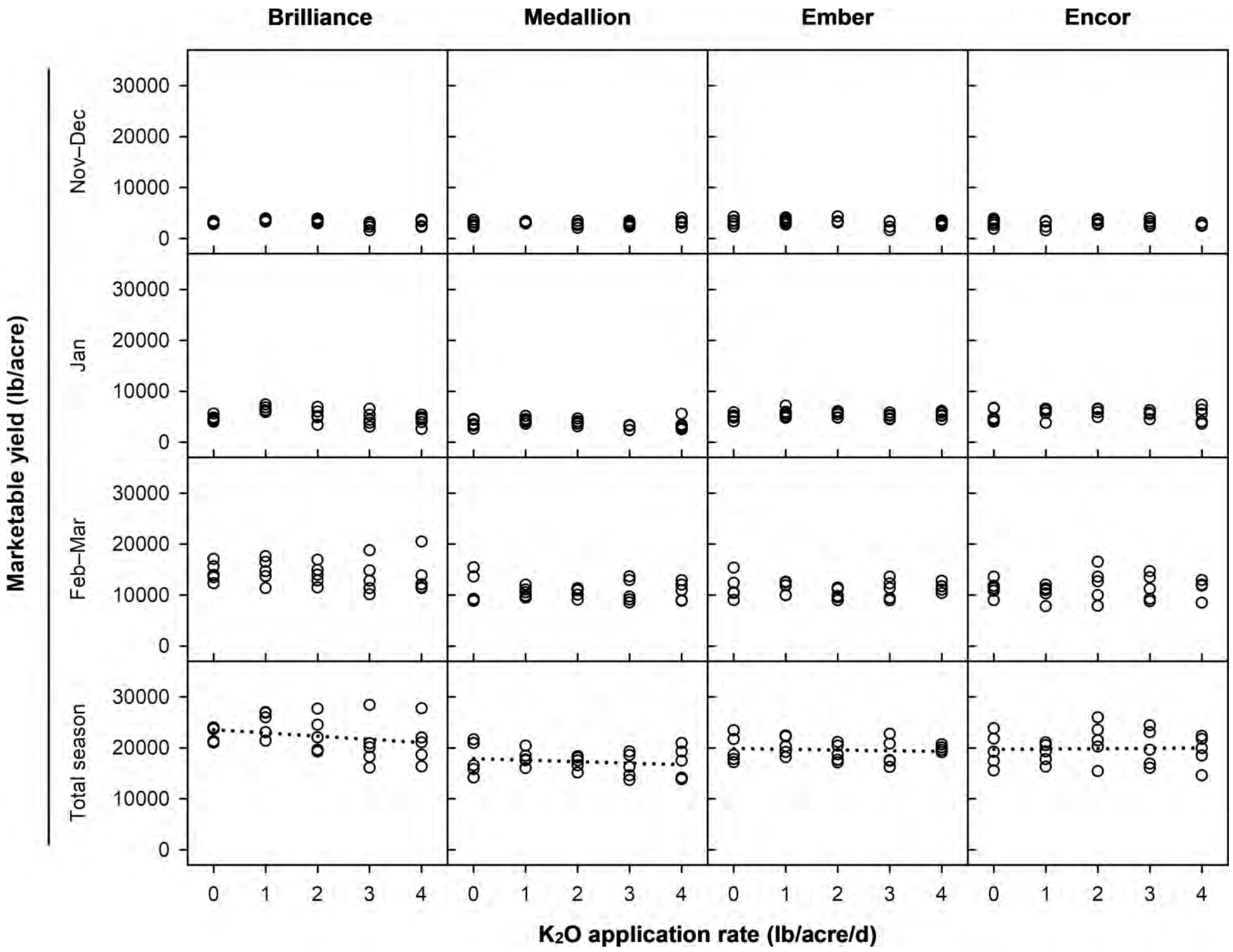
Nitrogen trial



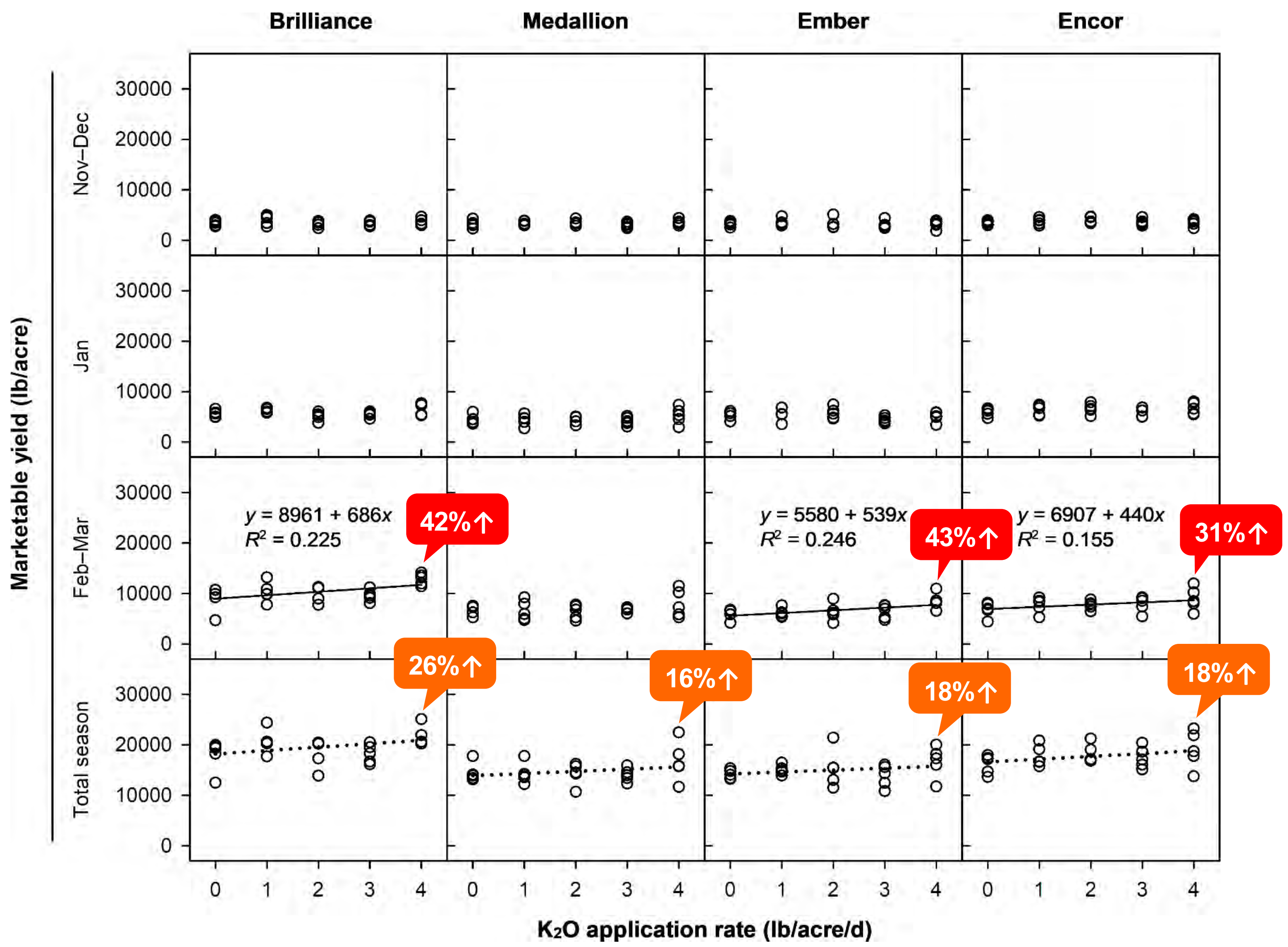
Potassium trial



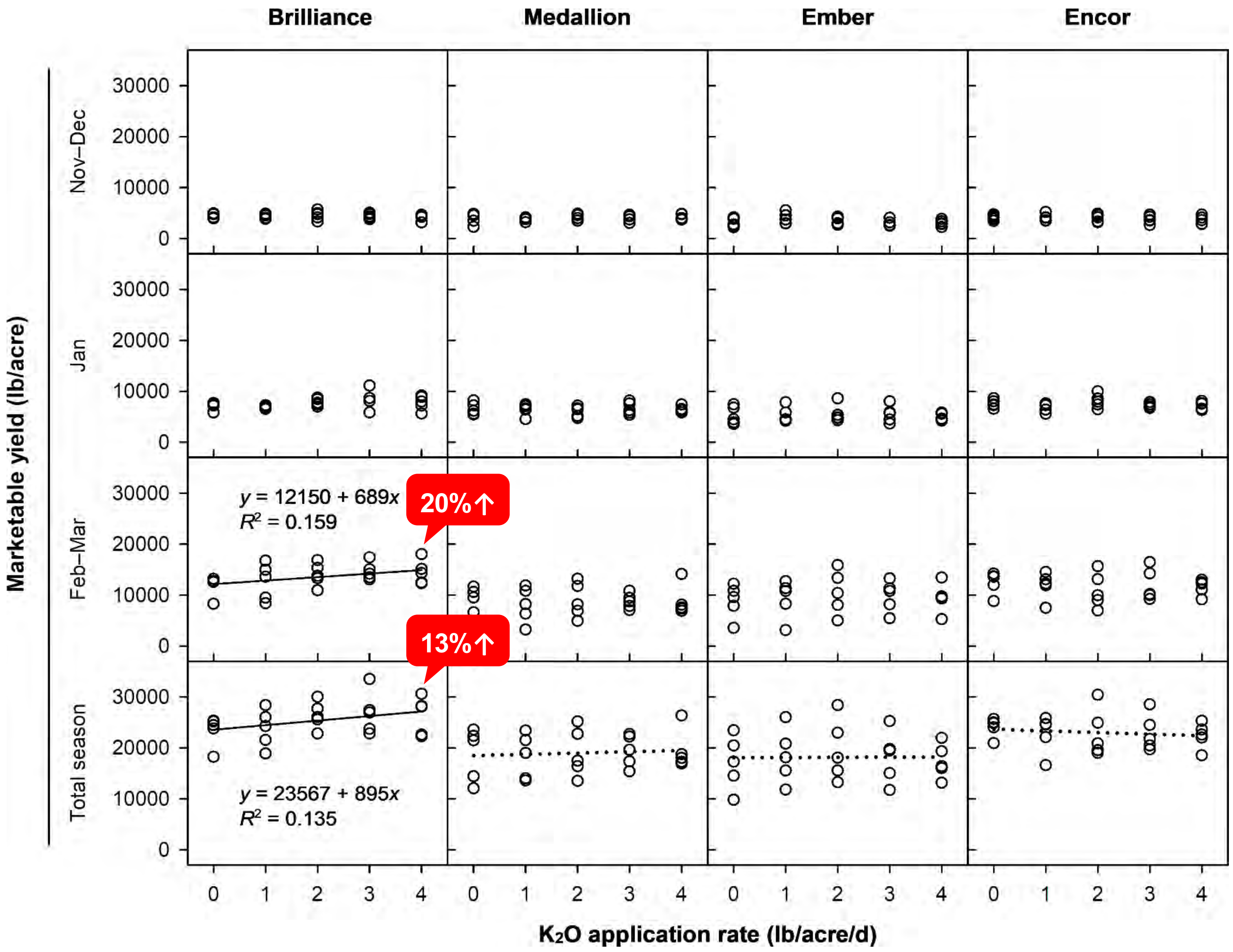
Year 1: Yield responses to early-season K



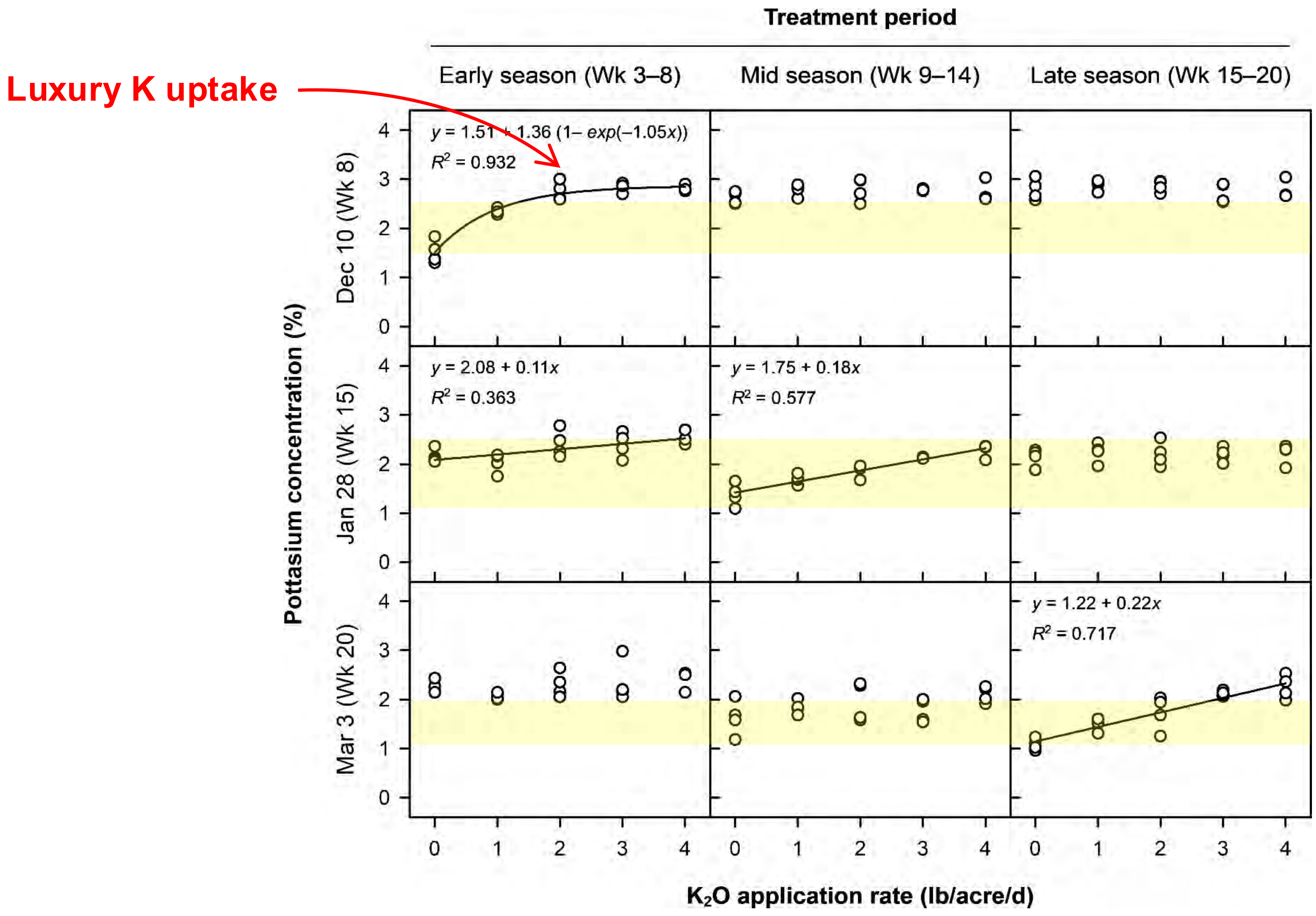
Year 1: Yield responses to mid-season K



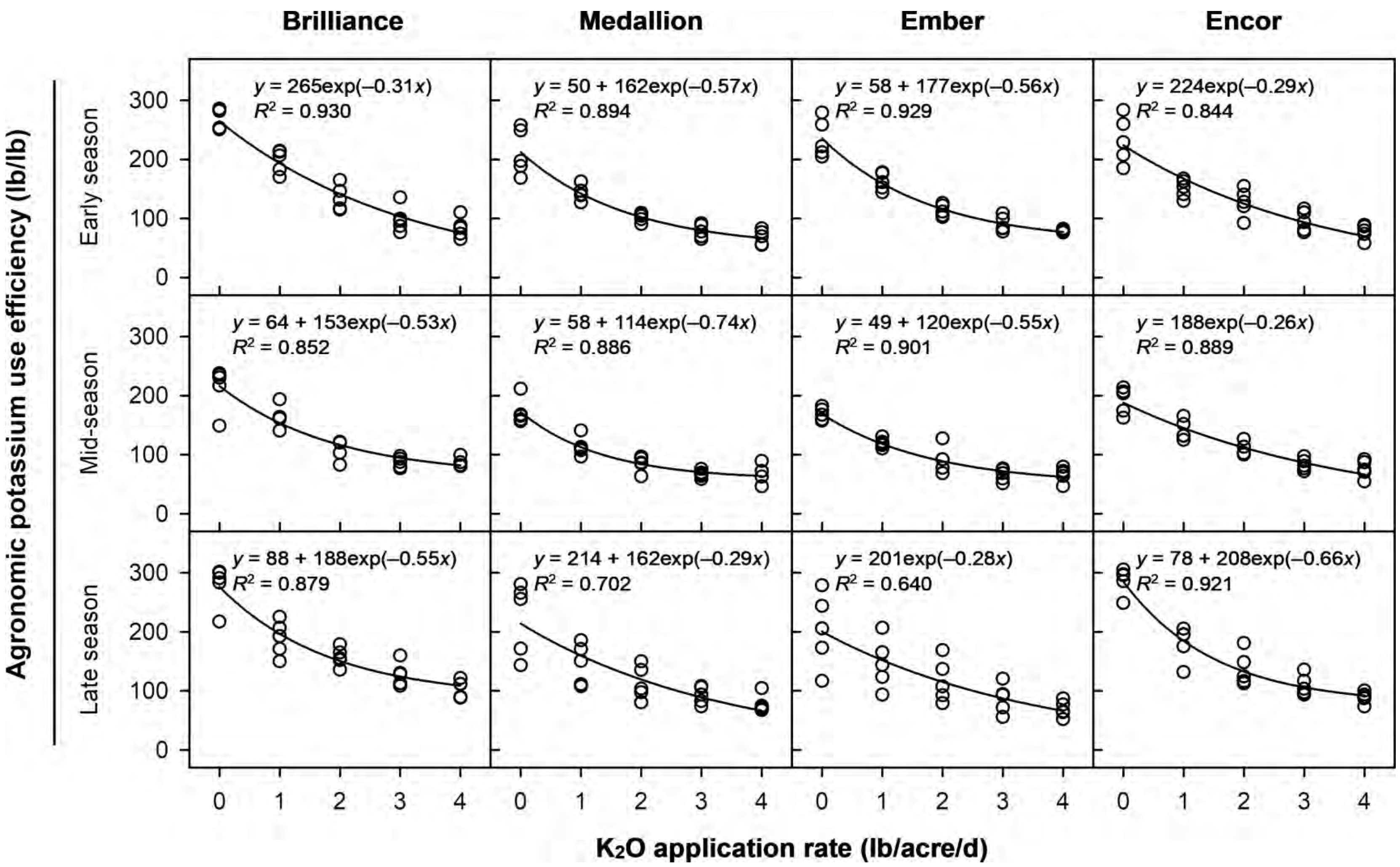
Year 1: Yield responses to late-season K



Year 1: Leaf K concentration (Brilliance)

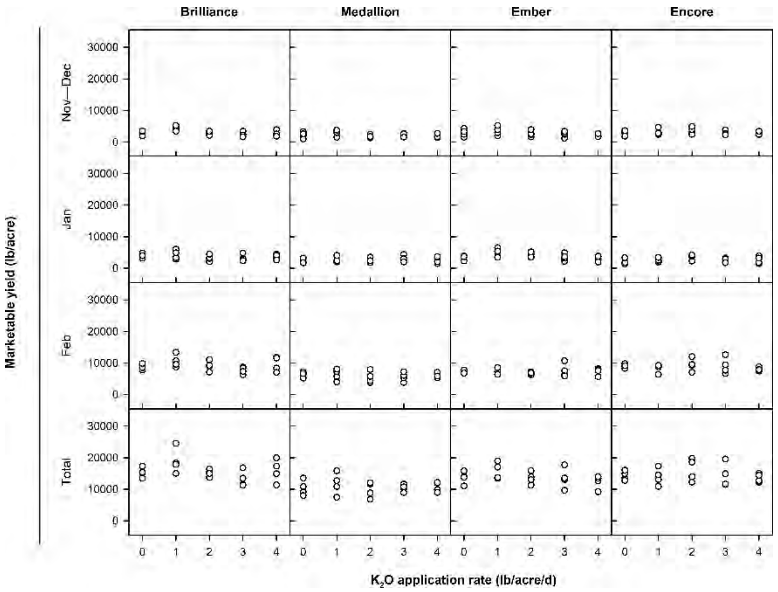


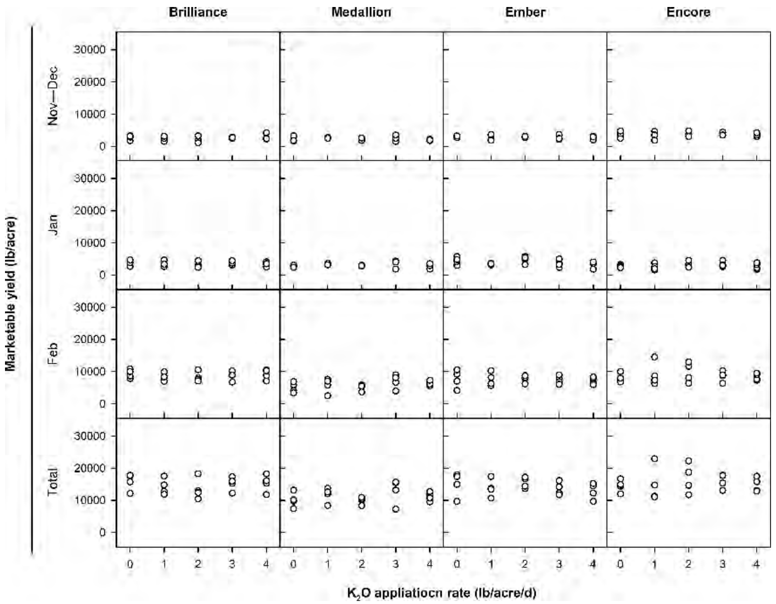
Year 1: Agronomic K use efficiency

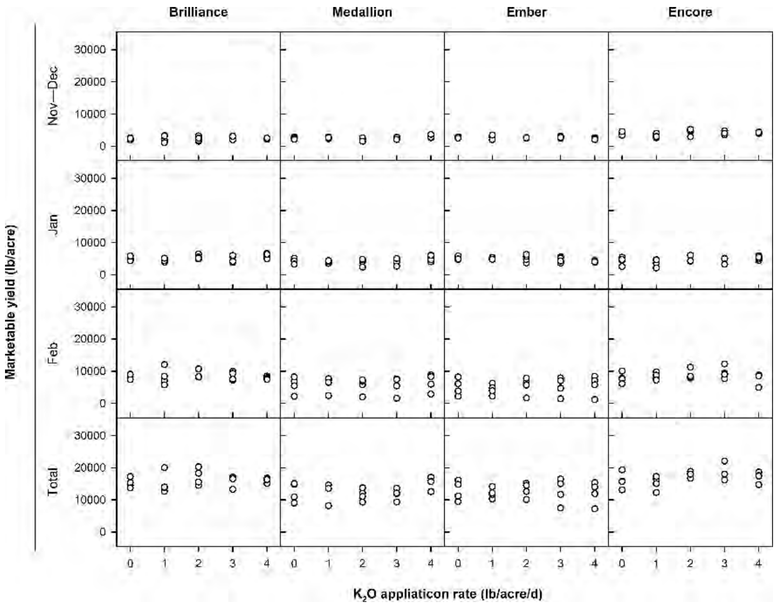


Year 2: Yield

No significant response to K rates in all trials







Summary

- Plants are more responsive to K applied during **mid- and late-growth stages**.
    - Vegetative growth = Sink K demand $\downarrow$
    - Fruit load $\uparrow$ = Sink K demand $\uparrow$
- Yield response to K rate: **Brilliance > Ember = Encor > Medallion**.
- K fertilization had **minimal effects on fruit size and Brix**.
- Yield gains by K fertilization are much smaller than N = **low agronomic K use efficiency**.
- **Adjust fertilizer formulation (N:K_2O ratio)** to match seasonal N and K demand.
    - Early season = 5 N : 1–2 K_2O
    - Mid to late season = 5 N : 6–8 K_2O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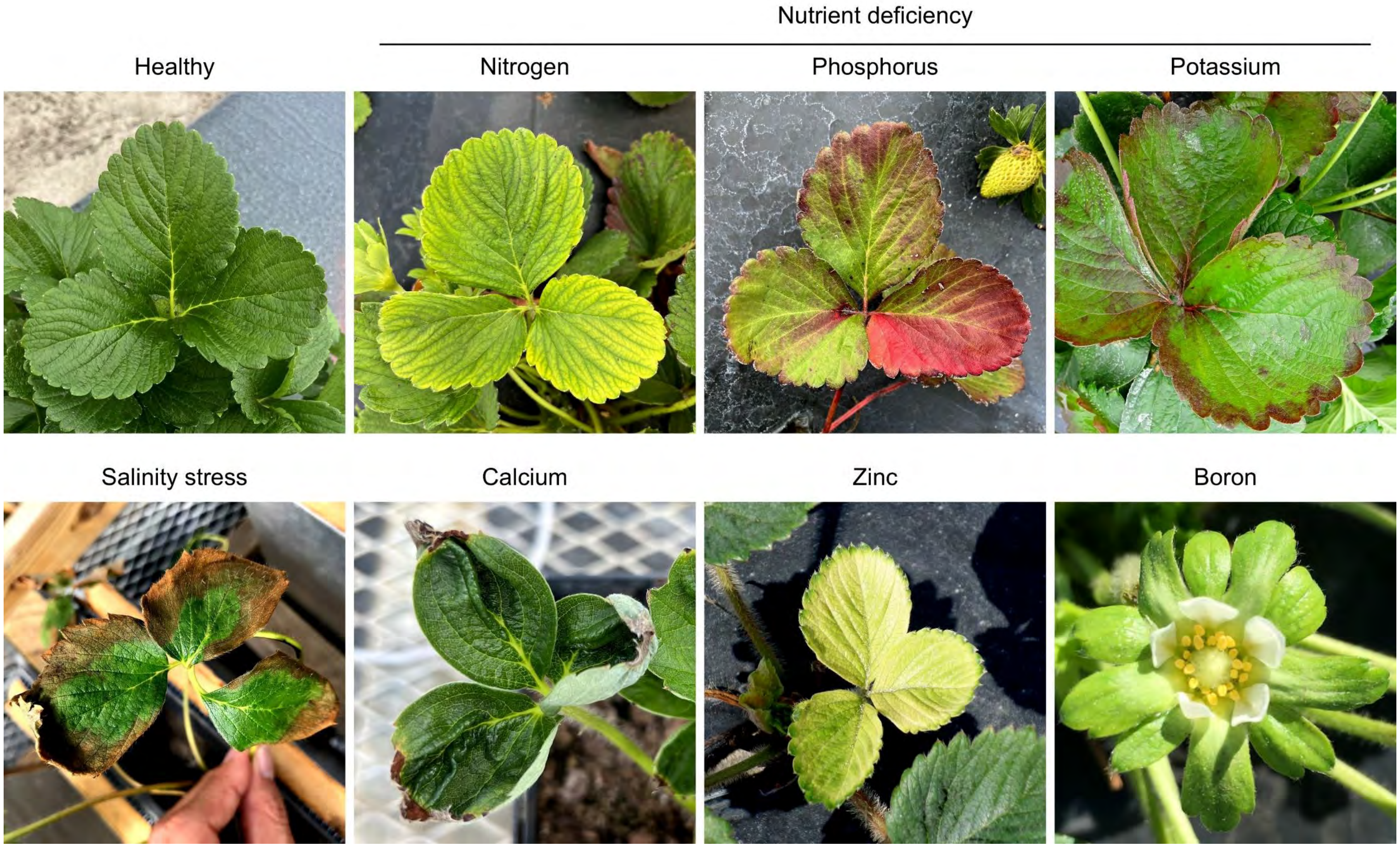
Presentation outline

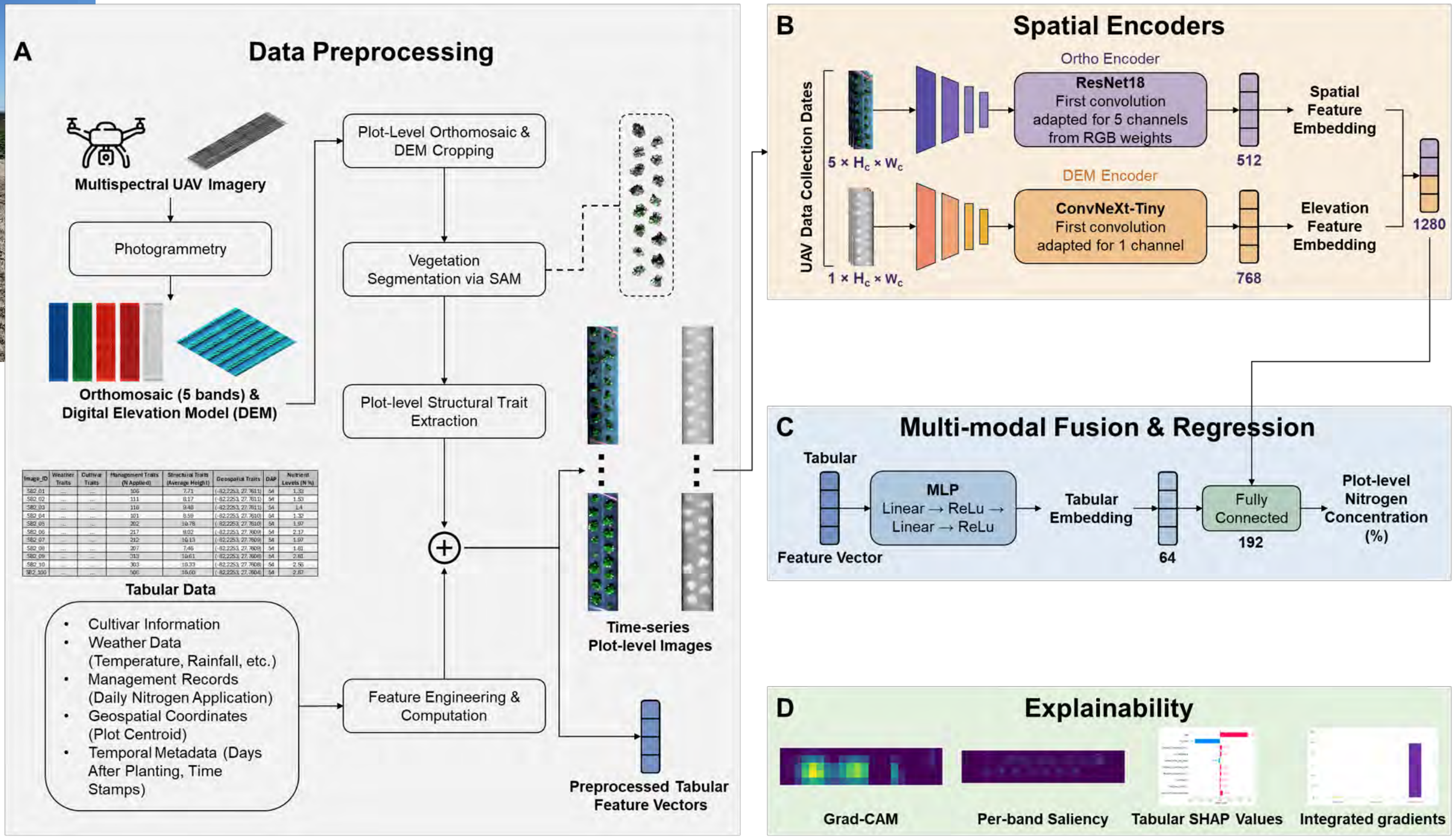
Potassium rate

AI-Driven
Plant Diagnosis

Nutrient deficiency symptoms

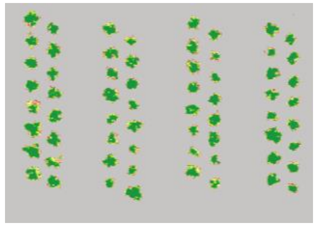


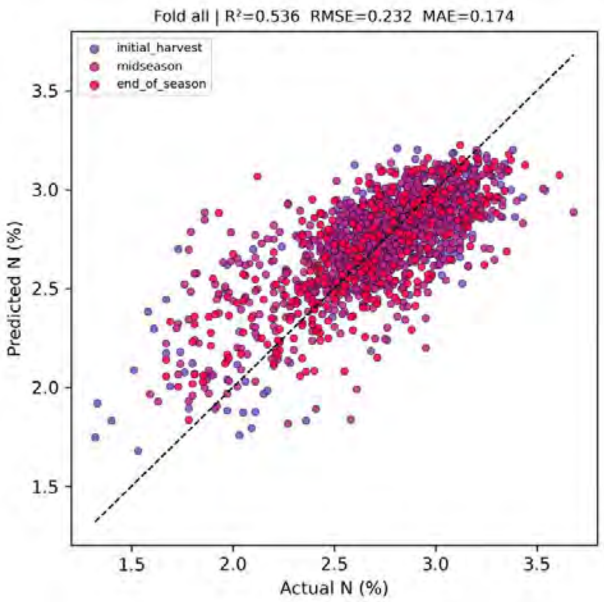
AI-based nutrient diagnosis pipeline



Kalara Dissanayake
PhD student

Leaf N estimation using spectral data



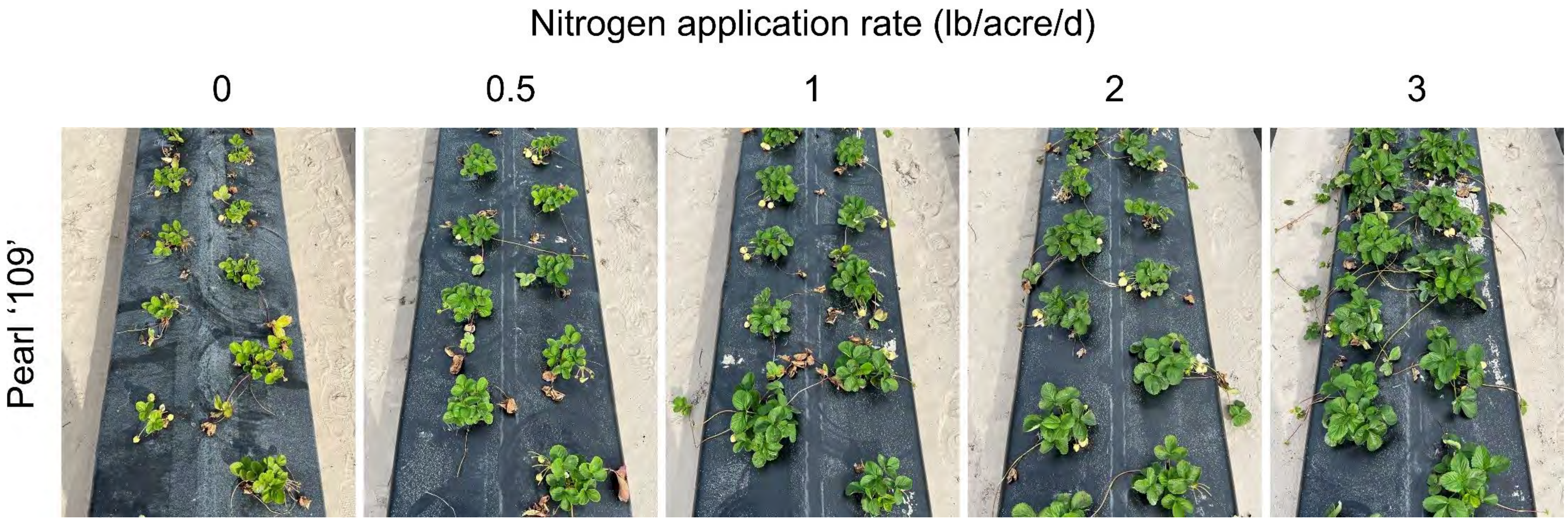


Season	RMSE	R^2
Early	0.24	0.63
Mid	0.23	0.45
Late	0.29	0.70

RMSE → Average prediction error = 0.23–0.29% N

R^2 → Variability in lab values explained by the model = 45–70%

Spectral vs. morphological symptoms



Chlorosis & Size reduction

Size reduction only

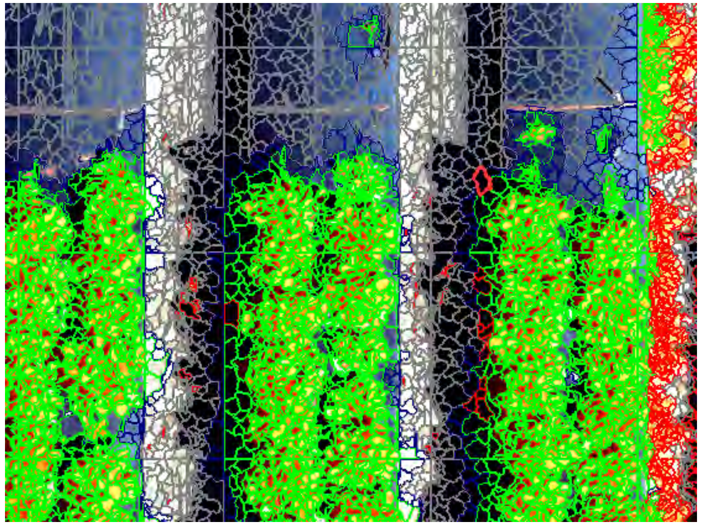
Within-canopy spectral patterns

Phosphorus deficiency

Zinc deficiency

Multi-scale data integration

Field level



Plant level

Metadata

- Weather
- Cultivar
- Days after planting
- Preplant soil test data
- Fertilization records

Multi-scale data integration to maximize the diagnosis accuracy

Acknowledgements

Funding

- Florida Strawberry Research and Education Foundation

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Horticultural Crop Physiology Lab

- Bill Wang (Biological Scientist II)
- Chris DelCastillo (Ag Assistant III)
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- Farhad Ghasemi (PhD Student)
- Kalara Dissanayake (PhD Student)
- Avninder Kaur (PhD Student)
- Álvaro Bautista (MS Student)
- Madelyn Graethouse (MS Student)

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