

Yuma Fall 2025 Romaine Trial

Yara – F3651 Rate Study

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Yuma County Cooperative Extension



THE UNIVERSITY OF ARIZONA

Cooperative Extension

Yuma County

Summary

- Preplant fertilizer trial evaluating effects of F3651 fertilizer coating on romaine.
- Drop plot 101 due to rupture in drip line.

Application

- 9/27 Product application
- 10/1 Seeding and wet date

Fertilization Plan

- 200# 11-52-0 MAP at preplant
- 12 GPA UAN 32
 - 10/21
 - 11/17
 - 12/9

Calculations

Product Rate:

Low Rate: 2 quarts per ton of dry fert = 1892.72 ml per 2000 lbs = 0.94636 ml / 1 lb

High Rate: 3 quarts per ton of dry fert = 2839.06 ml per 2000 lbs = 1.41953 ml / lb

Acres:

3.5 foot bed spacing x 30 ft plots x 6 reps = 630 sqft per treatment = 0.0144628 acres per treatment

Fertilizer Rate:

200 lbs 11-52-0 x 0.0144628 acres in each treatment = 2.8926 lbs 11-52-0 per treatment

2.8926 lbs 11-52 x 0.94636 = 2.7 ml of product in Low dose

2.8926 lbs 11-52 x 1.41953 = 4.1 ml of product in High dose

Total 11-52 needed in all treatments

Acres:

3.5 bed spacing x 30 ft plots x 6 reps x 3 treatments = 1890 sqft = 0.043388 acres

200 lbs 11-52 per acre = 8.8 lbs needed total

Total per plot = 2.8926 / 6 = 0.49 lbs

Mix 10% more than needed

Total = 9.68

Mix Low = 3.2 lbs + 3 ml

Mix High = 3.2 lbs + 4.5 ml

Field Map

Jan-17-2026 (T1 Yara Biostimulant Fertilizer)

University of Arizona

Trial ID: T-1 Yara Biostimulant Fertilizer
Protocol ID: Location: Yuma Arizona Trial Year: 2025
Study Director: Robert Masson Sponsor Contact:
Investigator:

Trial Map Treatment Description

Trt	Code	Description
1	CHK	Grower Standard Preplant Fertilizer
2		Low Rate F3651 2.0 QT/Ton
3		High Rate F3651 3.0 QT/Ton
4		No Preplant Fertilizer

106 1	206 4	306 3	406 2
105 2	205 1	305 4	405 3
104 3	204 4	304 2	404 1
103 2	203 1	303 4	403 3
102 4	202 3	302 1	402 2
101 1	201 4	301 2	401 3

Pesticide

Date	Pesticide	Rate	Type	Method
9/30	Verimark	13.5 oz/ac	Preplant insecticide	Shank
10/2	Prefar	6.0 qt/ac	Preemergent herbicide	Sprinkler
10/20	Avaunt Evo	8 oz/ac	Insecticide	Spray
10/20	Assail	6 oz/ac	Insecticide	Spray
12/17	Oroindis	8 oz/ac	Fungicide	Spray
12/17	NuFilmP	6 oz/ac	Adjuvant	Spray

Irrigation

Irrigation Date	Type	Irrigation Hours	Water Used (AC IN)
10/1	Drip	2	
10/2	Sprinkler	10	
10/3	Sprinkler	10	
10/4	Sprinkler	9	
10/5	Sprinkler	8	
10/8	Sprinkler	6	
10/9	Drip	2	
10/10	Rain		0.35
10/15	Drip	2	
10/21	Drip	8	
11/3	Drip	5	
11/11	Drip	7	

Sprinkler rate: 0.1 IN/HR
Drip rate: 0.186 Acre IN/HR

Irrigation

**Total Water
Applied 15.2
Acre IN**

Irrigation Date	Type	Irrigation Hours	Water Used (AC IN)
11/15	Rain		0.4
11/17	Rain		0.01
11/18	Rain		0.11
11/19	Rain		0.09
11/20	Drip	4	
11/21	Rain	x	0.83
11/22	Rain		0.17
11/23	Rain		0.01
12/8	Drip	4	
12/9	Drip	6	
12/20	Drip	4	
12/22	Drip	4	
12/23	Rain		0.03
12/24	Rain		0.04
12/25	Rain		0.09

Sampling

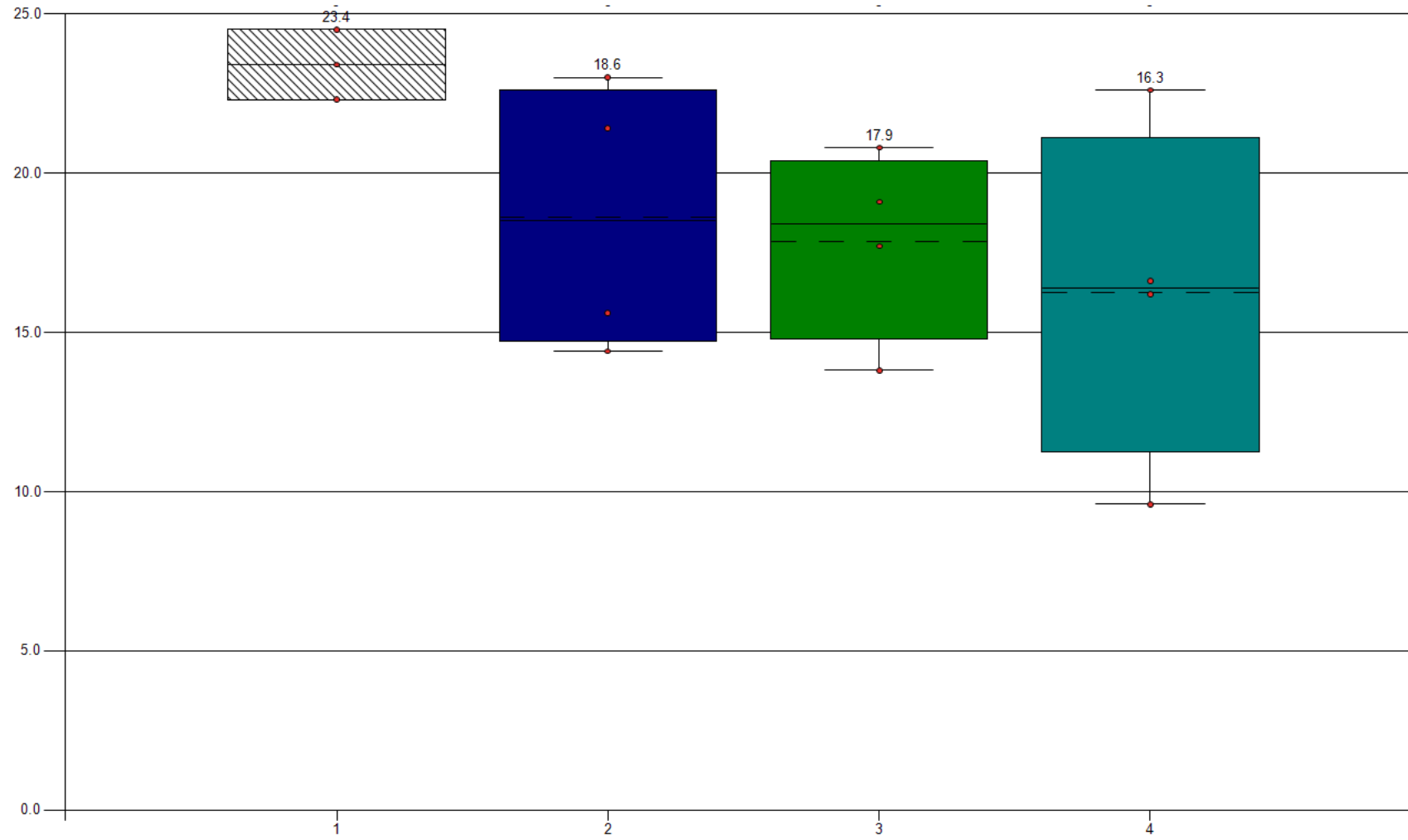
Date	Type	Notes
9/20	Soil	Before fertilizer addition
11/20	Tissue 1	
11/25	Whole Plant	
12/4	Tissue 2	
12/8	Tissue 3	
1/5	Tissue 4	

In Season Measurements (Dr. Bhupinder Singh)

- Net photosynthesis
- Gas exchange traits
 - Transpiration rate
 - Stomatal conductance
 - Vapor pressure deficit
- Light uptake traits
 - Maximum quantum yield
 - FY/FM
 - Electron transport rate
 - Chlorophyll content
- Meteorological traits
 - Canopy temperature
 - Surface temperature

Net Photosynthesis

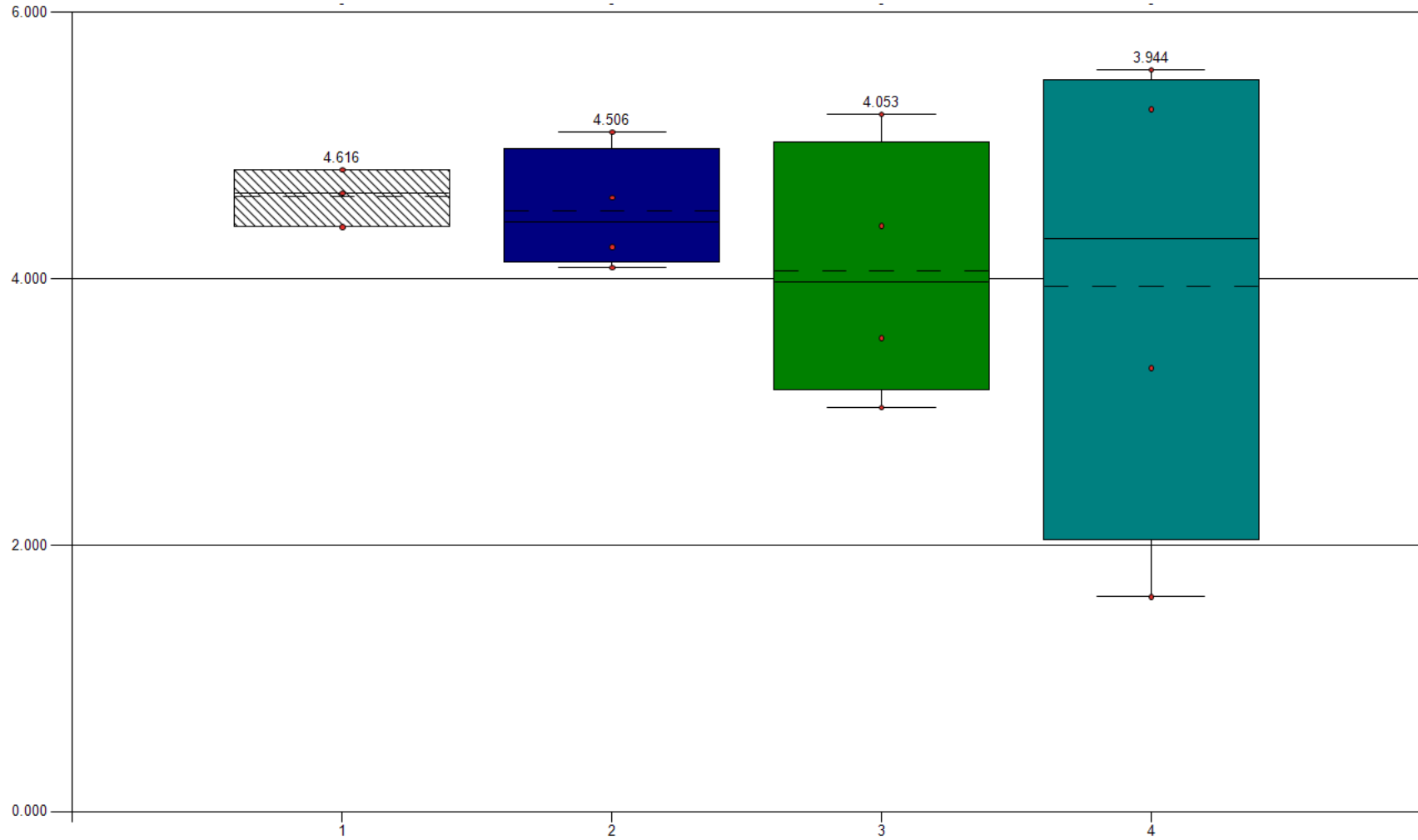
$\mu\text{mol m}^{-2}$



- 1 Grower Standard Preplant Fertilizer
- 2 Low Rate F3651 2.0 QT/Ton
- 3 High Rate F3651 3.0 QT/Ton
- 4 No Preplant Fertilizer

Transpiration

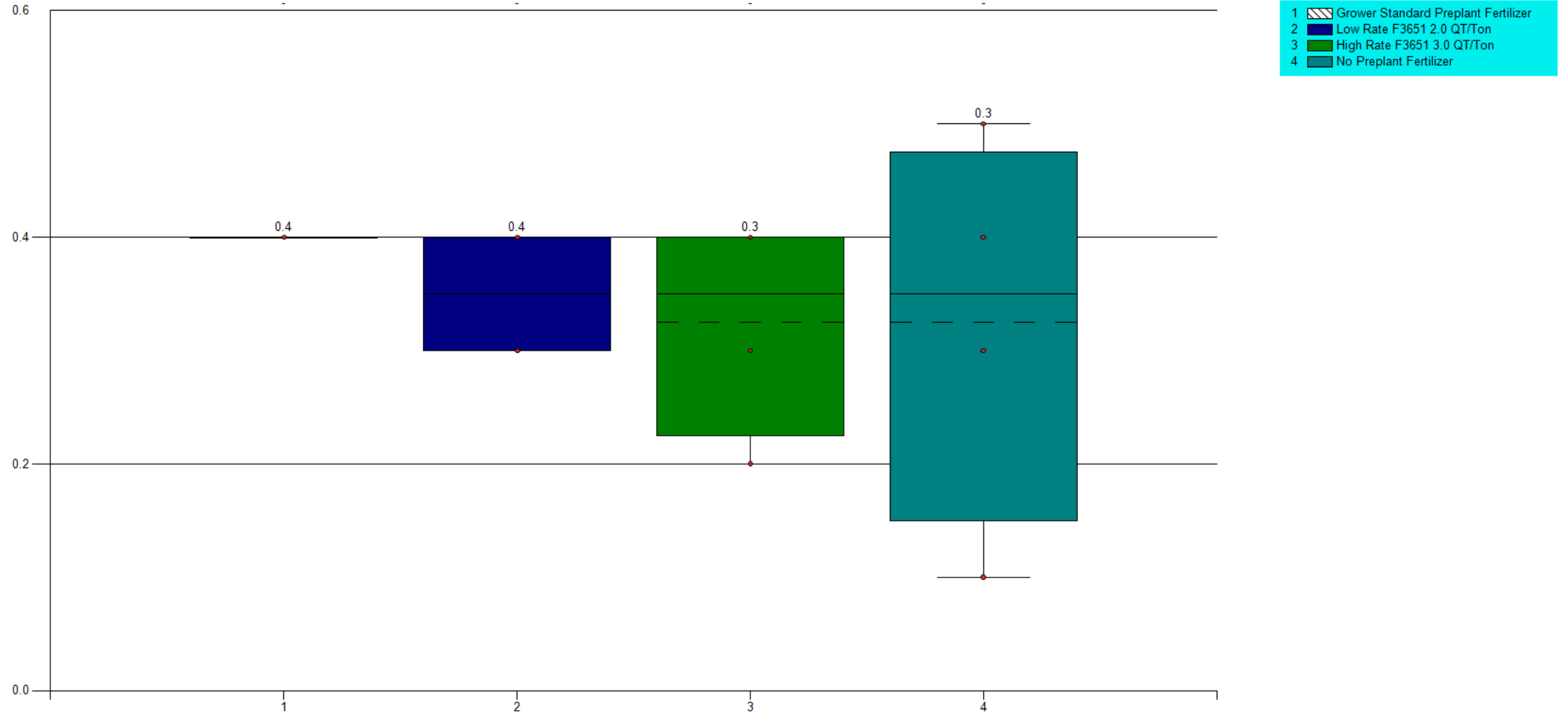
mol m⁻²



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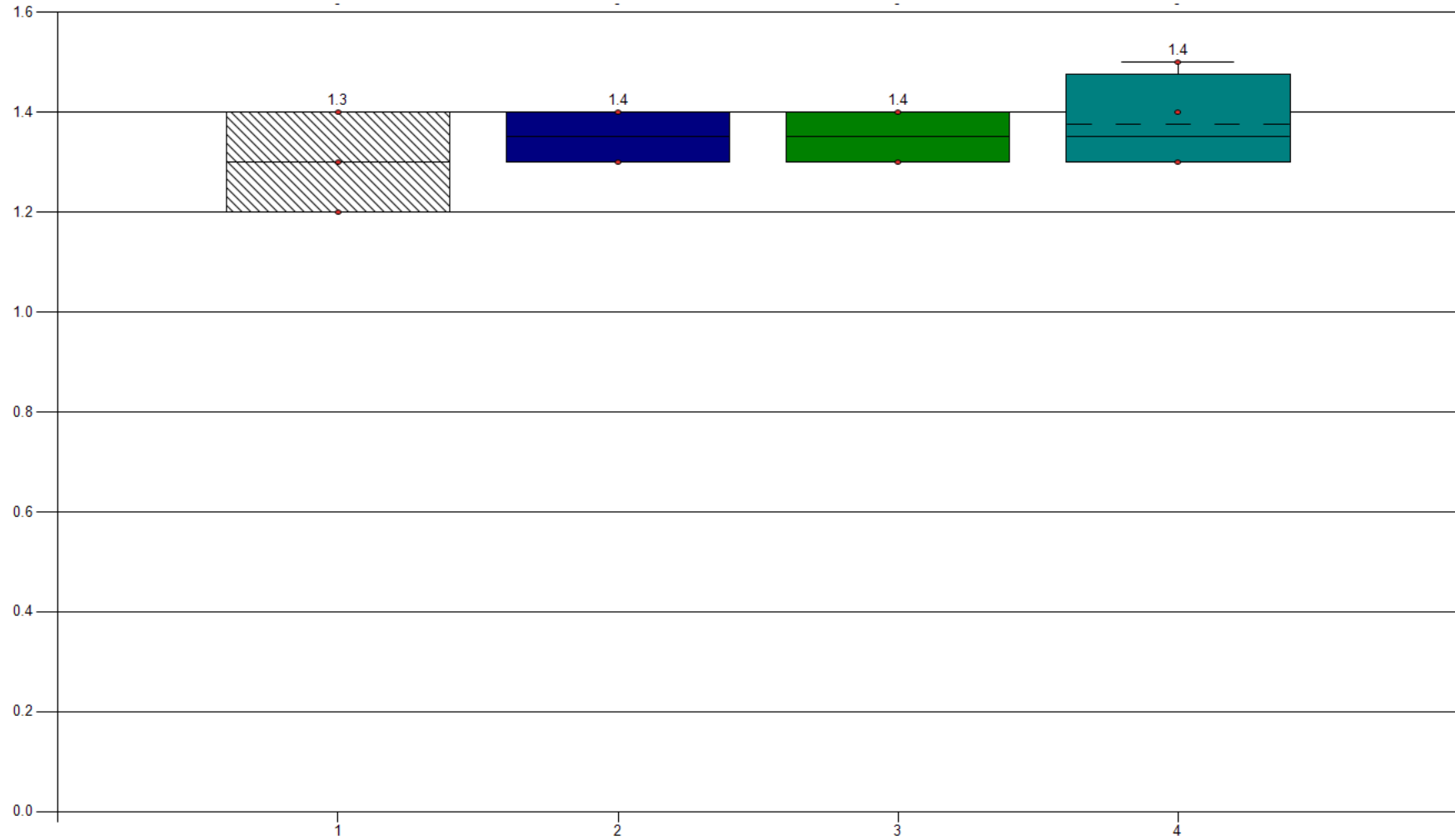
stomtal conductance

mol m⁻²



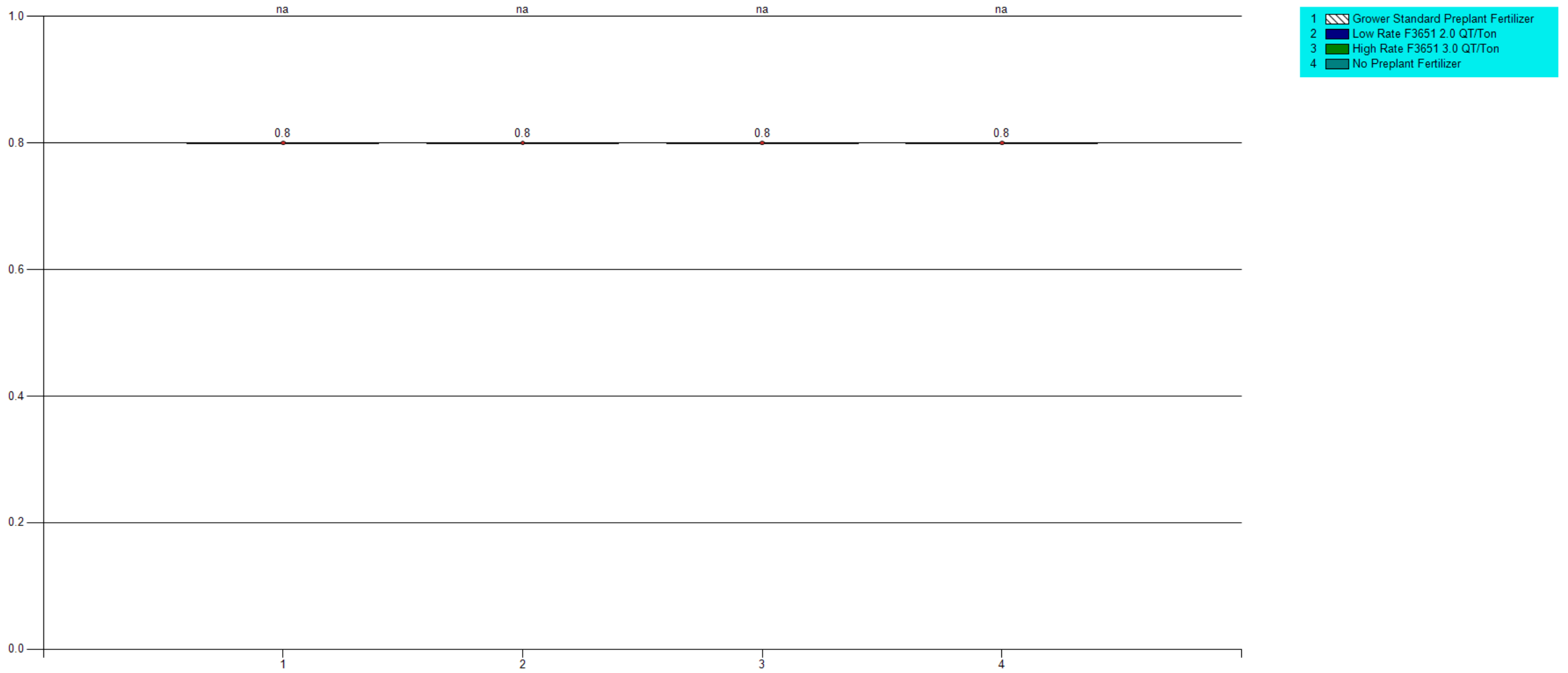
VPDleaf

kPa



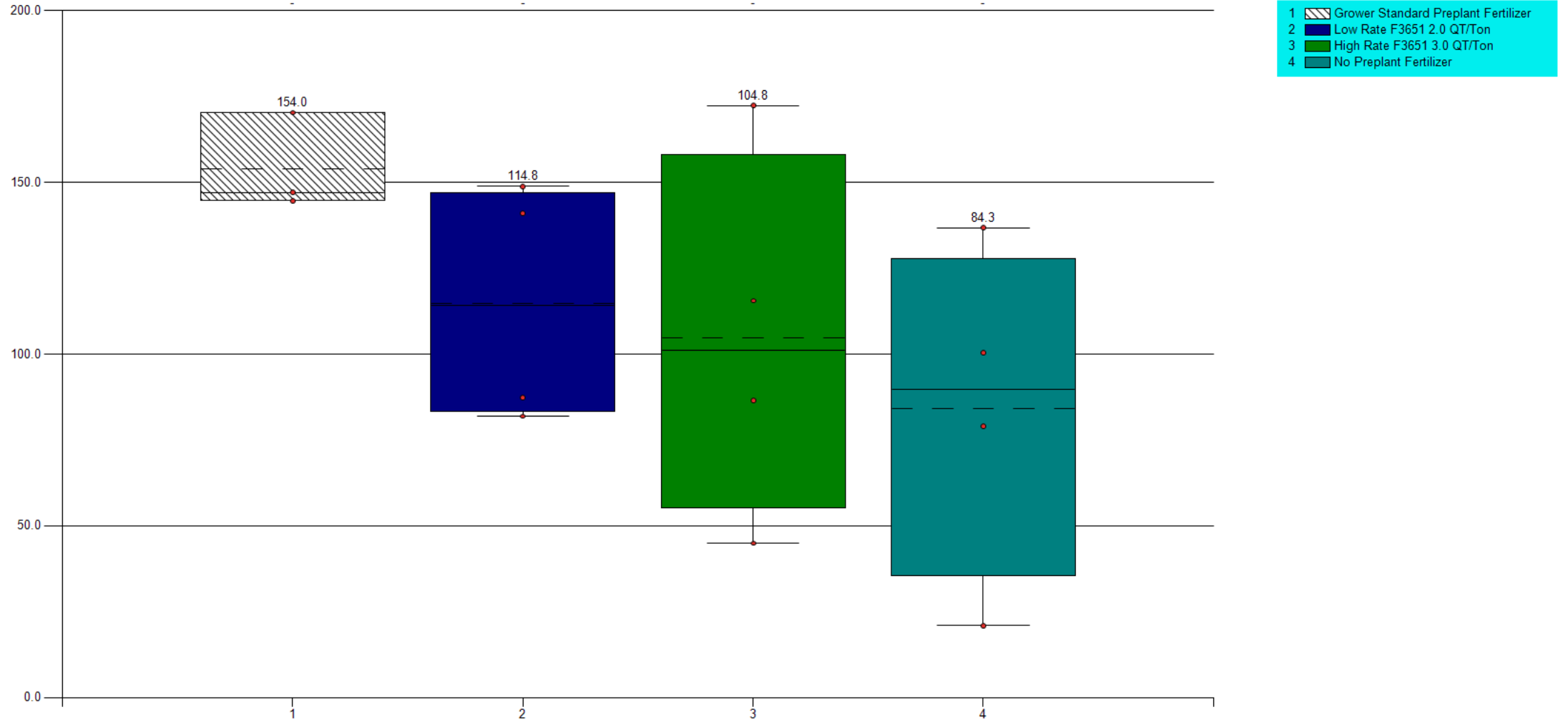
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maximum quantum yield (Fv/Fm)



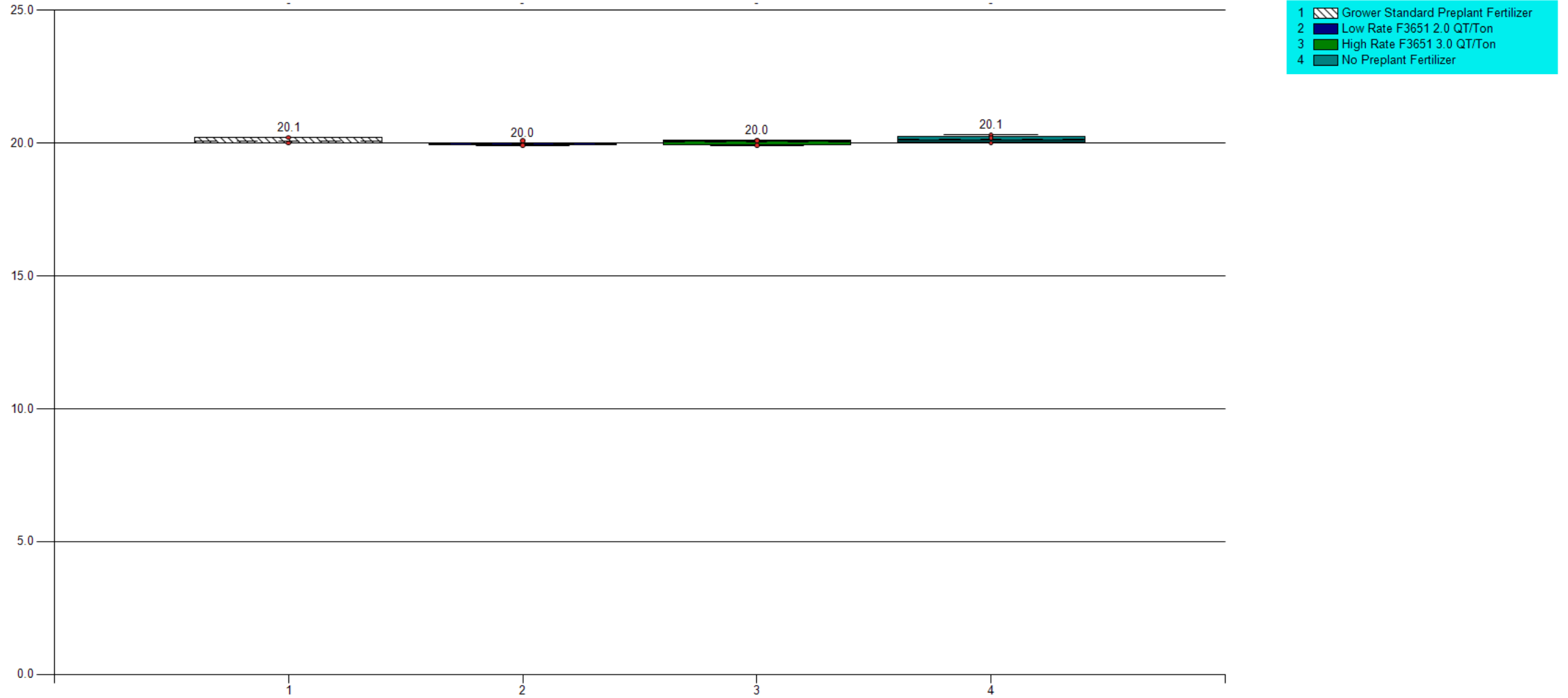
Electron Transport rate

umol m⁻²

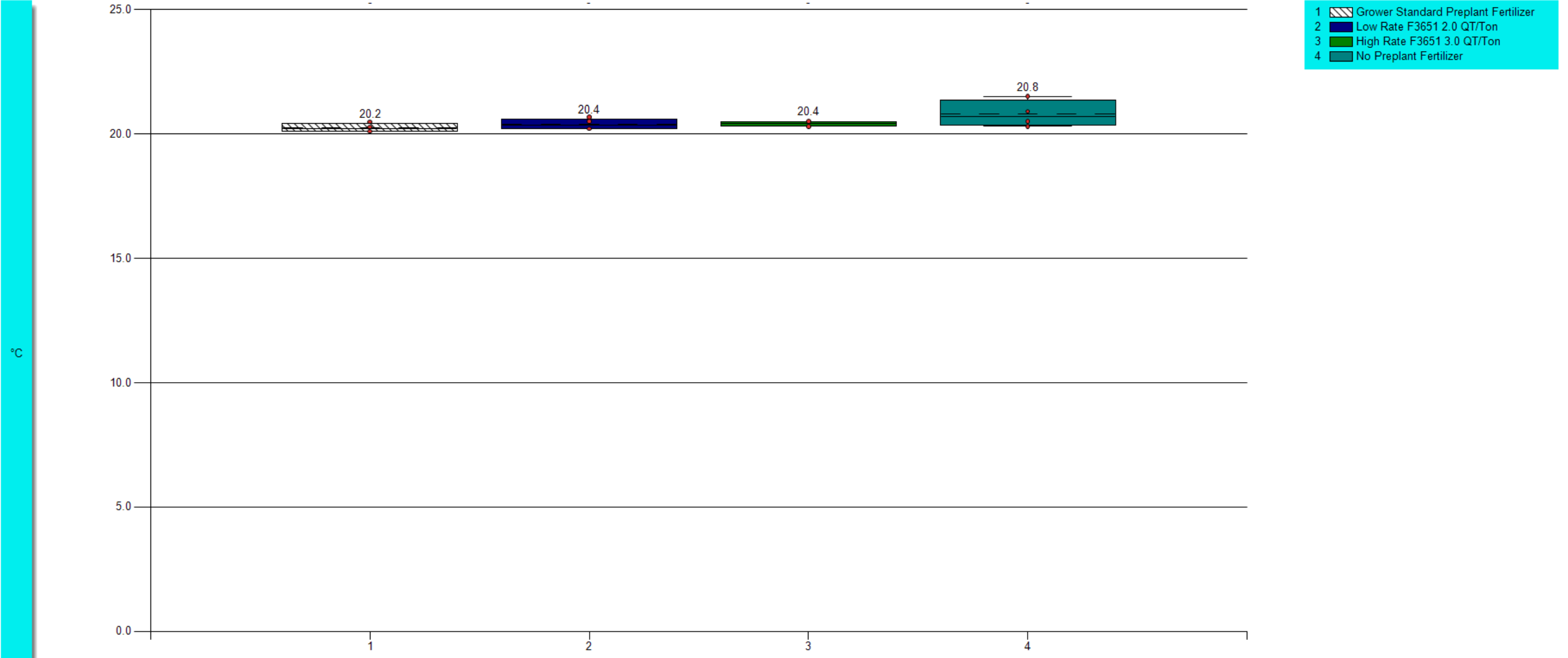


air temperature

°C



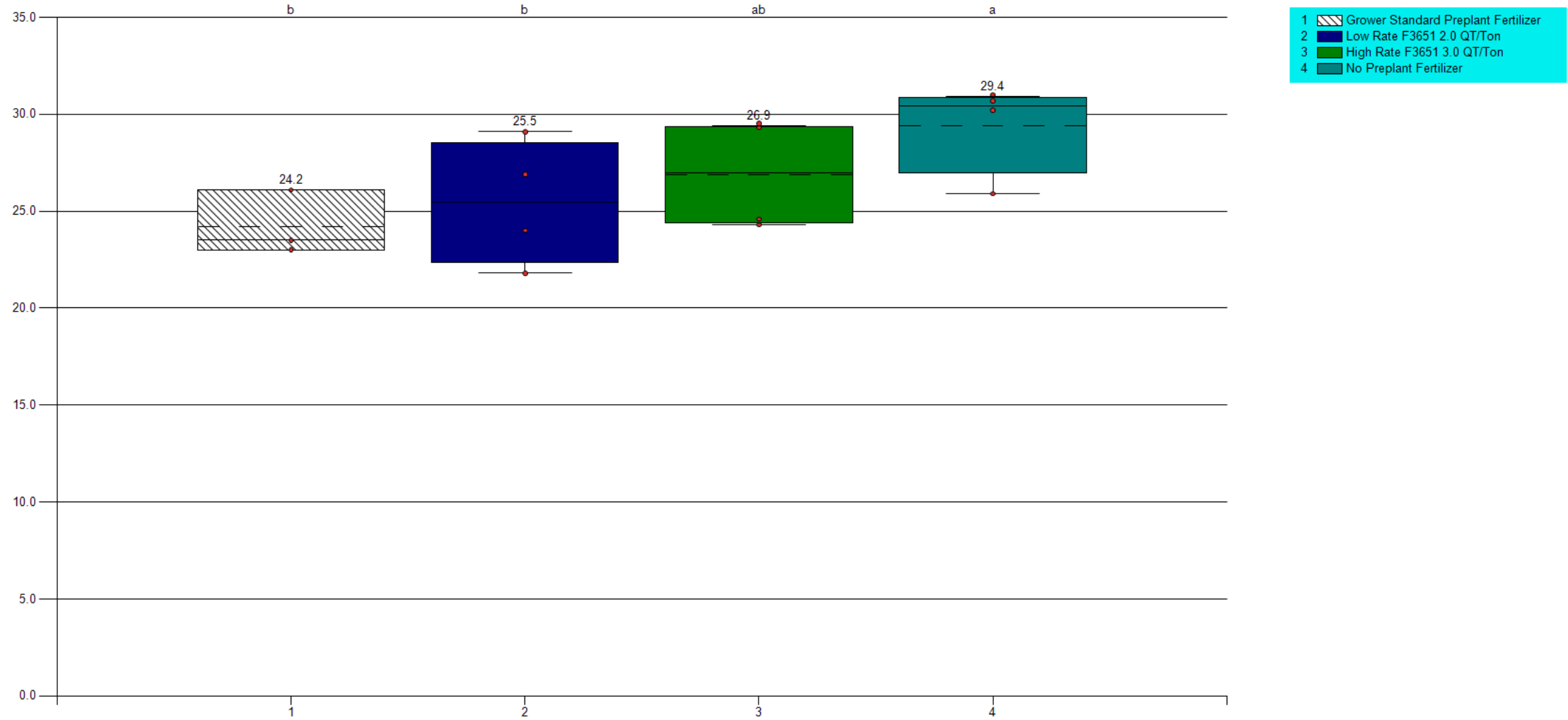
Canopy Temperature



°C

Chlorophyll content

$\mu\text{g m}^{-2}$

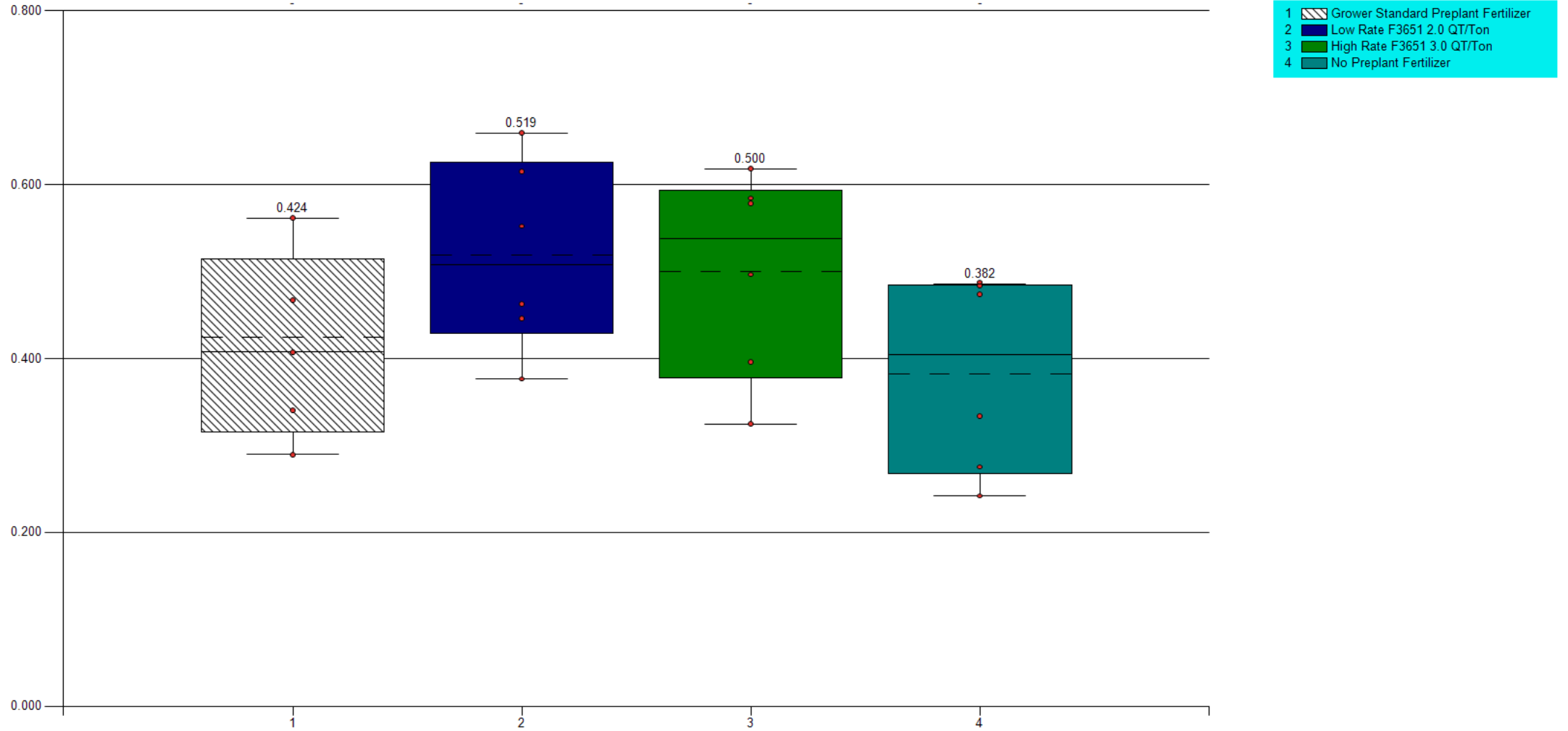


Harvest

- 1/2/26
- Harvest a 10 foot section of each plot
- Each plant weighed for total above ground biomass
- Hearts were trimmed from the biomass and weighed individually
- Walkby percentage was calculated by counting the plants that did not make a marketable heart
- Heart circumference and length was recorded for each trimmed head

YARA Yuma Romaine 2025 Trial (Untrimmed Above Ground Biomass)

KG per Plant



Assessment Data (KG/Plant)

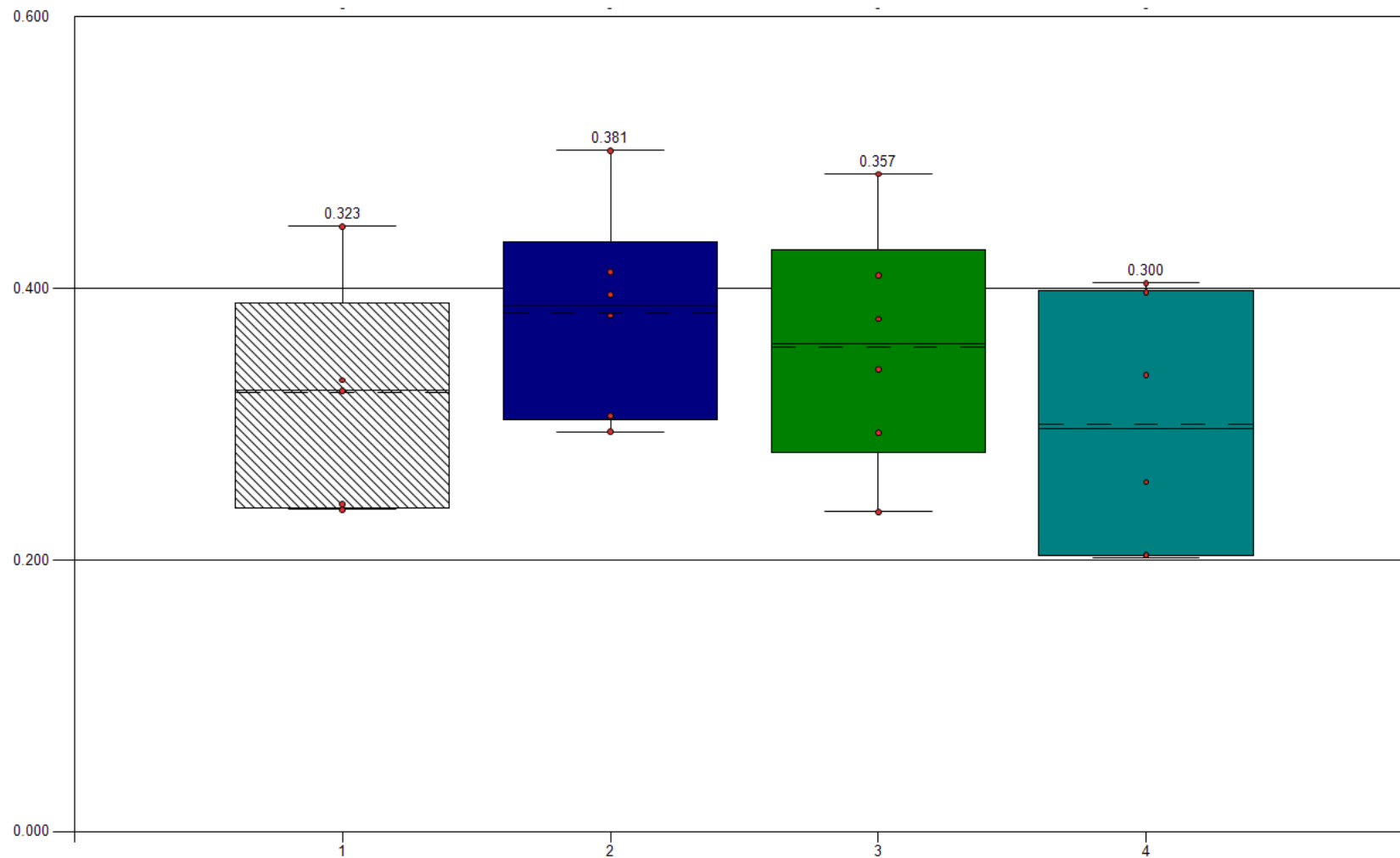
106 1	206 4	306 3	406 2
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104 3	204 4	304 2	404 1
103 2	203 1	303 4	403 3
102 4	202 3	302 1	402 2
101 1	201 4	301 2	401 3



Color Description	Options	Treatment Description	Assessment Description
	0.242 to 0.284		0.451 to 0.492
	0.284 to 0.325		0.492 to 0.534
	0.325 to 0.367		0.534 to 0.576
	0.367 to 0.409		0.576 to 0.617
	0.409 to 0.451		0.617 to 0.659

YARA Yuma Romaine 2025 Trial (Trimmed Heart Weight)

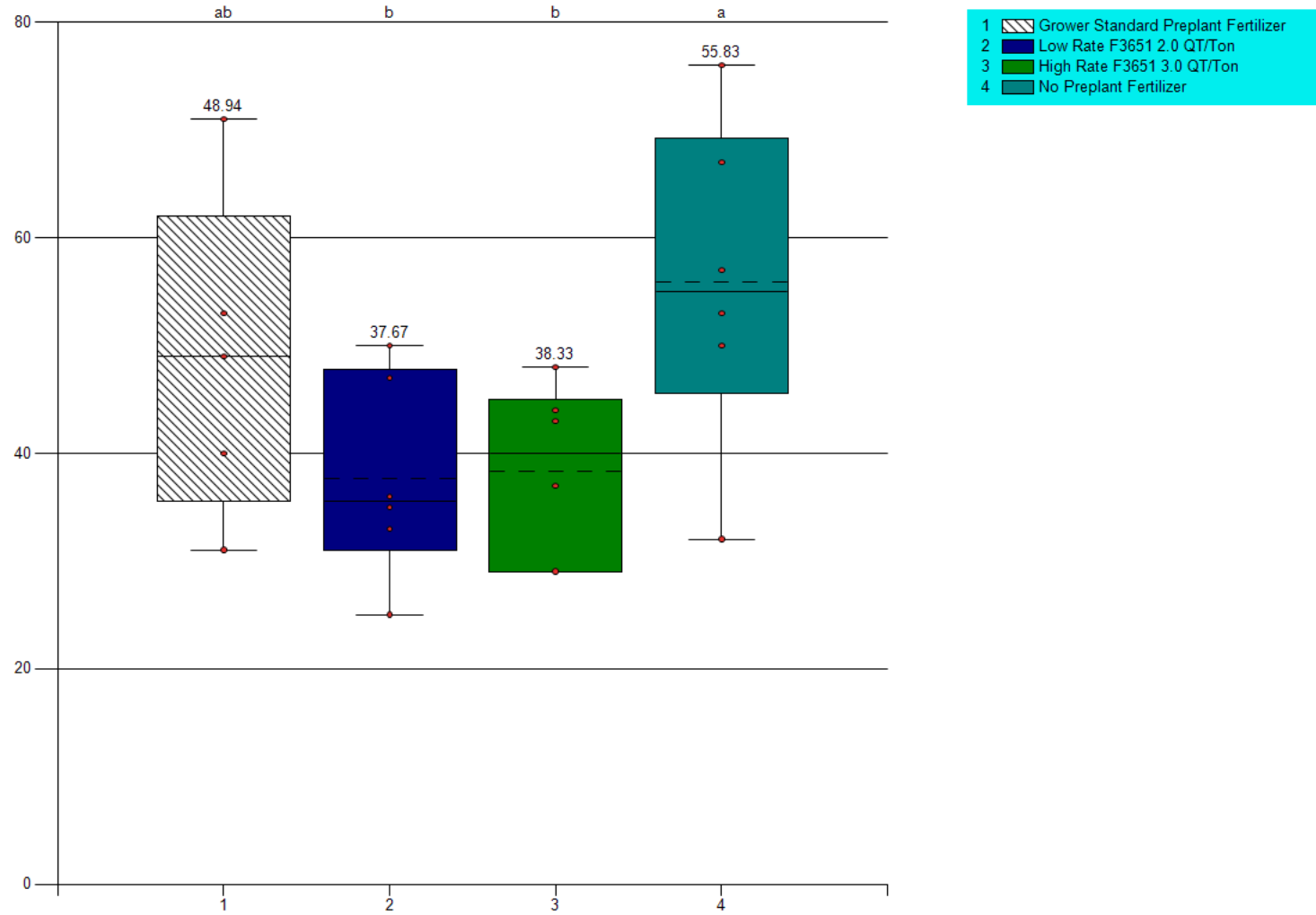
KG per Head



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- 2 Low Rate F3651 2.0 QT/Ton
- 3 High Rate F3651 3.0 QT/Ton
- 4 No Preplant Fertilizer

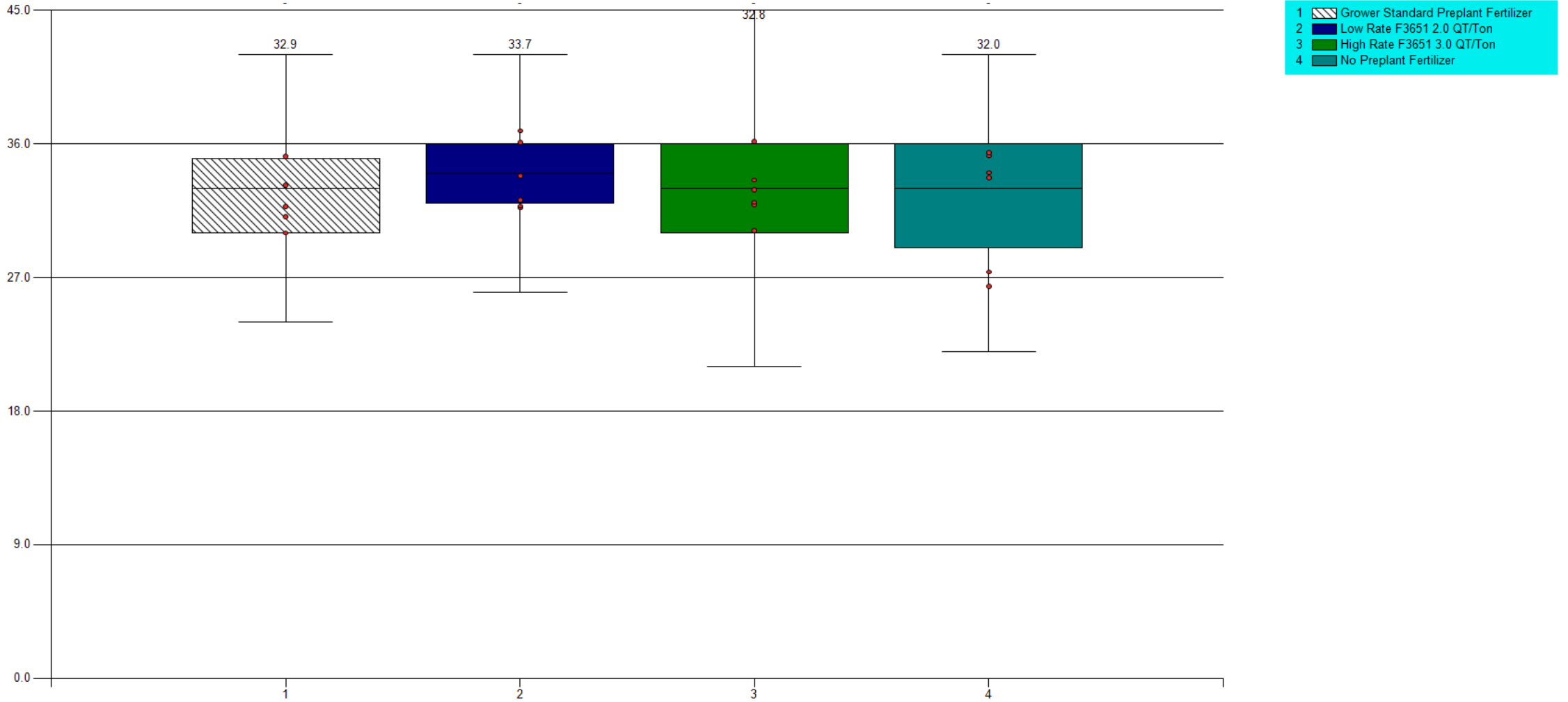
YARA Yuma Romaine 2025 Trial (Percent Walkby)

Percent Walkby



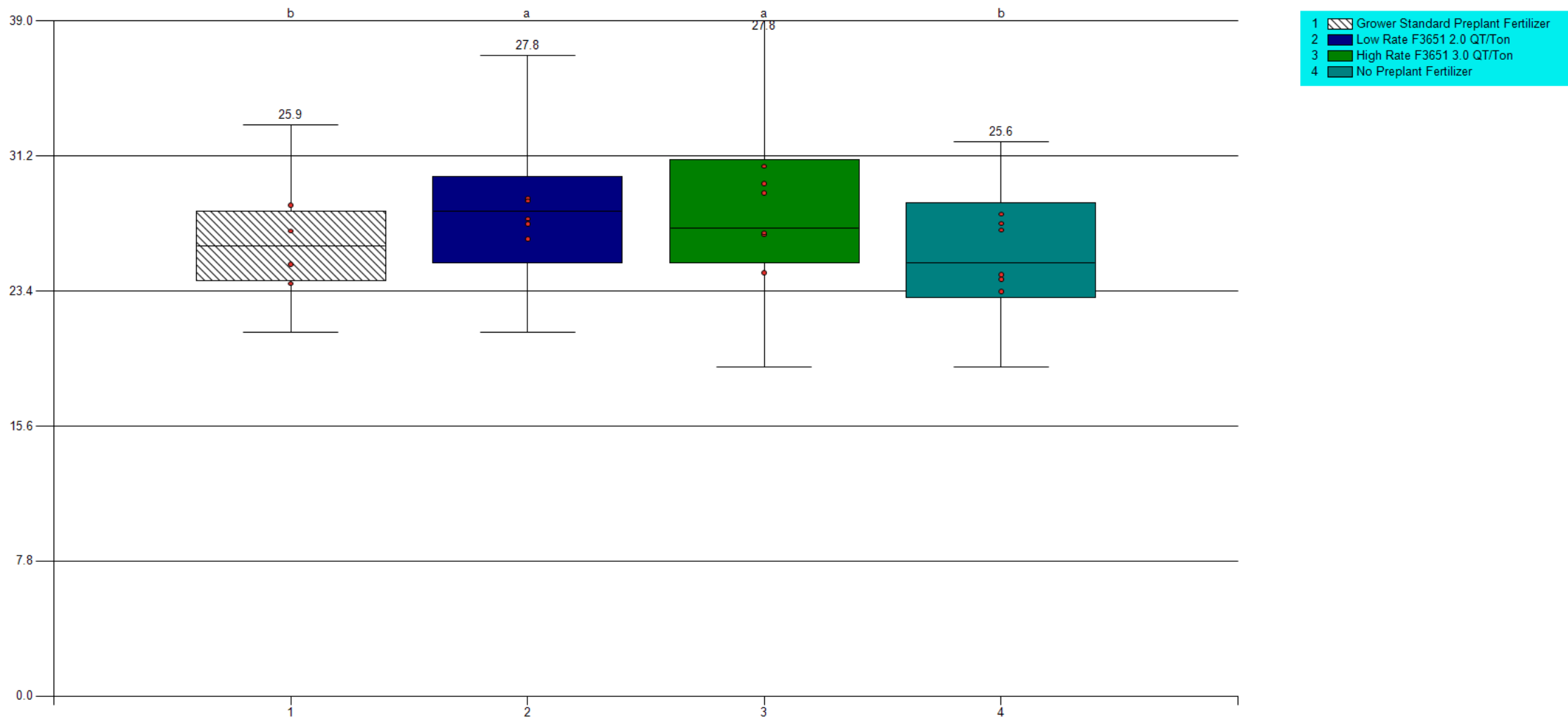
Difference in count between untrimmed biomass and trimmed hearts

YARA Yuma Romaine 2025 (Heart Circumference)



CM

YARA Yuma Romaine 2025 Trial (Heart Length)



CM

University of Arizona

Trial ID: T-1 Yara Biostimulant Fertilizer Protocol ID: _____ Location: Yuma Arizona Trial Year: 2025 Study Director: Robert Masson Sponsor Contact: _____ Investigator: _____							
Rating Date	Oct-16-2025	Oct-16-2025	Jan-2-2026	Jan-2-2026	Jan-2-2026	Jan-2-2026	
Rating Unit	Index	Index	KG	KG	KG	KG	
Rating Min/Max/Interval			0.08, 2, -			10, 50, -	
Number of Subsamples	1	1	43	24	23	23	
Planting Interval	15 DP-1	15 DP-1	93 DP-1	93 DP-1	93 DP-1	93 DP-1	
Description		Vigor	Untrimmed Above>	Trimmed Heart W>	Heart Circumfer>	Heart Circumfer>	
ARM Action Codes		AS					
Number of Decimals			3	3	1	1	
Data Entry Date	Jan-9-2026	Jan-9-2026	Jan-5-2026	Jan-5-2026	Jan-5-2026	Jan-5-2026	
Trt Treatment	Rate	Appl	1	2	3	4	5
No. Name	Rate Unit	Code		dAS			
1	Grower Standard Preplant Fertilizer		3.5 -	3.2 -	0.424 -	0.323 -	32.9 -
2	Low Rate F3651	2.0 qt/ton A	3.7 -	3.2 -	0.519 -	0.381 -	33.7 -
3	High Rate F3651	3.0 qt/ton A	3.5 -	3.0 -	0.500 -	0.357 -	32.8 -
4	No Preplant Fertilizer		3.5 -	2.8 -	0.382 -	0.300 -	32.0 -
LSD P=.10	0.38	0.39 - 0.39	0.1147	0.0909	2.50		
Standard Deviation	0.38	0.10t	0.1128	0.0893	2.45		
CV	10.63	5.5t	24.73	26.25	7.47		
Levene's F	0.625	0.338	0.119	0.317	0.609		
Ske wness	-0.1786	0.09	-0.0948	0.0628	-0.6539		
Kurtosis	-2.1557*	6.8014*	-0.964	-0.8185	0.4452		
Replicate F	5.235	0.266	0.963	0.721	2.396		
Replicate Prob(F)	0.0056	0.9247	0.4729	0.6184	0.0907		
Treatment F	0.294	1.031	1.926	0.973	0.502		
Treatment Prob(F)	0.8290	0.4072	0.1719	0.4332	0.6871		

University of Arizona

Trial ID: T-1 Yara Biostimulant Fertilizer
 Protocol ID: _____ Location: Yuma Arizona Trial Year: 2025
 Study Director: Robert Masson Sponsor Contact: _____
 Investigator: _____

Rating Date	Jan-2-2026	Jan-2-2026			
Rating Unit			$\mu\text{mol m}^{-2}$	mol m^{-2}	mol m^{-2}
Rating Min/Max/Interval	5, 40, -				
Number of Subsamples	23	1	1	1	1
Planting Interval	93 DP-1	93 DP-1			
Description	Heart Length	Percent Walkby	Net P photosynthe>	Transpiration	stomatal conduct>
ARM Action Codes				AL	EC
Number of Decimals	1	1	1	3	1
Data Entry Date	Jan-5-2026	Jan-5-2026	Jan-19-2026	Jan-19-2026	Jan-19-2026
Trt Treatment					
No. Name	Rate Appl				
	Rate Unit Code	6	7	8	9
				dAL	10
1 Grower Standard Preplant Fertilizer	25.9 b	48.9 ab	23.4 -	4.613 -	0.4
2 Low Rate F3651 2.0 qt/ton A	27.8 a	37.7 b	18.6 -	4.492 -	0.4 -
3 High Rate F3651 3.0 qt/ton A	27.8 a	38.3 b	17.9 -	3.985 -	0.3 -
4 No Preplant Fertilizer	25.6 b	55.8 a	16.3 -	3.645 -	0.3 -
LSD P= .10	1.89	13.43	5.83	1.7249 -2.0606	0.17
Standard Deviation	1.86	13.20	4.43	0.1213t	0.12
CV	6.93	29.22	23.3	17.0t	37.08
Levene's F	2.081	0.57	1.224	3.517	1.50
Ske wness	-0.1292	0.685	-0.532	-1.8975*	-0.8044
Kurtosis	-0.865	-0.0528	-0.4672	4.4463*	0.905
Replicate F	0.827	0.416	0.176	0.232	0.727
Replicate Prob(F)	0.5513	0.8302	0.9096	0.8716	0.5720
Treatment F	2.552	2.650	1.927	0.397	0.055
Treatment Prob(F)	0.0974	0.0894	0.2038	0.7588	0.9474

University of Arizona

Trial ID: T-1 Yara Biostimulant Fertilizer
 Protocol ID: Location: Yuma Arizona Trial Year: 2025
 Study Director: Robert Masson Sponsor Contact:
 Investigator:

Rating Date				
Rating Unit	kPa		umol m-2	°C
Rating Min/Max/Interval				
Number of Subsamples	1	1	1	1
Planting Interval				
Description	VPDleaf	maximum quantum >	Electron Transp >	air temperature
ARM Action Codes		EC		
Number of Decimals	1	1	1	1
Data Entry Date	Jan-19-2026	Jan-19-2026	Jan-19-2026	Jan-19-2026
Trt Treatment	Rate	Appl		
No. Name	Rate Unit	Code		
11			12	
13			14	
1	1.3 -		0.8	154.0 -
2	2.0 qt/ton A		0.8 na	114.8 -
3	3.0 qt/ton A		0.8 na	104.8 -
4	1.4 -		0.8 na	84.3 -
LSD P= .10	0.11		.	60.28
Standard Deviation	0.08		0.00	45.84
CV	6.21		0.0	40.06
Levene's F	0.475		0.00*	1.214
Ske wness	0.1303		1.1489	-0.501
Kurtosis	0.1825		-2.4444	-0.5009
Replicate F	0.569		NaN	0.463
Replicate Prob(F)	0.6507		NaN	0.7157
Treatment F	0.569		NaN	1.629
Treatment Prob(F)	0.6507		NaN	0.2581

University of Arizona

Trial ID: T-1 Yara Biostimulant Fertilizer
 Protocol ID: _____ Location: Yuma Arizona Trial Year: 2025
 Study Director: Robert Masson Sponsor Contact: _____
 Investigator: _____

Rating Date			
Rating Unit		°C	µg m ⁻²
Rating Min/Max/Interval			
Number of Subsamples		1	1
Planting Interval			
Description		Canopy Temperat>	Chlorophyll con>
ARM Action Codes		ET4	
Number of Decimals		1	1
Data Entry Date		Jan-19-2026	Jan-19-2026
Trt Treatment	Rate Appl	15	16
No. Name	Rate Unit Code		
1	Grover Standard Preplant Fertilizer	20.2 -	24.2 b
2	Low Rate F3651 2.0 qt/ton A	20.4 -	25.5 b
3	High Rate F3651 3.0 qt/ton A	20.4 -	26.9 ab
4	No Preplant Fertilizer	20.8	29.4 a
LSD P= .10		0.22	2.75
Standard Deviation		0.16	2.09
CV		0.77	7.9
Levene's F		2.083	1.034
Skewness		0.0985	0.0245
Kurtosis		-1.3693	-1.518
Replicate F		1.241	3.218
Replicate Prob(F)		0.3876	0.0827
Treatment F		1.316	4.602
Treatment Prob(F)		0.3474	0.0374





201
Trt - 4



301
Trt-2



401
Trt-3



102
Tvt-4



202
Trt-3



302
Trt-1



402
Irt-2



103
Trt-2



203
Tvt-1



303

Tvt-4



403
Trt-3



104
Trt-3



204
Trt-4



304
Irt-2



404
Trt-1



105
Trt-2





305
Tvt-4



4105
Irt-3



106
Tvt-1



206
Irt-4



306

Irt-3



406
Irt-2