

Potassium Requirements for Optimum Yield and Fruit Quality of Mature-Green Tomatoes in Florida

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Introduction

Potassium (K) soil test based fertilizer application is essential in Florida sandy soils with exchangeable soil K ranging from very low to medium. Current UF/IFAS K₂O fertilizer recommendations for tomatoes ranges from 0 to 225 lb/acre for soils testing 'very high' to 'very low' by 'Mehlich-1'plus supplemental K₂O fertilizer applications in specific situations, respectively. However, based on a survey, is not uncommon for tomato growers to use as much as 450 to 650 lb/K₂O/acre.

Objective

The objectives of this study was to evaluate the effect of K rates on tomato petiole K sap, plant K biomass uptake, yield and fruit quality on spring tomatoes grown in seepage irrigation.

Materials and Methods

- Two fertilizer trials were conducted in the spring of 2010 (very low K) and 2011 (medium K) in a randomized complete block design with four replications.
- Eight fertilization rates were applied: 0, 60, 120, 180, 240, 360, 480, 720, and 960 lb/ K₂O/acre.
- Data collection consisted on petiole K sap, yield, plant biomass and K content, K soil and postharvest quality as internal white tissue (IWT).
- K petiole sap was analyzed by ANOVA and mean separation by Duncan's multiple range tests. The yield, plant biomass and K-uptake, and K soil was analyzed by four models: linear, quadratic models, linear-plateau and quadratic-plateau. Maximum yields were determined at the intersection of the quadratic and plateau.

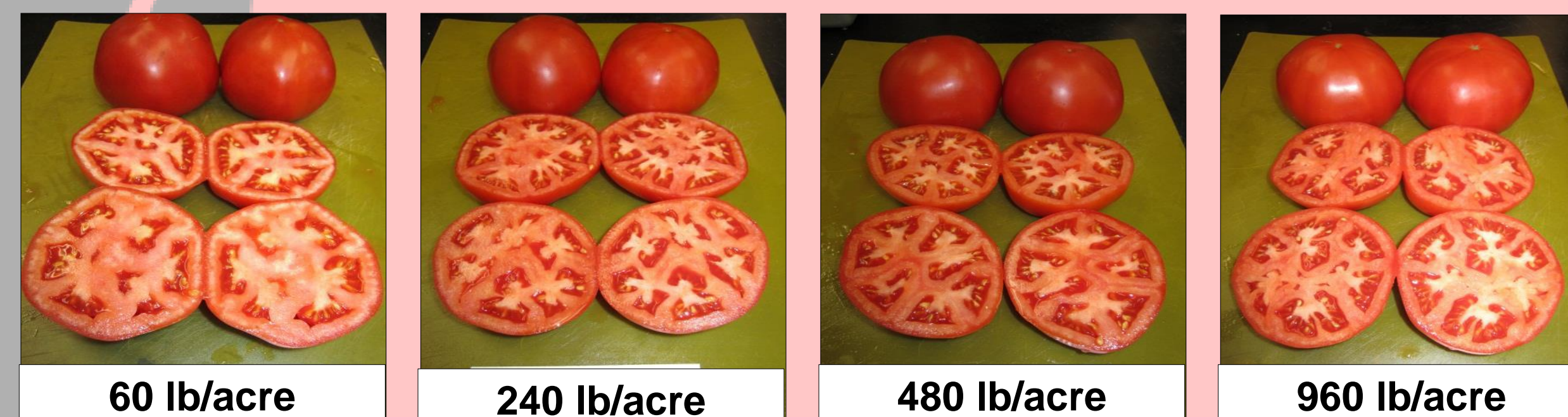


Figure 2. The effect of different K rates on tomato fruit quality as IWT in Palmetto, FL spring 2010.



Figure 3. The effect of different K rates on plant biomass in Palmetto, FL spring 2010.

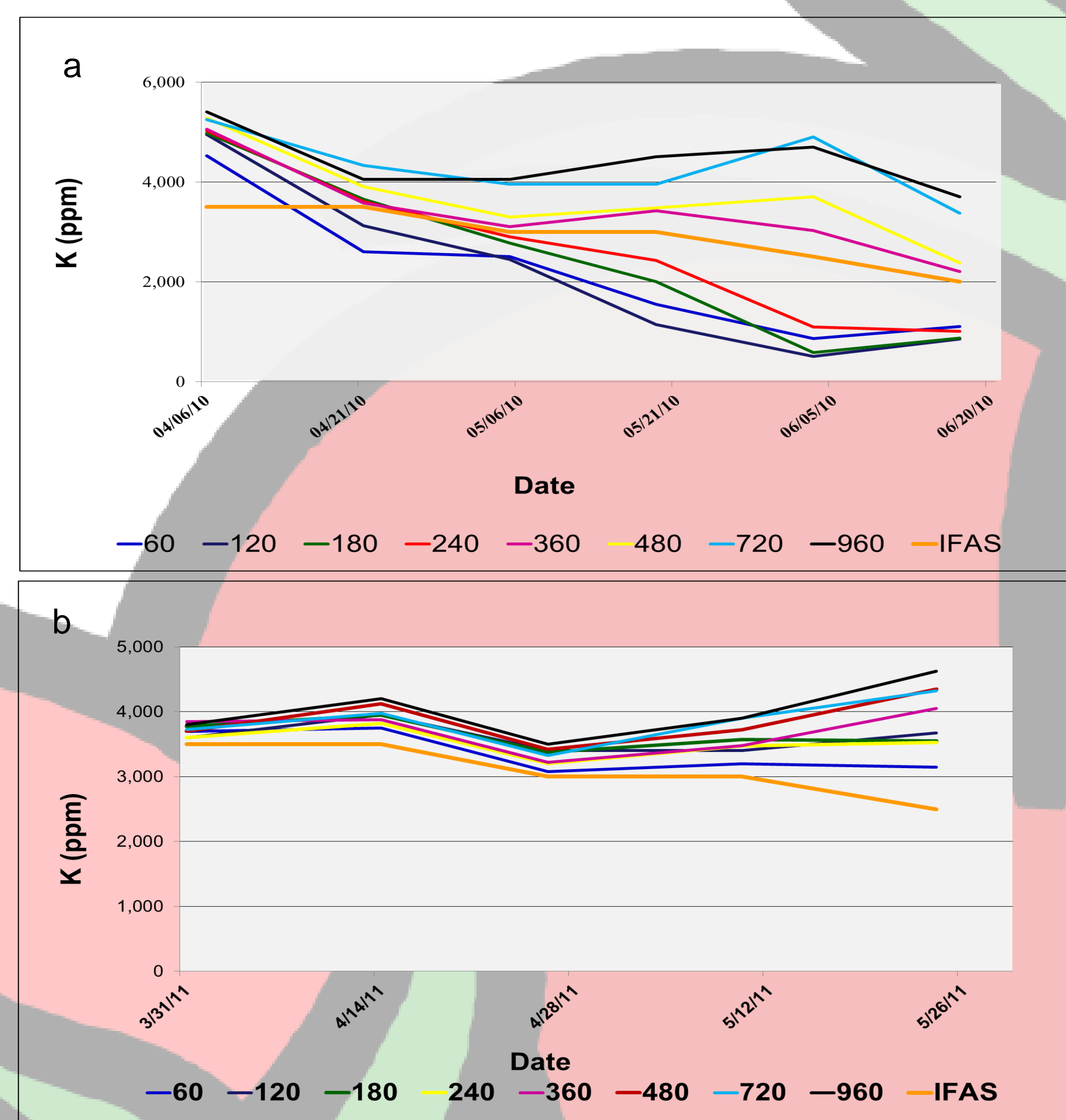


Figure 1. Changes of K concentrations in petiole sap with different K rates during spring 2010, very low K (a) and 2011, medium K (b) in Palmetto, FL.

Table 1. Total tomato plant biomass, fruit, and K uptake in response to different K rates in Palmetto, FL.

a. Spring 2010 (very low K)

K rates (K ₂ O lb/acre)	Total plant biomass		Fruit		Plant biomass and fruit	
	Biomass	K-uptake	Biomass	K-uptake	Biomass	K-uptake
	----- (lb/acre) -----					
60	1,865.6	13.75	611.1	19.31	2,476.7	33.06
120	1,887.0	24.39	1,438.4	52.14	3,325.4	76.52
180	2,110.8	30.81	1,632.0	35.16	3,742.8	65.96
240	2,883.7	55.56	2,113.0	83.39	4,996.7	138.95
360	2,939.7	79.39	2,618.1	117.92	5,557.9	197.31
480	2,793.1	91.61	2,631.8	127.22	5,424.9	218.83
720	2,457.3	106.07	2,296.0	132.98	4,753.3	239.06
960	2,358.7	102.22	2,159.9	131.20	4,518.6	233.42
P. value	0.006	0.0001	0.0001	0.0001	0.0001	0.0001
Regression ²	LP/QP	Q/QP	QP	LP	LP	LP
Optimal rate	338.9/292.4	640.7/606.9	308.0	338.9	214.5	355.0

b. Spring 2011 (medium K)

60	2,662.24	42.01	2,143.2	128.6	4,805.45	170.58
120	2,942.14	73.00	2,256.0	142.7	5,198.14	215.69
180	2,673.49	45.79	2,044.9	122.4	4,718.39	168.18
240	3,246.56	80.25	2,013.1	125.2	5,259.70	205.41
360	3,232.33	89.65	2,216.0	156.8	5,448.31	246.44
480	3,699.96	132.55	2,232.9	155.7	5,932.84	288.27
720	3,167.77	125.42	2,238.5	102.4	5,406.27	227.83
960	3,026.81	118.48	2,226.6	96.8	5,253.38	215.27
P. value	0.03/0.07	0.0001/0.0002	0.25	0.001	0.03	0.001/0.007
Regression	Q/QP	Q/QP	ns	Q	Q	Q/QP
Optimum rate	477.1/405.2	616.9/599.5	-	310.47	489.5	482.7/429.4

²QP = Quadratic-plateau regression; LP = Linear-plateau regression

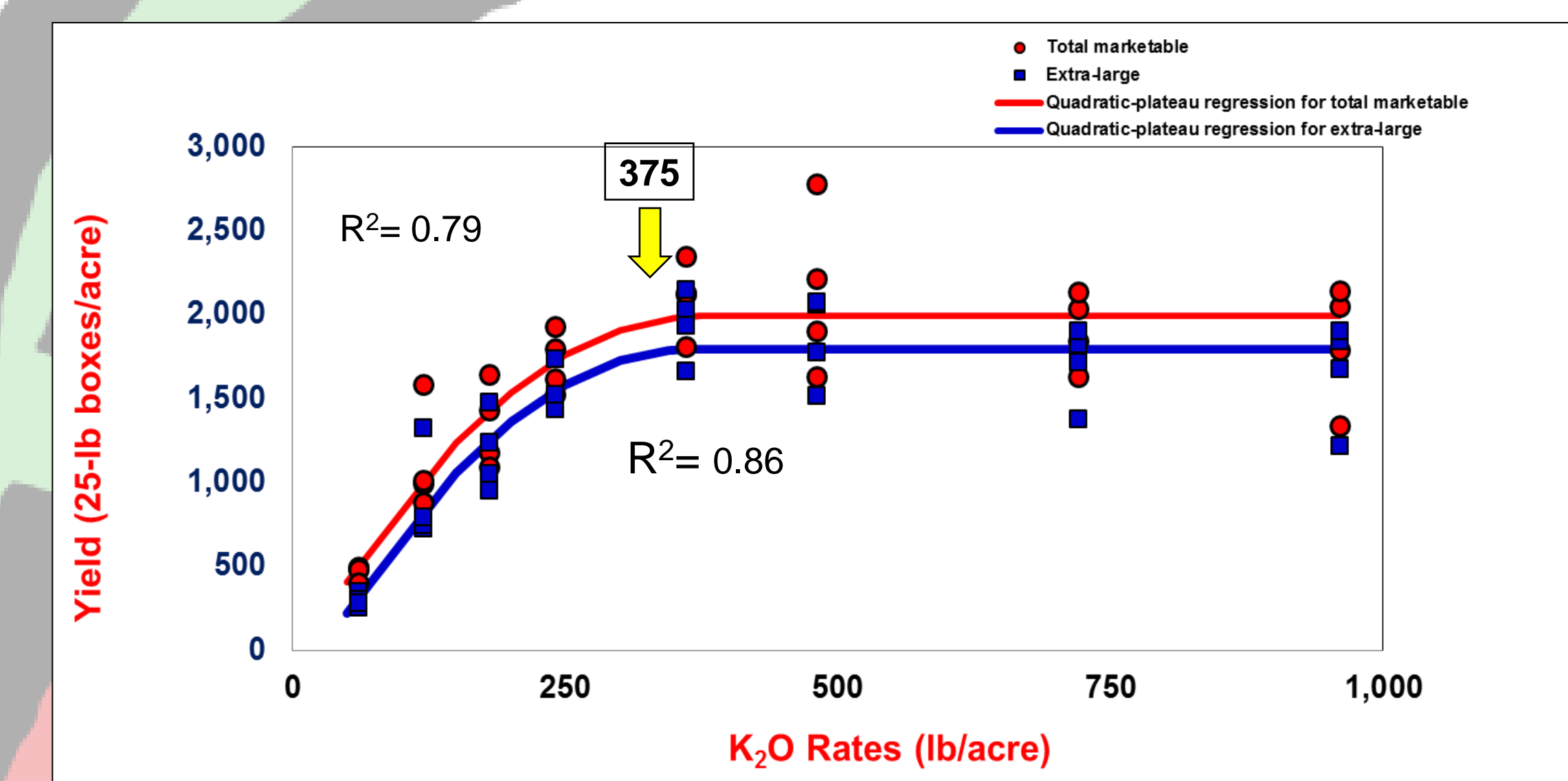


Figure 4a. Effect of K rates on total marketable yields and extra large fruit in spring, 2010 (very low K) in Palmetto, FL.

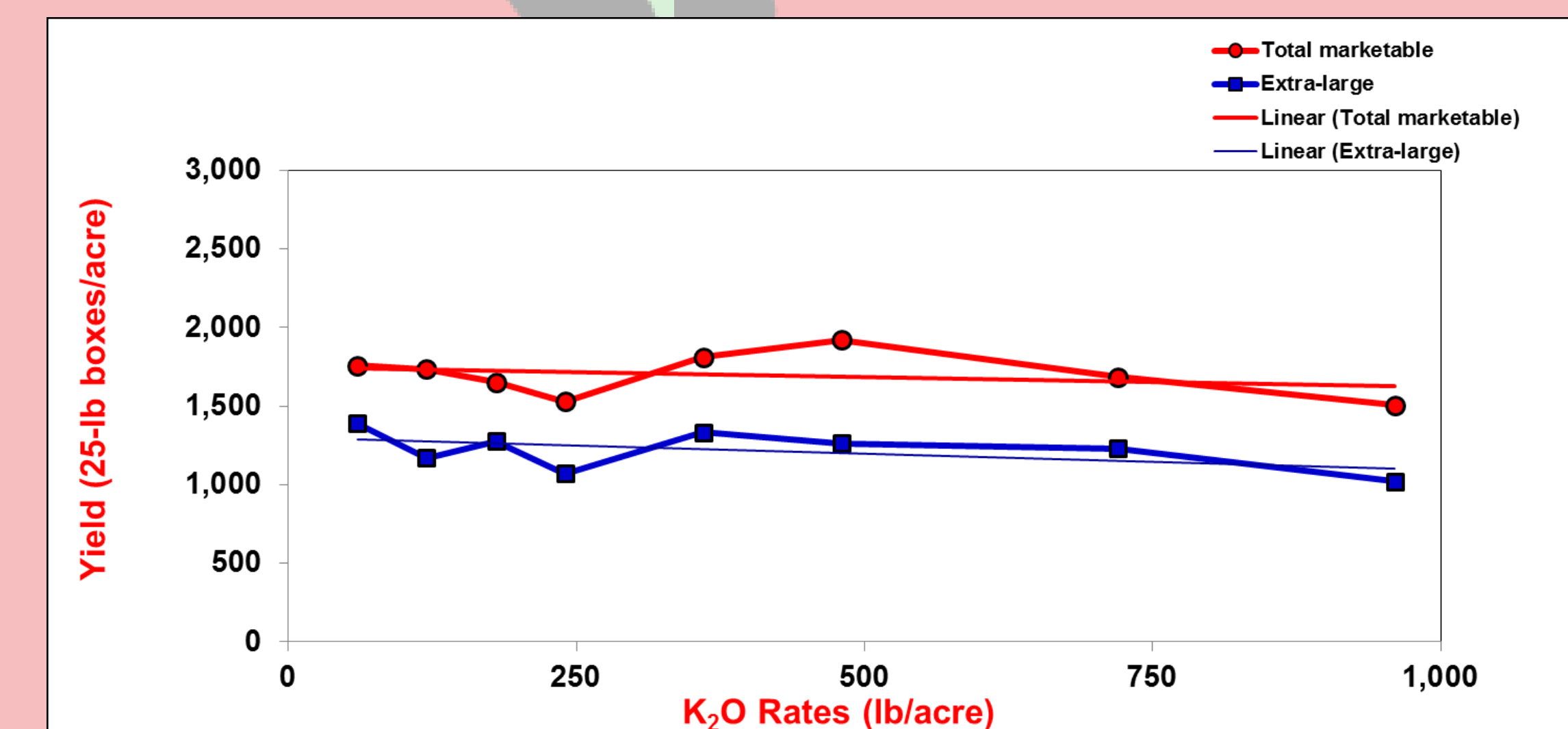


Figure 4b. Effect of K rates on total marketable yields and extra large fruit in spring, 2011 (medium K) in Palmetto, FL.



Results and Conclusion

Based on one year of data in very low soil test K, tomato petiole sap K concentrations were below UF/IFAS sufficiency levels at K₂O rates lower than 360 lb/acre (Figure 1a). Similarly, plant biomass accumulation and tomato yield production increased with added fertilizer K₂O rate to 380 lb/acre (Table 1a; Figure 2, 3 and 4a). However, the study with medium soil test K indicated no response to added fertilizer K₂O rate (Table 1b; Figure 1b and 4b). These results would indicate that further K rate studies with seepage irrigation.

Acknowledgements

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