Surfactant *vs.* Nutrient Use Efficiency and Yield of Tomato

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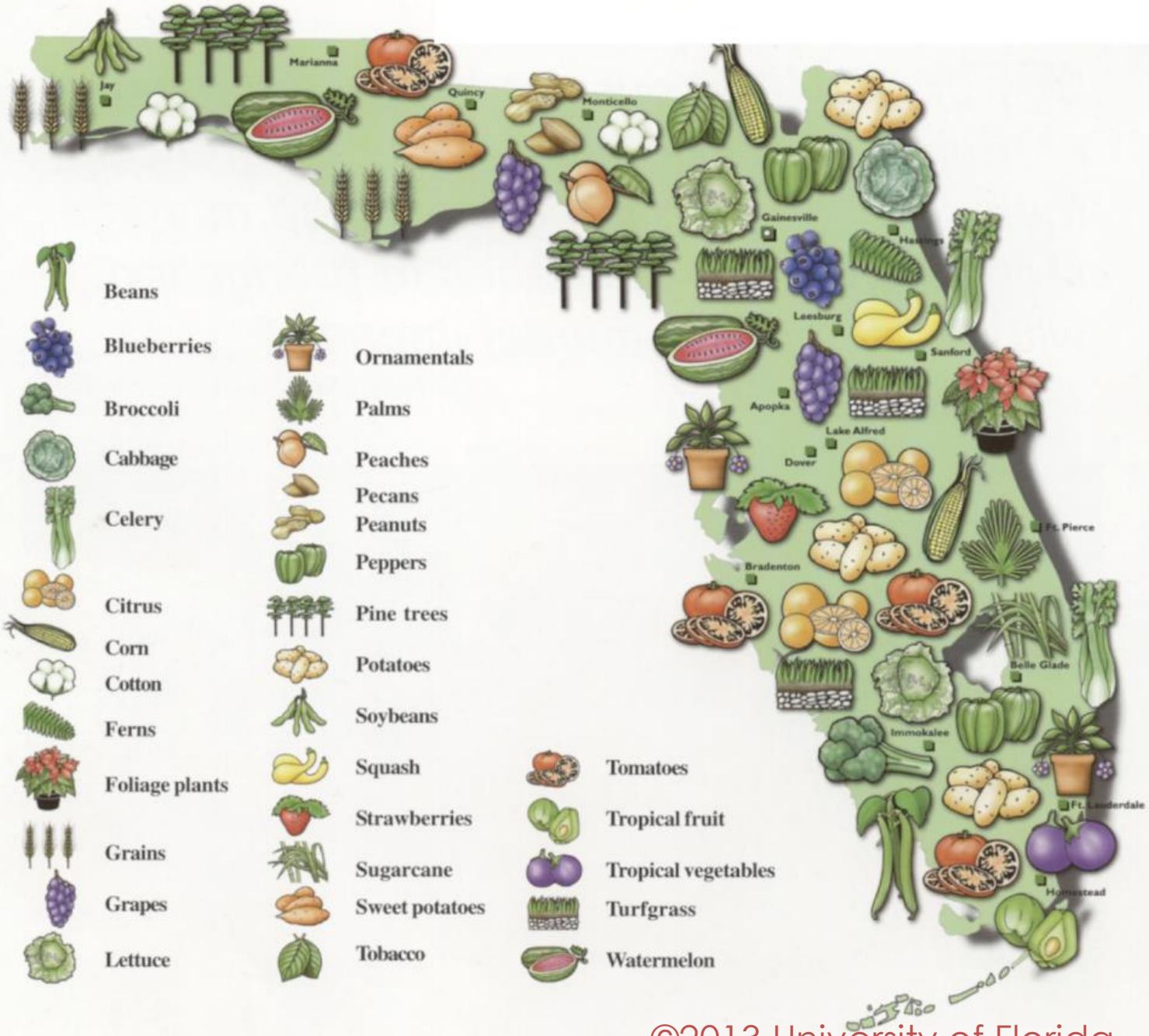


Most Soils in Florida Are Sandy in Nature

Problems associated with water repellent soils

1. Rapid leaching of fertilizers
2. Poor water and nutrient holding capacity
3. Uneven distribution of nutrients and water
4. High soil evaporation
5. Severe runoff
6. Soil erosion
7. Low productivity

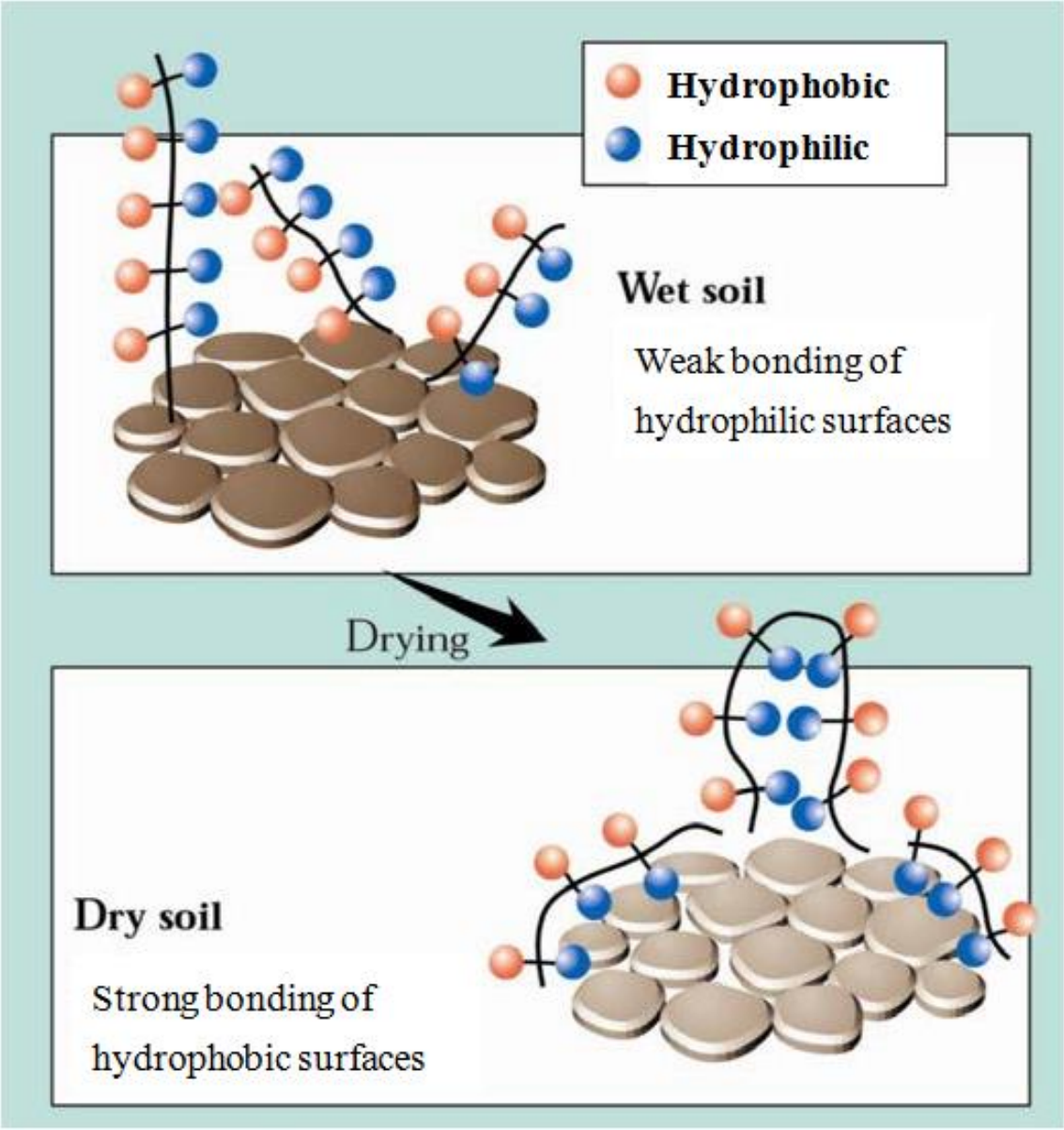
Vegetation shift caused by high P levels in water

Vegetation shift in the Everglades

Sawgrass

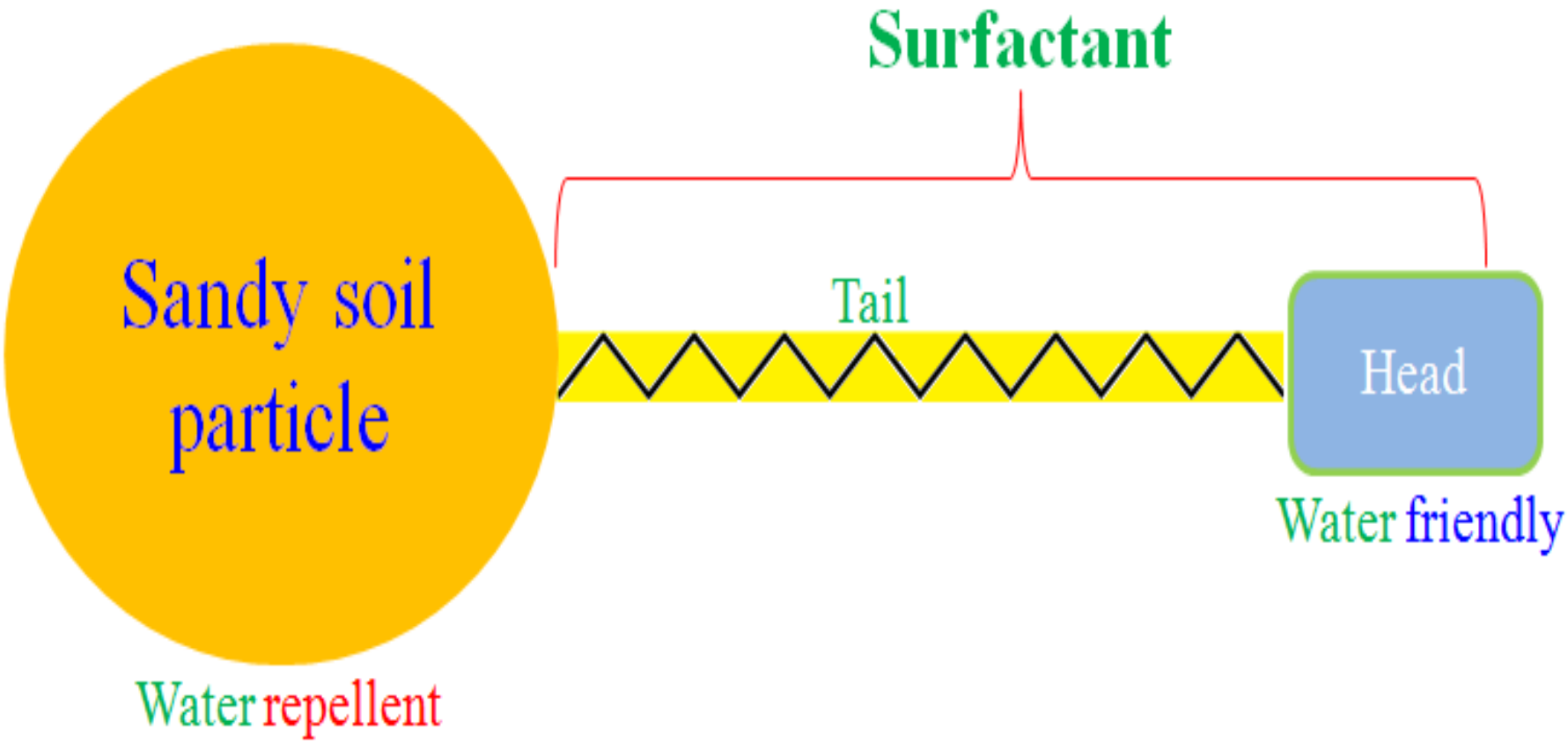
Cattail

Sandy Soils Are Water Repellent



Courtesy of P. Hallett

Why do surfactants work?



Hypothesis

Surfactants:

- Lower the surface tension
- May act as

1. Detergents; Emulsifiers; Foaming agents; and Dispersants
2. Wetting agents: help better hold water and nutrients in root zones

Objectives

To evaluate the surfactant effects on:

- N, P, K use efficiency
- Yield of tomato grown on sandy soil

Materials and Methods

- Trial time: Fall 2012
- Location: Citra, Florida
- Fertilization: N (urea), 160; P_2O_5(TSP), 83; K_2O (MOP), 250 lb/acre
- Irrigation: drip and plastic mulch
- Variety: Phoenix
- Surfactant: Stockosorb 660, 30 lb/acre
- Plot size: 135 square feet
- Number of replication: 3
- Nutrient use efficiency:

$$NUE(lb/lb) = \frac{TY_f - TY_0}{F}$$

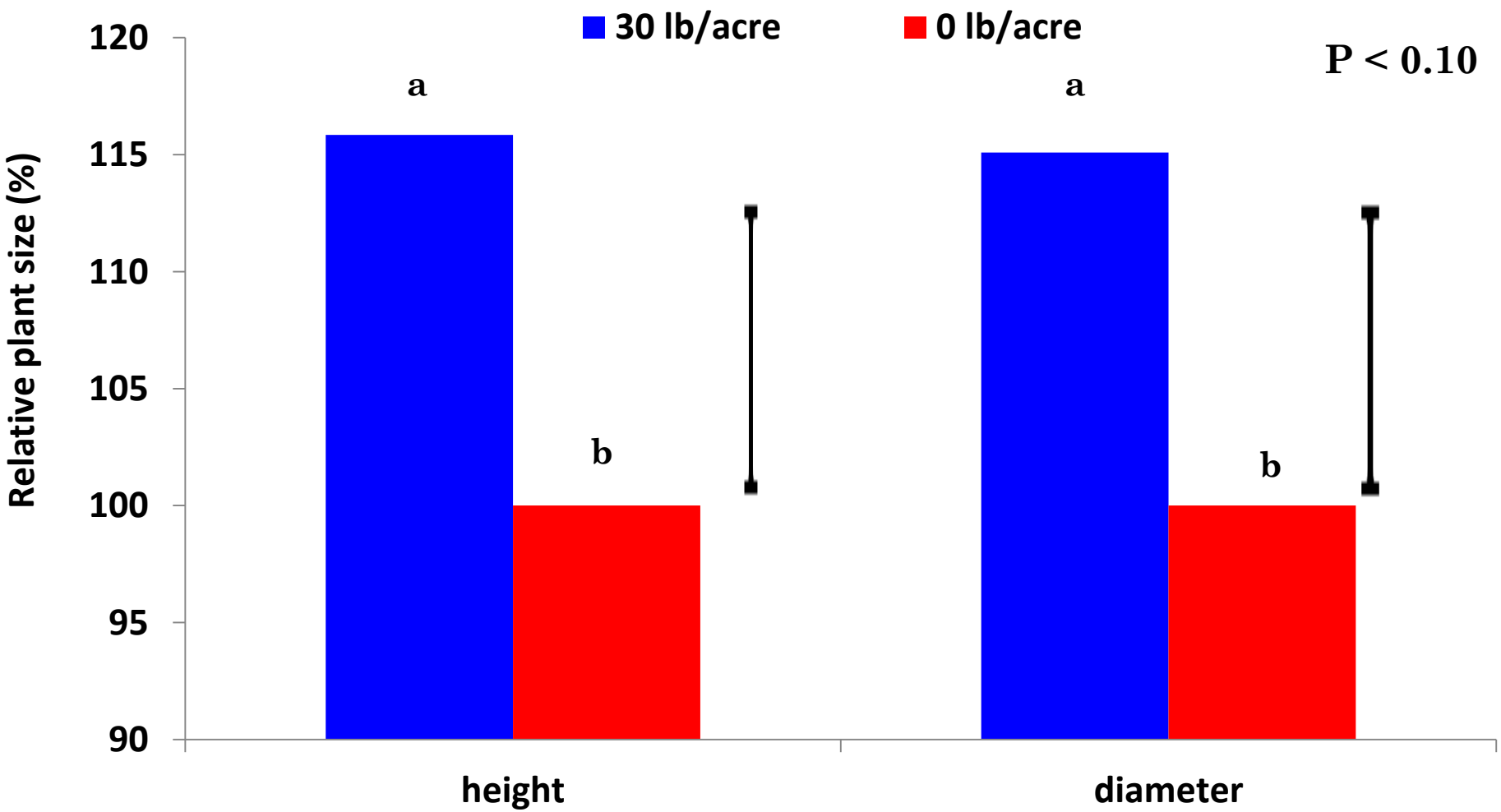
TY_f = tuber yield with N fertilizer

TY_0 = tuber yield without N fertilizer

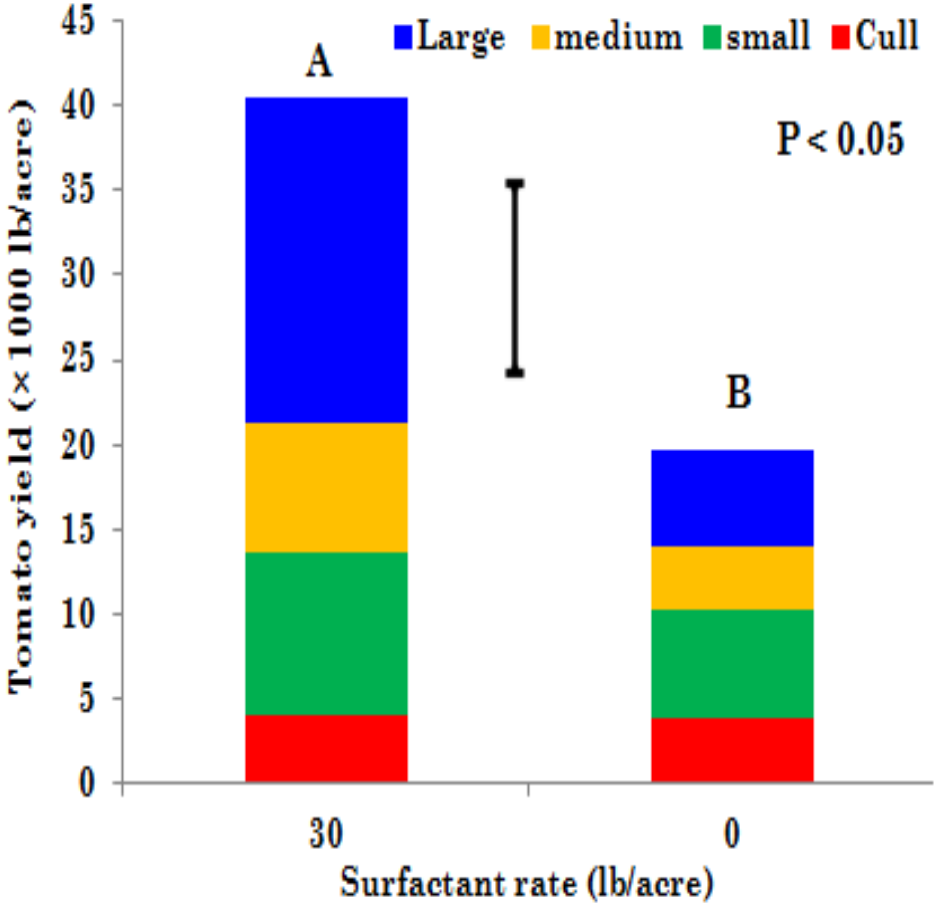
F = fertilizer

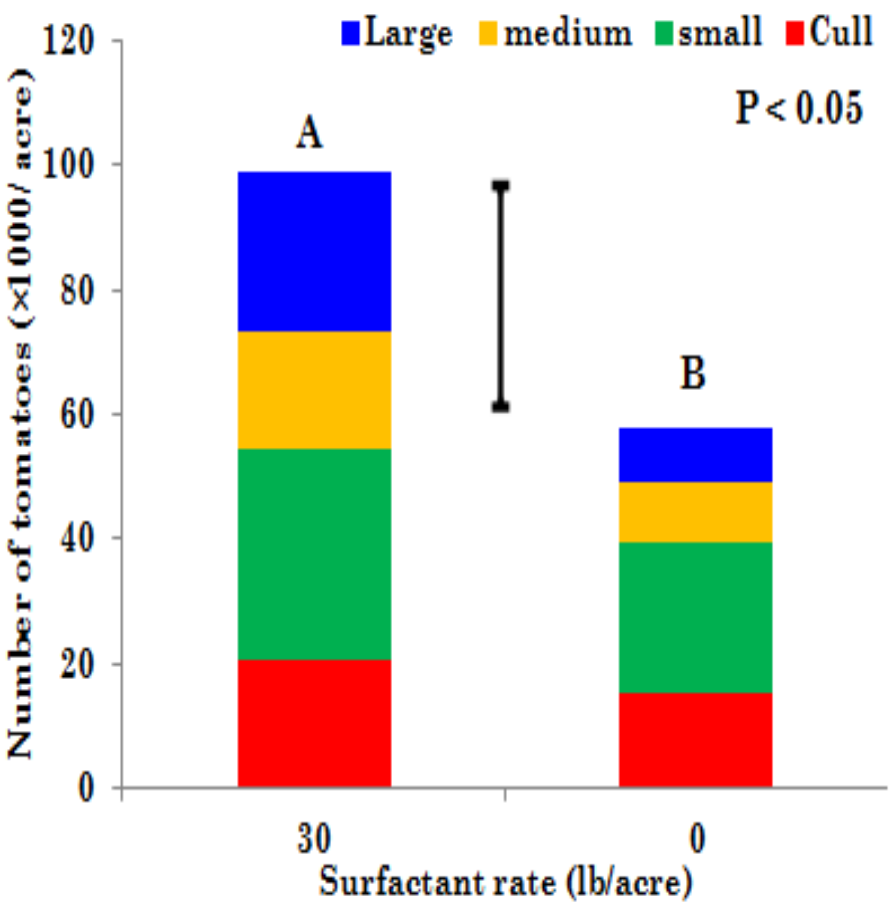
Plant size
(8 weeks after planting)

Surfactant: 30 lb/acre **0 lb/acre**

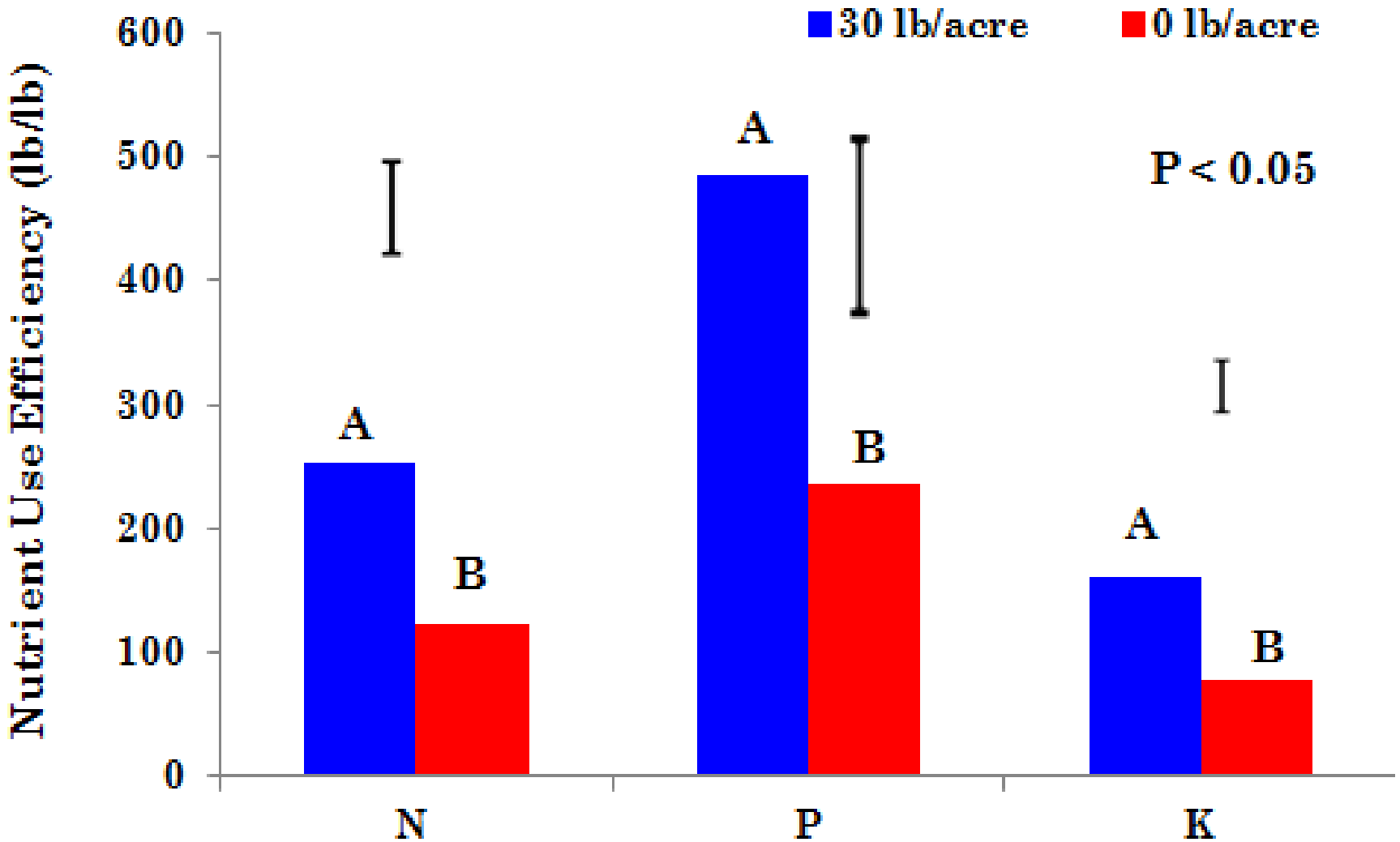

30 lb/acre
0 lb/acre
P < 0.10
Relative plant size (%)
120
115
110
105
100
95
90
a
b
a
b
height
diameter

Fruit yield


Large
medium
small
Cull
P < 0.05
A
B
Tomato yield (× 1000 lb/acre)
45
40
35
30
25
20
15
10
5
0
30
0
Surfactant rate (lb/acre)


Large
medium
small
Cull
P < 0.05
A
B
Number of tomatoes (×1000/ acre)
120
100
80
60
40
20
0
30
0
Surfactant rate (lb/acre)

NPK use efficiency



Summary

The surfactant significantly increased:

- Tomato growth and yield
- N, P, and K use efficiency

How about other crops?

Materials and Methods

- Trial time: Spring 2013
- Location: Hastings, Florida
- Fertilization: N (NH_4NO_3), 200; P_2O_5(TSP), 100; K_2O (MOP), 250 lb/acre
- Irrigation: seepage
- Variety: Atlantic
- Surfactant: Stockosorb 660, 30 lb/acre
- Treatment: (1) 200 lb/acre AN N. Two applications, (2) N mixed with SF, one application, (3) control, no N
- Plot size: 533 square feet
- Number of replication: 4
- Fertilizer use efficiency (FUE):

$$FUE(lb/lb) = \frac{TY_f - TY_0}{F}$$

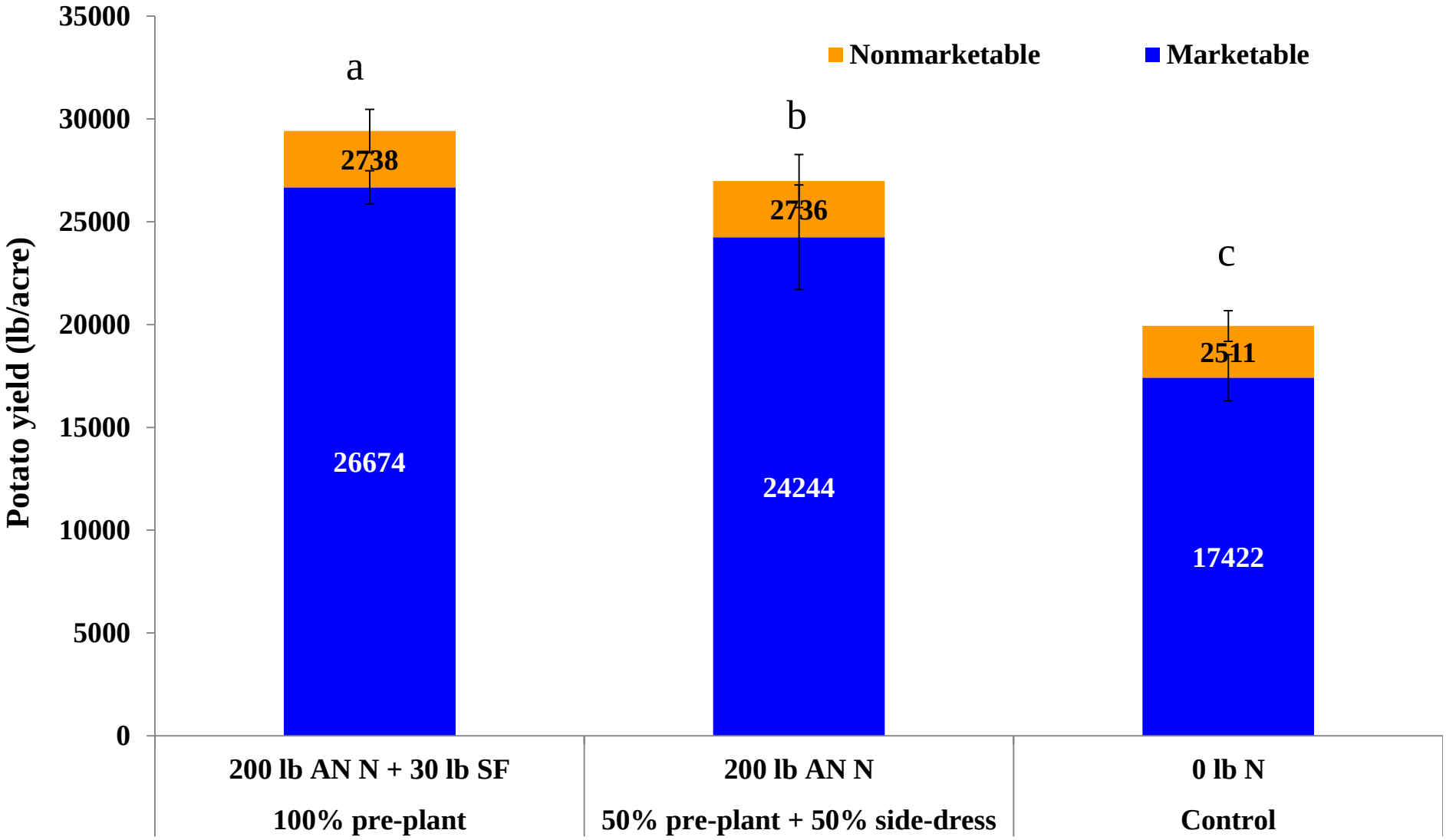
TY_f = tuber yield with N fertilizer

TY_0 = tuber yield without N fertilizer

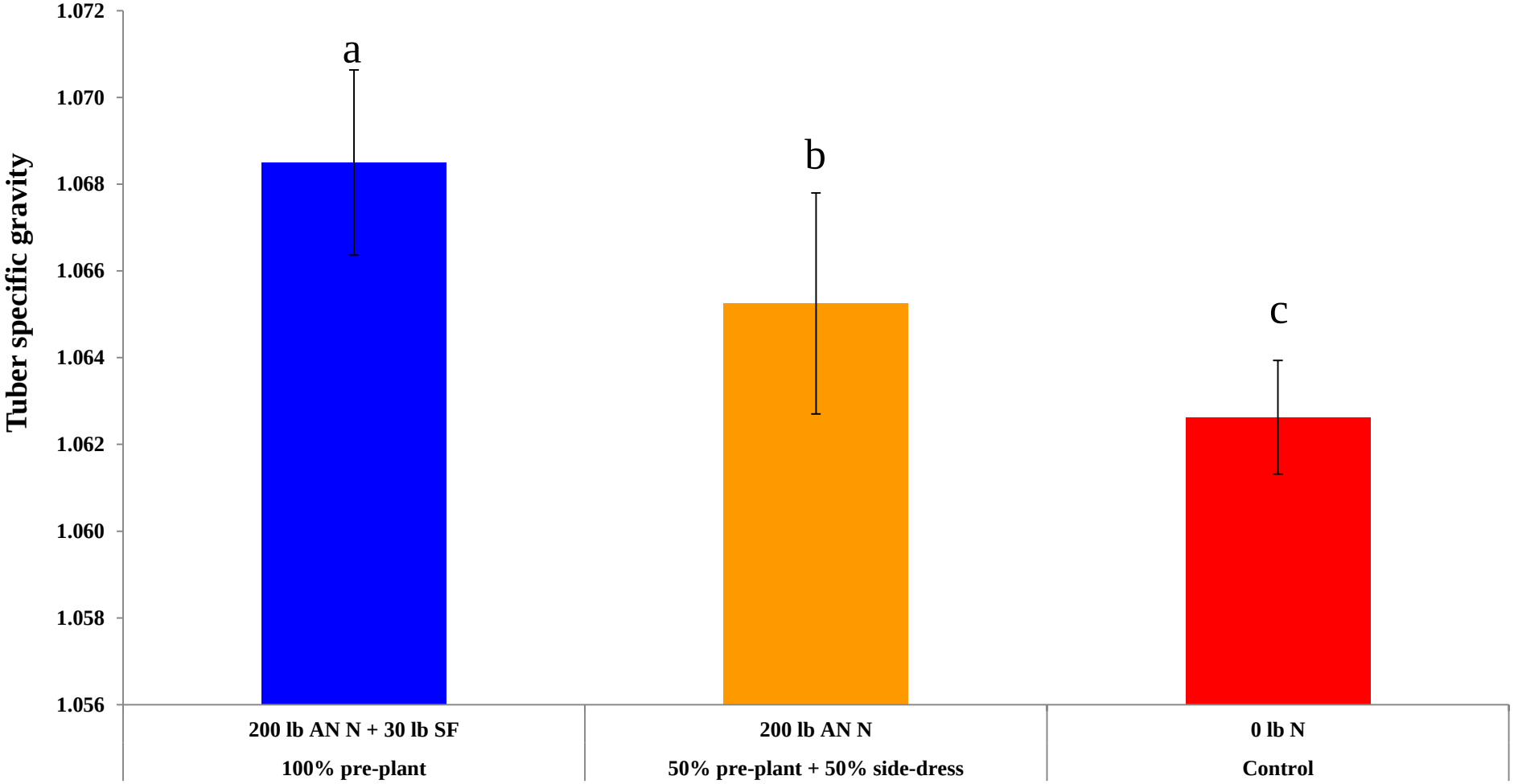
F = fertilizer

Results

Surfactant *vs.* Potato Yield



Surfactant Increases Tuber Specific Gravity



Potato Tuber Quality

Application method	N treatment					Brown Center		
		HH	BR	CRS	IHN	L	M	H
100% pre-plant	200 lb AN N + 30 lb SF	1	0	0	1	1	1	0
50% pre-plant + 50% side-dress	200 lb AN N	0	0	1	2	1	1	0
Control	0 lb N	0	0	0	1	0	1	0

HH = Hollow Heart
BR = Brown Rot
CRS = Corky Ringspot
IHN = Internal Heat Necrosis

Fertilizer Use Efficiency (lb/lb)

Application method	N treatment	Fertilizer use efficiency (lb/lb)		
		N	**P**	**K**
100% pre-plant	***200 lb AN N + 30 lb SF***	47.4a	94.8a	37.9a
50% pre-plant + 50% side-dress	***200 lb AN N***	35.2b	70.5b	28.2b
Control	***0 lb N***	-	0.0c	0.0c

$$FUE(lb/lb) = \frac{TY_f - TY_0}{F}$$

TY_f = tuber yield with N fertilizer

TY_0 = tuber yield without N fertilizer

F = fertilizer

Summary

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Acknowledgements

- Evonik Stockhausen, Inc. provided Stockosorb 600
- Superior Plant Co. provided tomato seedlings


Thank You!