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Foliar Potassium (K) Fertilization of Muskmelon: Effects on Fruit Quality

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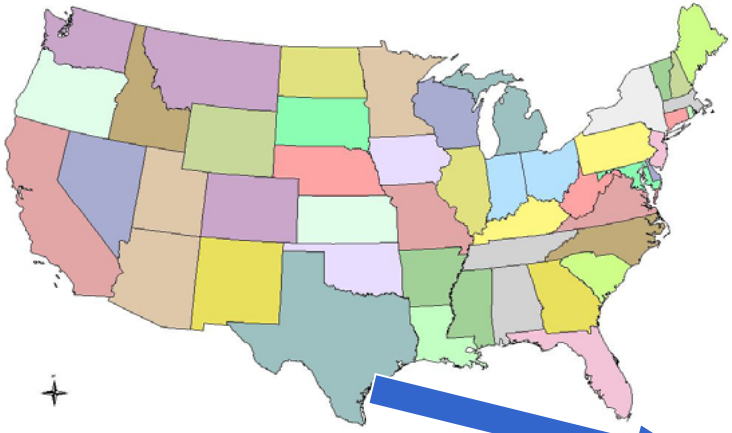
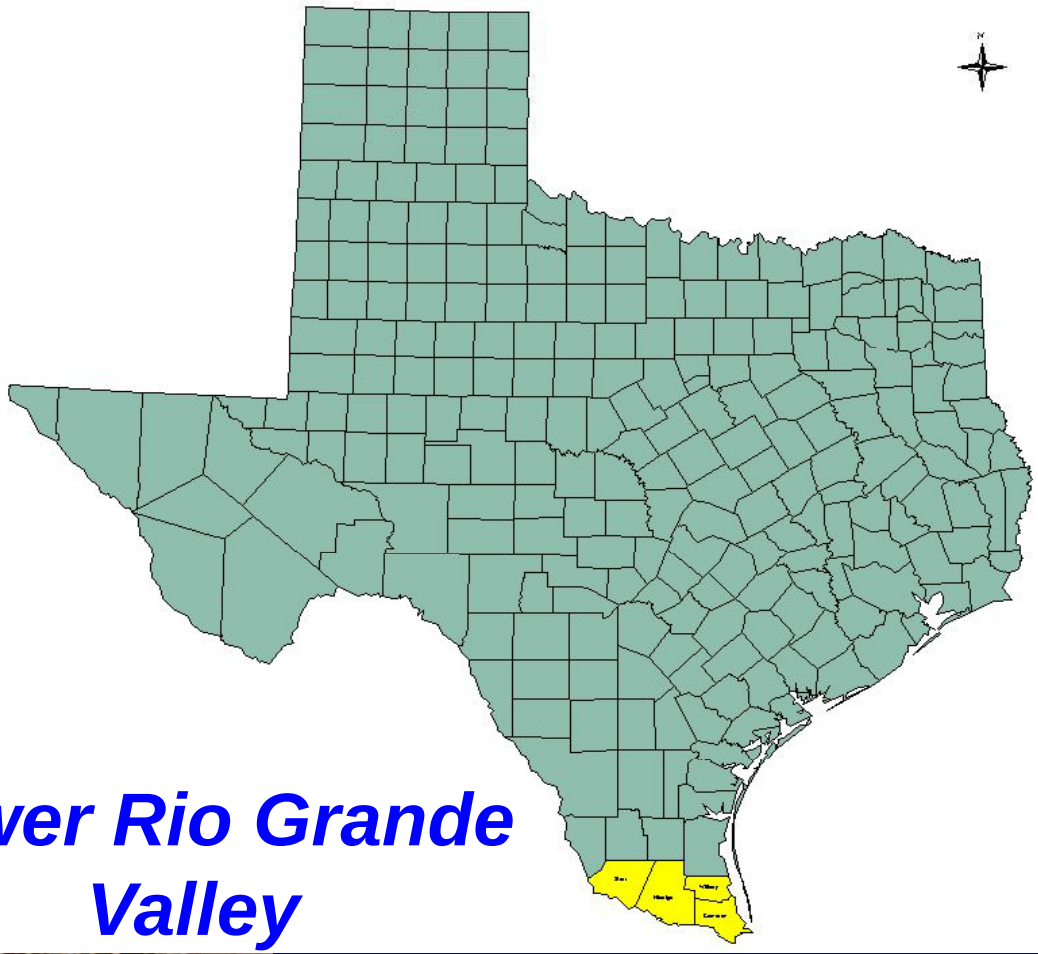
AgriLIFE RESEARCH
Texas A&M System

Vfic Foods for Health Vegetable and Fruit Improvement Center

USDA ARS





Lower Rio Grande Valley

The problem:

Inconsistent Fruit Quality

- Taste – Sweetness
- Flavor
- Appearance
- Texture
- Nutritional and health benefits
- Shelf life

The problem:
Inconsistent Fruit Quality

Genetics alone (cultivars) not enough

Nutrient imbalance - K

Focus on Potassium Fertilization

Quality nutrient: Numerous Functions in Plants

1. Photosynthesis: sugar production
2. Assimilate transport; phloem loading/unloading
3. Enzyme activation
4. Regulation of water loss
5. …many more….

Uptake limitations

- Most K uptake is prior to fruiting
- Soil moisture, temperature, aeration …root activity
- Sink competition (roots vs fruits) for carbohydrates
- Competitive interactions with other ions - Ca and Mg
- High pH (7.5+)
- ….many more..

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Consequence:

An apparent K deficiency during the critical fruit development period because root uptake cannot keep up with fruit demand.

Soil characteristics

	2005	2006	2007	CL
pH	8.1 ± 0.2	8.3 ± 0.2	8.4 ± 0.3	6.5
NO_3-N	29 ± 4	23 ± 2	25 ± 2	-
P	55 ± 3	53 ± 3	51 ± 4	50
K	664 ± 26	612 ± 75	572 ± 13	175
Ca	7307 ± 247	7677 ± 574	8069 ± 827	180
Mg	442 ± 43	390 ± 31	430 ± 51	50
Na	188 ± 5	168 ± 9	162 ± 3	-

Glasshouse studies

(Lester & Jifon, 2005, 2006)

- Supplementing soil derived K with foliar K applications can overcome the apparent deficiency
- Improve fruit quality (soluble solids & firmness)
- Increase human health quality traits

Objectives of the Current Study:

- Determine extent to which this approach is applicable under field conditions
- Evaluate effects of different K sources on fruit quality.

Treatments:

- **Foliar K sources:**

1. Control		0% K_2O
2. KCl	- potassium chloride	60% K_2O
3. KNO_3	- potassium nitrate	44% K_2O
4. MKP	- monopotassium phosphate (PeaK)	30% K_2O
5. K_2SO_4	- potassium sulfate	50% K_2O
6. KTS	- potassium thiosulfate	25% K_2O
7. K-Metalosate	- glycine amino acid-complexed K, +surfactant (Silwet)	24% K_2O

- **Timing & rates** 4lbs K_2O/A weekly (6 - 8am) from fruit set to maturation
- **Crop** netted muskmelon 'Cruiser'

Fruit harvests & processing

- Soluble solids
- Total Sugars
- Fruit firmness
- Internal color
- Tissue K content
- Vitamin C
- β-carotene

- Yield

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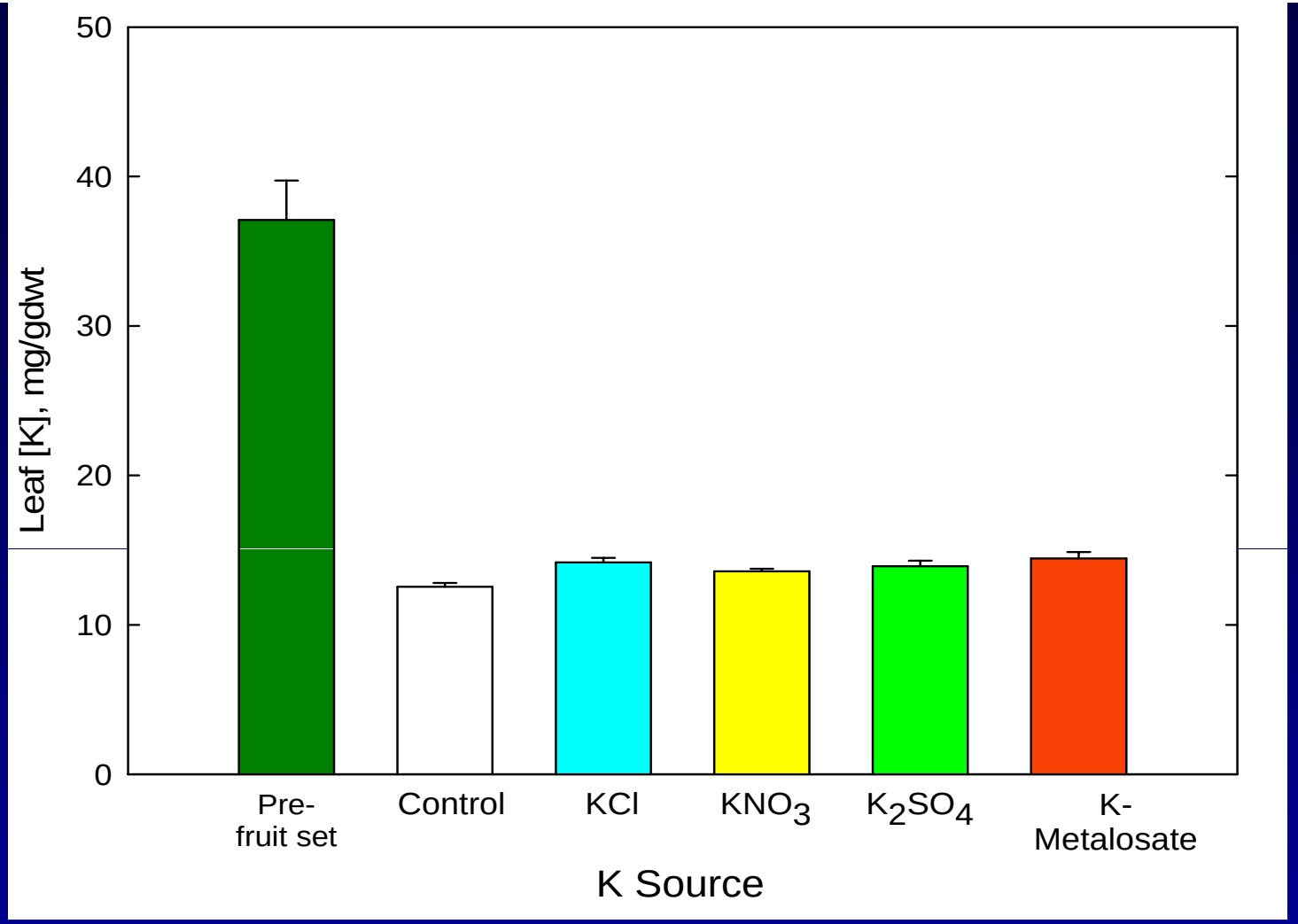
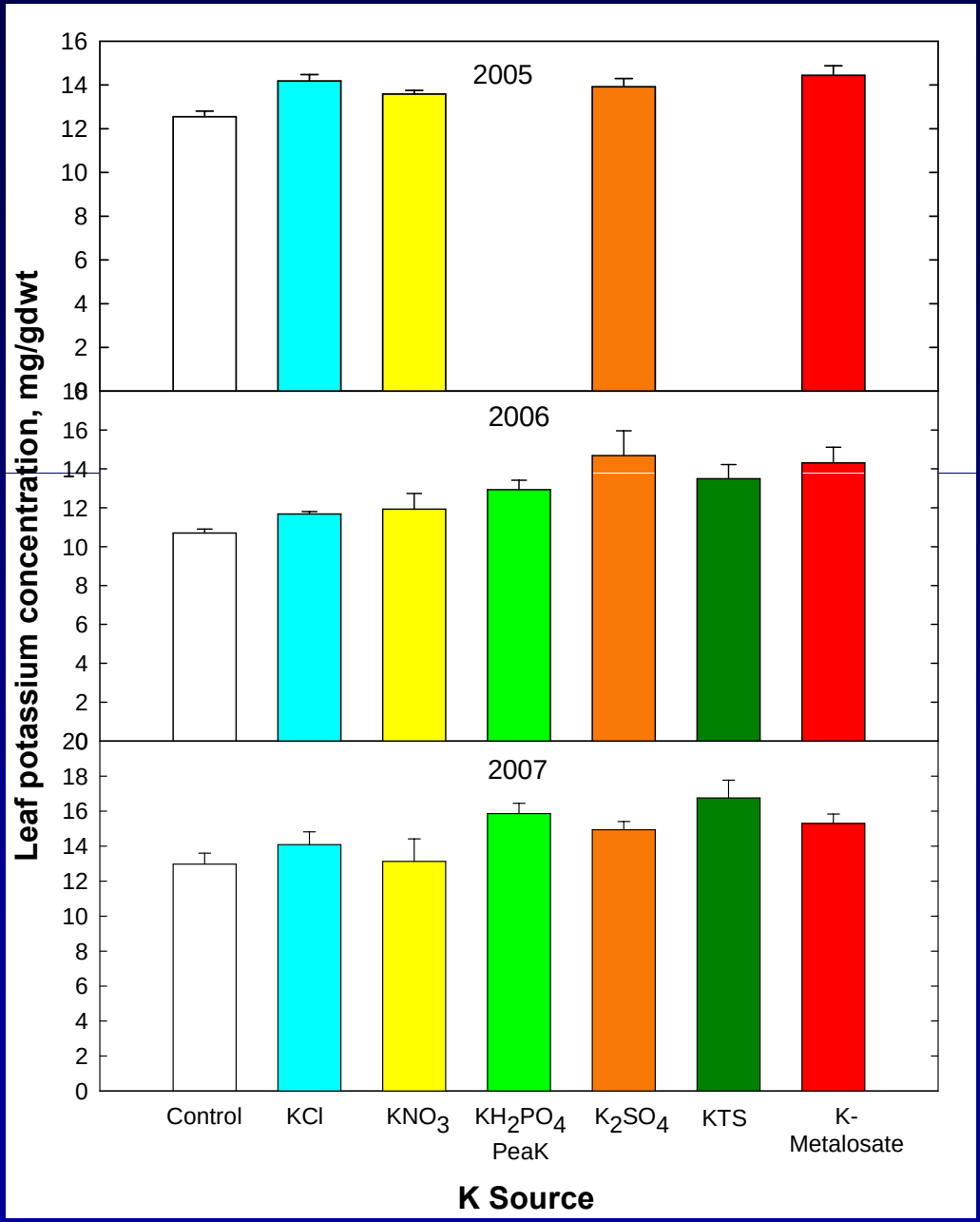
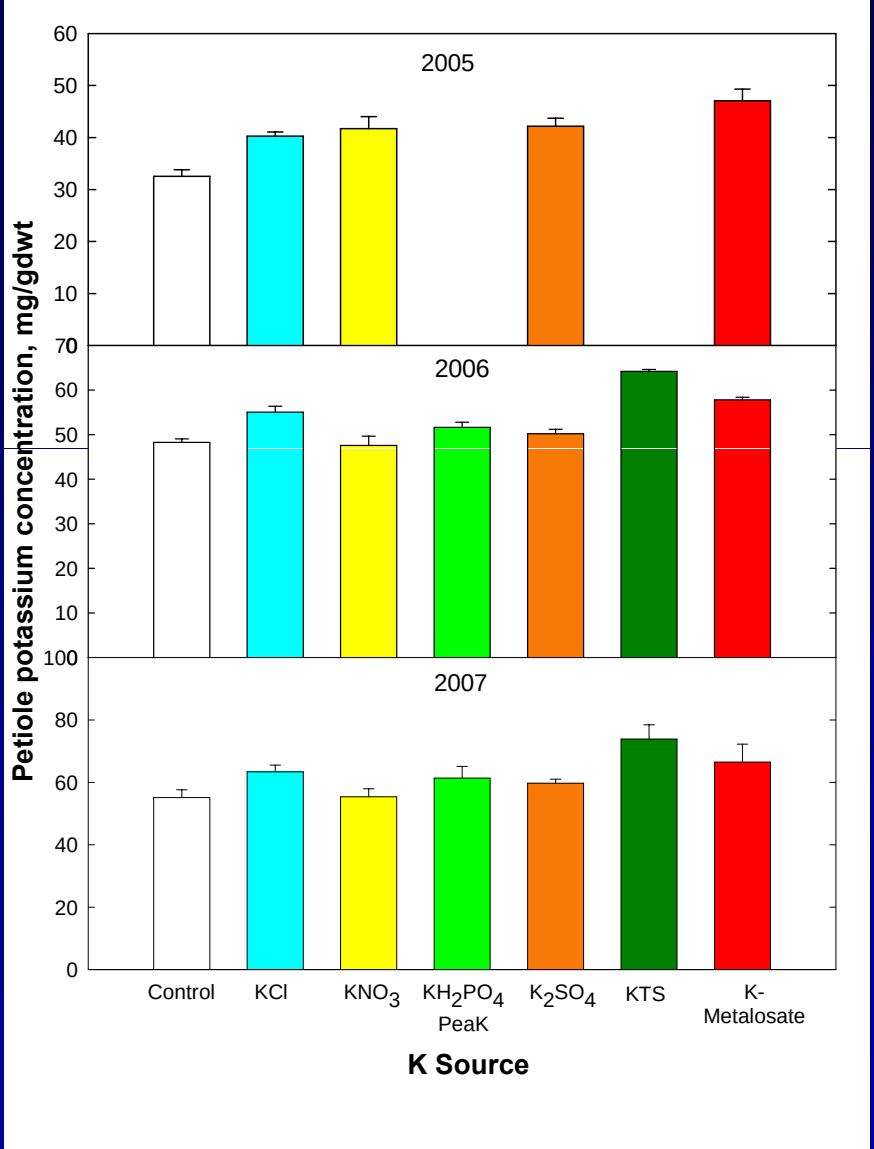
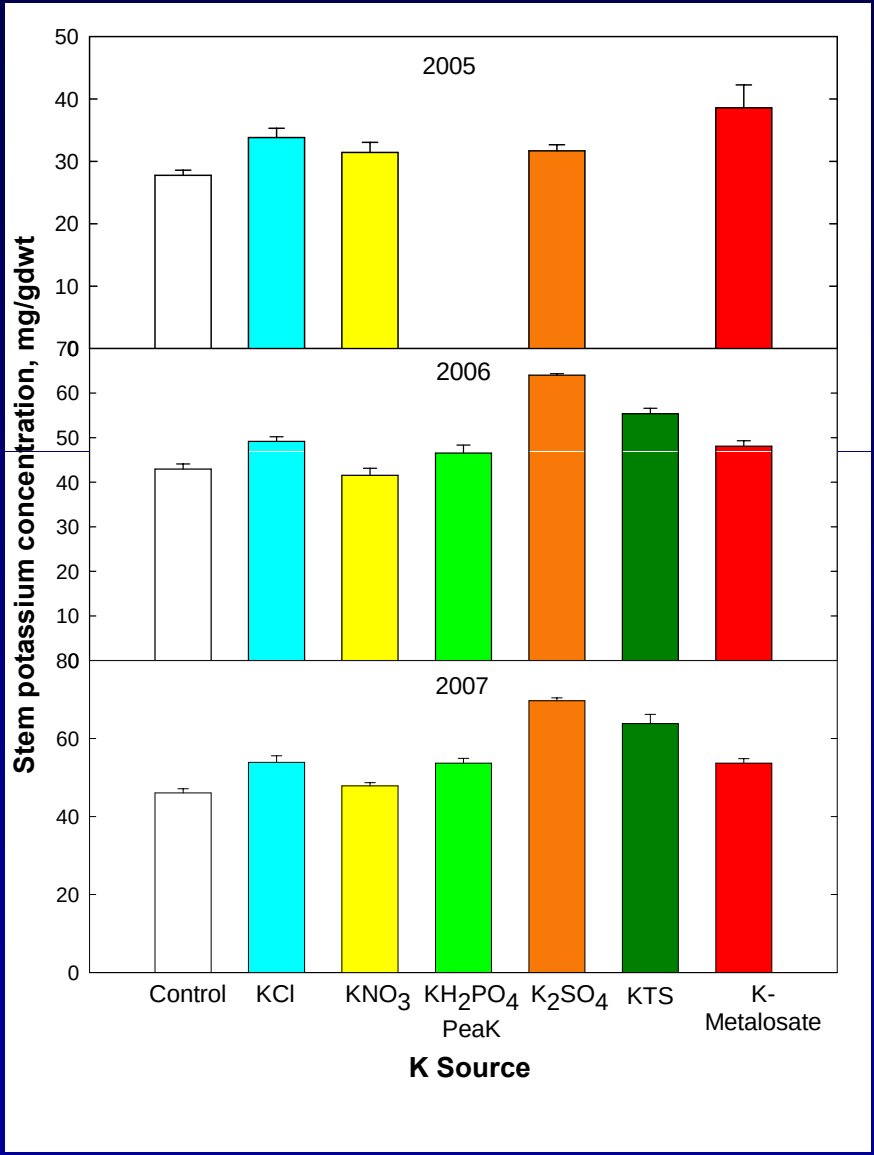

50
40
30
20
10
0
Leaf [K], mg/gdwt
Pre-
fruit set
Control
KCl
KNO3
K2SO4
K-
Metalosate
K Source


2005
2006
2007
Leaf potassium concentration, mg/gdwt
Control
KCl
KNO3
KH2PO4
PeaK
K2SO4
KTS
K-
Metalosate
K Source

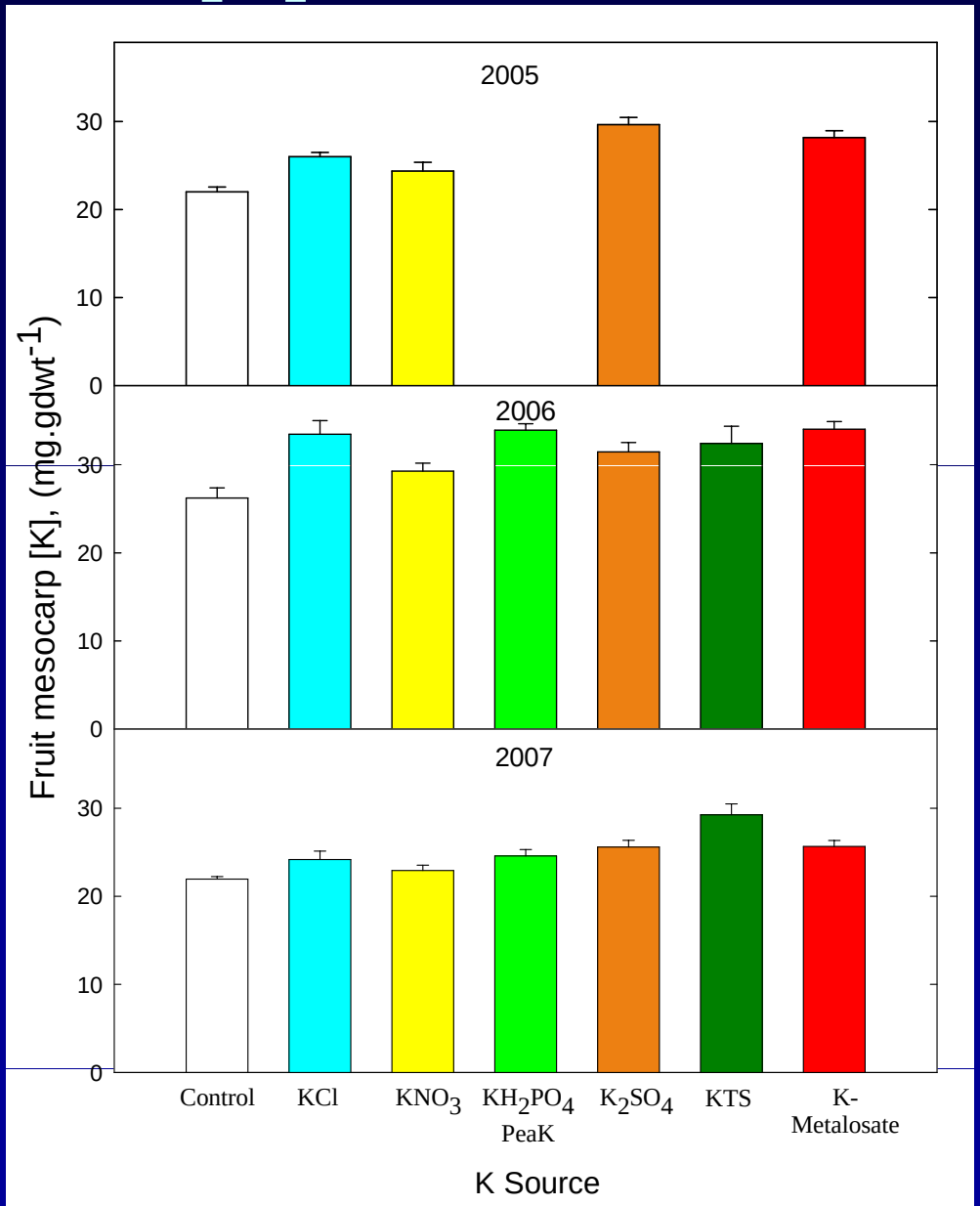
Petiole [K]



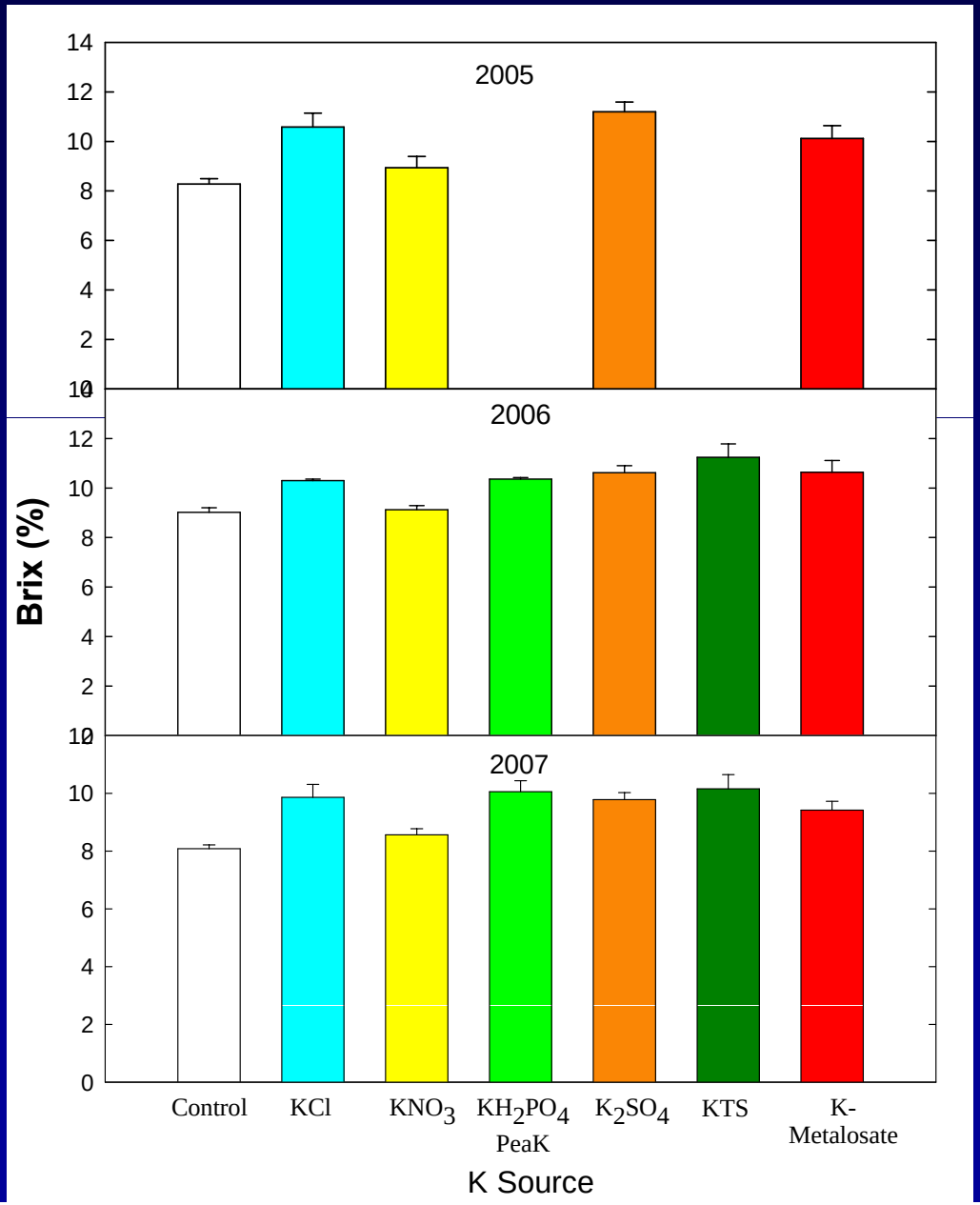
Stem [K]



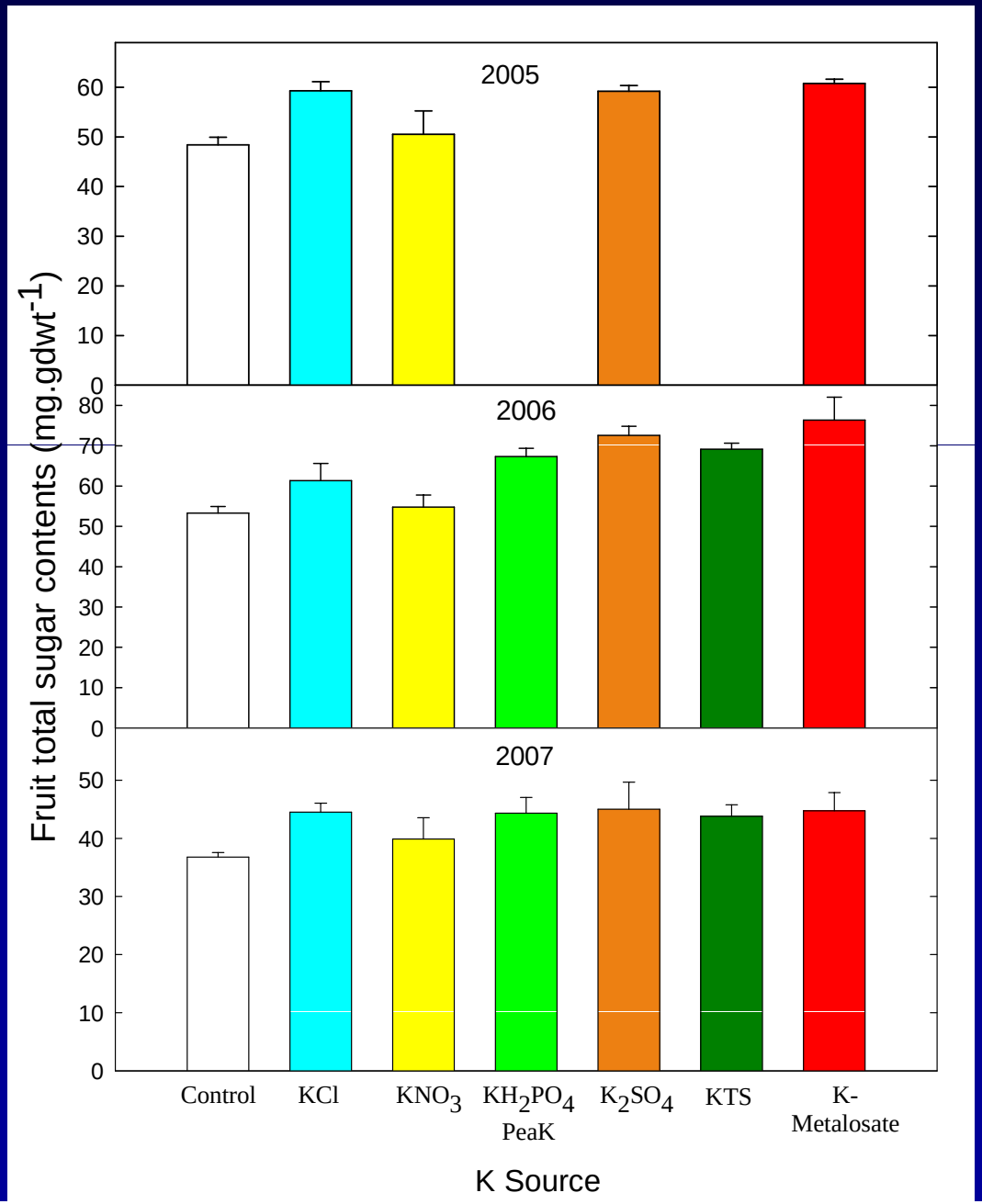
Fruit [K]


2005
2006
2007
Fruit mesocarp [K], (mg.gdwt-1)
0
10
20
30
Control
KCl
KNO3
KH2PO4
PeaK
K2SO4
KTS
K-
Metalosate
K Source

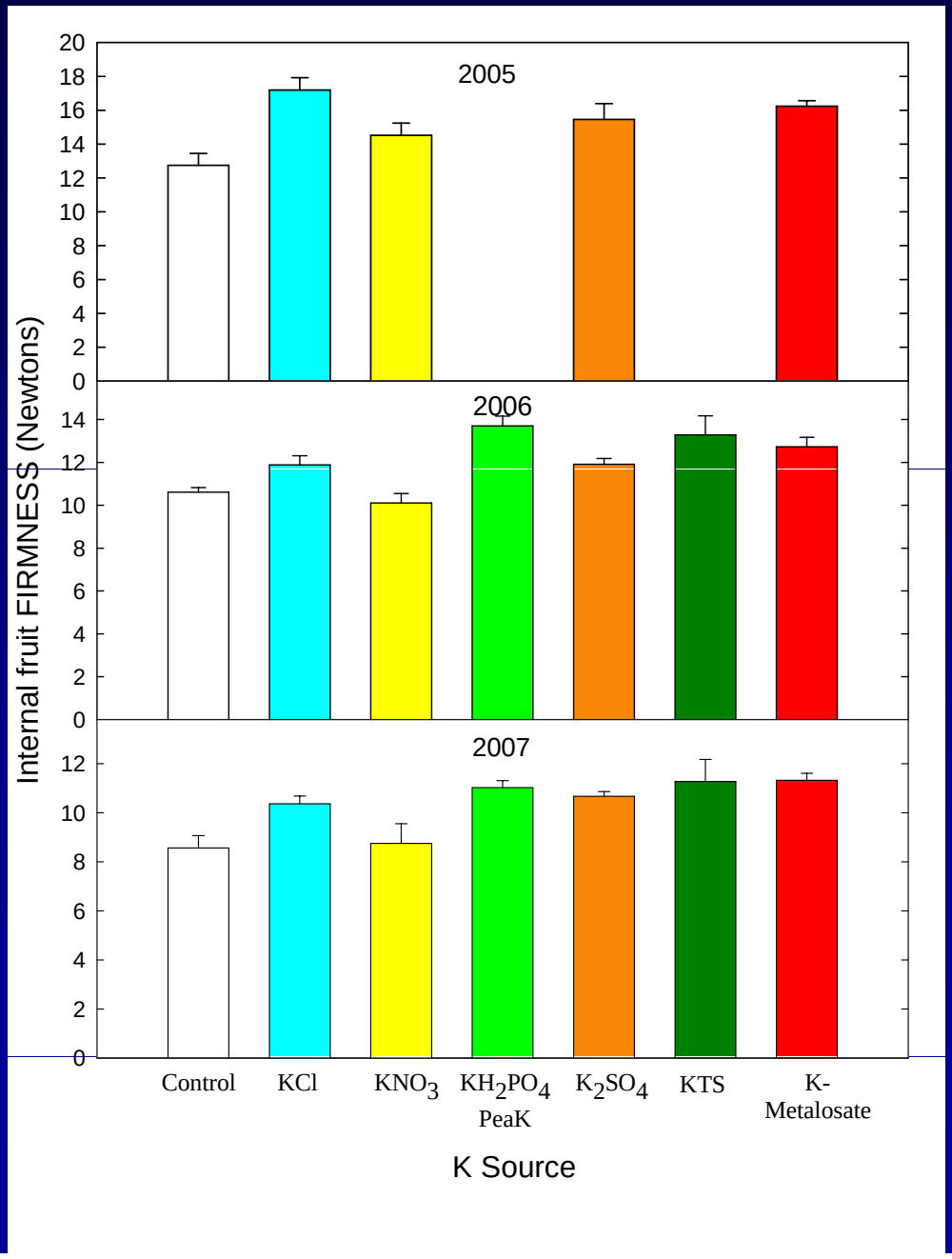
Soluble solids



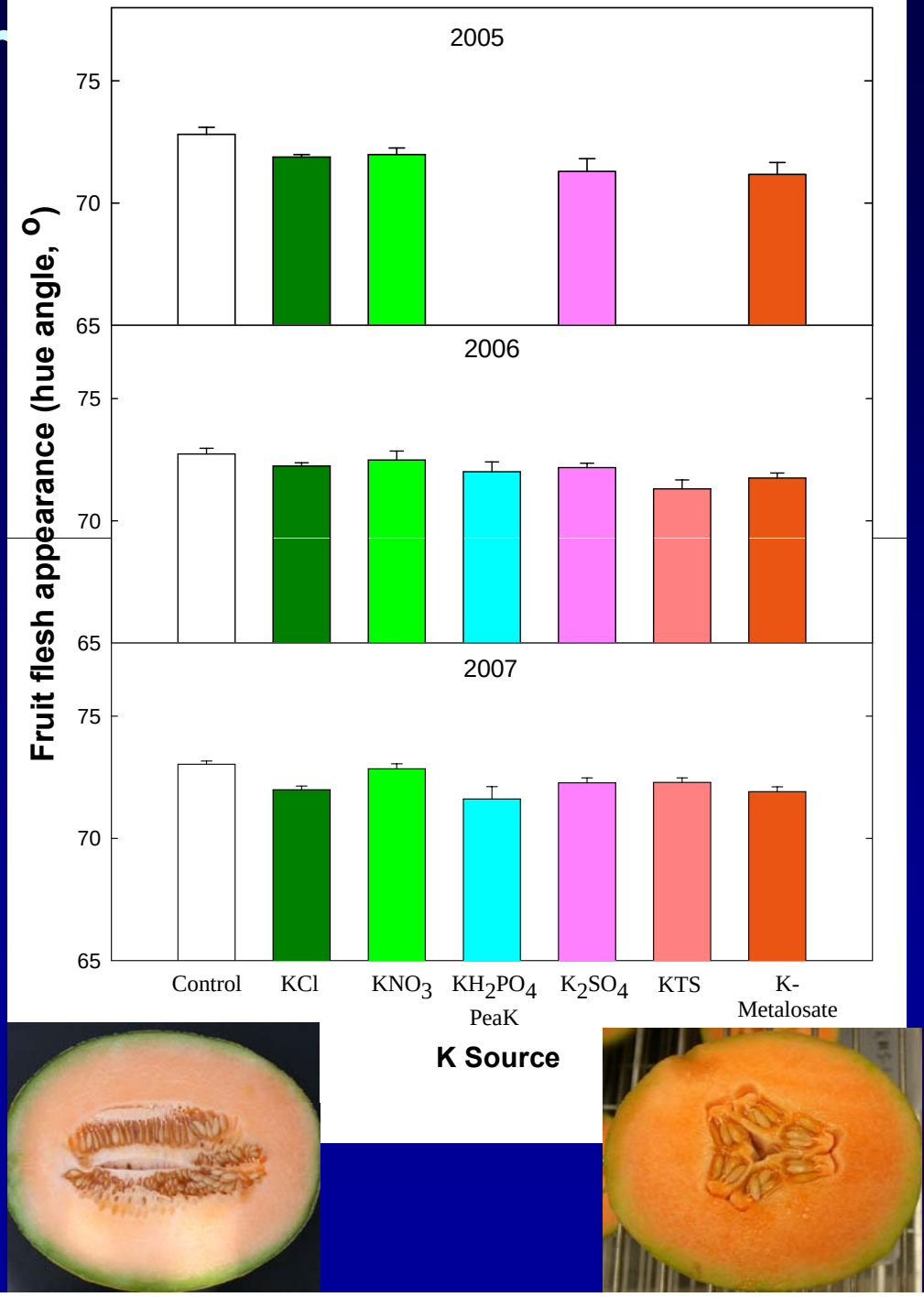
Fruit sugars



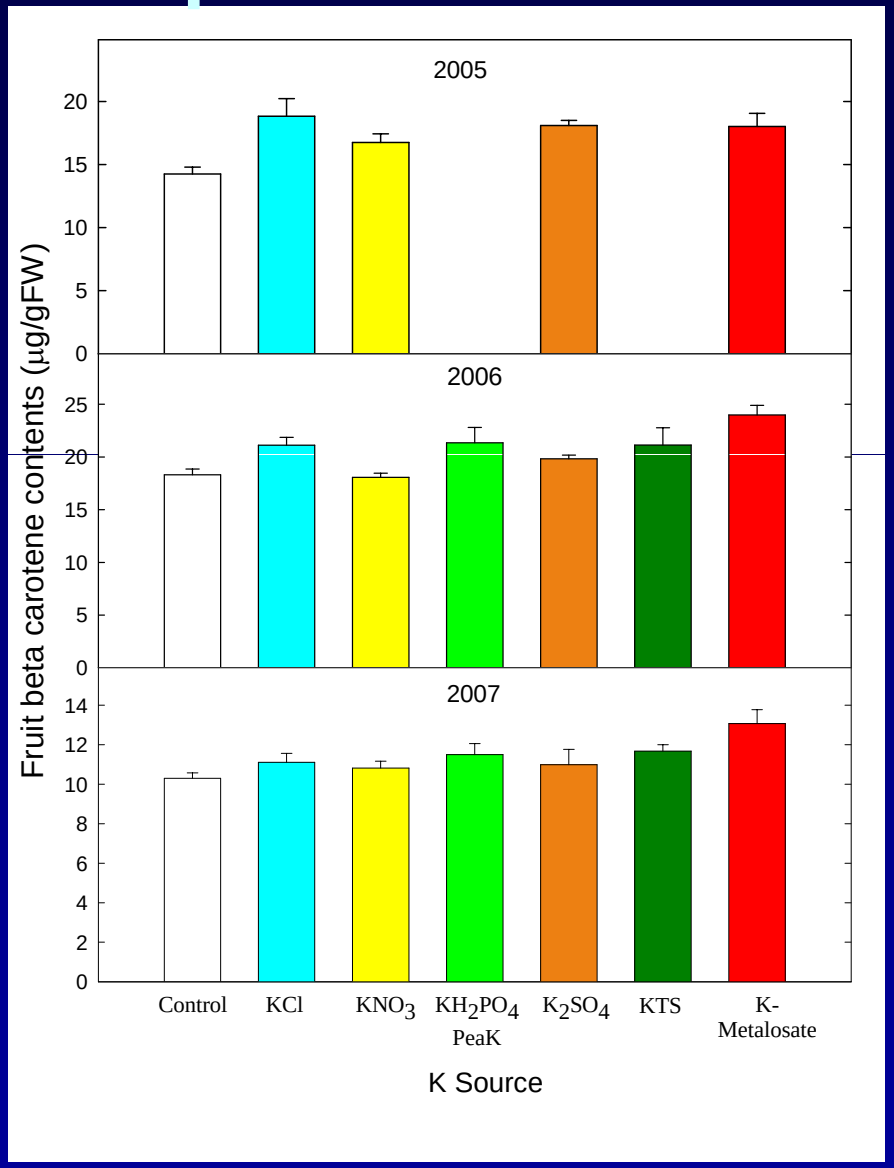
Fruit Texture



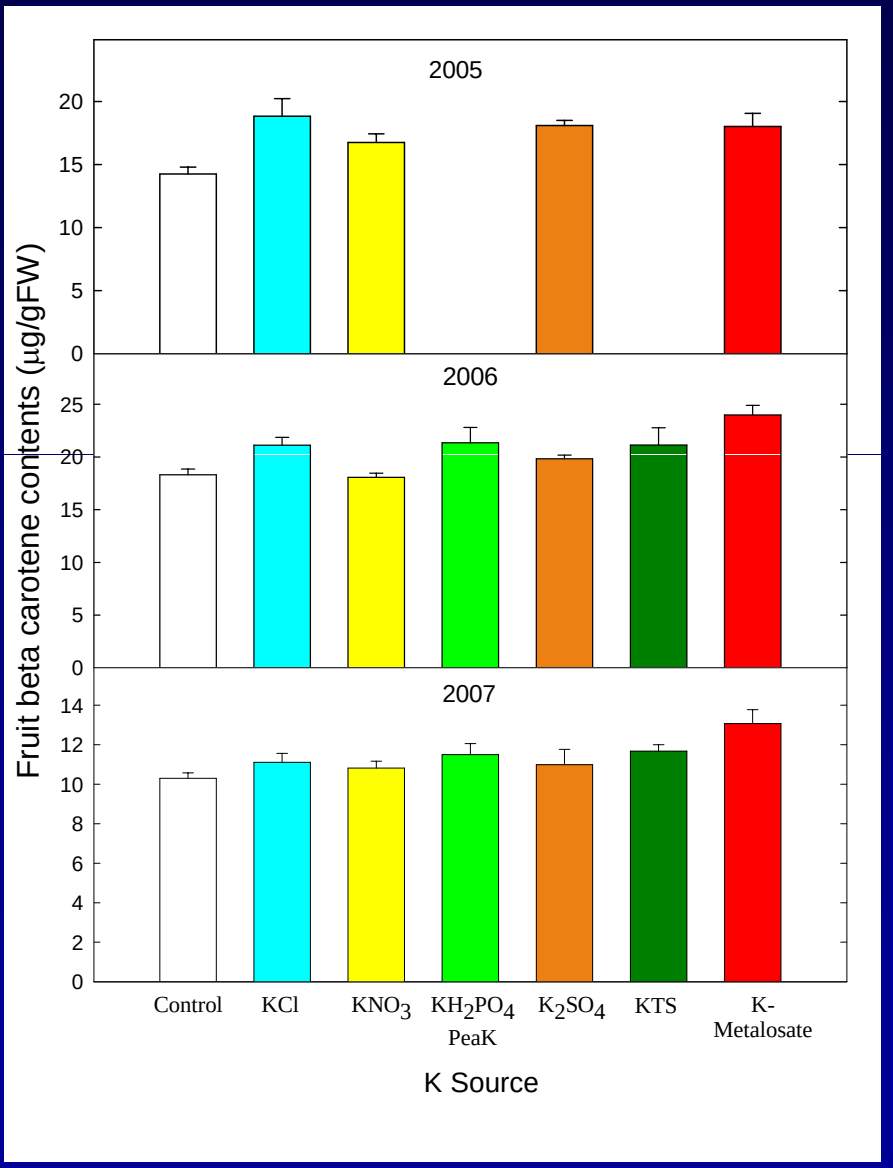
Fruit color


2005
2006
2007
75
70
65
Fruit flesh appearance (hue angle, °)
Control
KCl
KNO3
KH2PO4
PeaK
K2SO4
KTS
K-
Metalosate
K Source

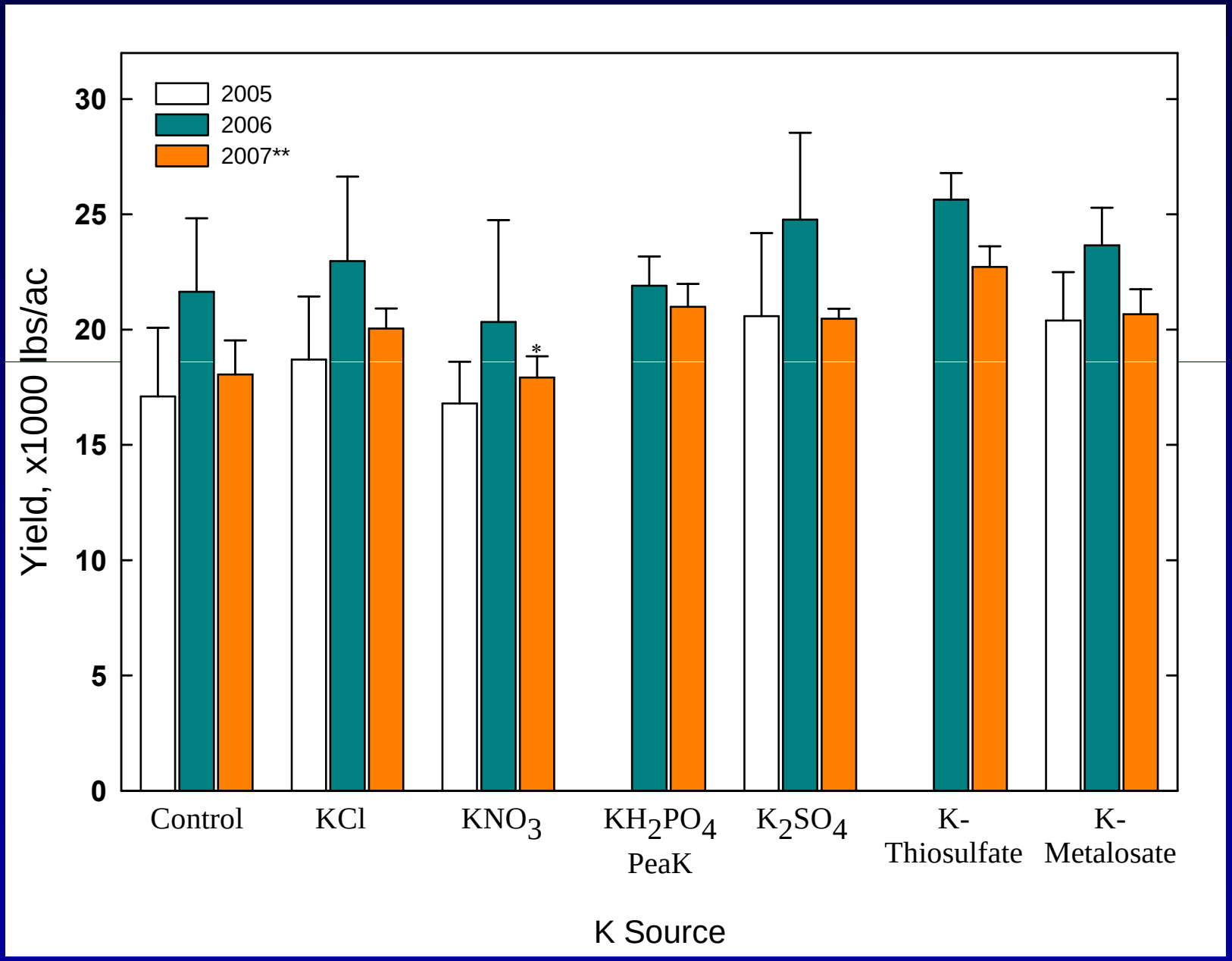
β-carotene



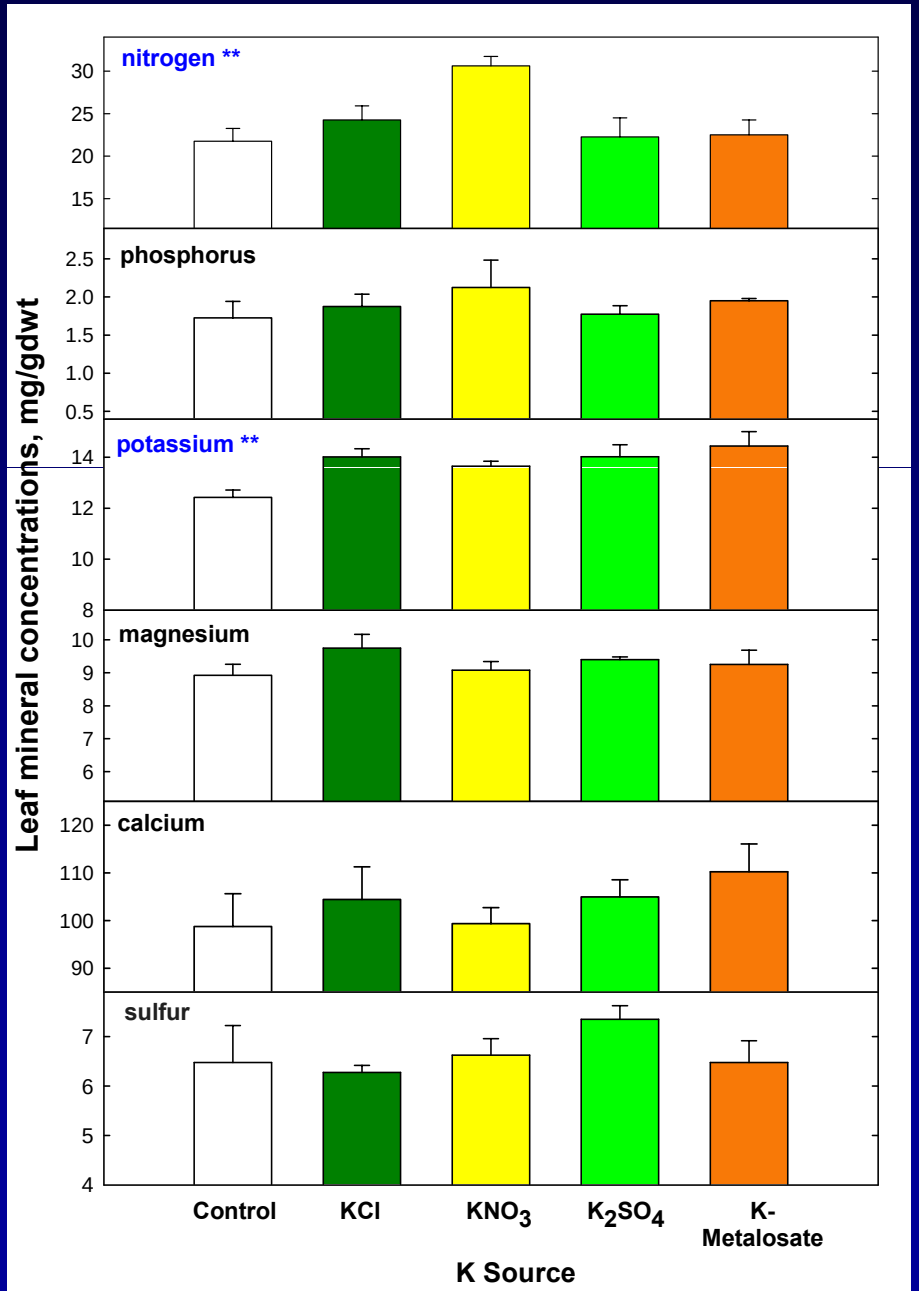
Ascorbic acid



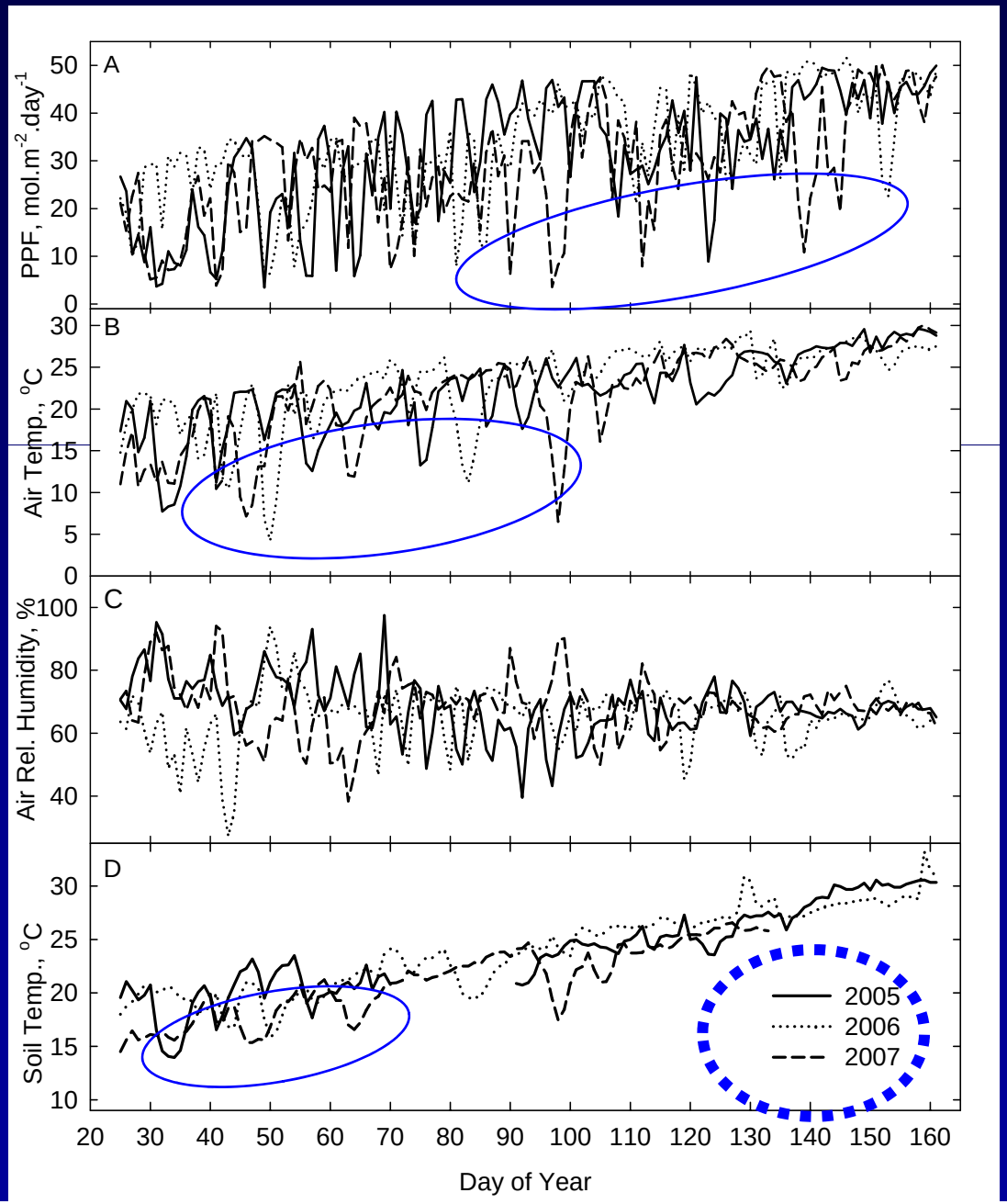
Fruit yield, x1000 lbs/acre



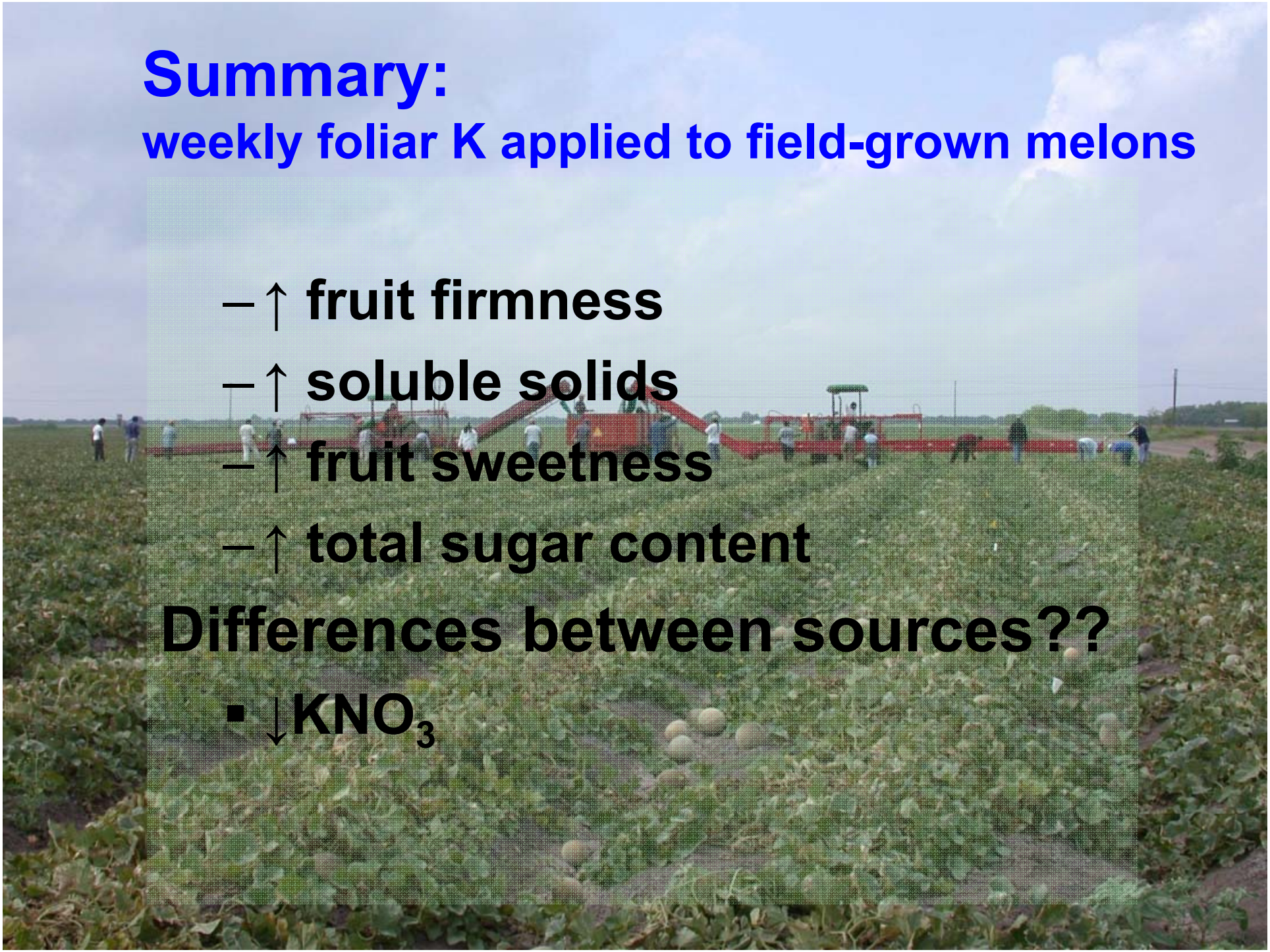
Leaf minerals



Weather Conditions



Summary:
weekly foliar K applied to field-grown melons



- ↑ fruit firmness
- ↑ soluble solids
- ↑ fruit sweetness
- ↑ total sugar content

Differences between sources??

- ↓KNO_3

Special Thanks

- Vegetable and Fruit Improvement Center – Texas A&M University; “Designing Foods for Health” Program,
- Fluid Fertilizer Foundation,
- International Plant Nutrition Institute,
- Tessenderlo Kerley Inc.,
- Albion Laboratories,
- Rotem BKG LLC,
- Nutra-Flo,
- Western Laboratories

Fluid Fertilizer Foundation

Solutions for AGRICULTURE

THANK YOU