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

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USDA ARS

Objectives:

To improve market quality and human health properties of fruits and vegetables

The problem: Poor Fruit Quality

Possible causes

- Weather conditions
- Cultivar selection
- Location/soil properties
- Cultural practices – irrigation & mineral nutrient management

Focus on Potassium

Quality nutrient: Numerous Functions in Plants

1. Enzyme activation
2. Regulation of water loss
3. Production of sugars in leaves
4. Transport of sugars – leaf to fruit
5. Unloading of sugars – into fruit
6. ……many more….

K is taken up by roots from the soil solution as the ionic form (K^+)

Uptake depends on:

Soil Factors:

Plant Factors:

Factors affecting K uptake:

Soil Factors:

- Soil type (clay > sandy)
- Soil pH 8+
- Moisture conditions
- Fertilizer K source
- Concentration of other cations - Ca and Mg
- Soil temperature
- … others…

Plant Factors:

- energy supply & root metabolism
- growth stage - most K uptake is prior to fruiting

K uptake limitations

- Most K uptake is prior to fruiting
- Soil temperature
- Concentration of other ions - Ca and Mg

  e.g. K: 542±28ppm; Ca: 13,800±400ppm; Mg: 521±12ppm
- High pH (7.5+)

Possible solution

- Supplemental Foliar K applications can overcome the apparent deficiency

- Glasshouse studies
  (Lester & Jifon, 2005, 2006)
- 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 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 (MoraLeaf P&K) — 30% K_2O
  5. K_2SO_4 - potassium sulfate — 50% K_2O
  6. KTS - potassium thiosulfate — 25% K_2O
  7. Potassium Metalosate - glycine amino acid-complexed K, +surfactant (Silwet) — 24% K_2O

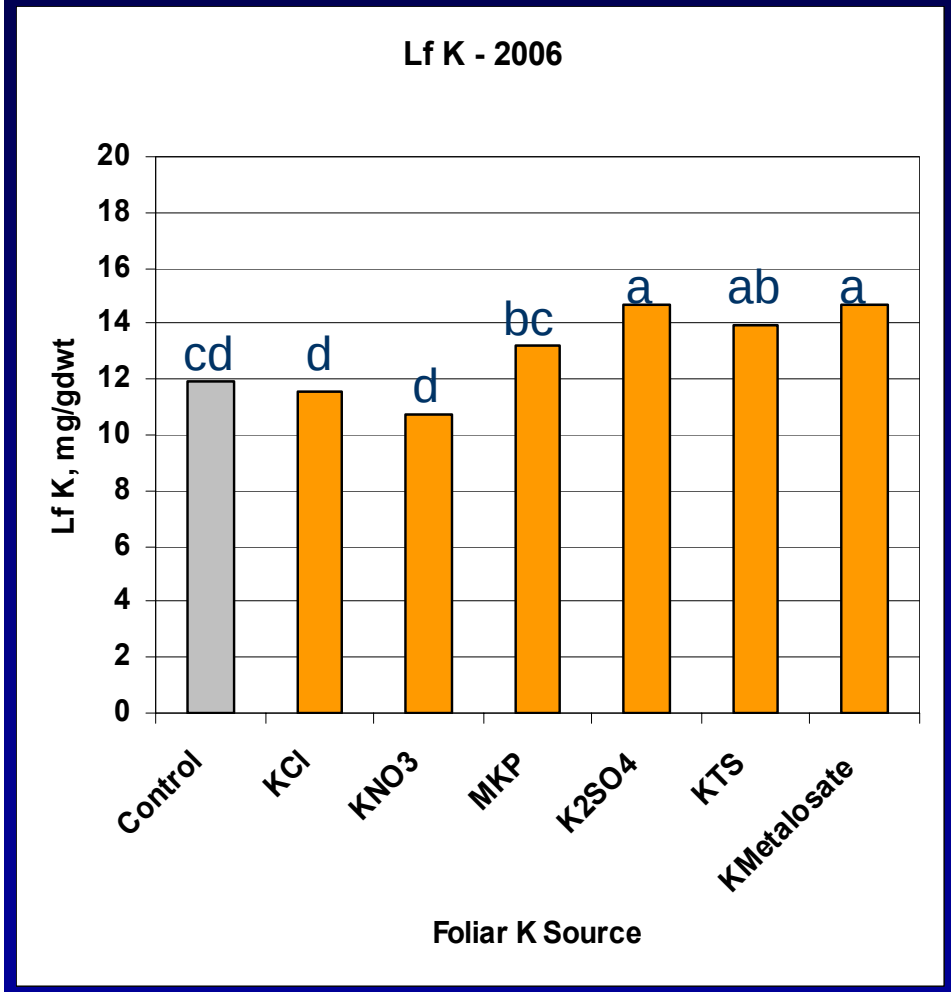
- **Timing & rates** 4 lbs K_2O/A weekly (6 - 8am) from fruit set to maturation
- **Crop** netted muskmelon 'Cruiser'

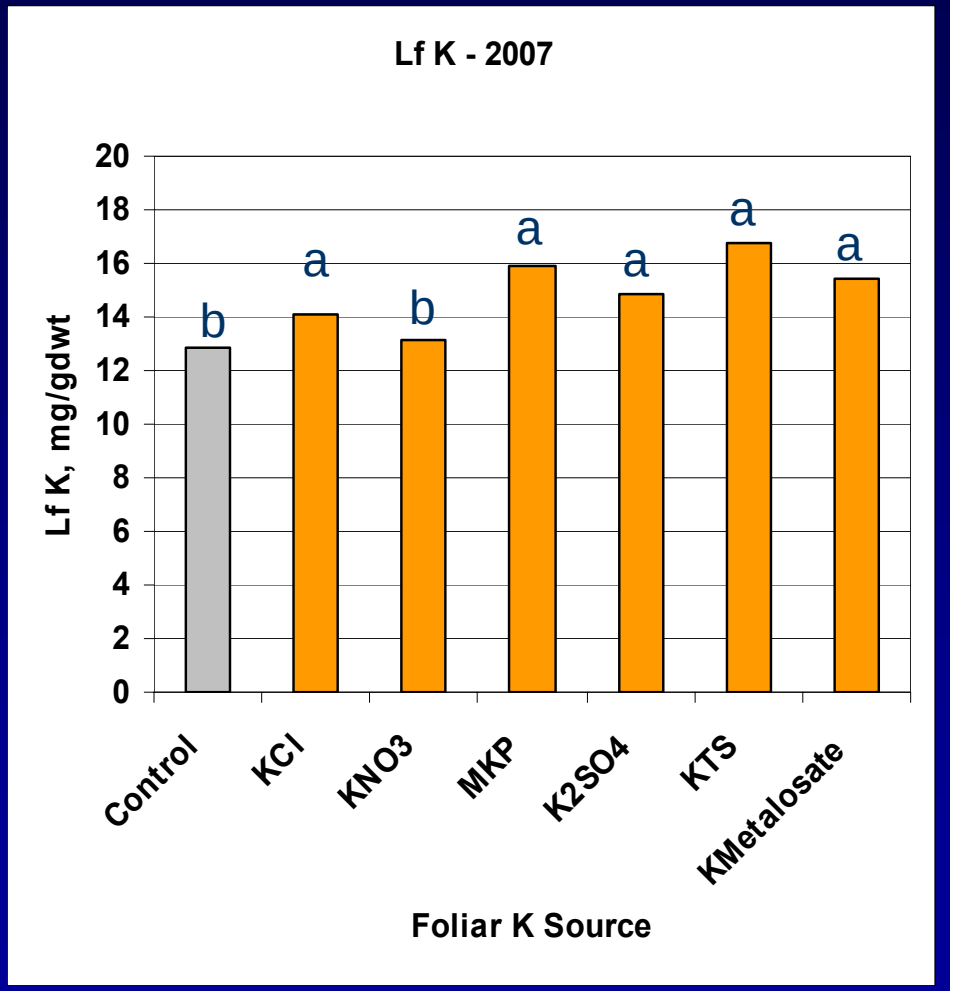
Procedures: Foliar K Application

Fruit harvests & processing

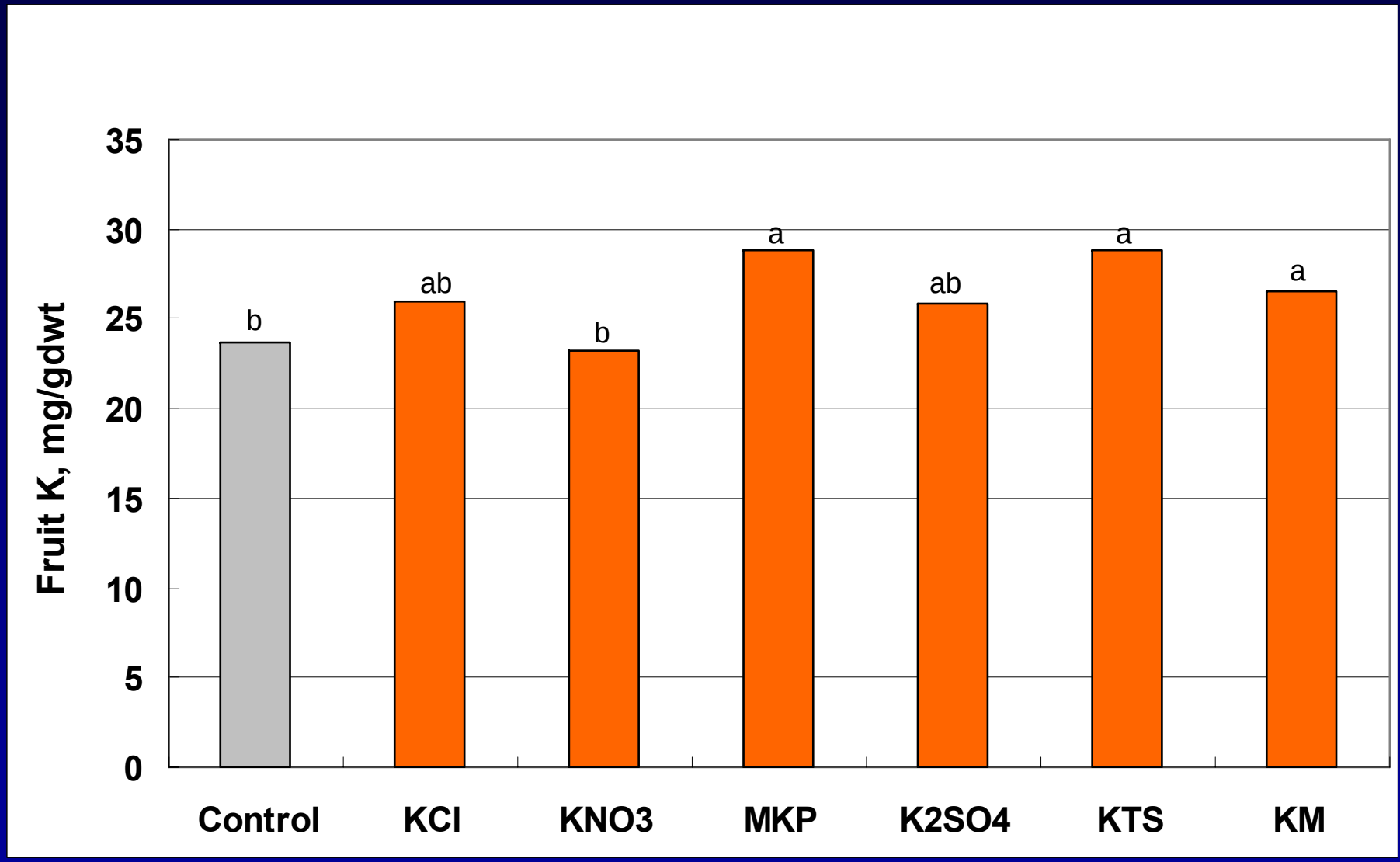
- Fruit firmness
- Internal color
- Tissue K concentrations
- Soluble solids
- Total Sugars
- Vitamin C
- β-carotene

Leaf K concentrations

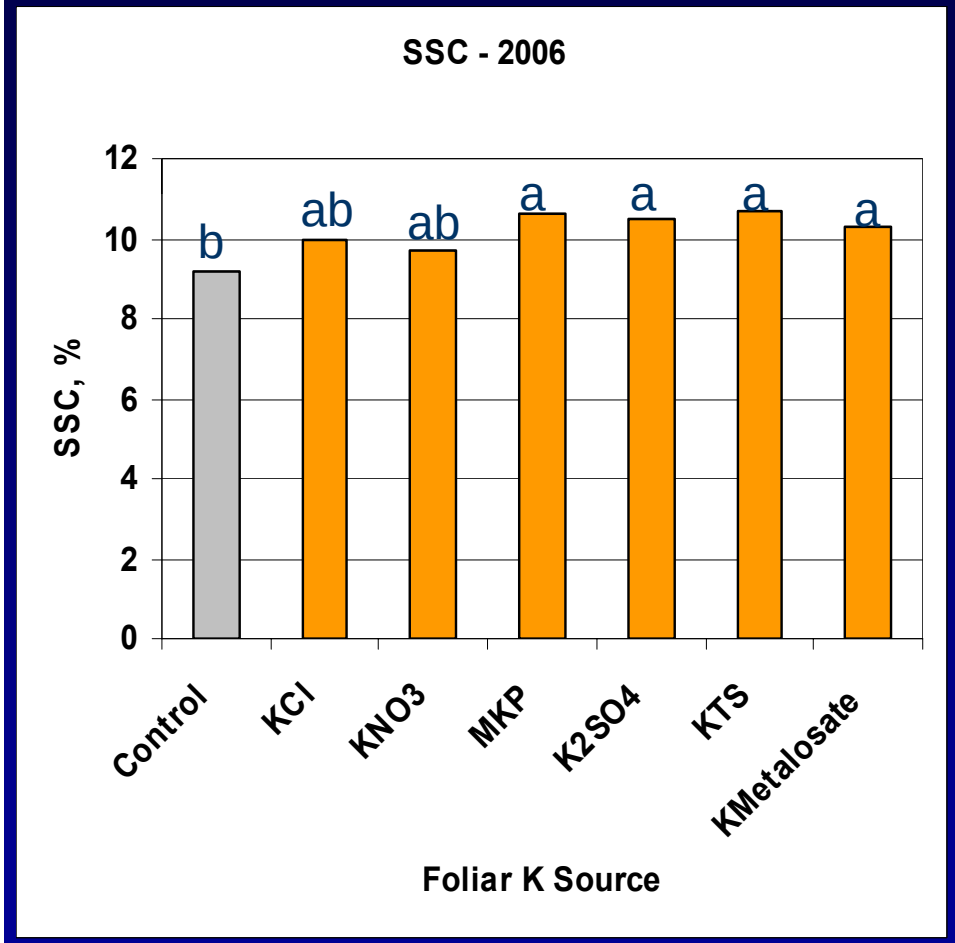


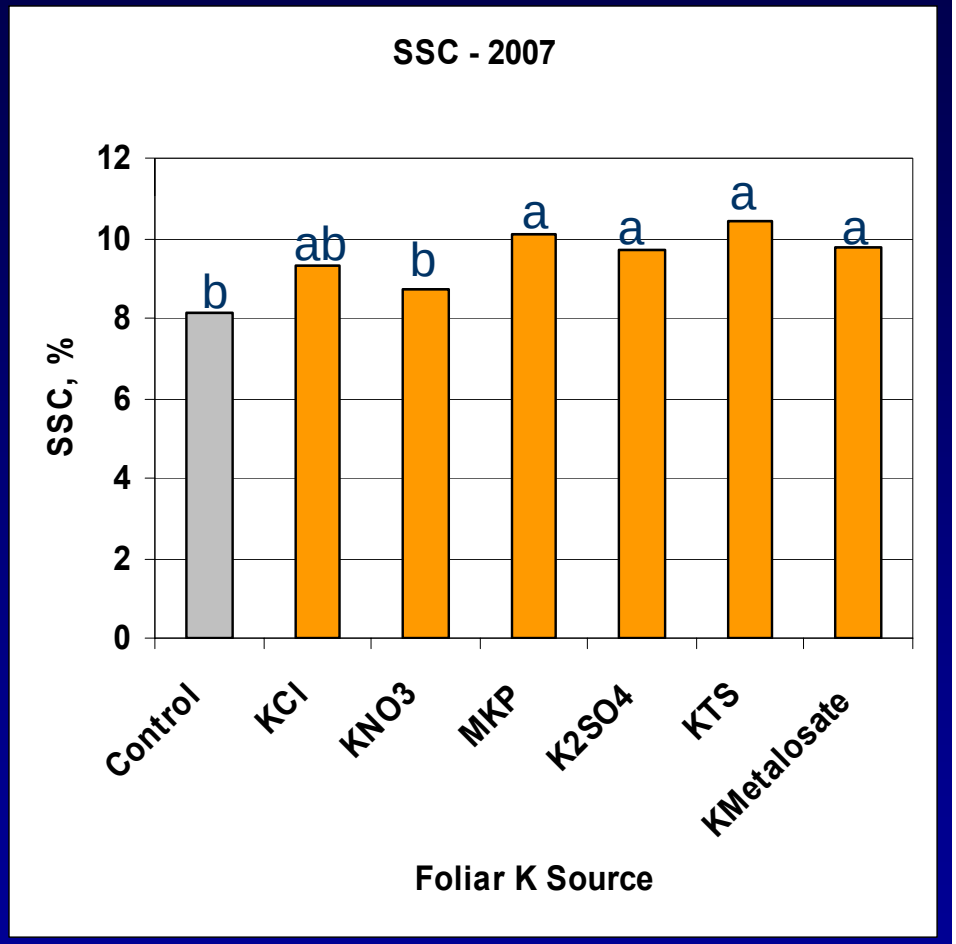


Fruit K: 2006

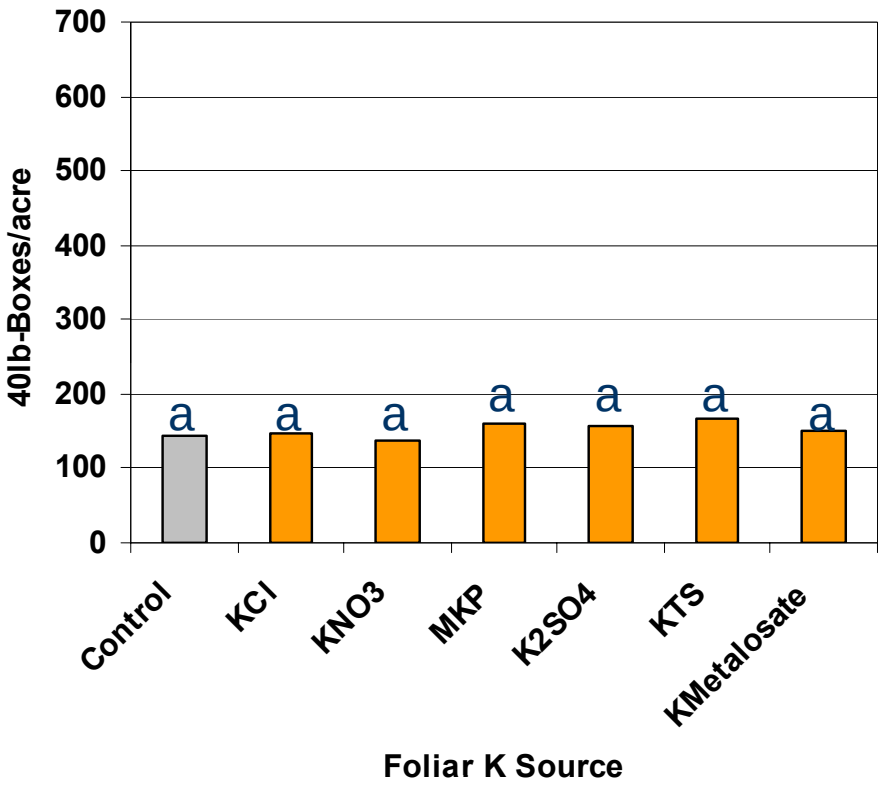

Fruit K, mg/gdwt
35
30
25
20
15
10
5
0
b
ab
b
a
ab
a
a
Control
KCl
KNO3
MKP
K2SO4
KTS
KM

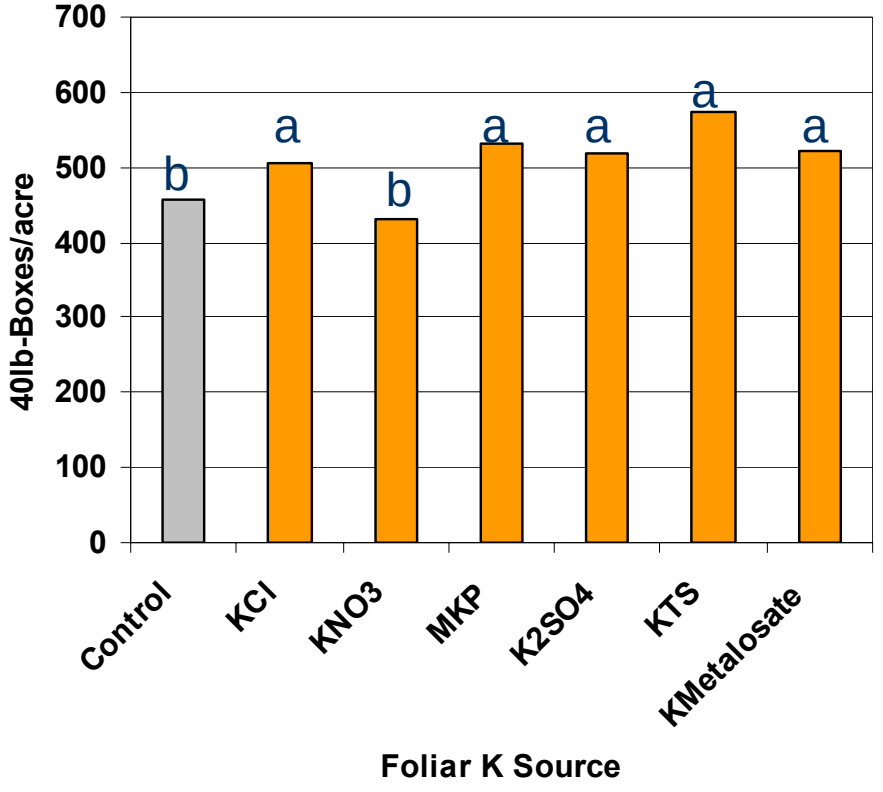
Soluble Solids Concentration - SSC



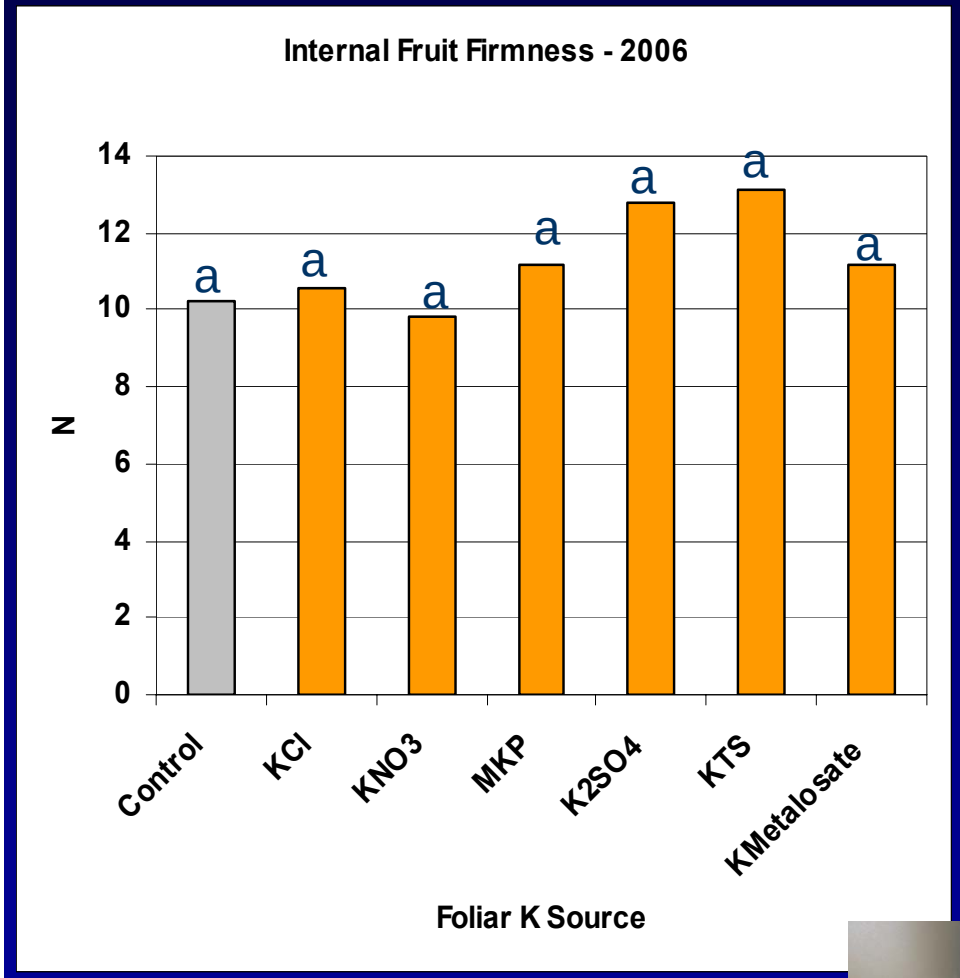


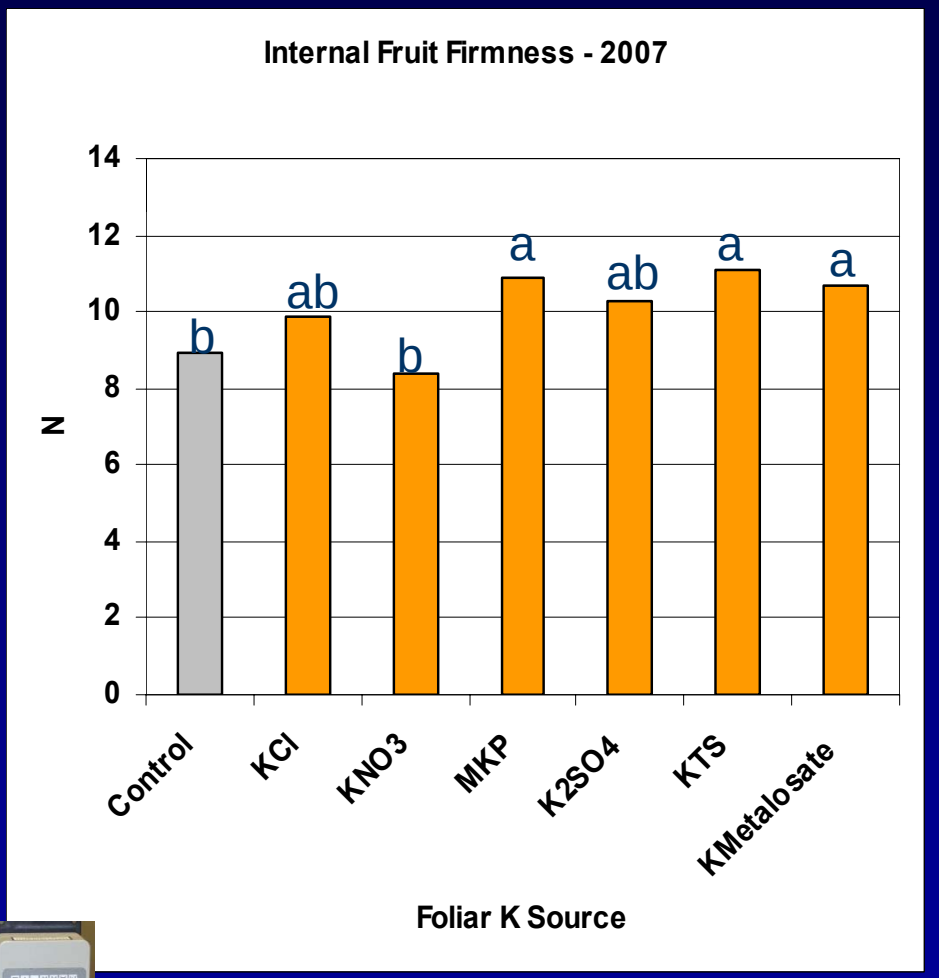
Yield


Yield - 2006
700
600
500
400
300
200
100
0
40lb-Boxes/acre
a
a
a
a
a
a
a
Control
KCl
KNO3
MKP
K2SO4
KTS
KMetalosate
Foliar K Source

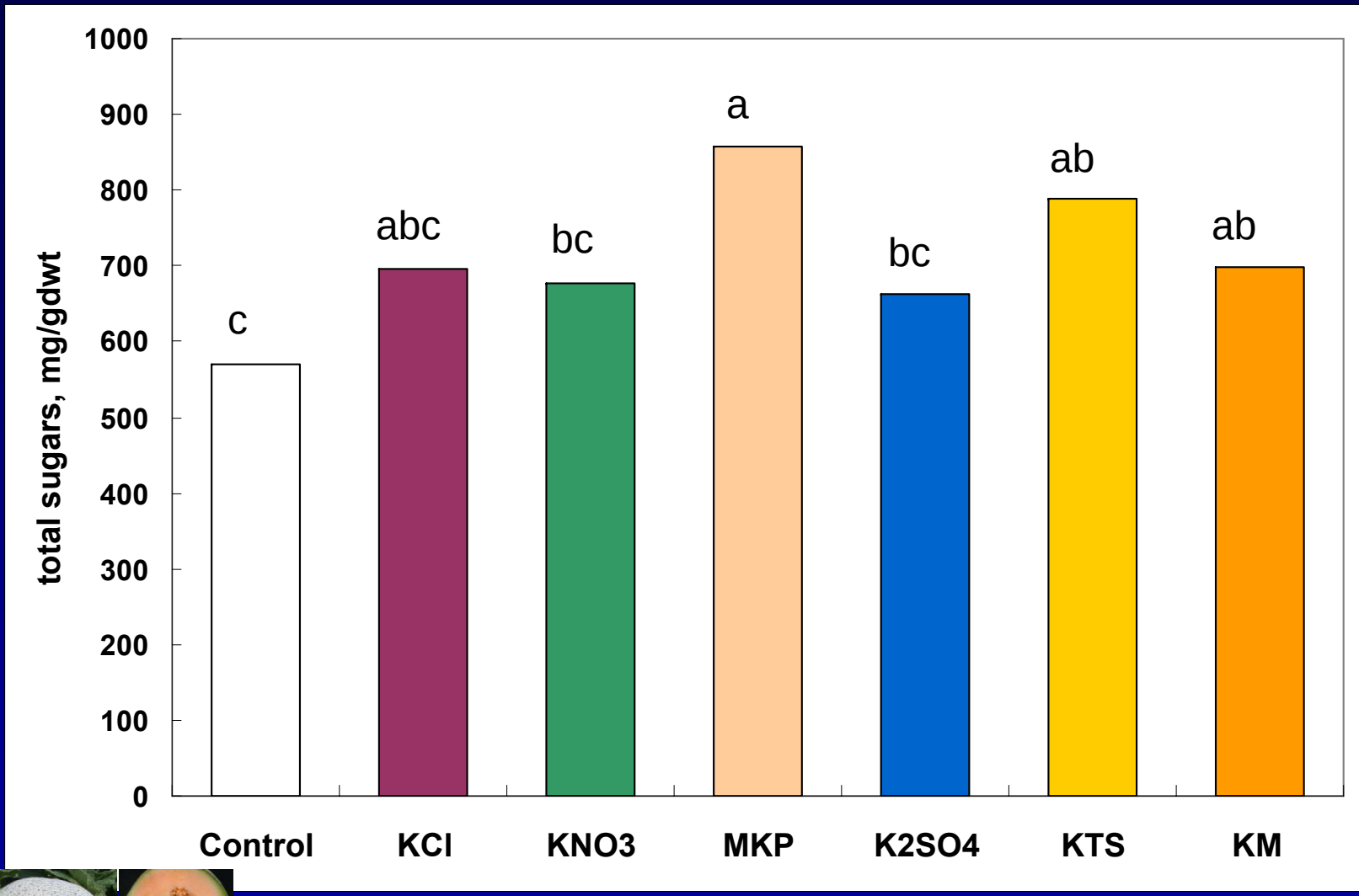

Yield - 2007
700
600
500
400
300
200
100
0
40lb-Boxes/acre
b
a
b
a
a
a
a
Control
KCl
KNO3
MKP
K2SO4
KTS
KMetalosate
Foliar K Source

Fruit Firmness

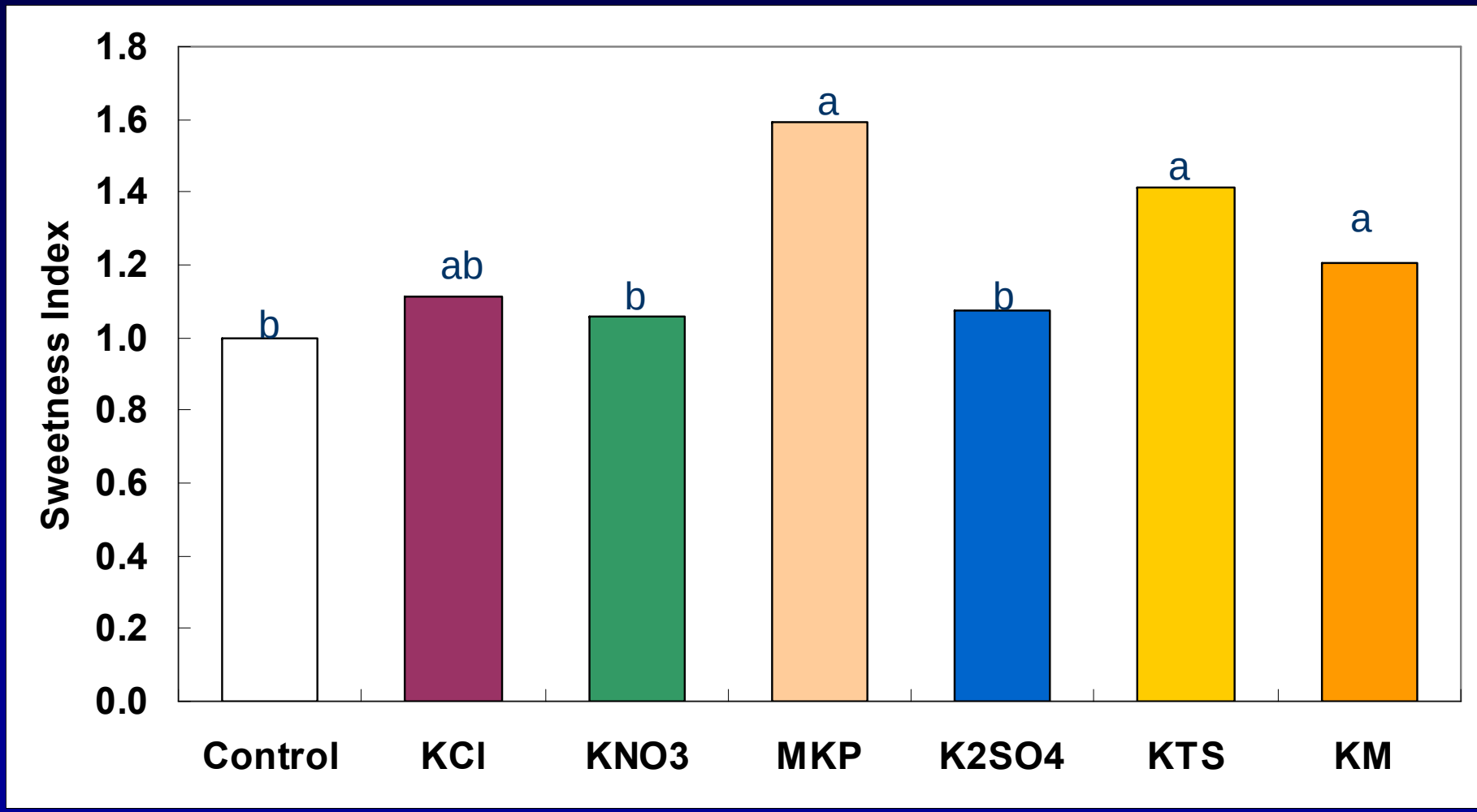




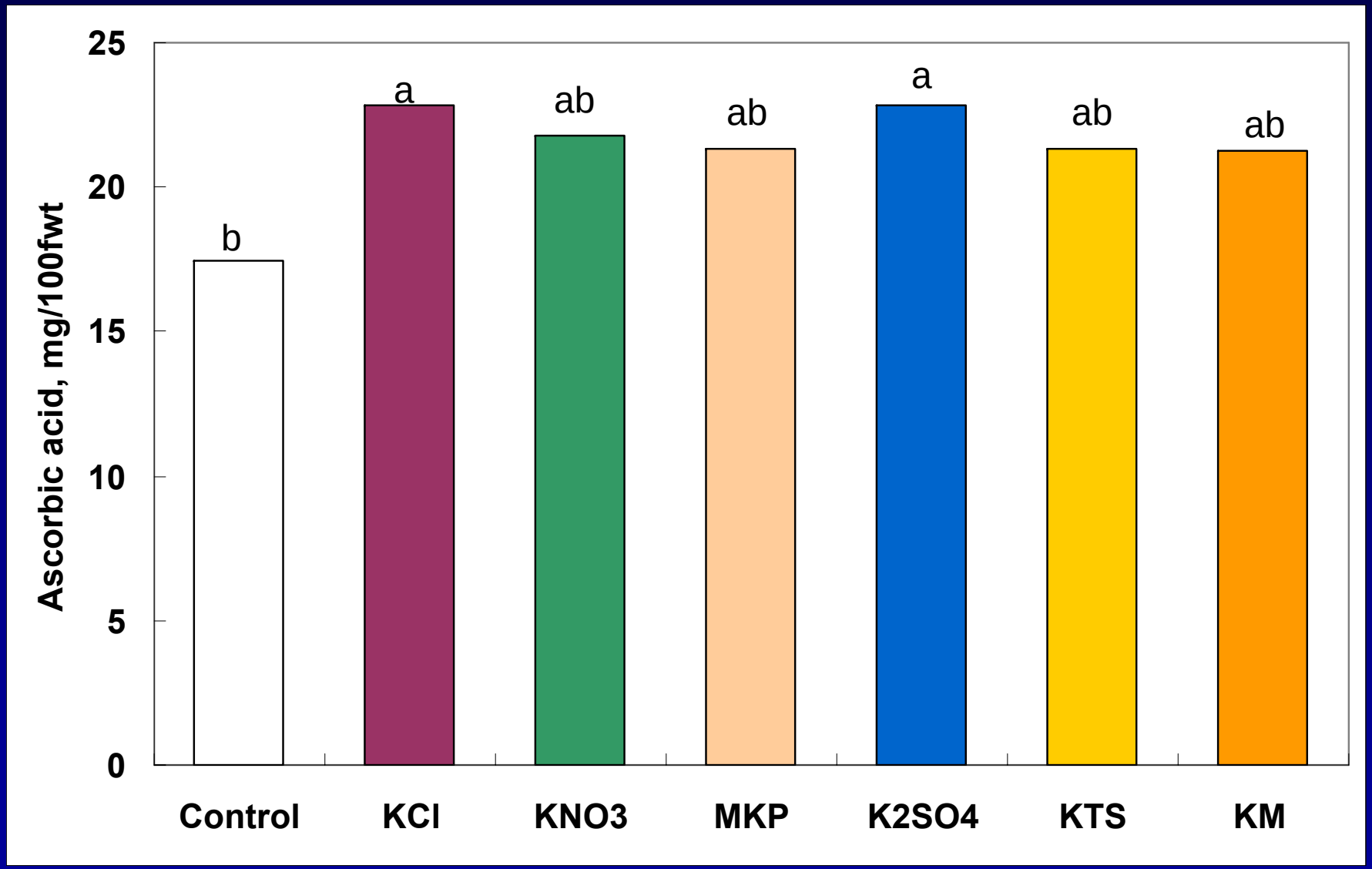
Fruit: Total sugars



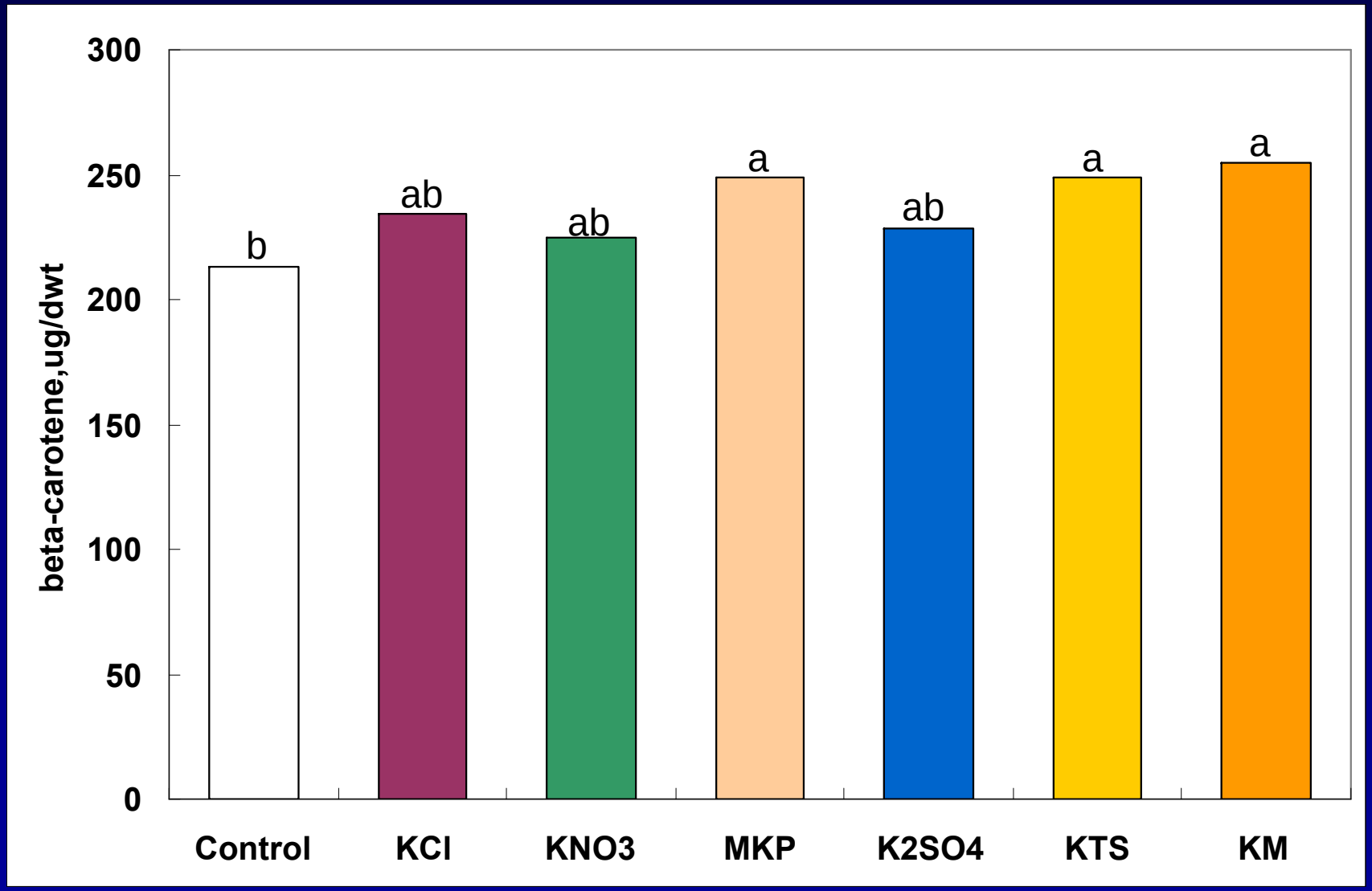
Relative Sweetness - 2006

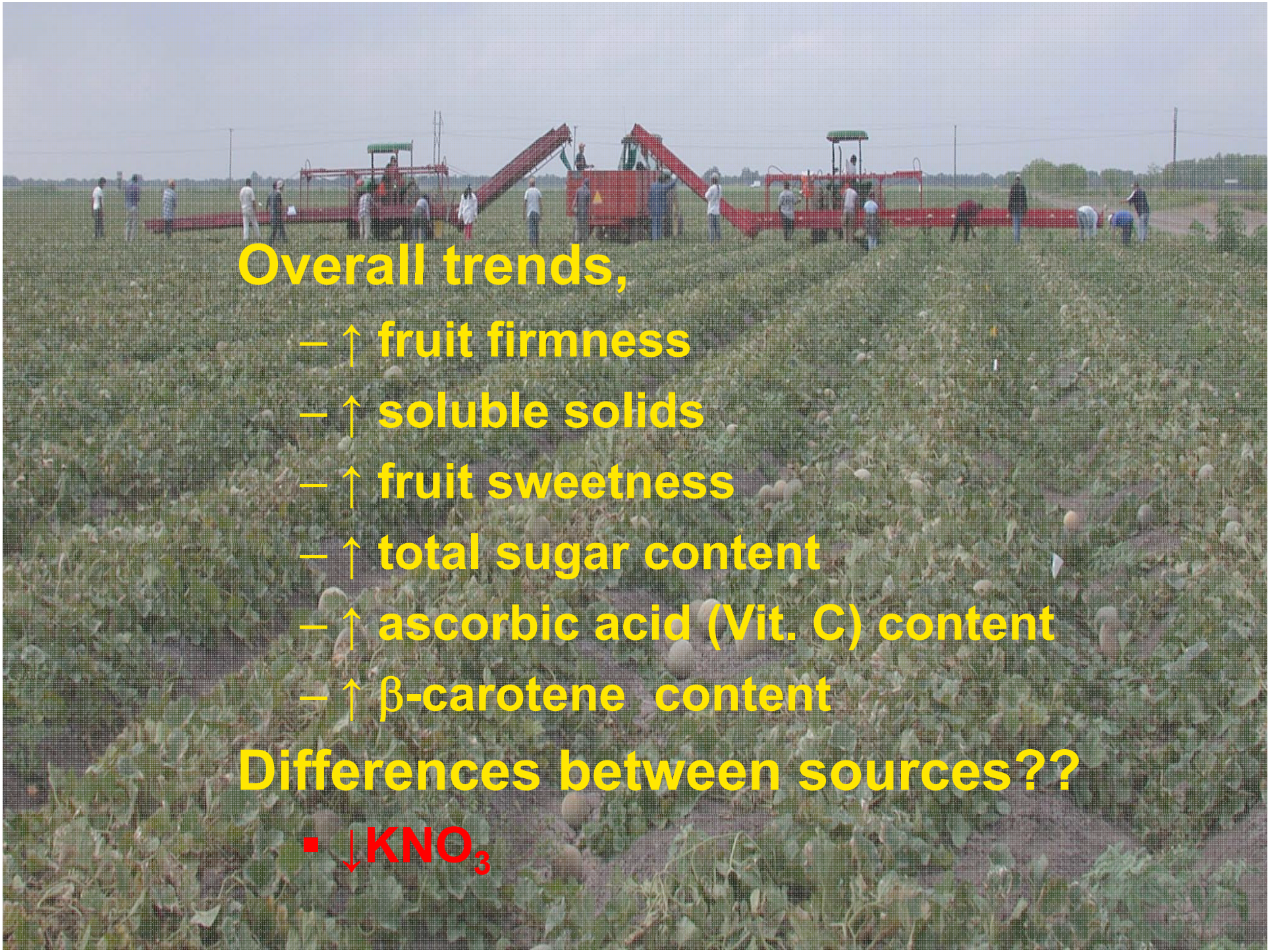


Ascorbic acid (Vit. C) Content - 2006



β-carotene content - 2006





Overall trends,

- ↑ fruit firmness
- ↑ soluble solids
- ↑ fruit sweetness
- ↑ total sugar content
- ↑ ascorbic acid (Vit. C) content
- ↑ β-carotene content

Differences between sources??

- ↓KNO_3

Special Thanks

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Thank You