

Cost Effective Zinc Nutrition

Scott Johnson – UC Pomology Specialist
Kearney Ag Center



Hiawatha

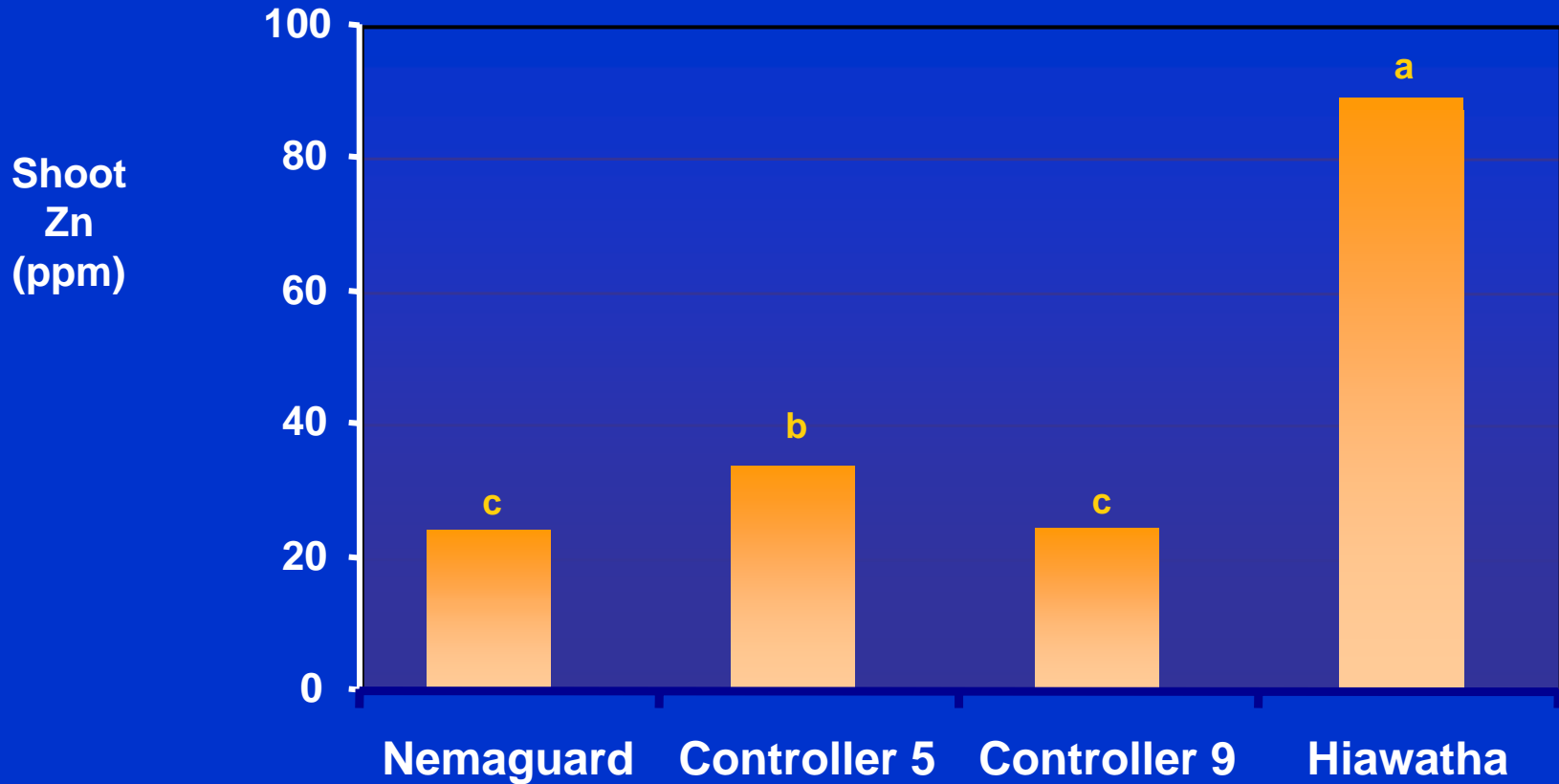


Nemaguard



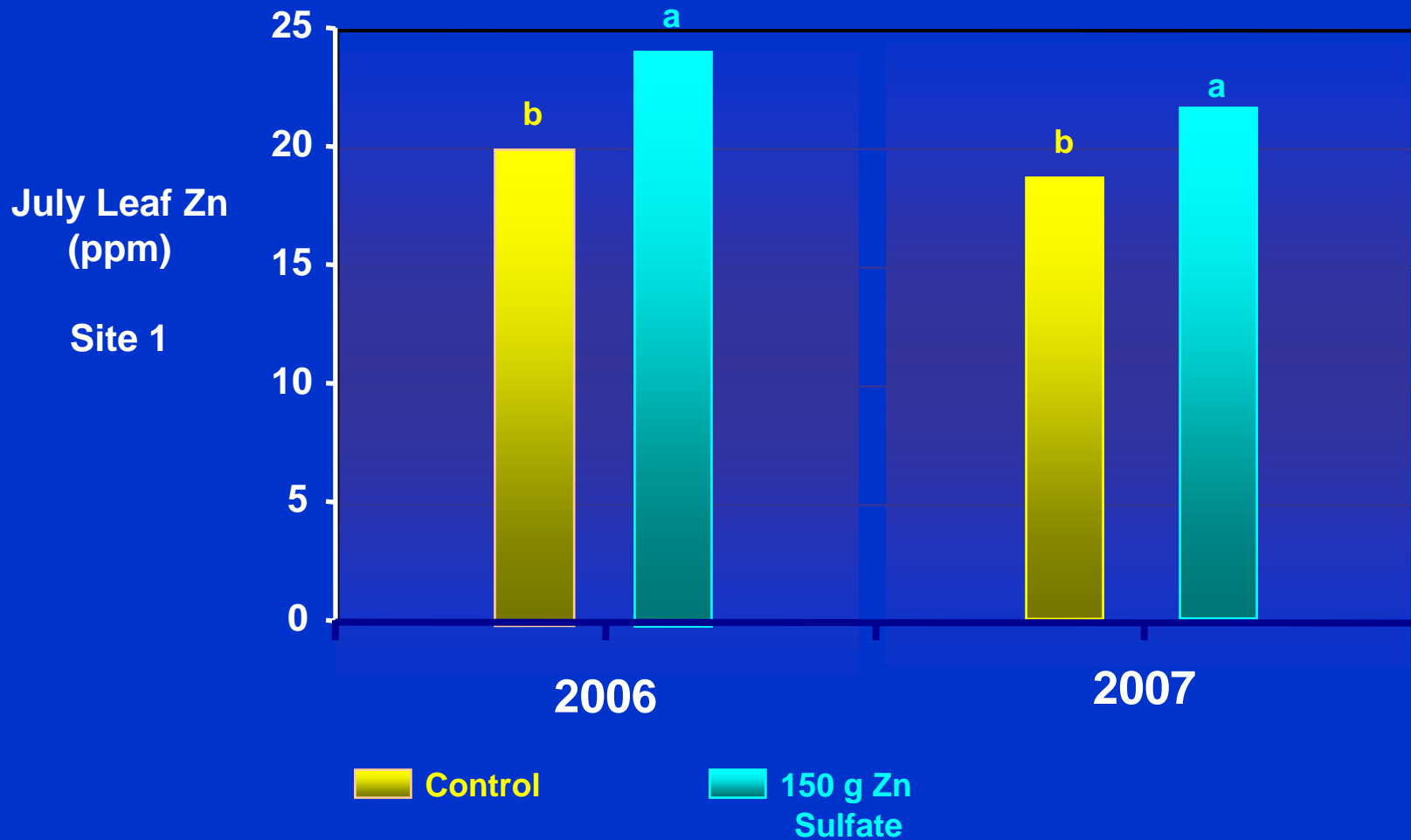
Peach Rootstocks and Zn Uptake

December 2006 Shoot Zn





Applying “Root Bags” with Sulfur, Urea and Zinc Sulfate to the Planting Hole in Spring 2006





EnviroSul

MICRONUTRIENTS

NET WEIGHT / POIDS NET
25 KG / 55.115 LBS



CODE 615/G

SULPHUR 65% + ZINC 18%

REGISTRATION NUMBER

NUMÉRO D'ENREGISTREMENT
LOI SUR LES ENGRAIS

FERTILIZERS ACT

GUARANTEED MINIMUM ANALYSIS

Sulphur (S)	65.00%
Zinc (Zn)	18.00%

Derived from Zinc Oxide and Elemental Sulphur.

RECOMMENDATIONS: For effective use, Tiger micronutrients should be surface broadcast and incorporated at least one year prior to planting.

CAUTION: this fertilizer contains Zinc and should be used only as recommended. It may prove harmful when misused. Always consult a professional agronomist for advice on use.

L'ANALYSE DE MINIMUM GARANTIE

Soufre (S)	65.00%
Zinc (Zn)	18.00%

CONSEILS: Pour que les micro nutriments agissent de façon optimale, il faudrait les répandre à la surface et les incorporer au moins un an avant de planter.

PRÉCAUTION: cet engrais contient du zinc et ne devrait être utilisé qu'en suivant les conseils. Il peut s'avérer dangereux s'il n'est pas utilisé correctement. Il faut toujours

TO BE USED IN BLENDING FERTILIZER FOR SOIL APPLICATION

RISKS:
WARNING - POISON - May be fatal if swallowed.
PRECAUTIONS:
Do NOT take internally. Avoid eye or skin contact. Do not breathe dust.
Store in cool, dry, well-ventilated area. Keep out of reach of children.
Wash thoroughly after use. Use with adequate ventilation. This container is hazardous when empty - all labelled precautions must be observed.
FIRST AID:

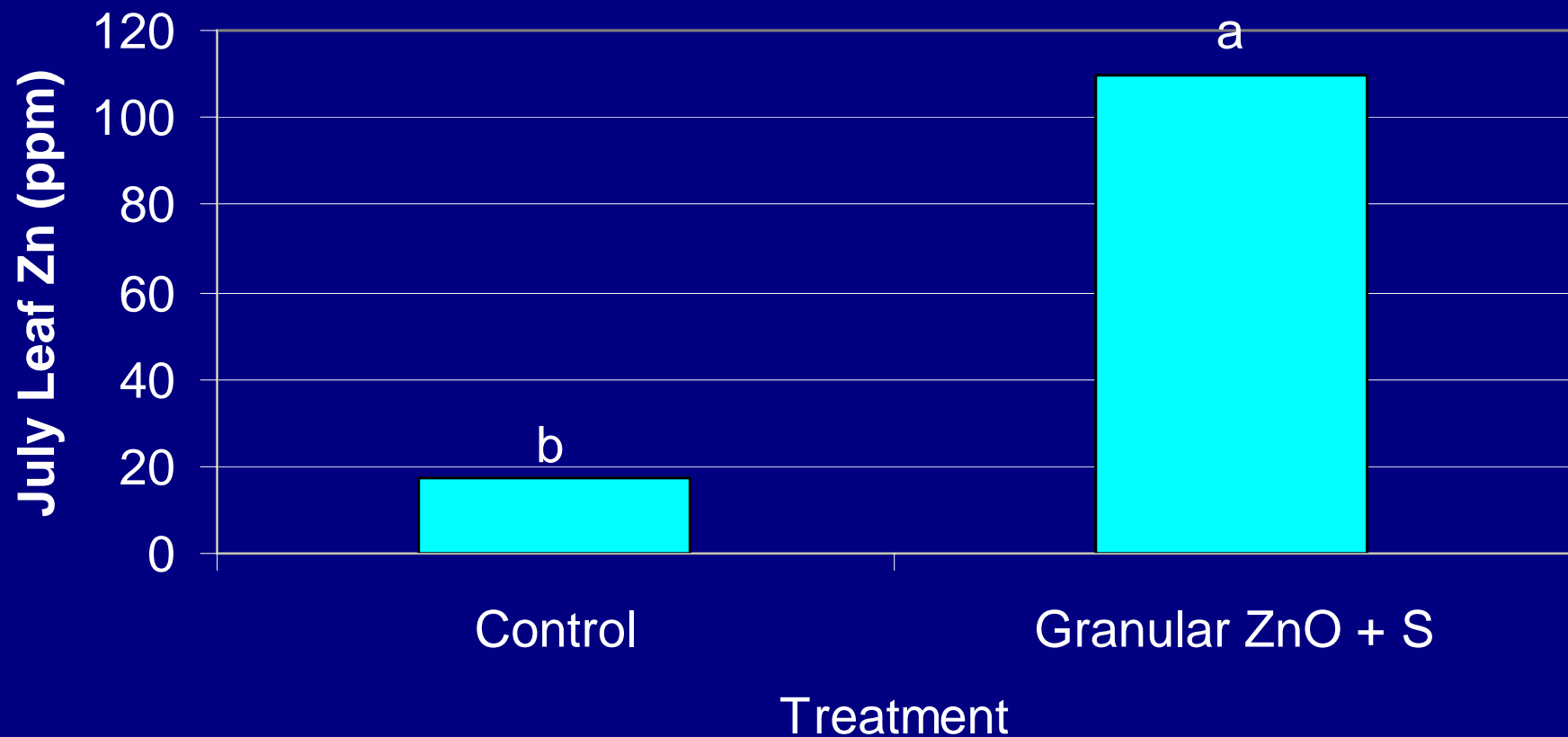
POUR EMPLOI EN MÉLANGE D'ENGRAIS POUR APPLICATION AU SOL

RISQUES:
AVERTISSEMENT - POISON - L'ingestion peut entraîner la mort.
Risque d'irriter pour les yeux, la peau et les voies respiratoires.
PRÉCAUTIONS:
Ne pas ingérer. Éviter tout contact avec les yeux ou la peau. Ne pas respirer les poussières. Entreposer dans un endroit frais, sec et bien ventilé. Garder hors de la portée des enfants. Se laver soigneusement après toute utilisation. Utiliser avec une ventilation adéquate. Ce contenant est dangereux lorsqu'il est vide. Toutes les précautions mentionnées sur l'étiquette doivent être observées.
PREMIERS SECOURS:





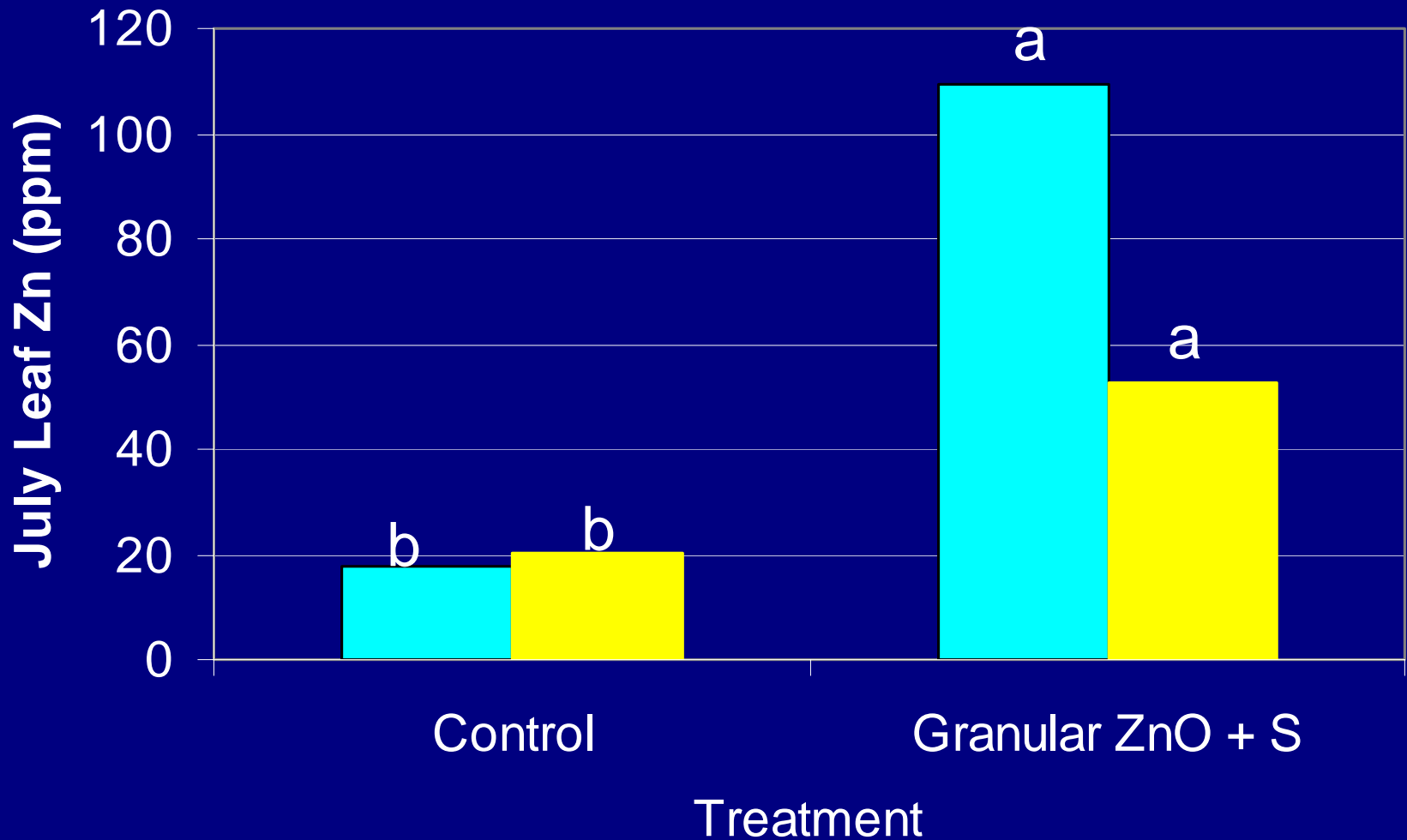
Granular ZnO + Sulfur Material Added to Planting Hole of Peach (1.25 lbs/tree)



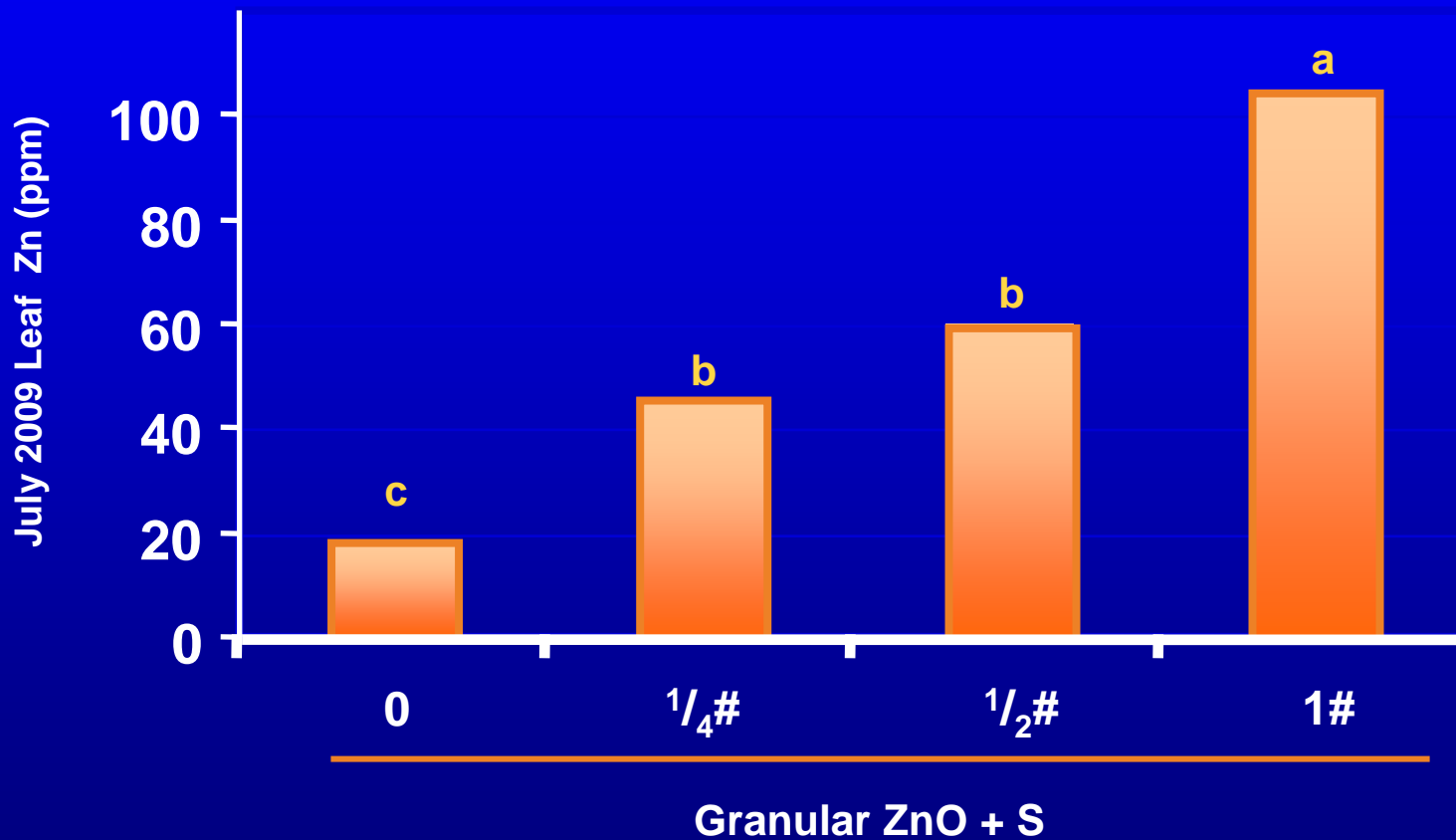


Granular ZnO + Sulfur Material Added to Planting Hole of Peach (1.25 lbs/tree)

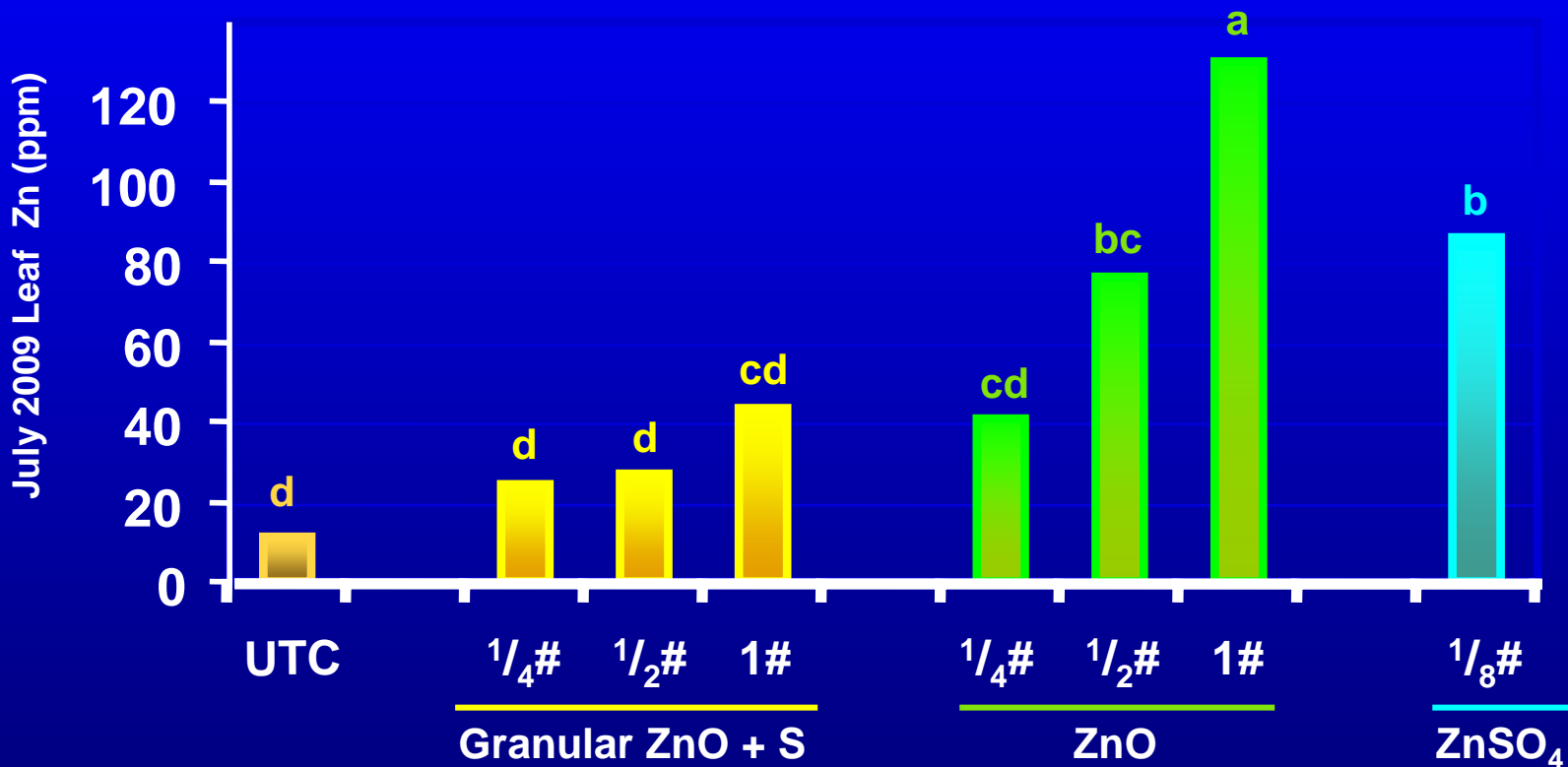
2008 2009



Granular ZnO + Sulfur Added to Planting Hole of Zee Fire Nectarine January 2009



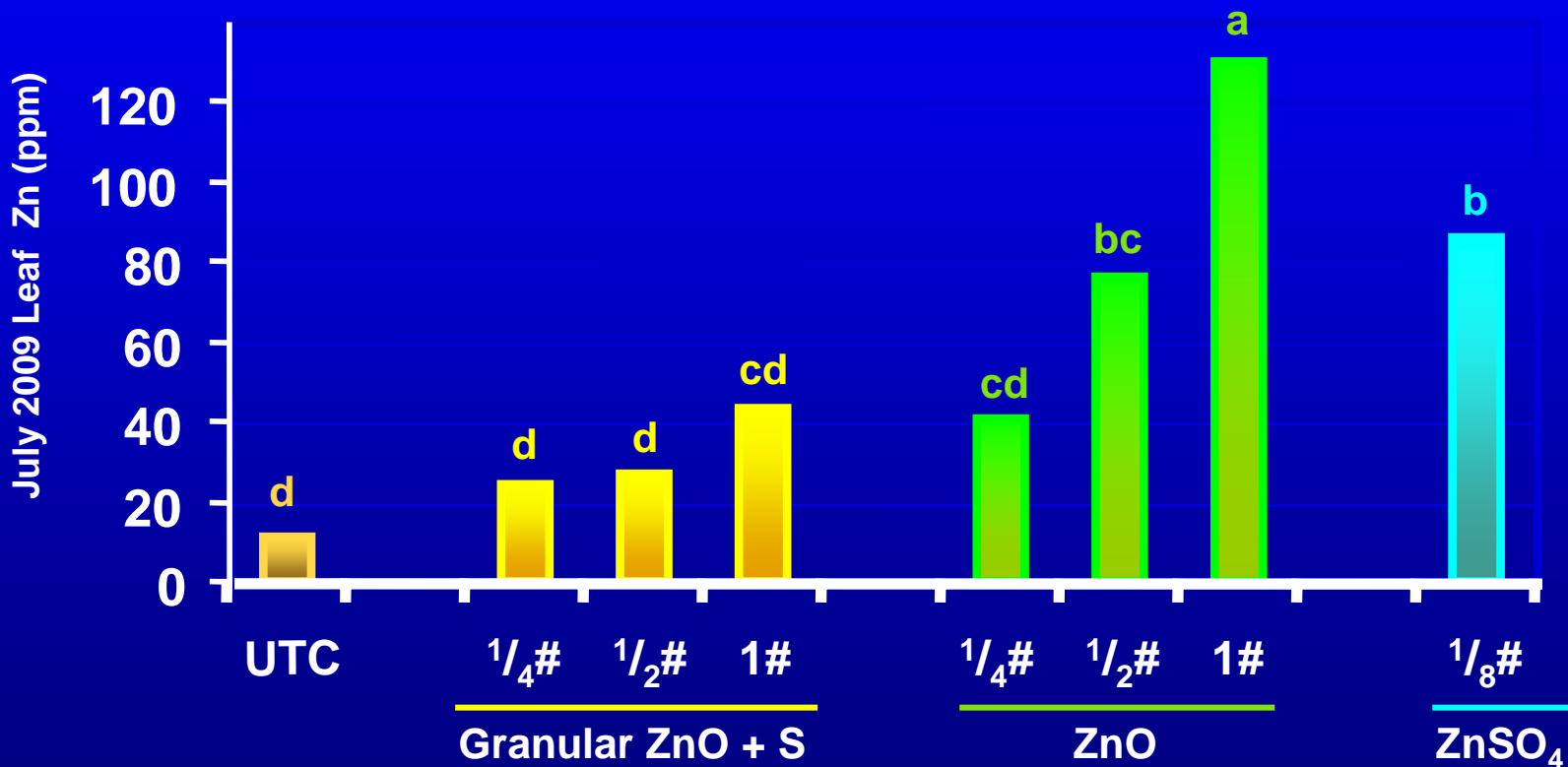
Zinc Materials Added to Planting Hole of Friar / Nemaguard Plums February 2009







Zinc Materials Added to Planting Hole of Friar / Nemaguard Plums February 2009



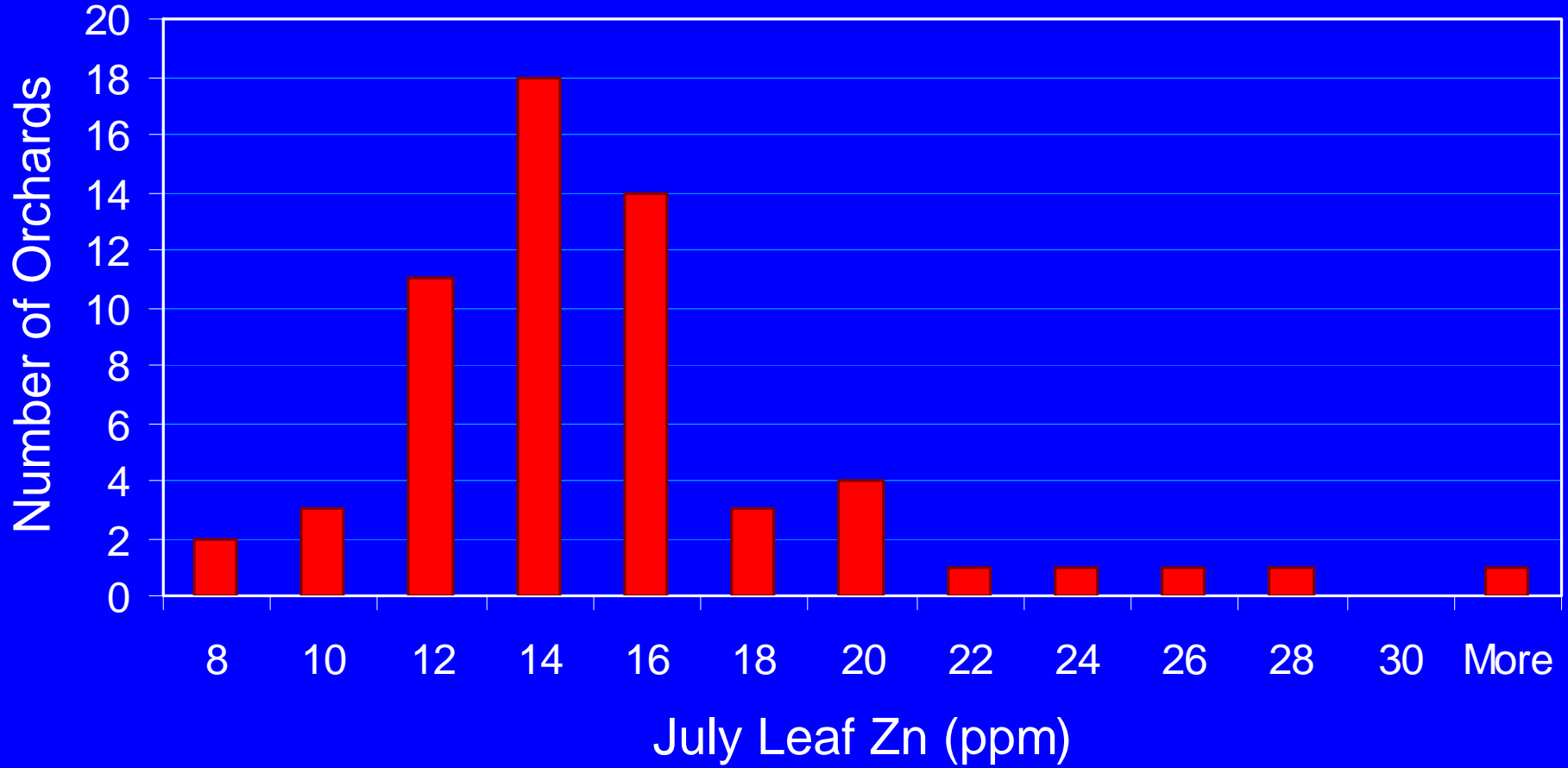


Nutrient Elements in Stone Fruit

Level in leaves

	PEACHES AND NECTARINES			PLUMS		
	Deficient below	Optimum range	Toxic over	Deficient below	Optimum range	Toxic over
	%	%	%	%	%	%
N	2.3	2.6 - 3.0	-	-	2.3 - 2.8	-
P	-	0.1 - 0.3	-	-	0.1 - 0.3	-
K	1.0	Over 1.2	-	1.0	Over 1.1	-
Ca	-	Over 1.0	-	-	Over 1.0	-
Mg	0.25	Over 0.25	-	0.25	Over 0.25	-
Cl	-	-	0.3	-	-	0.3
S	-	-	-	-	-	-
	p p m					
Fe	60	Over 60	-	-	-	-
Mn	20	Over 20	-	20	Over 20	-
Zn	15	Over 20	-	18	Over 18	-
B	18	20 - 80	100	25	30 - 60	80
Cu	-	Over 4	-	4	Over 4	-
Mo	-	-	-	-	-	-

Orchard Survey - Zinc





Zinc in Dormant Shoots (ppm)



Deficient

Sufficient

High

6.4

13.7

26.5

8.1

21.6

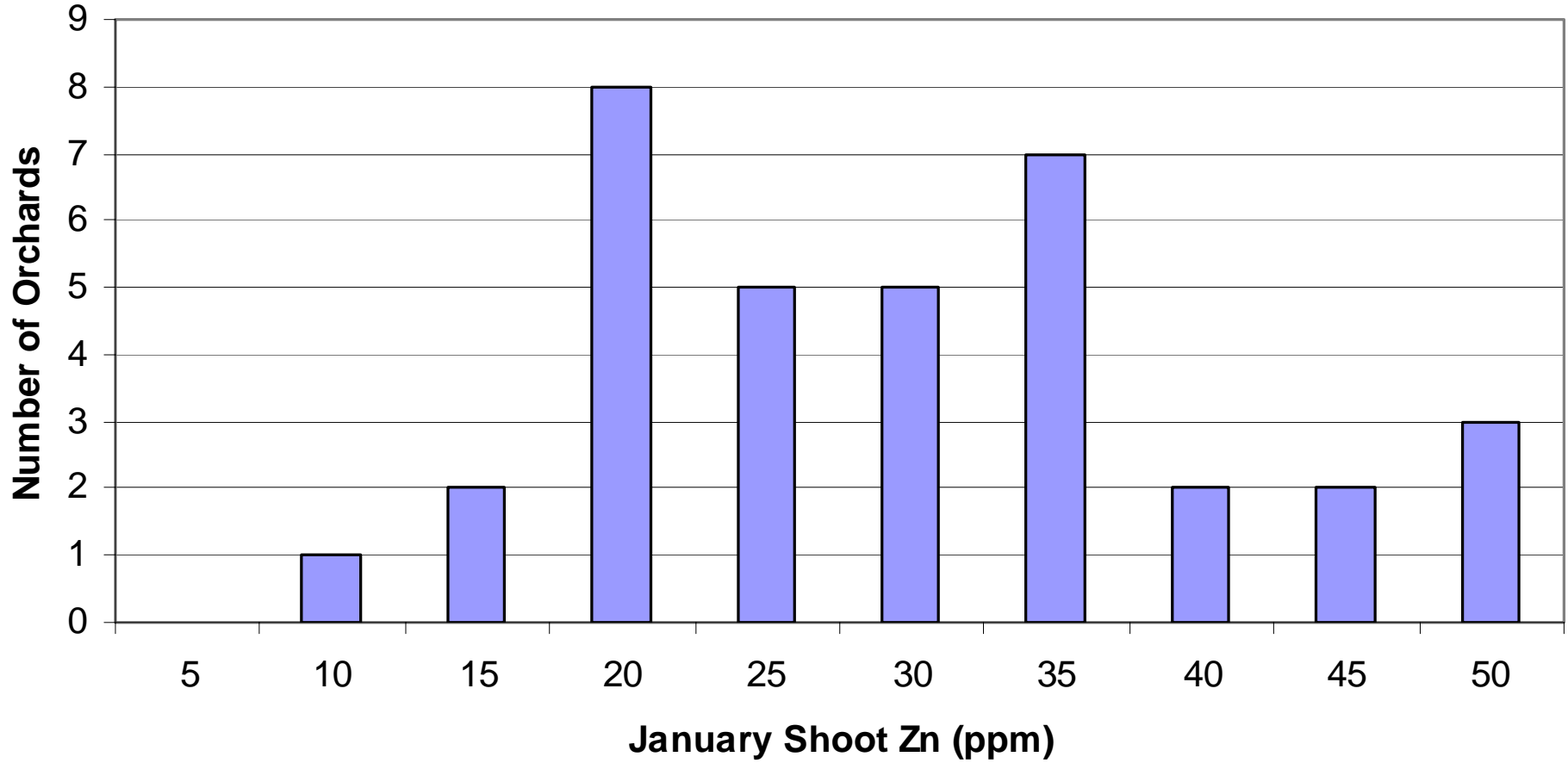
50.0

10.1

35.6

74.5

Orchard Survey - Zinc



Zinc Materials

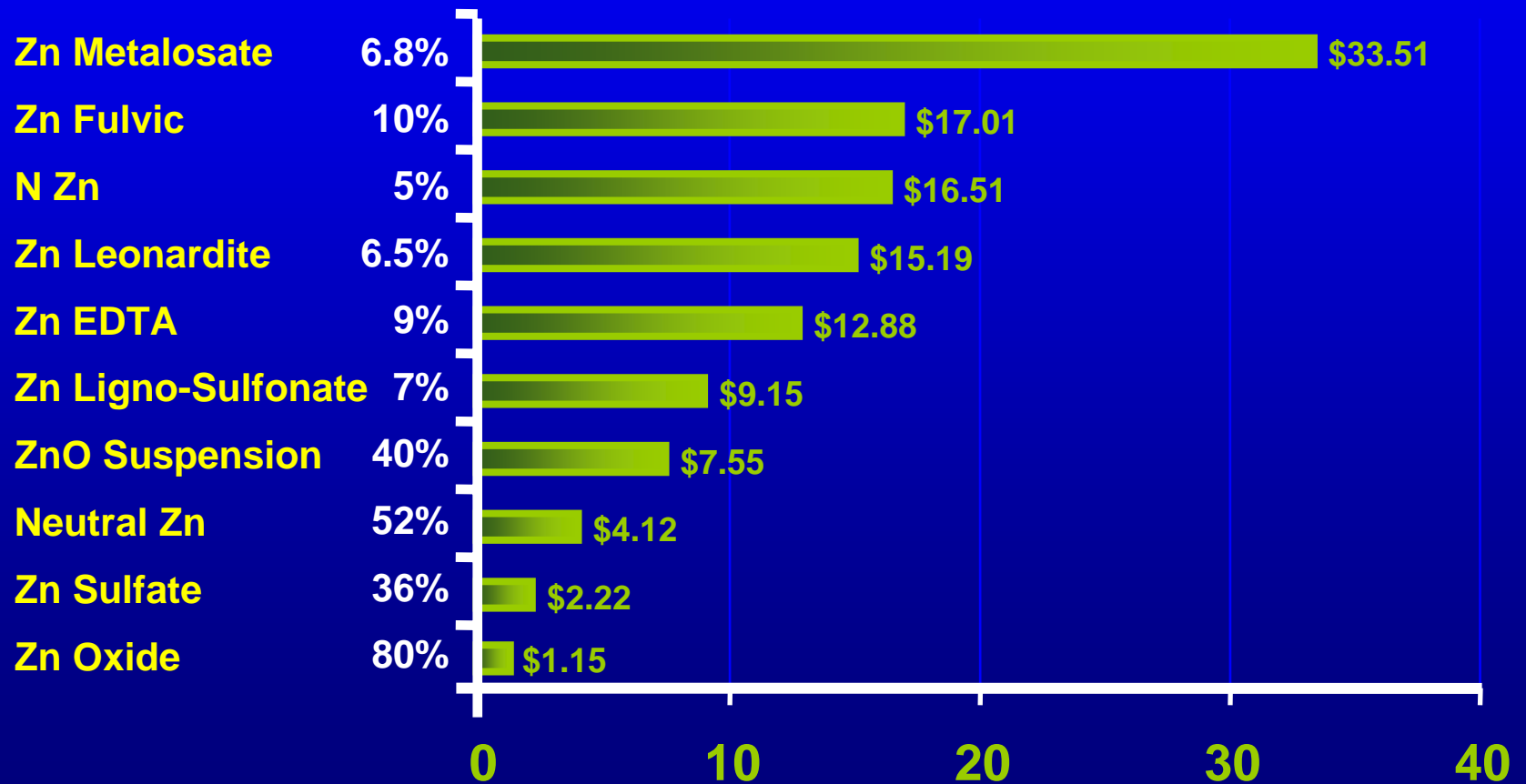
Basic Chemicals

- Zn sulfate
- Zn oxide
- Zn carbonate
- Zn chloride
- Zn oxysulfate
- Zn nitrate

Chelates & Complexes

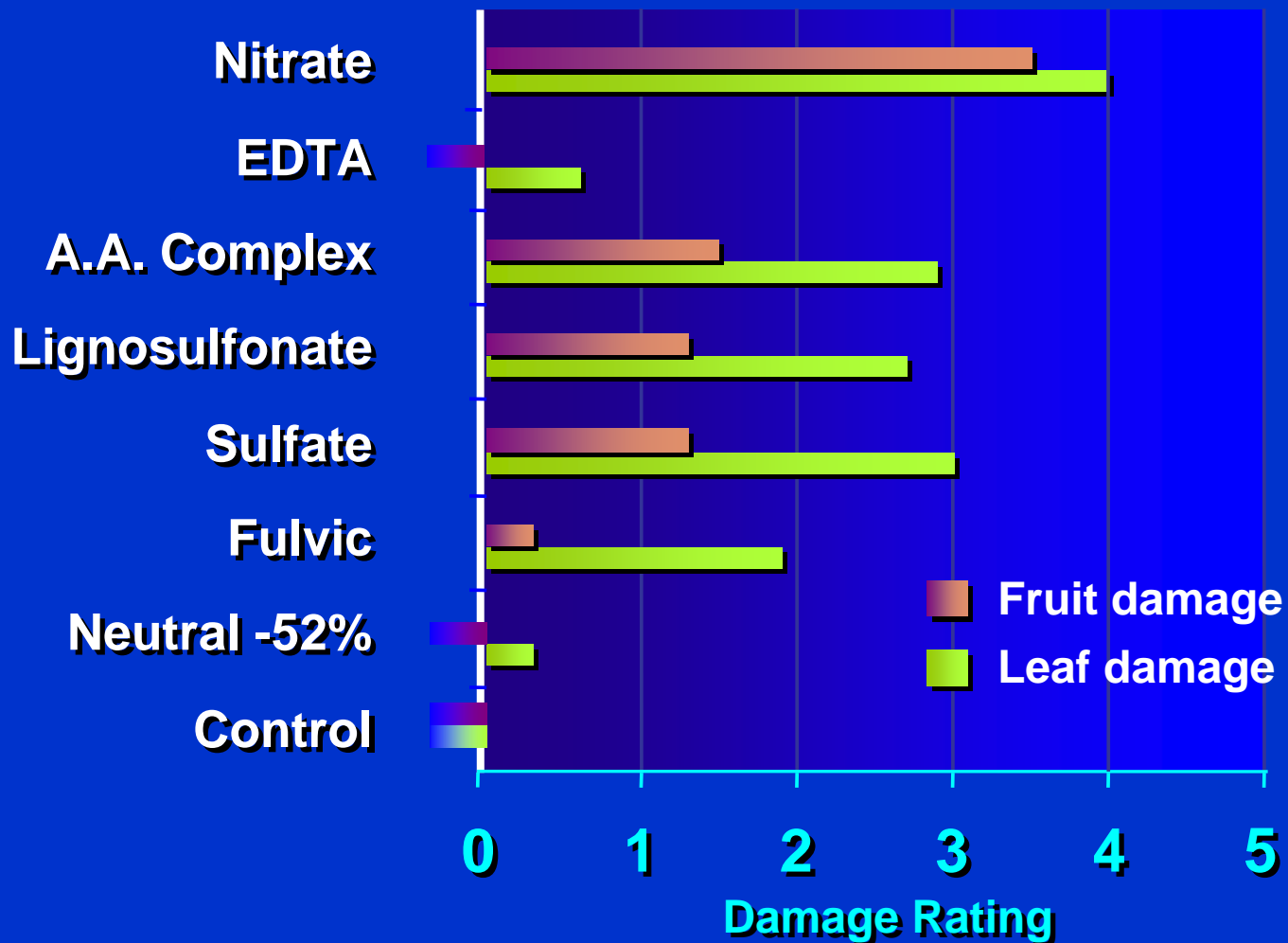
- EDTA
- Lignosulfonate
- Amino acid
- Sugar
- Citric acid
- Fulvic acid, humic acid

Cost of Zinc Materials - October 2007





Leaf & Fruit Damage on Peach, Plum and Apricot Trees Sprayed in April with Different Formulations of Zn at 1,000 ppm









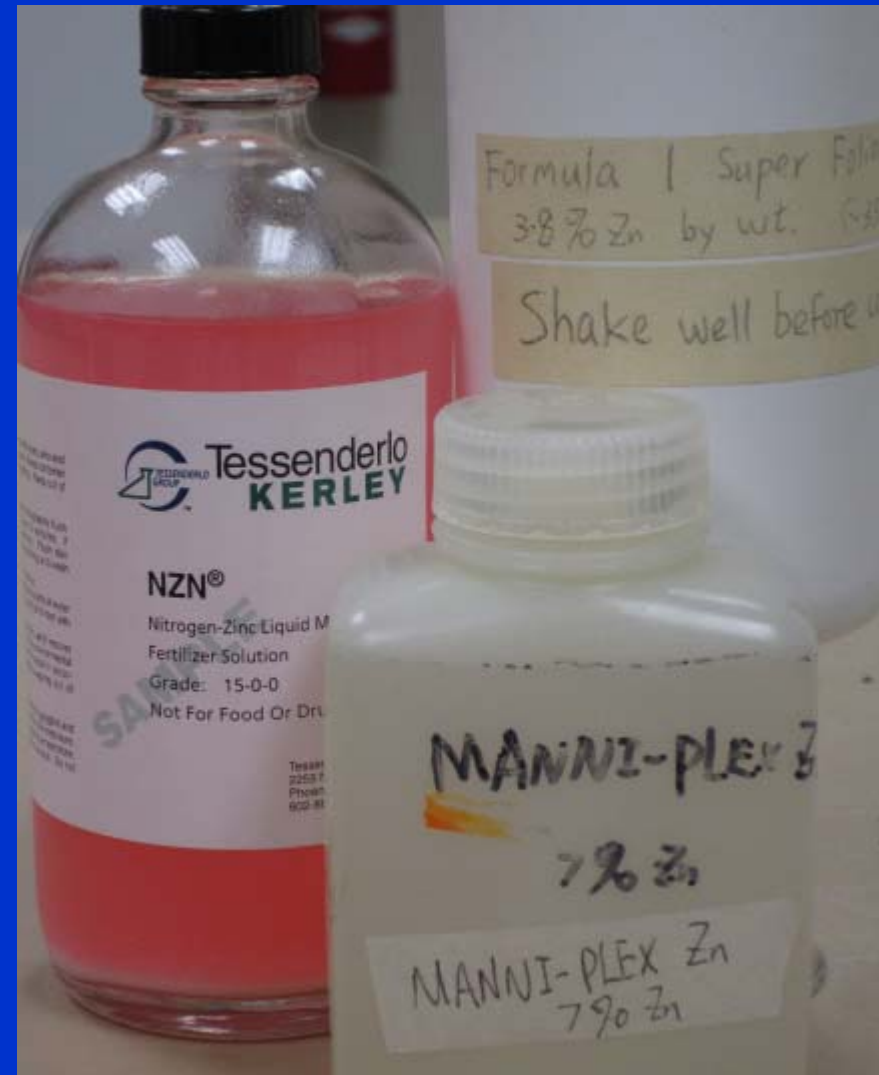
Comparing Zinc Formulations

<u>Ranking</u>	<u>Formulation</u>	<u>Anion Size</u>	<u>Solubility</u> (g/100 H ₂ O)	<u>Phytotoxicity</u>
<u>Most Effective</u>	Zinc Chloride	35	432	High (58*)
<u>Almost As Good</u>	Zinc Nitrate	62	324	High (54)
	Zinc Nitrate Mix	62 & 96	324	High (59)
<u>Next Best</u>	Zinc Sulfate	96	50	Moderate (12)
	Zinc Carbohydrate	96 & ?	High	Moderate
	Zinc Polyamine	96 & 75-204	High	Moderate
	Zinc Glycine	96 & 75		Moderate (15)
<u>Less Effective</u>	Zinc EDTA	292	High	Low
	Zinc Leonardite	1000+	High	Low
	Zinc Oxysulfate	16 & 96	1.3	None
<u>Least Effective</u>	Zinc Phosphite	79	?	Low (17)
	Zinc Oxide Suspension	16	Insoluble	None

Zinc Materials

Zinc Nitrate Mixes

- Not cheap
- Very soluble
- Very phytotoxic
- Not used much
- 4 to 7% zinc



Comparing Zinc Formulations

<u>Ranking</u>	<u>Formulation</u>	<u>Anion Size</u>	<u>Solubility</u> (g/100 H ₂ O)	<u>Phytotoxicity</u>
<u>Most Effective</u>	Zinc Chloride	35	432	High (58*)
<u>Almost As Good</u>	Zinc Nitrate	62	324	High (54)
	Zinc Nitrate Mix	62 & 96	324	High (59)
<u>Next Best</u>	Zinc Sulfate	96	50	Moderate (12)
	Zinc Carbohydrate	96 & ?	High	Moderate
	Zinc Polyamine	96 & 75-204	High	Moderate
	Zinc Glycine	96 & 75		Moderate (15)
<u>Less Effective</u>	Zinc EDTA	292	High	Low
	Zinc Leonardite	1000+	High	Low
	Zinc Oxysulfate	16 & 96	1.3	None
<u>Least Effective</u>	Zinc Phosphite	79	?	Low (17)
	Zinc Oxide Suspension	16	Insoluble	None

Zinc Materials

Zinc Sulfate

- Inexpensive
- Very soluble
- Widely used
- Considered to be effective
- Can be phytotoxic

AG Specialties BRAND
ZINC SULFATE
(Monohydrate)

Guaranteed Analysis		
Sulfur (S)		17%
17% Combined Sulfur (S)		
Zinc (Zn)		35%
35% Combined Zinc (Zn)		
Derived from Zinc Sulfate		
TYPICAL Heavy Metals		
As.....5PPM	Se.....5PPM	Hg.....1PPM
Cd.....10PPM	Ni.....20PPM	Mo.....5PPM
Co.....10PPM	Pb.....10PPM	

Caution: Harmful if inhaled. Causes irritation of eyes, skin and respiratory tract. Harmful if swallowed. Avoid breathing dust. Do not get in eyes, on skin, or clothing. Wear eye protection and protective clothing. Wash thoroughly after handling.

First Aid: In case of Contact: Immediately flush eyes and skin with plenty of water for at least 15 minutes. For eyes, get medical attention. If inhaled: Move to fresh air.

Strategies with Zinc Sulfate

(Timing, Rate, etc)

1. **Spring – Phytotoxicity concerns**
2. **All Season – Low rate**
3. **Fall or Dormant**

Fruit Damage from Zinc Sprays







Strategies with Zinc Sulfate

(Timing, Rate, etc)

1. Spring – Phytotoxicity concerns
Zn Oxide or Neutral Zn?
2. All Season – Low rate
3. Fall or Dormant

Strategies with Zinc Sulfate

(Timing, Rate, etc)

1. Spring – Phytotoxicity concerns
Zn Oxide or Neutral Zn?
2. All Season – Low rate
Efficiency?
3. Fall or Dormant





Strategies with Zinc Sulfate

(Timing, Rate, etc)

1. Spring – Phytotoxicity concerns

Zn Oxide or Neutral Zn?

2. All Season – Low rate

Efficiency?

3. Fall or Dormant

Early fall better than late fall

Use rate that doesn't defoliate quickly





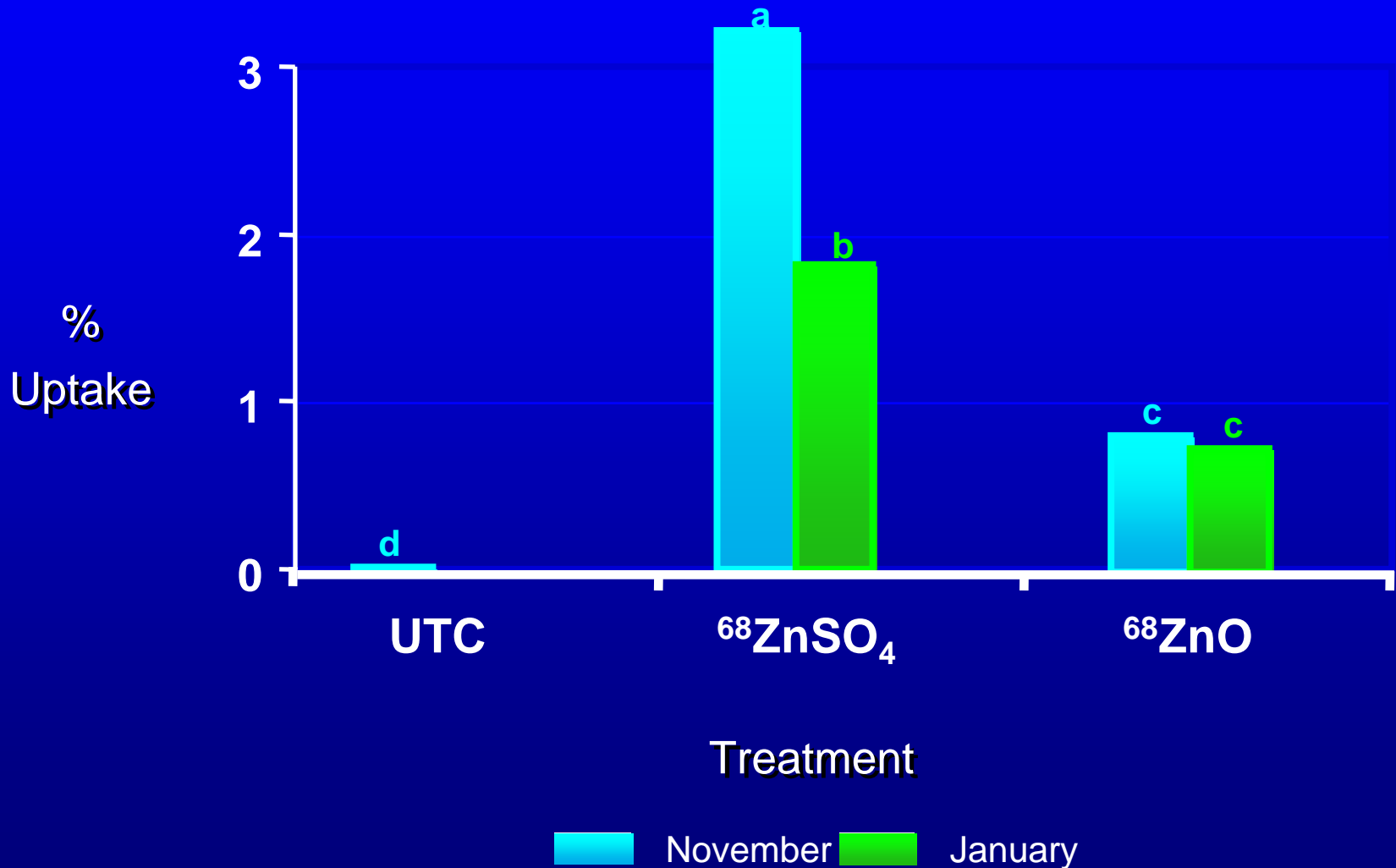




Jan 2nd 2014
Pip 1

Nursery Trees in Pots - Application to Dormant Shoots

$^{68}\text{ZnSO}_4$ vs. ^{68}ZnO - % of Applied Taken Up



Strategies with Zinc Sulfate

(Timing, Rate, etc)

1. Spring – Phytotoxicity concerns

Zn Oxide or Neutral Zn?

2. All Season – Low rate

Efficiency?

3. Fall or Dormant

Early fall better than late fall

Use rate that doesn't defoliate quickly

Fall better than dormant