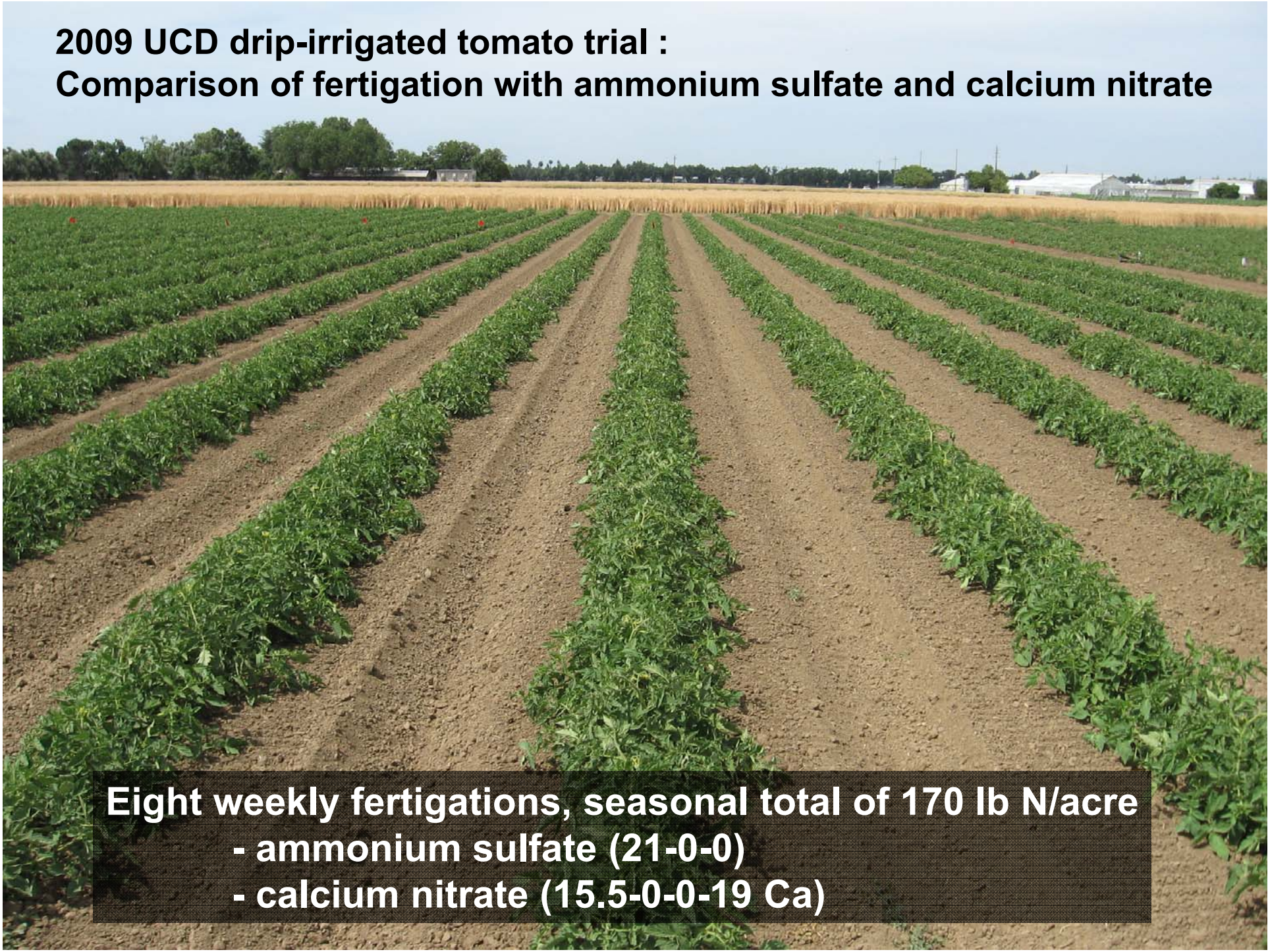
Evaluating fertilizer forms and additives

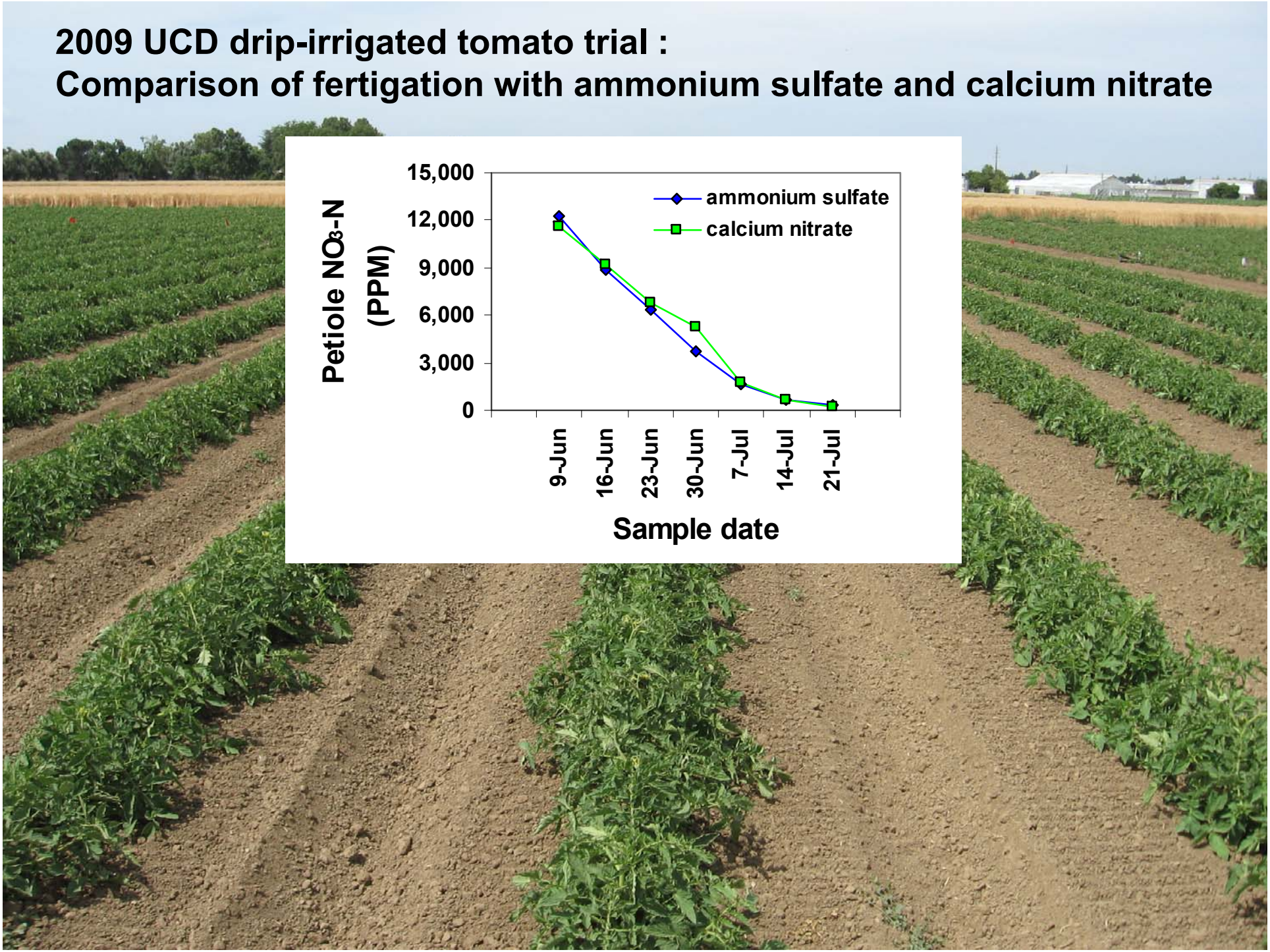
Does the form of N make a difference ?

Average of 1985-86 Miyao / grower sidedress trials :

N fertilizer	Early season petiole NO_3-N (PPM)	Fruit yield (tons/acre	Brix yield (tons/acre)
Ammonium sulfate	11,700	44.2	2.12
UN-32	11,900	43.5	2.08
CAN-17	11,700	44.6	2.11
effects significant ?	no	no	no


2009 UCD drip-irrigated tomato trial :
Comparison of fertigation with ammonium sulfate and calcium nitrate
Eight weekly fertigations, seasonal total of 170 lb N/acre
- ammonium sulfate (21-0-0)
- calcium nitrate (15.5-0-0-19 Ca)

2009 UCD drip-irrigated tomato trial : Comparison of fertigation with ammonium sulfate and calcium nitrate



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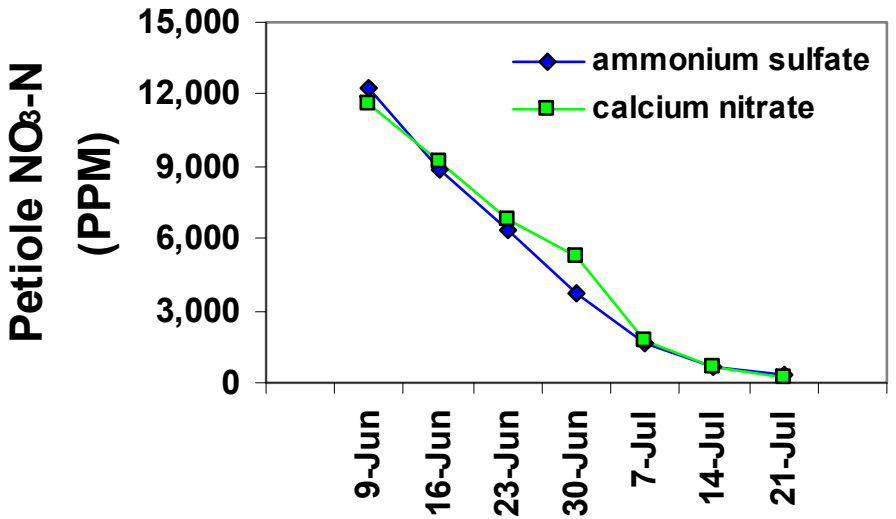

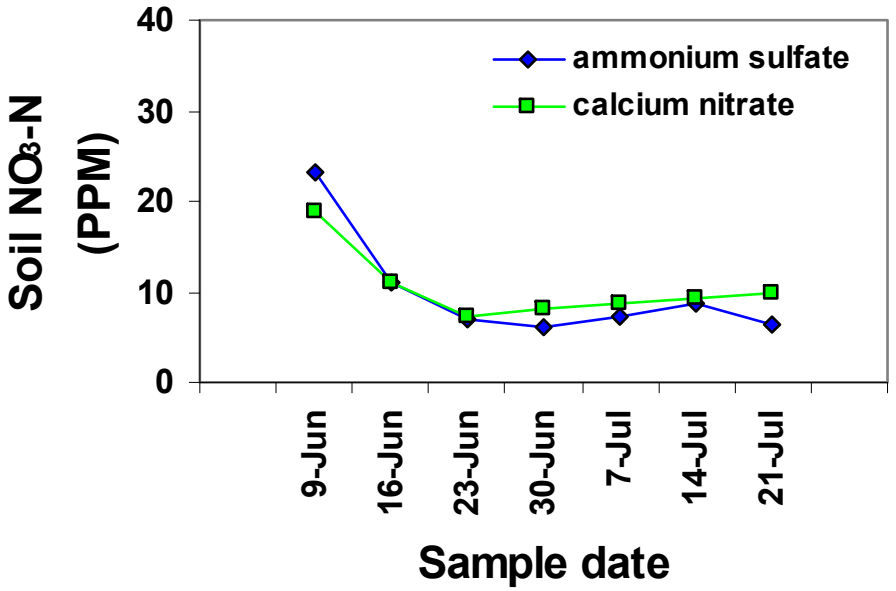

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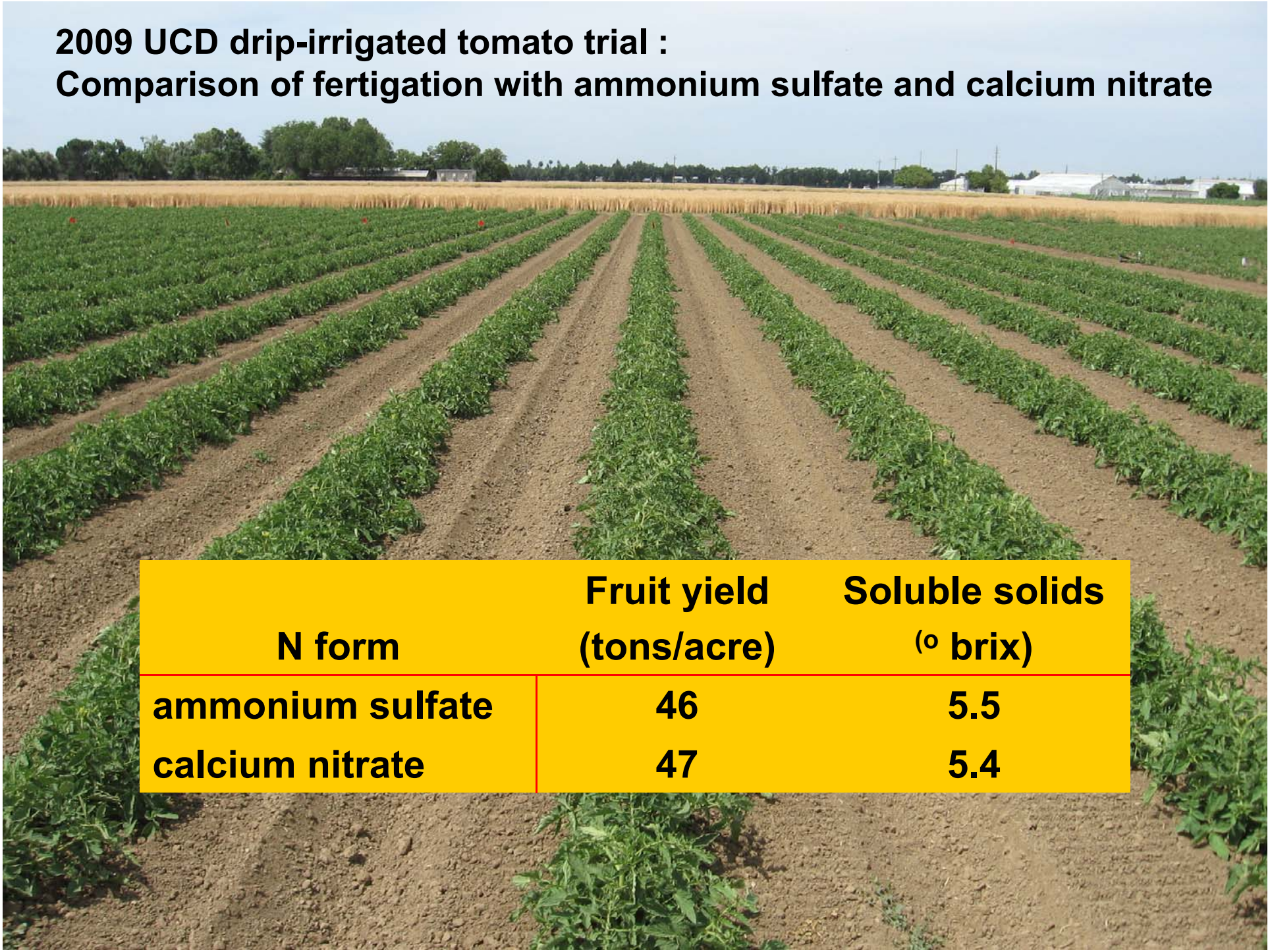

N form	Fruit yield (tons/acre)	Soluble solids (^{o} brix)
ammonium sulfate	46	5.5
calcium nitrate	47	5.4

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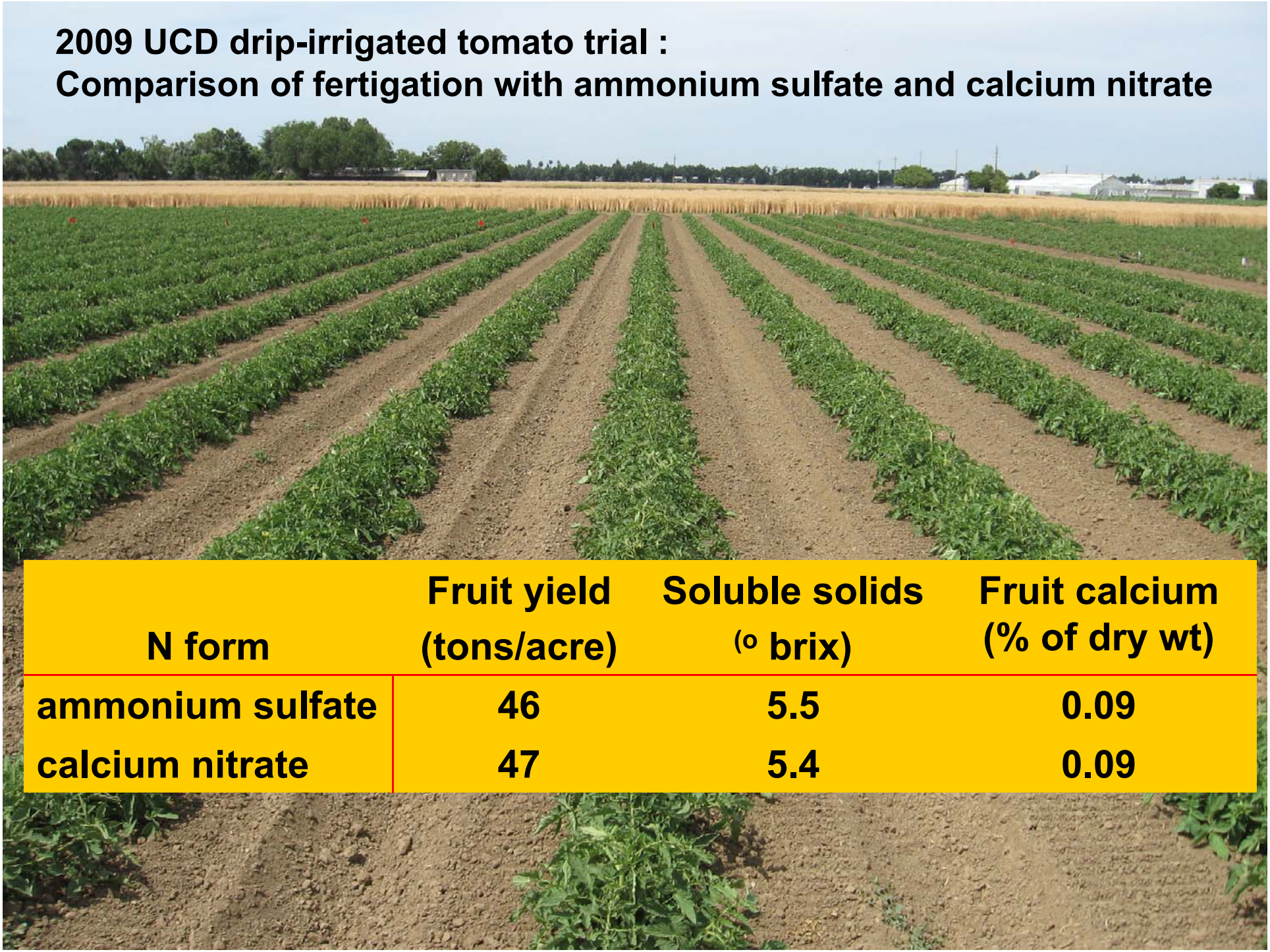

N form	Fruit yield (tons/acre)	Soluble solids (° brix)	Fruit calcium (% of dry wt)
ammonium sulfate	46	5.5	0.09
calcium nitrate	47	5.4	0.09

210 lb Ca / acre was applied with calcium nitrate

- why no difference in fruit Ca ?

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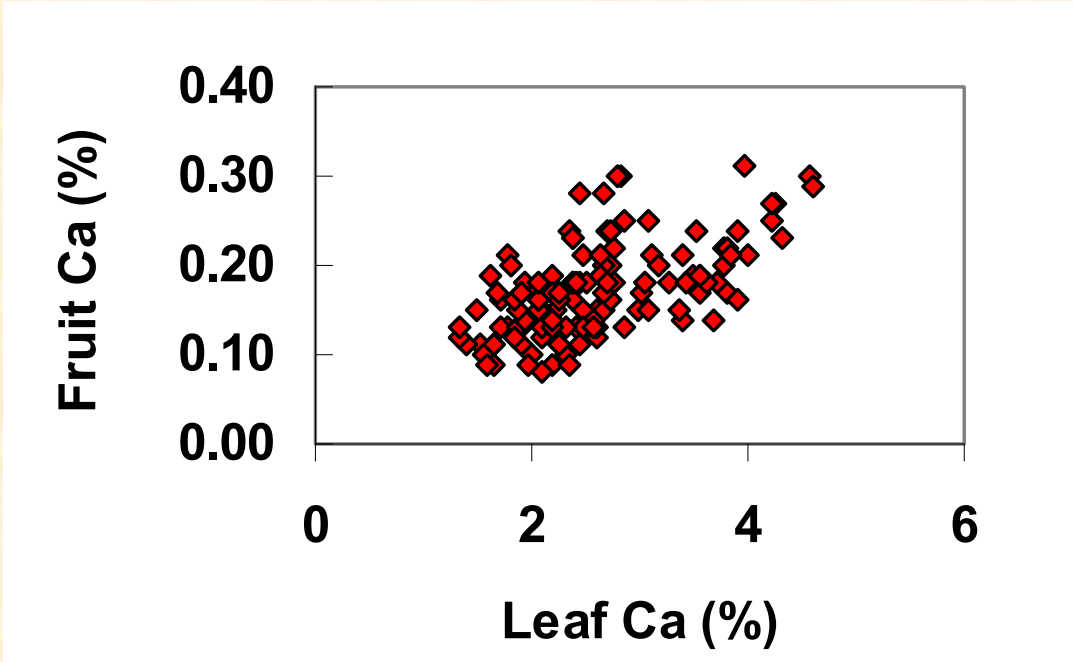
Processing tomato fruit quality survey :



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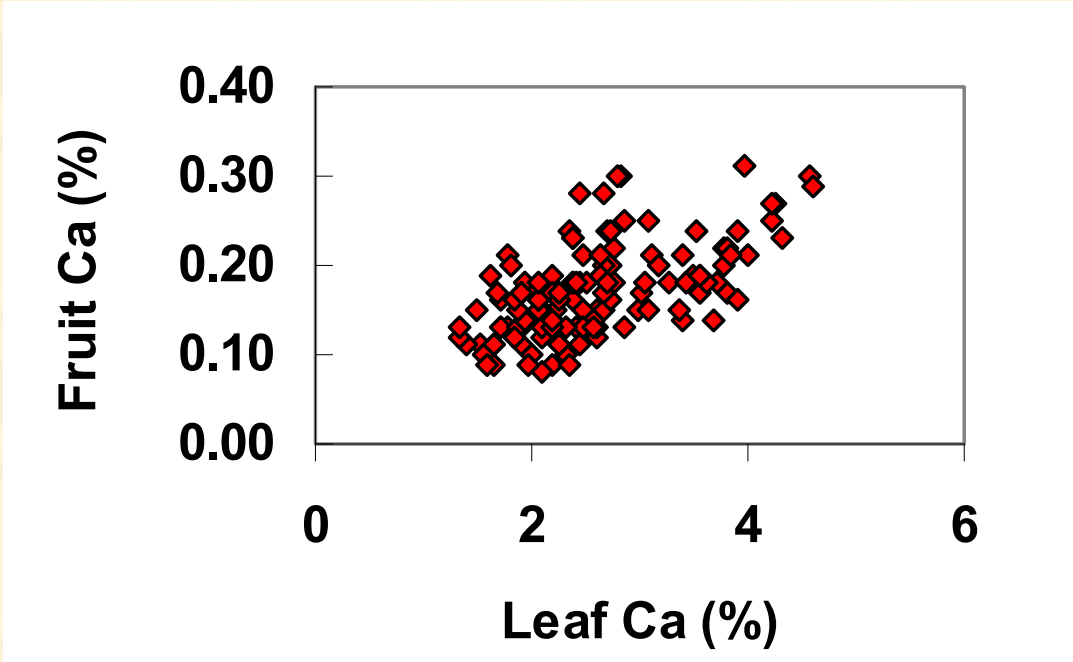

- **Ca moves in transpirational flow in xylem, so leaf Ca is high**
- **surface wax on fruit limits transpiration, limiting Ca in xylem flow; Ca does not move in phloem**

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- ✓ K chloride
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To what degree is chloride toxic?

Tomato is reasonably salinity tolerant, and chloride tolerant

- no detrimental effects < 175 PPM Cl in soil solution
- 200 lb K_2O/acre from KCl contains ≈ 35 PPM Cl averaged over a season's irrigation

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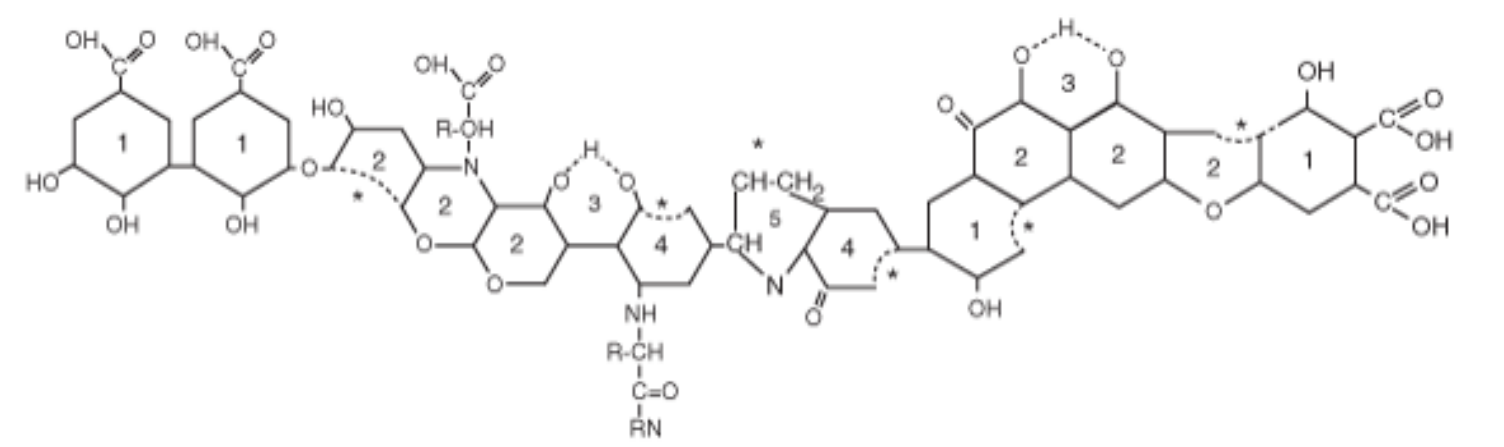
- no detrimental effects < 5 meq/liter (175 PPM Cl)
- 200 lb K_2O/acre from KCl contains < 35 PPM Cl averaged over a season's irrigation

Are there beneficial effects of sulfate or thiosulfate ions?

- sulfur availability is limited only in very low organic matter soil, and low salt irrigation water
- thiosulfate ion acidifies soil

Does humic acid improve fertilizer performance ?



What has been proven :

In hydroponic studies, humic / fulvic acids can

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Are commercial humic products effective in field soils ?

Replicated field data from western states is very limited
- slight benefit in potatoes (University of Idaho)
- no benefit in onions (Oregon State University)

2007-09 UCD trials :

Products tested :

- ✓ Actagro Humic acid
- ✓ Actagro Liquid humus
- ✓ Organo Liquid Hume
- ✓ Quantum-H
- ✓ ESP-50

Does humic acid stimulate microbial activity in field soils ?

- ✓ Two field soils wetted with a solution of humic acid and 10-34-0
  - all products at 2 lb active ingredient/acre
- ✓ Incubated in sealed jars for 7 days
- ✓ CO_2 released by microbial respiration measured

Does humic acid stimulate microbial activity in field soils ?

	mg of carbon mineralized	
	Soil with 0.8% organic matter	Soil with 2.5% organic matter
P + Humics	5.9	11.0
P fertilizer alone	5.5	11.2
Humic effects significant ?	yes	no

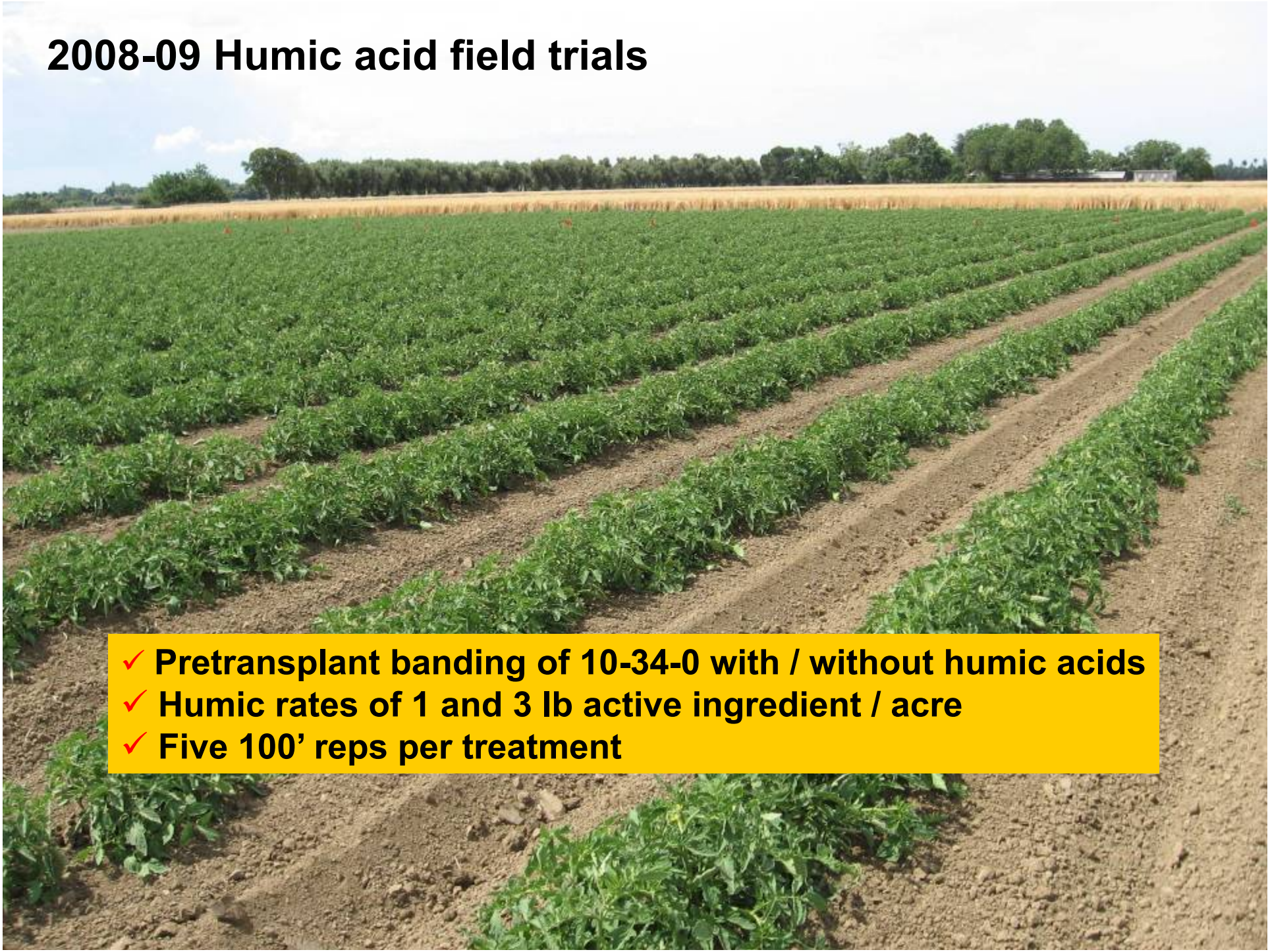
Does humic acid affect the microbial community in field soils ?

	Phospholipid fatty acids increased ?	
	Soil with 0.8% organic matter	Soil with 2.5% organic matter
fungi	yes	no
bacteria	yes	no
actinomycetes	yes	no

Does humic acid improve fertilizer efficiency ?

	Plant dry weight (g)			
	Soil 1	Soil 2	Soil 3	Soil 4
No P or Humic	0.21	0.50	0.79	1.06
Humic only	0.26	0.53	0.89	1.21
Humic effects significant ?	no	no	no	no
P only	2.08	1.89	2.69	2.74
Humic + P	1.77	1.70	3.16	2.88
Humic effects significant ?	no	no	yes	no

2008-09 Humic acid field trials



- ✓ Pretransplant banding of 10-34-0 with / without humic acids
- ✓ Humic rates of 1 and 3 lb active ingredient / acre
- ✓ Five 100’ reps per treatment

Early season sampling :

- ✓ **Whole plant sacrifice to evaluate growth**
- ✓ **Leaf samples to evaluate nutrient uptake**

2008 :

		% in plant		
	Plant dry wt (g)	N	P	K
Fertilizer + Humics @ l lb/acre	88	4.6	0.42	3.4
Fertilizer + Humics @ 3 lb/acre	87	4.7	0.42	3.5
Fertilizer alone	87	4.6	0.39	3.4
Humic effects significant ?	no	no	no	no

Sampling 6 weeks after transplanting

2009 :

		% in leaf		
	Plant dry wt (g)	N	P	K
Fertilizer + Humics @ l lb/acre	21	5.6	0.63	2.4
Fertilizer + Humics @ 3 lb/acre	22	5.6	0.64	2.4
Fertilizer alone	22	5.7	0.68	2.4
Humic effects significant ?	no	no	no	no

Sampling 4 weeks after transplanting

How about micronutrients ?

- ✓ **in neither year did humic acid consistently increase leaf micronutrient concentration**

At harvest :

	2008		2009	
	Mkt yield (tons/acre)	Solids (° brix)	Mkt yield (tons/acre)	Solids (° brix)
Fertilizer + Humics @ l lb/acre	50.9	5.5	42.2	5.5
Fertilizer + Humics @ 3 lb/acre	51.8	5.5	45.6	5.5
Fertilizer alone	52.7	5.6	44.2	5.6
Humic effects significant ?	no	no	no	no

Why such disappointing results ?

- ✓ **Hydroponic studies suggest that HA concentration of 50-100 PPM necessary for optimum response; typical field application rates are too low**

- ✓ **Dissolved organic matter in soil can perform the same functions as HA, thereby masking potential HA effects**