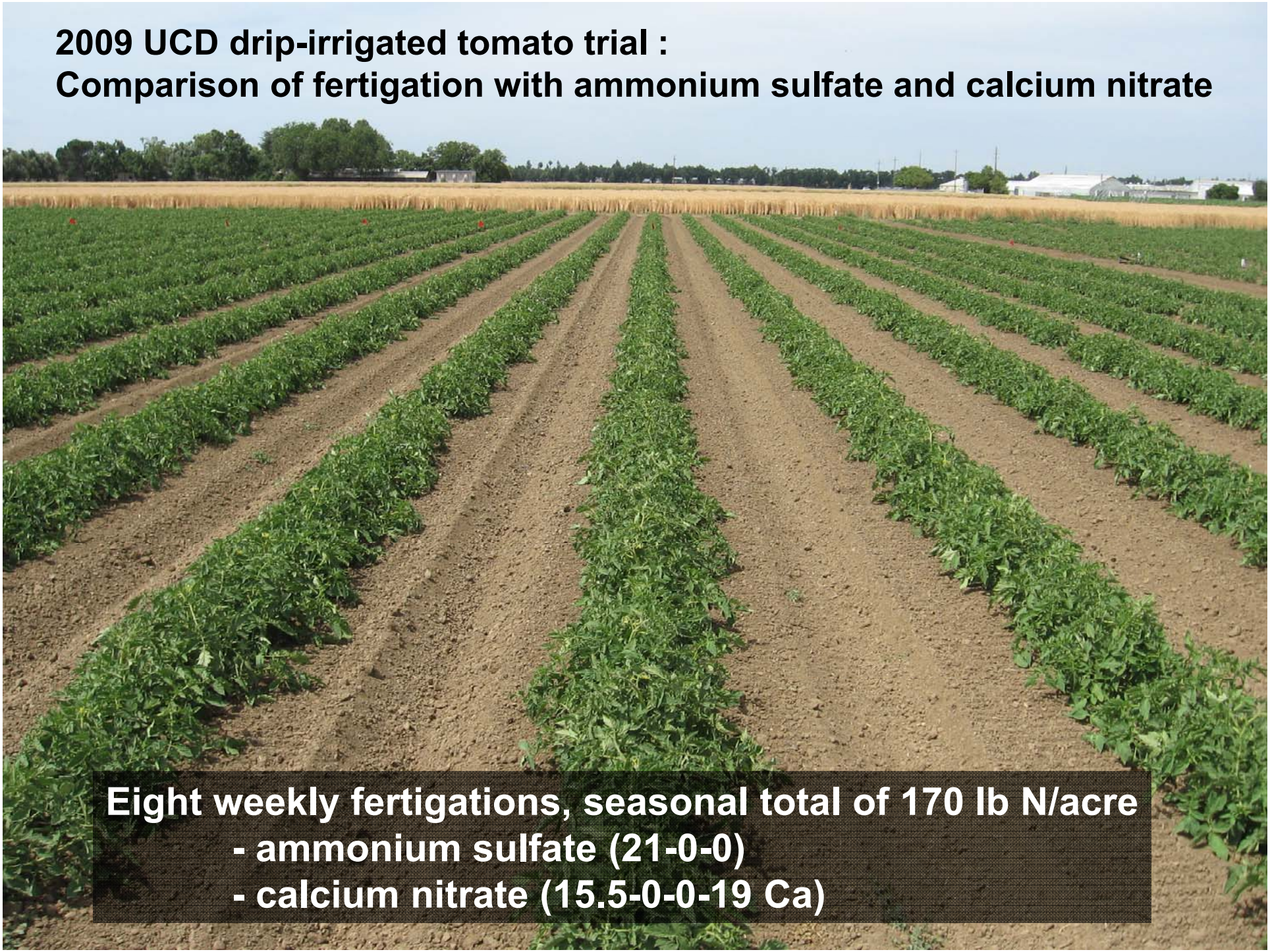
Evaluating fertilizer forms and additives

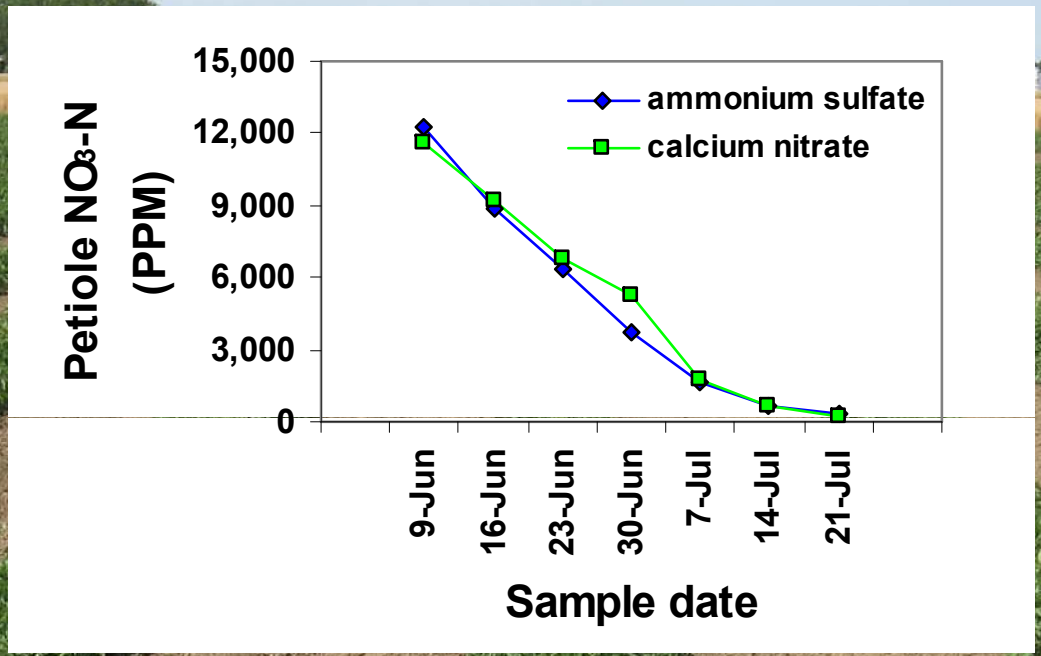
Does the form of N make a difference ?

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


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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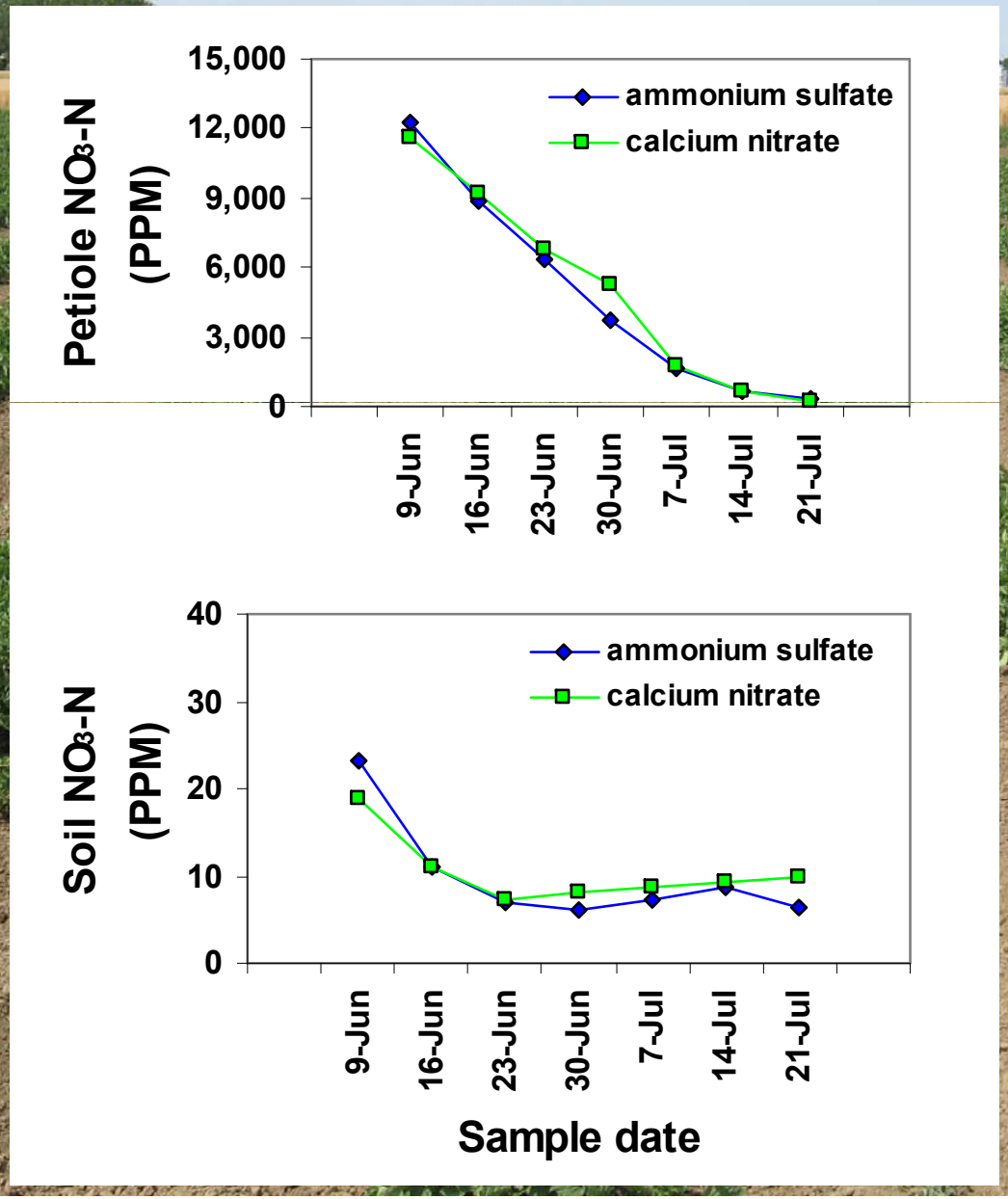

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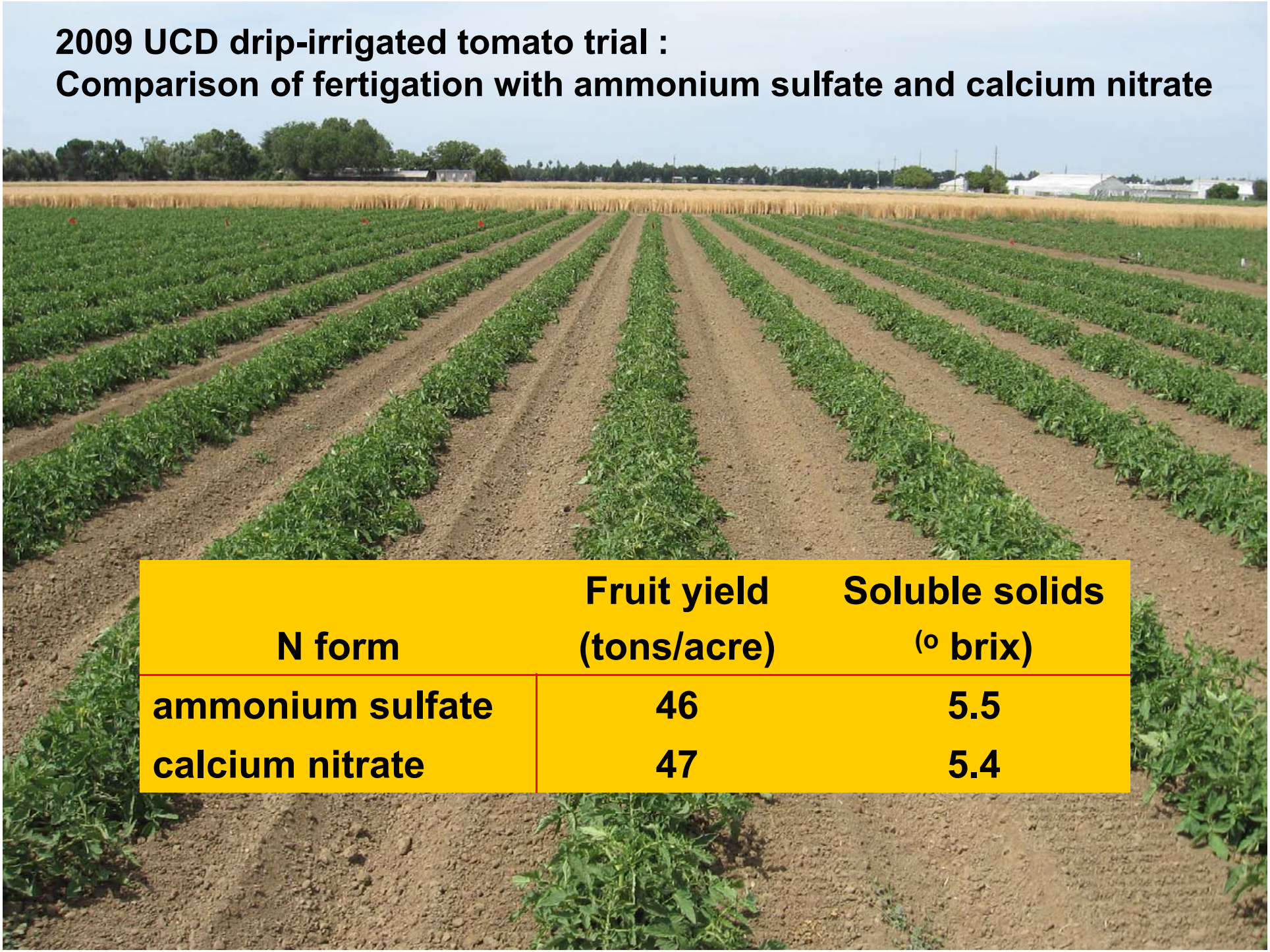
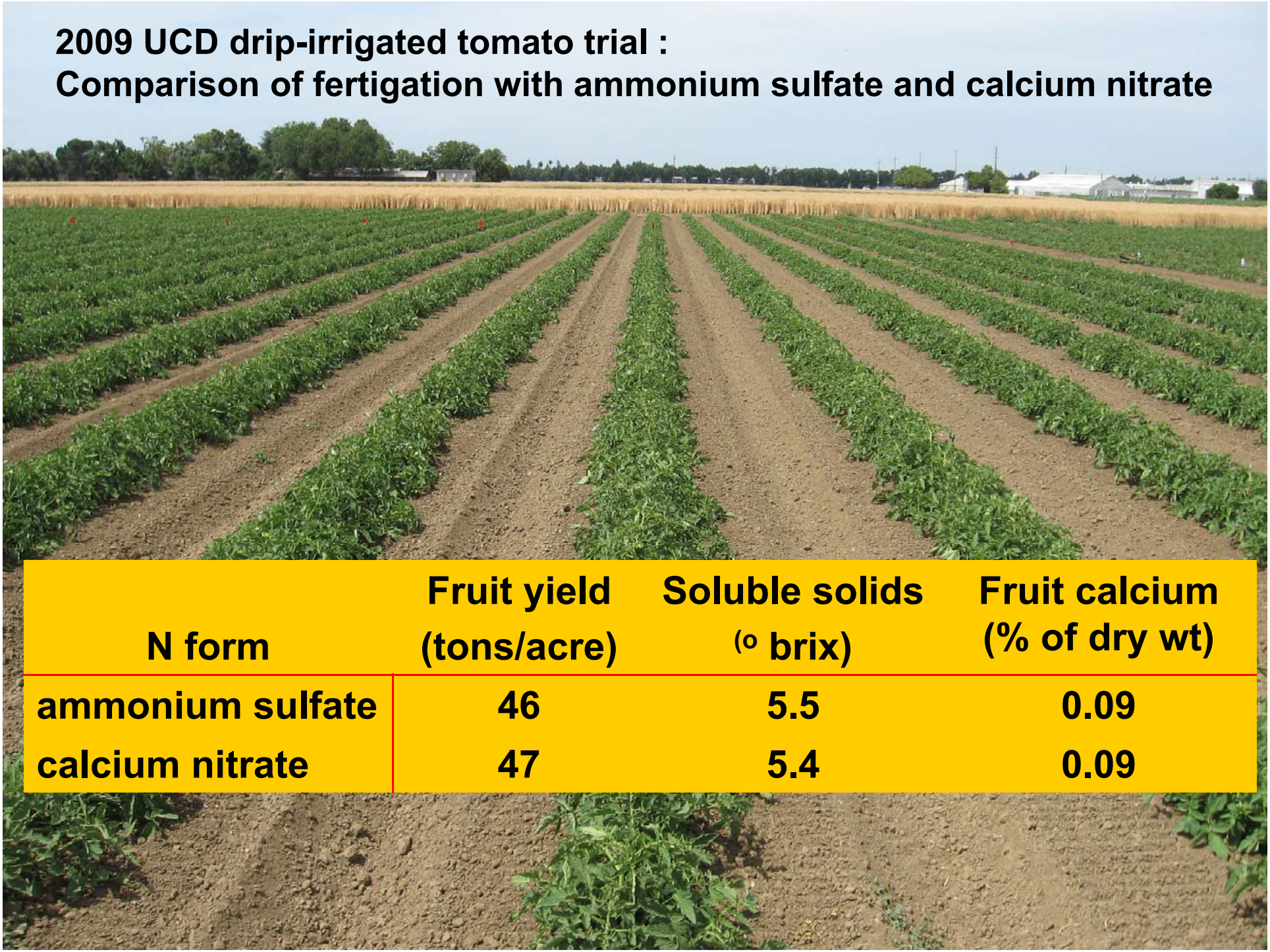


N form	Fruit yield (tons/acre)	Soluble solids (° brix)
ammonium sulfate	46	5.5
calcium nitrate	47	5.4

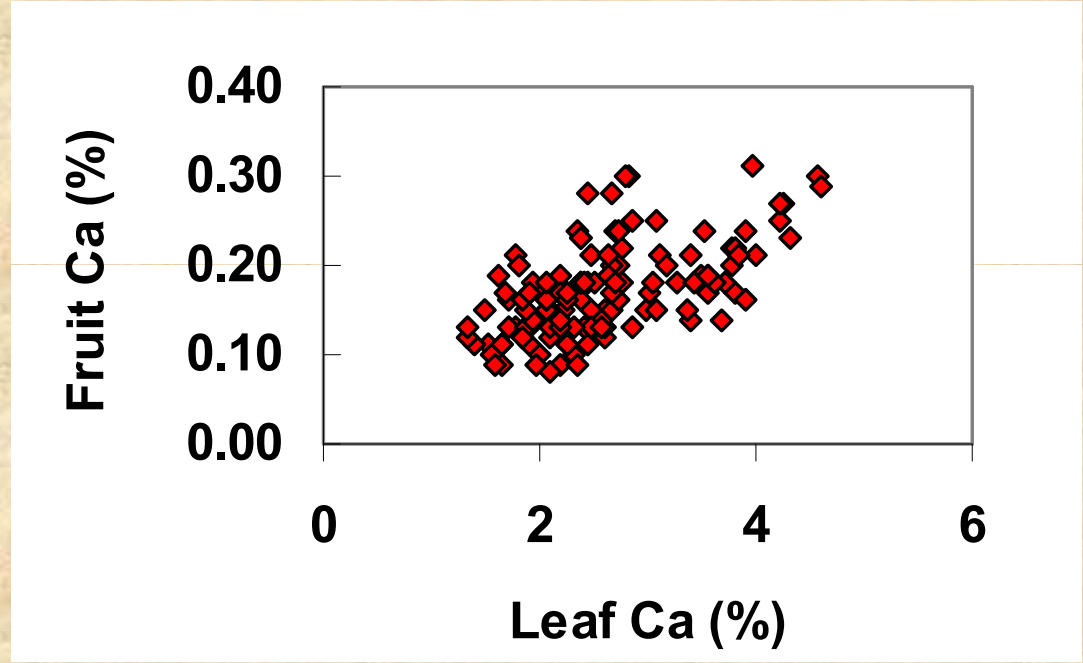
2009 UCD drip-irrigated tomato trial :
Comparison of fertigation with ammonium sulfate and calcium nitrate



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 - why no difference in fruit Ca ?

Processing tomato fruit quality survey :



- **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**

Does the form of K make a difference ?

- ✓ K chloride
- ✓ K sulfate
- ✓ K thiosulfate

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**

Does the form of K make a difference ?

- ✓ K chloride
- ✓ K sulfate
- ✓ K thiosulfate

To what degree is chloride toxic?

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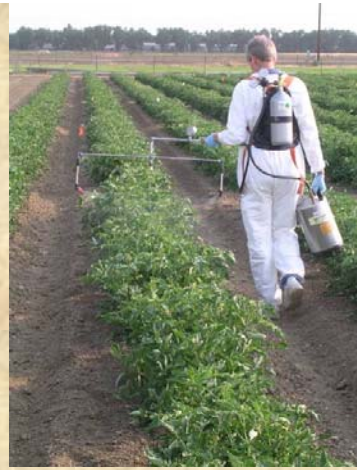
- **no detrimental effects < 5 meq/liter (175 PPM Cl)**
- **200 lb K_2O/acre from KCl contains < 35 PPM Cl averaged over a season's irrigation**

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**

Is foliar K application useful ?

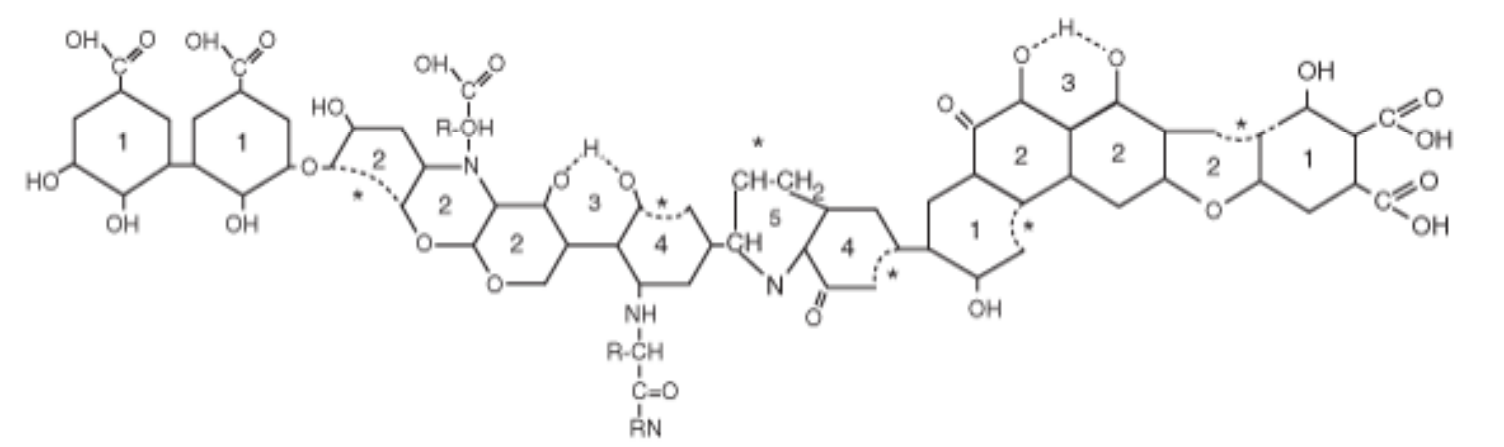


Mean of 5 trials :

K treatment	Fruit yield (tons/acre)	º brix
Foliar spray	45	4.7
Untreated control	46	4.7

5-6 weekly sprays @ 7-10 lb K/acre from K_2SO_4

Does humic acid improve fertilizer performance ?



What has been proven :

In hydroponic culture humic / fulvic acids can

- **increase plant growth**
- **increase nutrient uptake**

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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

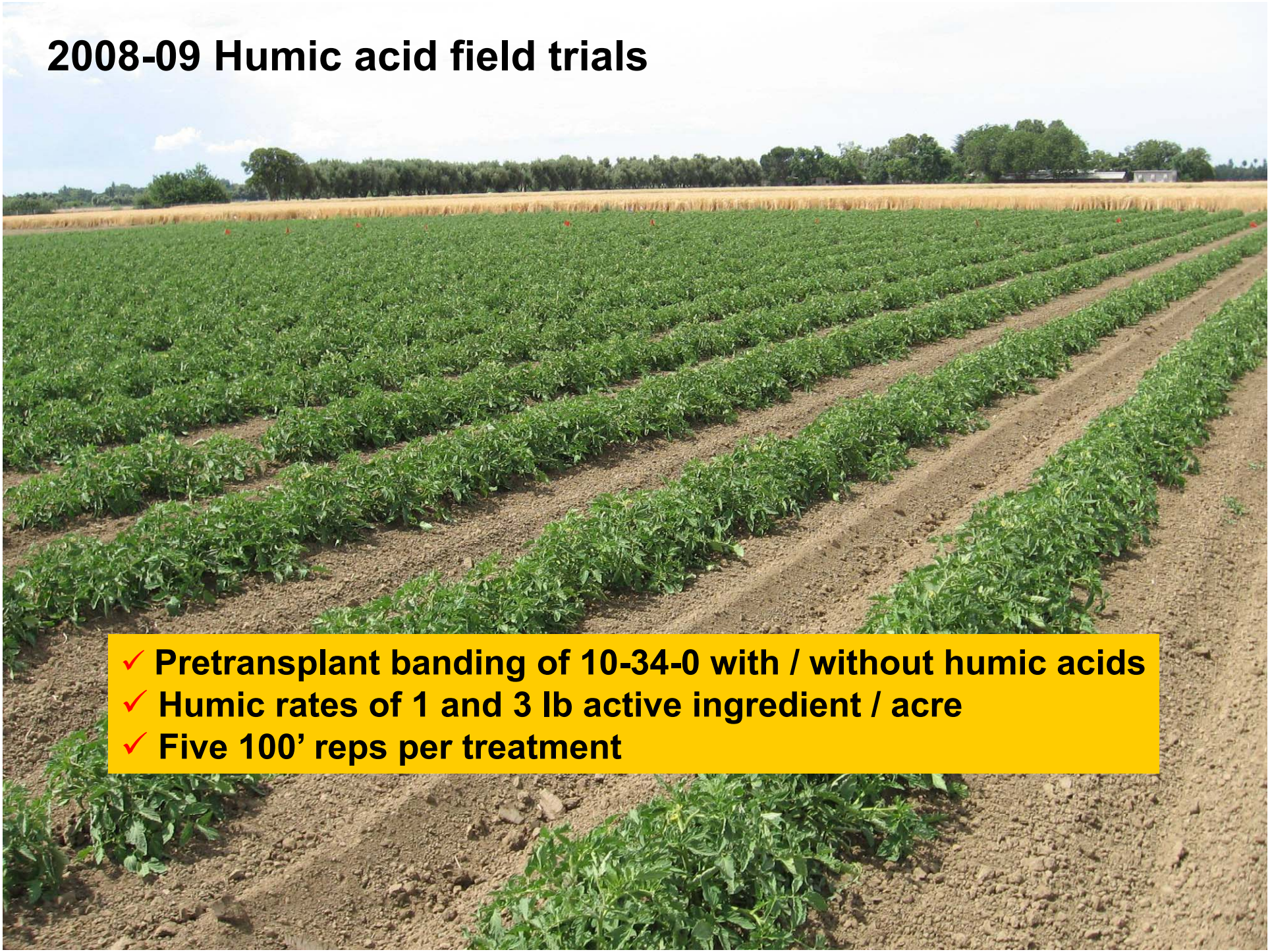
Does humic acid stimulate microbial activity in field soils ?

	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

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 :

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

Sampling at 6 weeks after transplanting

2009 :

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

Sampling 4 weeks after transplanting

At harvest :

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

Bottom line :

despite the potential to be bioactive, low rate humic acid application provided no agronomic benefit in normal field soil