Benefits of Using Liquid Sources of Potassium Fertilizer in Blueberry

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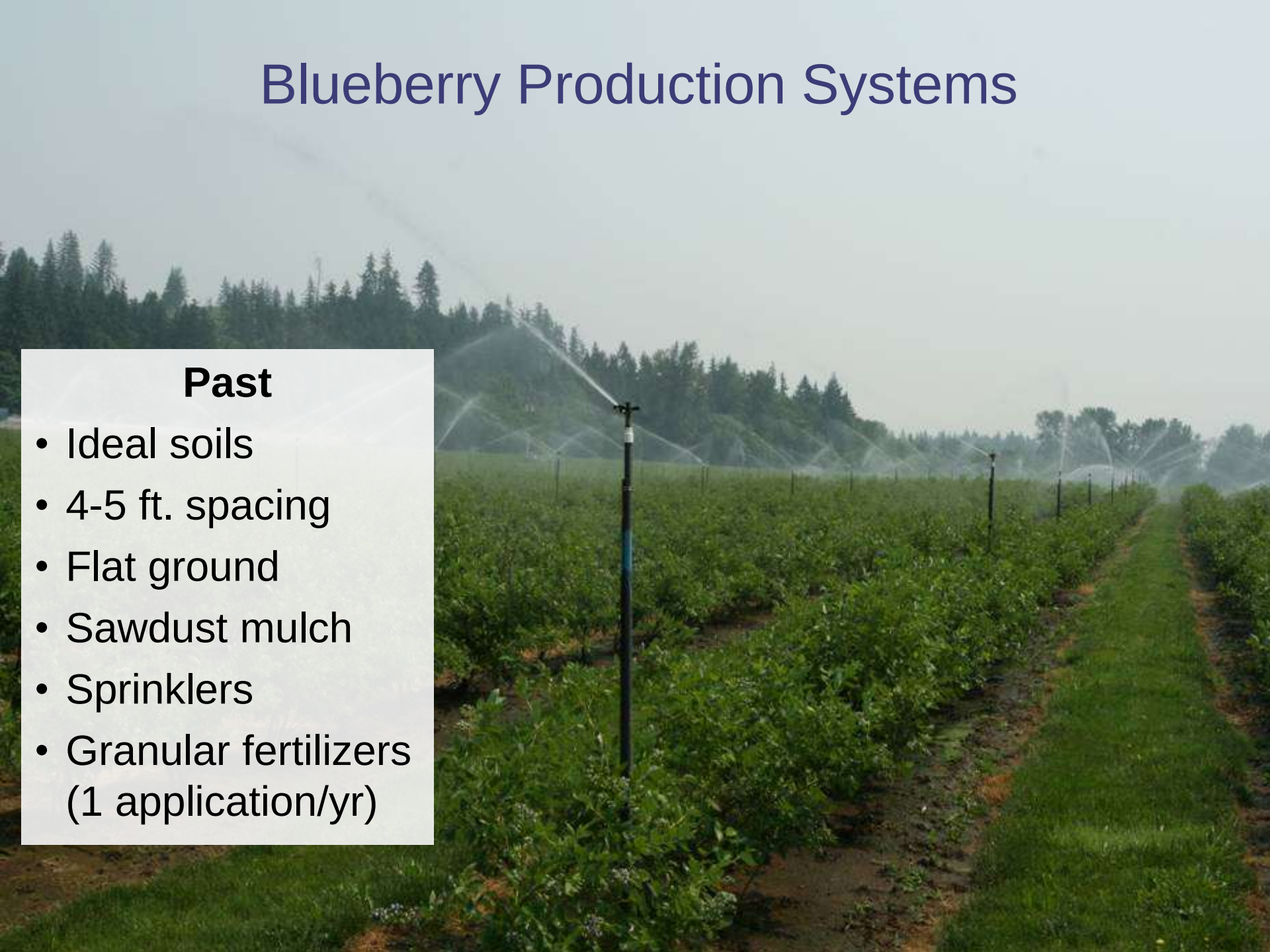
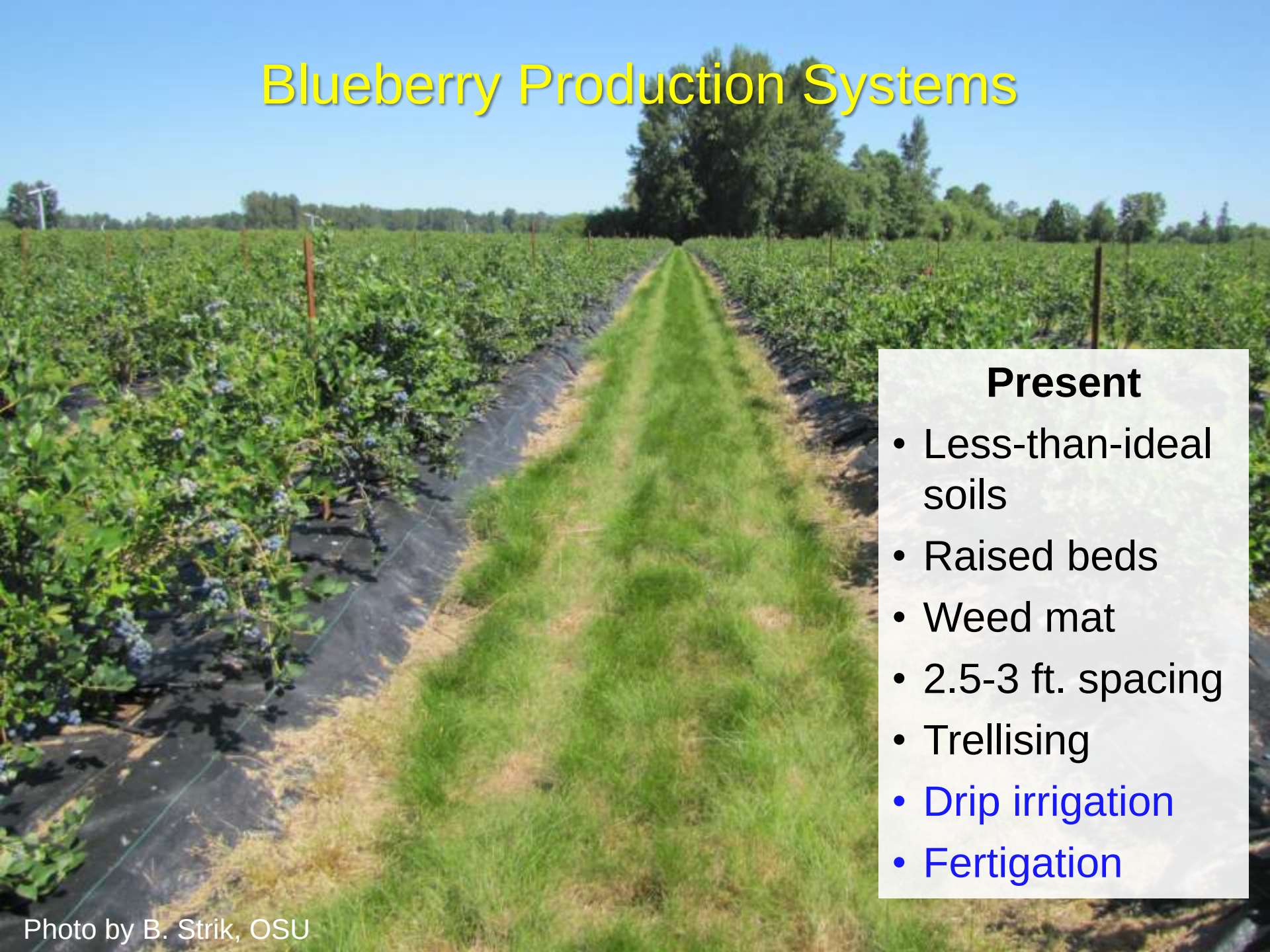
Blueberry Production Systems



Past

- Ideal soils
- 4-5 ft. spacing
- Flat ground
- Sawdust mulch
- Sprinklers
- Granular fertilizers (1 application/yr)

Blueberry Production Systems



Present

- Less-than-ideal soils
- Raised beds
- Weed mat
- 2.5-3 ft. spacing
- Trellising
- Drip irrigation
- Fertigation

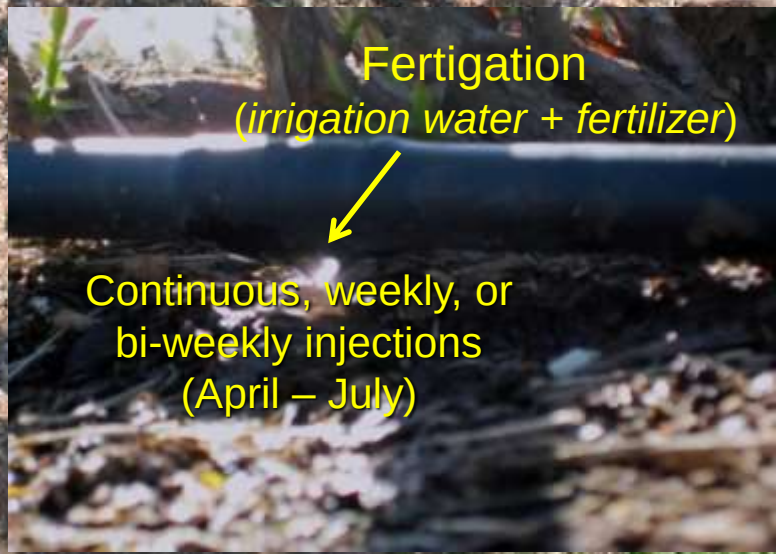
Photo by B. Strik, OSU

Fertigation

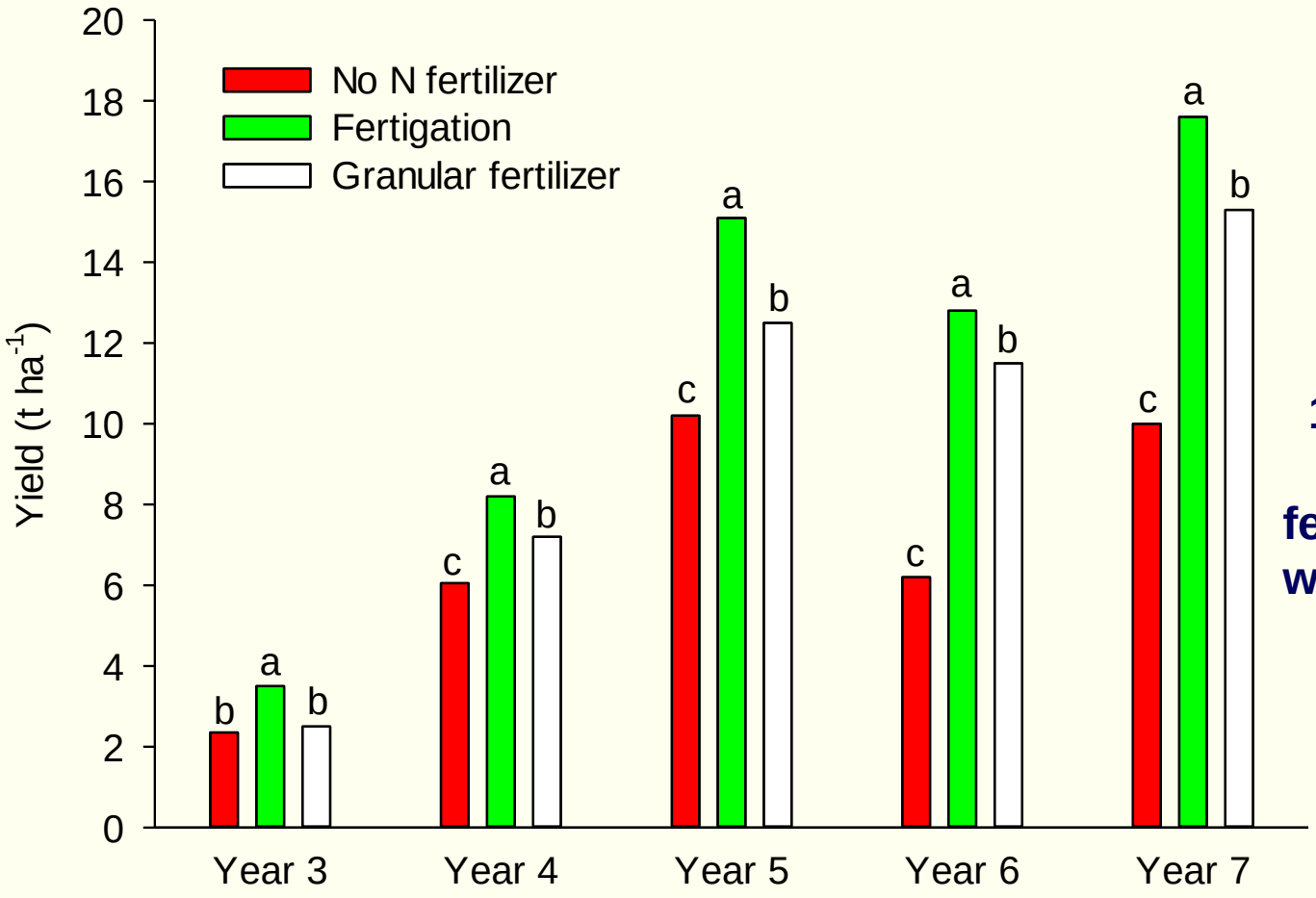
Application of fertilizers through the irrigation system

Advantages

- Reduced application costs
- Greater control
- Targeted application
- Reduced fertilizer usage



Fertigation vs. granular nitrogen applications



12-40% more yield with N fertigation than with granular N fertilizer

Vargas & Bryla (2015)

Nitrogen Fertigation is the Way to Go

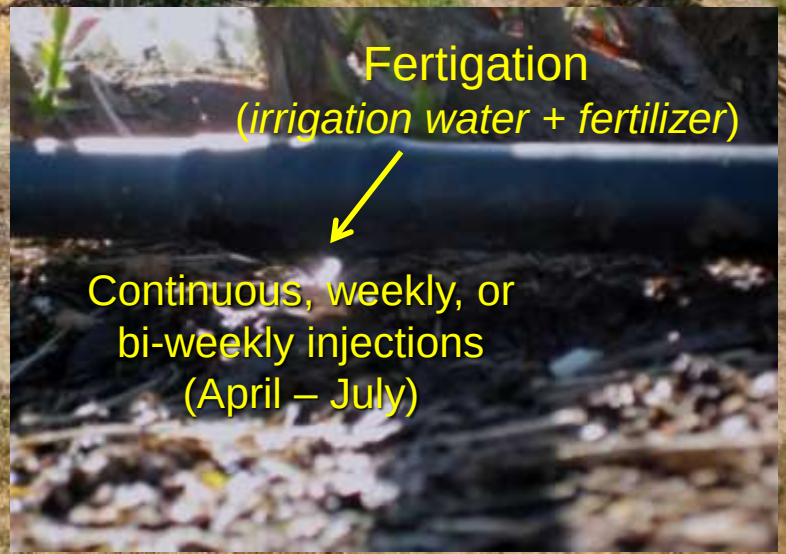
N fertigation produces:
- Larger plants
- Higher yields

What about other nutrients?

K^+

High amounts in the fruit

*About 150 lb/acre N is needed per year in mature plants



K Deficiency

- Drought
- Poor drainage
- Very low soil pH
- Heavy crop loads
- Sandy soil / low organic matter

Current K Guidelines

75-100 lb/acre K_2O

- Soil K < 100 ppm
- Leaf K < 0.2%

0-75 lb/acre K_2O

- Soil K = 100-150 ppm
- Leaf K = 0.2-0.4%

Fertilizer: potassium sulfate (0-0-52)


K Toxicity

Preliminary greenhouse study

- **Two liquid K sources** [potassium sulfate (K_2SO_4) and potassium thiosulfate (KTS)]
- **Five liquid N sources** [ammonium sulfate, urea, ammonium thiosulfate (ATS), urea ammonium nitrate (UN32), urea-triazone (slow release)]
- **Five K rates** (0-0.2 g/L)
- **Two soil types** (excellent & marginal)

Why potassium thiosulfate (KTS)?

- Highly soluble in water and compatible with many other fluid fertilizers
- Acidifying agent

$$S_2O_3^{2-} + 2\ H_2O \rightarrow 2\ H_2SO_4$$

thiosulfate water sulfuric acid

Blueberry is adapted to acidic soils (pH 4.5 to 5.5)

Soil Types

Willamette silt loam (excellent)	
Soil pH	4.9
OM (%)	3.7
Nutrients (g/kg)	
Total N	1.0
P	0.1
K	0.3
Ca	0.5
Mg	0.1

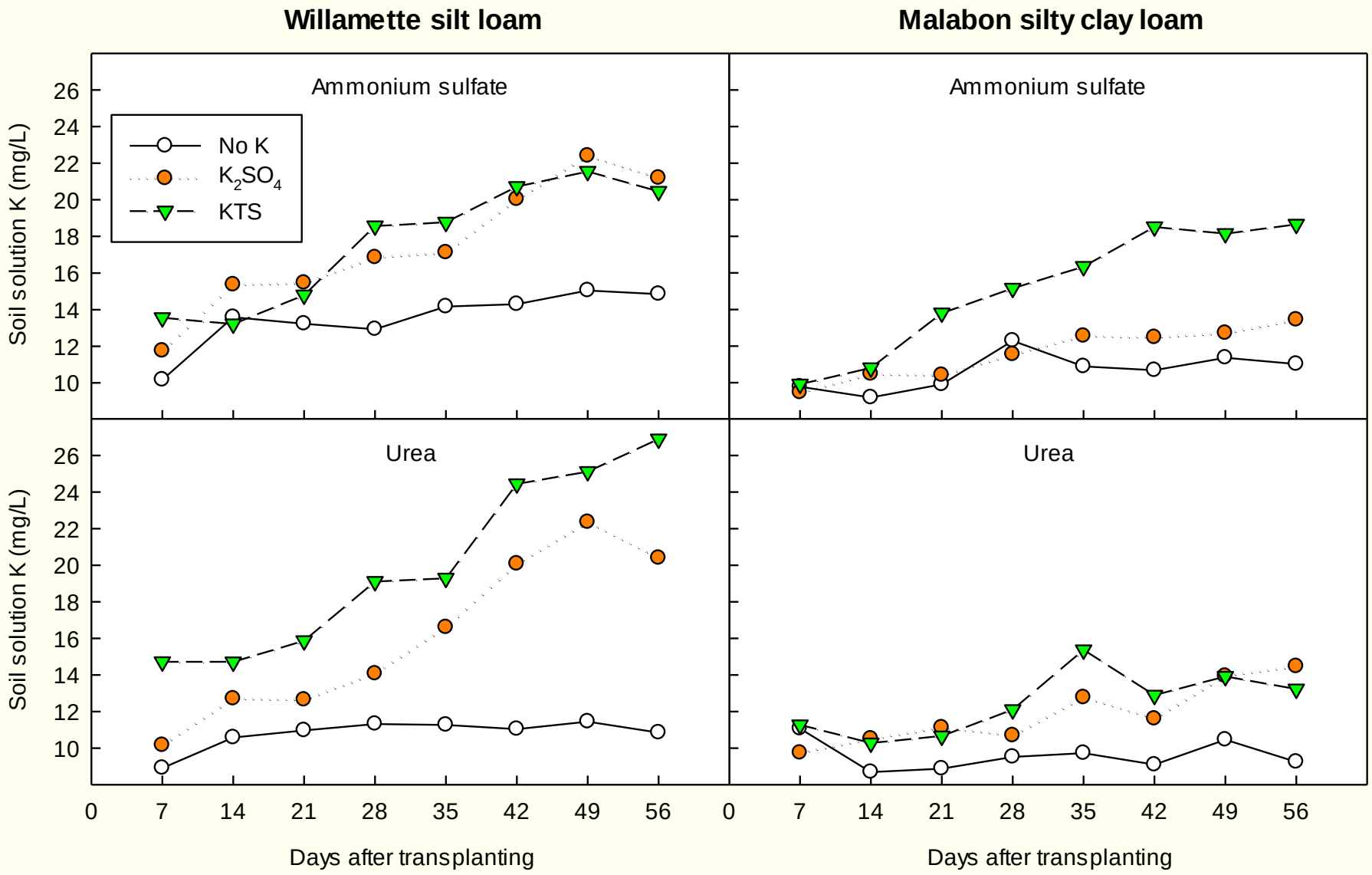
Malabon silty clay loam (marginal)	
Soil pH	6.2
OM (%)	2.3
Nutrients (g/kg)	
Total N	--
P	<0.1
K	0.3
Ca	2.2
Mg	0.6

Preliminary greenhouse study

Measurements:

- Dry weights
- Leaf nutrients
- Soil nutrient availability

Concentration of K



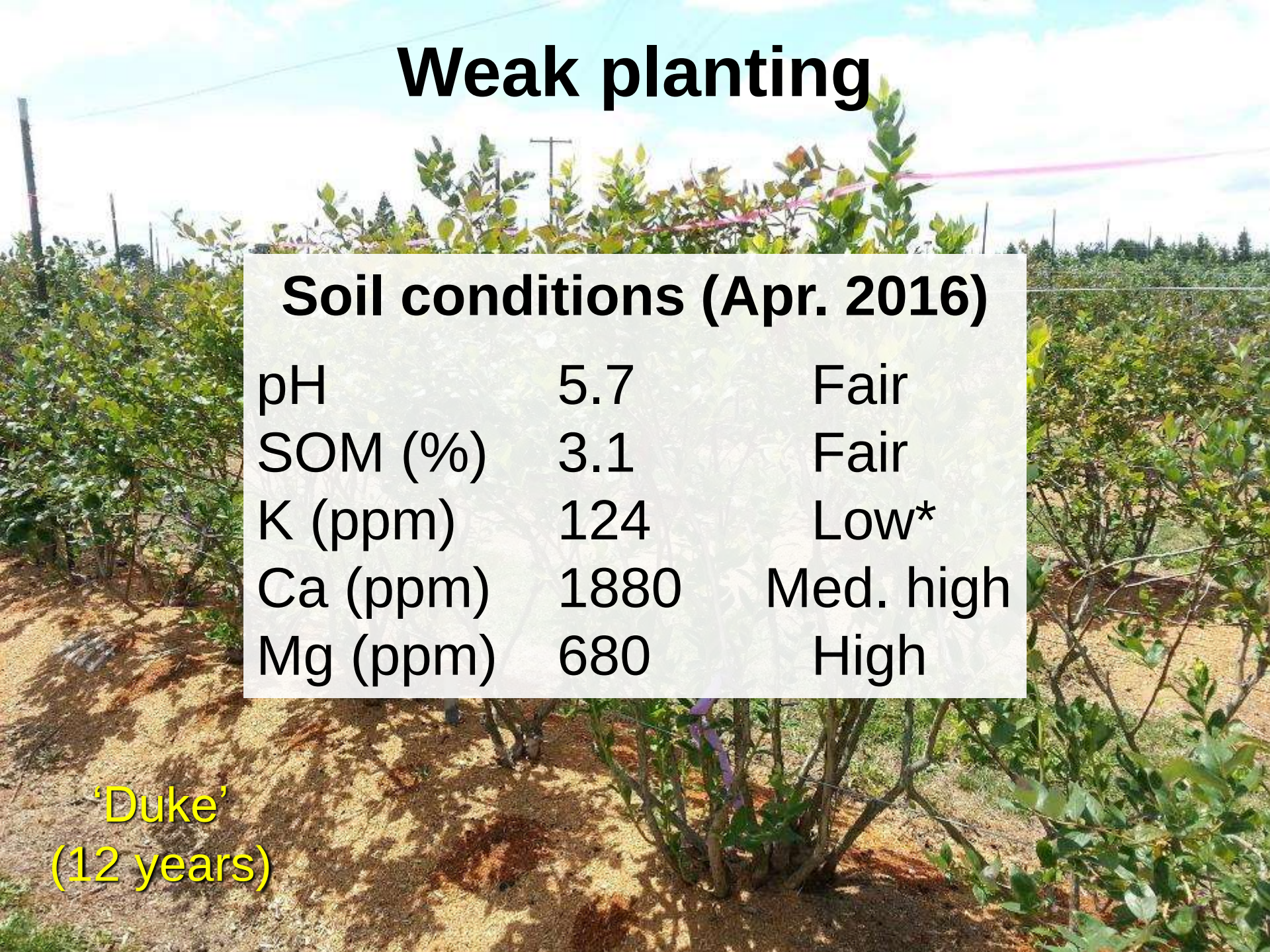
Preliminary Conclusions

(based on greenhouse study)

KTS appears promising

- *Use with ammonium sulfate on high pH soils*
- *Use with urea on soil with optimum pH*

Weak planting



Soil conditions (Apr. 2016)

pH	5.7	Fair
SOM (%)	3.1	Fair
K (ppm)	124	Low*
Ca (ppm)	1880	Med. high
Mg (ppm)	680	High

‘Duke’
(12 years)

Weak planting

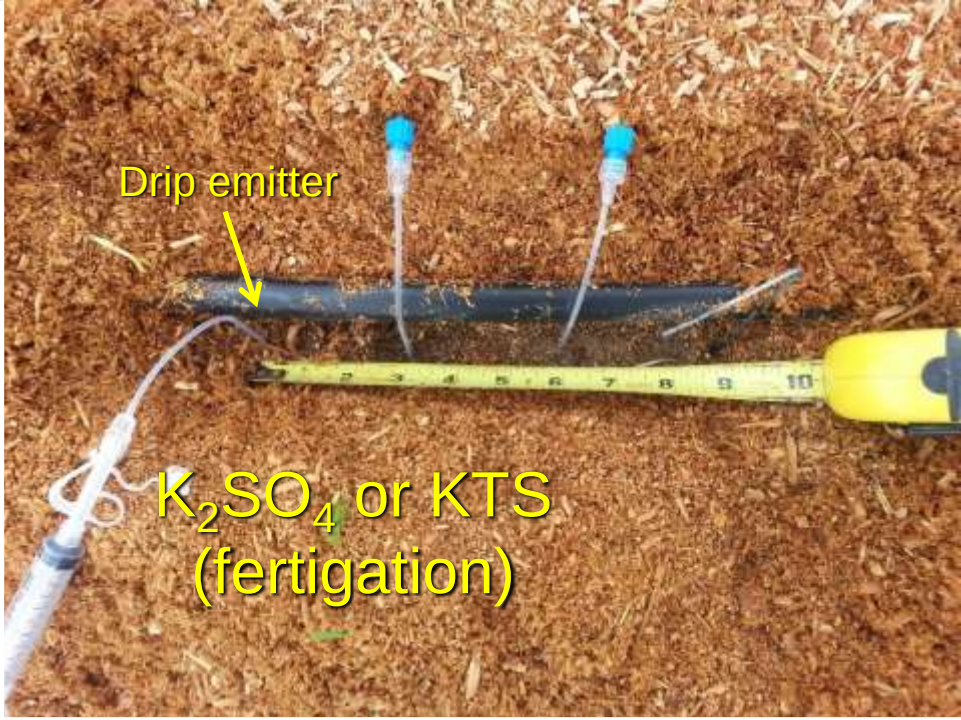
Treatments

- No K
- K_2SO_4 (granular)*
- K_2SO_4 (liquid)*
- KTS (liquid)*

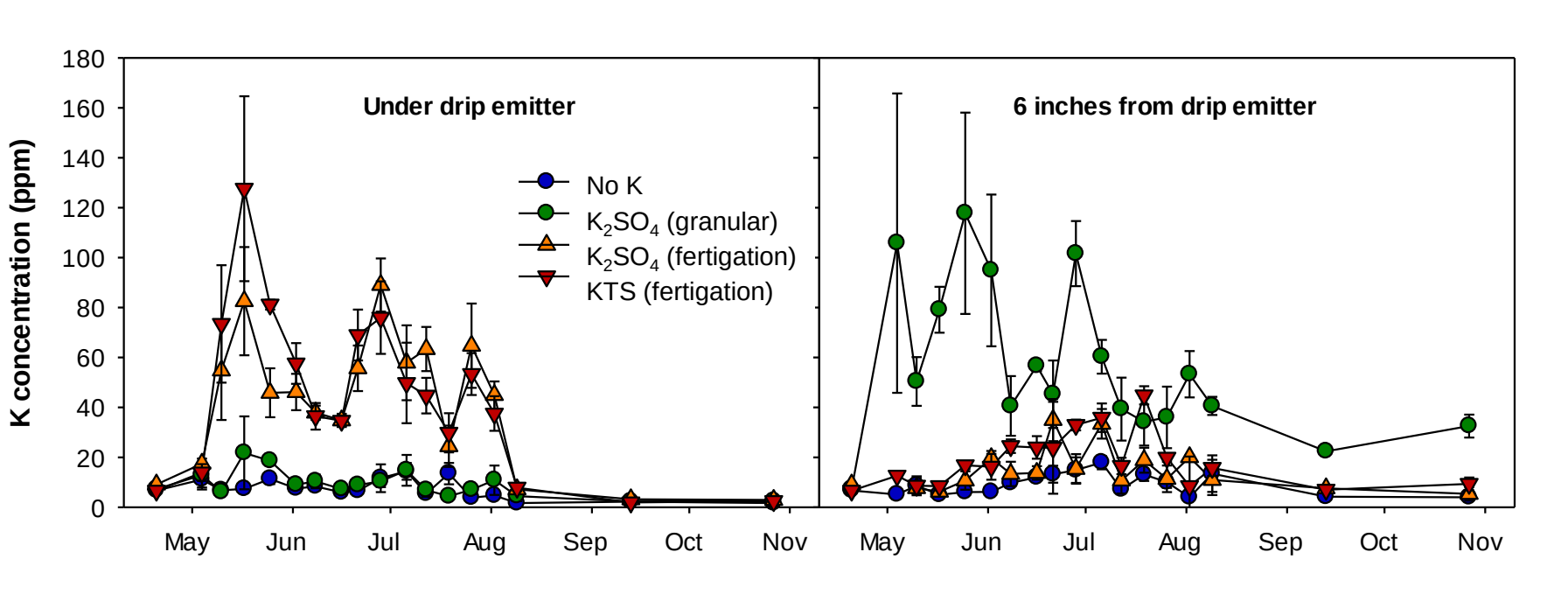
*75 lb/acre K_2O

N source: ammonium sulfate

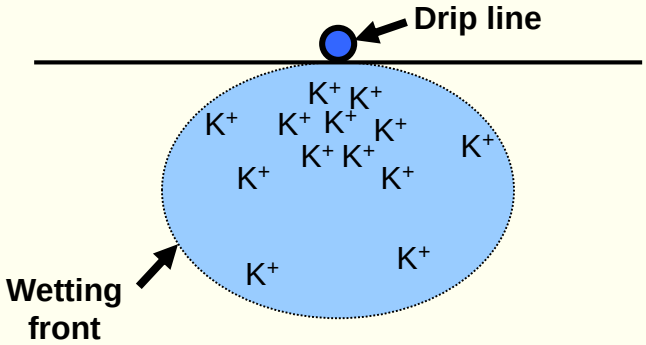

Drip irrigation
(covered w/mulch)
K_2SO_4
(banded)


Drip emitter
K_2SO_4 or KTS
(fertigation)

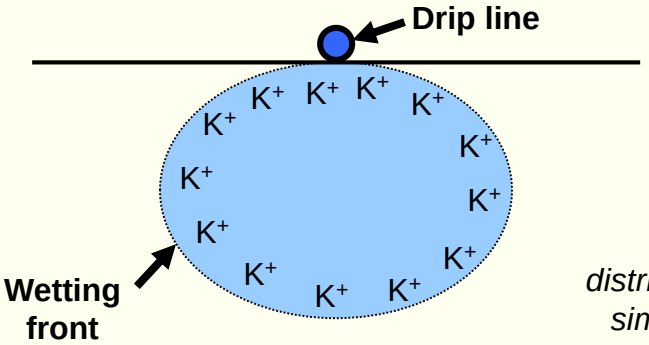
Soil solution



Fertigation



Granular fertilizer

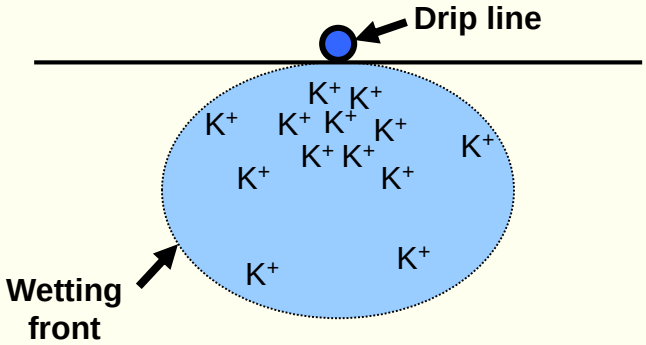


SO_4^{2-} distribution was similar to K^+

Soil solution

	pH			Ca concentration (ppm)	
K treatment	**Under emitter**	**6” from emitter**		**Under emitter**	**6” from emitter**
No K	5.7 ab	5.0 a		62 b	87
K_2SO_4 (granular)	6.0 a	4.5 b		62 b	119
K_2SO_4 (fertigation)	5.0 c	4.2 c		93 a	129
KTS (fertigation)	5.1 bc	4.4 bc		85 a	139
Significance	**	**		*	NS

Fertigation



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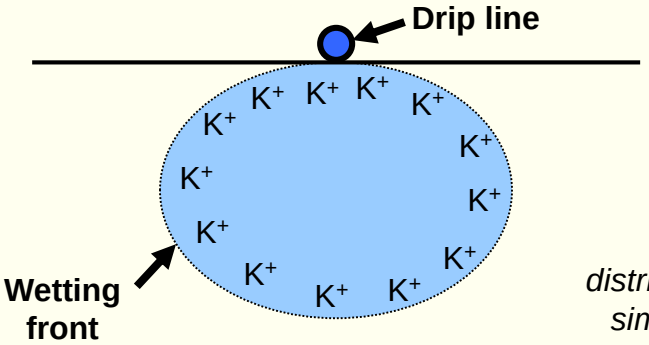

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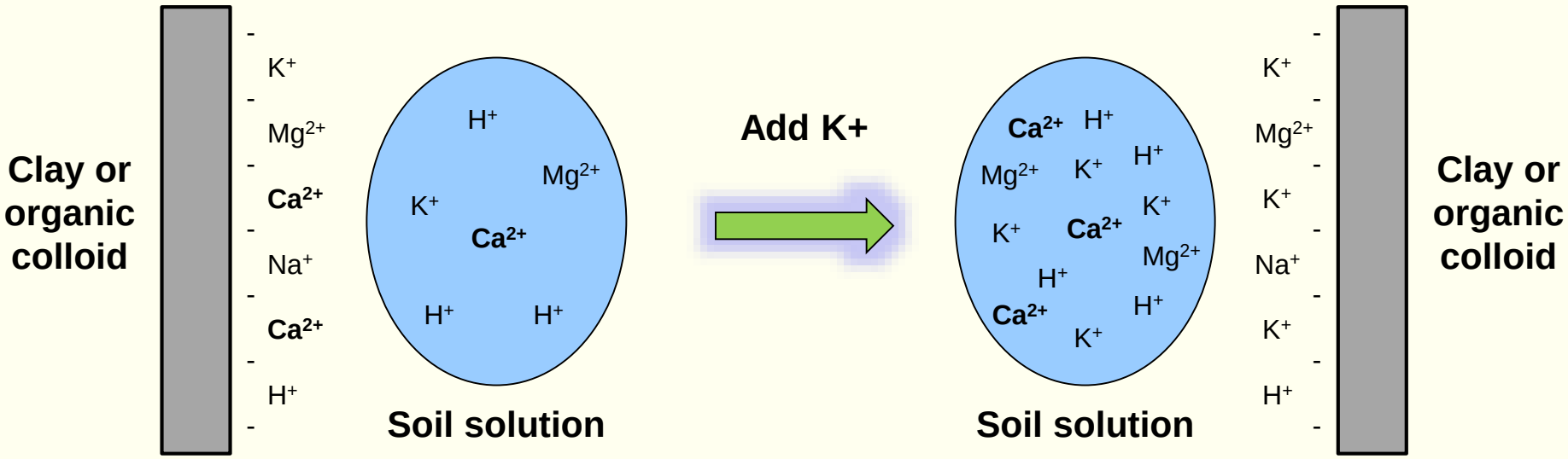
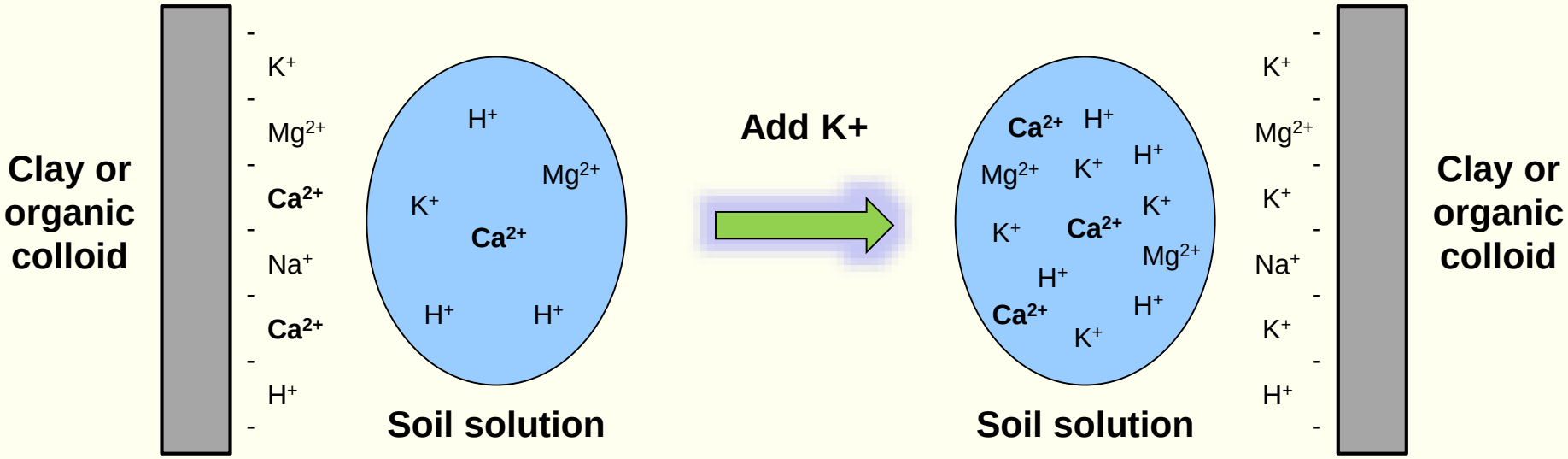


Leaf nutrients

K treatment	K (%)	Ca (%)	Mg (%)	S (%)	Mn (ppm)
No K	0.37	0.47 b	0.17 b	0.141 c	99 b
K_2SO_4 (granular)	0.40	0.53 a	0.20 a	0.159 a	106 b
K_2SO_4 (fertigation)	0.37	0.53 a	0.21 a	0.151 ab	133 a
KTS (fertigation)	0.35	0.52 a	0.21 a	0.146 bc	117 ab
Significance	NS	†	*	**	*

The treatments had no effect on other leaf nutrients



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Significance	NS	†	*	**	*

The treatments had no effect on other leaf nutrients

Berry nutrients

K treatment	K (%)	Mg (%)
No K	0.54 a	0.043 b
K_2SO_4 (granular)	0.52 ab	0.048 ab
K_2SO_4 (fertigation)	0.50 c	0.050 a
KTS (fertigation)	0.51 bc	0.049 a
Significance	**	†

The treatments had no effect on other berry nutrients

Conclusions

- Fertigation with K had more effect on soil & plant nutrition than granular K
  - Reduced soil pH & increased K, Ca, and S in the soil solution
  - Increased leaf Ca, Mg, S, and Mn (but not K)
  - Reduced berry K (but increased Mg)
  - Improved leaf color (SPAD)
- K fertilizer had no effect on yield (or fruit quality)

Thank you

Technical Support

- David Leon (PhD student)
- OSU undergraduates

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- Oregon Blueberry Commission
- Fall Creek Farm & Nursery
- Fluid Fertilizer Foundation
- Tessenderlo Kerley Inc.