Using Liquid Sources of Potassium Fertilizer in Highbush Blueberry

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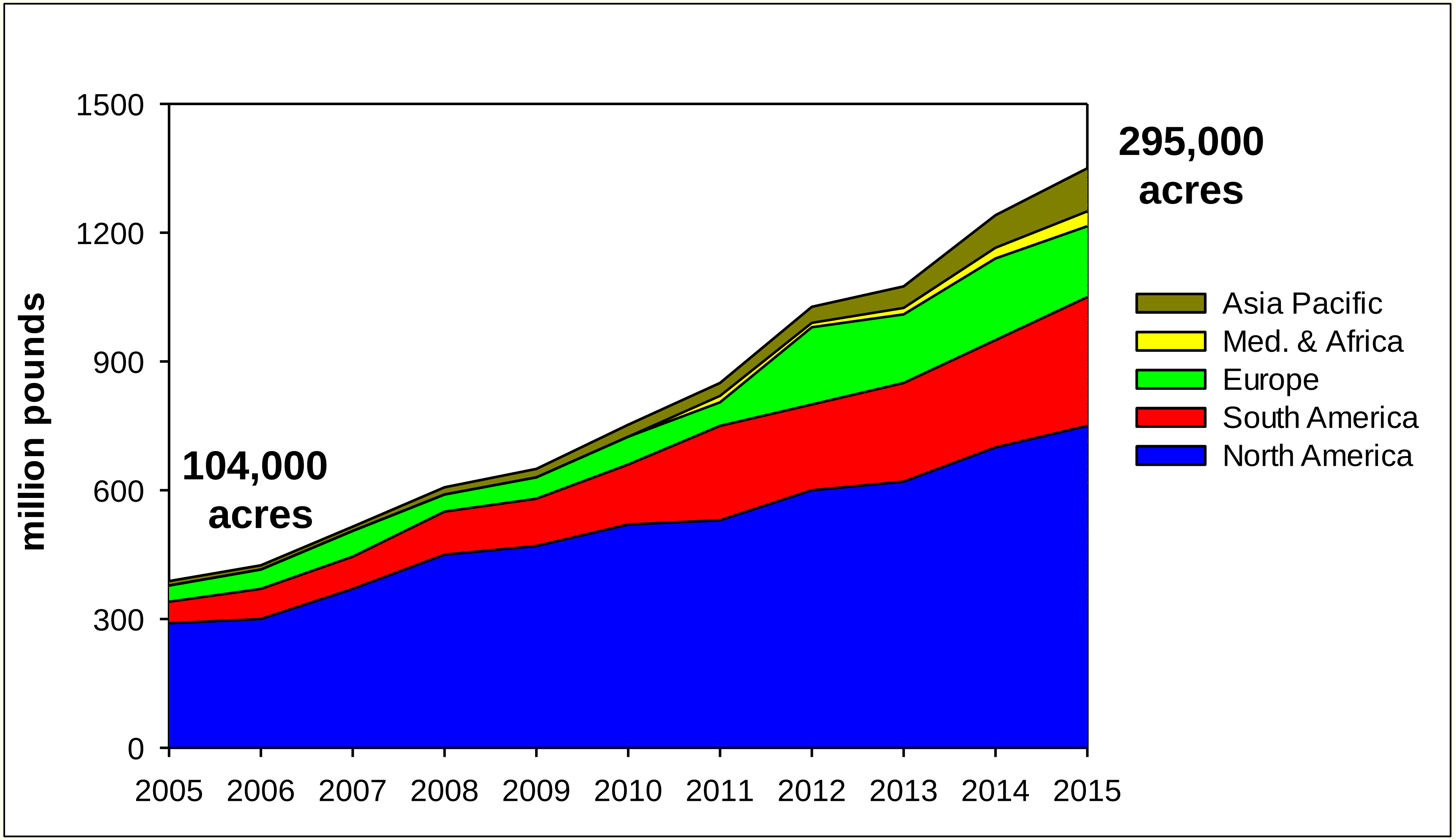
Global blueberry production



From *U.S. Highbush Blueberry Council*

Fresh Market


Processed Market
Takes 6-8 years
for a field to mature
(10 ton/acre = $20K/acre)

Blueberry is a Unique Crop

- **Shallow-rooted**
[extremely fine (40 – 70 μm) & concentrated in top 12” of soil]
- **“Acid loving”**
[adapted to low soil pH (4.5–5.5) & high organic matter]
- **Prefers NH_4- over NO_3-N**
[NO_3-N is mobile in soil, whereas NH_4-N is not]
- **Sensitive to salinity**
[ammonium sulfate has a high salt index]

Granular fertilization

Triple-split application (April, May & June)

- Soil pH > 5.5: Ammonium sulfate (21-0-0)
- Soil pH < 5.0: Urea (46-0-0)

Blueberry Irrigation

Most commercial blueberry fields are irrigated by sprinklers or drip

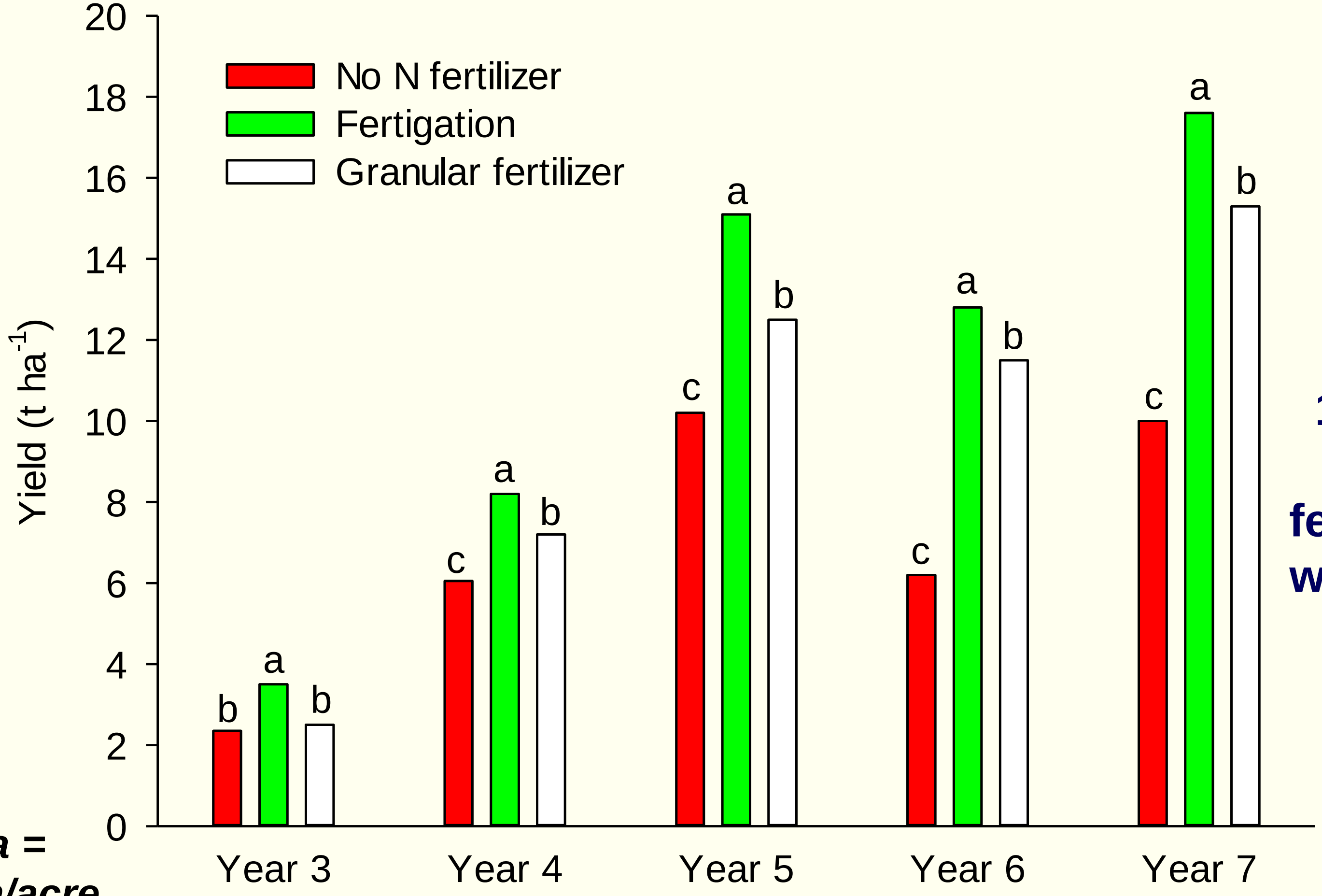
2003: 90% of fields irrigated by sprinklers
2015: 80% fields irrigated by drip

Nitrogen Fertigation Trial

Granular fertilizer
Triple-split application
(April, May & June)

Fertigation
Weekly application
(mid-April to early August)

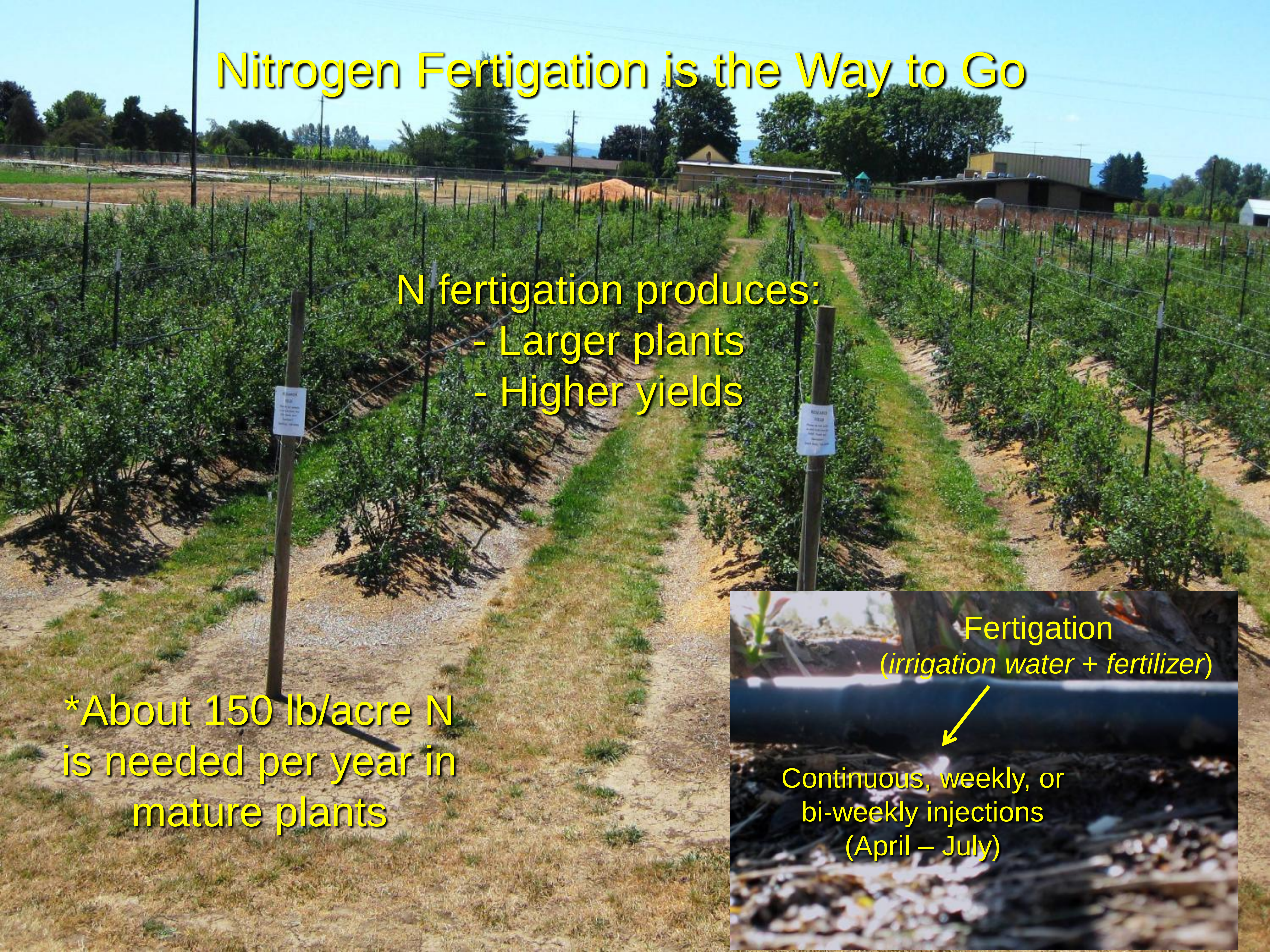
Annual Production



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

1 t/ha = 0.45 ton/acre

Vargas & Bryla (2015)


Nitrogen Fertigation is the Way to Go
N fertigation produces:
- Larger plants
- Higher yields
*About 150 lb/acre N is needed per year in mature plants
Fertigation
(irrigation water + fertilizer)
Continuous, weekly, or bi-weekly injections (April – July)

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%

K Deficiency

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

Year 1 (2015)

Preliminary greenhouse study

- Two K sources (K_2SO_4 and KTS)
- Five N sources (AS, urea, ATS, UAN, urea-triazone)
- Five K rates (0-0.2 g/L)
- Two soil types (excellent & marginal)

Results:

- KTS appeared promising (growth, soil pH, leaf K)
  - ✓ Use with ammonium sulfate on high pH soils
  - ✓ Use with urea on soils with high pH

Why KTS?

- Acidifying agent

$$S_2O_3^{2-} \xrightarrow[\text{reductase} - 2[H]]{\text{Thiosulfate}} H_2S + SO_3^{2-}$$

- Inhibits nitrification

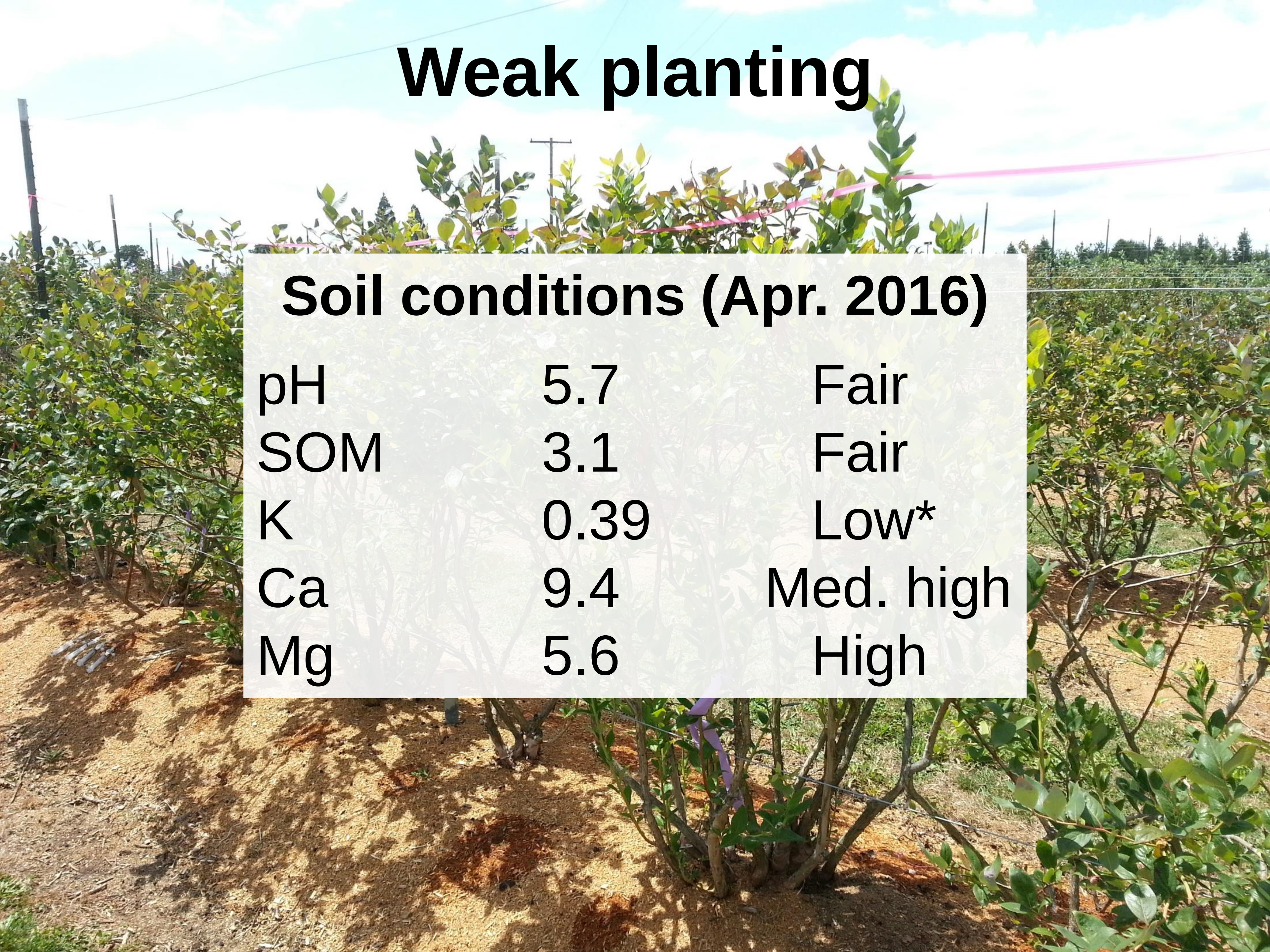
Year 2 (2016)

Weak planting

Vigorous planting

Measurements:

- Plant and soil nutrients
- Yield
- Fruit quality and storage

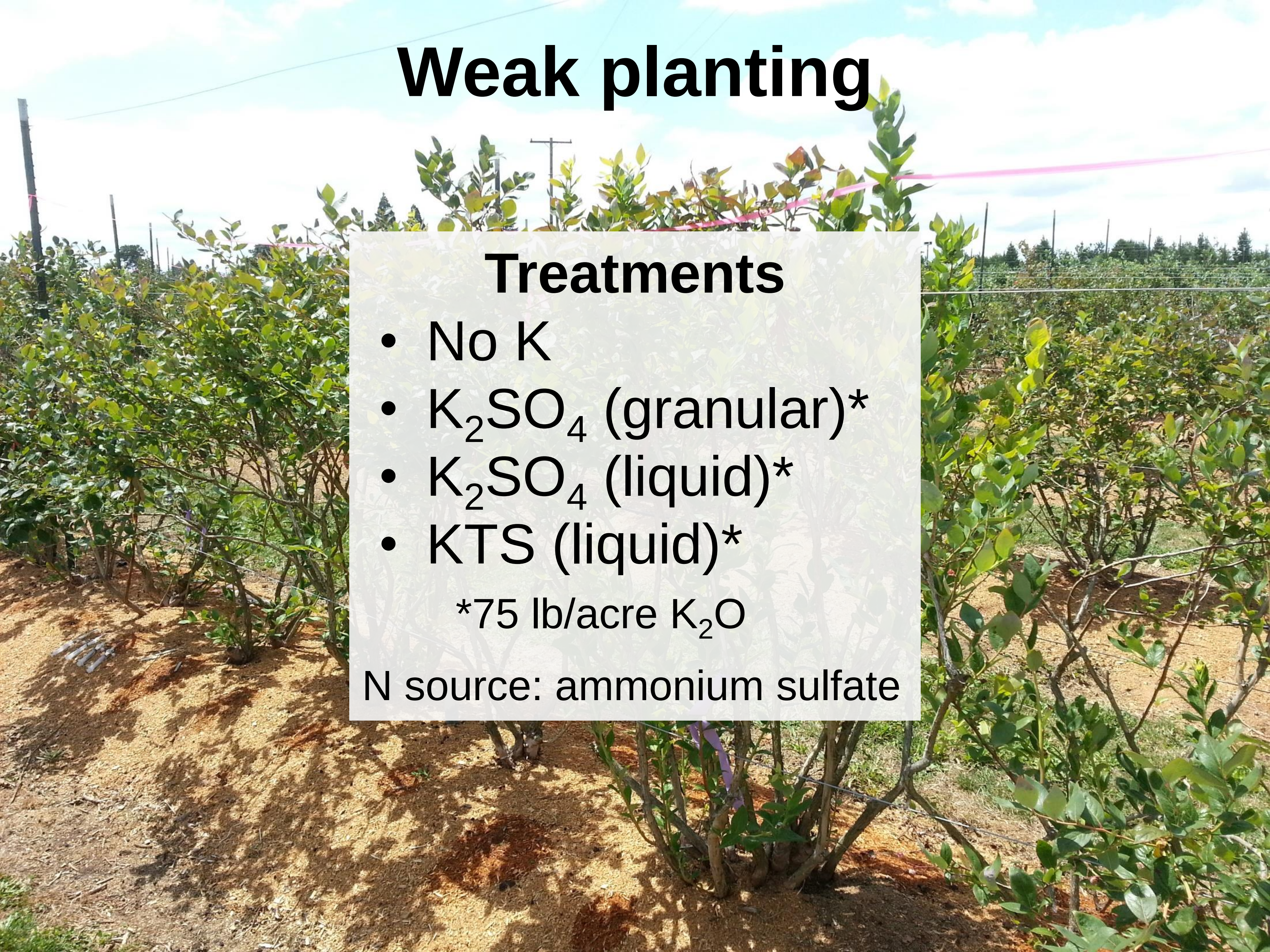


Weak planting

Soil conditions (Apr. 2016)

pH	5.7	Fair
SOM	3.1	Fair
K	0.39	Low*
Ca	9.4	Med. high
Mg	5.6	High

Weak planting



Treatments

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

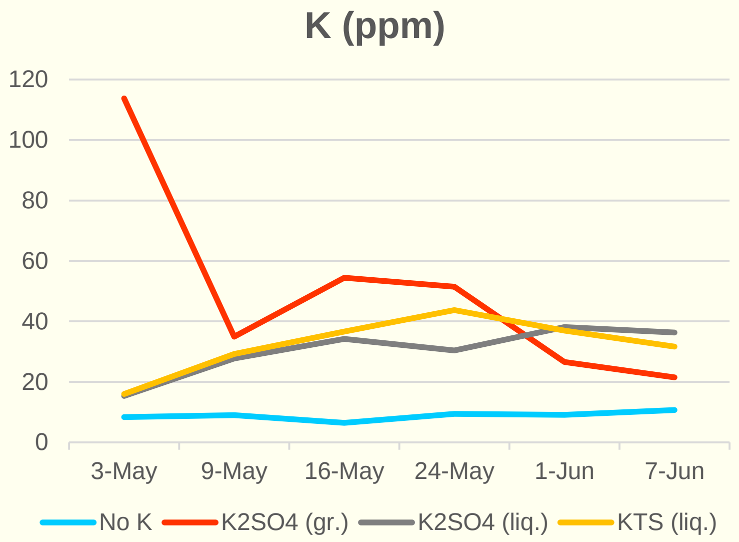
*75 lb/acre K_2O

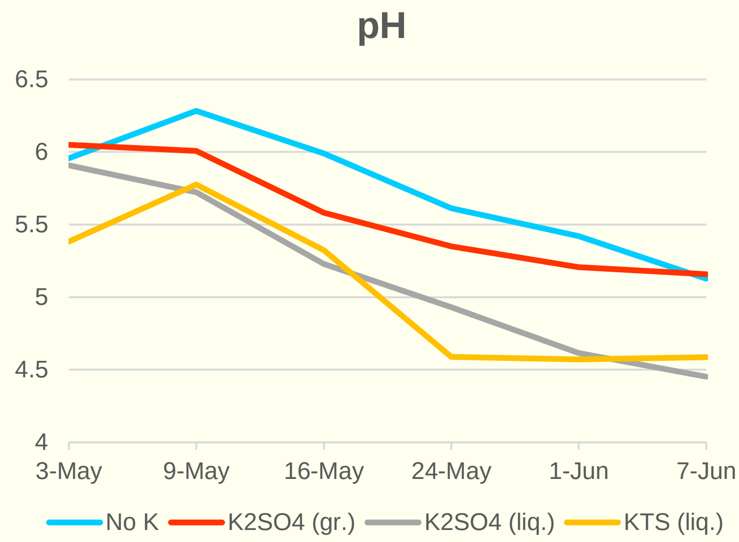
N source: ammonium sulfate

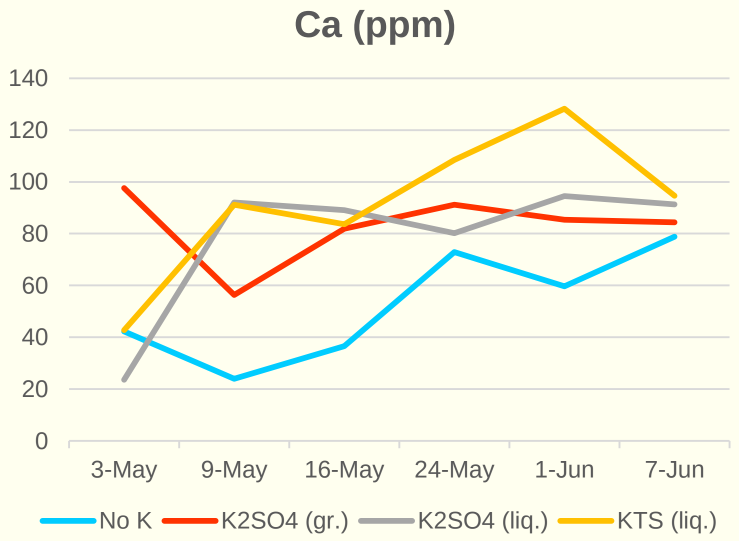

Drip irrigation
(covered w/mulch)
K_2SO_4
(banded)
Drip emitter
K_2SO_4 or KTS
(fertigation)

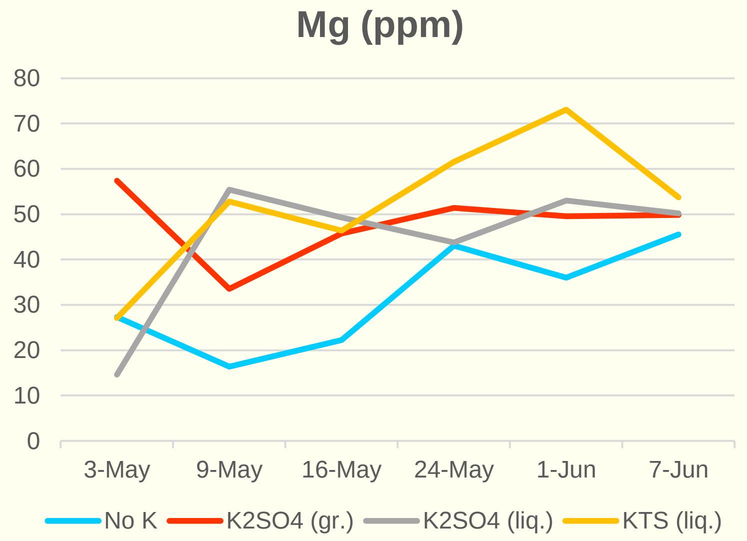

Soil solution sampler

Soil solution









Soil conditions (Oct. 2016)

Fertilizer	pH	NH_4-N (ppm)	NO_3-N (ppm)	------ meq/100g ------ K	Ca	Mg
*Initial**	*5.7*	*3.1*	*1.2*	*0.39*	*9.4*	*5.6*
No K	5.0	5.1	1.1	0.28	8.7	5.1
K_2SO_4 (gr.)	5.6	4.4	2.4	0.32	10.3	6.1
K_2SO_4 (liq.)	4.4	8.1	11.2	0.48	6.1	4.2
KTS (liq.)	4.6	17.2	9.1	0.51	6.7	4.4

*Measured Apr. 2016.

Leaf nutrients (Aug. 2016)

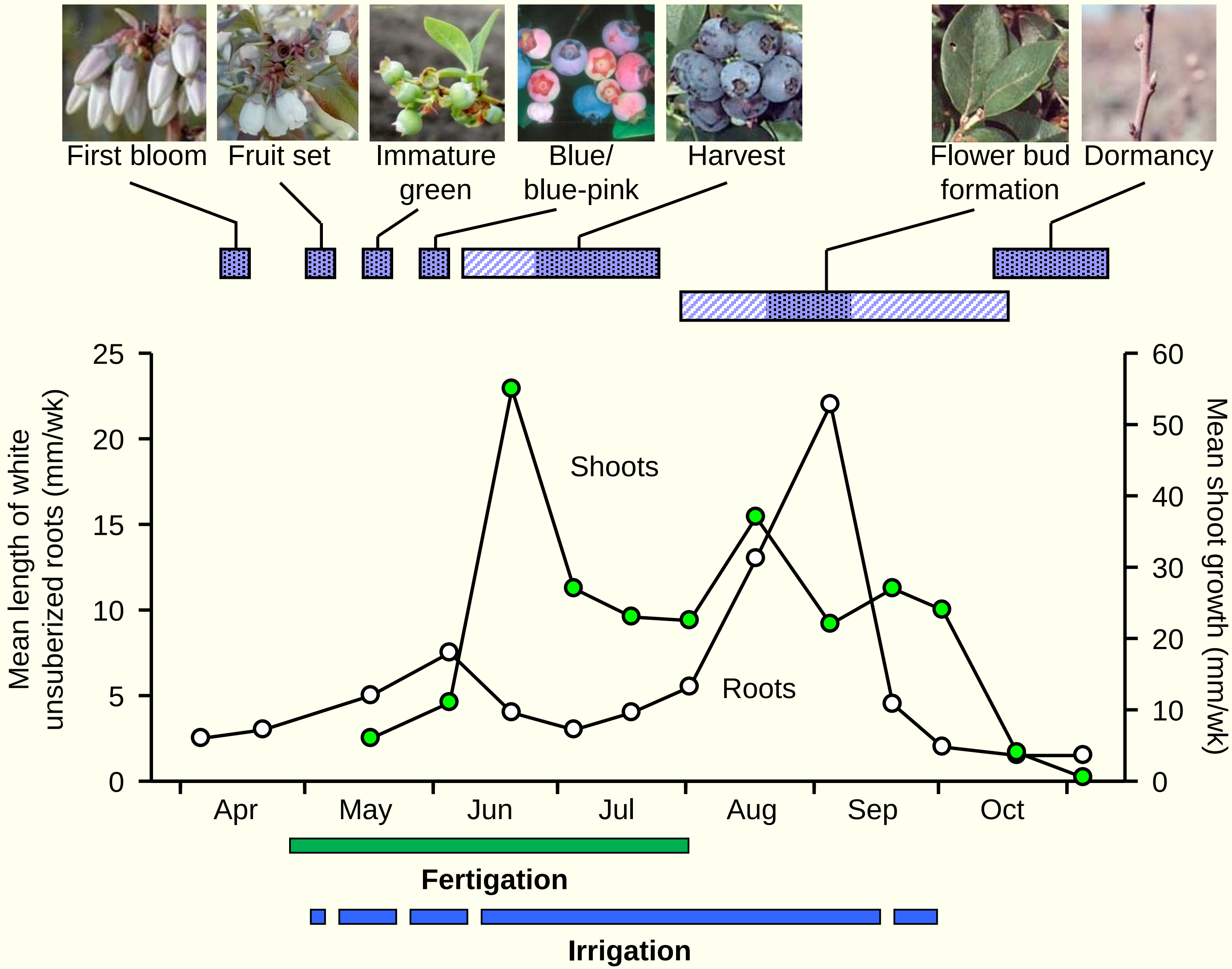
Fertilizer	N	K	Ca	Mg	S	Mn
	------------------------------		%	------------------------------		(ppm)
No K	1.28	0.57	0.47	0.17 b	0.14 b	99 b
K_2SO_4 (gr.)	1.37	0.60	0.53	0.20 ab	0.16 a	106 ab
K_2SO_4 (liq.)	1.36	0.57	0.53	0.20 ab	0.15 ab	133 a
KTS (liq.)	1.31	0.55	0.52	0.21 a	0.15 ab	117 ab
Signif.	NS	NS	NS	*	*	**

Yield & fruit quality (July 2016)

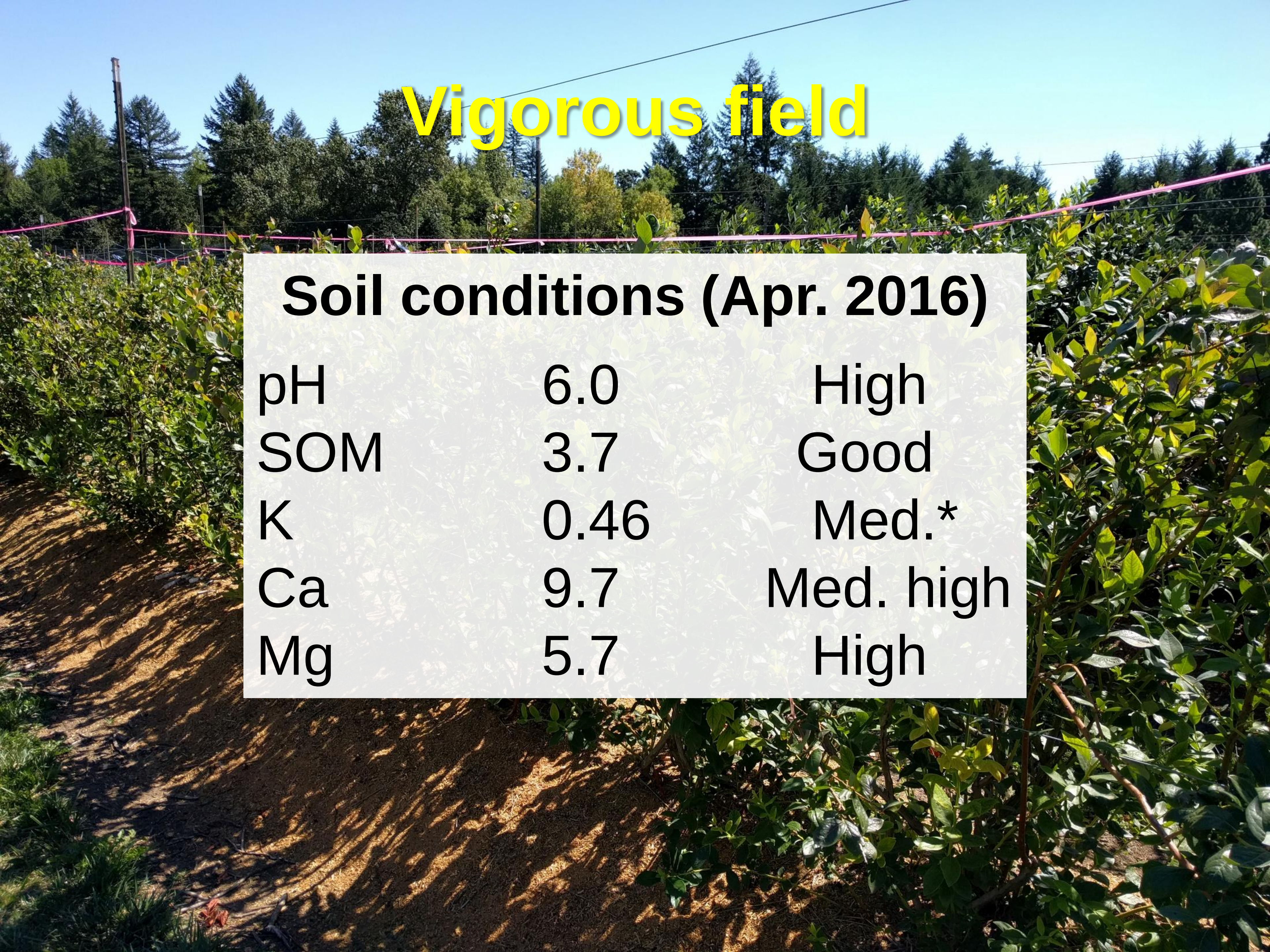
Fertilizer	Yield (kg)	Berry wt (g)	Brix	TA* (%)	Sugar: acid
No K	2.2	1.7	12.8	0.41	31
K_2SO_4 (gr.)	2.0	1.7	13.4	0.45	30
K_2SO_4 (liq.)	2.9	1.9	12.6	0.46	27
KTS (liq.)	2.2	1.7	13.4	0.42	32
Signif.	NS	NS	NS	NS	NS

*TA – titratable acidity

Timing of fertilizer applications

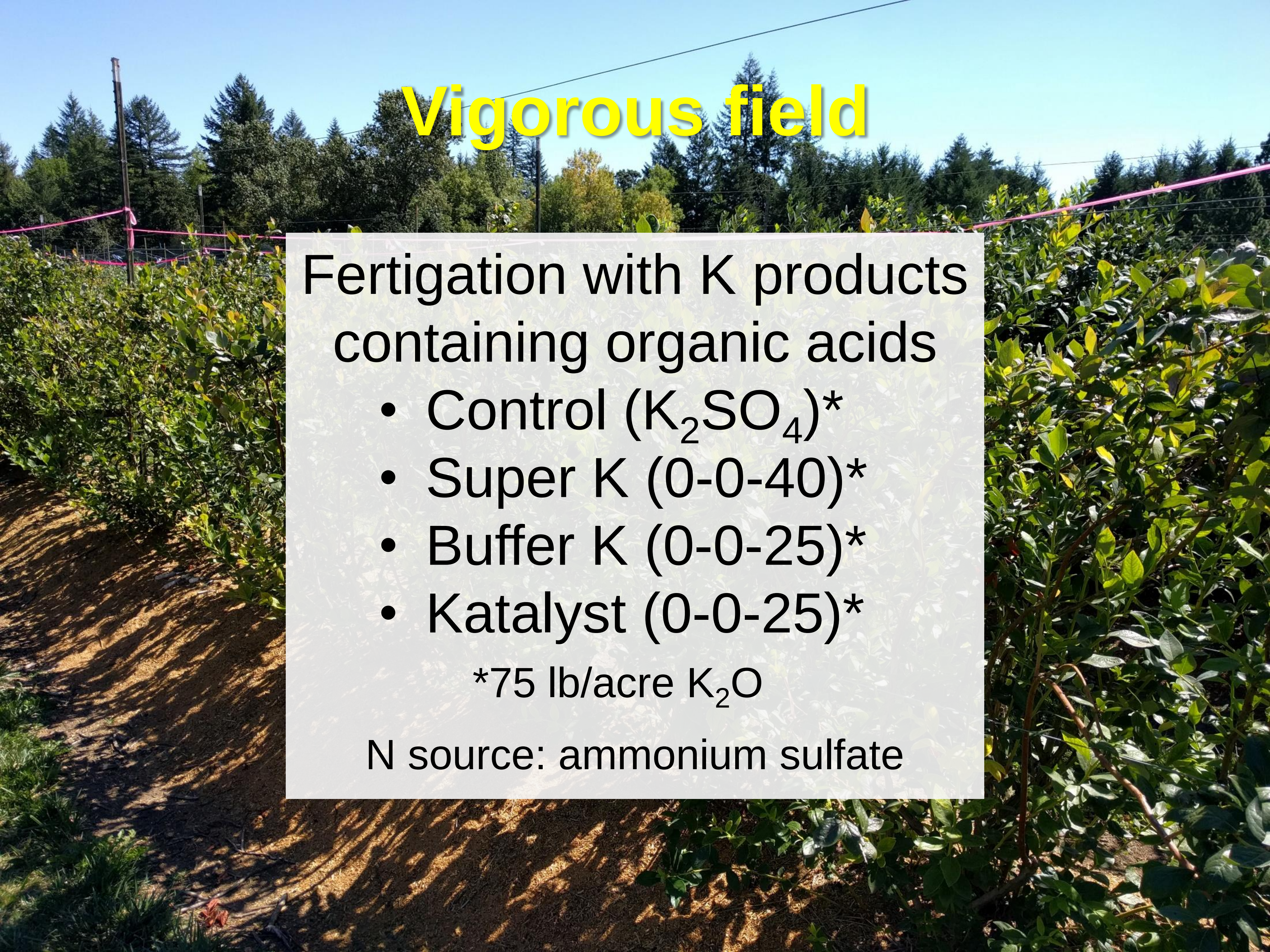


Vigorous field



Soil conditions (Apr. 2016)

pH	6.0	High
SOM	3.7	Good
K	0.46	Med.*
Ca	9.7	Med. high
Mg	5.7	High



Vigorous field

Fertigation with K products containing organic acids

- Control (K_2SO_4)*
- Super K (0-0-40)*
- Buffer K (0-0-25)*
- Katalyst (0-0-25)*

*75 lb/acre K_2O

N source: ammonium sulfate

Benefits of Organic Acids

Fertilizers

Fertilizers + organic acids

Soil conditions (Oct. 2016)

Fertilizer	pH	NH_4-N (ppm)	NO_3-N (ppm)	------ meq/100g ------ K	Ca	Mg
*Initial**	*6.0*	*3.3*	*0.9*	*0.46*	*9.7*	*5.7*
K_2SO_4	5.4	2.8	1.4	0.46	9.9	5.8
Super K	6.0	3.3	0.8	0.51	10.8	6.1
Buffer K	5.7	4.3	0.8	0.56	11.1	5.8
Katalyst	5.3	4.8	4.4	0.52	9.2	5.3

*Measured Apr. 2016.

Leaf nutrients (Aug. 2016)

Fertilizer	N	K	Ca	Mg	Mn (ppm)
	------------------------	%	------------------------		
K_2SO_4	1.52	0.50	0.79 b	0.27 ab	143 b
Super K	1.52	0.50	0.94 a	0.29 a	141 b
Buffer K	1.55	0.51	0.90 a	0.26 ab	146 b
Katalyst	1.58	0.51	0.69 c	0.25 b	177 a
Signif.	NS	NS	**	*	**

Yield & fruit quality (July 2016)

Fertilizer	Yield (kg)	Berry wt (g)	Brix	TA* (%)	Sugar: acid
K_2SO_4	3.5	1.8	12.7	0.43	29 b
Super K	3.5	1.9	12.1	0.40	30 ab
Buffer K	4.2	1.9	12.3	0.36	34 a
Katalyst	4.4	1.9	12.0	0.36	33 ab
Signif.	NS	NS	NS	NS	*

*TA – titratable acidity

Early Conclusions *(Year 2)*

- Fertigation with each K source increased soil K … but none had any effect on leaf K
- Liquid K_2SO_4 & KTS reduced soil pH
- Two K sources with organic acids increased leaf Ca … impact on fruit quality?

Thank you

Technical Support

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- OSU undergraduates

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