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Horticulture Update: Three years of blueberry research

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Research Projects

Fertilization	Ethephon	Pruning
• P and K • Sap analysis • Ca and B in fruit, fruit quality	• Rate • Timing*Rate	• Pruning techniques and timing

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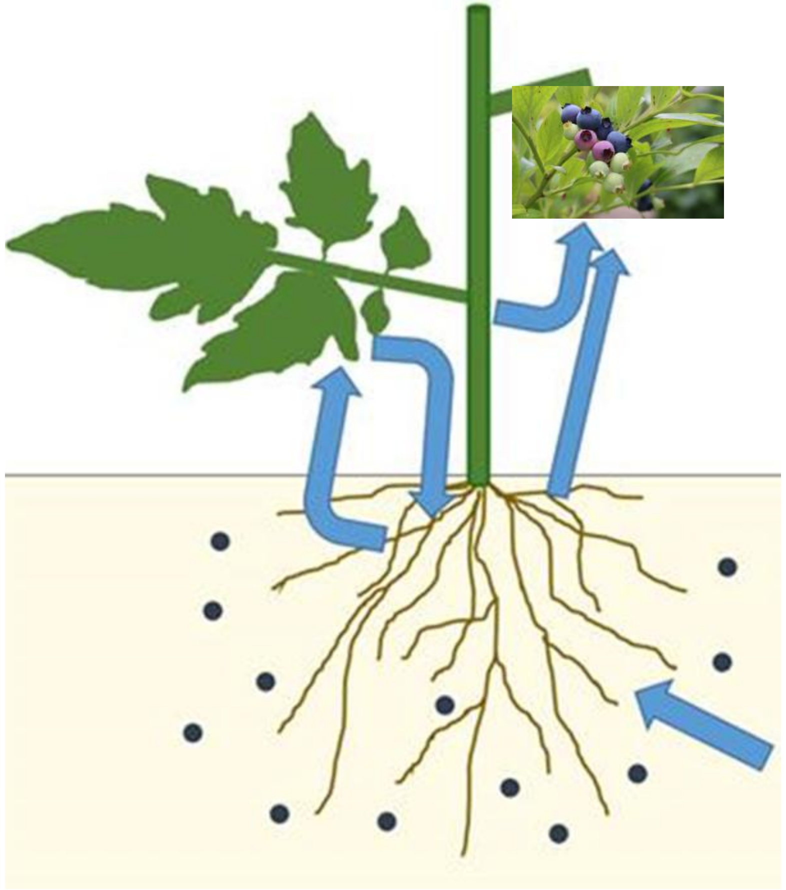
Fertilization – Sufficient Levels

Krewer and NeSmith, 1999

Sufficient or normal foliar concentrations of nutrients for rabbiteye

Nutrient	Georgia (%)	Michigan (%)
N	1.20 -1.70	1.70 - 2.10
P	0.08 - 0.17	0.08 - 0.40
K	0.28 - 0.60	0.40 - 0.65

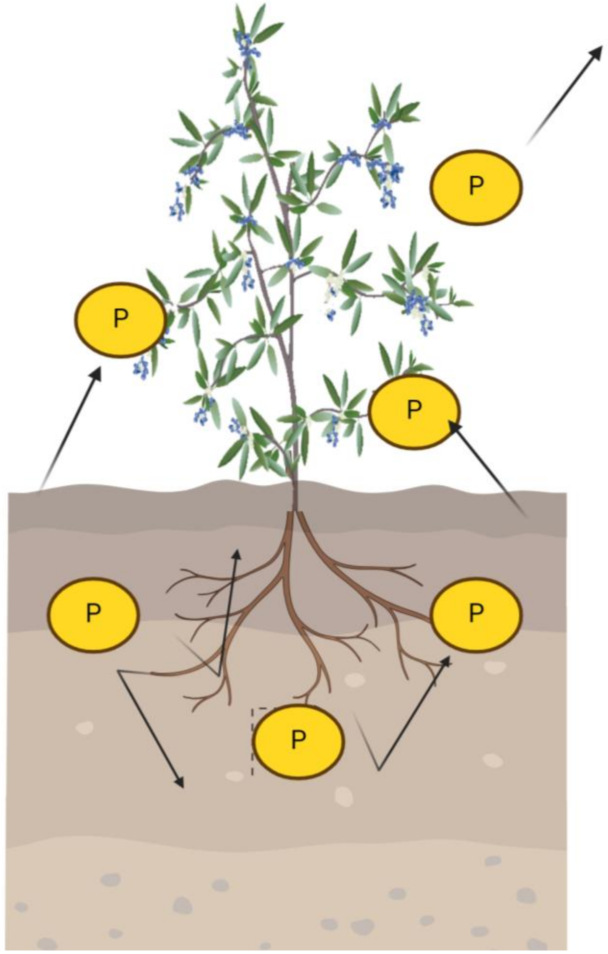


How much is recommended for P and K?

- Annual fertilization of 50 lb/ acre of P and K
- Soil for blueberry needs 70 to 120 lb/acre of K
- Soils above 61 lb/ acre no P apply

PK Fertilization

- What is already in the soil?
- When does the plant need it?
- Nutrient uptake
- Nutrient mobility in the plant and the soil
- How much nutrient is needed?



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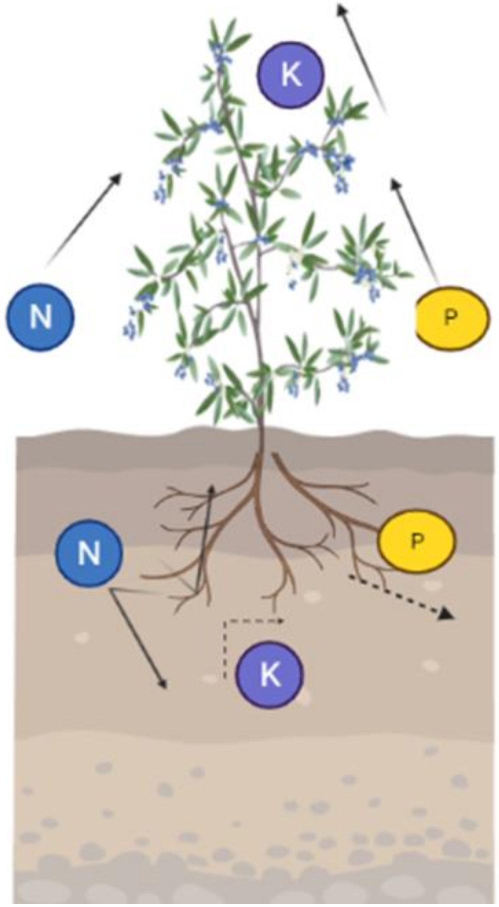
Nutrient Mobility

- **Phosphorus** is **mobile** in **the plant** but has low mobility in the soil. *Deficient plants are stunted and often dark green, and leaves may have a red tinge due to the accumulation of anthocyanins.*
- **Potassium is mobile** in the **plant, low to medium mobility** in the soil. *Deficient plants have older leaves with necrotic lesions*



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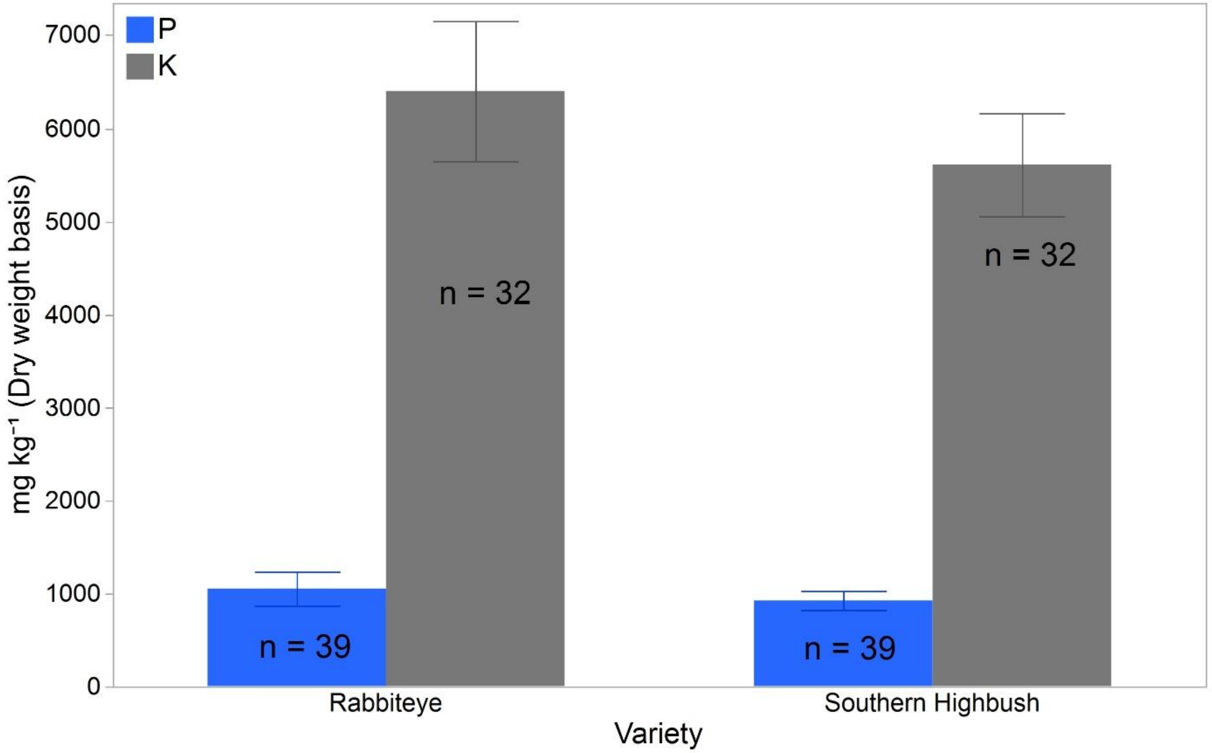
Fruit: Phosphorus and Potassium



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Experimental Design

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Experimental plots were established on four commercial farms with different nutrient management during the 2022 growing season.

Experimental Sites	Farm 1: Nahunta – RE – P	Farm 2: Alma – RE – V	Farm 3: Alma – SHB – F	Farm 4: Hoboken – SHB – F
Location	Nahunta	Alma	Alma	Hoboken
Variety	Premier	Vernon	Farthing	Farthing
Year of establishment	2009	2013	2018	2014
P fertilization (g/plant per year)	33.8	16.5	15.5	27.1
Reported Yield (kg/ha)	3,970	9,073	9,640	13,608

Location

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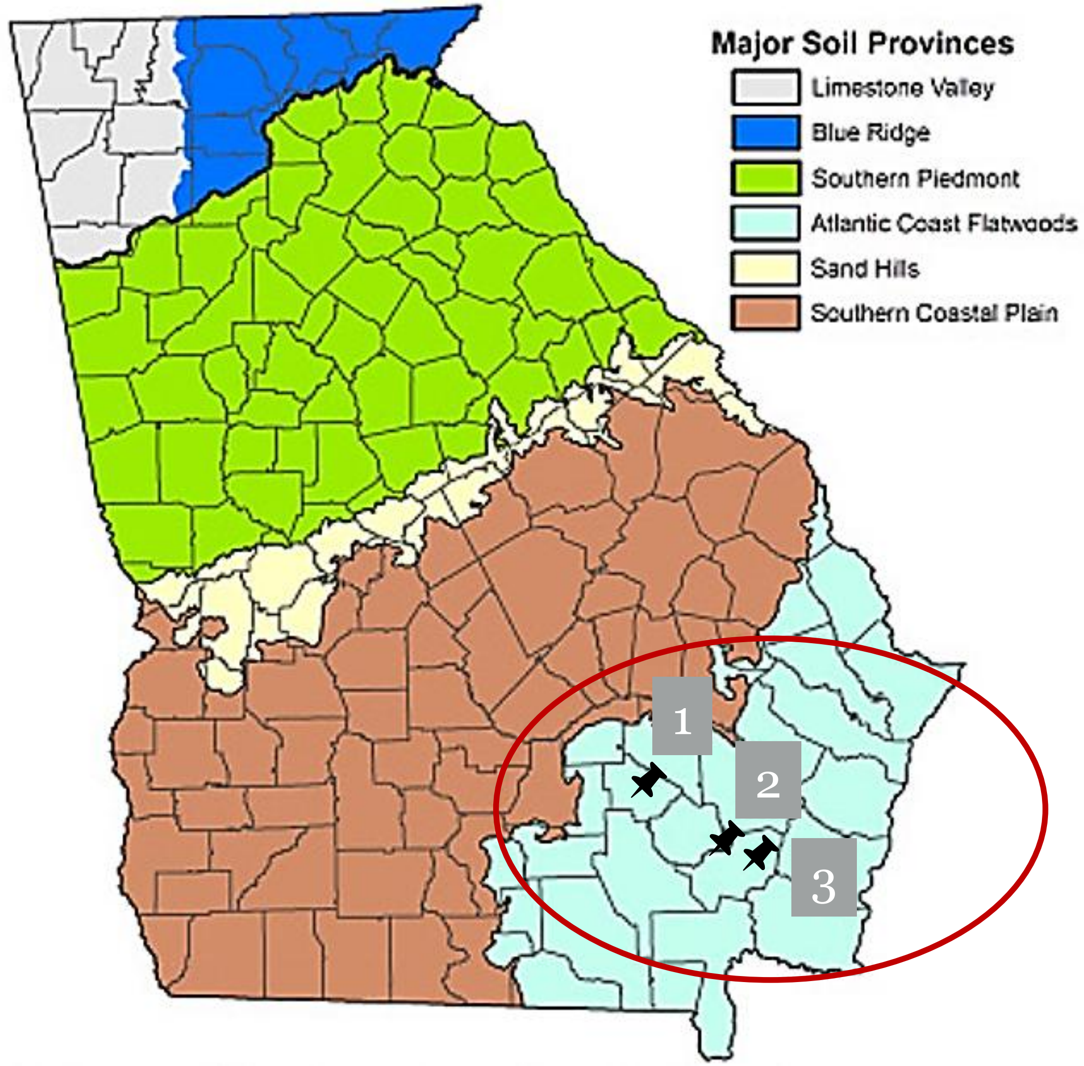
Soil Textures (NRCS, 2023)

1) Alma: sandy
2) Hoboken: fine sand
3) Nahunta: loamy fine sand



Six Soil Provinces in Georgia. Hancock et al. 2014.

Plant Material Information

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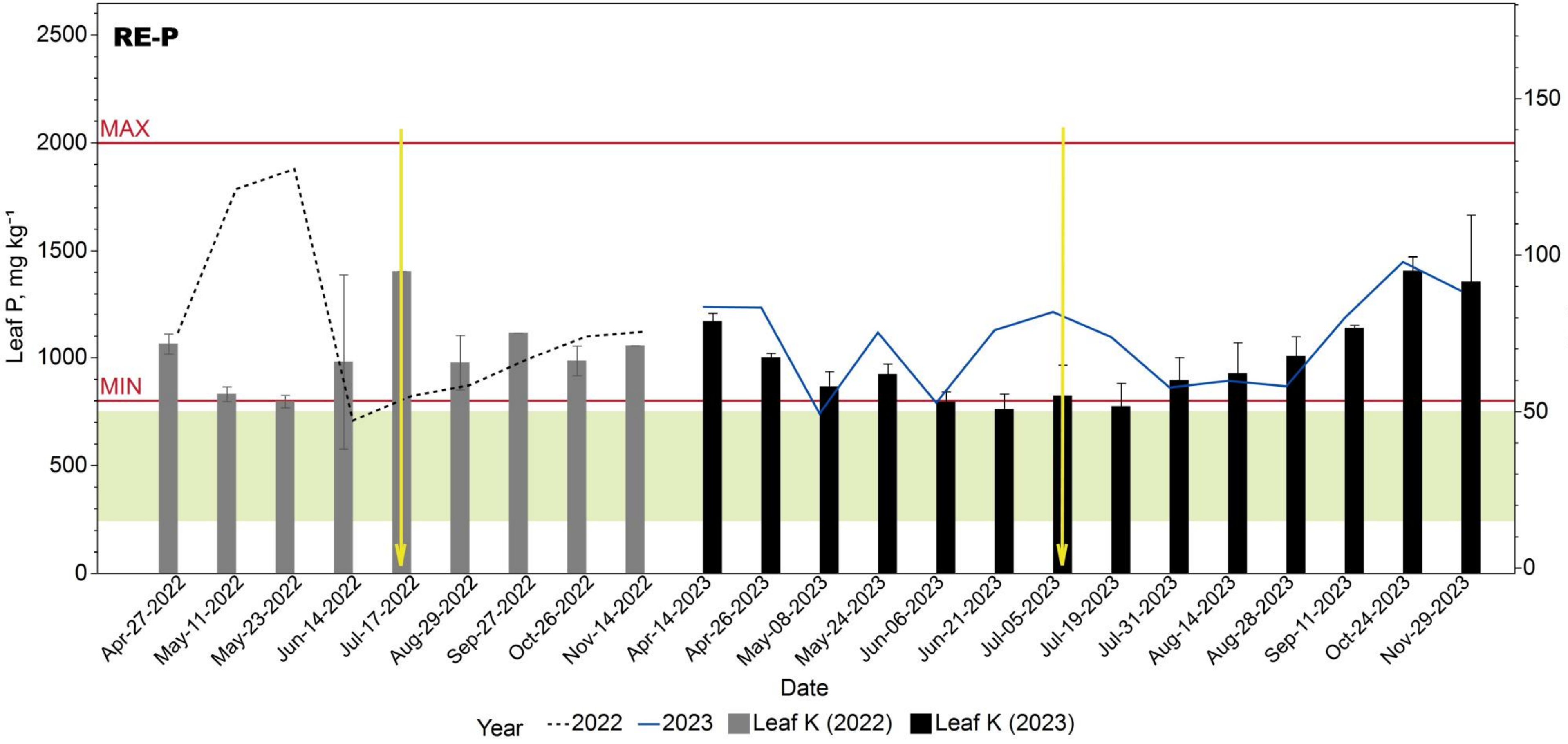
- Samples from old and young leaves were collected from May to July, in two-week intervals.
- Soil samples were also collected and divided into two depths, 0–10 cm, and 10–20 cm.
- Samples were sent to the Agricultural & Environmental Service Lab from UGA.

Phosphorus concentration in soil and leaf



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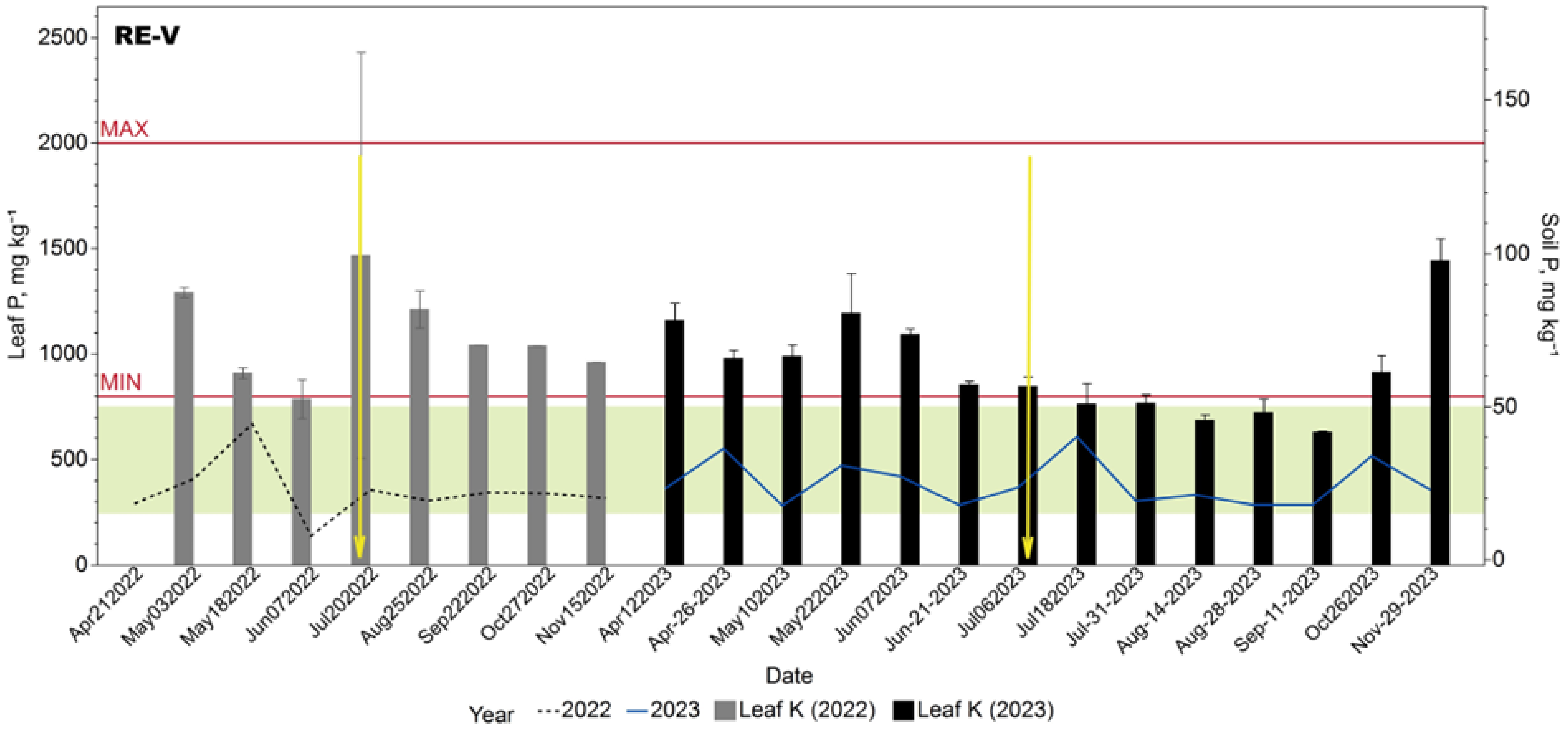
Phosphorus concentration in soil and leaf



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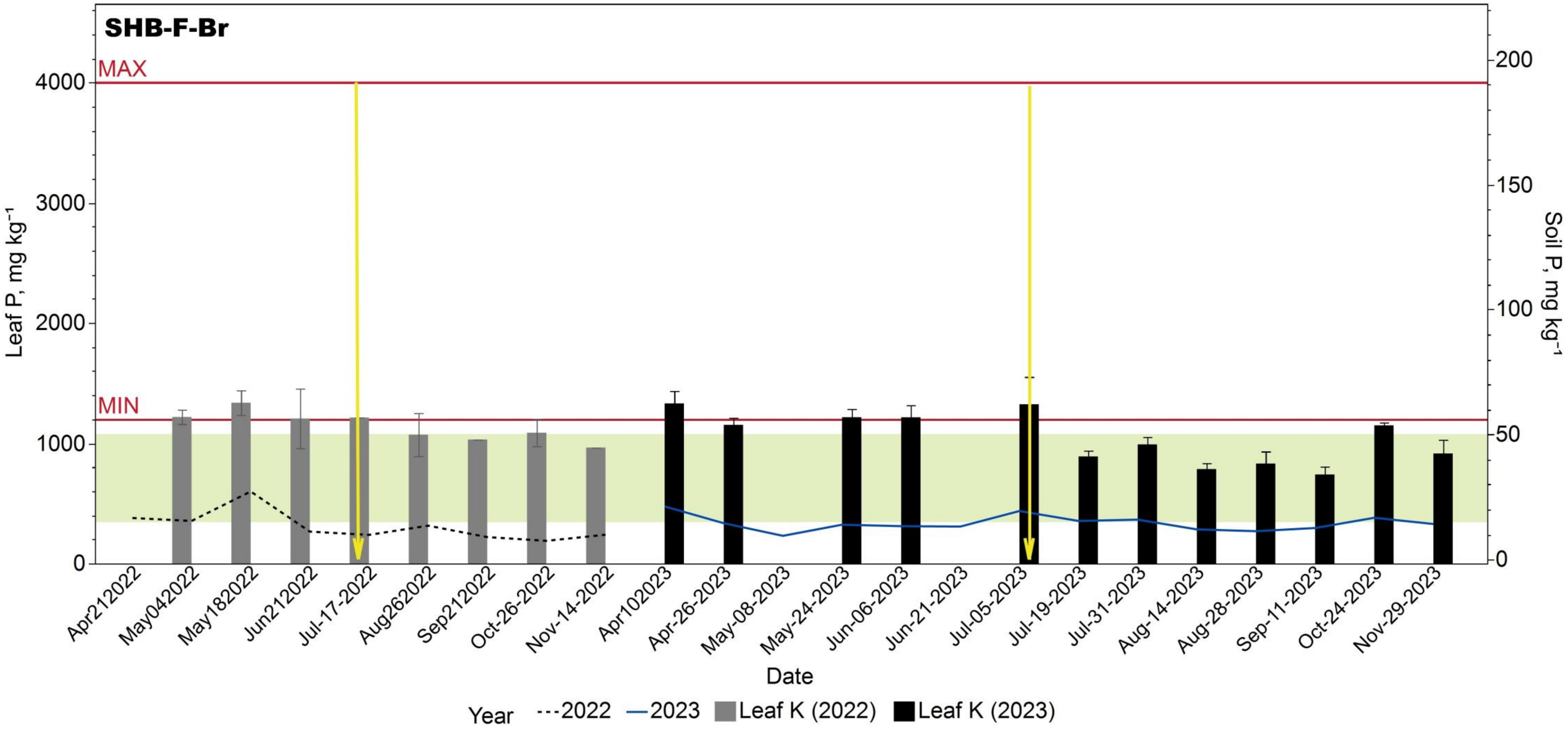
Phosphorus concentration in soil and leaf



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Leaf P interaction with Soil P

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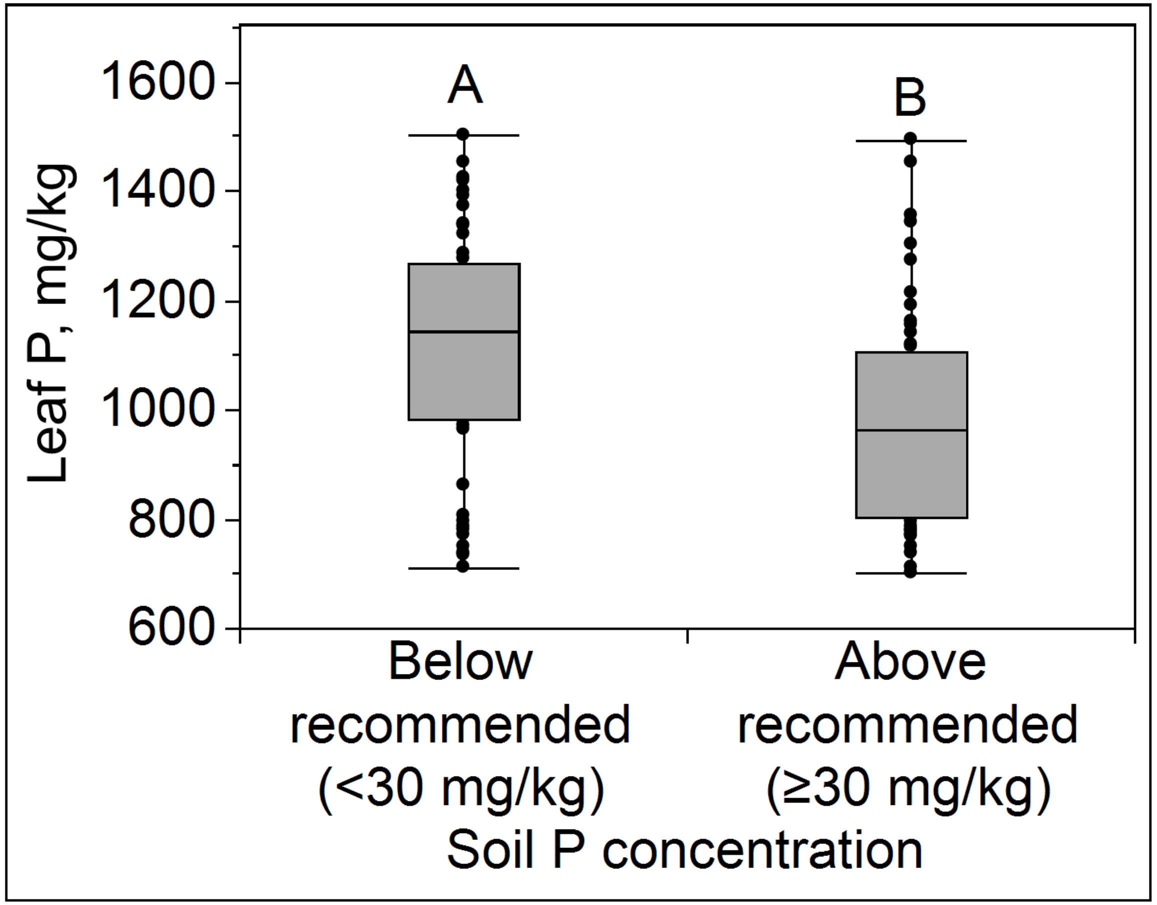
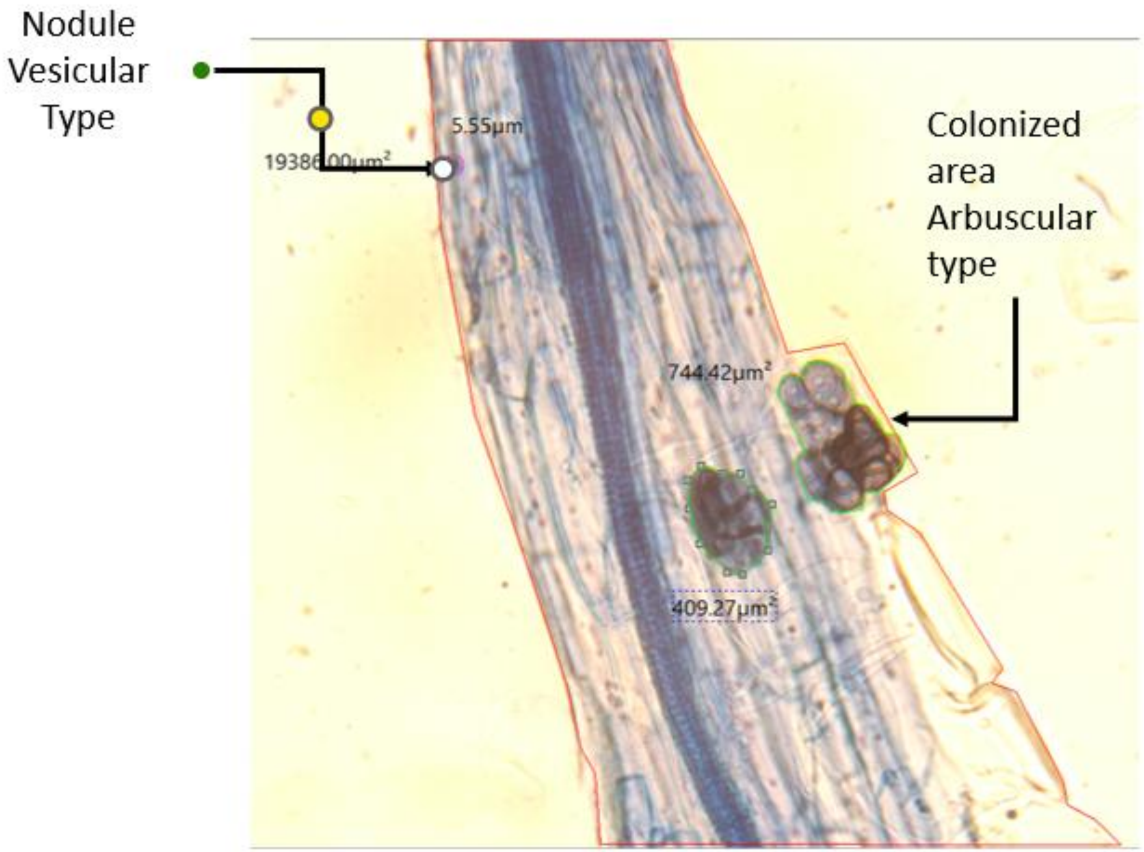
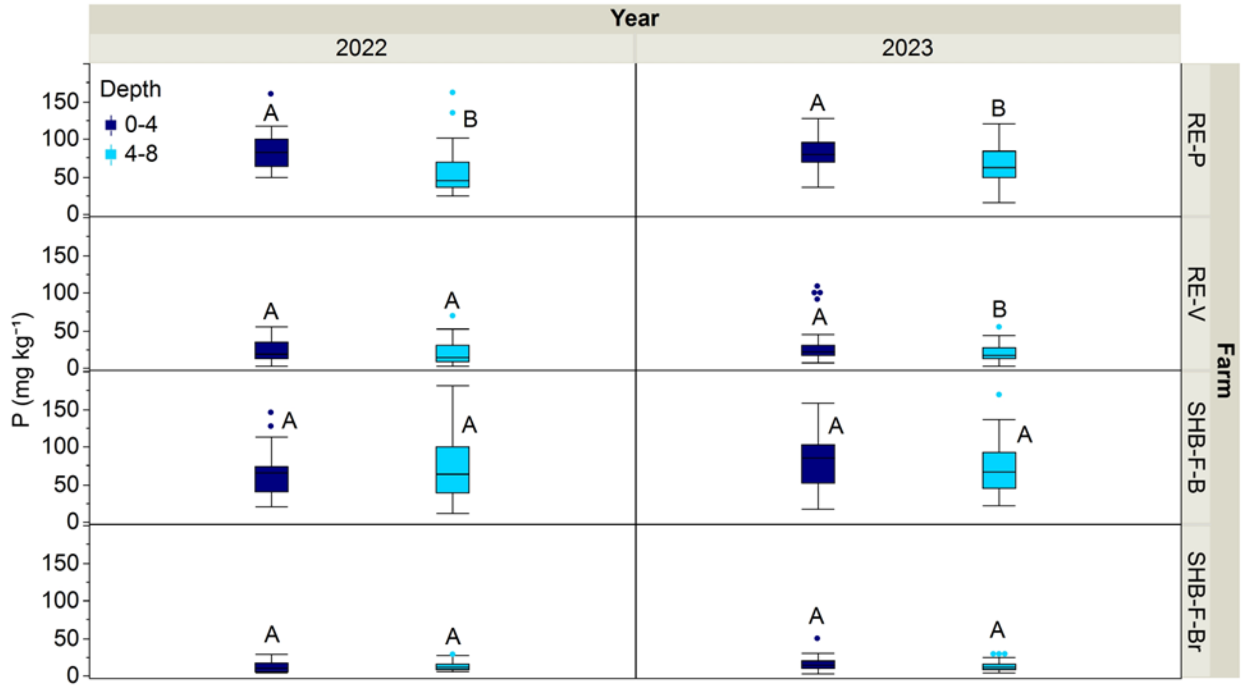
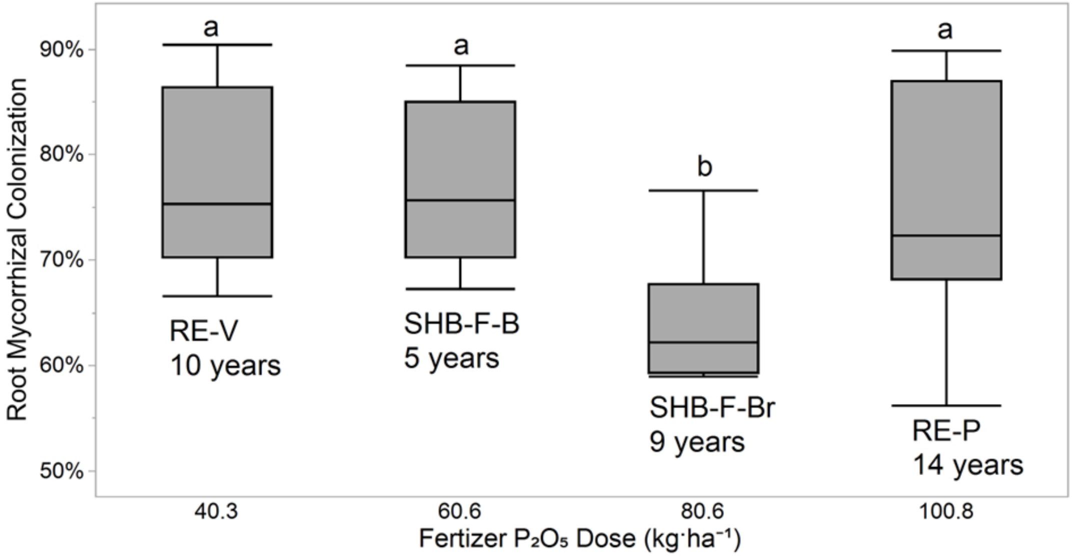


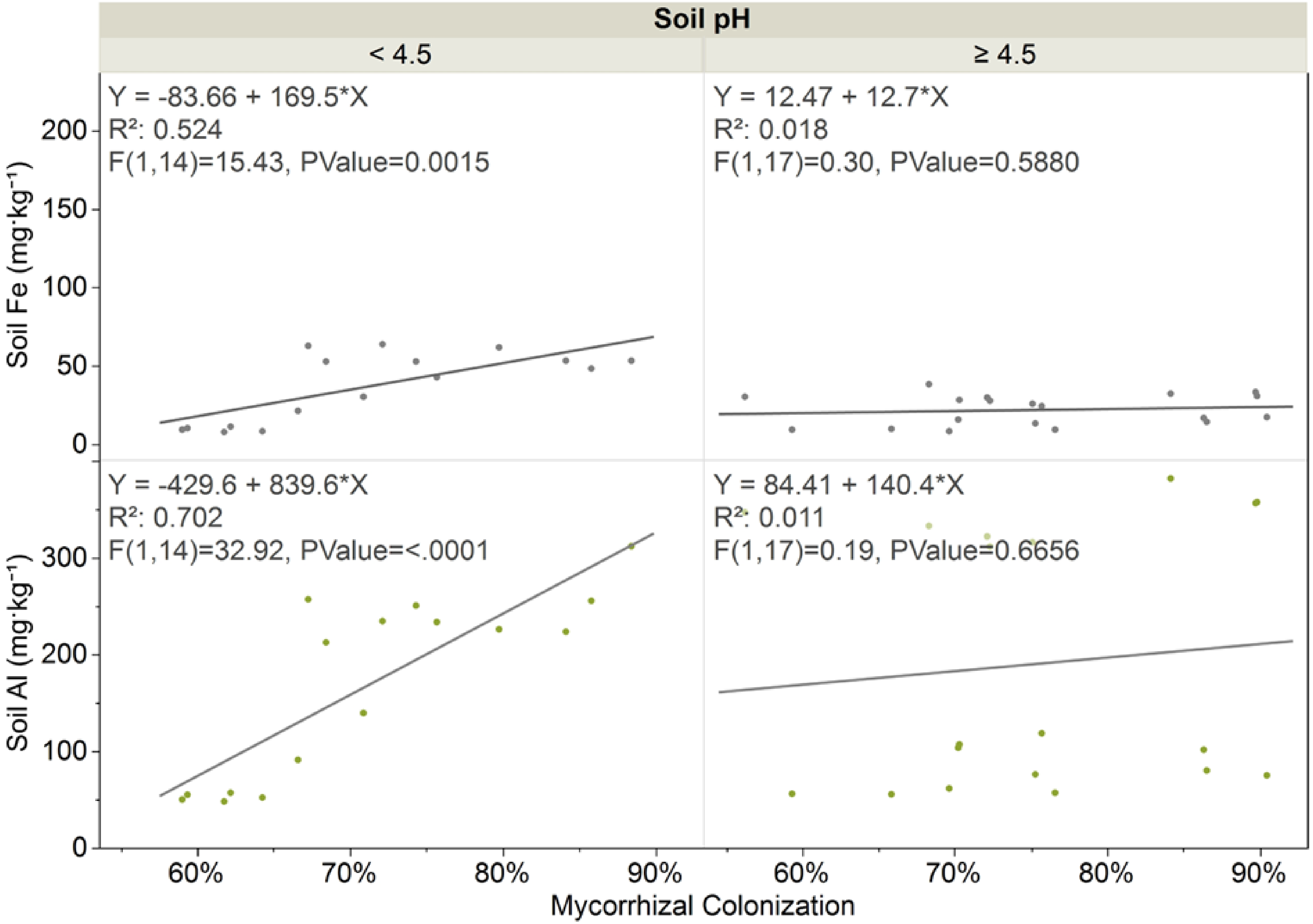


Soil Phosphorus and mycorrhizal colonization





Mycorrhiza relationship with Al and Fe



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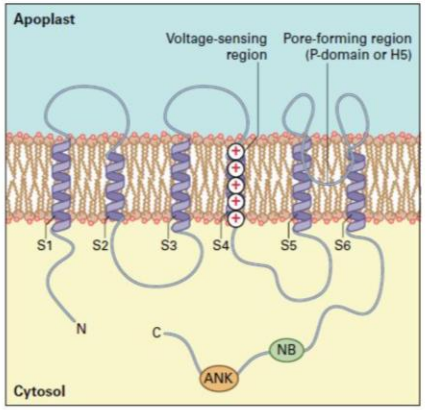
Potassium

- K constituted 10% of plant dry matter
- K maintains electric potential gradients, activates enzymes, and regulates osmotic potential
- K maintains leaf relative water content and stomatal conductance, influencing freeze tolerance, gas exchange, and evaporative cooling
- Plants absorb K^+ from soil solution through K channels located in the plasma membranes of cortical and epidermal root cells



Britto et al. 2021; Buchanan et al. 2015; Chérel et al. 2014; Epstein and Bloom 2004; Marschner 2011, Hasanuzzaman et al. 2018; Lotfi et al. 2022; Tinker et al.,2000;Wang et al. 2013

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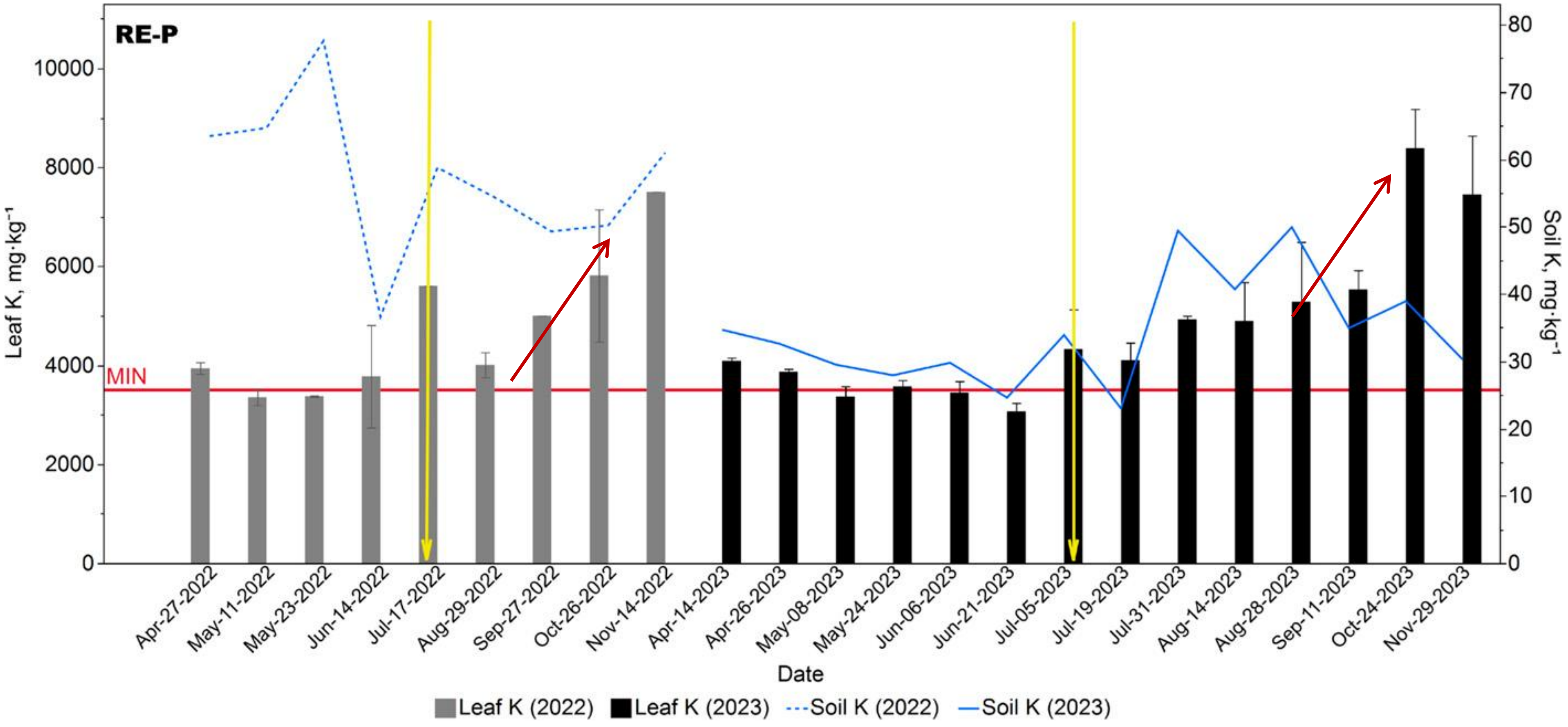
Location	Nahunta	Alma	Alma	Hoboken
Variety	Premier	Vernon	Farthing	Farthing
Year of establishment	2009	2013	2018	2014
K fertilization year	100.8 kg/ha K2O	40.3 kg/ha K2O	60.6 kg/ha K2O	94.1kg/ha K2O
Reported Yield (kg/ha)	3,970	9,073	9,640	13,608

Potassium

Graph published in HortScience
Espinoza et al., 2024



Leaf and soil K concentrations from Apr to Nov 2022 and 2023 in RE blueberry commercial fields of ‘Premier’ (RE-P). Bars show the mean of three replicates, and error bars indicate the standard deviation. The red lines represent the minimum leaf K level (3500 mg·kg1) recommended for blueberries in Georgia by Plank and Kissel (2024a, 2024b). Yellow lines indicate the date, 2 weeks after the end of harvest, which was used to compare with the sufficiency levels.

Potassium

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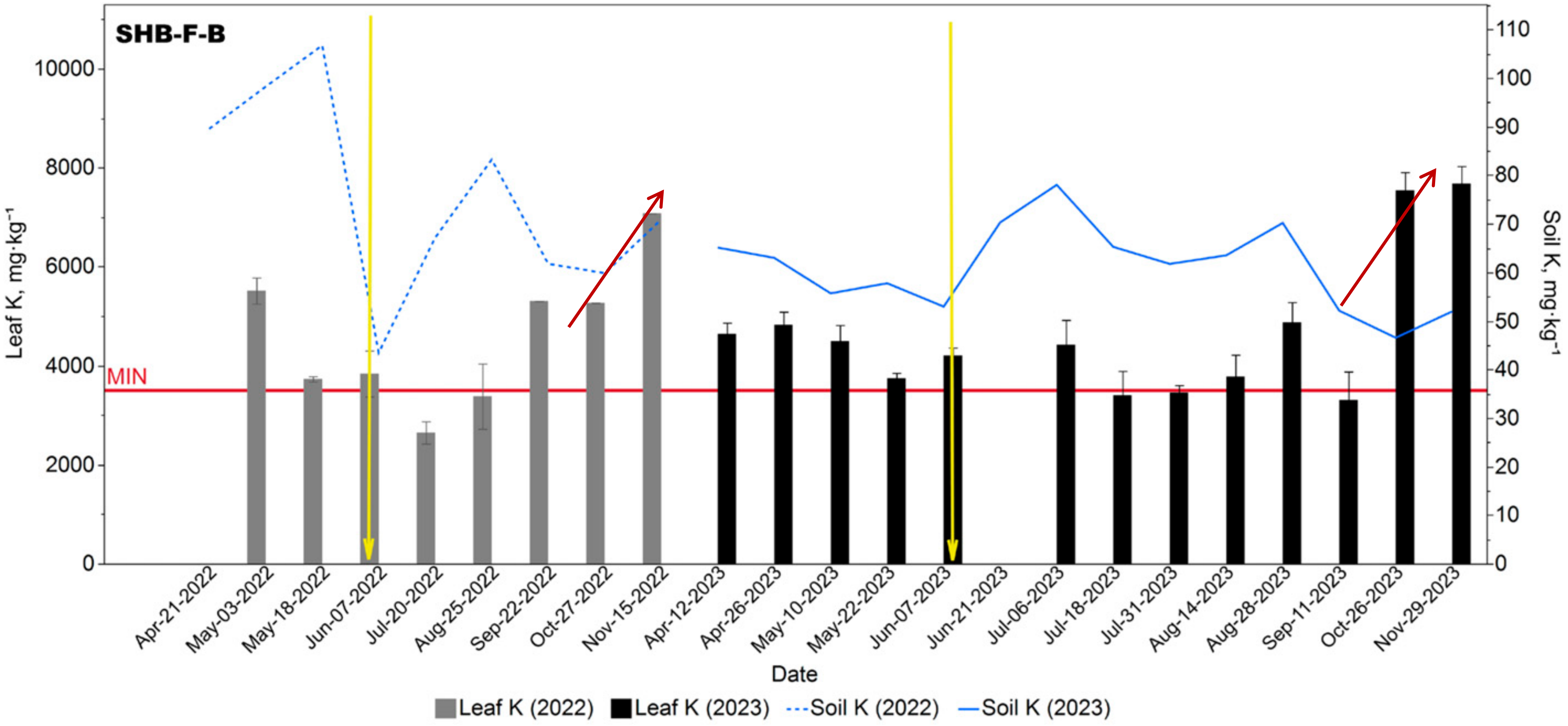
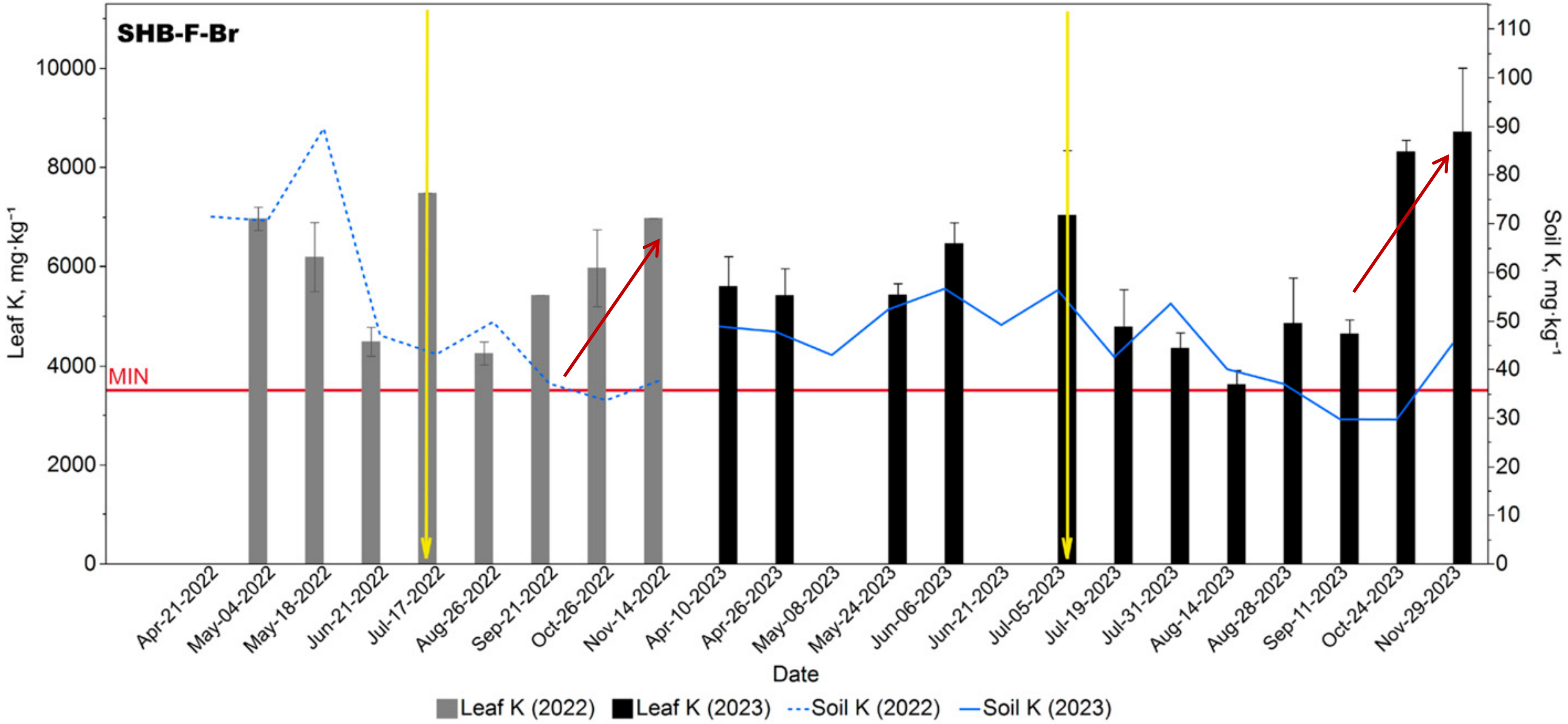
Espinoza et al., 2024



Leaf and soil K concentrations from Apr to Nov 2022 and 2023 in SHB 'Farthing' (SHB-P-B). Bars show the mean of three replicates, and error bars indicate the standard deviation. The red lines represent the minimum leaf K level (3500 mg·kg1) recommended for blueberries in Georgia by Plank and Kissel (2024a, 2024b). Yellow lines indicate the date, 2 weeks after the end of harvest, which was used to compare with the sufficiency levels.

Potassium

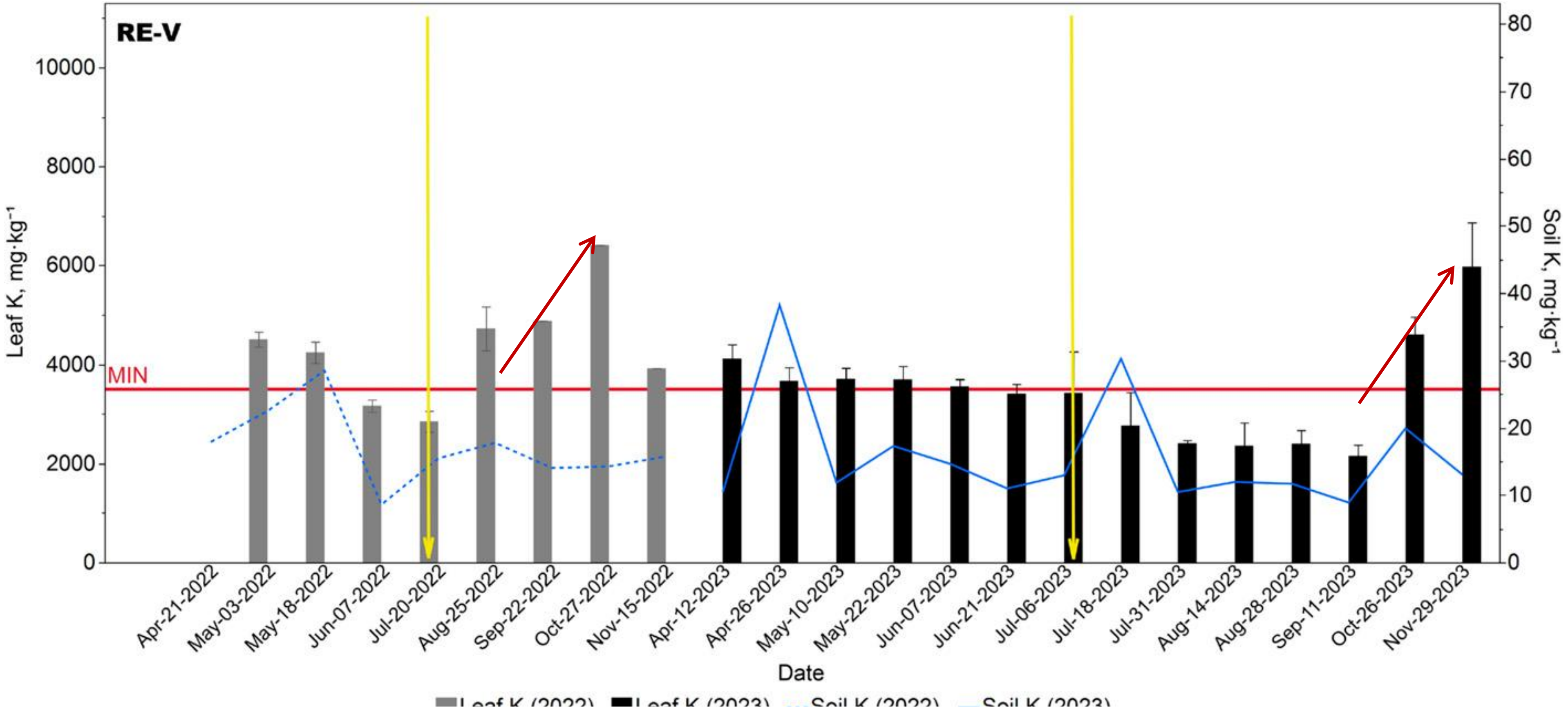
Graph published in HortScience
Espinoza et al., 2024



Leaf and soil K concentrations from Apr to Nov 2022 and 2023 SHB 'Farthing' (SHB-P-Br). Bars show the mean of three replicates, and error bars indicate the standard deviation. The red lines represent the minimum leaf K level (3500 mg·kg1) recommended for blueberries in Georgia by Plank and Kissel (2024a, 2024b). Yellow lines indicate the date, 2 weeks after the end of harvest, which was used to compare with the sufficiency levels.

Potassium

Graph published in HortScience
Espinoza et al., 2024



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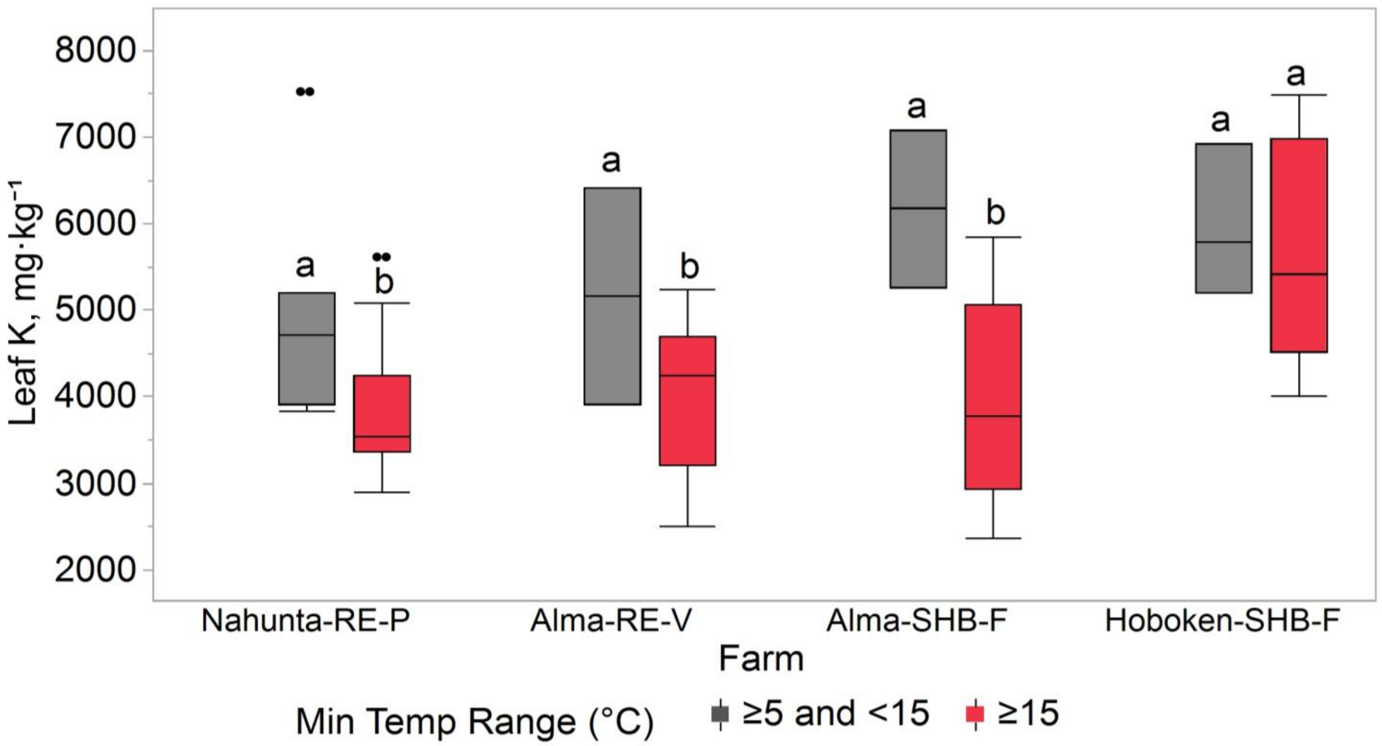
Leaf and soil K concentrations from Apr to Nov 2022 and 2023 in RE 'Vernon' (RE-V). Bars show the mean of three replicates, and error bars indicate the standard deviation. The red lines represent the minimum leaf K level (3500 mg·kg1) recommended for blueberries in Georgia by Plank and Kissel (2024a, 2024b). Yellow lines indicate the date, 2 weeks after the end of harvest, which was used to compare with the sufficiency levels.

Potassium

Graph published in HortScience
Espinoza et al., 2024



Average leaf K concentration. Boxplots were categorized by the minimum temperature range the plant experienced on each sampling date. Letters mark the levels of significance between the minimum temperature range for each farm ($p<0.05$ Wilcoxon Test each pair).

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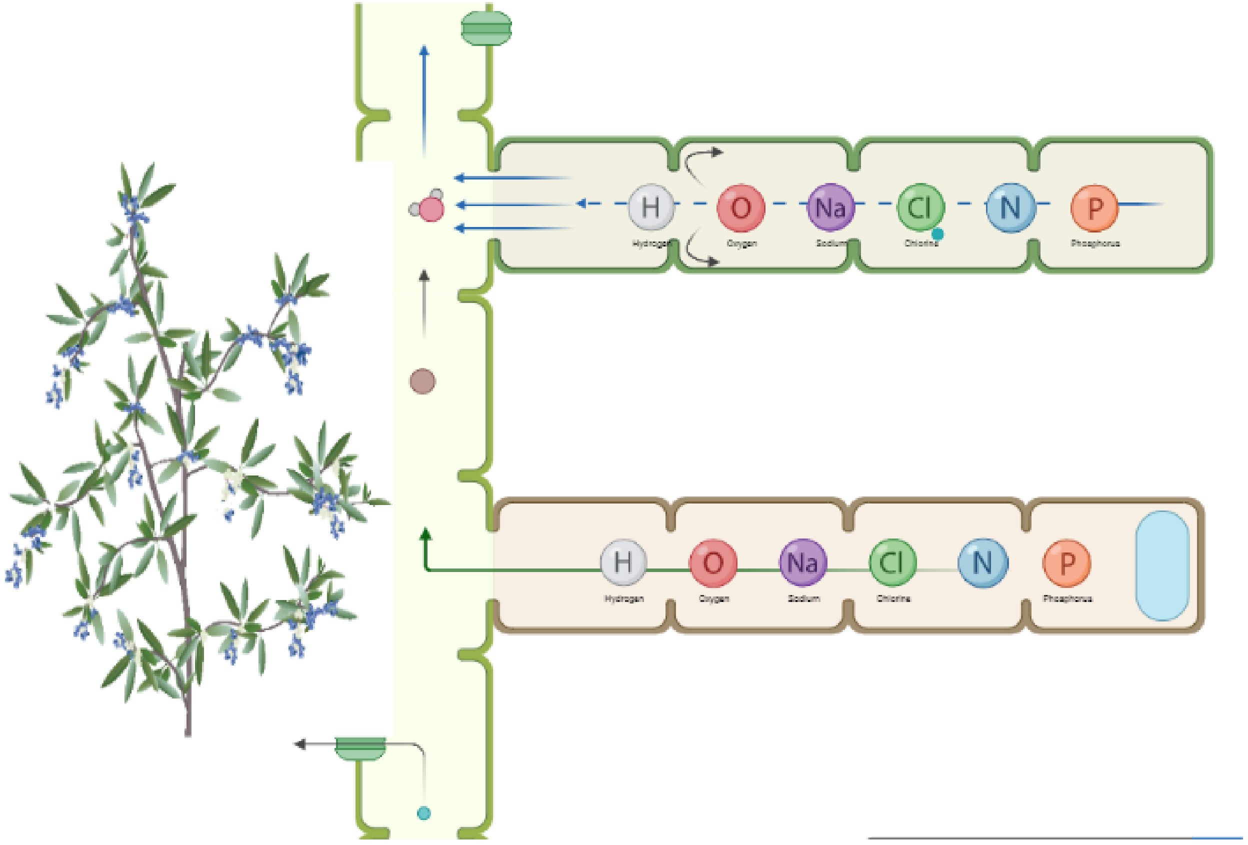
Conclusion

- Soil P content did not match the leaf P content, in fact, doses of soil P above the recommended level may result in lower P in leaves
- Higher doses of P fertilizer do not guarantee higher production
- Increasing doses of K fertilization are not translated into higher soil K concentrations nor are they a predictor for higher yields
- The K nutrient concentration of blueberry leaves was affected by seasonality and temperature

What is sap?

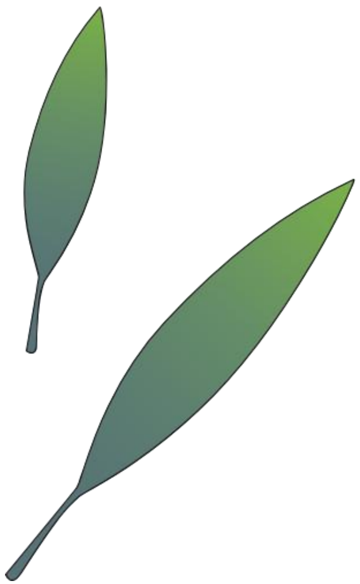
- Sap: the extractable liquid from the xylem and phloem (leaf or petiole), the fluid from conductive tissues.

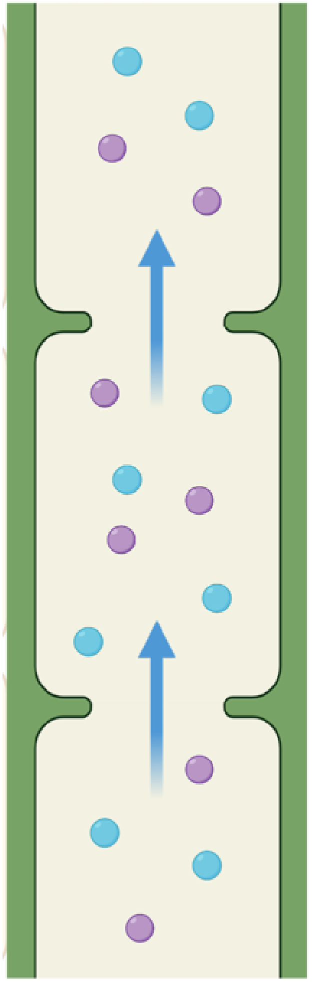


What is difference?

- Leaf tissue sample, measures the accumulation of each nutrient in the plant.

- Analysis of sap composition: NPK and micronutrients that are readily available.





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Objectives

- Identify the best methodology for tissue sample collection
- Identify similarities between sap, soil, and leaf tissue analysis
- Provide sap analysis as a service through the UGA laboratory

Blueberry field

Location:
Pierce
Bacon

Varieties:
'Brightwell'
'Farthing'

Sap nutrient content

Tissue Type (old or young)

Sample Type (leaf or petiole sap)

Time: 9:00 am
12:00 pm
3:00 pm

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RESULTS-BLUEBERRY

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Results- sampling time

Sap Nutrients (mg/L)	Highbush									Rabbiteye								
	9:00 AM			12:00 PM			3:00 PM			9:00 AM			12:00 PM			3:00 PM		
	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL
NO_3^-	50.7	36.7	a	56.3	51.5	a	37.4	35.5	a	26.6	16.1	b	**53.0**	**44.3**	**a**	43.4	39.8	ab
Al	9.0	4.3	a	11.1	6.1	a	9.7	4.7	a	12.6	5.4	a	12.2	5.9	a	12.0	5.5	a
B	6.3	4.1	a	4.8	2.8	a	5.1	3.6	a	**12.5**	**9.1**	**a**	5.4	3.6	b	6.0	3.8	ab
Ca	1049.9	379.5	a	909.4	320.8	a	814.5	239.4	a	**1569.3**	**634.4**	**a**	948.0	379.7	b	976.9	361.4	b
Cu	0.4	0.3	b	**0.7**	**0.3**	**a**	**0.7**	**0.3**	**a**	1.8	1.8	a	1.0	0.8	a	1.5	1.4	a
Fe	2.4	0.5	a	2.0	0.8	a	2.3	* 0.8	a	**4.8**	**2.7**	**a**	3.1	1.7	b	2.8	1.8	b
Mg	957.9	347.5	a	719.6	209.7	a	755.2	224.0	a	1114.7	358.4	a	892.0	300.6	a	903.7	321.1	a
Mn	23.3	13.4	a	19.5	10.5	a	17.7	9.0	a	**35.1**	**14.4**	**a**	25.8	12.5	b	22.8	12.4	b
Mo	**0.2**	**0.1**	**a**	0.1	0.0	b	0.1	0.0	b	0.2	0.1	a	0.2	0.1	a	0.2	0.1	a
Na	**17.1**	**10.4**	**a**	11.5	7.5	b	13.0	6.3	ab	**33.4**	**17.1**	**a**	22.1	13.7	b	22.8	14.3	ab
Ni	0.2	0.1	a	0.2	0.0	a	0.2	0.0	a	0.2	0.1	a	0.2	0.0	a	0.3	0.1	a
P *	207.2	40.7	a	195.4	44.8	a	178.9	42.2	a	**231.8**	**76.9**	**a**	202.0	51.5	b	176.3	35.6	b
K *	2322.6	514.9	a	2186.1	299.1	a	2124.5	326.7	a	**2425.2**	**711.0**	**a**	1965.1	361.3	b	1921.6	272.5	b
S *	246.5	73.5	a	238.2	72.3	a	246.8	73.2	a	**599.7**	**339.3**	**a**	345.2	184.6	b	339.9	188.8	b
Zn	6.6	1.8	b	**7.8**	**1.4**	**a**	**7.3**	**1.6**	**a**	8.2	2.7	a	8.1	2.7	a	8.3	2.2	a

SL: Significant Level. on the SD cell showed a significant difference between sampling times. Wilcoxon each pair analysis ($p<0.05$).
MAD: Median Absolute Deviation

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Results- sampling time

Sampling time does not have a big impact on the sap nutrient concentration

Petiole Nutrient mg/L	Highbush									Rabbiteye								
	9:00 AM			12:00 PM			3:00 PM			9:00 AM			12:00 PM			3:00 PM		
	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL	Median	MAD	SL
NO_3^-	17.9	9.7	a	11.3	5.8	a	13.5	12.8	a	20.0	10.8	a	14.9	14.4	a	16.4	15.9	a
Al	5.0	0.0	b	5.0	0.0	ab	**5.0**	**0.0**	**a**	5.0	0.0	a	5.0	0.0	a	5.0	0.0	a
B	3.9	0.8	a	3.9	0.9	a	3.3	0.5	a	3.5	0.7	a	3.2	0.9	a	3.8	0.7	a
Ca	426.5	43.1	b	**512.7**	**59.0**	**a**	**485.1**	**31.5**	**a**	457.0	38.6	b	461.7	59.4	ab	**508.7**	**45.9**	**a**
Cu	2.0	0.0	a	2.0	0.0	a	2.0	0.0	a	2.0	0.0	a	2.0	0.0	a	2.0	0.0	a
Fe	4.0	0.1	a	4.0	0.0	a	4.0	0.6	a	3.5	0.5	a	3.8	0.2	a	3.6	0.7	a
Mg	576.2	81.2	b	**650.8**	**59.1**	**a**	647.9	66.7	ab	586.4	94.8	a	645.0	96.5	a	670.1	113.5	a
Mn	14.9	8.2	a	15.8	6.2	a	17.0	6.9	a	22.4	12.7	a	23.5	13.0	a	24.7	15.2	a
Mo	0.2	0.1	a	0.2	0.0	a	0.2	0.0	a	0.4	0.1	a	0.4	0.2	a	0.4	0.2	a
Na	14.9	10.9	a	14.1	10.1	a	16.3	9.9	a	18.8	14.8	a	14.9	10.5	a	13.3	9.3	a
Ni	0.4	0.0	a	0.4	0.0	a	0.4	0.0	a	0.4	0.0	a	0.4	0.0	a	0.4	0.0	a
P	353.6	97.3	a	429.1	111.5	a	376.6	57.6	a	344.0	117.6	a	357.6	133.8	a	438.6	156.1	a
K	2616.7	156.6	b	**3006.6**	**305.1**	**a**	**2795.3**	**267.8**	**a**	2766.2	480.9	a	2510.8	339.0	a	2794.9	312.0	a
S	270.4	33.9	a	293.3	62.9	a	288.2	71.8	a	236.8	41.2	a	233.0	42.9	a	233.3	32.8	a
Zn	15.8	6.6	a	23.3	8.3	a	18.4	5.9	a	21.5	5.0	a	18.4	6.3	a	17.5	7.0	a

SL: Significant Level. the SD cell showed a significant difference among the time of samples. Wilcoxon each pair analysis ($p<0.05$).
MAD: Median Absolute Deviation

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Results- tissue age

Sap Nutrients (mg/L)	Highbush					Rabbiteye				
	New		SD	Old		New		SD	Old	
	Median	MAD		Median	MAD	Median	MAD		Median	MAD
NO_3^-	65.8	51.8		30.5	27.5	34.8	25.7		38.4	30.0
Al	5.0	2.5	*	**12.6**	**4.6**	8.3	3.9	*	**13.9**	**5.0**
B	3.3	2.1	*	**8.4**	**4.3**	5.3	4.1	*	**10.1**	**7.1**
Ca	680.5	187.6	*	**1056.8**	**259.2**	948.0	411.8	*	**1278.9**	**566.8**
Cu	0.5	0.4		0.6	0.4	1.4	1.4		1.2	1.1
Fe	2.1	0.7	*	**2.5**	**0.8**	3.4	2.1		4.4	2.6
Mg	676.5	217.1		895.6	244.5	916.6	349.9		1065.1	377.3
Mn	12.2	5.8	*	**27.3**	**11.5**	20.8	9.3	*	**37.3**	**13.9**
Mo	0.1	0.0		0.1	0.0	0.2	0.1		0.2	0.1
Na	11.5	6.4	*	**17.5**	**8.7**	22.6	14.4		27.4	14.8
Ni	0.2	0.1		0.2	0.0	0.2	0.0		0.2	0.0
P	**213.1**	**52.6**	*	181.4	41.9	202.0	44.1		201.9	71.5
K	2082.5	299.6	*	**2390.7**	**483.2**	2051.7	389.4		2110.5	480.9
S	205.9	64.2	*	**287.4**	**73.7**	380.6	223.2	*	**482.6**	**283.2**
Zn	7.0	1.7		7.2	1.6	7.2	2.0	*	**9.3**	**2.5**

SD: Significant Difference. Nutrients with an * on the SD cell showed a significant difference between young and old tissue samples. Wilcoxon each pair analysis ($p<0.05$).

Values in bold represent the significantly highest values of a nutrient among tissue ages in a determined variety.

MAD: Median Absolute Deviation

Results- type

Petiole Nutrient	Highbush					Rabbiteye				
	Young		SD	Old		New		SD	Old	
	Median	MAD		Median	MAD	Median	MAD		Median	MAD
NO_3^-	9.5	5.0	*	**18.1**	**8.3**	10.9	10.4	*	**26.5**	**9.9**
Al	5.0	0.0		5.0	0.0	5.0	0.0		5.0	0.0
B	3.0	0.5	*	**4.4**	**0.5**	3.5	1.2		3.6	0.8
Ca	459.5	40.9		491.4	66.6	455.5	59.3	*	**492.0**	**51.3**
Cu	2.0	0.0		2.0	0.0	2.0	0.0		2.0	0.0
Fe	4.0	0.3		4.0	0.1	3.4	0.6		3.7	0.3
Mg	647.9	52.1		597.3	64.0	**725.9**	**84.9**	*	562.0	60.1
Mn	10.9	3.1	*	**27.3**	**7.9**	15.6	8.2	*	**39.3**	**22.3**
Mo	0.2	0.0		0.2	0.0	0.4	0.2		0.4	0.1
Na	12.4	8.4	*	**22.0**	**10.1**	13.3	9.3		18.3	13.8
Ni	0.4	0.0		0.4	0.1	0.4	0.0		0.4	0.0
P	290.1	50.0	*	**475.4**	**75.6**	334.0	119.1	*	**446.5**	**164.9**
K	2678.2	180.0	*	**2824.8**	**340.1**	2690.9	295.4		2696.7	527.3
S	239.1	37.4	*	**345.2**	**47.6**	229.2	29.5	*	**246.6**	**52.2**
Zn	13.5	3.1	*	**28.4**	**6.0**	15.2	3.9	*	**24.4**	**7.3**

Sap petiole sample could be a faster way to identify N deficiencies

SD: Significant Difference. Nutrients with an * on the SD cell showed a significant difference between new and old tissue samples. Wilcoxon each pair analysis ($p<0.05$).
Values in bold represent the significantly highest values of a nutrient among tissue ages in a determined variety.
MAD: Median Absolute Deviation

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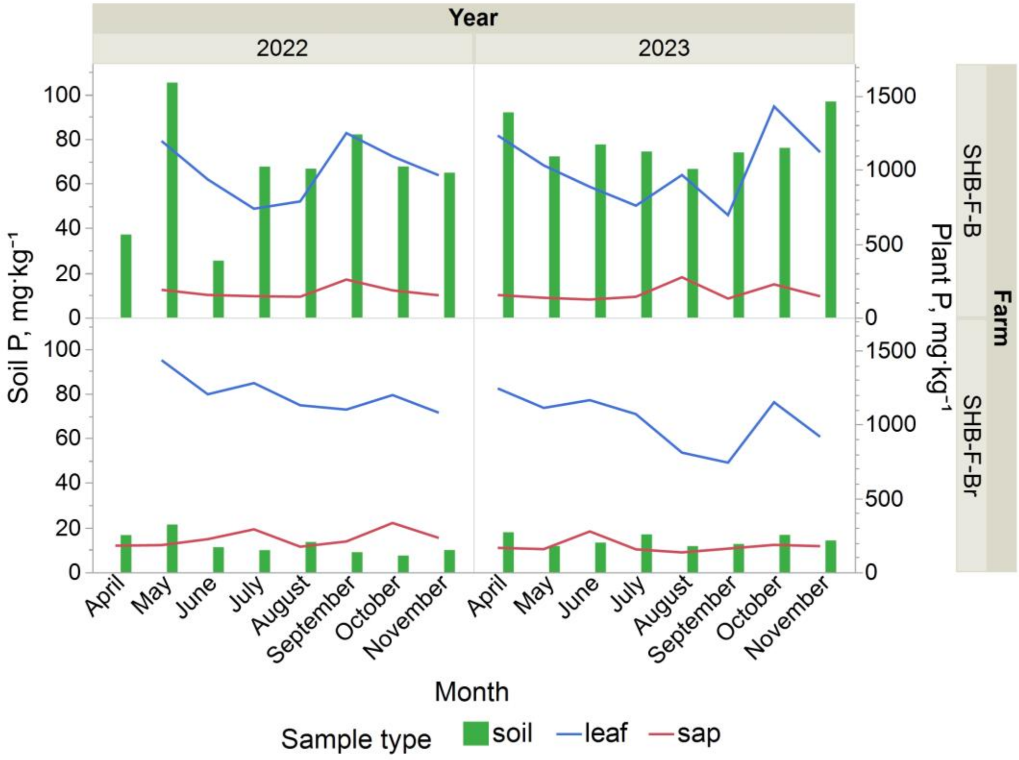
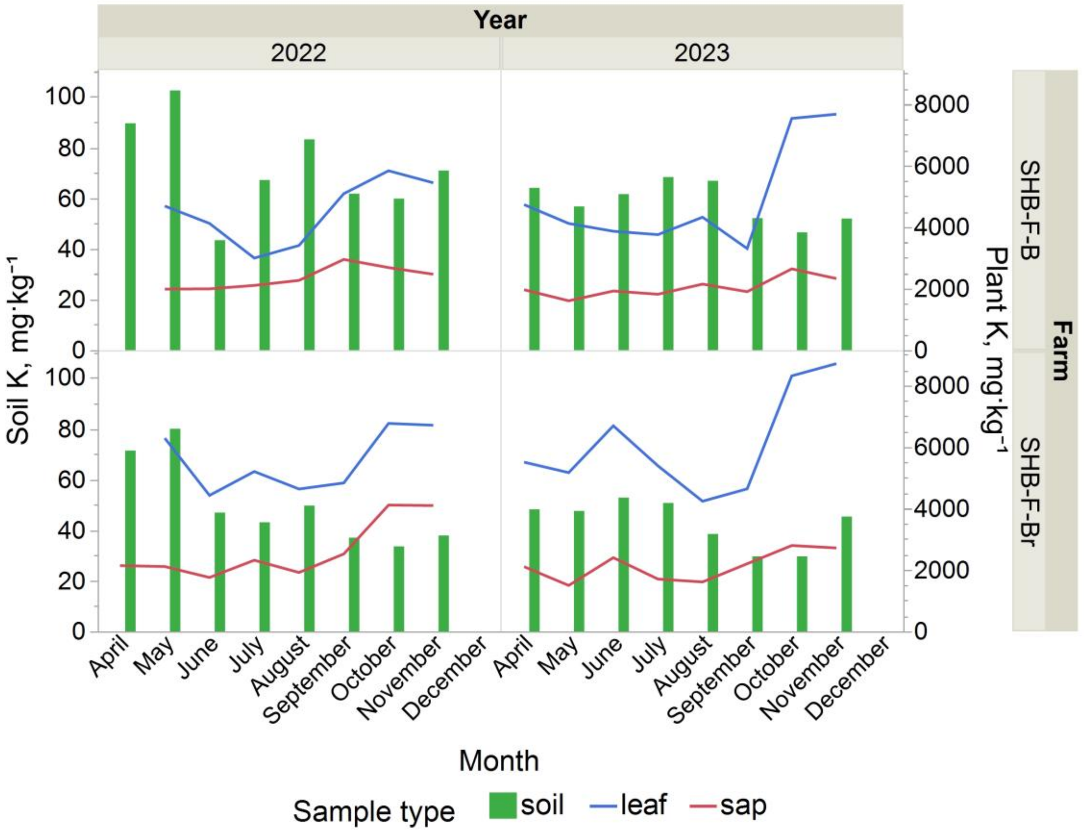
Trends: soil, sap, and leaf tissue samples





Sap and leaf nutrient content have a similar pattern

K increased after September

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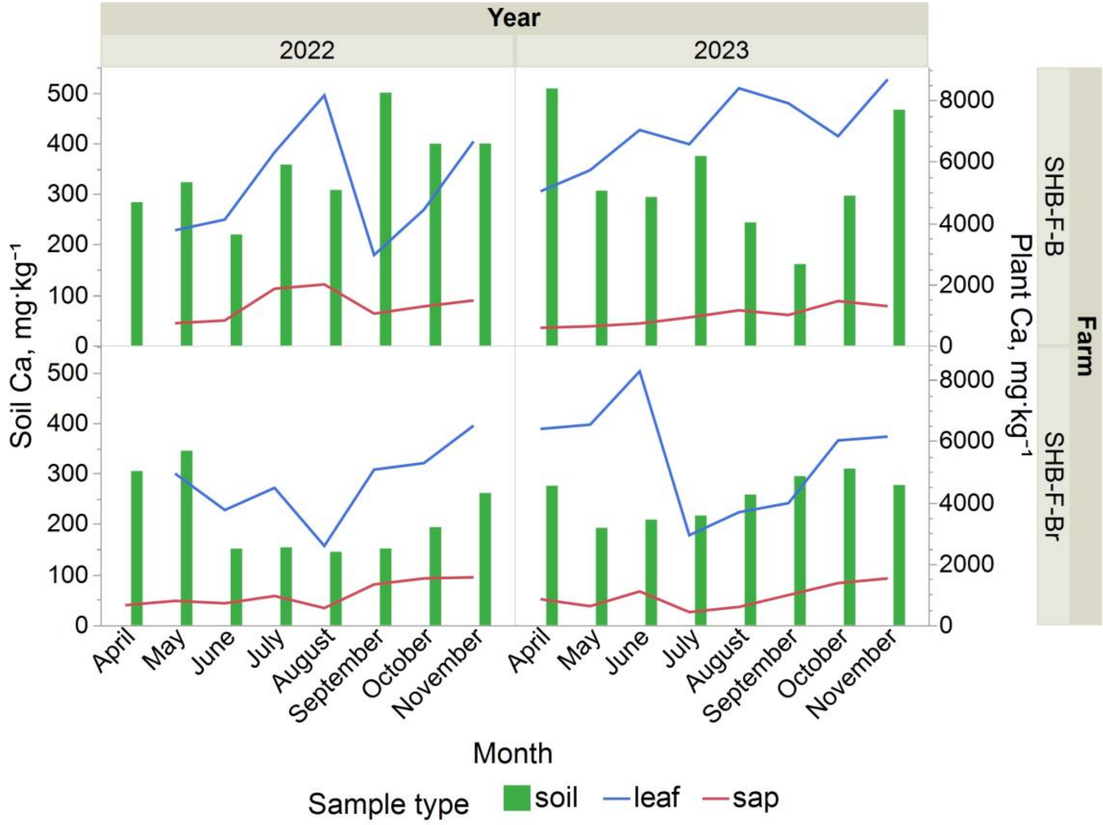
Trends: soil, sap, and leaf tissue samples



Calcium has low mobility in the plant

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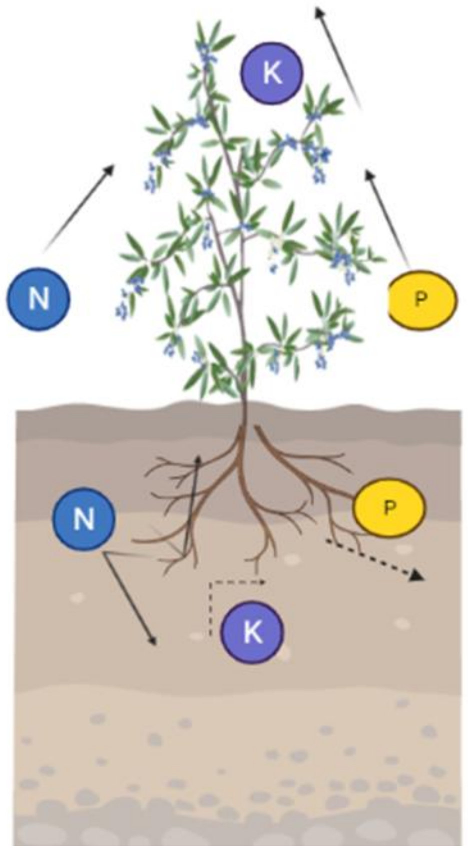
Summary

- Sampling time does not influence nutrient concentration in sap, samples can be taken any time during the day
- Old tissue had higher nutrient concentration, which could be linked to nutrient mobility, which is similar to leaf tissue sample
- Sap nutrient concentration changes through the year and has a similar trend to leaf nutrient concentration



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Sufficient levels for sap

Mineral		Current Level	Optimum	
Total Sugars	%	3,0	1,6 - 4,9	1
	%	4,4		2
pH		3,3	5,3 - 5,7	1
		3,3		2
EC	mS/cm	6,7	5,3 - 6,7	1
	mS/cm	7,2		2
K - Potassium	ppm	2179	1740 - 2260	1
	ppm	3004		2
Ca - Calcium	ppm	1203	710 - 1290	1
	ppm	1429		2
K / Ca		1,81		1
		2,10		2
Mg - Magnesium	ppm	938	420 - 630	1
	ppm	1128		2
Na - Sodium	ppm	18	7 - 15	1
	ppm	25		2
NH4 - Ammonium	ppm	130	30 - 100	1
	ppm	61		2
NO3 - Nitrate	ppm	<20	<20 - 45	1
	ppm	<20		2
N in Nitrate	ppm	<5	<5 - 10	1
	ppm	<5		2
N - Total Nitrogen	ppm	366	234 - 316	1
	ppm	344		2
Cl - Chloride	ppm	159	67 - 133	1
	ppm	162		2
S - Sulfur	ppm	182	87 - 143	1
	ppm	265		2
P - Phosphorus	ppm	382	132 - 308	1
	ppm	395		2
Si - Silica	ppm	25,3	14,4 - 21,6	1
	ppm	27,2		2
Fe - Iron	ppm	3,99	11,39 - 22,61	1
	ppm	8,46		2

Do we need to develop sufficient levels for sap nutrient concentration?

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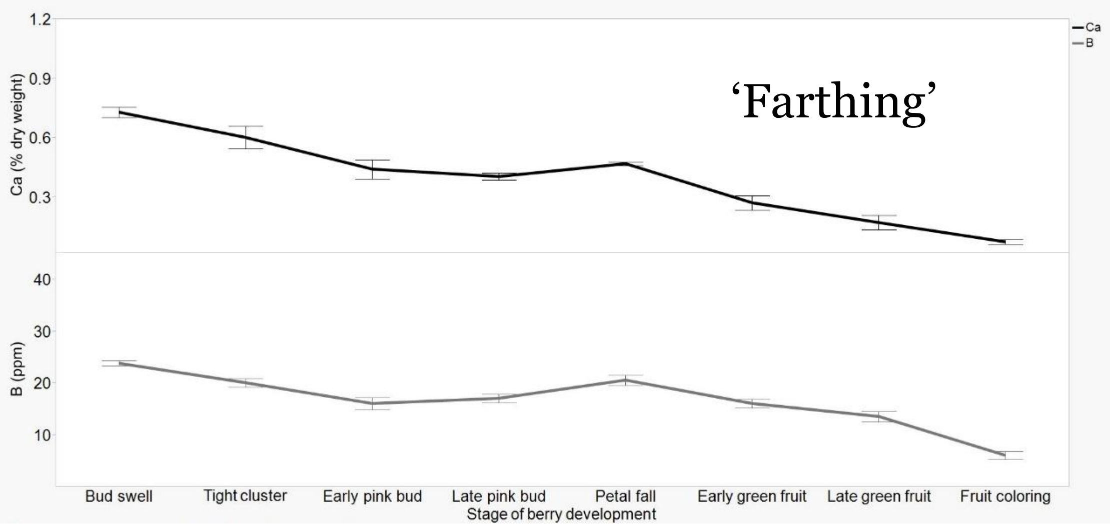
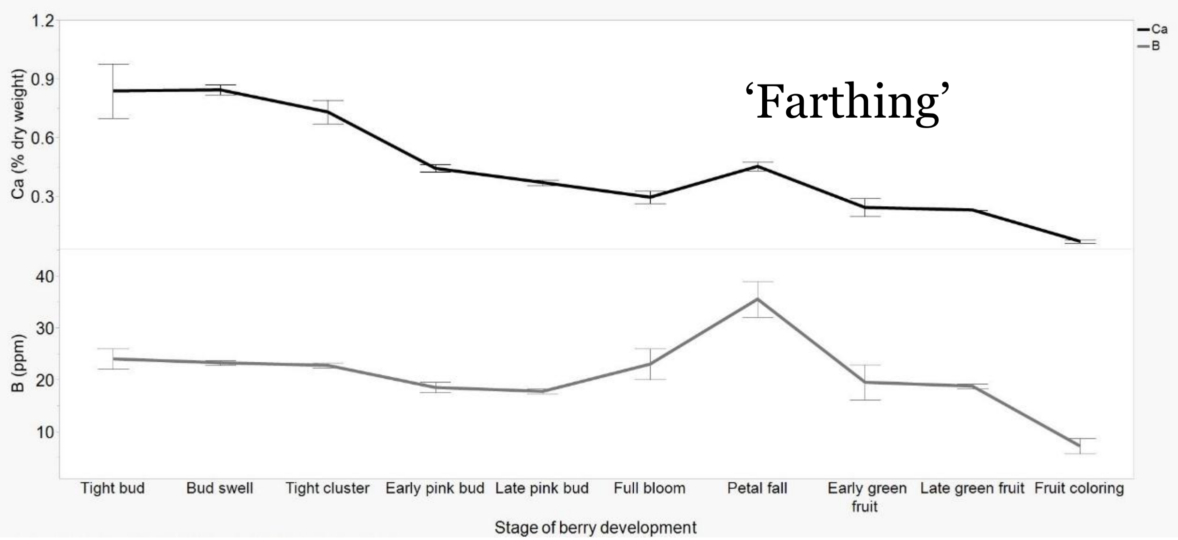
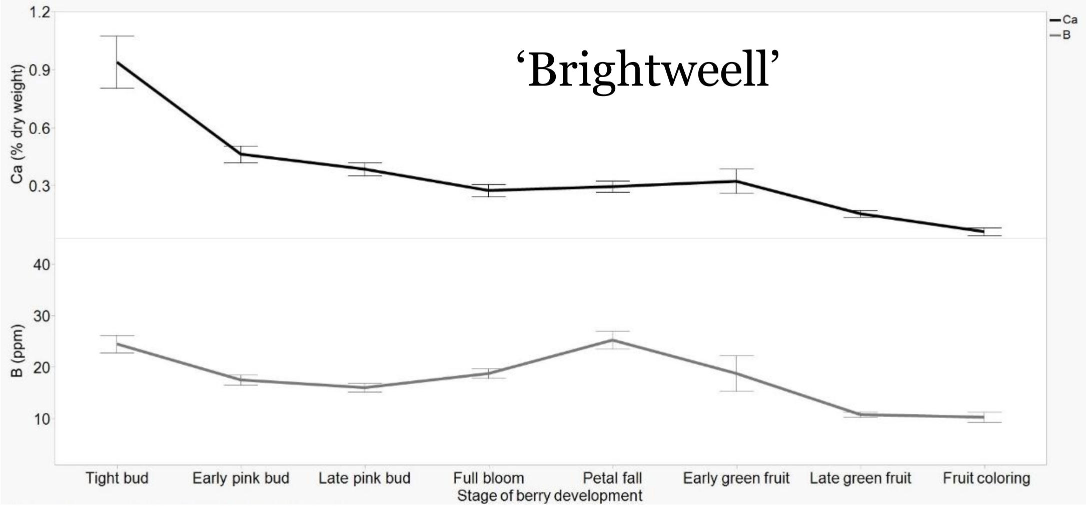
Ca and B Accumulation at different growth stages







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Plant Growth Regulator -Ethephon

- Plant growth regulators (PGR) are natural or synthetic compounds that alter physiologic processes in plants
- Ethephon is a PGR that releases ethylene during breakdown.
- Ethylene can also delay ripening.
- Currently, blueberry growers spray ethephon on new SHB cultivars.
- Fall application of ethephon delayed blooming by 7–10 days
- There is a lack of information regarding the impact of ethephon on new SHB cultivars.

(Lopez-Lauri, 2016; Rademacher, 2015; Crisosto et al., 1990; Krewer et al., 2000; Krewer et al., 2005; Nečas et al., 2023)

Zilfina Rubio

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Objectives

Evaluating the effect of ethephon treatments on:

- Bloom delay
- Fruit ripening

Cultivars: ‘Farthing,’ ‘Georgia Dawn’ and ‘Kee Crisp’ in 2023

Cultivars: : ‘Farthing,’ ‘Georgia Dawn’ in 2024

Materials and Methods

- Location: a commercial farm in Newton, Georgia in 2022 and 2023.
- Three SHB cultivars: 'Farthing,' 'Georgia Dawn,' and 'Kee Crisp.'
- A randomized complete block design was used with five replicates per treatment. Each treatment included five plants.
- Ethephon was sprayed on 4-year-old plants once on November, 2022 using a backpack at four concentrations (0, 200, 400, and 800 $mg.L^{-1}$).
- Ethephon was combined with a 0.25% nonionic surfactant for application.

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Materials and Methods

Location: a commercial farm in Pearson, Georgia in 2023 and 2024.

- Three SHB cultivars: ‘Farthing,’ and ‘Georgia Dawn,’ A randomized complete block design was used with five replicates per treatment. Each treatment included five plants.

- 800 ppm pf Ethephon was sprayed on

  Early (10/11/24),

  Mid+Late (10/25/24 + 11/7/23)

  Mid (10/25/23),

  Late (11/7/23)

  Control (without ethephon)

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Materials and Methods

Assessment of growth stages

- Three branches on each of the three central plants per treatment were tagged.
- The number of developing flower buds was counted in each branch from December 2022 to March 2023.
- Flower buds and fruit development growth stages were evaluated using a modified version of the scale developed by Michigan State University.
- Data were collected from the three central plants in each experimental plot.
- Each tagged branch was evaluated from the top 10 inches.

Fabian Reyes

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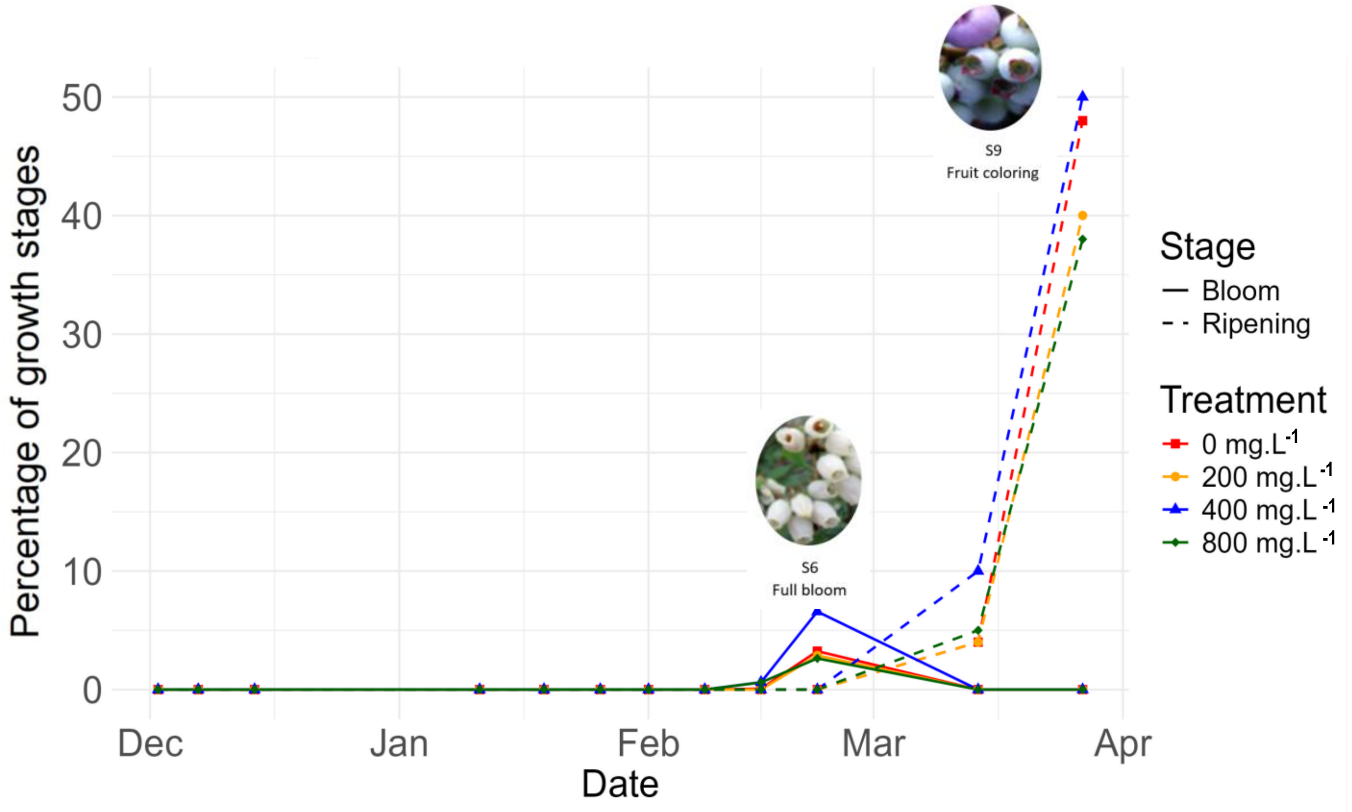
Results

'Farthing'



Percentage of open flowers (Bloom) and berries at the fruit coloring stage (Ripening) from December 2022 to March 2023 for SHB blueberry cultivar 'Farthing.'

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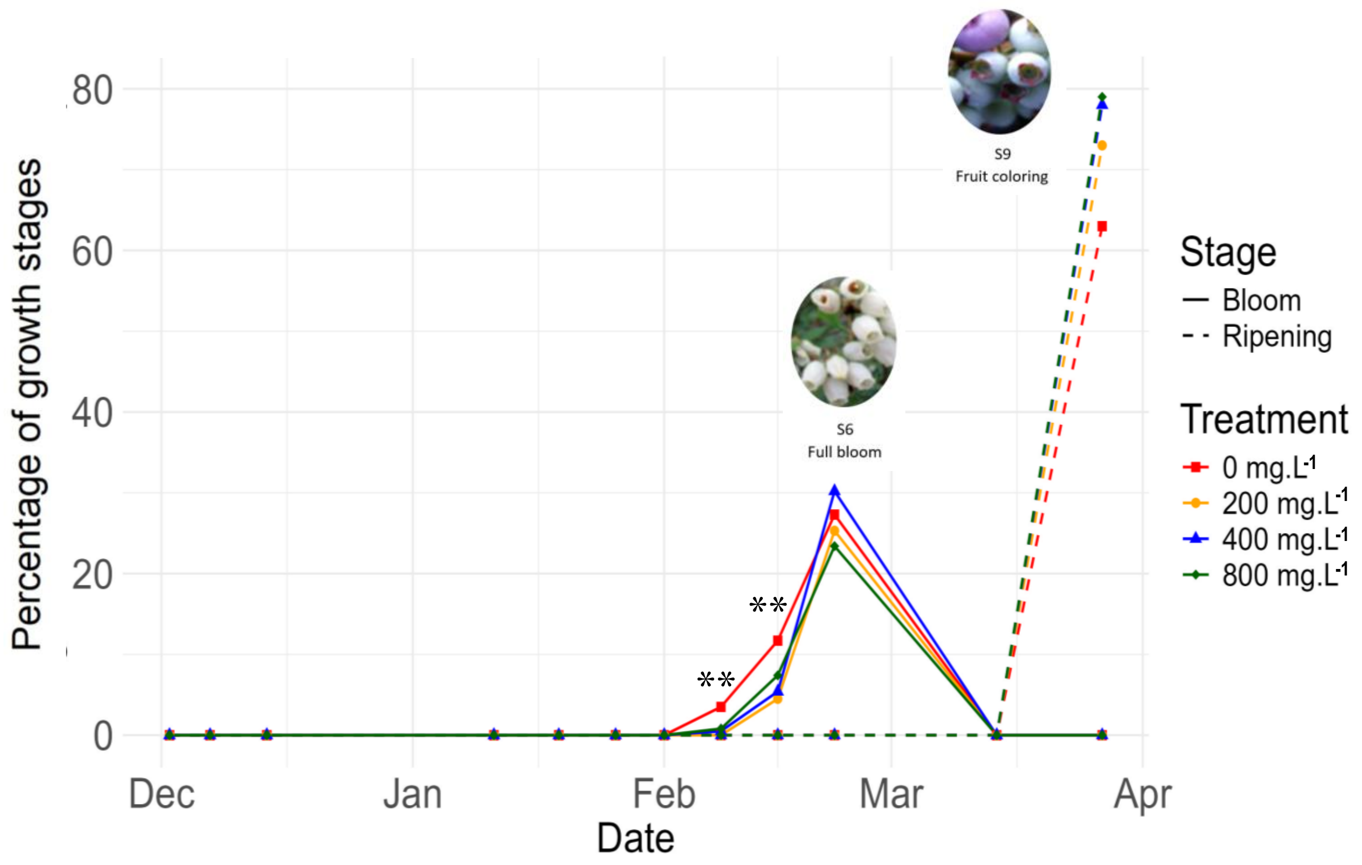
Results

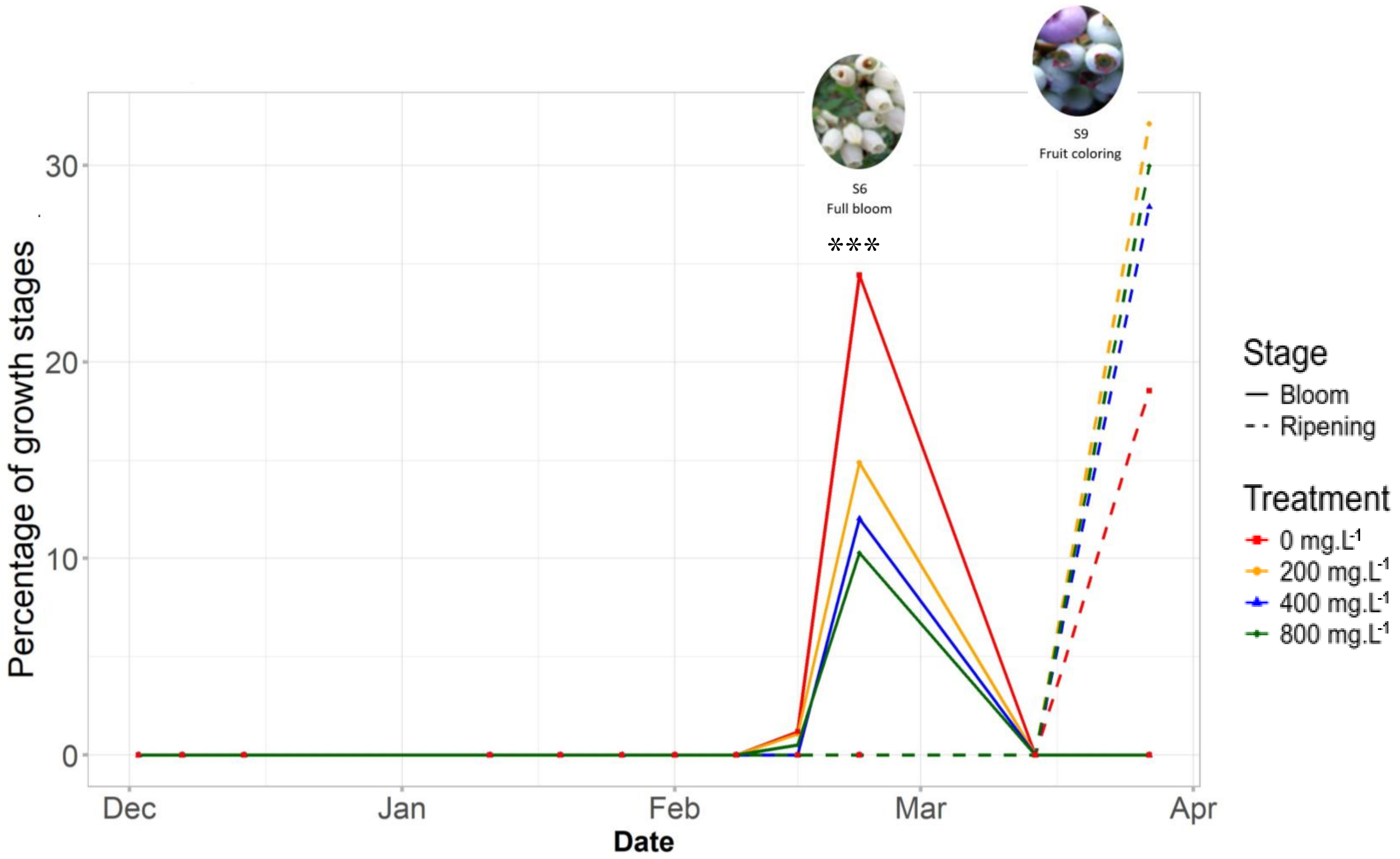
‘Georgia Dawn’



Percentage of open flowers (Bloom) and berries at the fruit coloring stage (Ripening) from December 2022 to March 2023 for SHB blueberry cultivar ‘Georgia Dawn.’
**: significant at P<0.01.

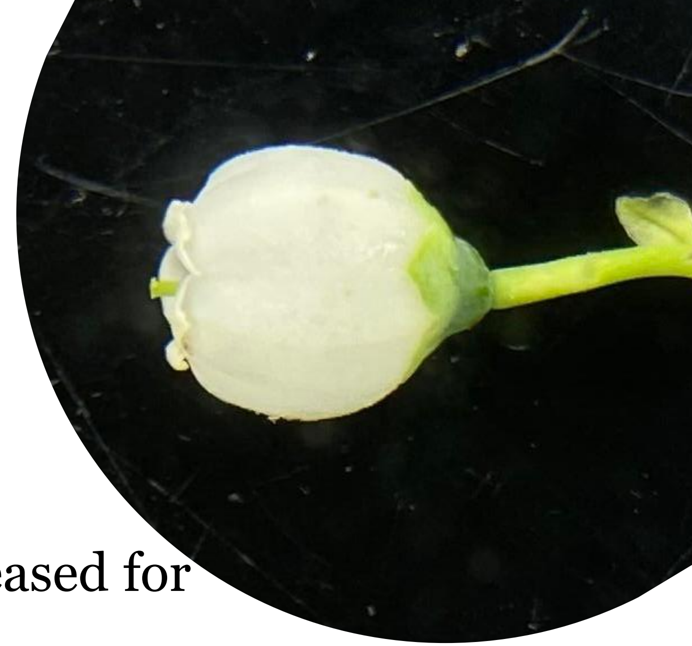
Results

'Kee Crisp'



Percentage of open flowers (Bloom) and berries at the fruit coloring stage (Ripening) from December 2022 to March 2023 for SHB blueberry cultivar 'Kee Crisp.'
***: significant at P<0.0001.

General remarks



- Ethephon delayed bloom in ‘Georgia Dawn’ and ‘Kee Crisp’ cultivars.
- No significant differences were found in ‘Farthing.’
- As the concentration of ethephon increased, the bloom delay also increased for ‘Georgia Dawn’ and ‘Kee Crisp.’
- The ‘Kee Crisp’ variety exhibited a more pronounced effect on blooming delay.
- Fruit ripening was not delayed by ethephon application. Thus, ethephon can be used as a tool to prevent freeze damage.

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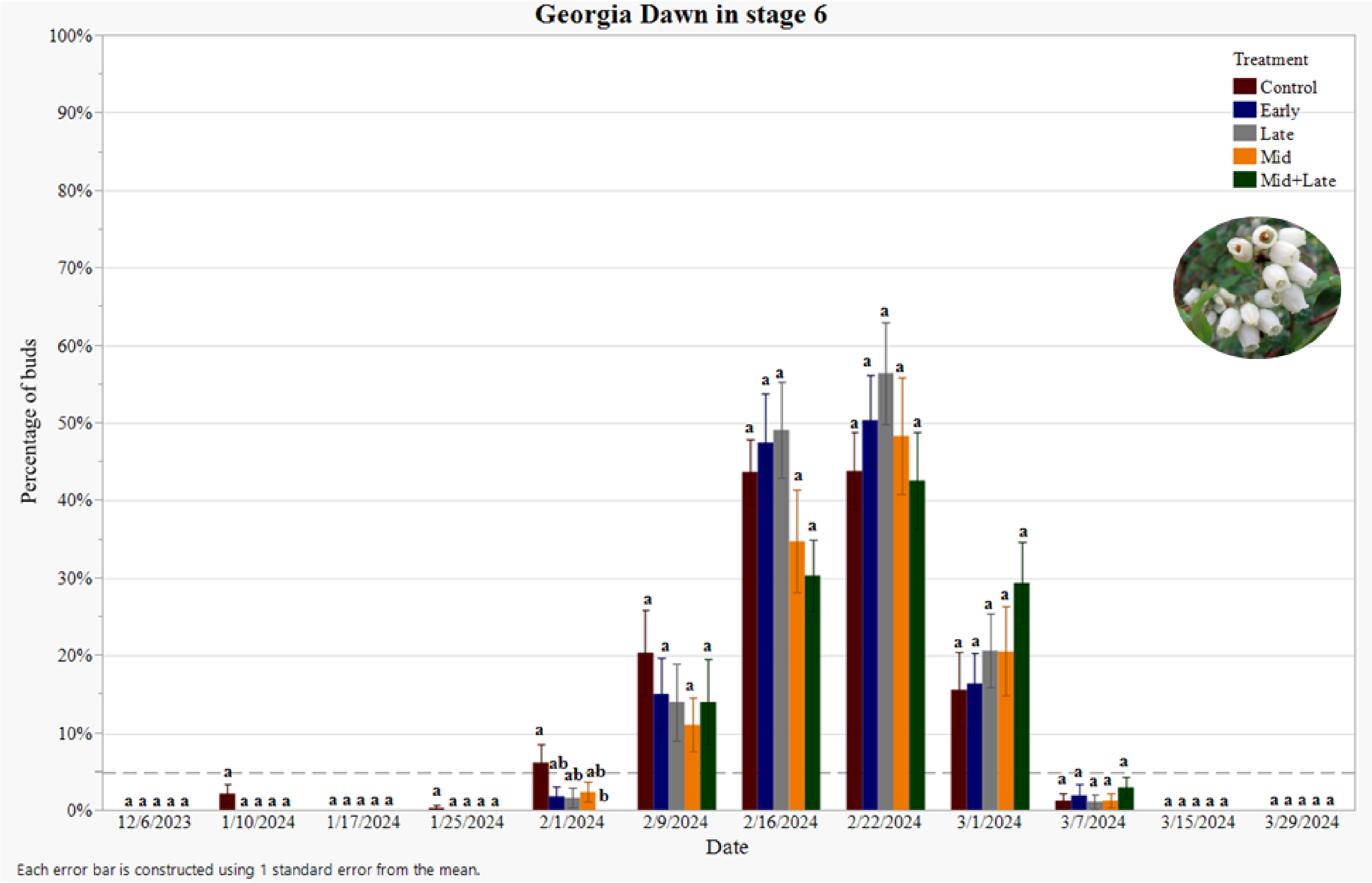
Results ‘ Georgia Dawn’



Georgia Dawn	
Treatment	Days to bloom
Early	67 ± ab
Mid	66 ± ab
Mid+Late	70 ± a
Late	67 ± ab
Control	59 ± b

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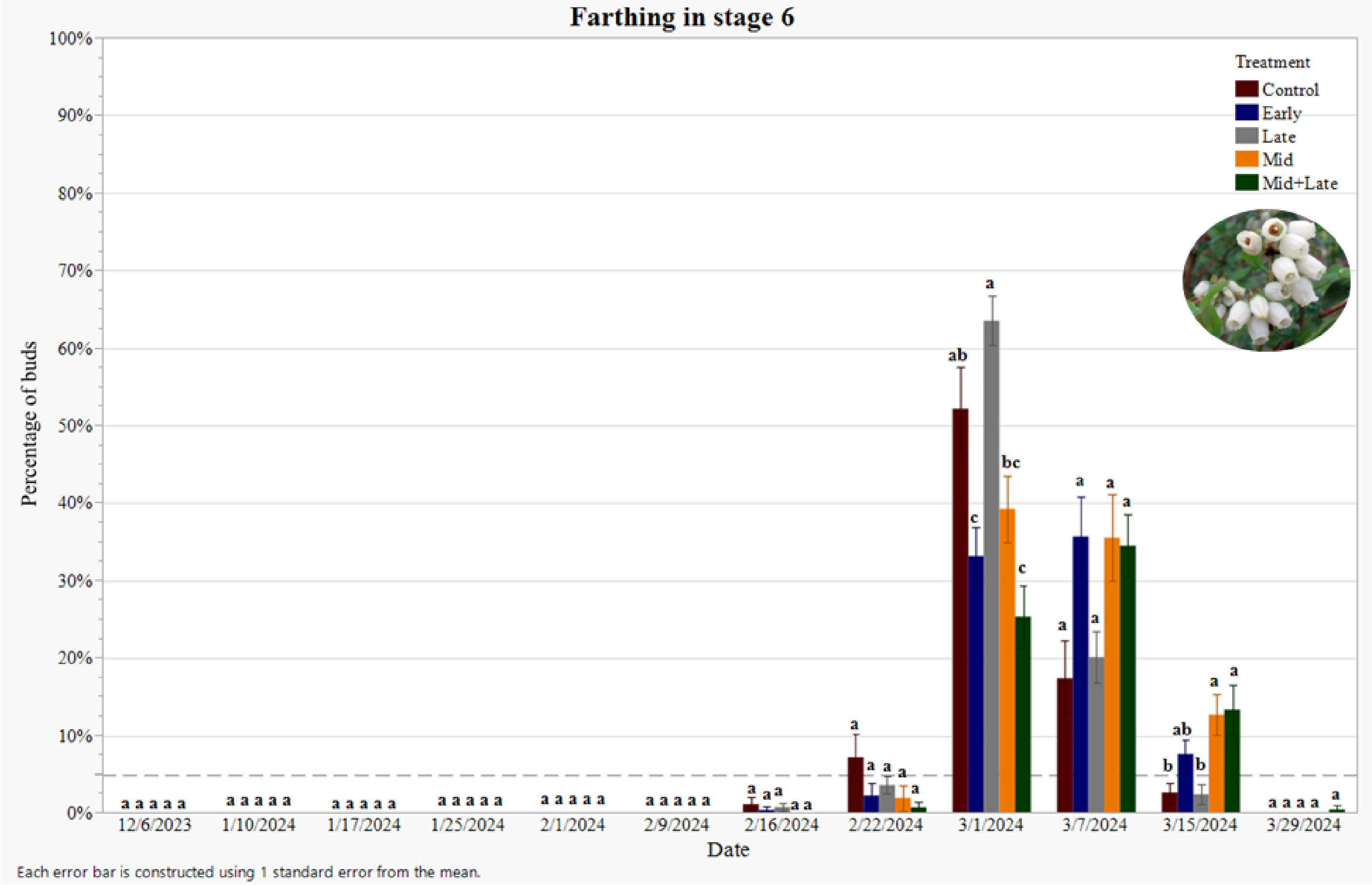
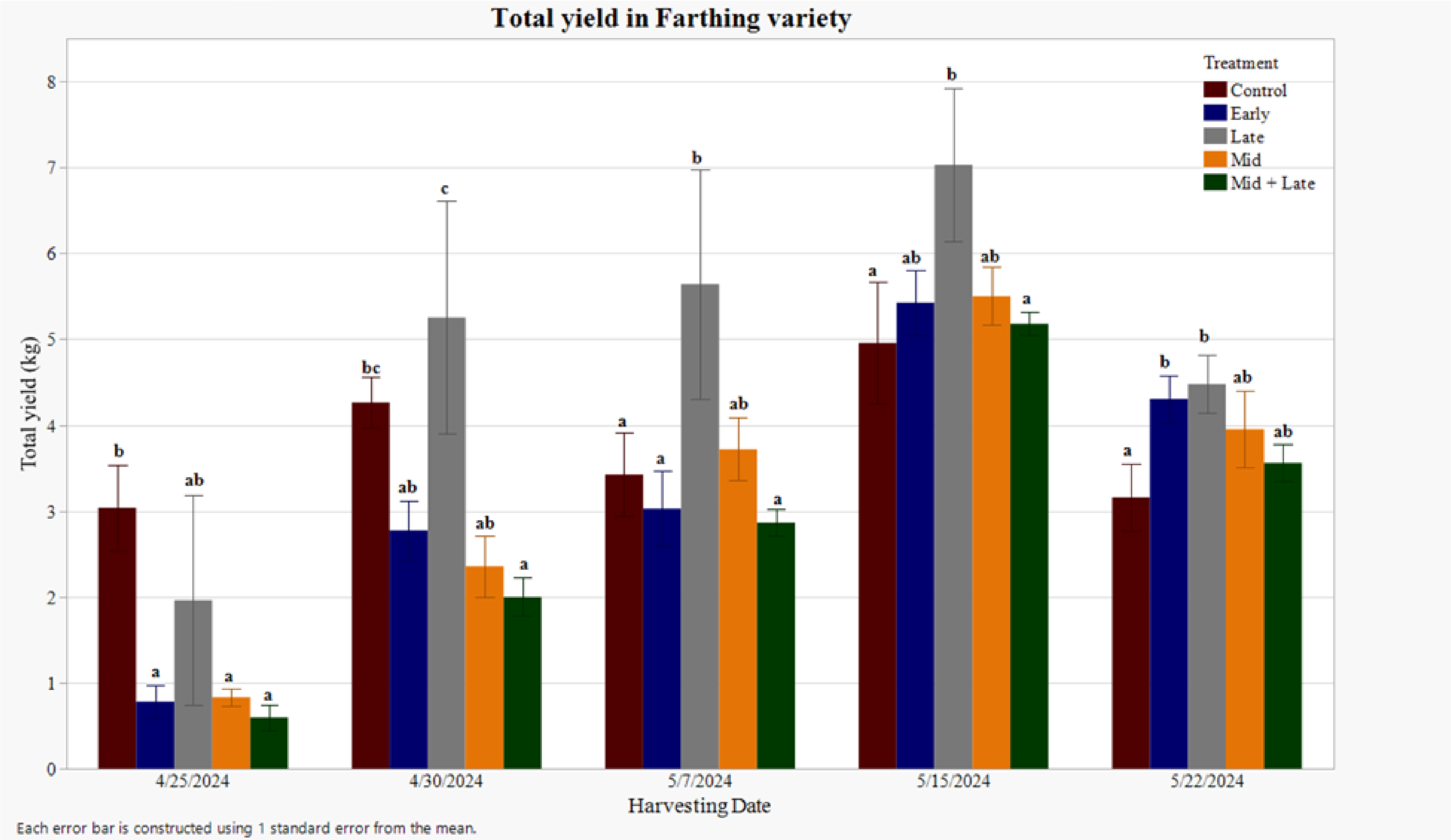
Results ‘Farthing’



Farthing	
Treatment	Days to bloom
Early	84 ± a
Mid	85 ± a
Mid+Late	85 ± a
Late	85 ± a
Control	83 ± a

Results ‘Farthing’



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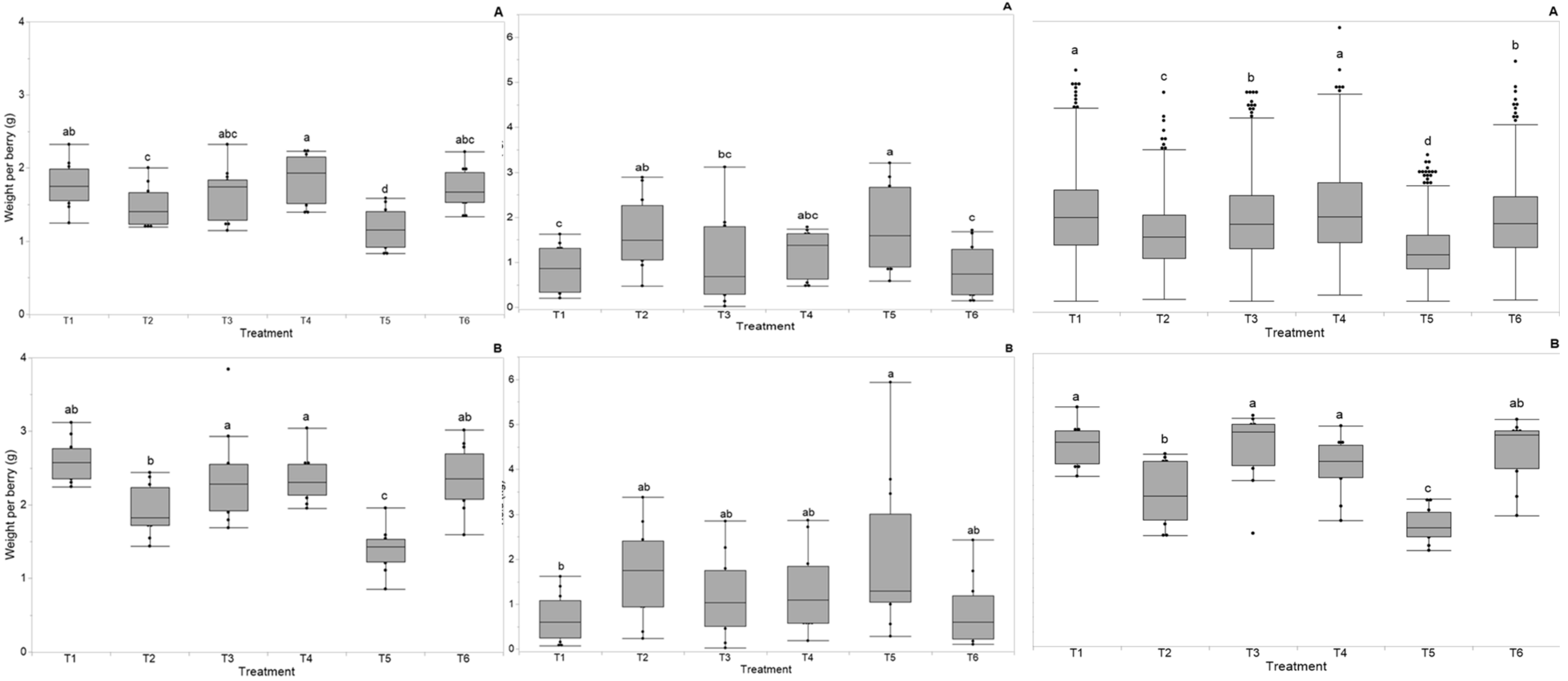
Pruning Does Not Reduce Yield Of ‘Farthing’



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Acknowledgement

- This work was funded by the Georgia Blueberry Commission and the Georgia Farm Bureau.
- We thank the growers that allowed us to use their farm.

Questions?

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Thank you!

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Pruning Treatments

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Experimental Layout

Treatment	Description
T1	Hedge summer/hand pruned fall
T2	Hedge summer/tipping in fall (commercial practice)
T3	Hand pruned fall
T4	Hand pruned summer/hand pruned fall
T5	No pruning or hedging
T6	Hedge and hand pruned summer/ hand pruned fall

- Summer pruning was performed in August and fall pruning in November
- RCB - 3 replicates
- 3 locations
- 4 year old ‘Farthing’

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