Nitrogen in the Vineyard or Winery

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Nitrogen in the Vineyard or Winery

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Primary Question:

Can we produce better wines by:

1) Boosting vine N status in the vineyard ?

2) Maintaining low N in the vineyard ?
With the option to adjust N in the Winery

Second Question:

Does the type of winery N supplement matter?

Inorganic-N VS Organic-N

Ammonium (DAP) VS Amino (Nutriferm)

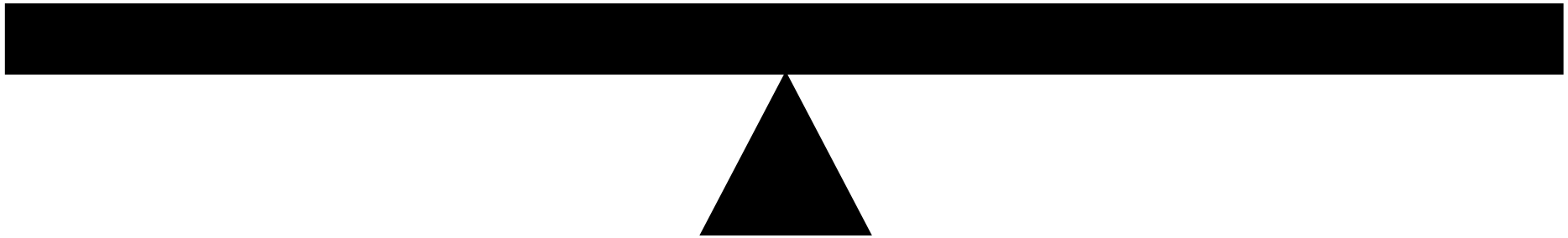
Rationale:

- Vine N status drives vegetative growth - vigor (more critical in high rainfall regions)
- Vine N status impacts reproductive growth
- Tug of war 1 (Shoots or Fruits)

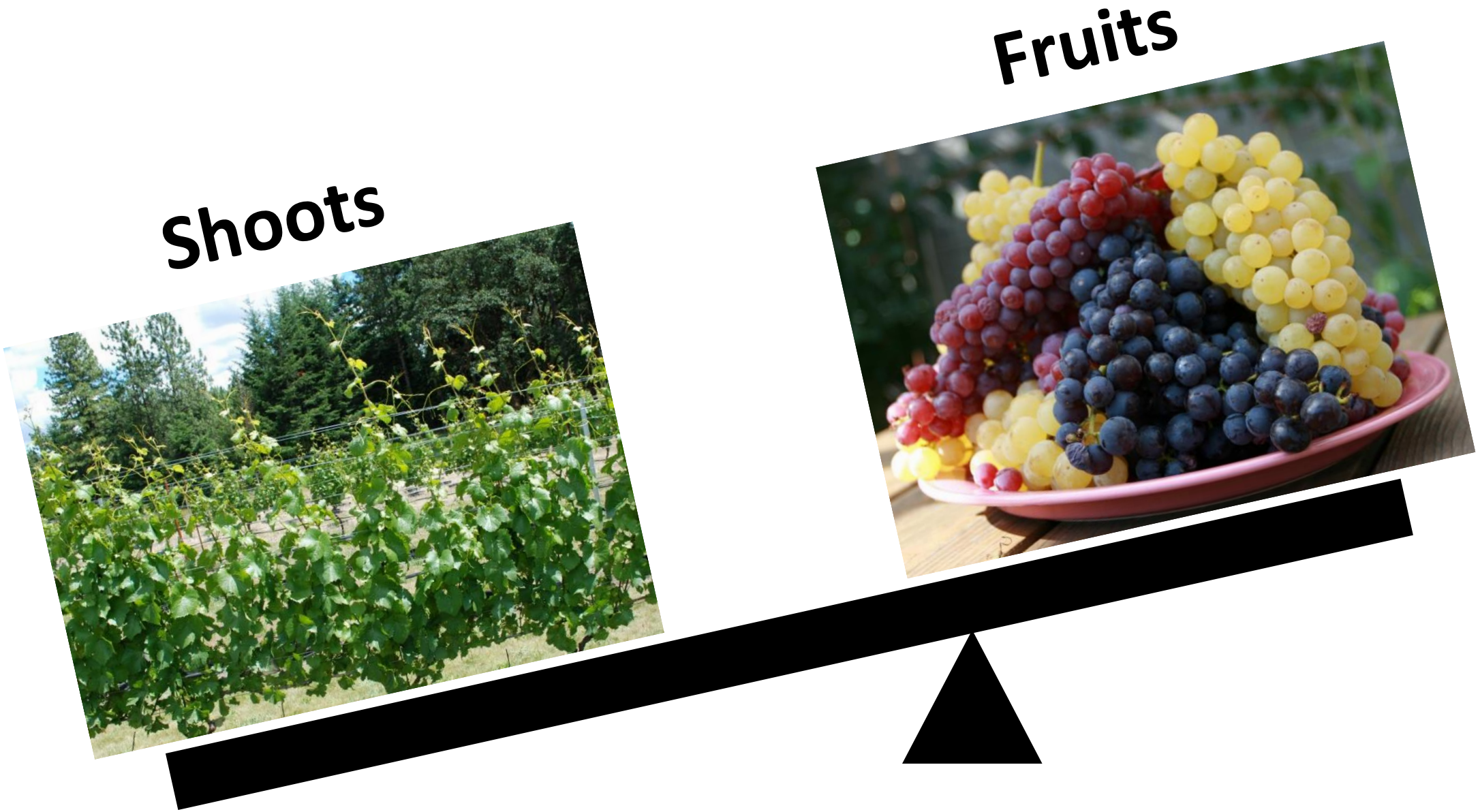
Nitrogen & Balance - Growth

Shoots

Fruits

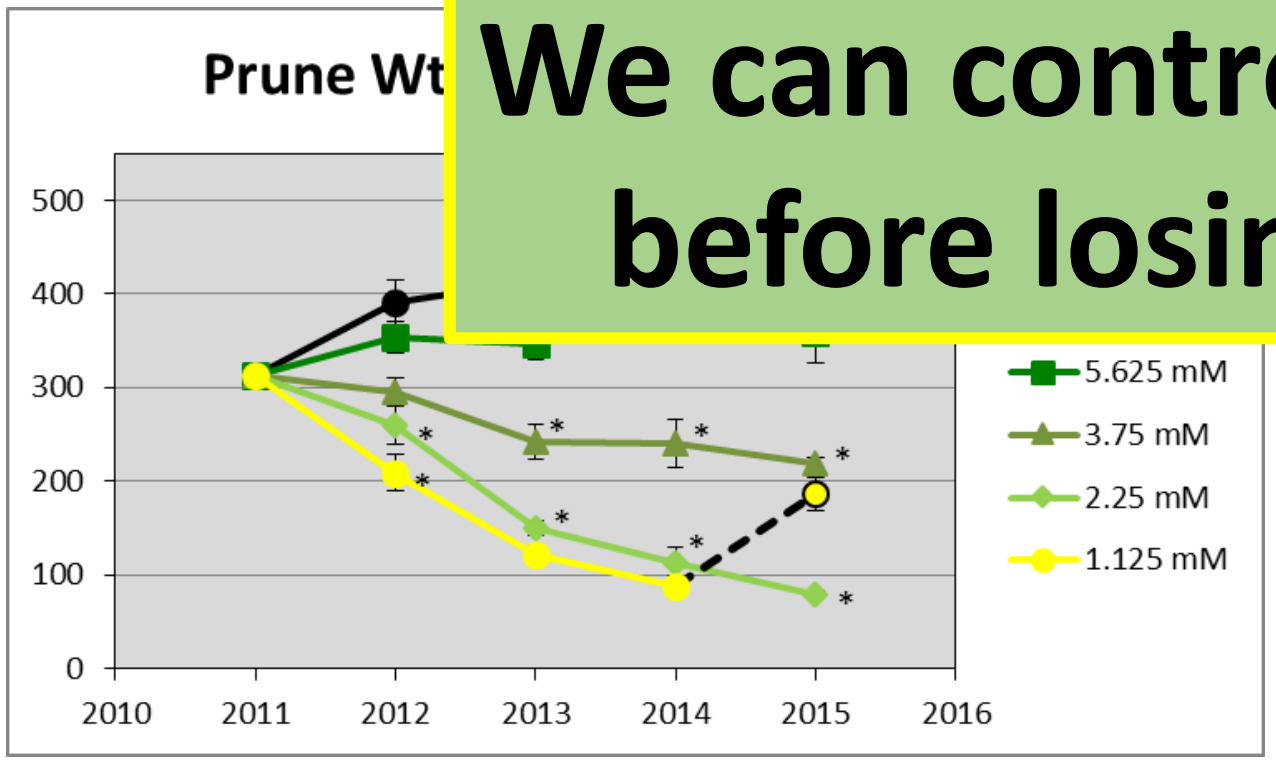


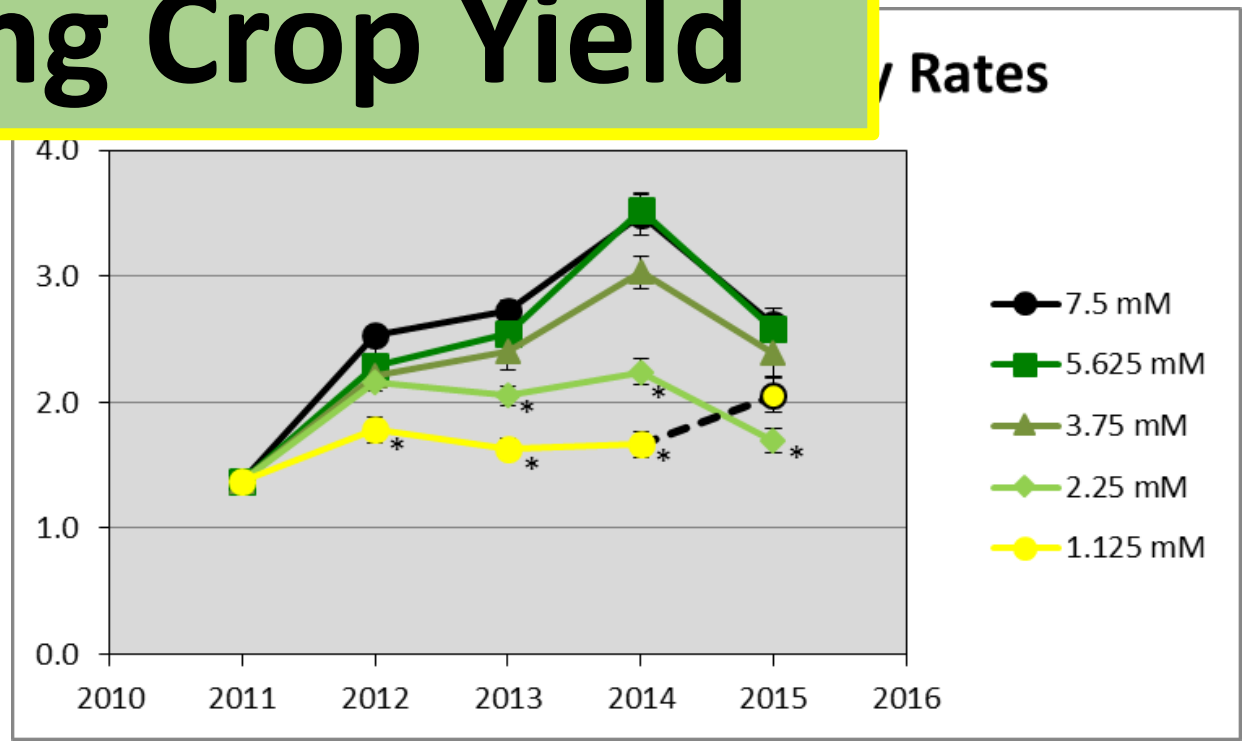
Nitrogen & Balance - Growth



Nitrogen - MicroPlot Experiments

We can control Canopy Size before losing Crop Yield





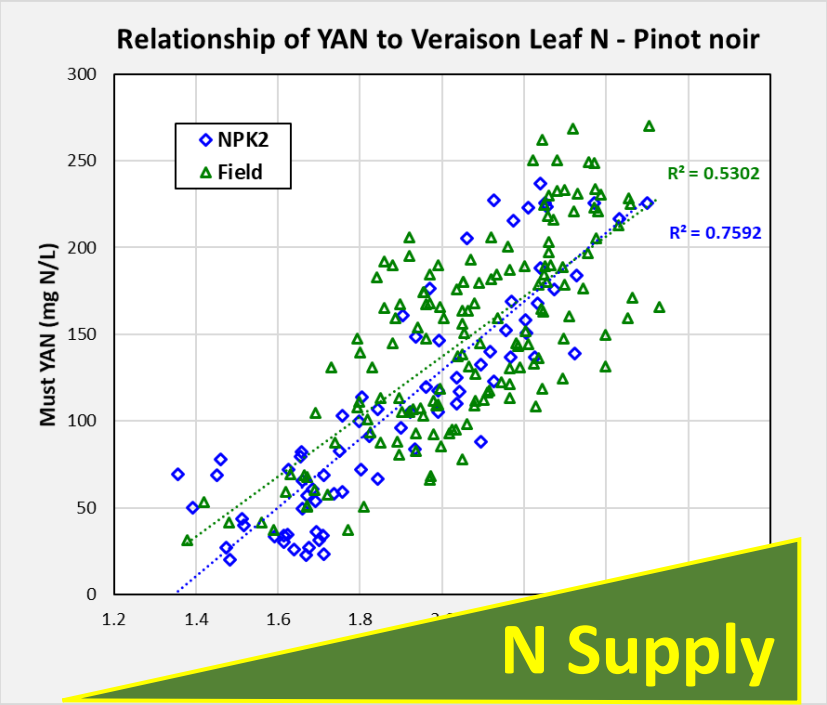
Schreiner et al. 2018 AJEV

Rationale:

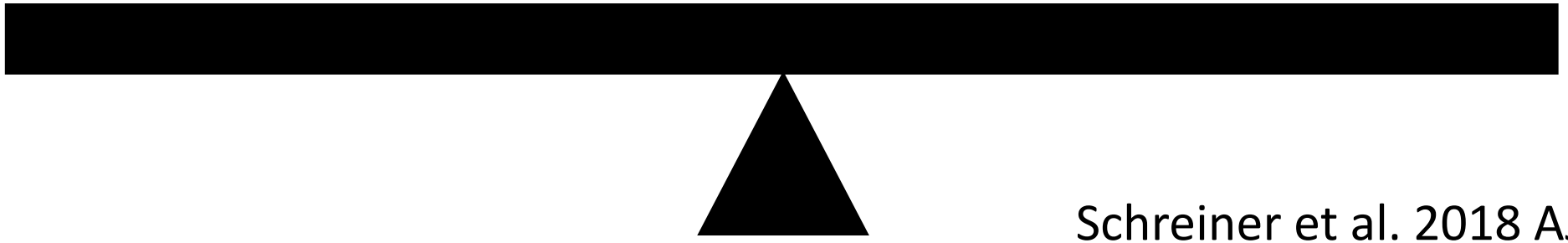
- Low N status often improves red fruit quality attributes
  2° metabolites (phenolics, some aroma precursors)
- Low N status reduces berry N or must YAN
  1° metabolites (amino acids linked to specific aromas)
- Tug of war 2 (primary VS secondary metabolites)

Nitrogen & Balance - Quality

1° metabolites



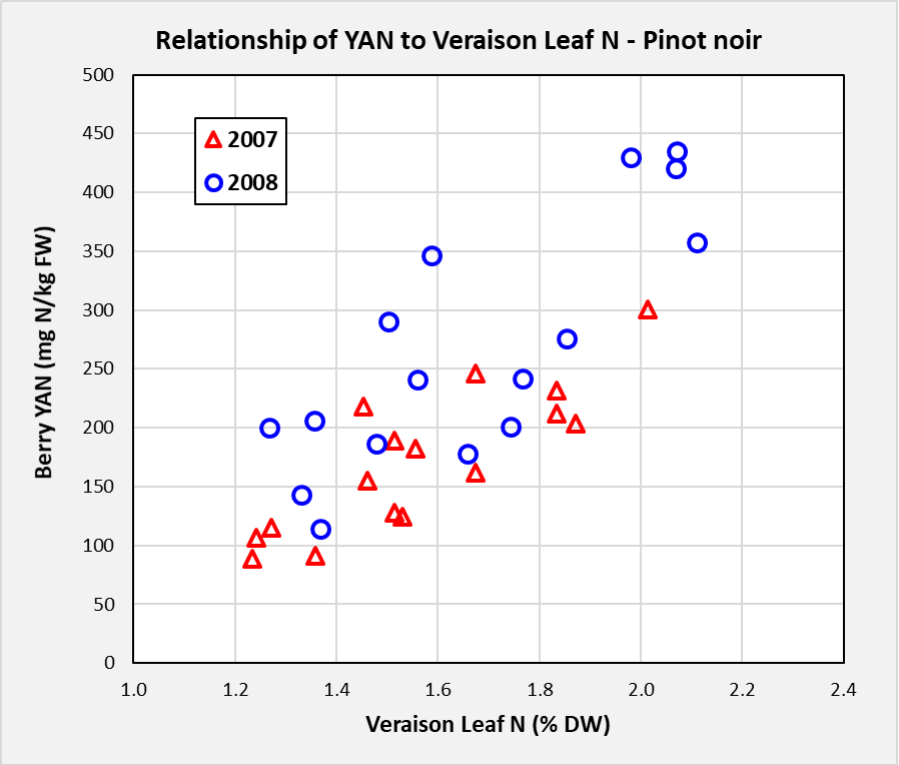
2° metabolites



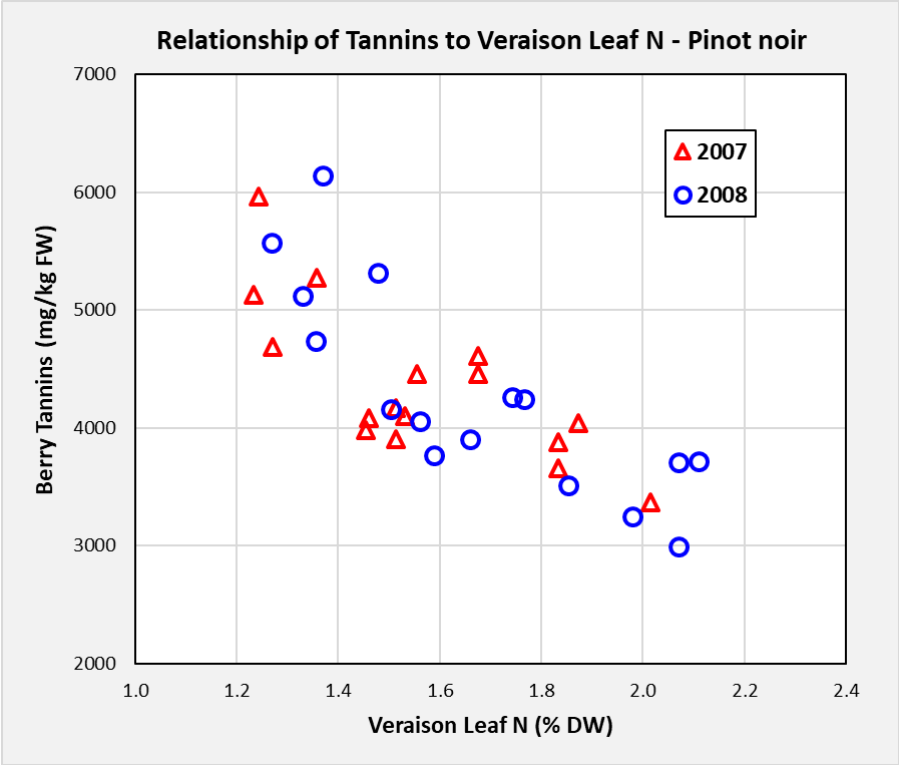
Schreiner et al. 2018 AJEV

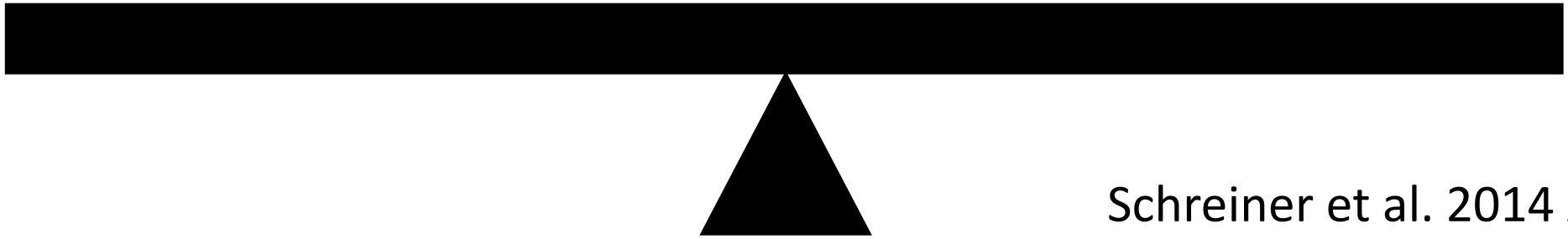
Nitrogen & Balance - Quality

1° metabolites



2° metabolites





Schreiner et al. 2014 AJEV

Experimental Design:

- Work in ‘Chardonnay’ and ‘Pinot noir’
- 3 Treatments in the Vineyard (no N, Soil N, Foliar N)
- Soil N applied as UAN @ 40-60 lbs/acre N (2-3 doses)
- Foliar N applied as urea @ 18 lbs/acre (3 doses)
- Wide array of Viticultural measurements
- 2 Treatments added at Winery (+DAP, +Nutriferm)
- 4 field replicates maintained in separate ferments
- 5 treatments were produced and evaluated

No N (control), +Soil N, +Foliar N, +DAP, +Nutriferm

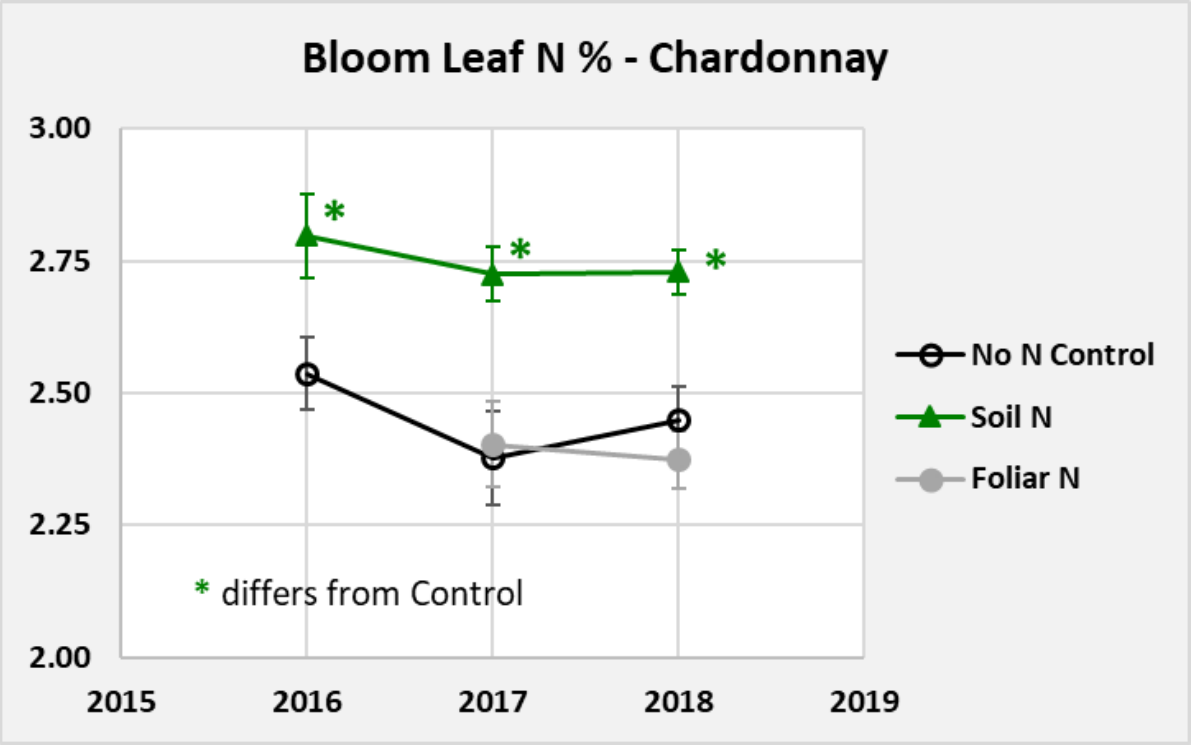
Viticulture Results - Chardonnay

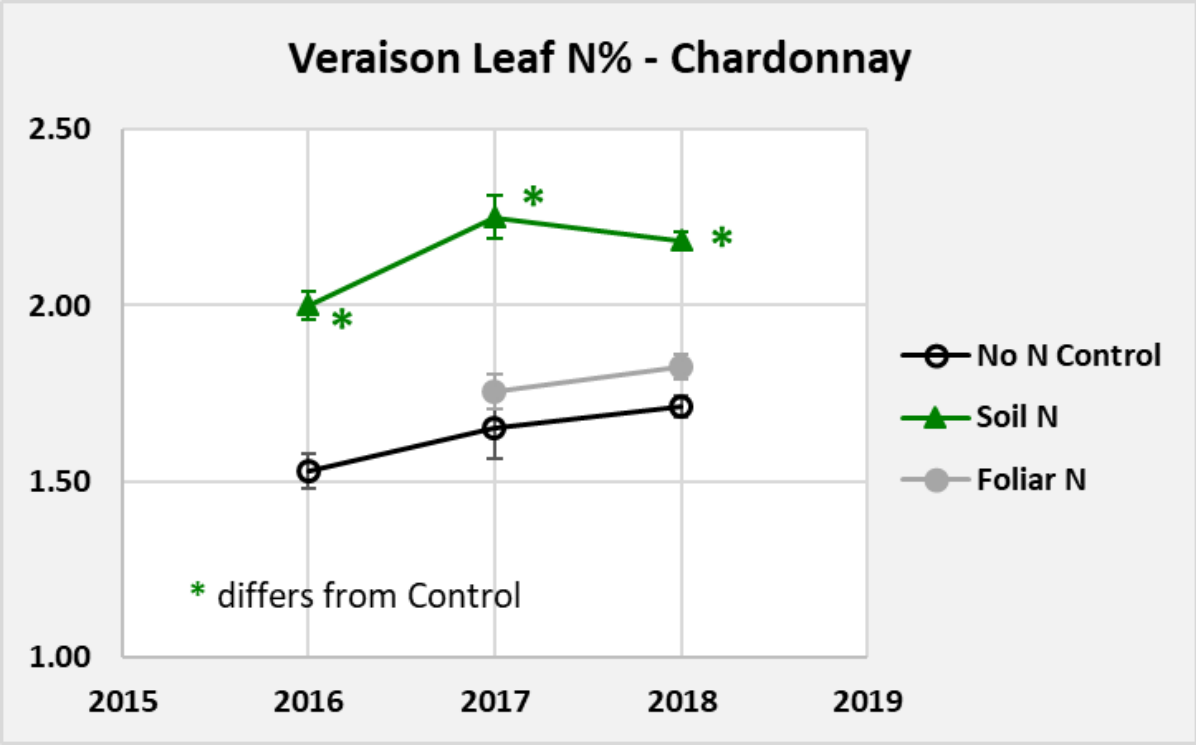
Soil N in Chardonnay - **60** pounds/acre N in 2016 & 2017, **40** pounds in 2018

September 28, 2016 – 2 weeks after harvest

August 25, 2017 – Veraison

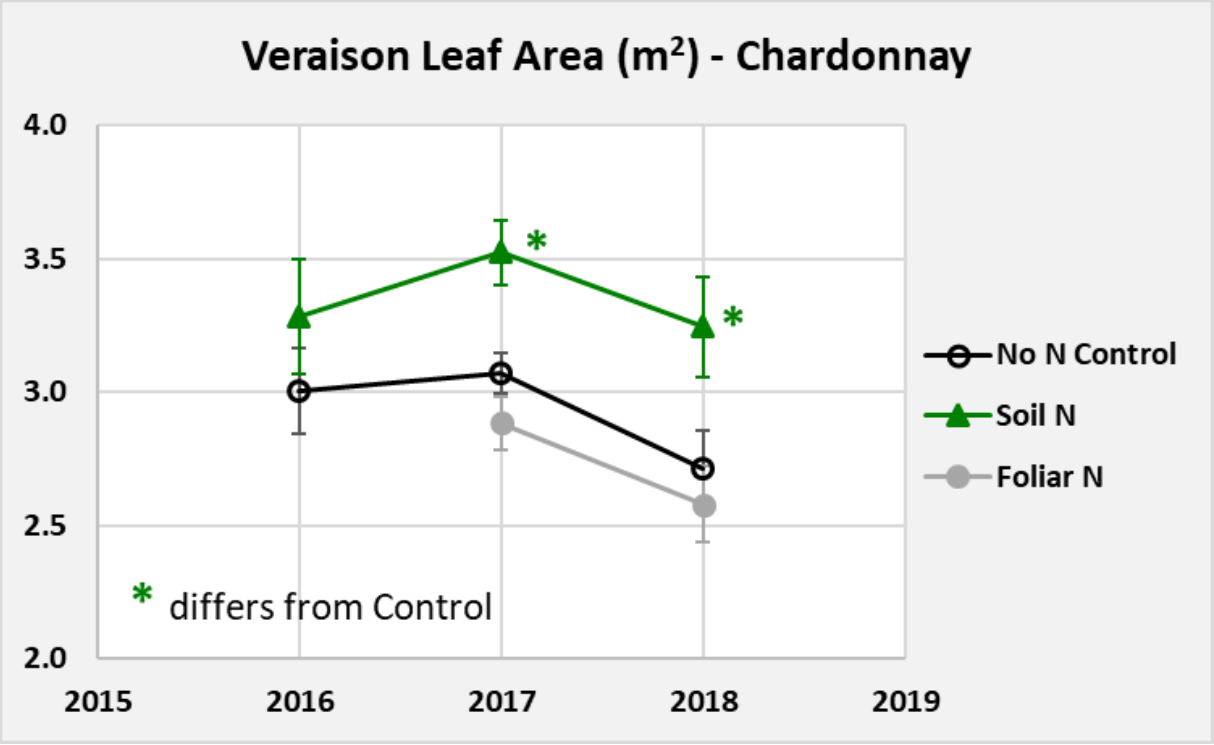
Effect of N Treatments on Vine N Status

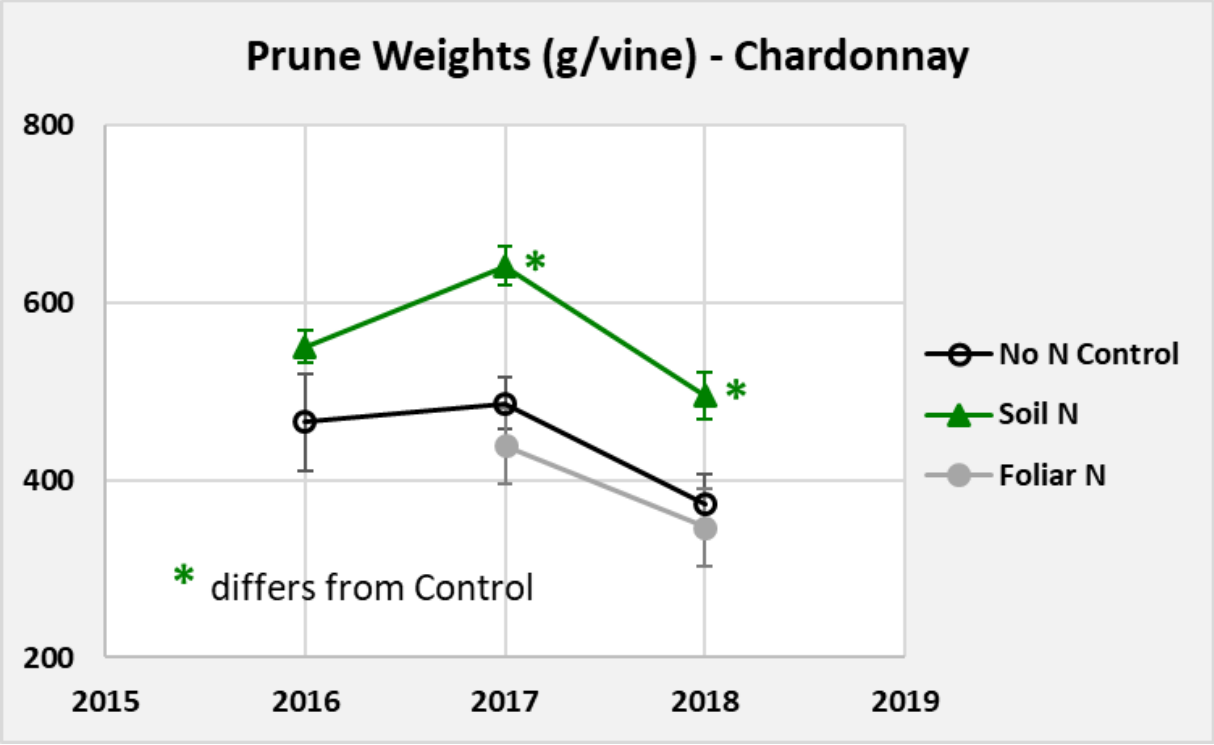




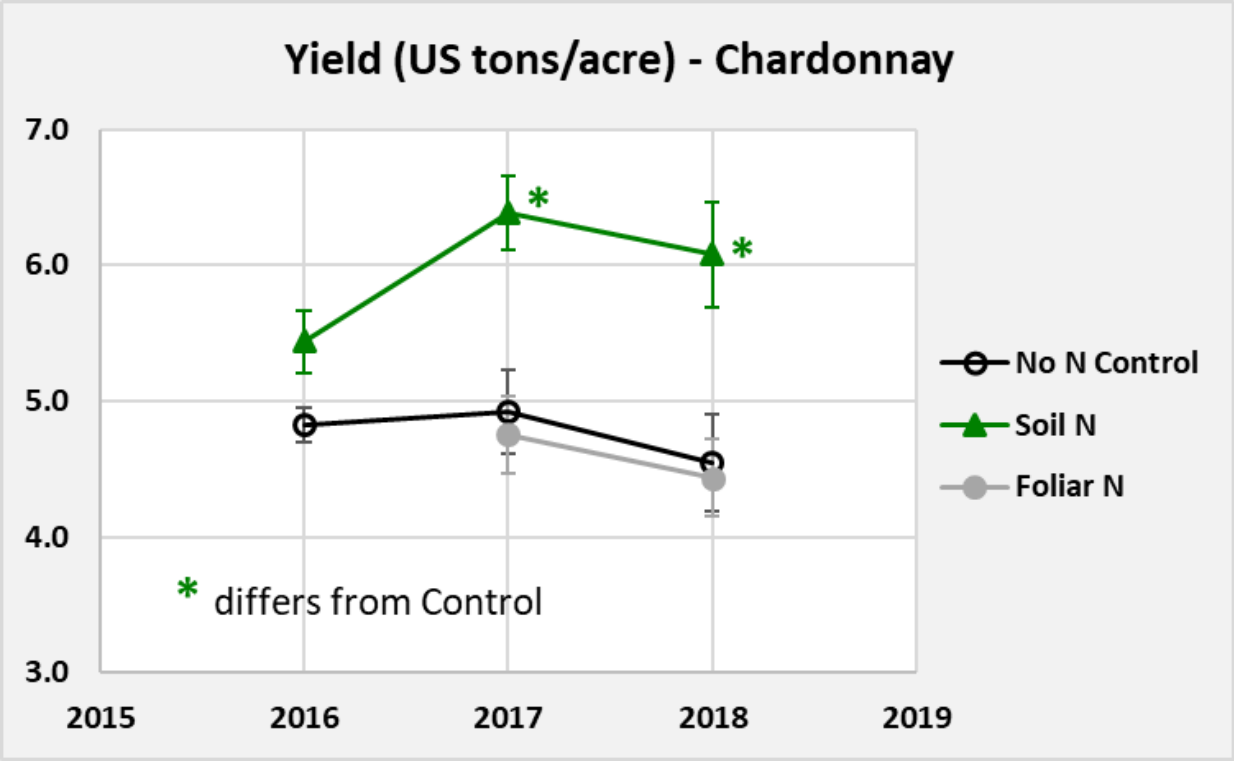
Petiole N - Responded the same as Leaf Blade N

Effect of N Treatments on Vegetative Growth





Effect of N Treatments on Yield Parameters



Cluster Weights - Chardonnay

Year	Control	+ Soil N	+ Foliar N
2016	107	110	N.D.
2017	102 b	131 a	101 b
2018	109	132 *	109

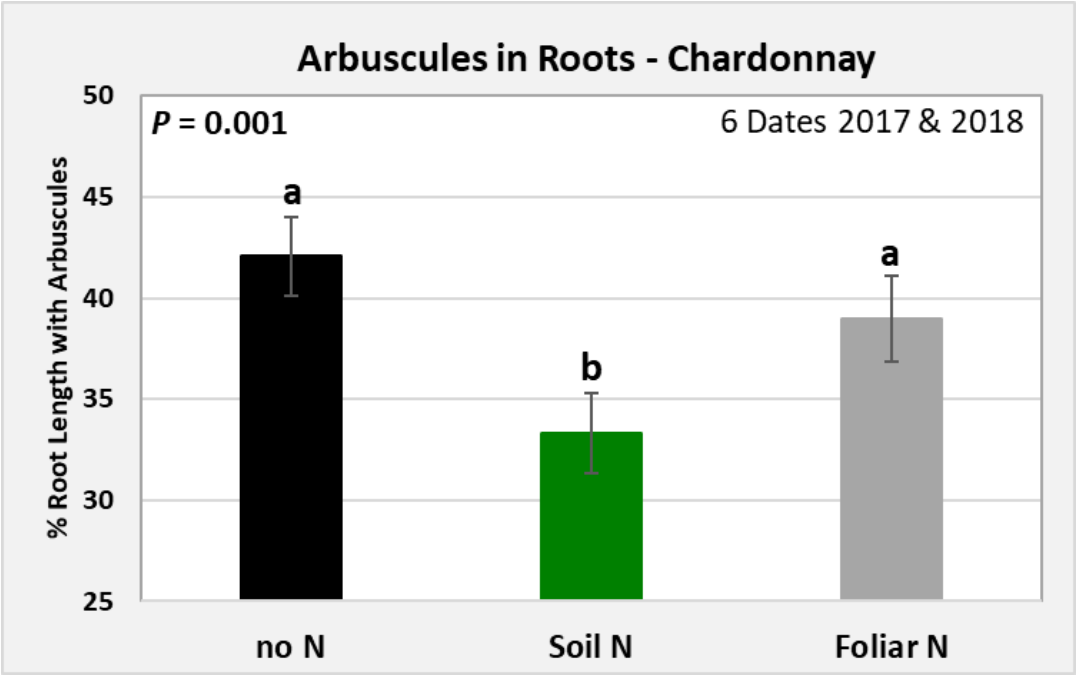
* *P* value = 0.071

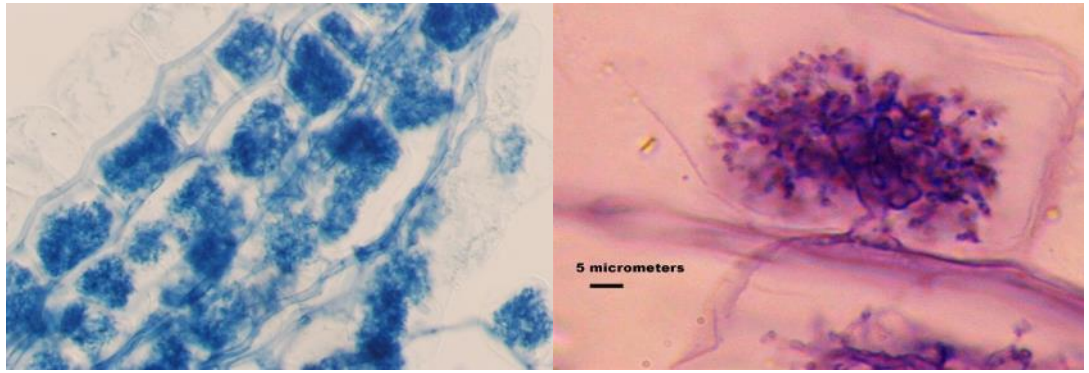
Other Reproductive Parameters were <u>not</u> Significantly Altered by N:

1) Fruitfulness 2) Cluster # per vine 3) Average Berry Weight

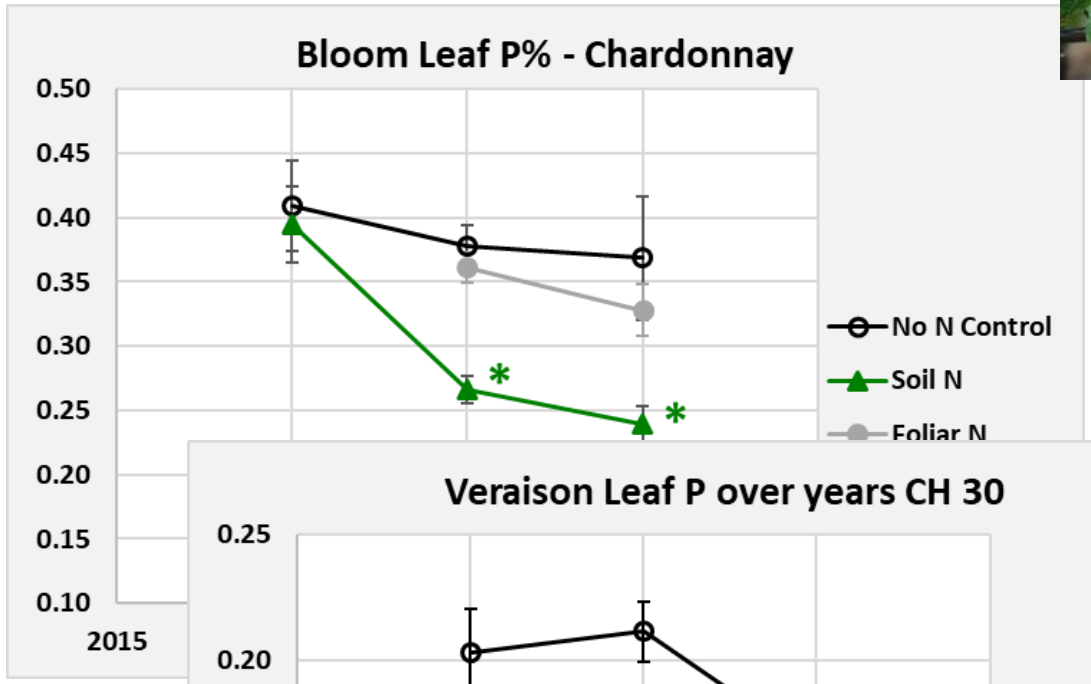
Other Impacts of Vineyard N

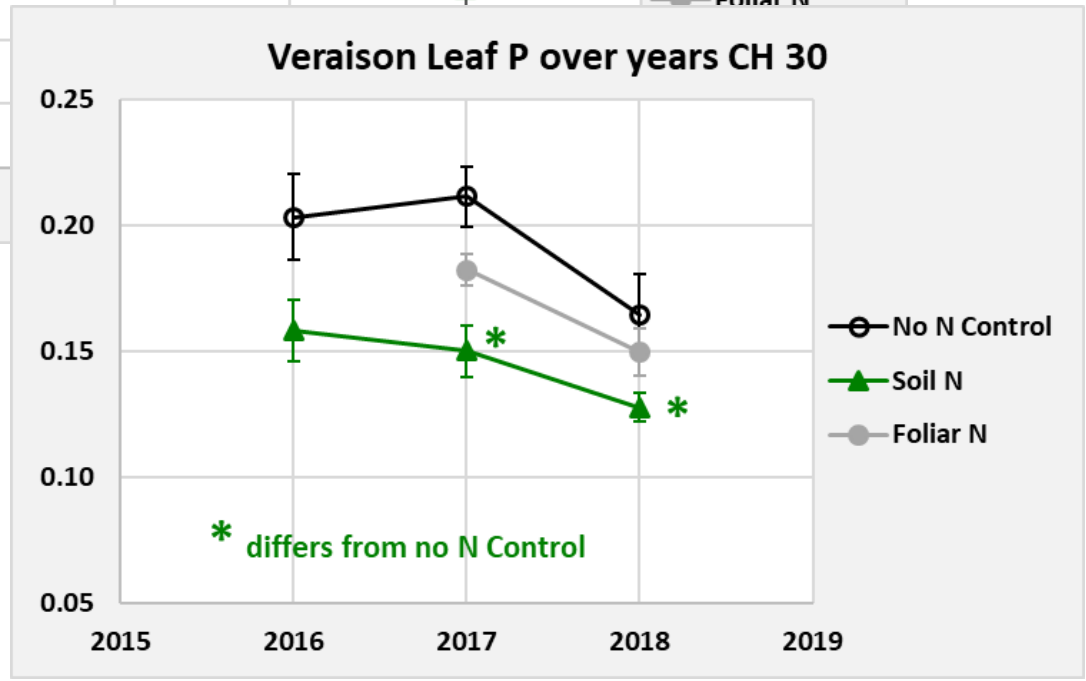
Soil N reduced AMF in roots





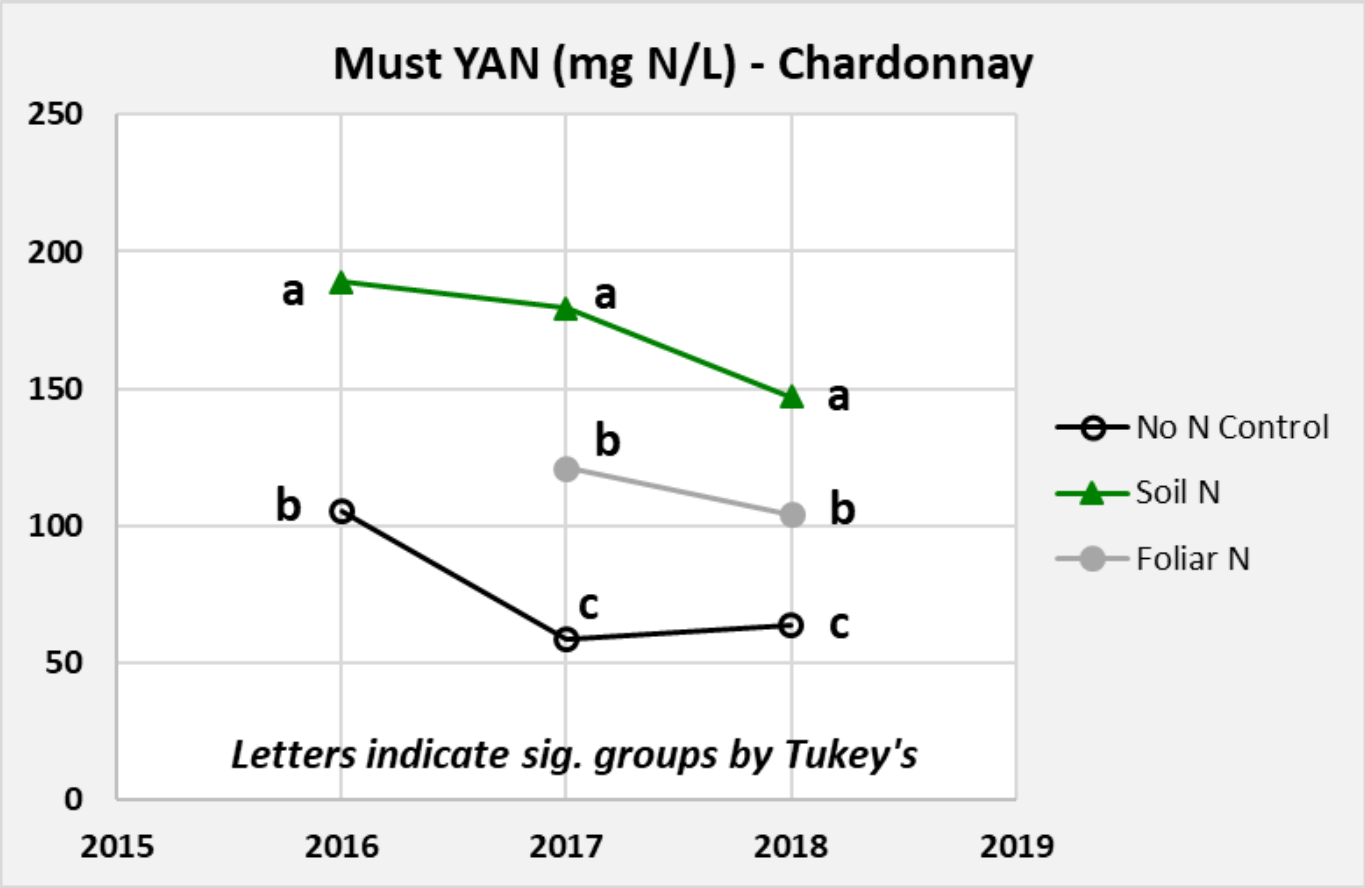
Lower AMF = Lower P Uptake





Dilution Effect due to larger canopy? **NO** - Veraison LA up by 16% -- Veraison leaf P down by 32%

Must YAN Levels - Chardonnay



Other Must Measures <u>not</u> Altered by N:

1) Brix 2) pH 3) Titratable Acids

Summary: Vineyard N Additions - Chardonnay

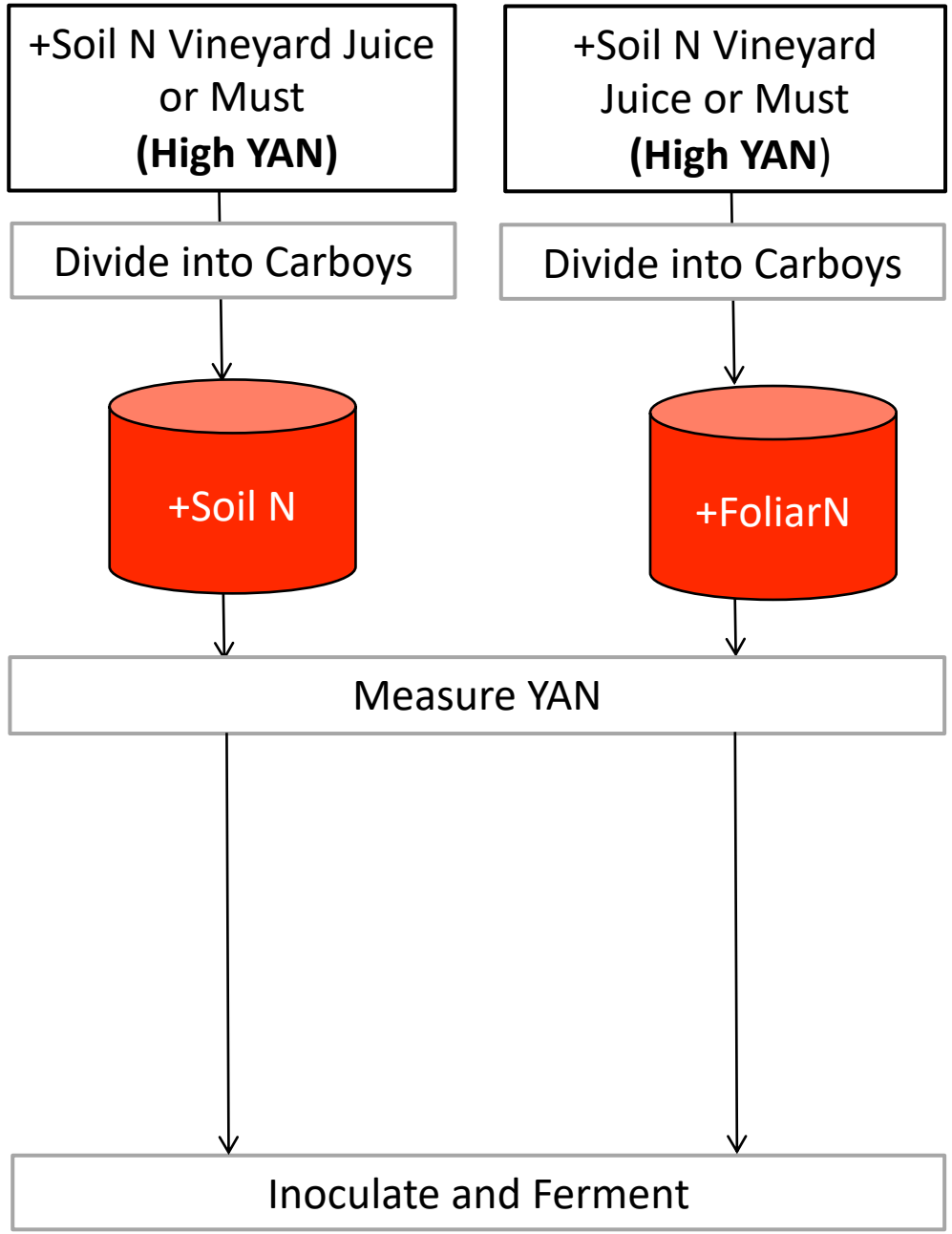
- Soil N Increased Vine N Status in all years & Improved Vine Growth & Yield in year 2 & 3.
- Foliar N did not alter Vine N status, Growth or Yield.
- Soil N Boosted must YAN better than Foliar N.

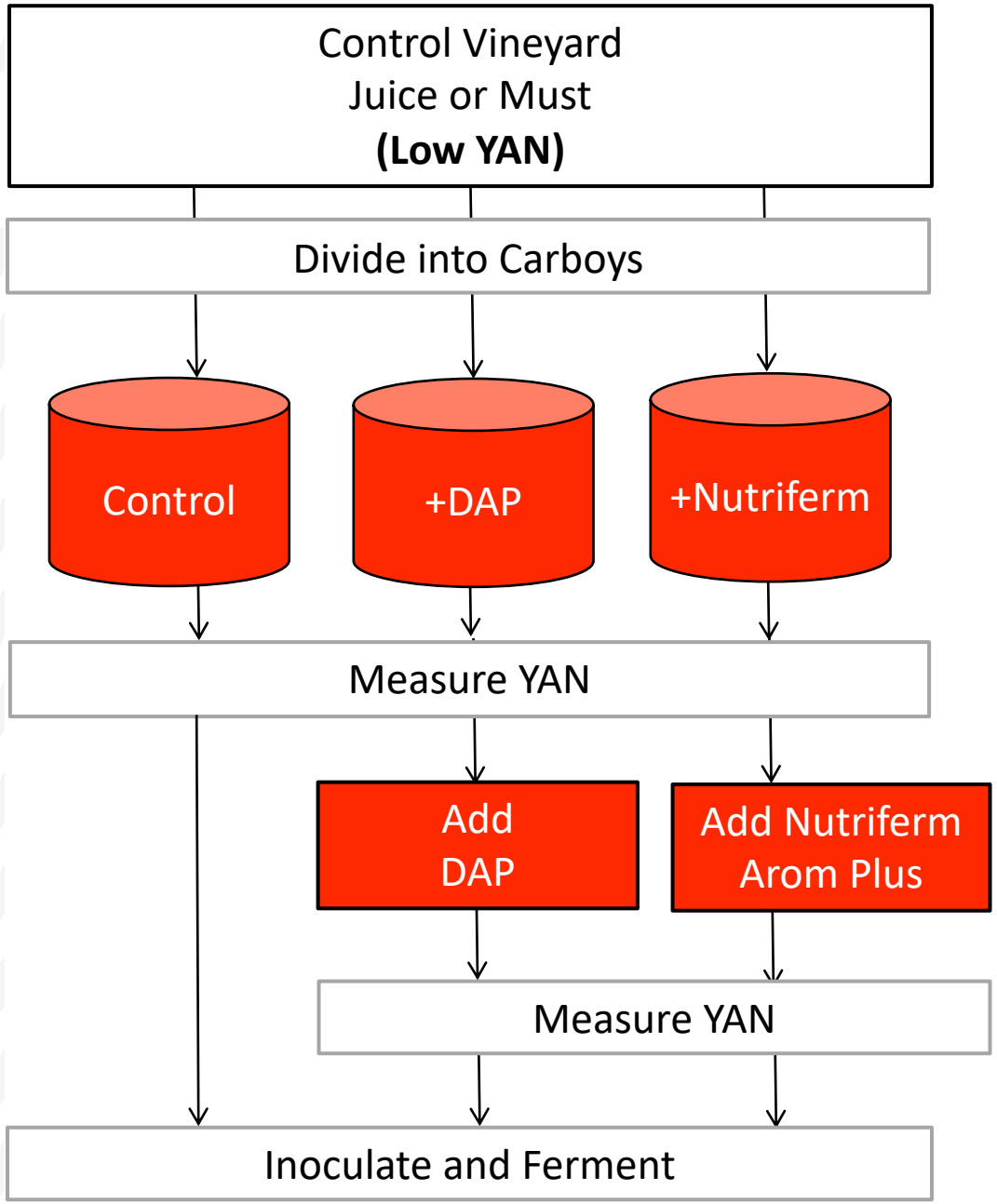
?

Will changes to nitrogen source and concentration impact fermentation and wine quality attributes?

+Soil N

+Foliar N





Control = No Vineyard or Winery Nitrogen Added

Control + DAP

Control + NutriFerm

YAN (mg N/L): Chardonnay Juice

Year	Control	+Soil N	+Foliar N	+DAP	+NutriFerm
2016	**99 c**	189 a	-	191 a	162 b
2017	**59 c**	179 a	121 b	166 a	123 b
2018	**64 c**	147 a	103 b	150 a	111 b

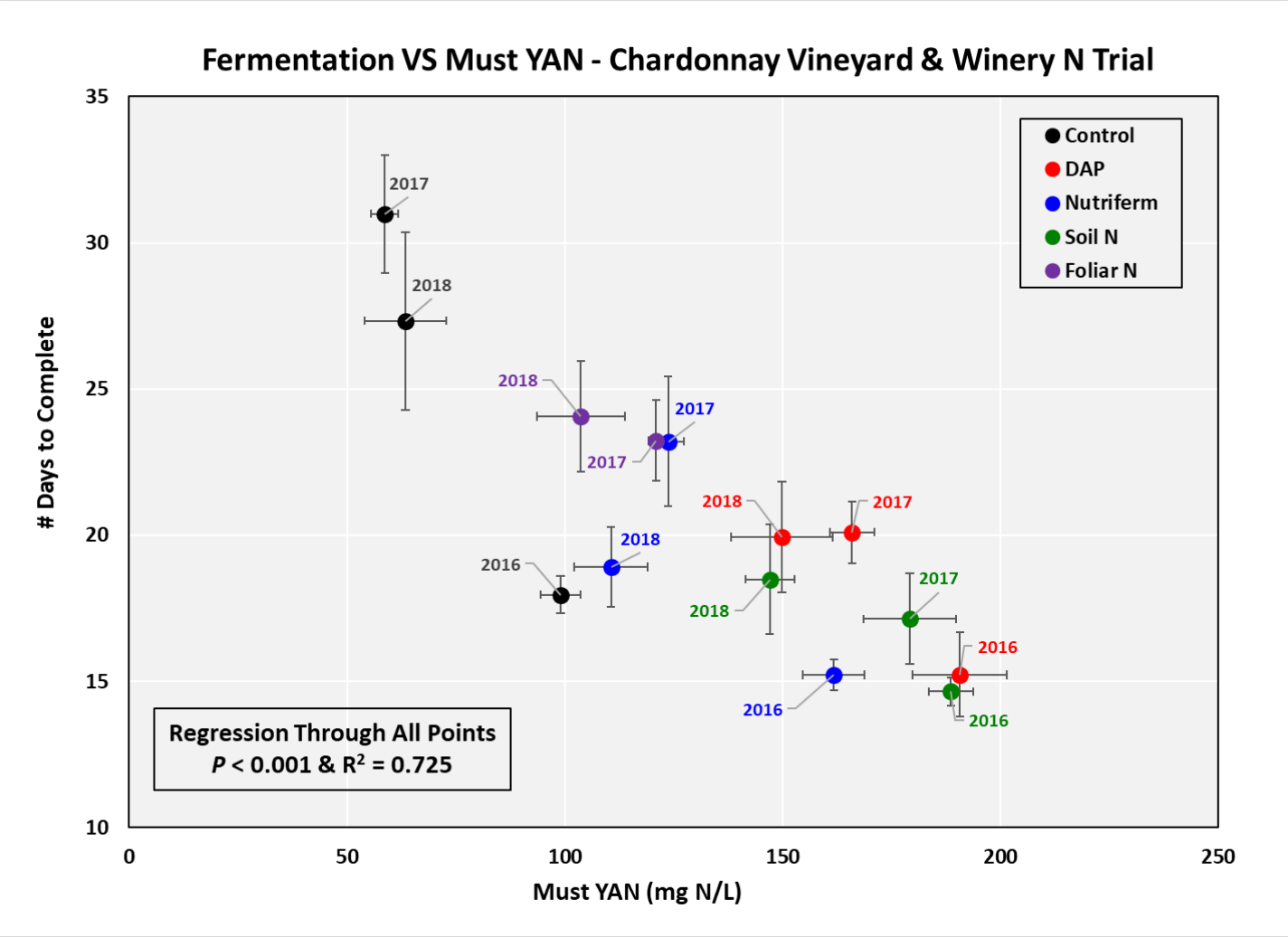
Winemaking

	Chardonnay
Fermentation Temperature	15°C
Yeast Strain	D47
MLF	No
Aging time before sensory	6 months

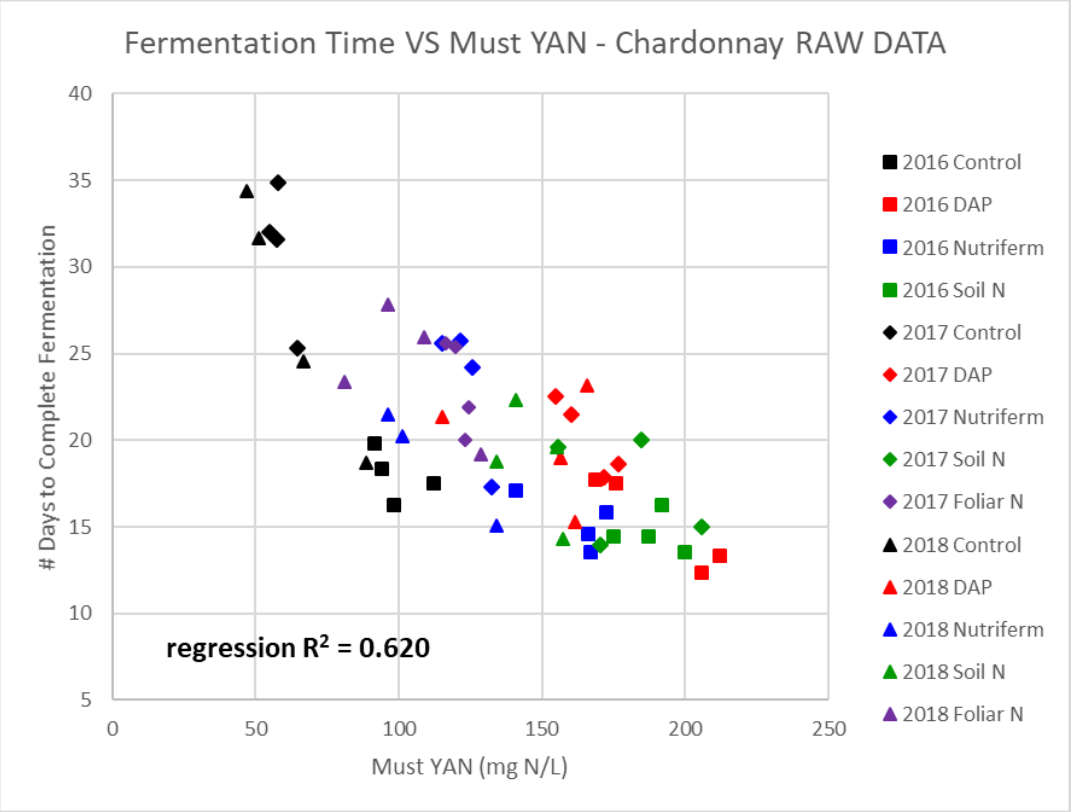
All wines had free SO_2 boosted to 30ppm and were sterile filtered prior to bottling. Wines aged at 13°C until sensory

Relationship between Fermentation Time and YAN

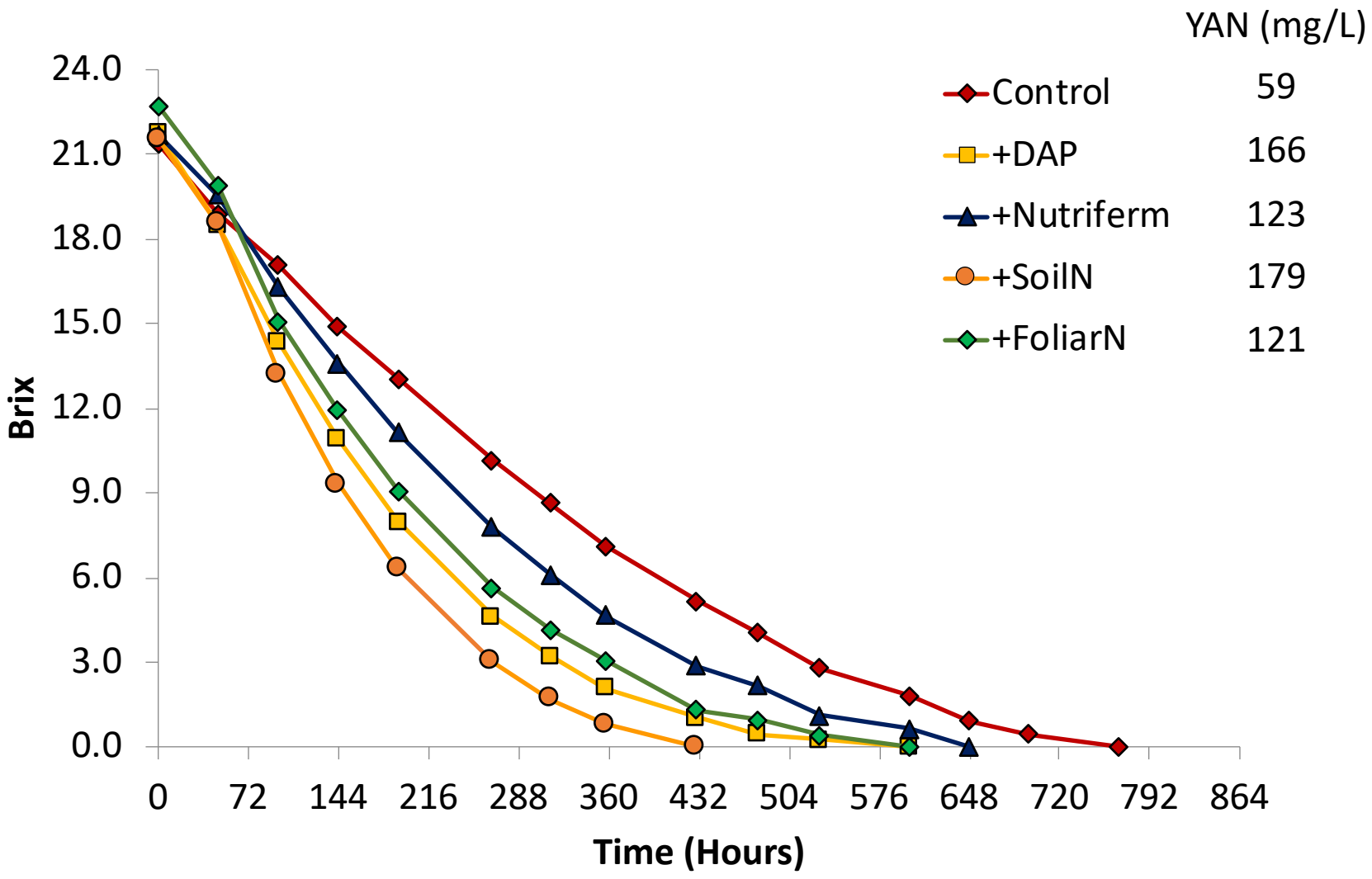
Means



All Reps



2017 Chardonnay Fermentations



Take Home….

- YAN was effectively raised in the *vineyard and the winery* promoting *successful fermentation* of Chardonnay
- YAN concentration impacted fermentation kinetics

How do the different nitrogen supplements modify YAN composition?

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Amino Acid Profiles: Chardonnay

- **Soil N**
  - Increased the concentration of the most individual amino acids in each year
  - Significantly increased the concentration of alanine, arginine, glutamine, and serine compared to the control in every year

- **+Nutriferm**
  - Increased the concentration of threonine compared to the control in every year

Do different nitrogen supplements impact wine sensory attributes?

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Chardonnay YAN Tasting

Only evaluate the Chardonnay wines

1

2

3

4

Chardonnay YAN Tasting

Only evaluate the Chardonnay wines

Nutriferm

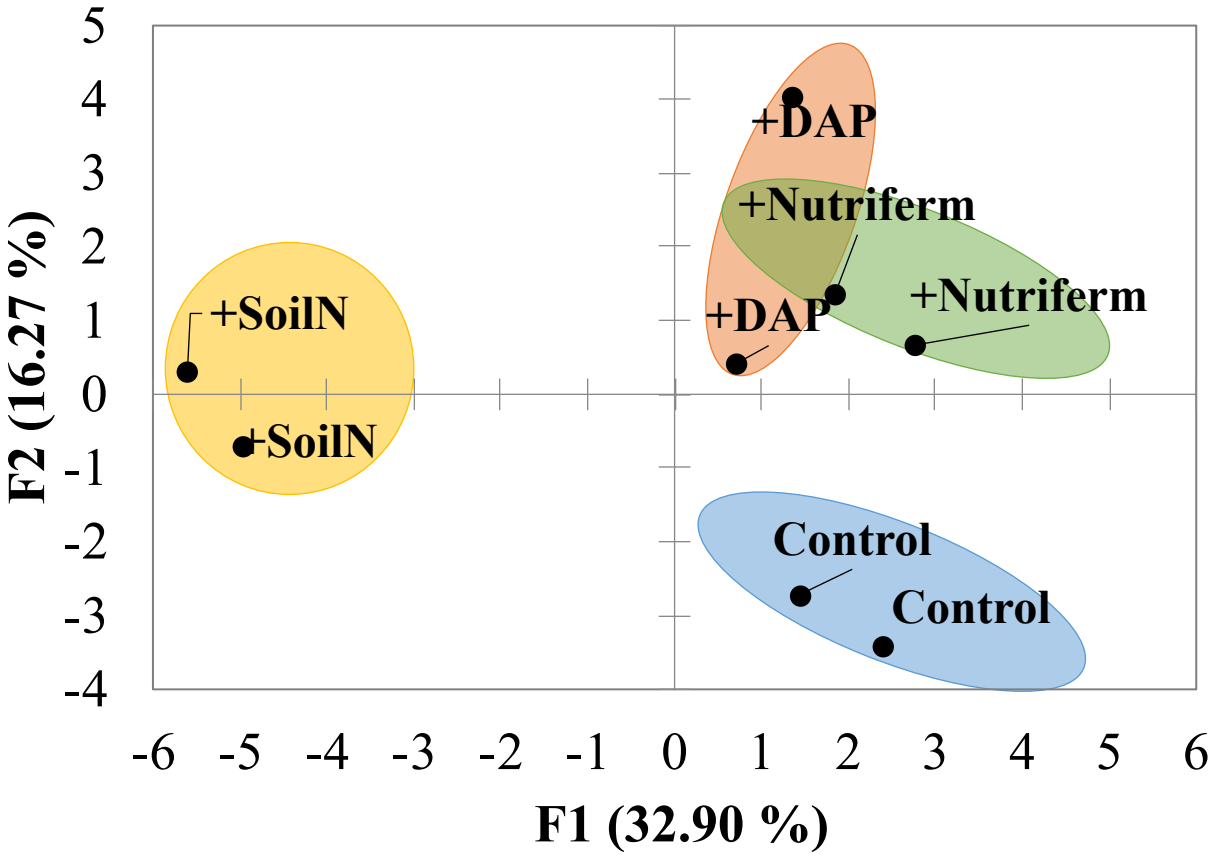
Soil N

Control

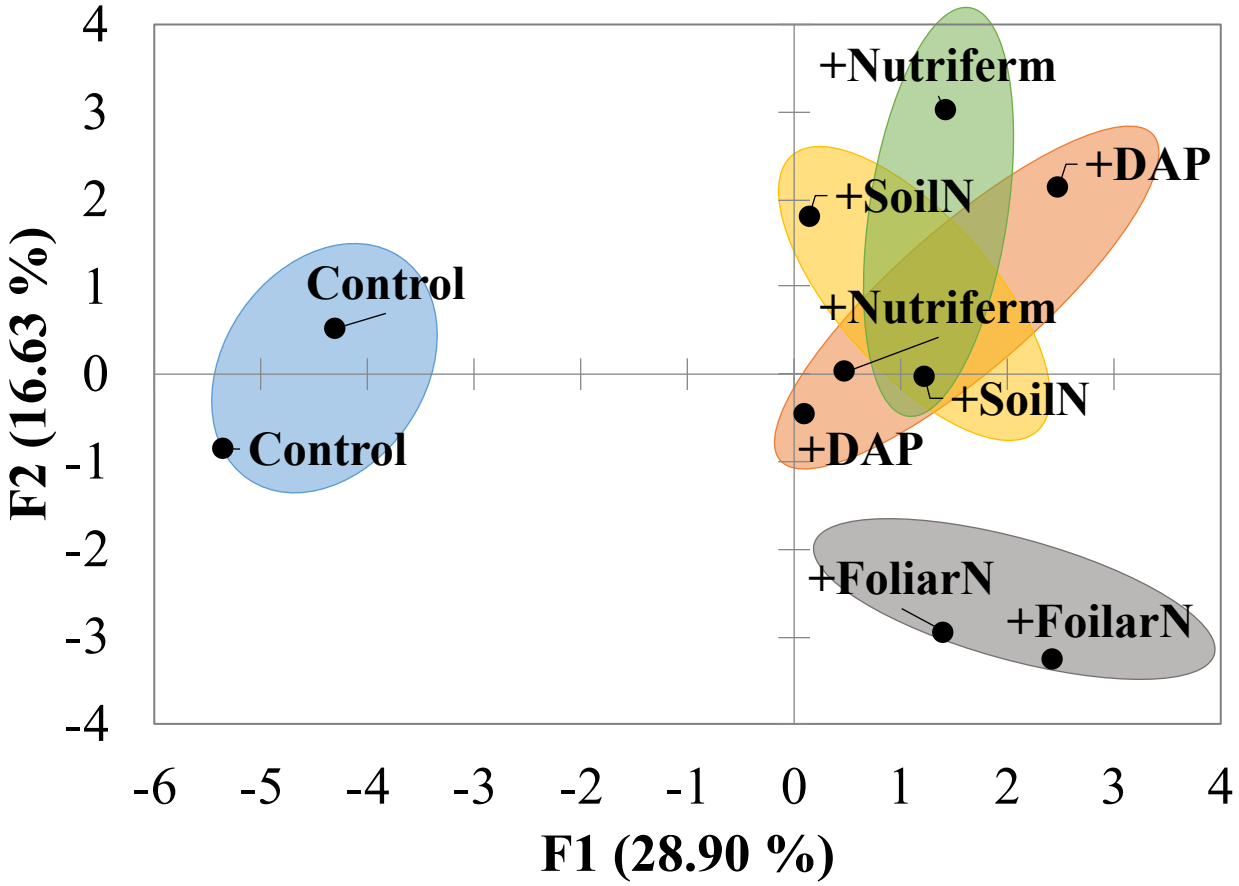
DAP

Aroma: Chardonnay

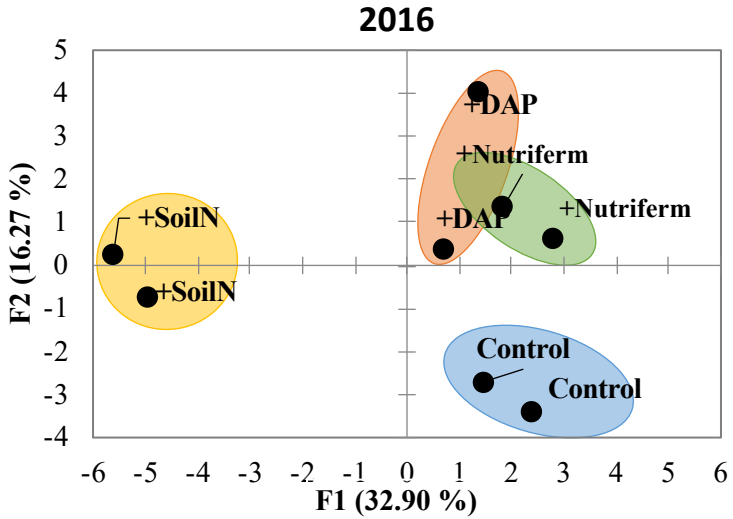
2016

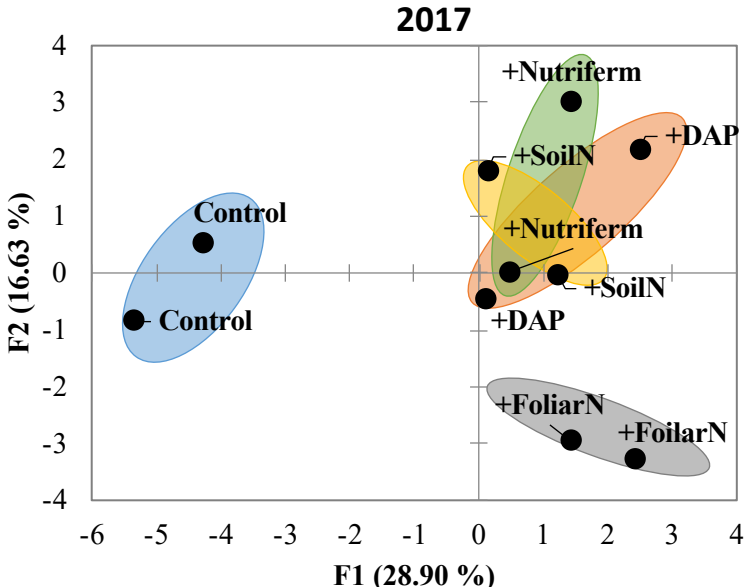


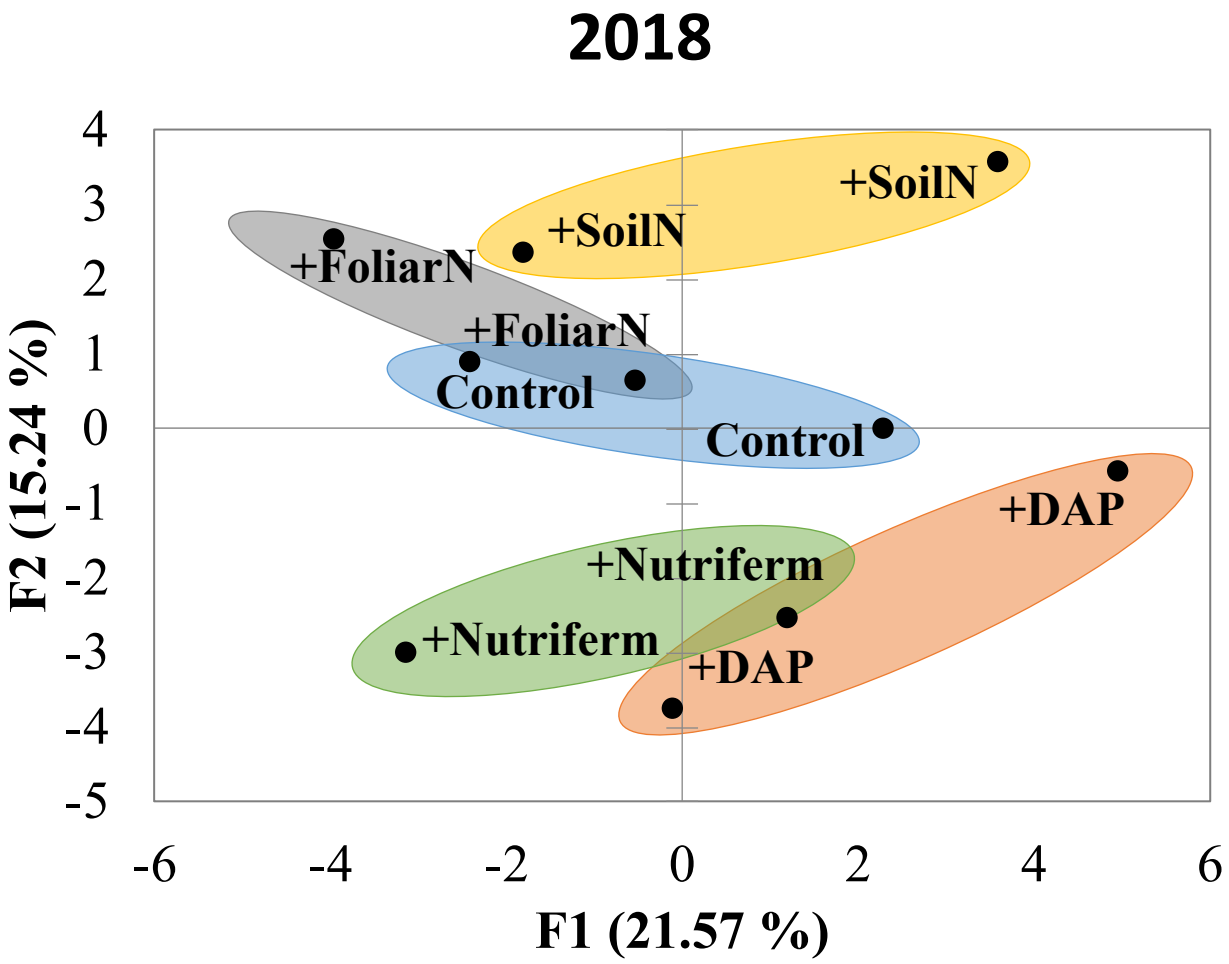
2017



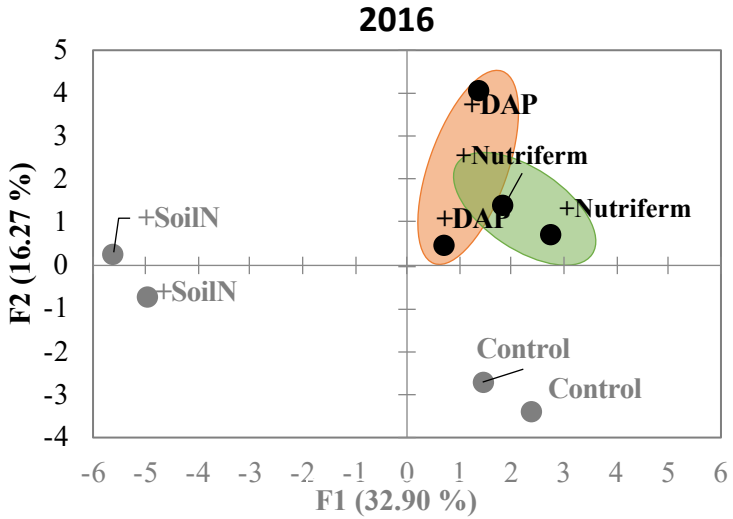
Aroma: Chardonnay

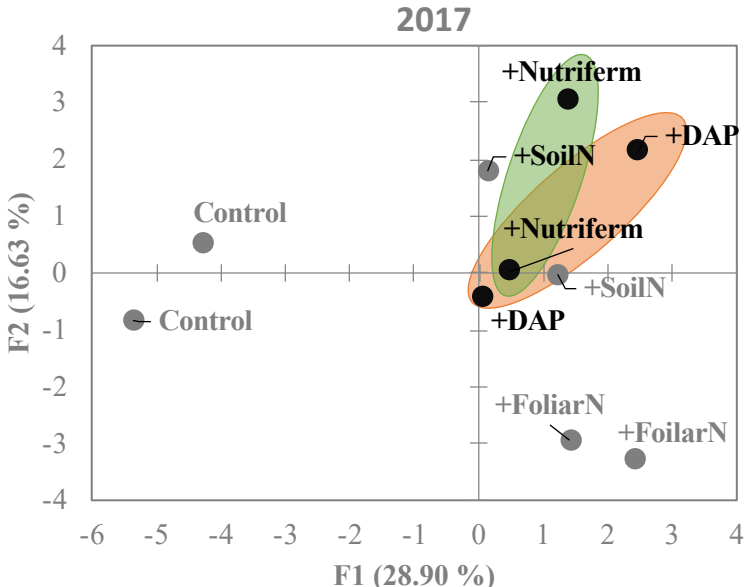


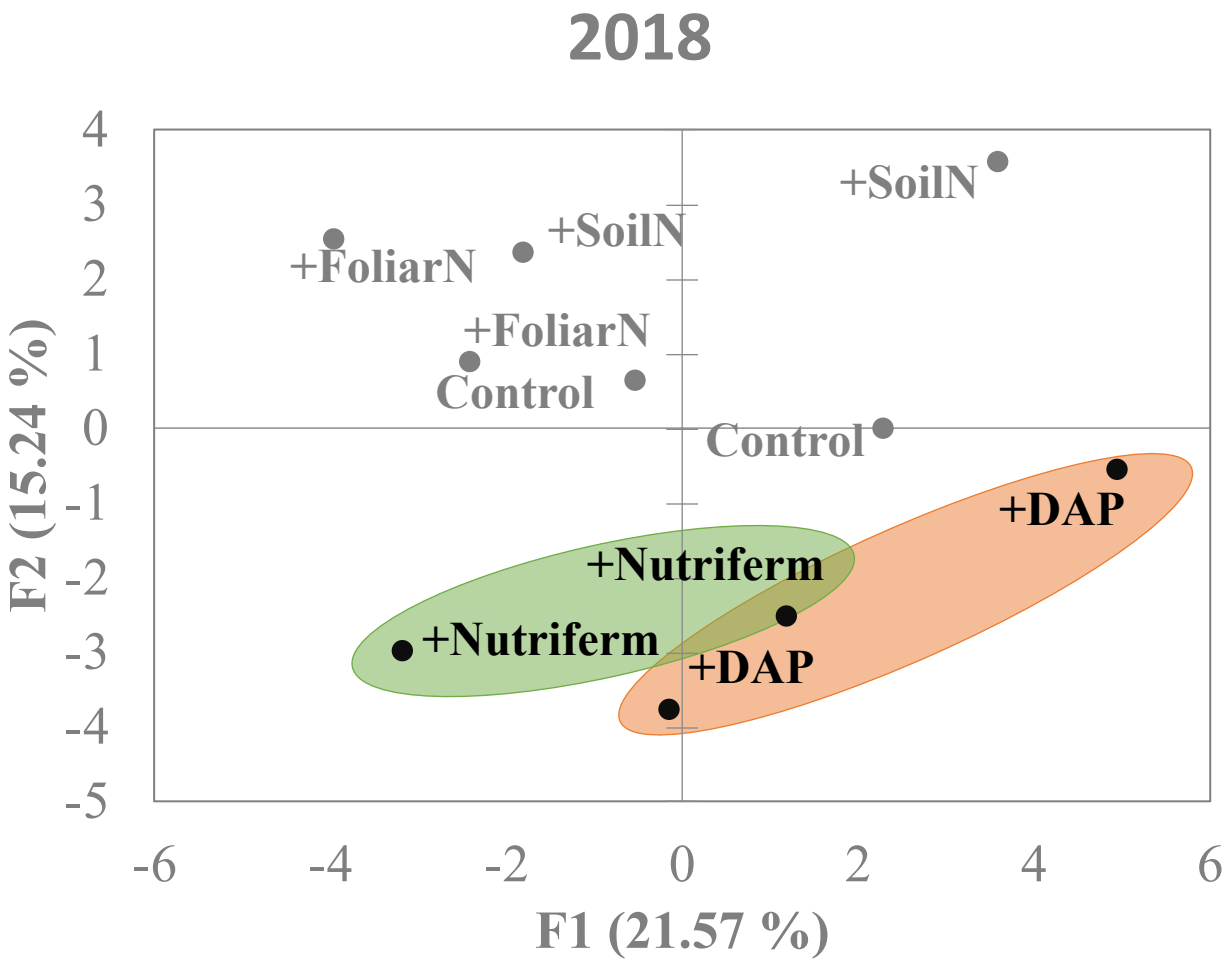




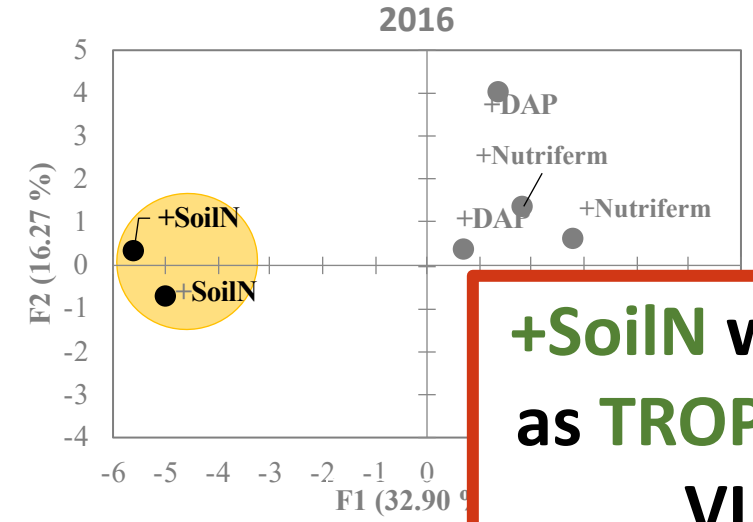
Aroma: Chardonnay



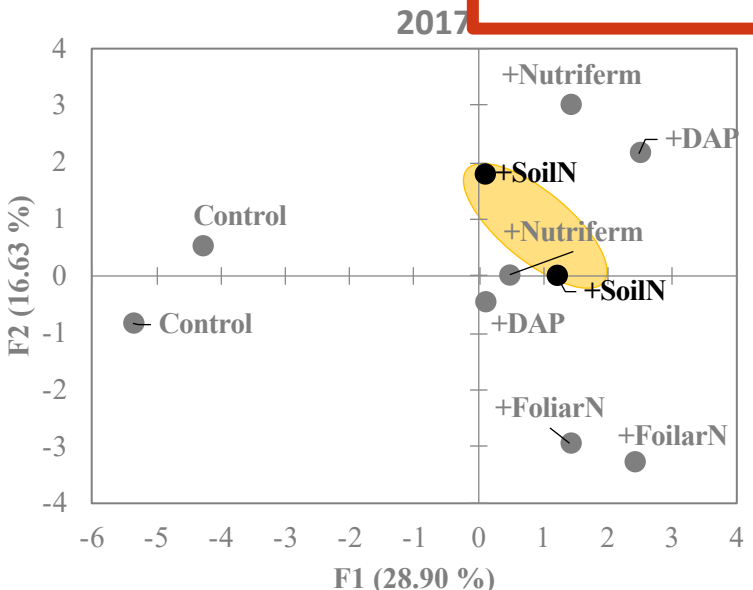


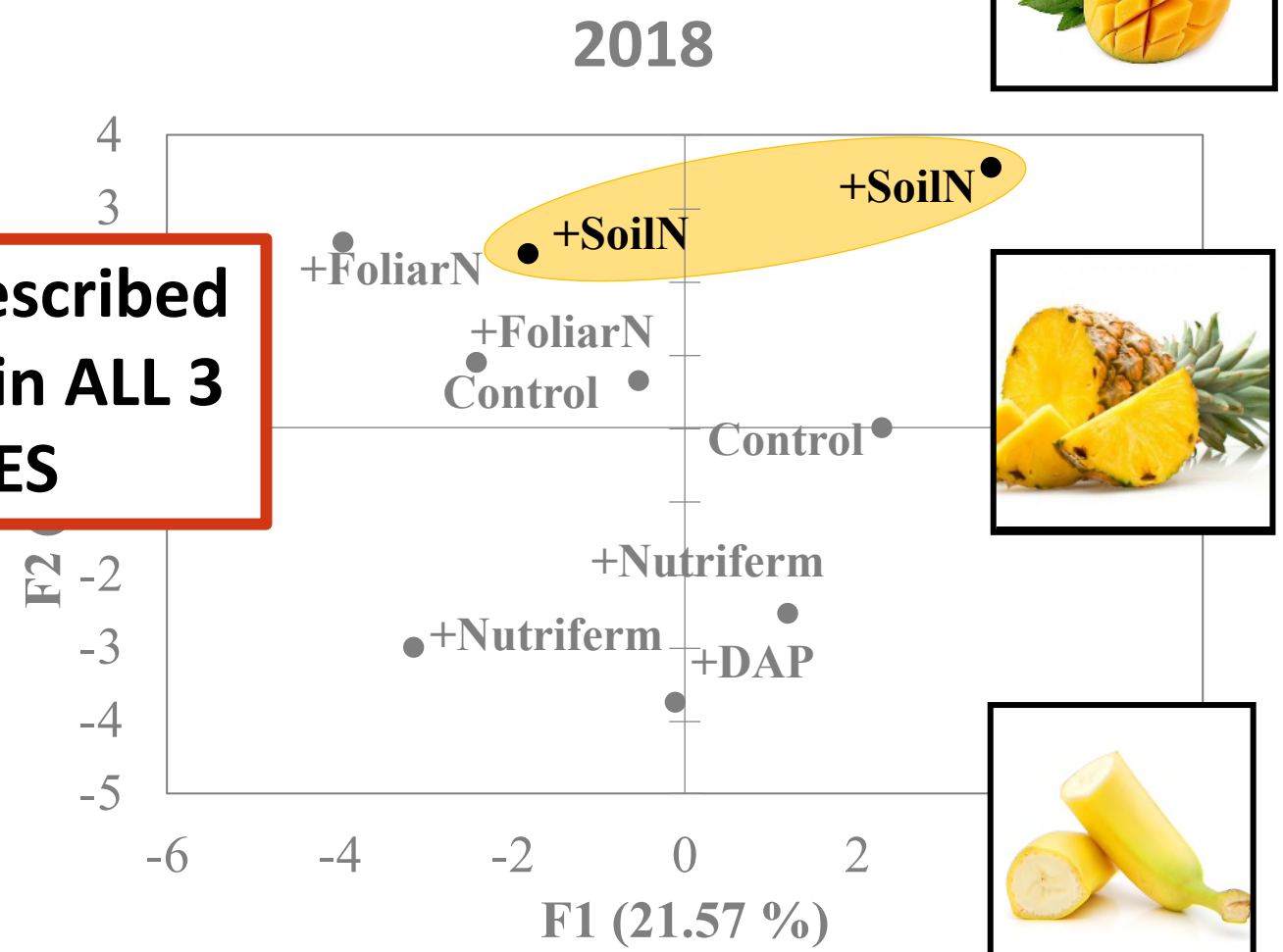


Aroma: Chardonnay



+SoilN was described as TROPICAL in ALL 3 VINTAGES





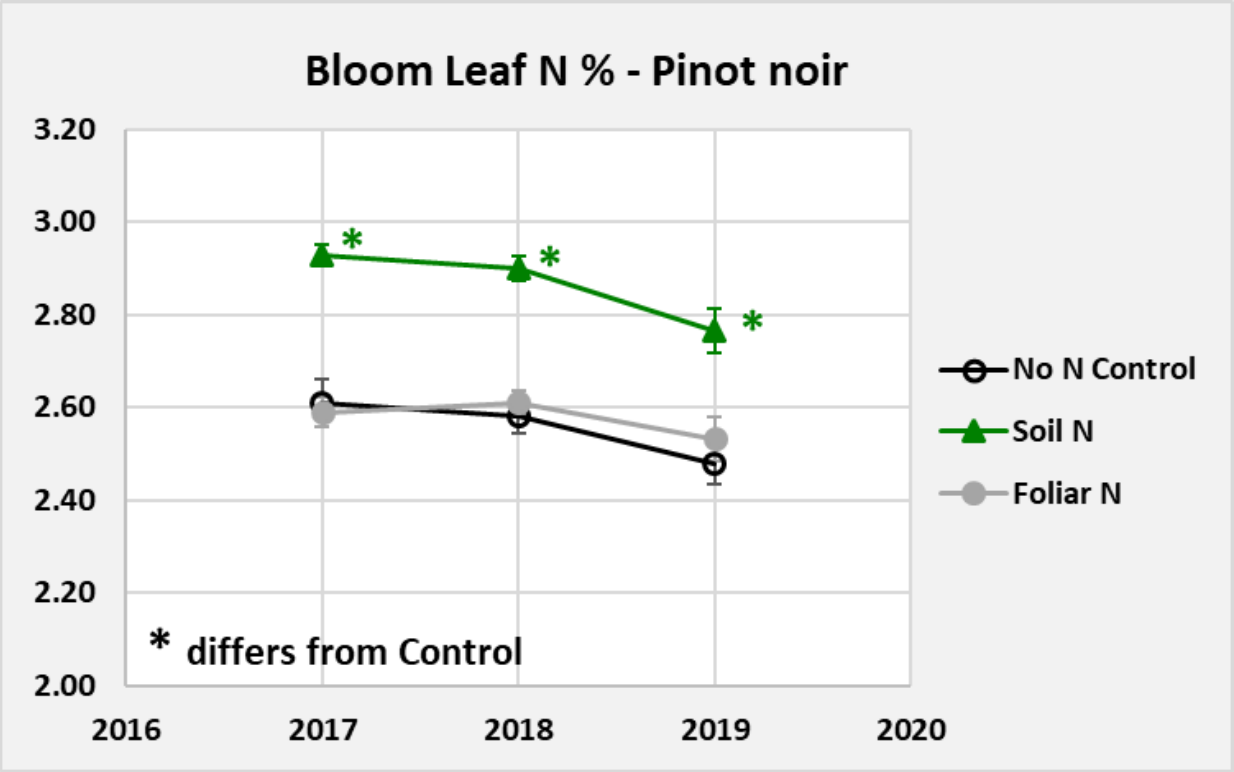
Take Home….

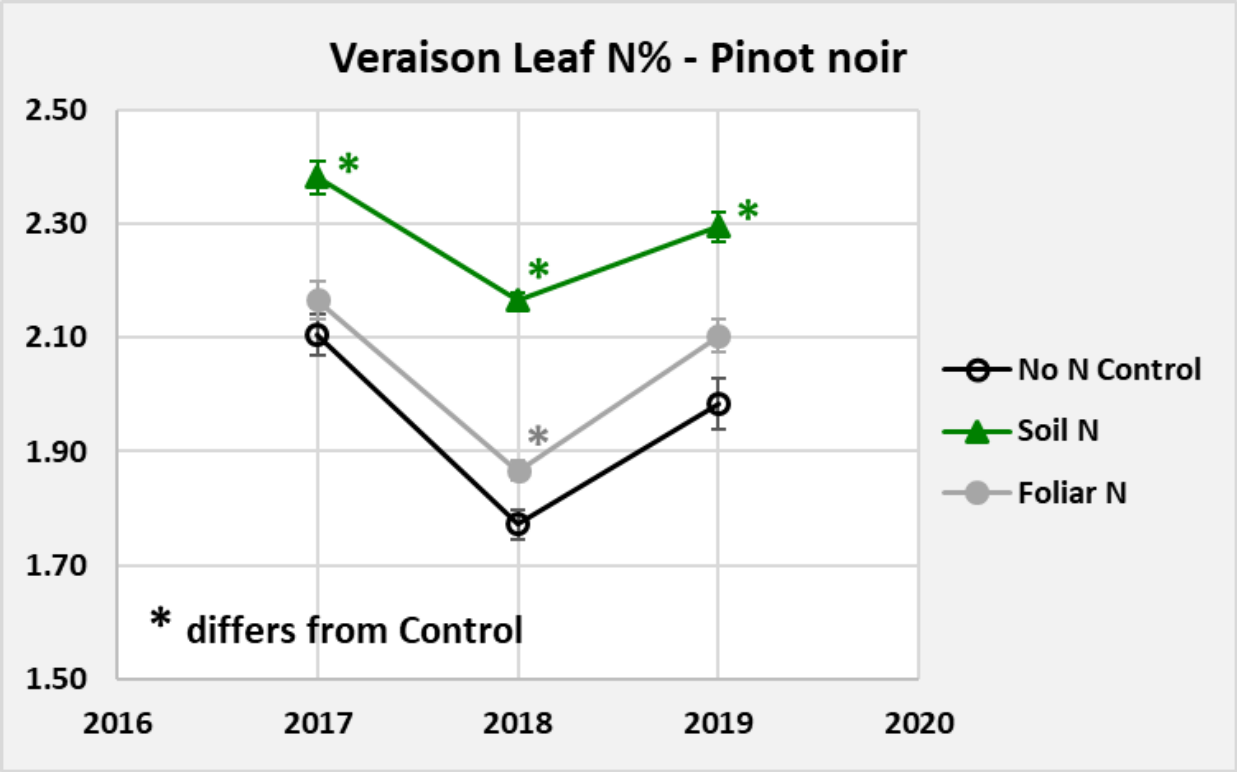
- *Source of nitrogen* impacted Chardonnay aromatic sensory properties
- Soil nitrogen consistently resulted in “tropical” aromas.

Viticulture Results - Pinot noir

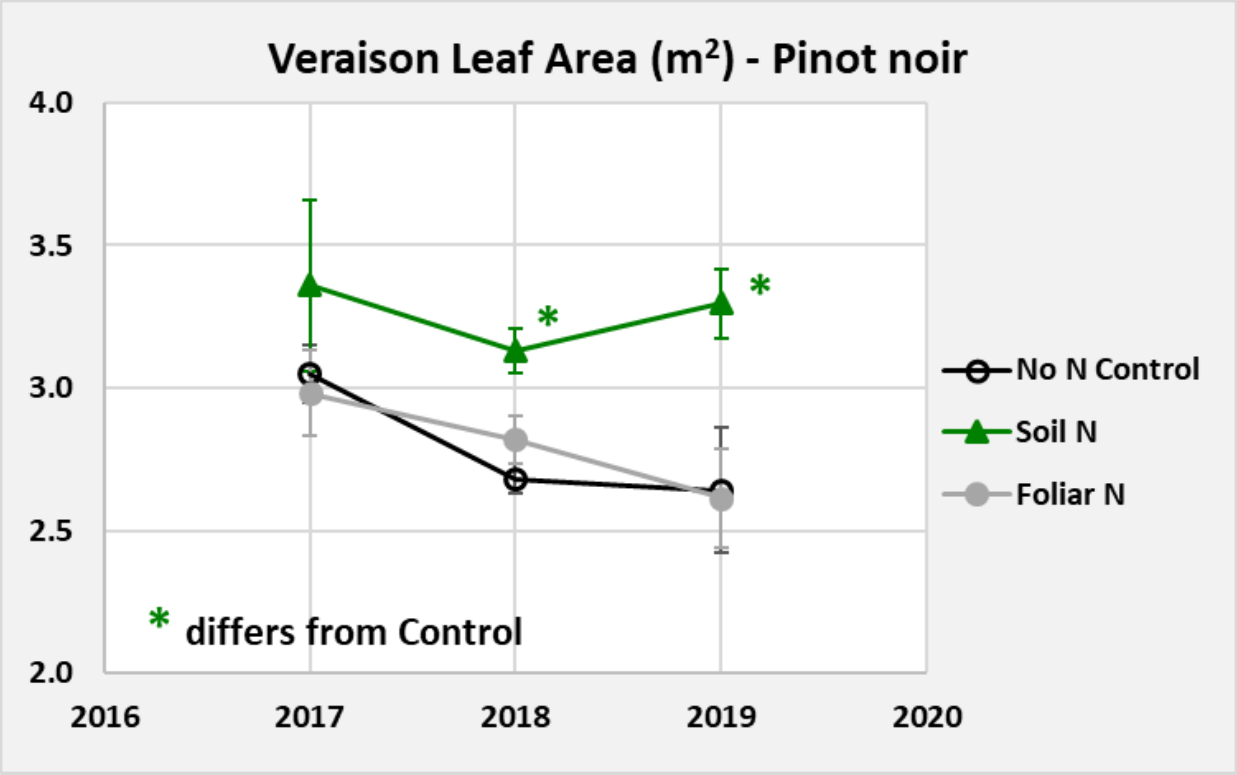
Soil N in Pinot noir - **60** pounds/acre N in 2017, **40** pounds in 2018 & 2019

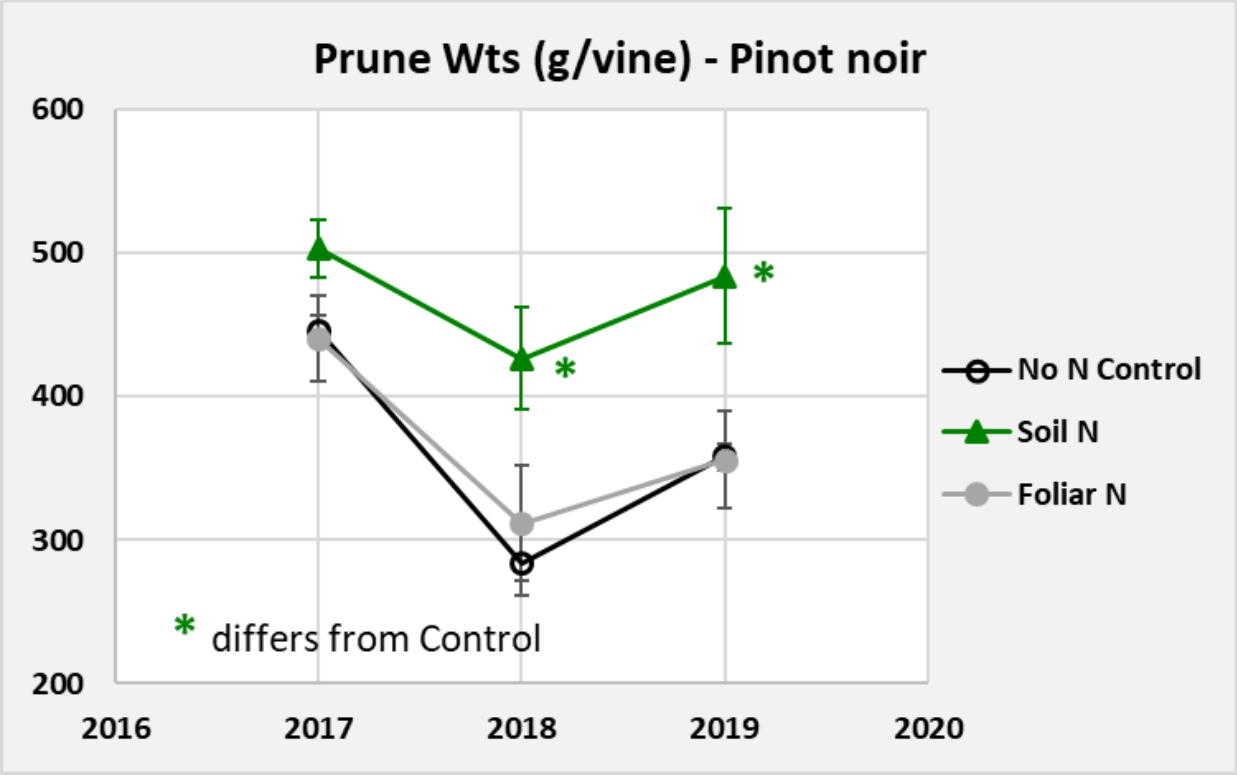
Effect of N Treatments on Vine N Status



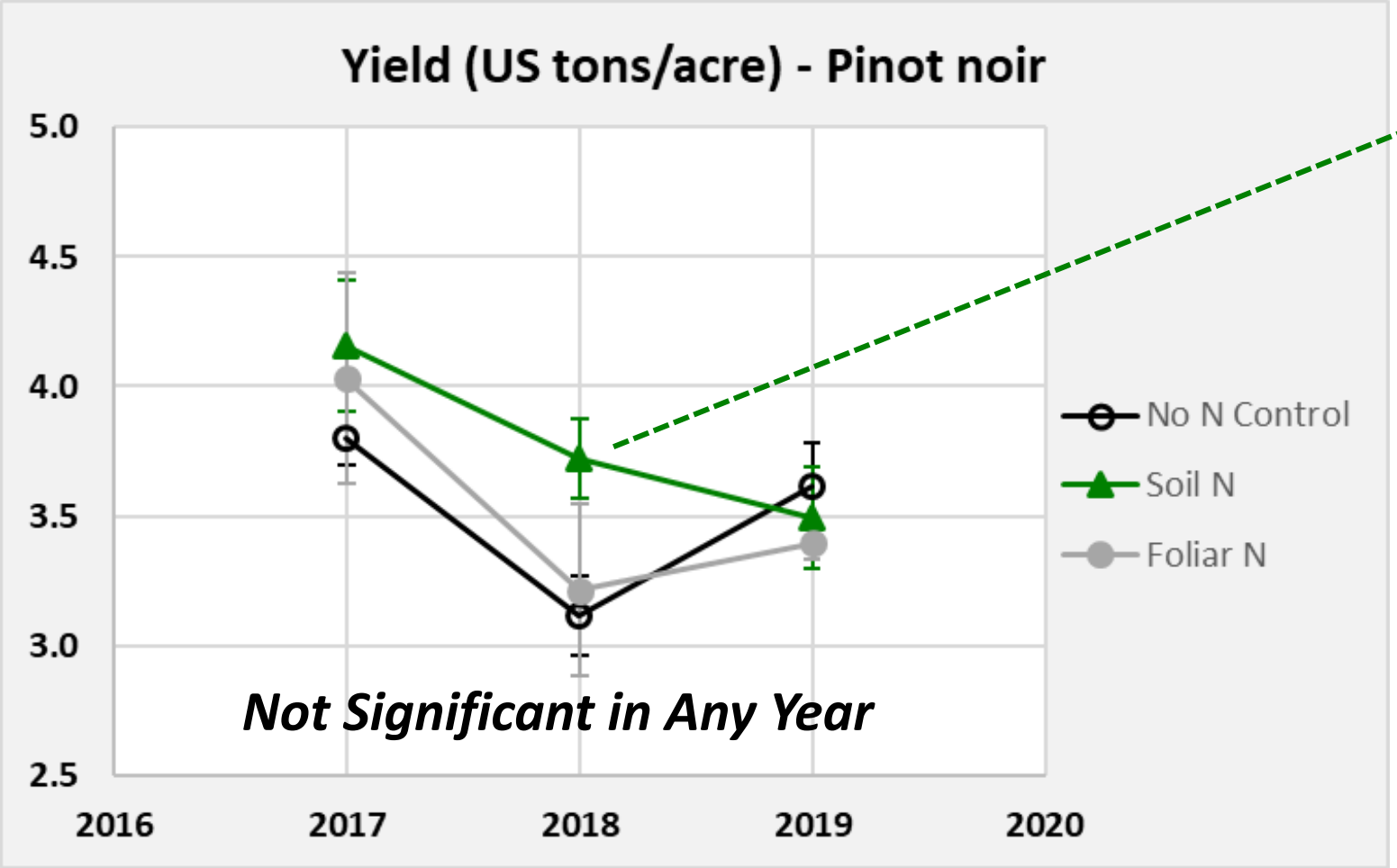


Effect of N Treatments on Vegetative Growth





Effect of N Treatments on Yield Parameters



Cluster Weights sig. in 2018

Soil N = 114 a

Control = 102 b

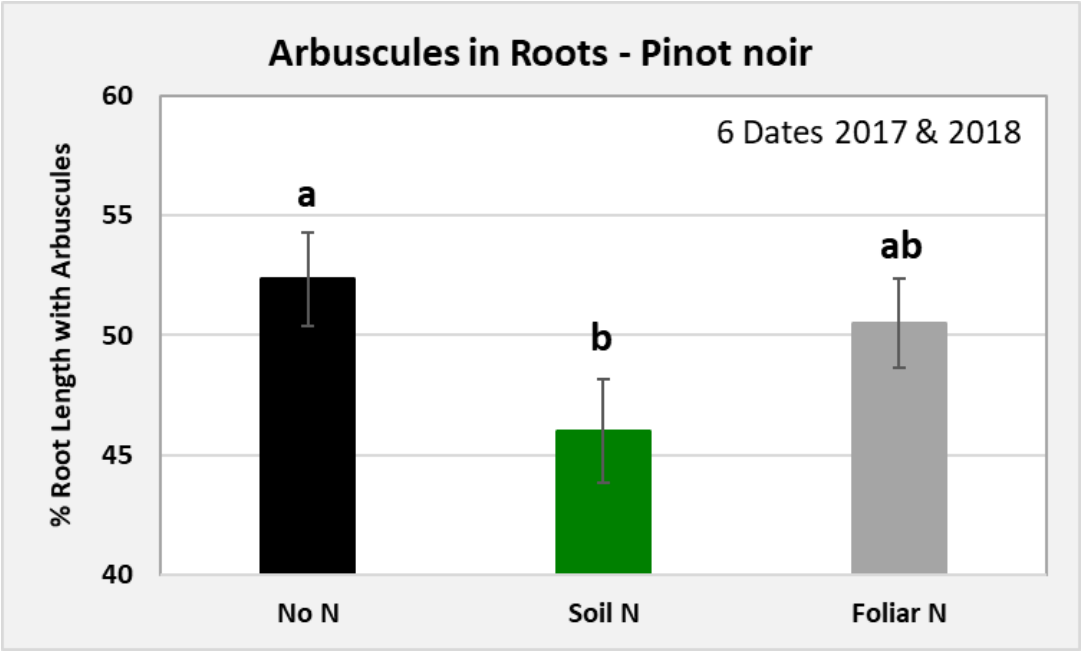
Foliar N = 101 b

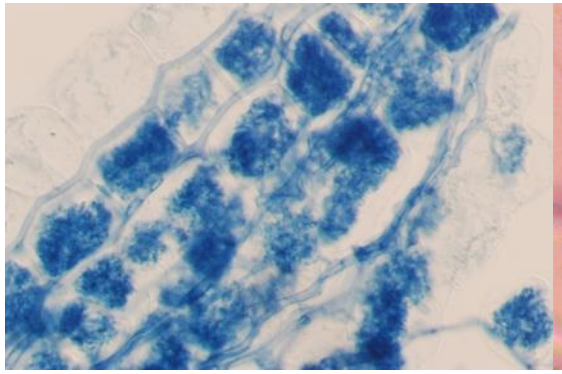
Other Reproductive Parameters were <u>not</u> Altered by N:

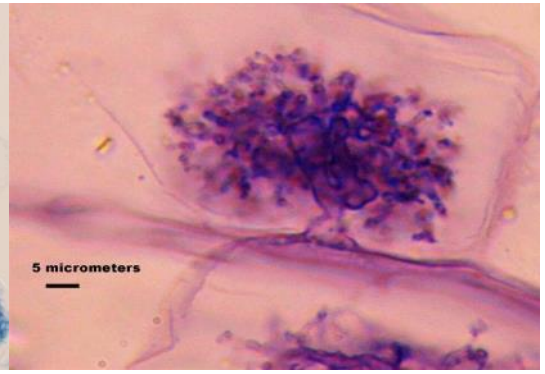
1) **Fruitfulness**
2) **Cluster # per vine**
3) **Ave. Berry Weight**

Other Impacts of Vineyard N

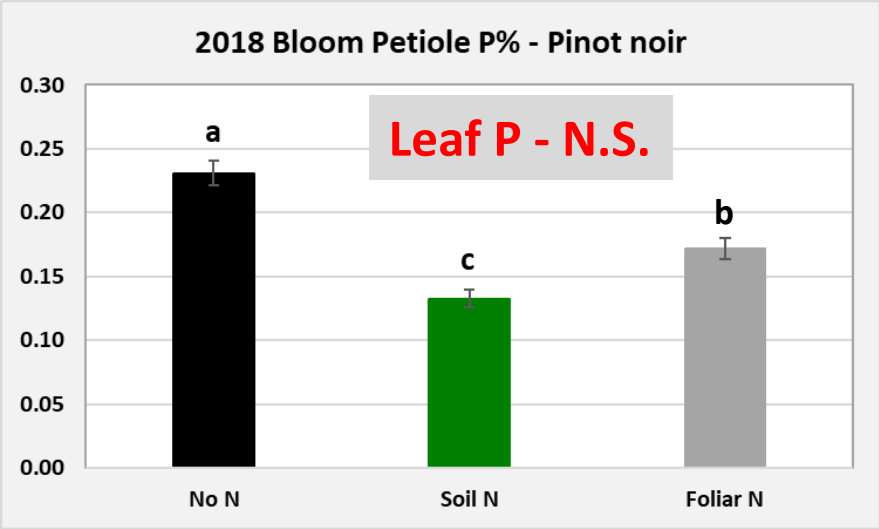
Soil N reduced AMF in roots

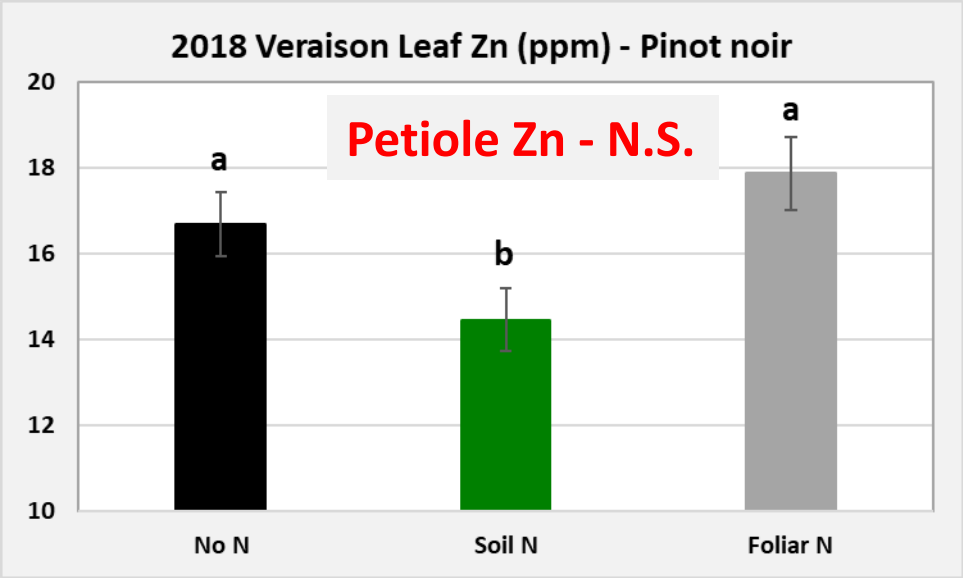




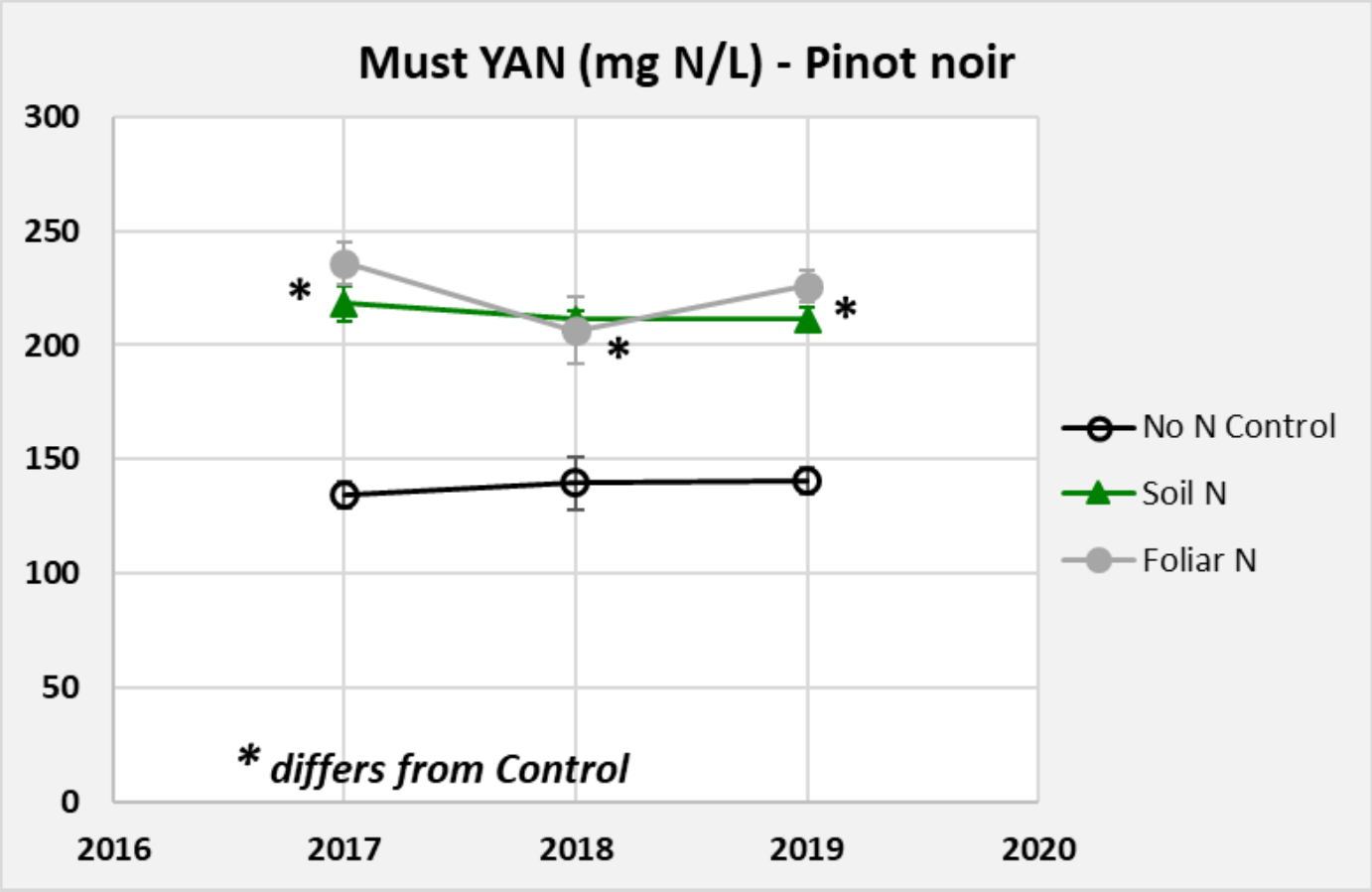


Smaller & Less Consistent Impact on Nutrients





Must YAN Levels - Pinot noir



Other Must Measures <u>not</u> Altered by N:

1) Brix 2) pH 3) Titratable Acids

Summary: Vineyard N Additions – Pinot noir

- Soil N Increased Vine N Status in all years & Improved Vine Growth in year 2 & 3.
- Soil N <u>did not</u> alter Yield.
- Foliar N did not alter Vine N status, Growth or Yield.
- Soil N & Foliar N Boosted must YAN equally.

YAN (mg N/L) : Pinot Noir Must

Year	Control	+Soil N	+Foliar N	+DAP	+NutriFerm
2016*	**176 b**	243 a	-	257 a	253 a
2017	**134 c**	218 ab	235 ab	244 a	206 b
2018	**140 b**	211 a	206 a	245 a	210 a

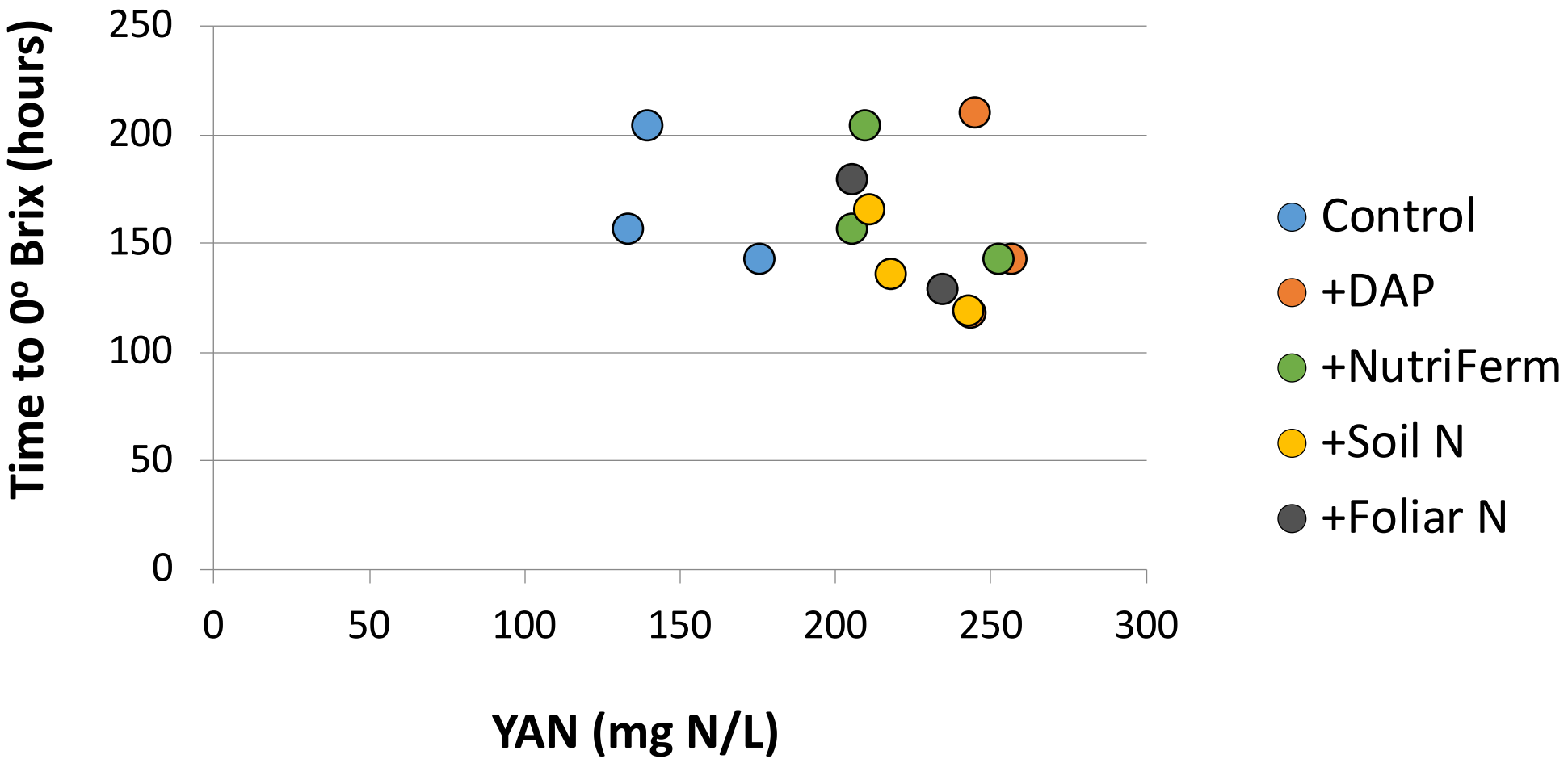
* Data from 2016 was from a separate Pinot noir vineyard block

Winemaking

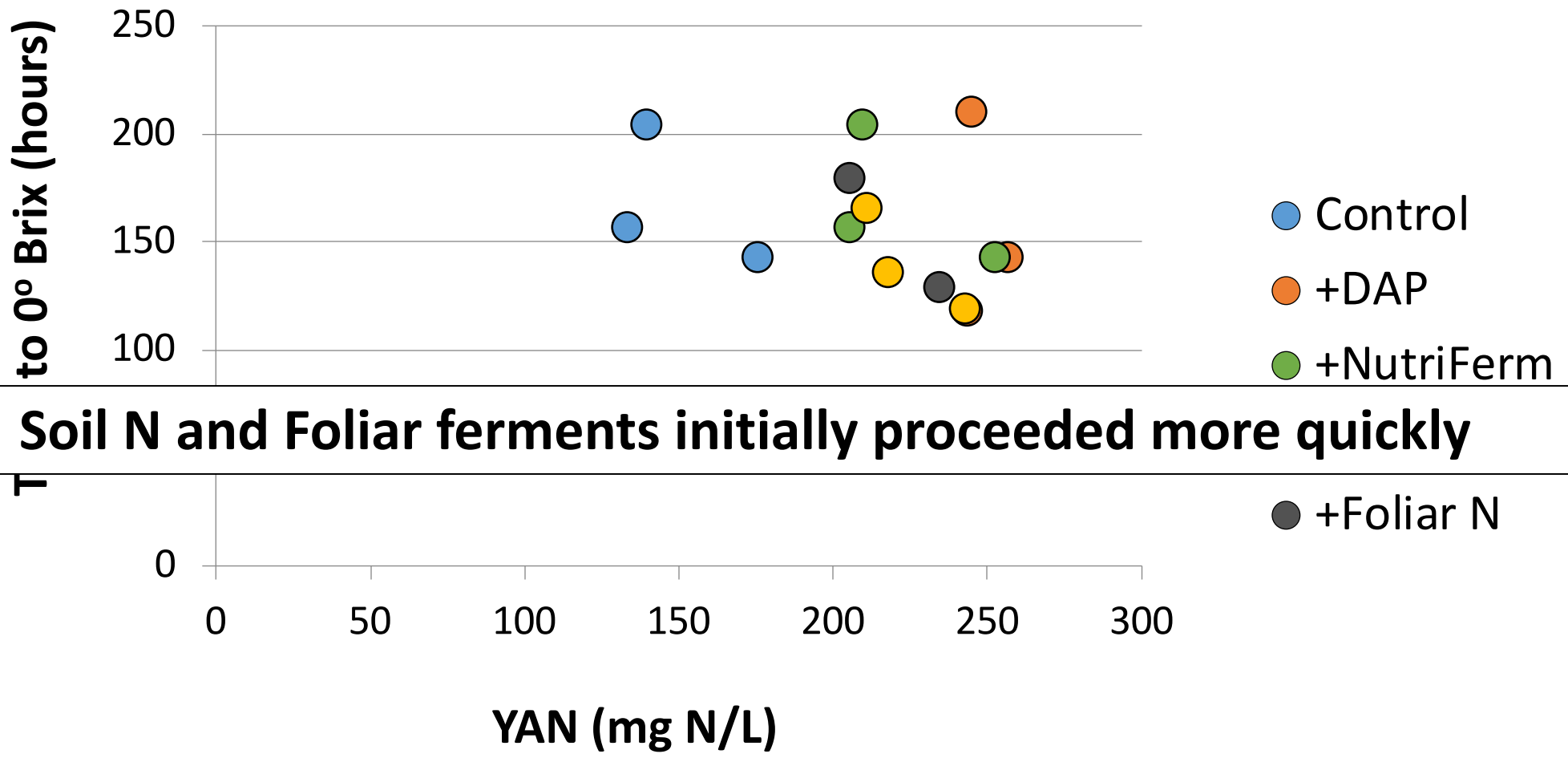
	Pinot Noir
Fermentation Temperature	27°C
Yeast Strain	RC212
Punch Downs	2x Daily
MLF	VP41
Aging time before sensory	1 year

All wines had free SO_2 boosted to 30ppm and were sterile filtered prior to bottling. Wines aged at 13°C until sensory

Fermentation Time: 2017 Pinot Noir

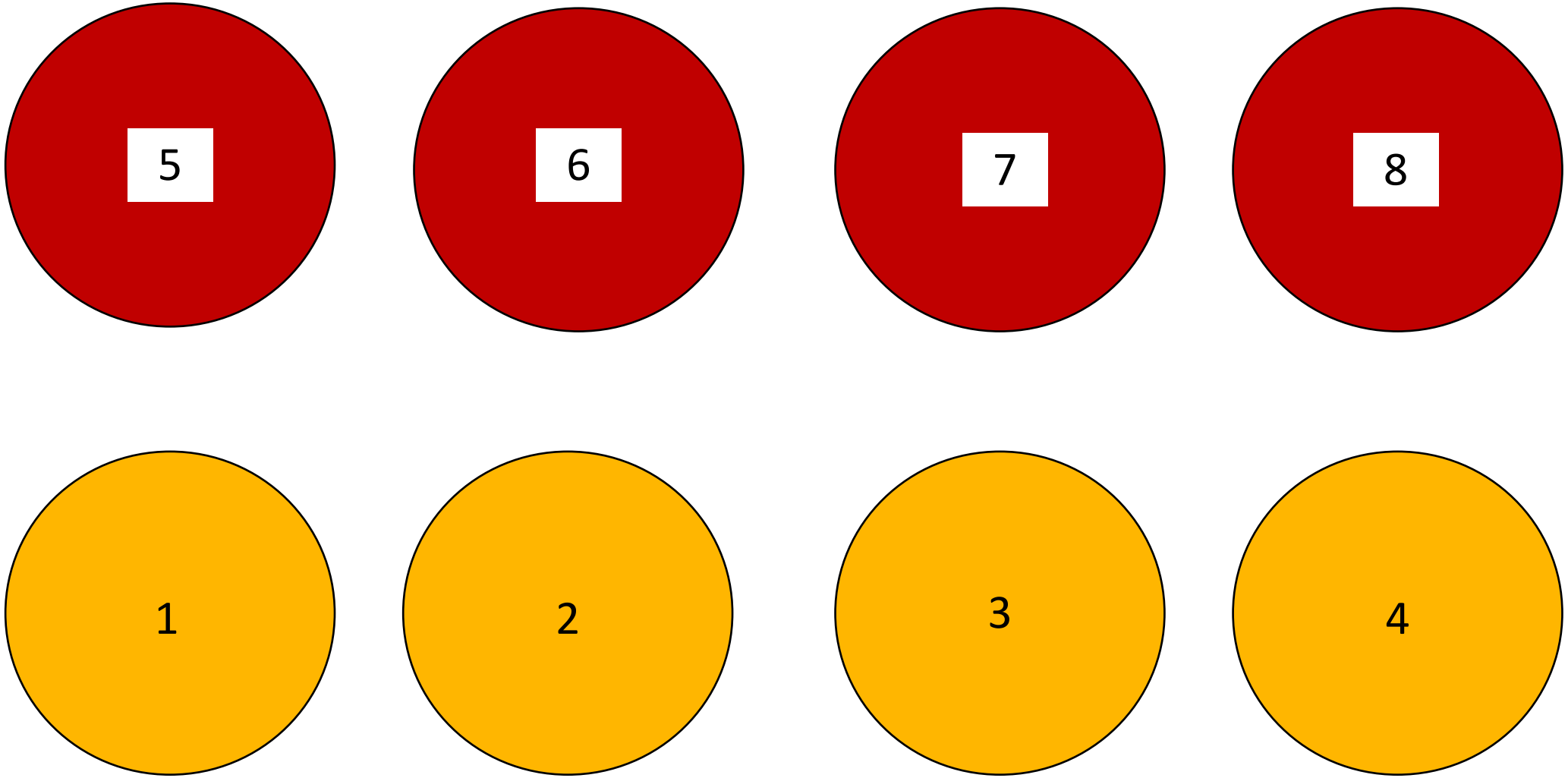


Fermentation Time: 2017 Pinot Noir

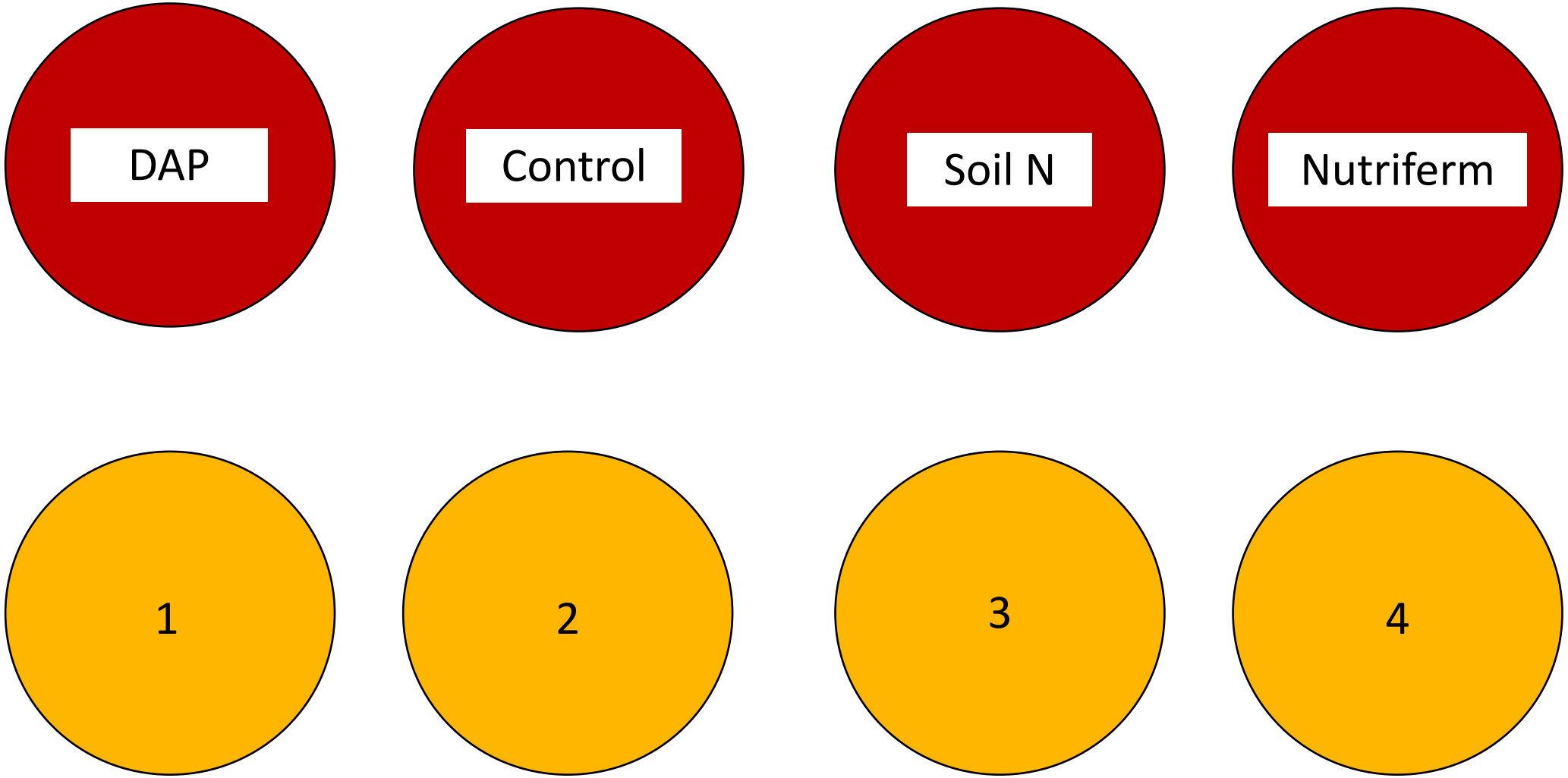


Soil N and Foliar ferments initially proceeded more quickly

Pinot noir YAN Tasting

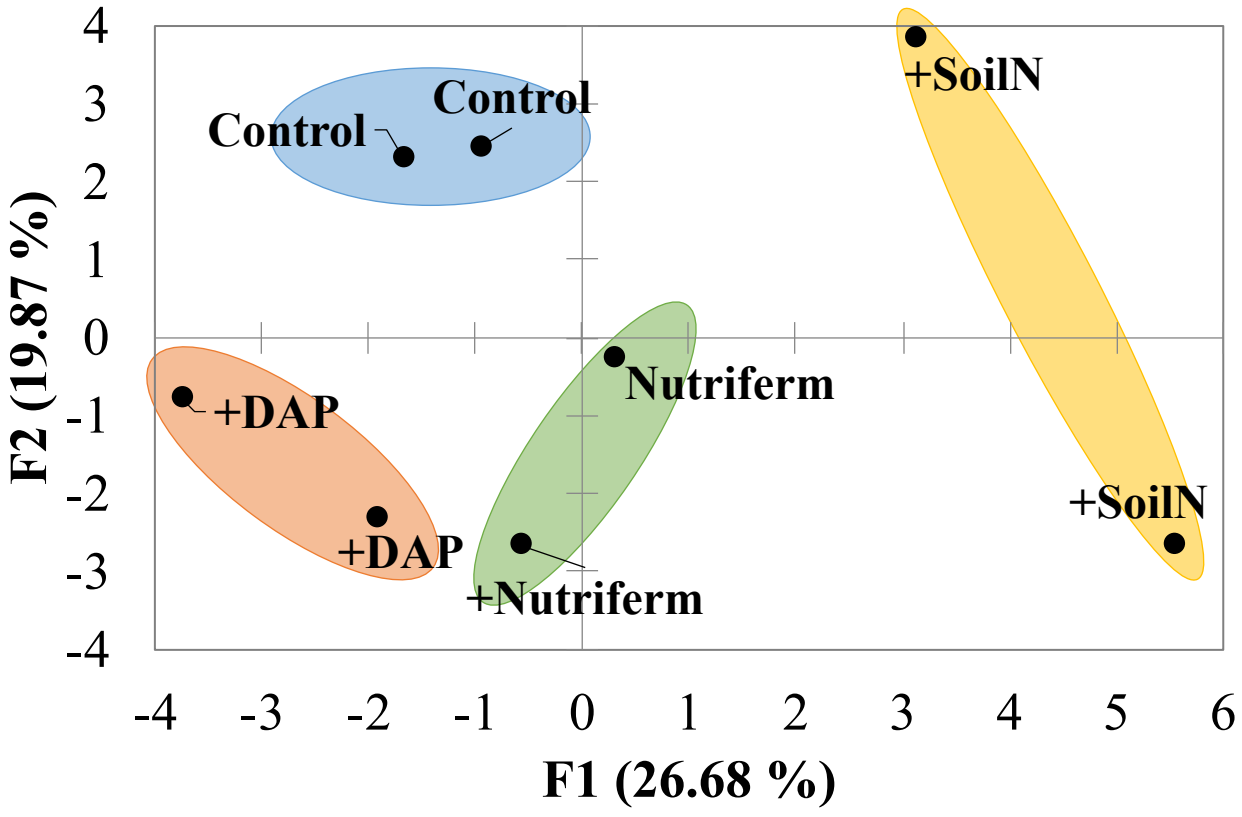


Pinot noir YAN Tasting

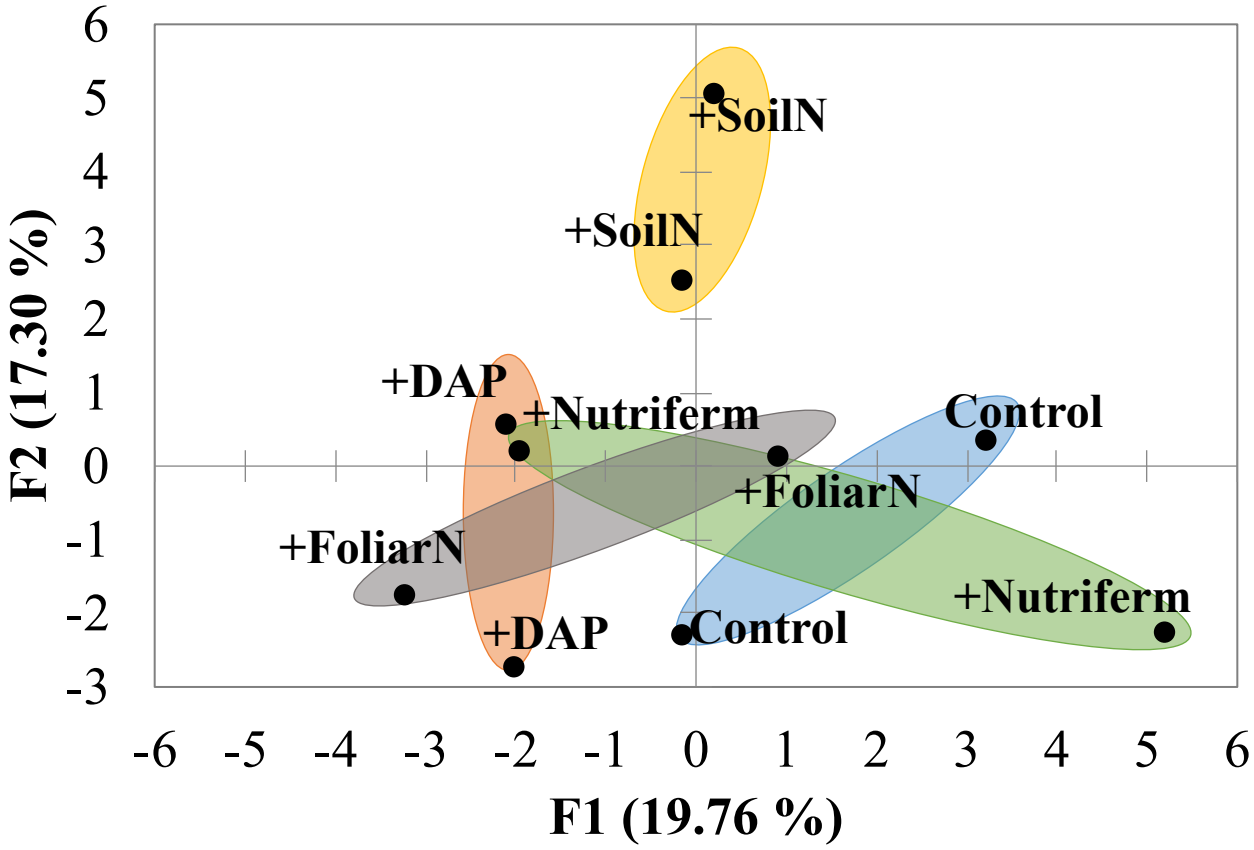


Aroma: Pinot Noir

2016

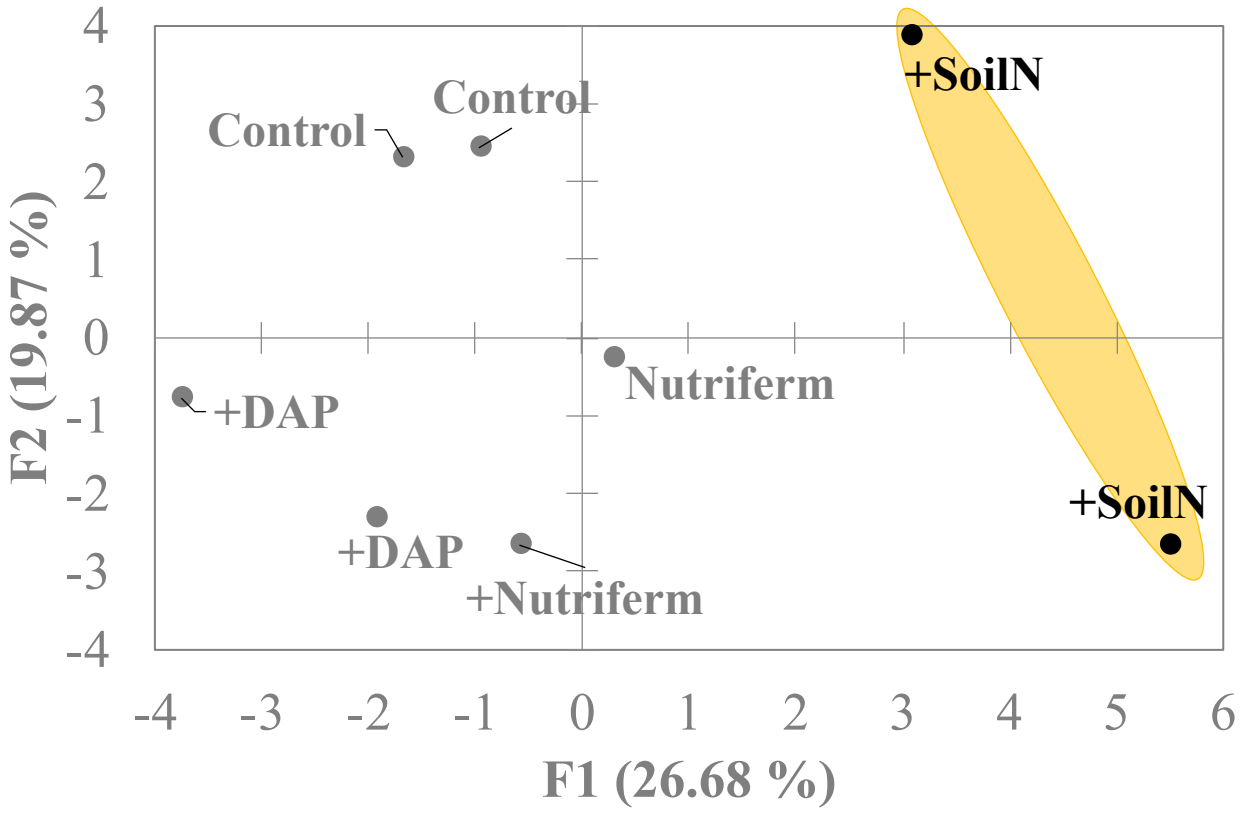


2017

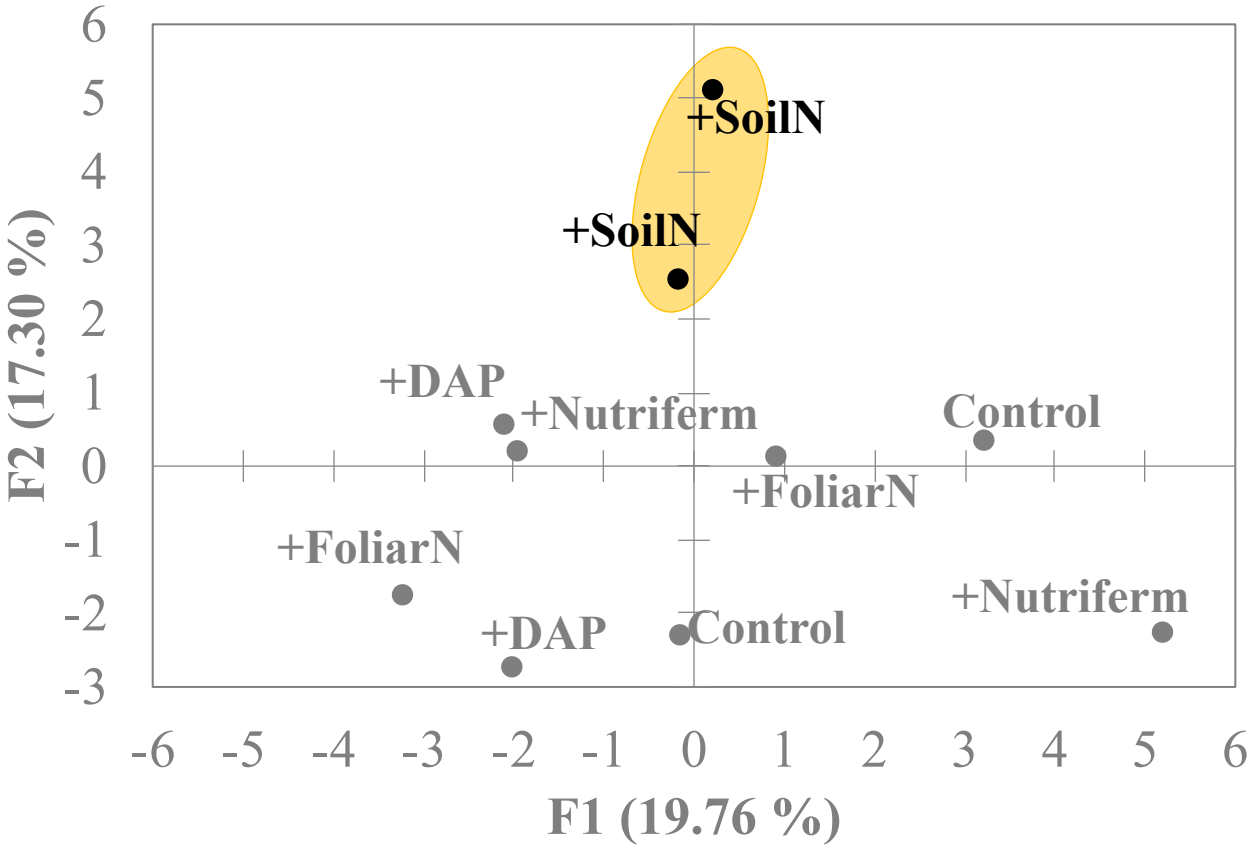


Aroma: Pinot Noir

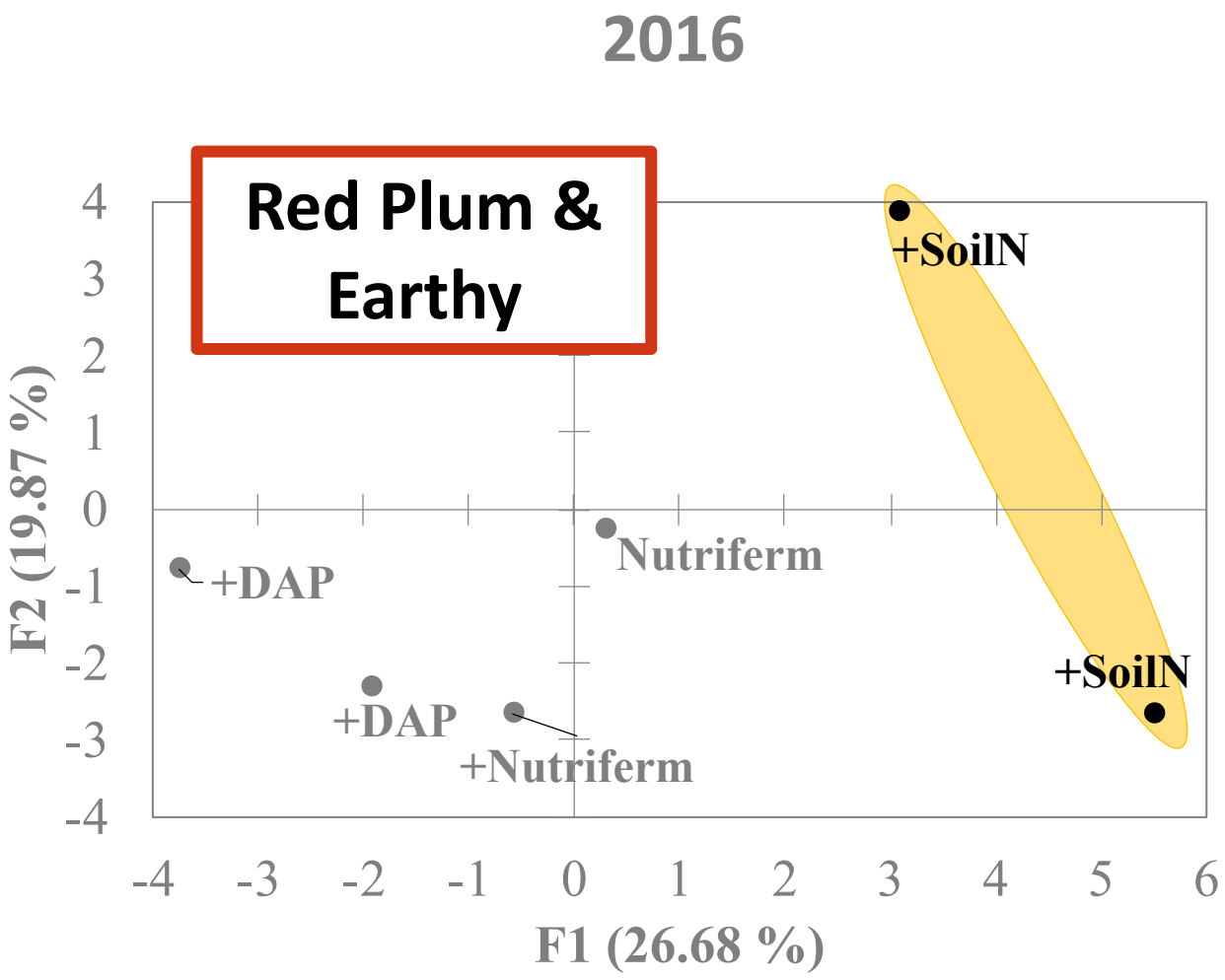
2016

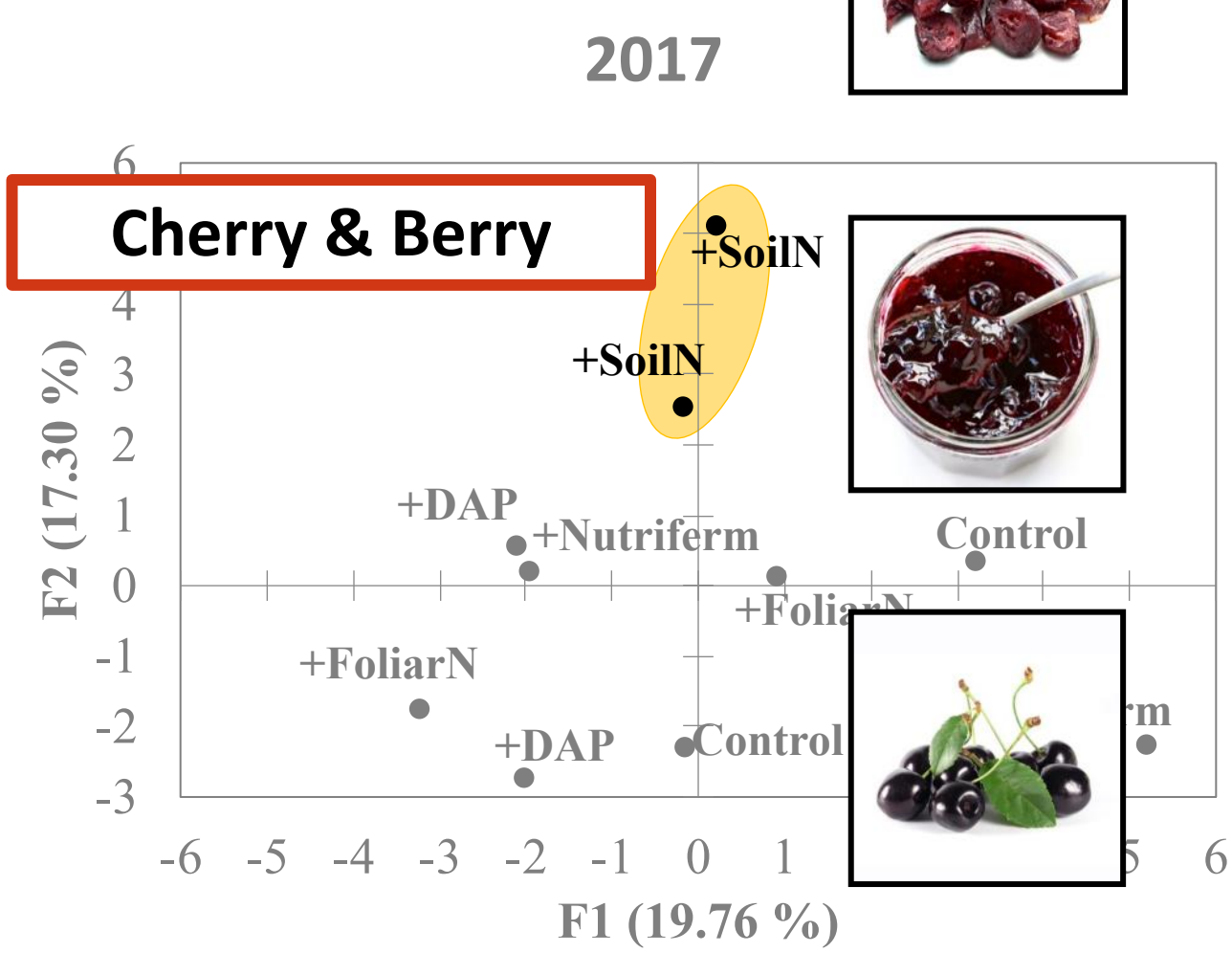


2017

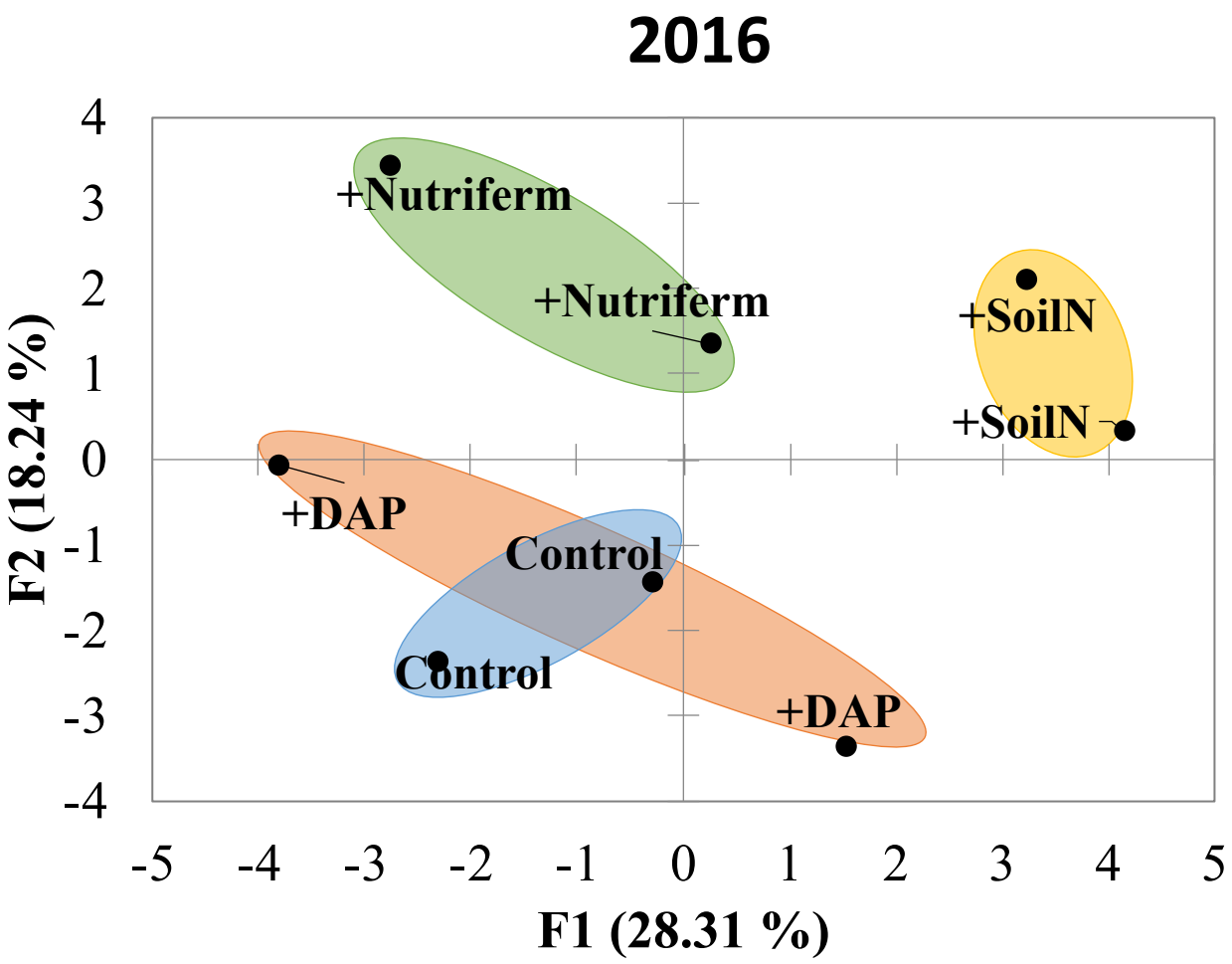


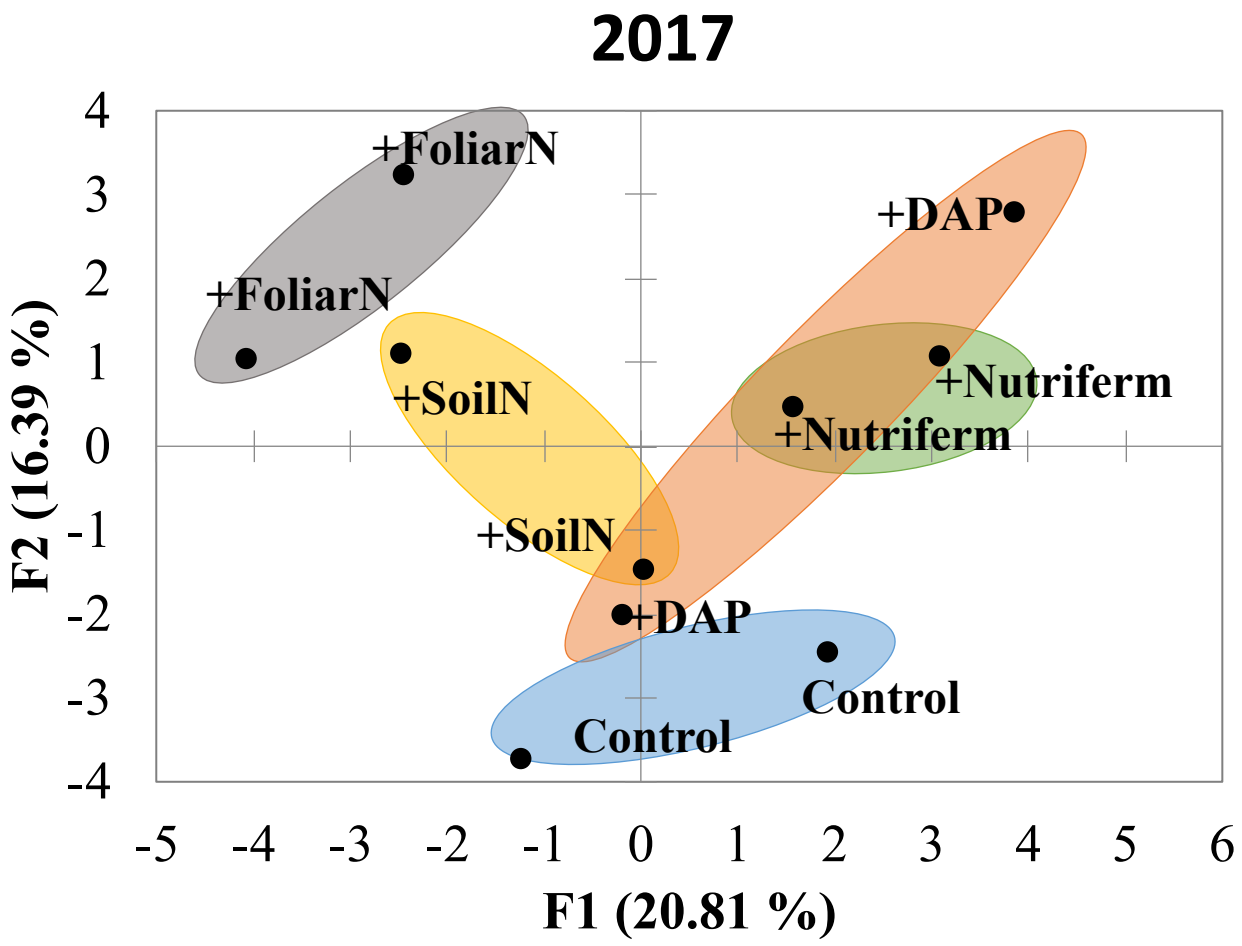
Aroma: Pinot Noir



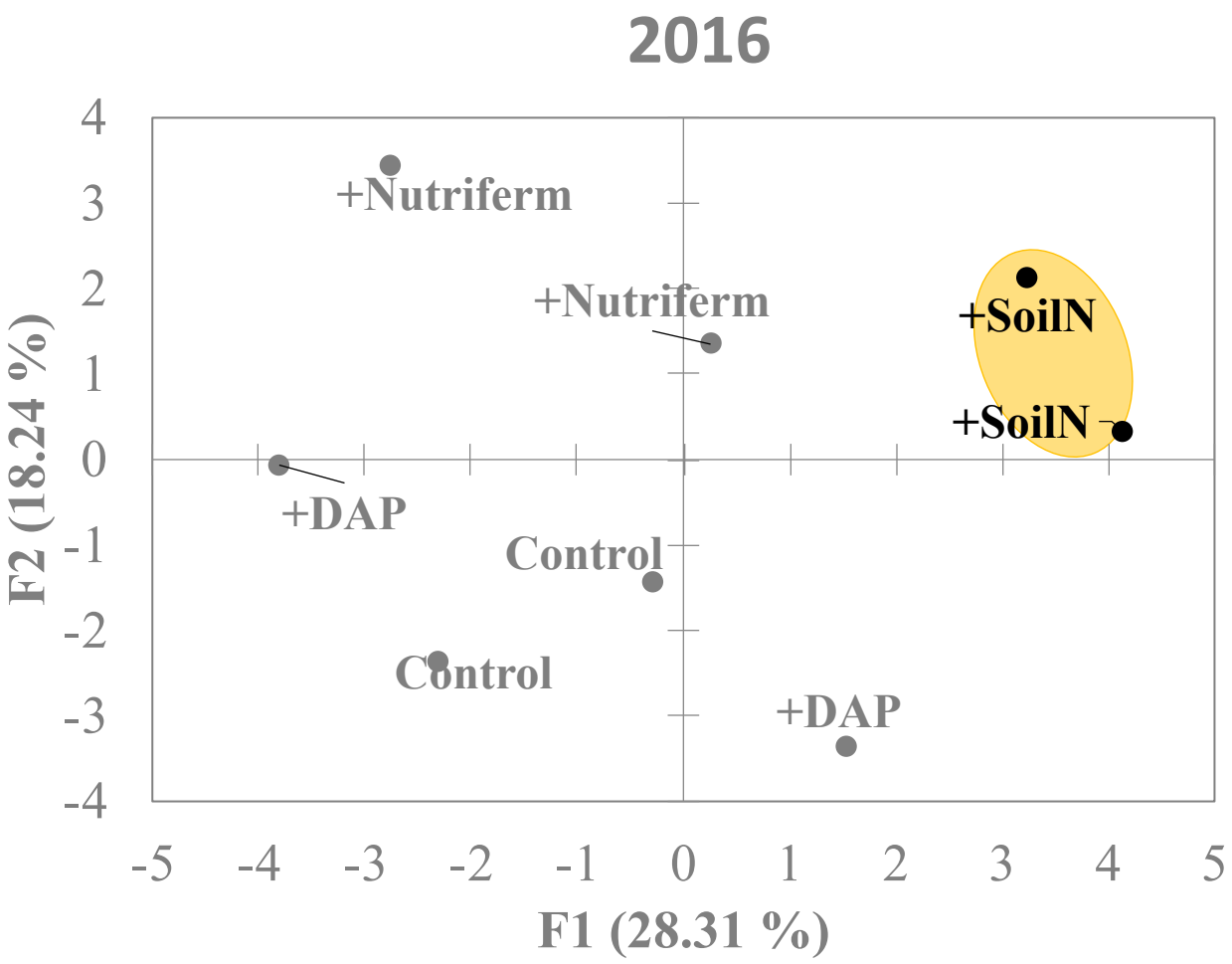


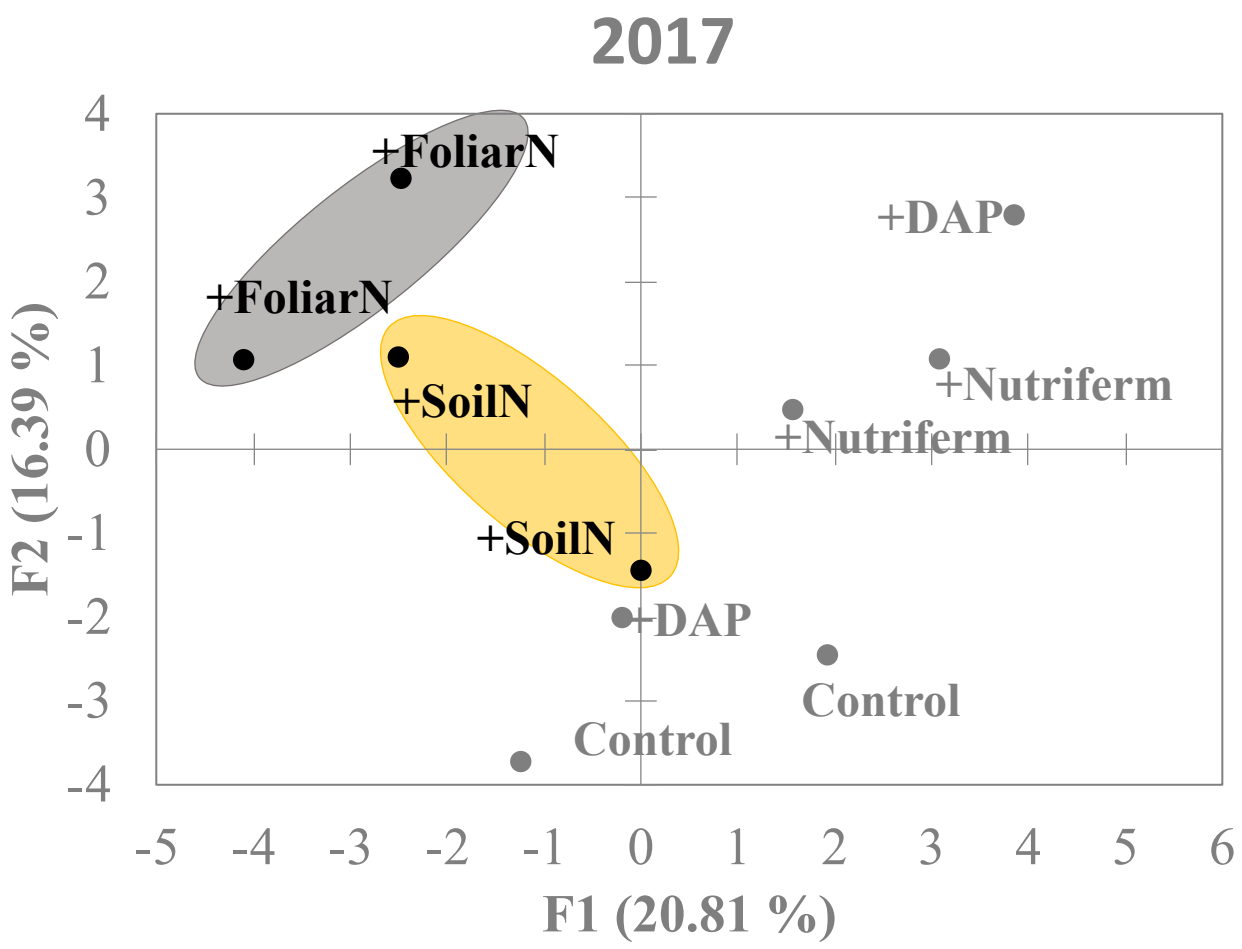
Mouthfeel: Pinot Noir





Mouthfeel: Pinot Noir





Take Home….

- Soil N significantly boosted native YAN and increased yield in Chardonnay but not Pinot noir
- Foliar N boosted native YAN, w/o causing increased growth
- Nitrogen *source and concentration* altered wine sensory attributes to a *more consistent* extent in *Chardonnay* than in Pinot Noir.