"OLD" VS "NEW" FIELDS: EXPLORING CAUSAL FACTORS FOR THE YIELD GAP

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EXPERIMENTAL DESIGN

- 3 field pairs (old vs new from walnut), 5 locations per field
- Match:
  - Soil type
  - Variety
  - Approximate planting time (Late March/ early April)

Location	Soil type	Old/New	Variety	Harvest date
Madison	Tehama loam (light surface soil, clay layer)	Old	SVTM 9027	8-Aug
		New	SVTM 9027	4-Aug
Winters	Brentwood silty clay loam (heavier soil, clay layer)	Old	HM 58841	18-Aug
		New	HM 58841	31-Jul
Zamora	Yolo silt loam (medium texture, no subsurface layer)	Old	HM 0371	1-Aug, 12-Aug
		New	HM 0371	30-Aug

- Measure biological, physical, chemical indicators

Factor Type	Analyses	Timing (1st year)
Biological	Greenhouse assays; sterilized vs unsterilized soils	Planting
	Nematode communities	Planting
	Microbial communitiy structure (PLFA)	Planting
	Declined plants, pathogen identities	Pre-harvest
	Microbial communities (DNA)	Planting
Physical	Bulk density (0-6", 6-12" , 12-18", 18-24")	Early season
	Aggregate size distribution	Planting
	Moisture content (center vs edge, 0-24")	Midseason
	Soil pit, root distribution (observational, only)	Mid - late season
Chemical	Basic fertility	Planting
	Nutrient distributions (center vs edge, 0-24")	Midseason
	Leaf nutrients	Midseason
	Carbon fractions & enzyme analyses	Planting

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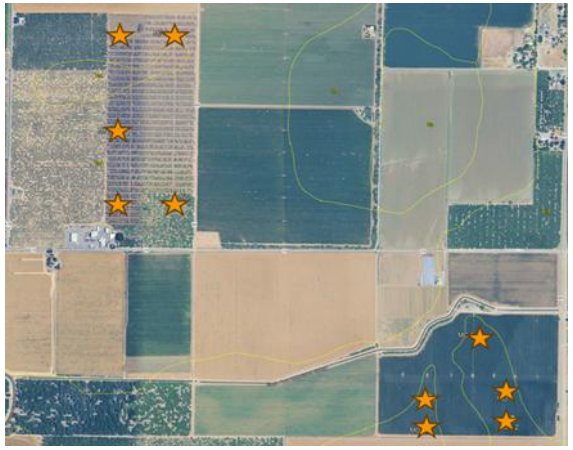
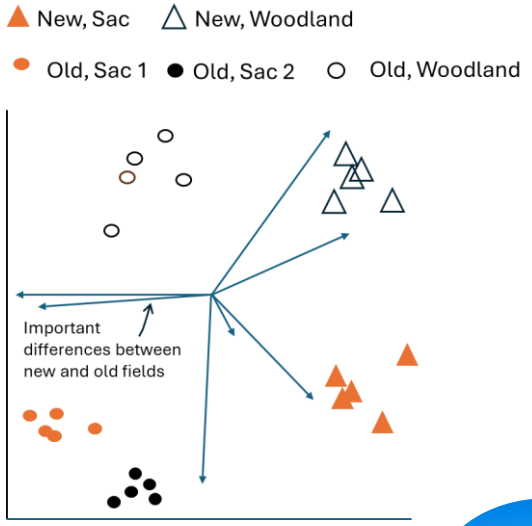
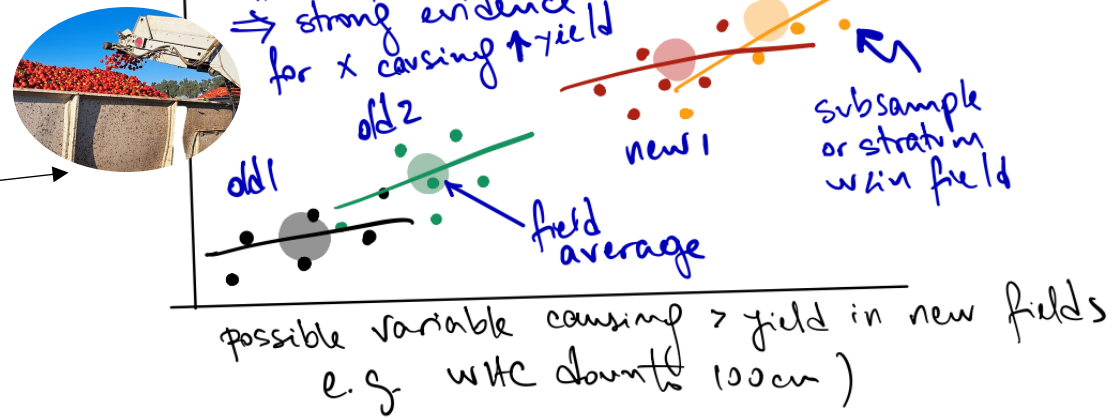
Questions:

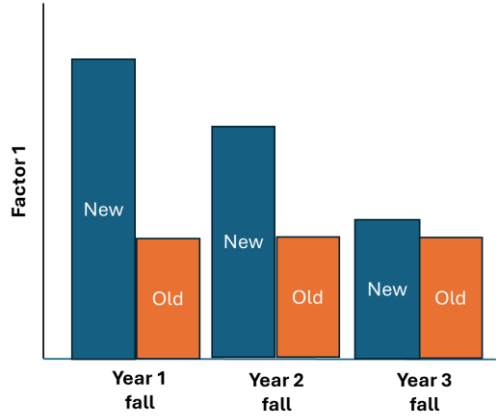




"What factors look most different between old and new fields?"



"What factors positively correlate with yields, both between and within fields?"



"What factors start to look more alike over time?"

YIELDS & QUALITY

Soil type	Old/New	Variety	Harvest date	Yield (t/a)*	Brix	Yield % difference	Brix % difference
Tehama loam	Old	SVTM 9027	8-Aug	65.6	5.68	17	-7
	New	SVTM 9027	4-Aug	76.5	5.3		
Brentwood silty clay loam	Old	HM 58841	18-Aug	80.5	5.33	10	-10
	New	HM 58841	31-Jul	88.5	4.81		
Yolo silt loam	Old	HM 0371	1-Aug, 12-Aug	79.8	5.05	27	2
	New	HM 0371	30-Aug	101.6	5.13		

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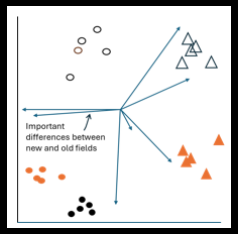
**Mean of 5 200-ft plots throughout the field, machine harvested into a GT cart*

“WHAT LOOKS DIFFERENT?”

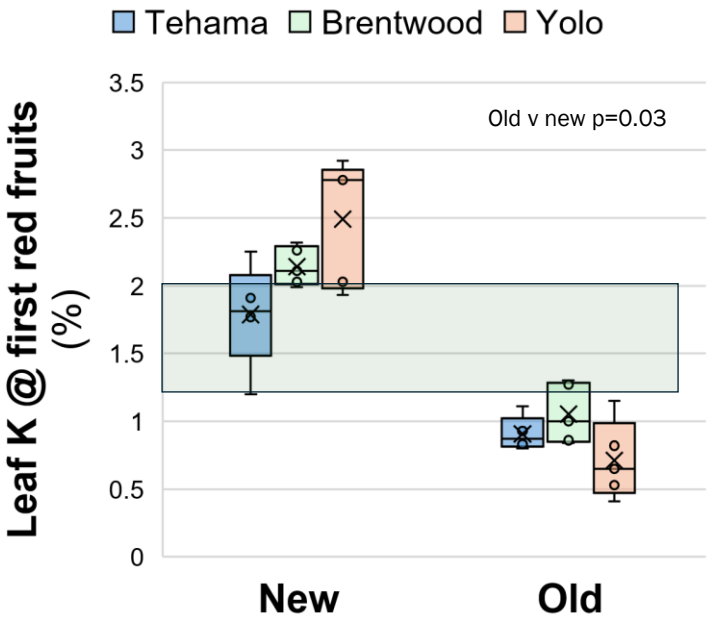
- Nutrition
- Compaction
- Disease



HIGH POTASSIUM IN ‘NEW’

Rectangle = sufficiency threshold

Soil at planting (0-12”)



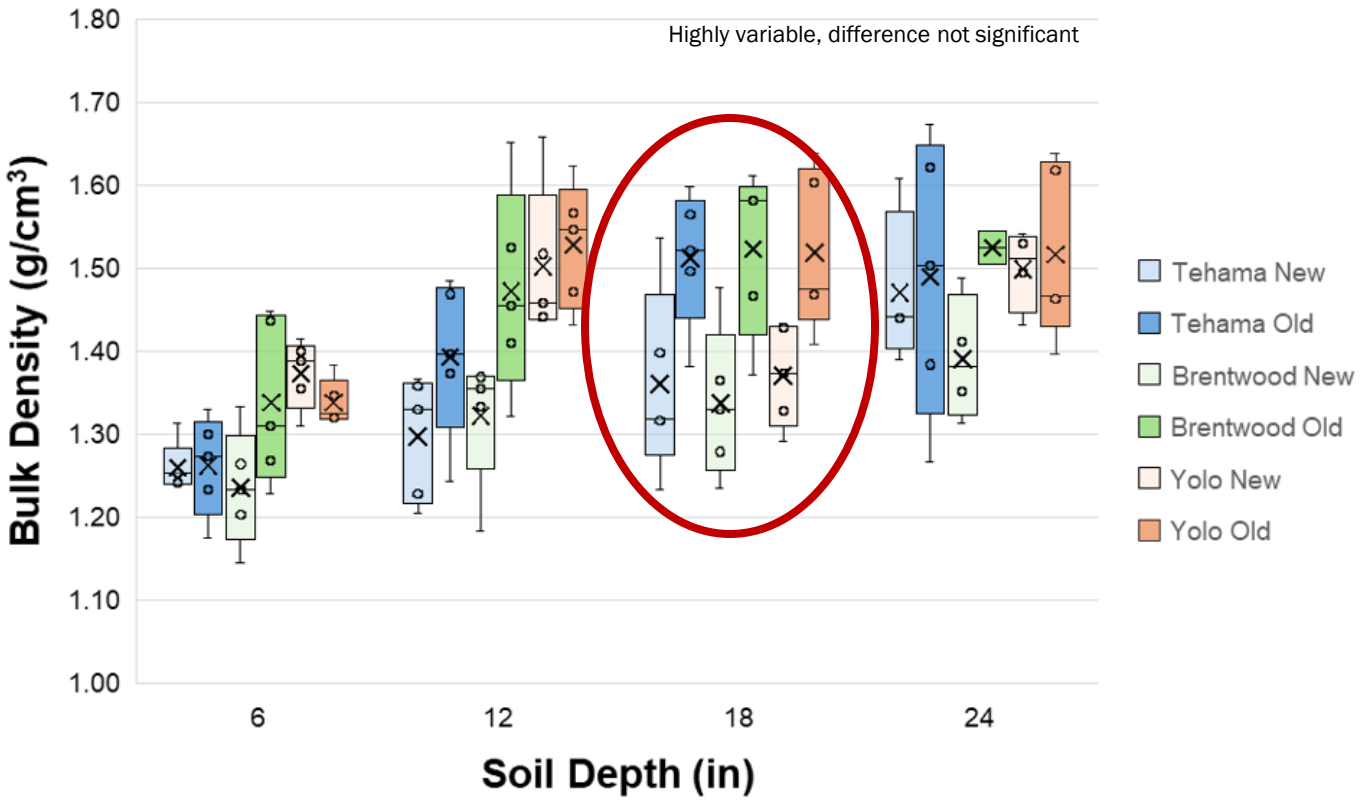
Young mature leaf @ first red fruits

Yolo silt loam “Old” pre-harvest
(8/1; 127 DAP)

Yolo silt loam “New” pre-harvest
(8/30; 148 DAP)

(Also consistently different between old & new: available phosphorus, leaf copper, leaf sodium)

SUBSURFACE COMPACTION

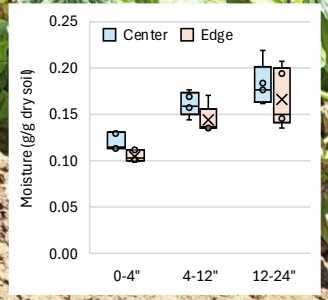


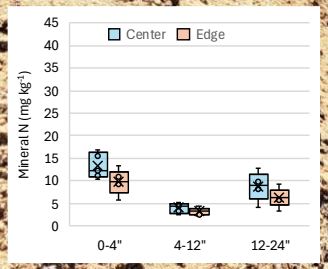
Brentwood silty clay loam “Old”

Bulk density=
1.52 g/cm^3

Brentwood silty clay loam “New”

Bulk density=
1.34 g/cm^3





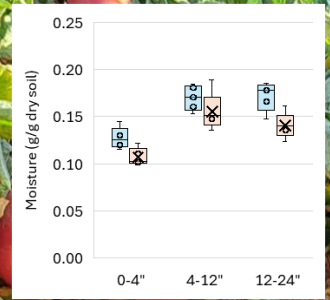
1.26 g/cm^3

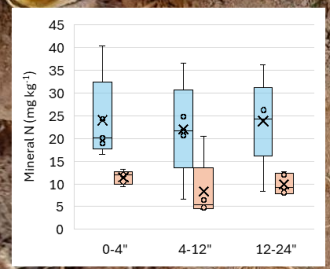
1.30 g/cm^3

1.36 g/cm^3

1.47 g/cm^3

Tehama New





1.26 g/cm^3

1.39 g/cm^3

1.51 g/cm^3

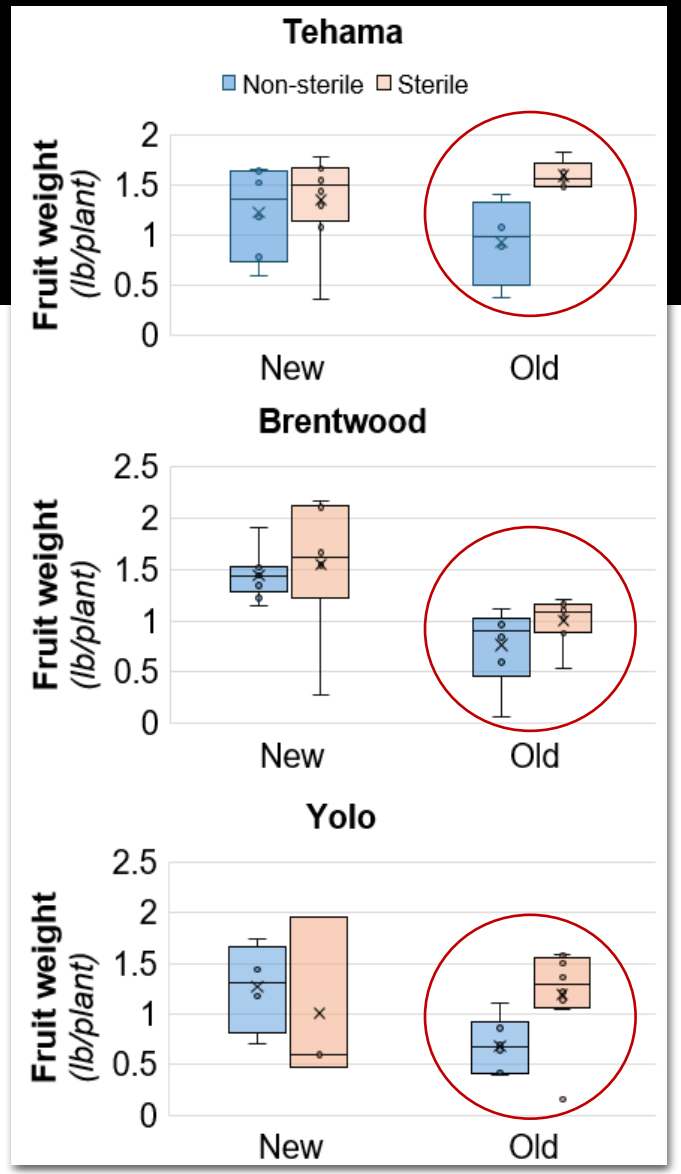
1.49 g/cm^3

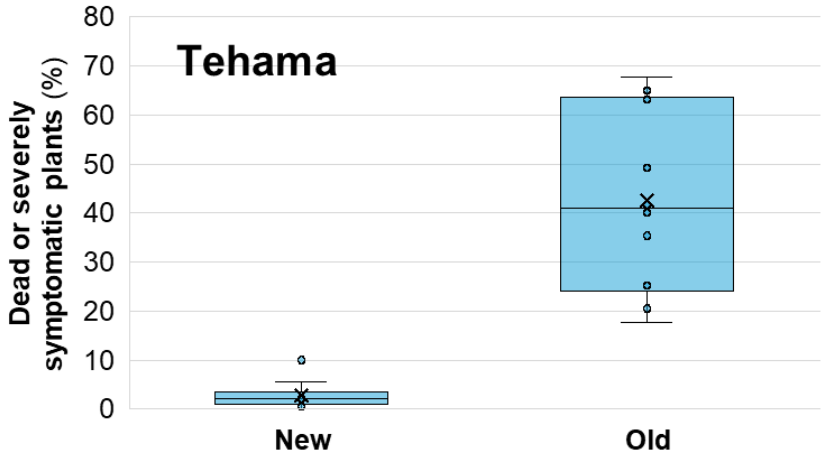
Tehama Old

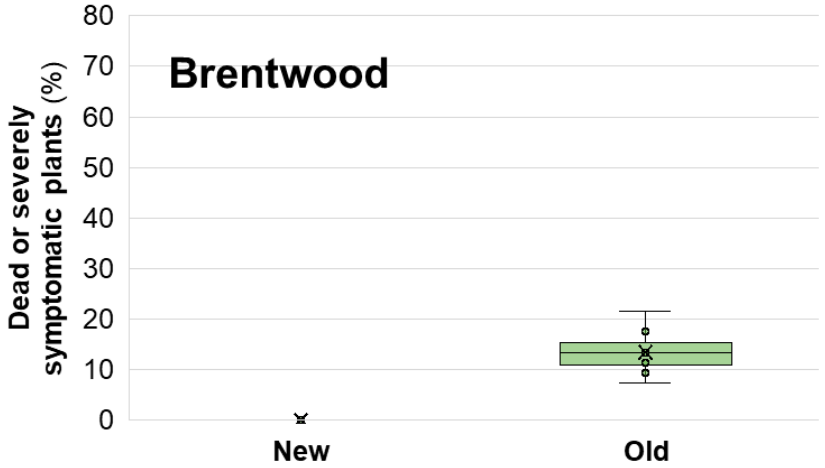
DISEASE

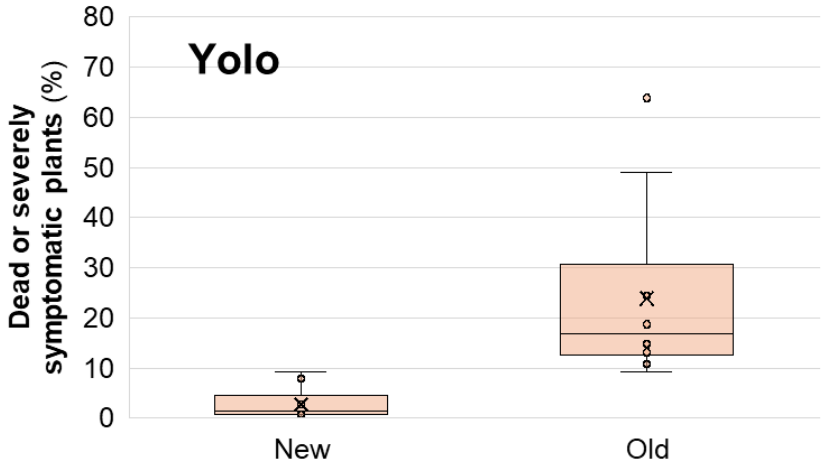
Hypothesis:

Sterilized soils will outyield non-sterilized soils in “old” fields, but not “new” ones









Fusarium stem rot & decline (FRD); F. foot rot

FRD; southern blight

SVTM 9027

No disease

Fusarium wilt (F2); southern blight

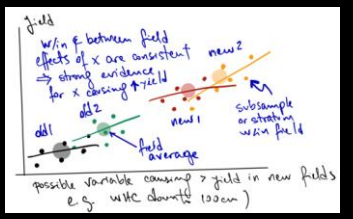
HM 58841

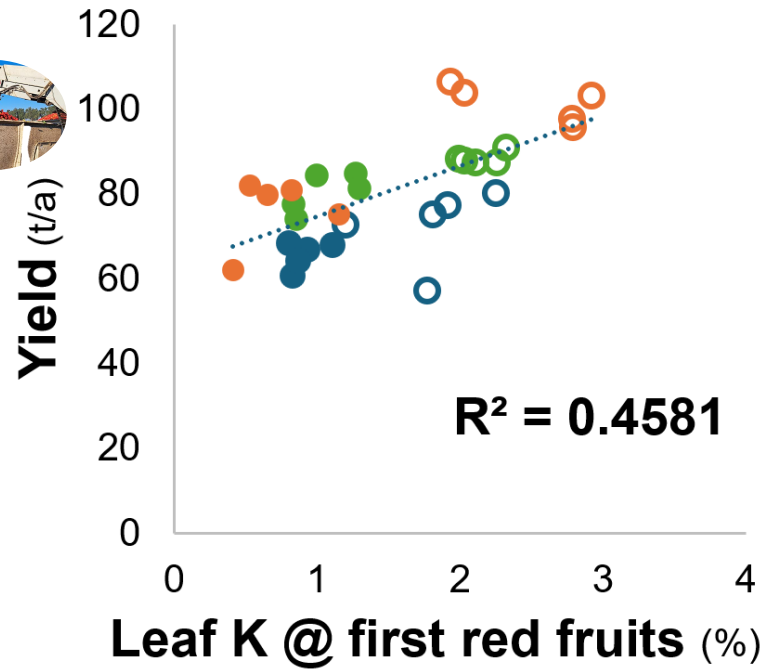
Rhizoctonia; charcoal rot

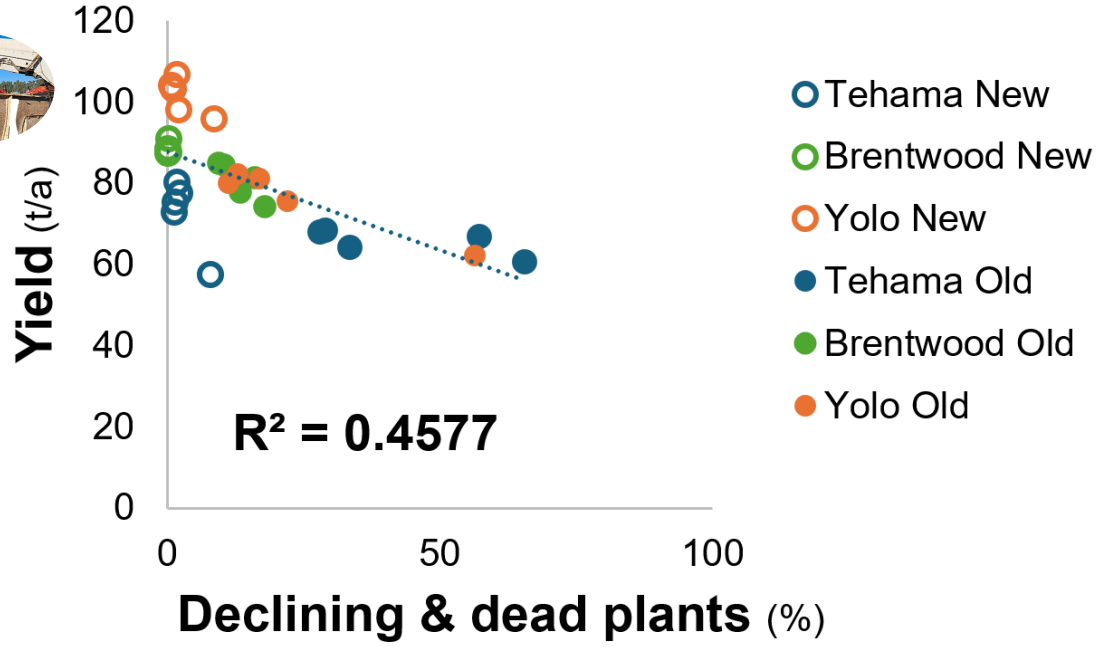
FRD; Verticillium wilt

HM 0371

WHAT CORRELATES TO YIELD?







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CONCLUSIONS

- **Pilot study suggests soil K, subsurface structure, disease consistently differ between old & new fields**
- **Need to confirm!**
  - ✓ Do these hold true for non-walnut fields?
  - ✓ Test mechanisms
  - ✓ Test management implications
- **Practical implications so far**
  - ✓ Regular K monitoring, especially on light-textured soils
  - ✓ Considering practices which may reduce soil compaction (e.g. reduced tillage, controlled traffic patterns, periodic inclusion of deep-rooted, vigorous crops such as alfalfa in the rotation)
  - ✓ Equipment sanitation to avoid the risk of spreading pathogens to new fields

Acknowledgements

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- **Blake Harlan & Chris McAlister** (Harlan Family Ranch)
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QUESTIONS?

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