

2018 New England Tomato High Tunnel Study



Last updated 4/7/19

Purpose of the Study

To improve our understanding of tunnel tomato production practices, with a focus on crop nutrition, across New England.

This was a 'landscape scan' of management and fertility practices for in-ground tomatoes.

Findings have helped improve our crop management and soil fertility recommendations.

Greenhouse tomato production in project states

from U.S. Census of Agriculture; includes greenhouses, high tunnels and all types of production systems.

State	no. of farms	sq. ft. of production
MA	227	744,199
NH	198	532,328
RI	48	101,962
VT	263	659,911
Total	736	2,038,400



Data collected

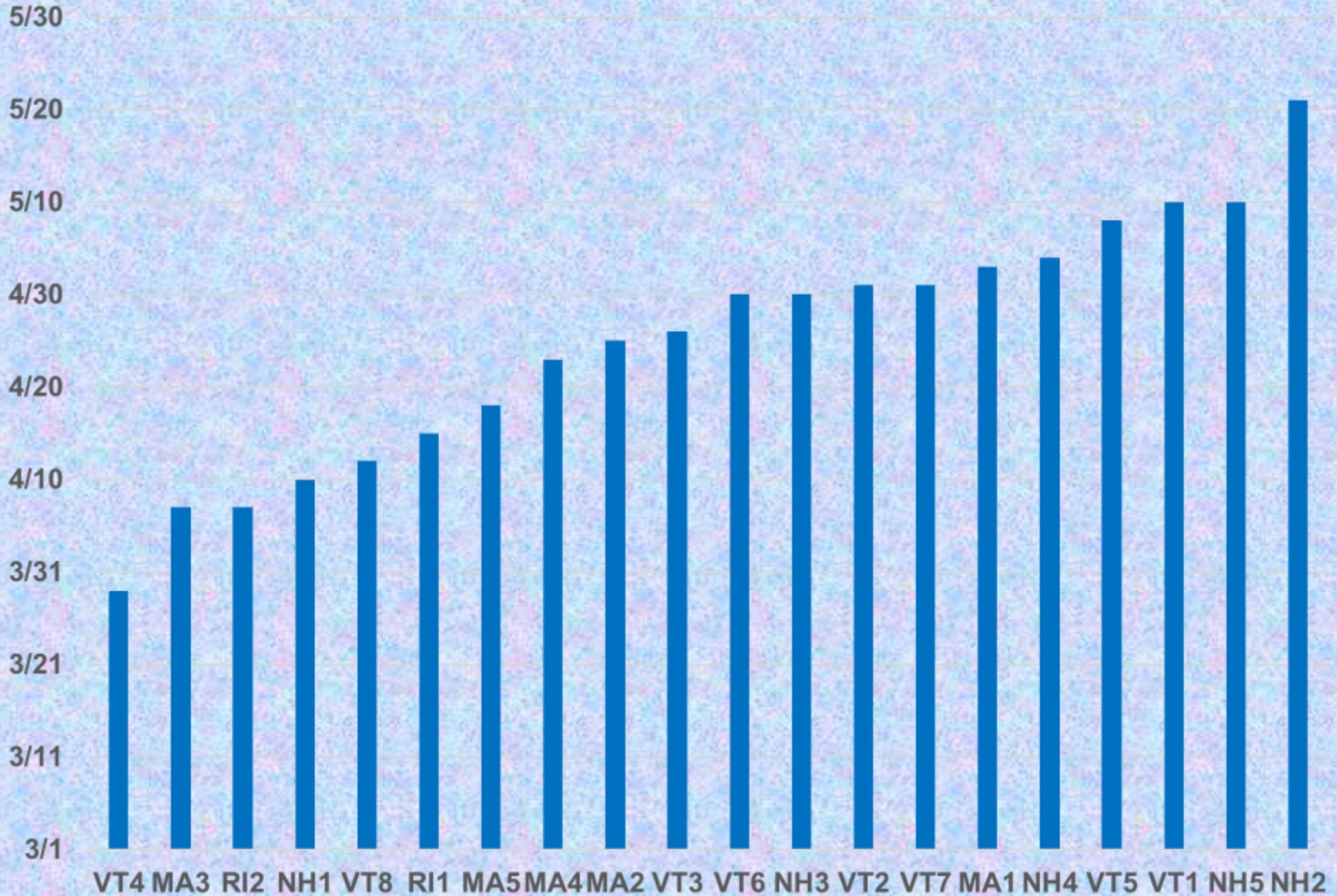
20 farms

- Compaction
- Spacing / # of leaders
- Irrigation
- Fertilizer
- Pesticides
- Varieties
- Yield
- Monthly Lab Analyses:
 - Modified Morgan
 - Saturated Media
 - Leaf Tissue

Production practices used

- **13 of 20 farms planted Geronimo**
- **12 farms used grafted plants**
- **11 farms are certified organic**
- **Avg. of 1.8 drip lines/row, 11 farms fertigate**
- **9 farms used more than one leader/plant**
- **Mulch: black plastic (6), white plastic (4), none (3), landscape fabric (3), weed mat (2), silver (1)**

Tomato transplant date



Monthly crop images



May 1st



June



July



August

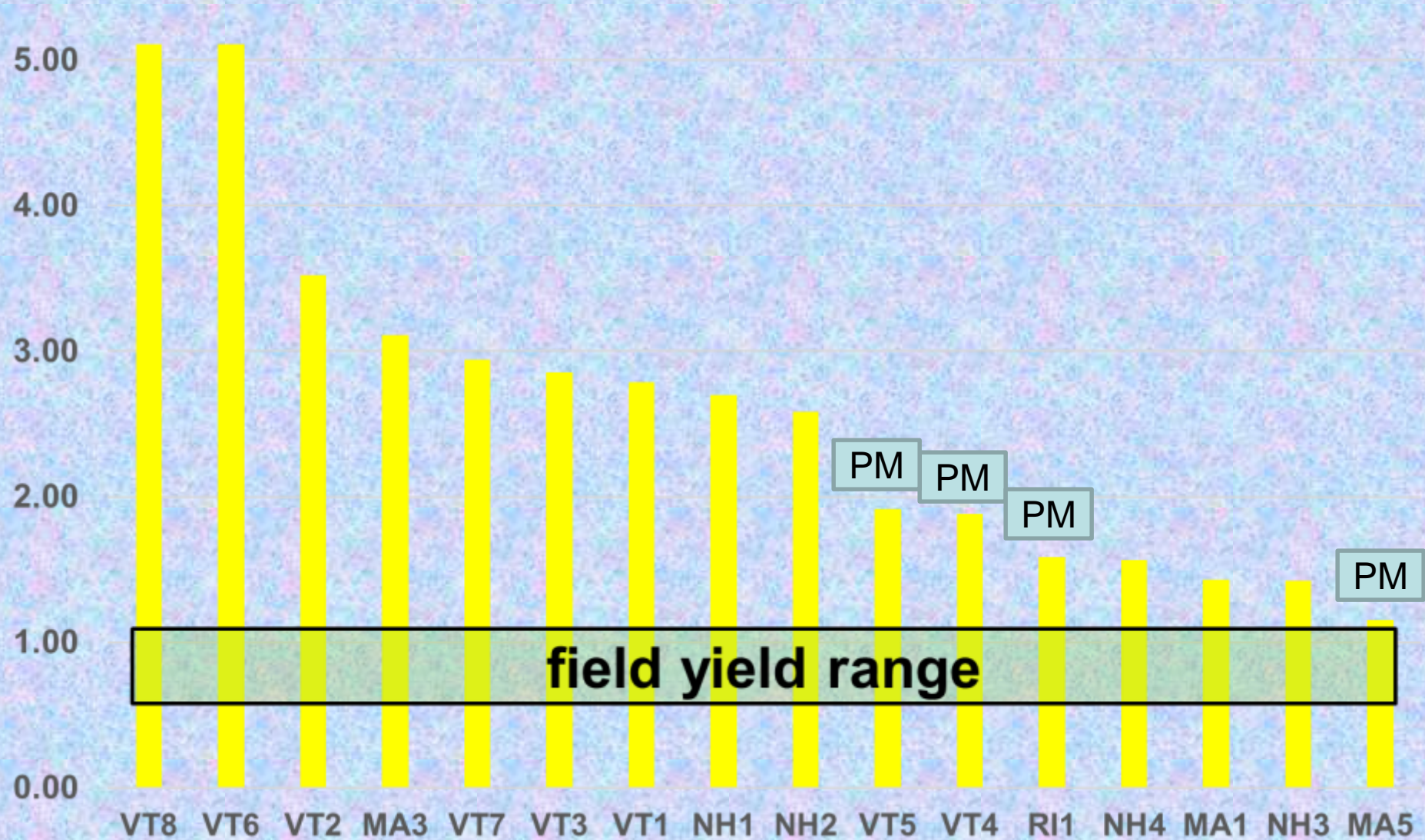


September



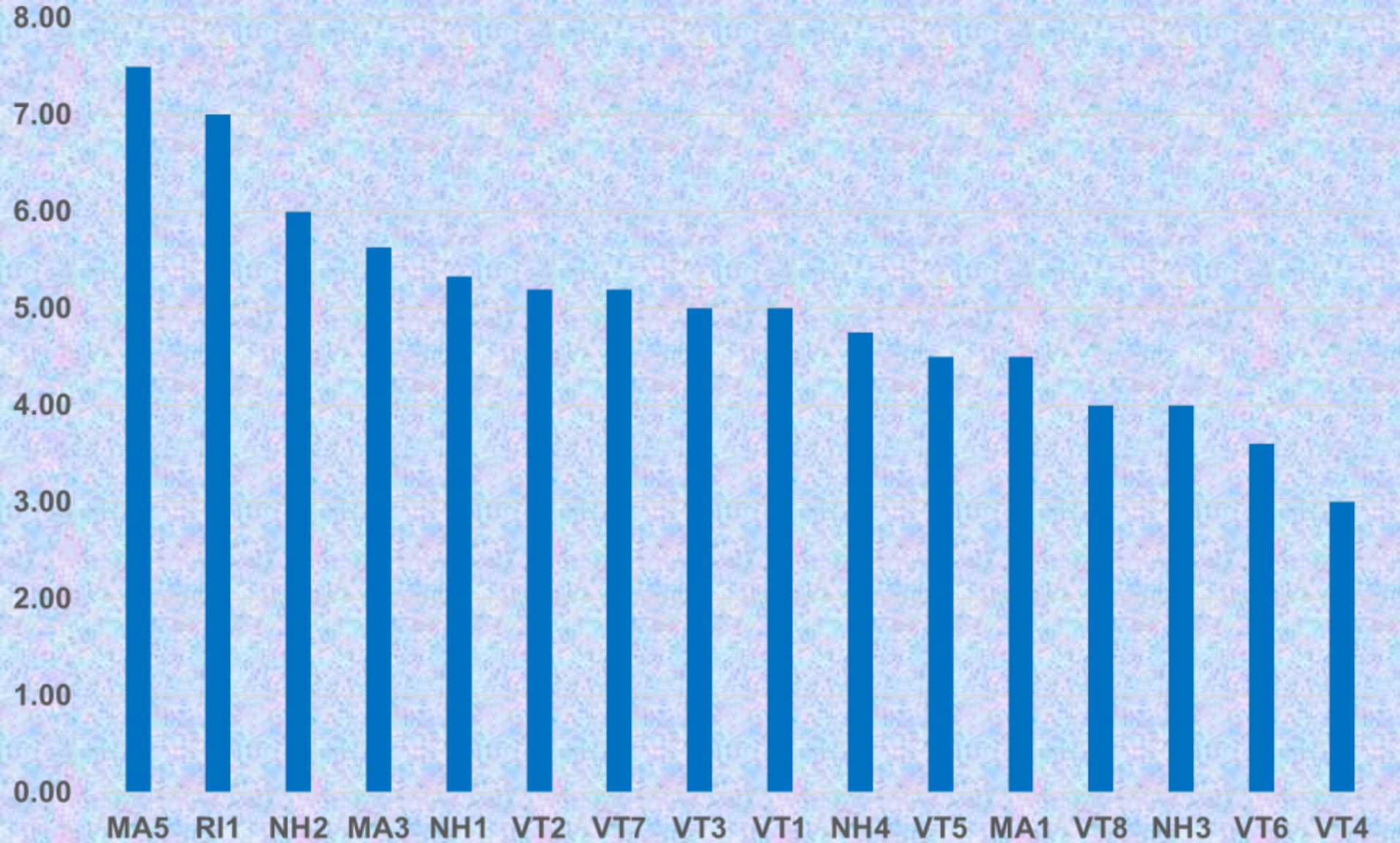
November

Total tomato yield pounds/sq.ft.



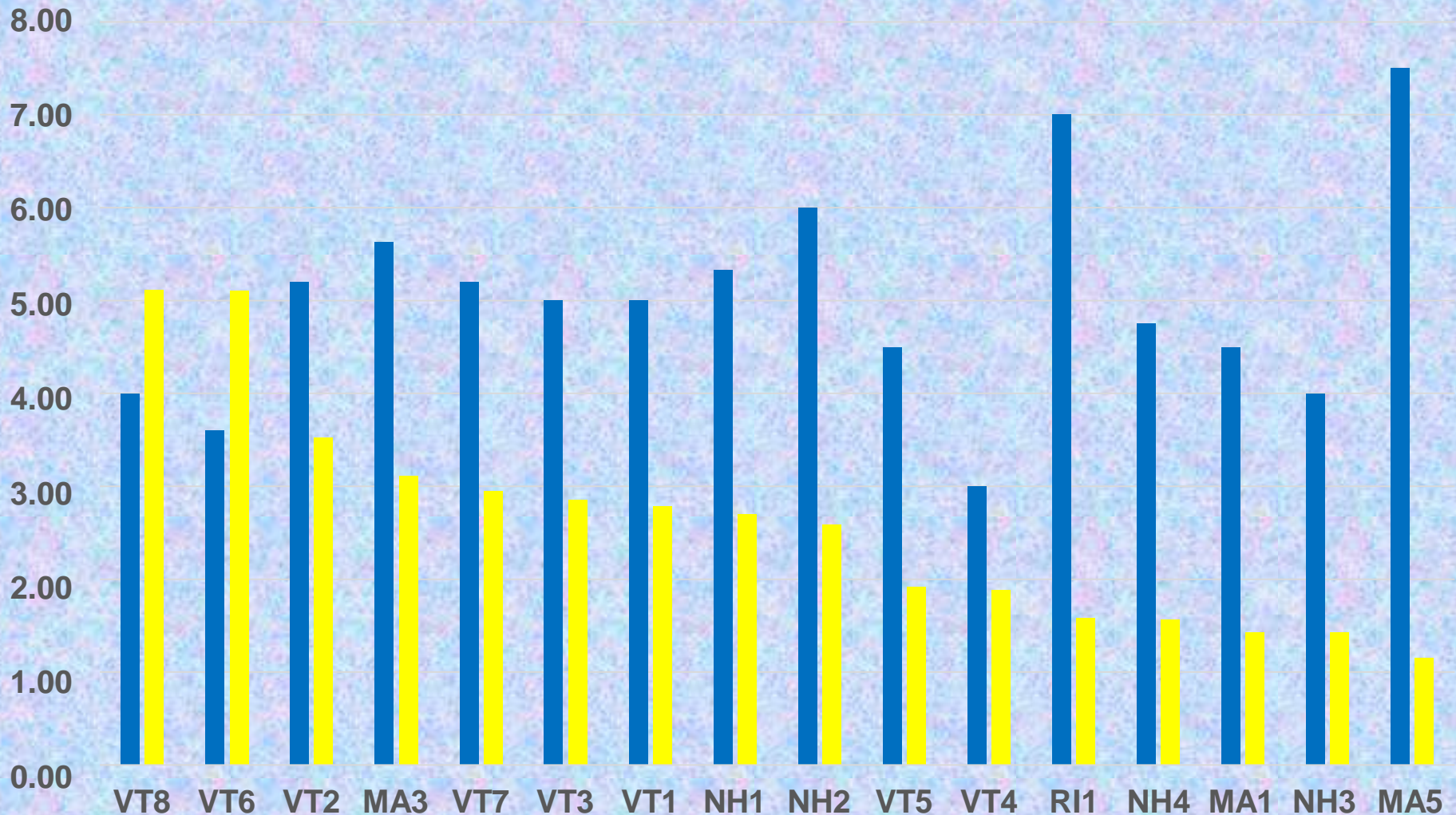
Tomato plant spacing

Square foot per leader

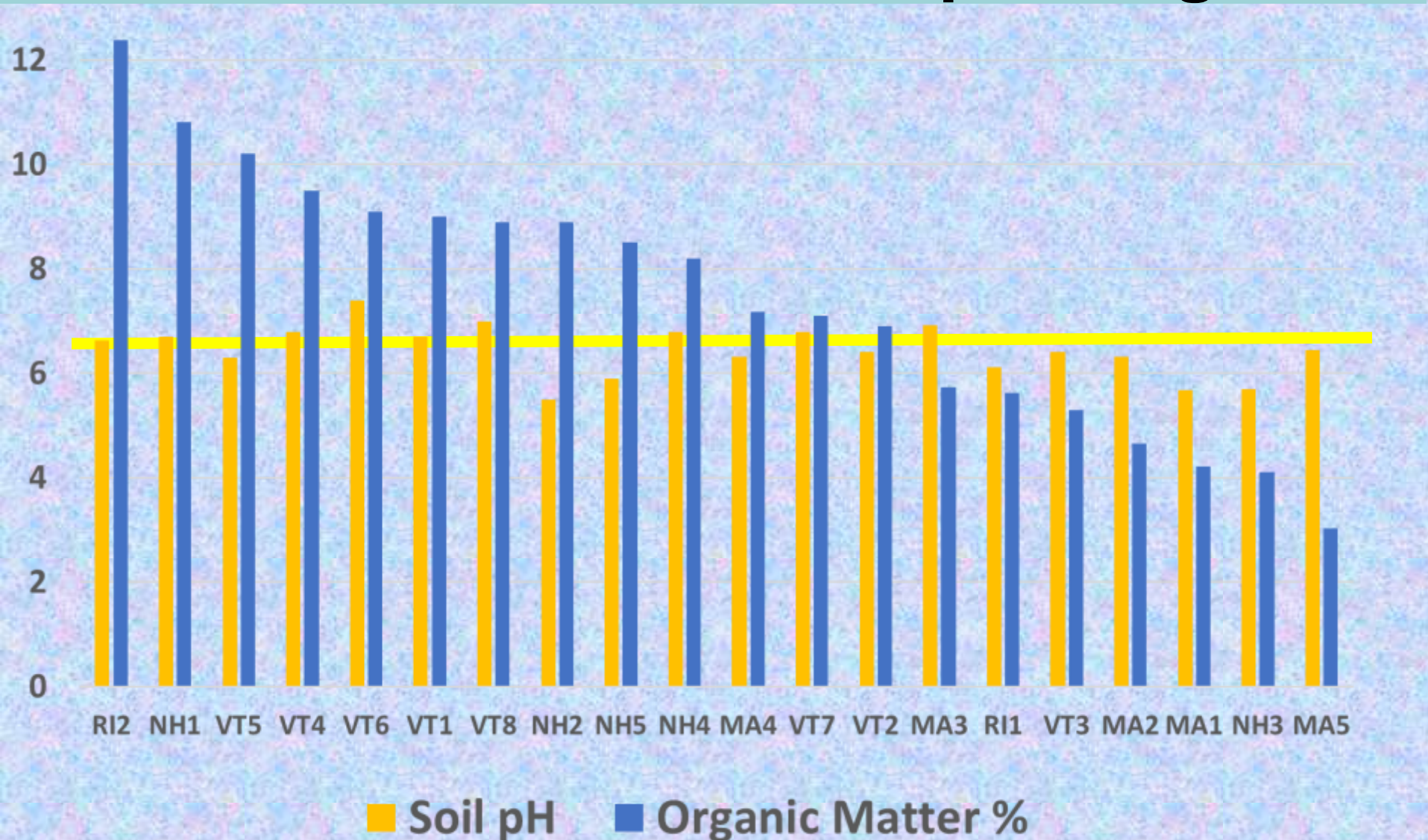


Total yield and plant spacing

Yield (yellow) and square foot per leader (blue)



Soil pH and % organic matter one month after transplanting



Monitoring Nutrient Levels

Soil

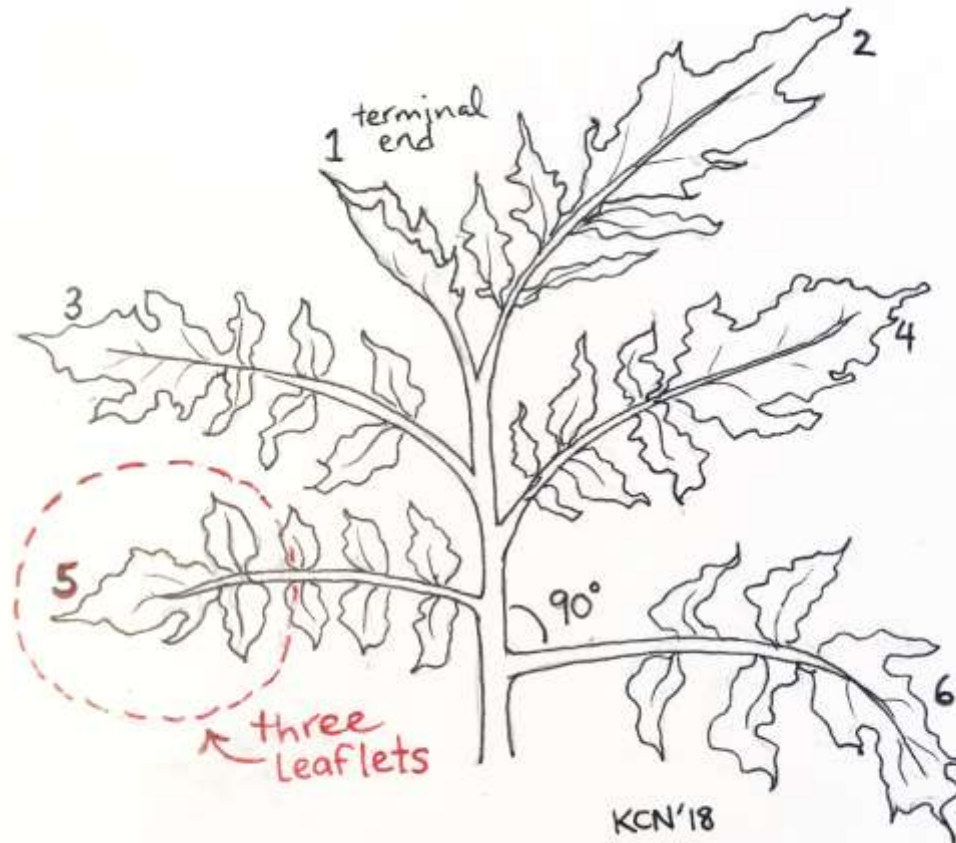
Increasing availability



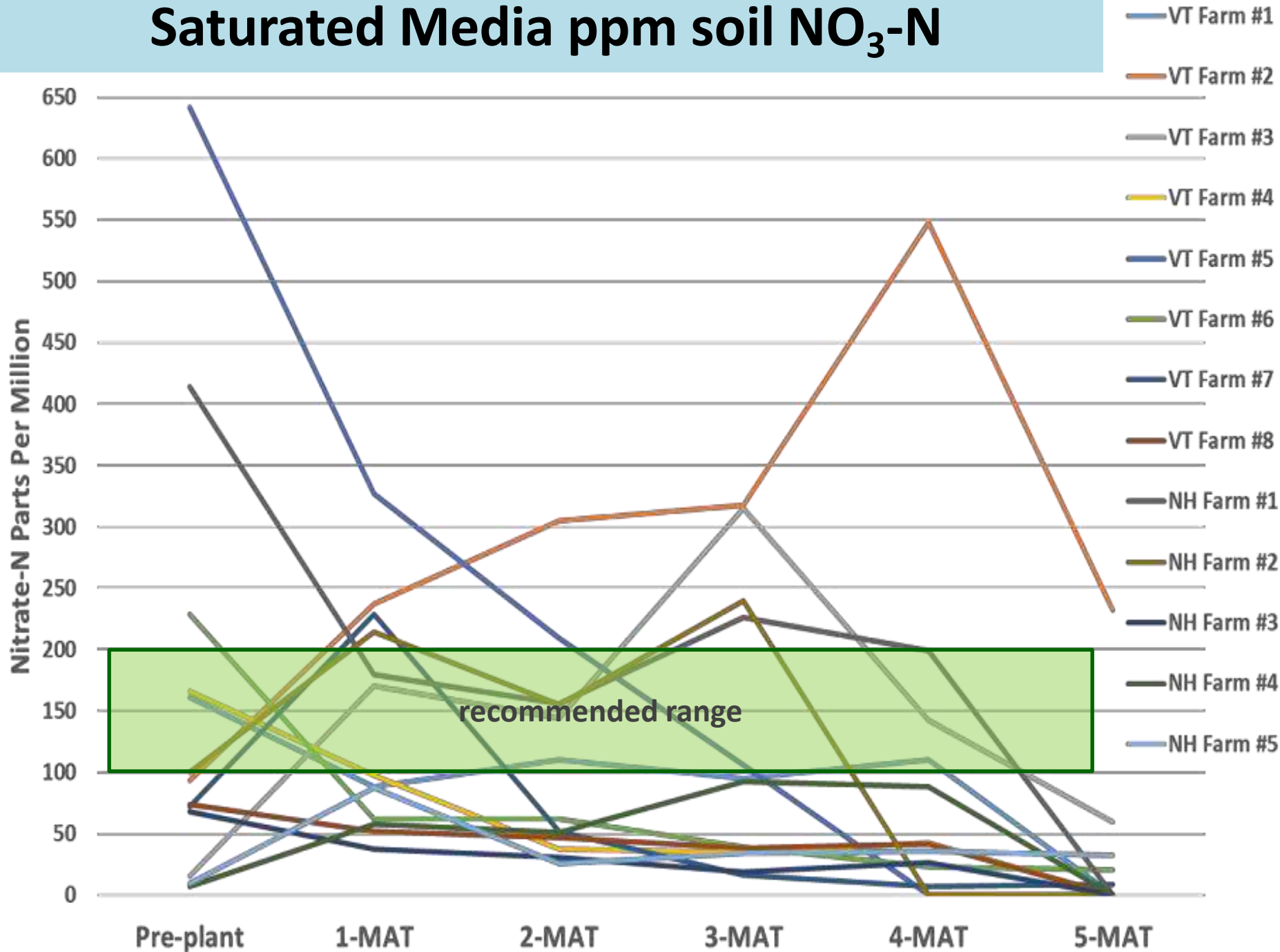
Modified Morgan

Saturated Media

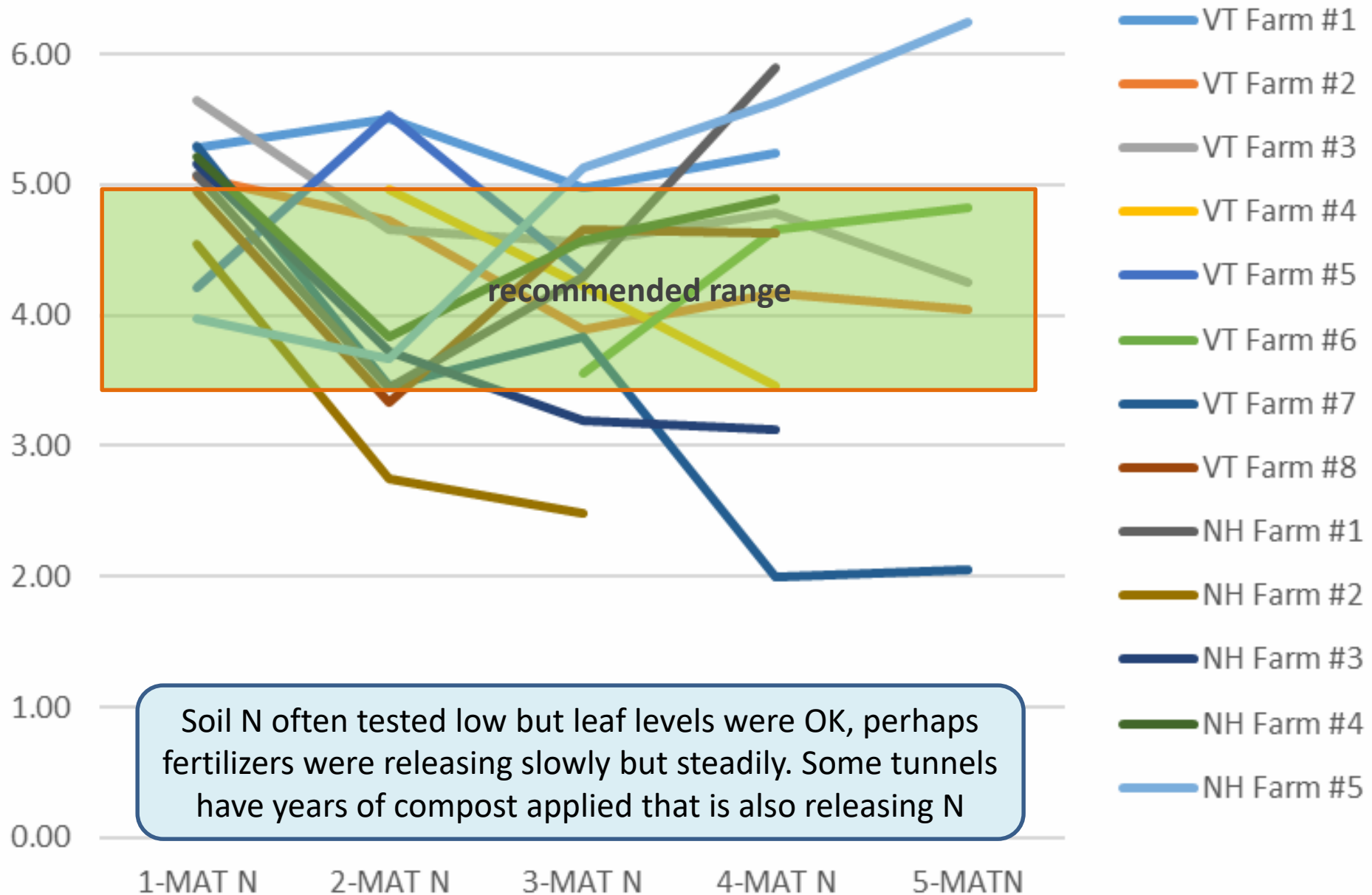
Leaf



Saturated Media ppm soil NO₃-N




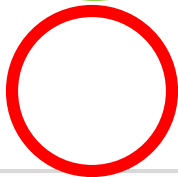
% N in leaf samples



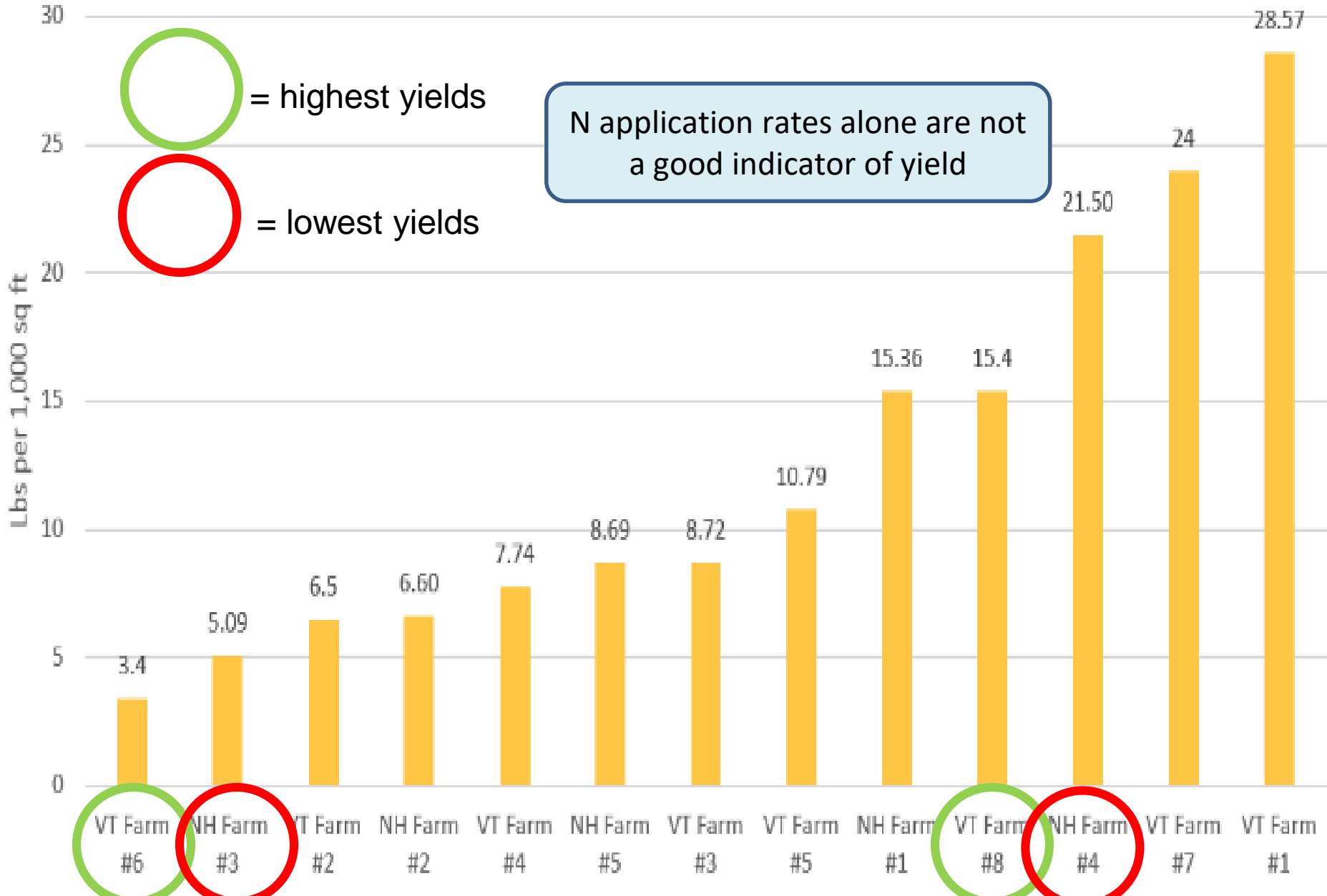
Soil N often tested low but leaf levels were OK, perhaps fertilizers were releasing slowly but steadily. Some tunnels have years of compost applied that is also releasing N

N applied

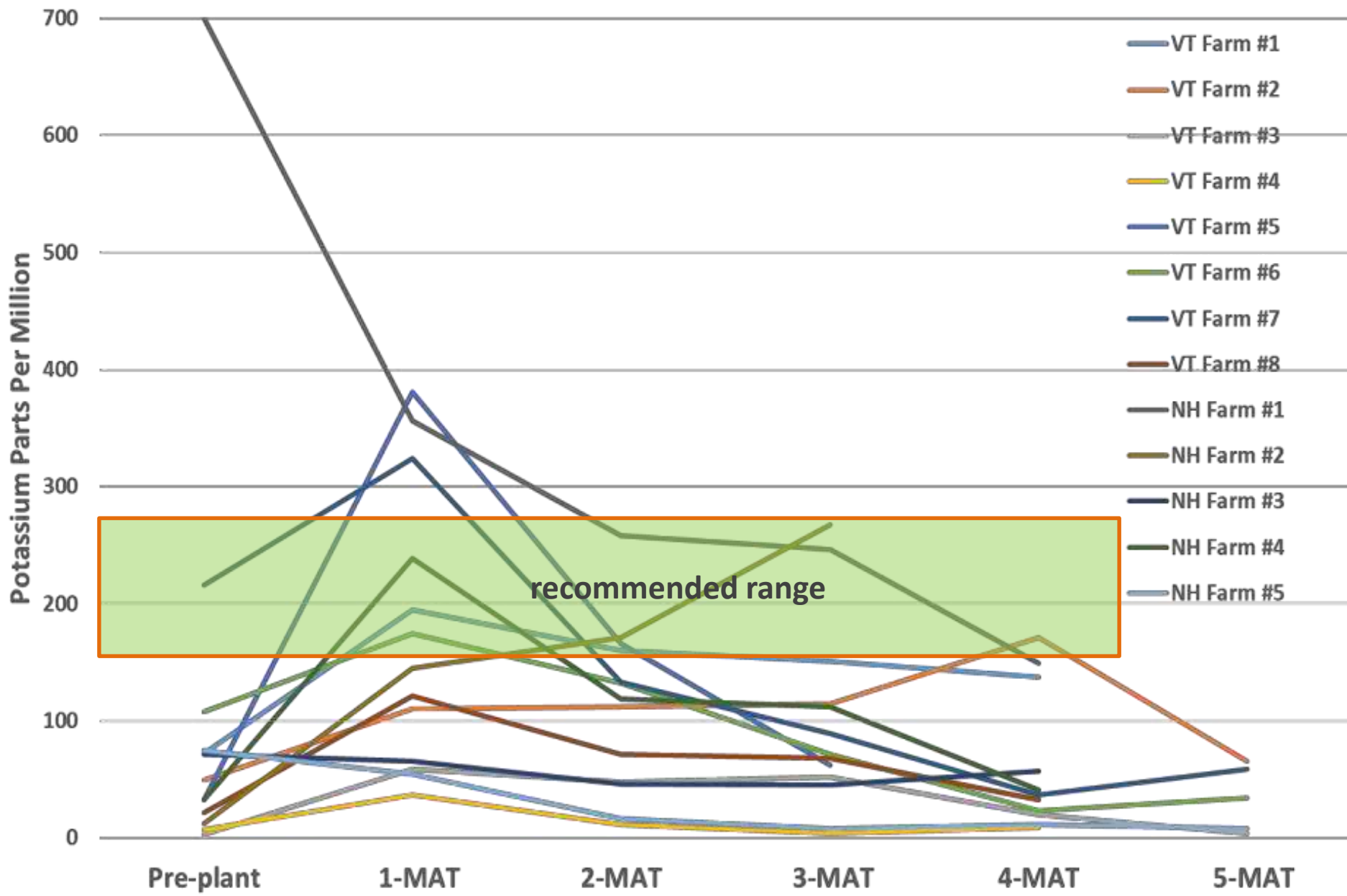
 = highest yields

 = lowest yields

N application rates alone are not a good indicator of yield

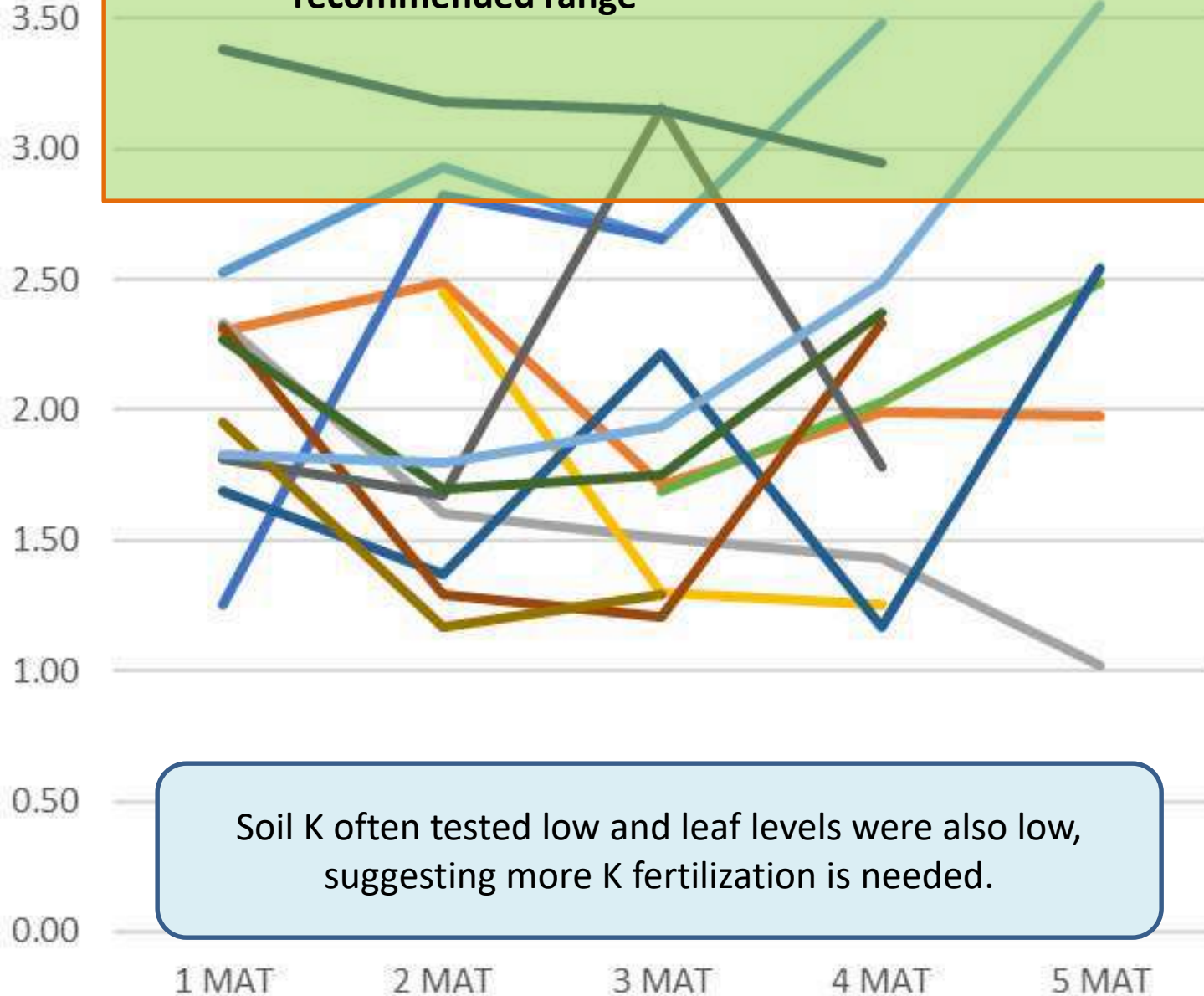


Saturated Media ppm soil K



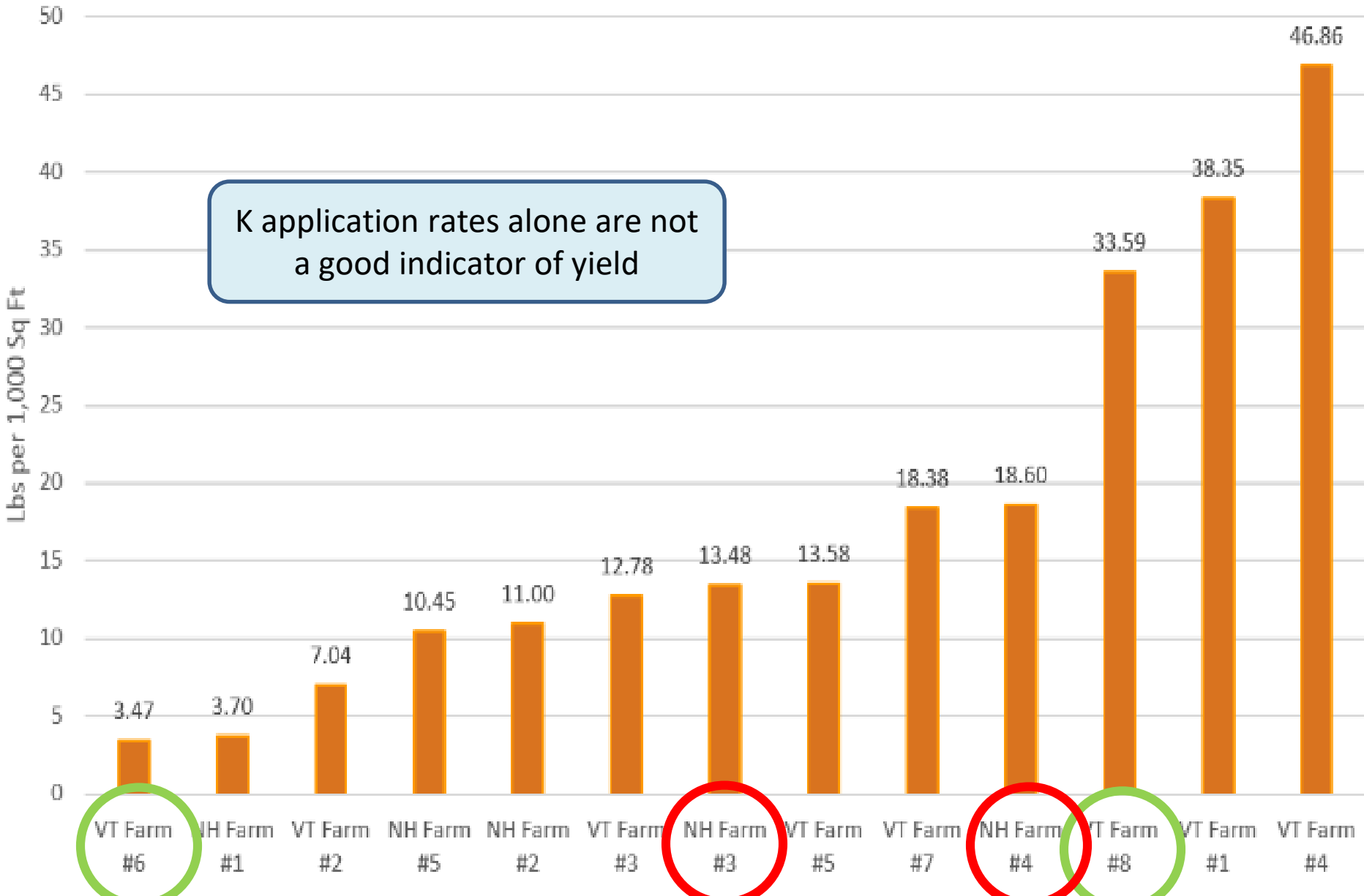
% K in leaf samples

recommended range

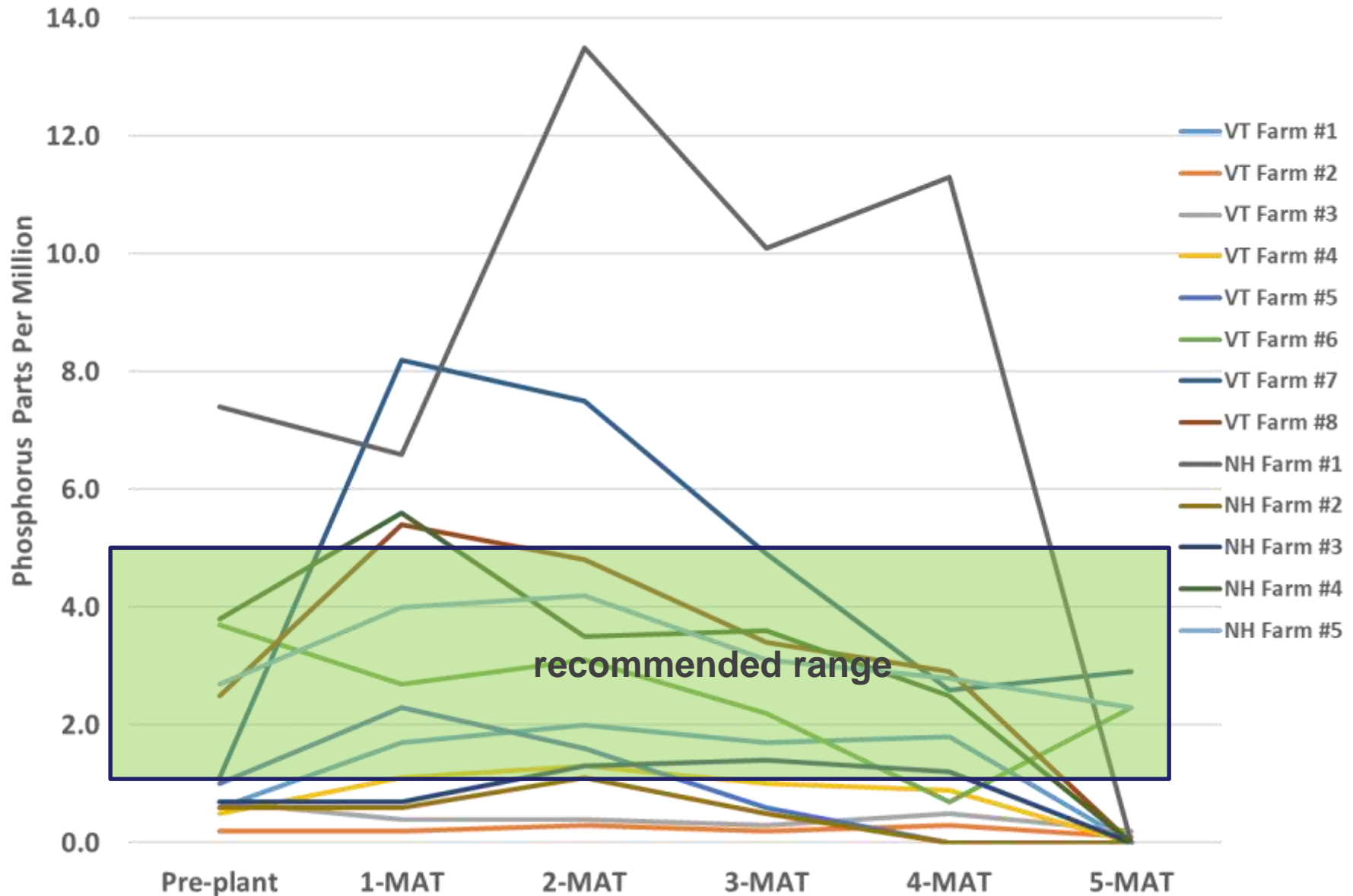


Soil K often tested low and leaf levels were also low, suggesting more K fertilization is needed.

K₂O applied



Saturated media ppm soil P

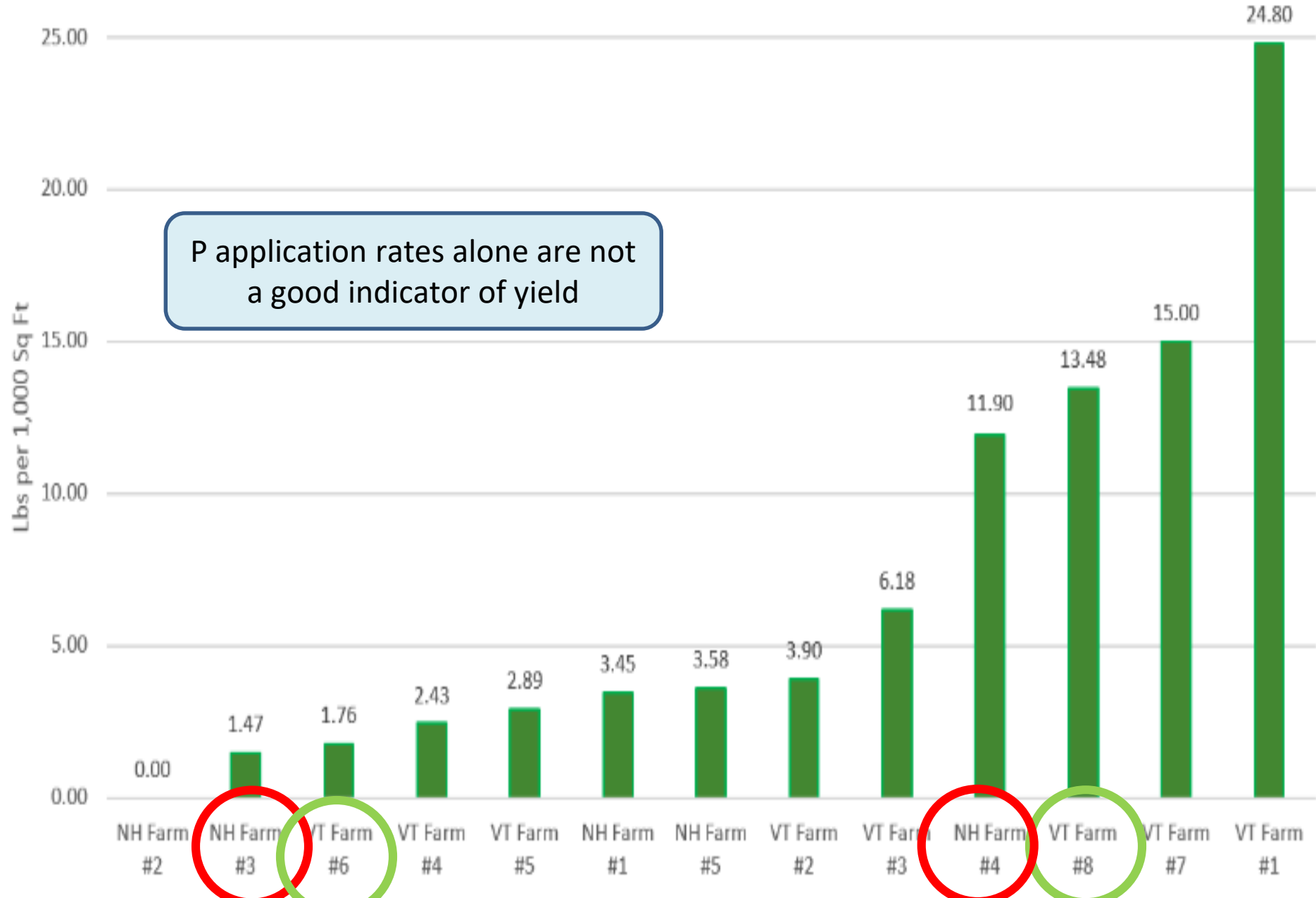


% P in leaf samples



There seems to be plenty of P available in tunnels

P₂O₅ applied



Nitrogen applications should be based on yield potential

N application rate based on yield goal						
	Yield goal lb/acre	=Yield lb/ft ²	=Yield lb/stem = lb/4 ft ²	Approx. plant height	N need lb/acre @ 90% recovery	N need* lb/1,000 ft ²
Low yield	40,000	1	4	8'	100	2.3
Medium yield	80,000	2	8	12'	200	4.6
Good yield	120,000	3	12	16'	300	6.9
High yield	160,000	4	16	20'	400	9.2

* Subtract N credit for each 1% soil organic matter of .25 lb/1,000 ft², up to 1 lb.

Fertilizers options to meet N target application rate (lb./1,000 ft²)

Target N application lb/1,000 ft ²	Soybean meal 7% N 75% avail.	5-4-3 organic 75% avail.	feather meal 10% N 75% avail	soluble fertilizer 20% N	soluble fertilizer 16% N	soluble fertilizer 12% N
2	38	53	27	10	13	17
4	76	107	54	20	25	34
6	114	160	81	30	38	50
8	152	213	108	40	50	67

If using soluble N fertilizer it is important to spread applications over the growing season to provide for consistent growth. Slower-release organic fertilizers may be front-loaded if well mixed into the soil, throughout the rooting zone, to allow for N recovery throughout the season. However, on light textured soils and/or high N application rates it is advisable to apply 1/3 to 1/2 of the total N after fruiting begins, either by using soluble materials or by spreading fertilizer by hand under mulch/drip lines.

K₂O application rate based on Modified Morgan's soil test

Yield goal	Low <400 lb./A = <200 ppm K		Medium 400-800 lb./A = 200-400 ppm K		High/optimum 800-1200 lb./A = 400-600 ppm K		Excessive > 1200 lb./A = > 600 ppm K	
	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²
Low yield	300	6.9	200	4.6	100	2.2	0	0
Med yield	450	10.3	300	6.9	150	3.4	0	0
Good yield	600	13.8	400	9.2	200	4.6	0	0
High yield	750	17.2	600	13.8	300	6.9	0	0

To provide 1 lb K₂O: apply 2 lb potassium sulfate, or 4.5 lb sul-po-mag, or 5 lb 20% soluble K₂O etc. If concurrent SME test shows less than 100 ppm K prior to transplanting, apply an additional 100 lb/acre soluble K₂O as a starter fertilizer (2.3 lb/1,000 ft²). On light-texture soils (sandy loams) K application should be split: pre-plant and sidedressing. On heavier soils (with more silt, clay) all K may be front-loaded. If Mg < 60 ppm in SME, use sul-po-mag, if >60 ppm use potassium sulfate as a K source.

P₂O₅ application rate based on modified Morgan's soil test

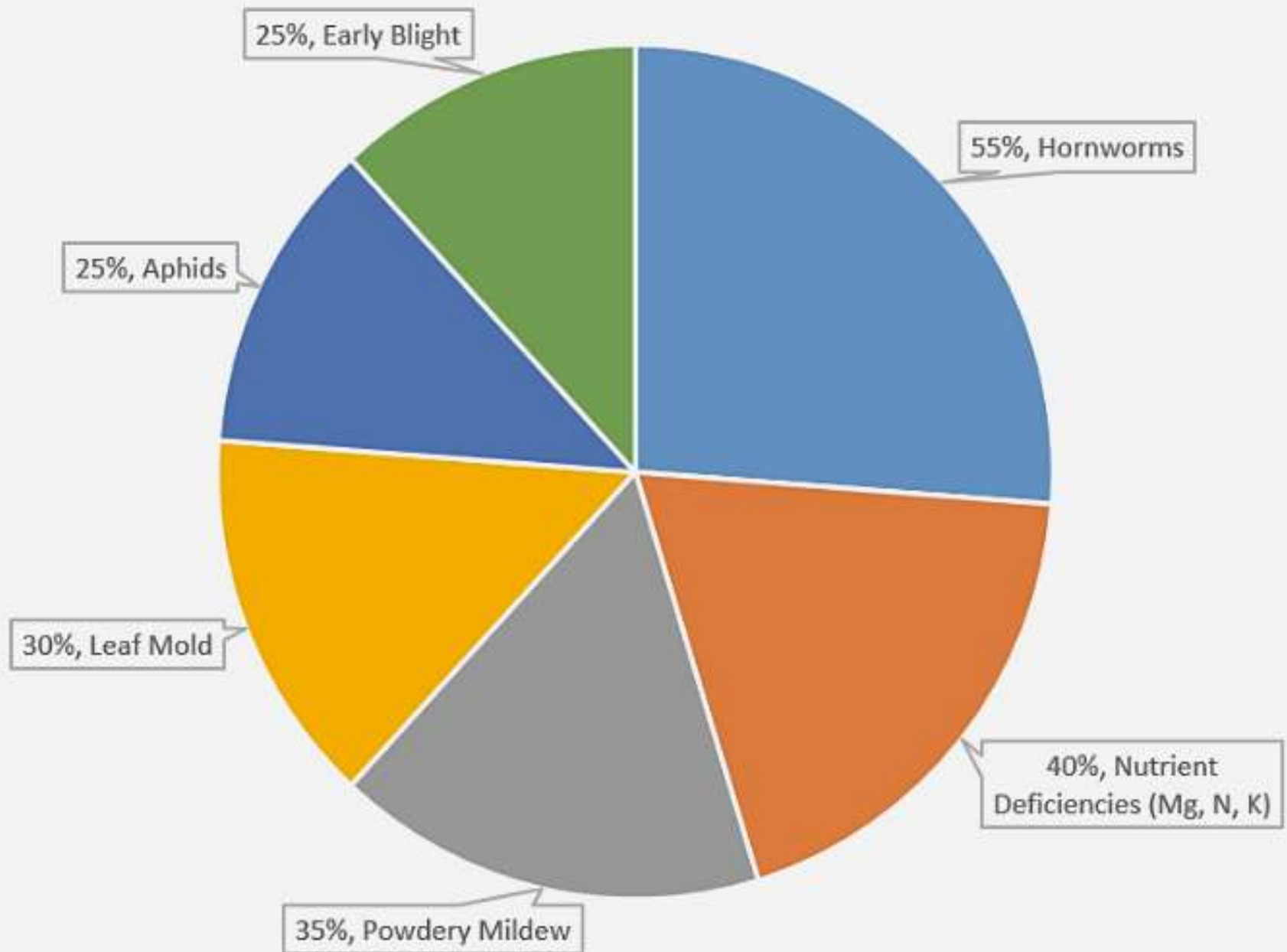
Yield goal	Low <20 lb./acre = <10 ppm		Medium 20-40 lb./acre = 10-20 ppm		High/optimum 40-80 lb./acre = 20-40 ppm		Excessive > 80 lb./acre= > 40 ppm	
	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²	lbs/acre	lbs/ 1000 ft ²
Low yield	180	4.1	120	2.8	60	1.4	0	0
Med yield	240	5.5	160	3.7	80	1.8	0	0
Good yield	300	6.9	200	4.6	100	2.3	0	0
High yield	360	8.3	240	5.5	120	2.8	0	0

If concurrent SME test shows less than 1 ppm P prior to transplanting, apply some soluble P₂O₅ as a starter fertilizer, in the range of 1 lb P₂O₅/1,000 ft².

Some fertilizer options to meet P target application rate (lb./1,000 ft²)

Target P ₂ O ₅ application lb./1,000 ft ²	Bone char 16% available	5-4-3 organic	Rock phosphate 3% available	soluble fertilizer 20% P ₂ O ₅	soluble fertilizer 10% P ₂ O ₅	soluble fertilizer 5% P ₂ O ₅
1 lb	6.3	25	33	5	2.5	20
2 lb	12.5	50	66	10	5	40
3 lb	18.8	75	99	15	7.5	60
4 lb	25	100	132	20	10	80
5 lb	31.3	125	165	25	12.5	100

Top insects and diseases reported



Powdery mildew has become a serious threat to tunnel tomatoes



Do not delay treatment! Consider tolerant varieties (Rebelski, others?)

Soil compaction does not appear to be widespread, but it can be a problem in tunnels



Test before planting using penetrometer in 10+ locations. If >300 psi is found at less than ~15 inches, subsoil or form raised beds.



Use enough drip lines to moisten the entire rooting area when irrigating; roots cannot get nutrients from dry soil

Recommendations



- **Estimate your target yield – then track yields**
- **Consider tighter plant spacing, if appropriate**
- **Measure soil compaction, address if needed**
- **Add irrigation lines for uniform soil moisture**
- **Keep up with leaf pruning**
- **Scout for pests often; be prepared to manage them**
- **Adjust soil pH to 6-7, aim for organic matter 6%+?**
- **Monitor available and reserve soil nutrient levels**
- **Provide sufficient N, P and K needed for high yields**