Potassium (K) Tissue Demonstration project 2013

- Plant tissue testing for nutrient content has increased greatly past 5 years
- Many questions on how the soil conditions in the field can effect nutrient levels in plant tissue
- Potassium was the nutrient chosen for this project since it seems to be the first nutrient effected by changes in soil moisture level.

K Tissue Project Questions?

- What happens to the K tissue levels as crops grow through the growing season?
- What effect does soil moisture have on K tissue level.
- Will excessive K fertilizer application result in luxury uptake of K by the crop?
- Will the “Chloride” in the potash show up in the “Cl” tissue levels for all crops?
- What effect will K rate have on soil test levels after harvest?

K Tissue Project Method

- K fertilizer (0-0-60) applied and tilled into soil before planting
- Four Fields: wheat, corn, soybeans, sugarbeet
- K rates: 0, 50, 100, 200, 400 lb/a K_20
- Tissue samples collected 2-3 times during growing season
- Soil samples collected after harvest


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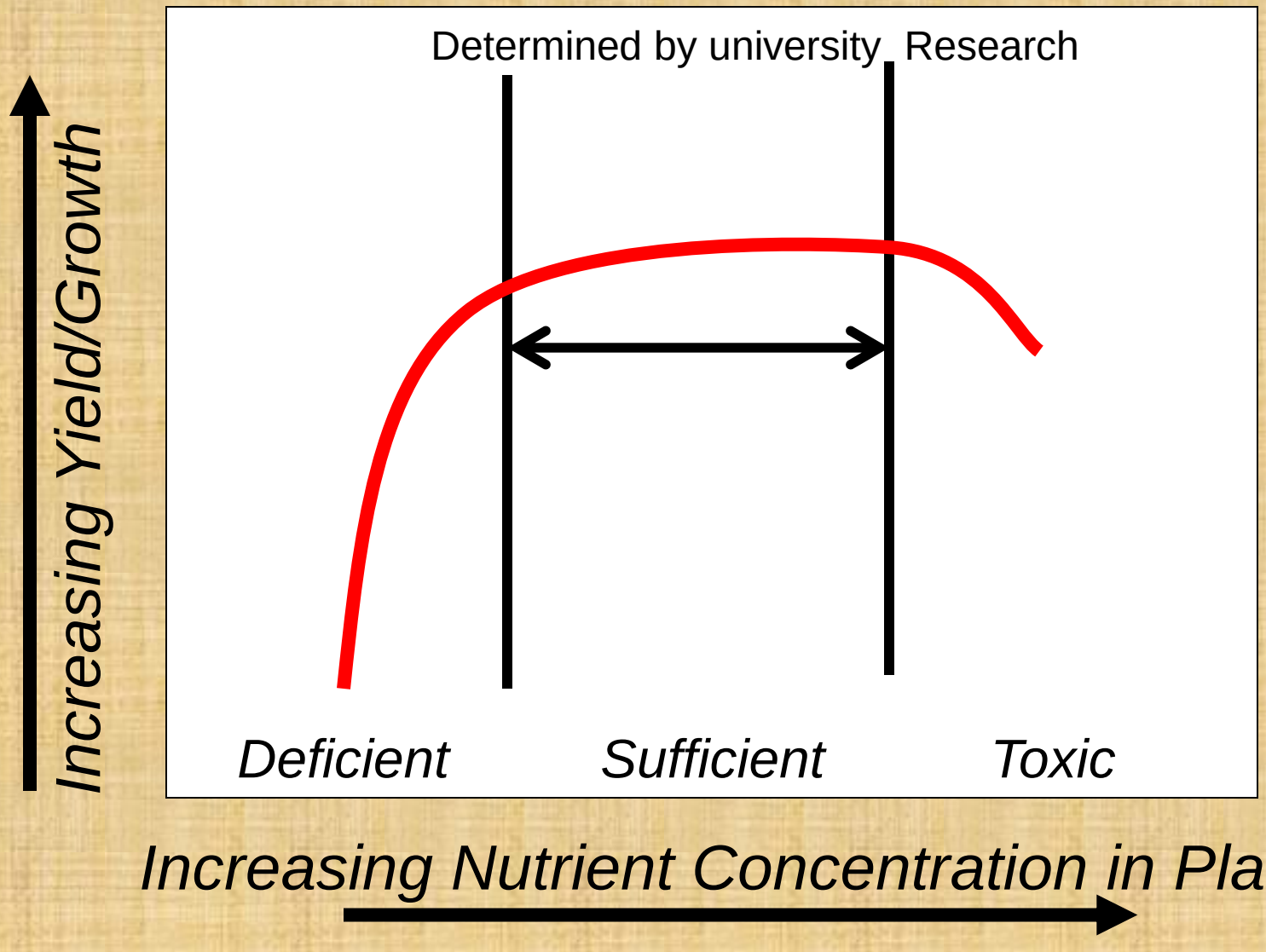
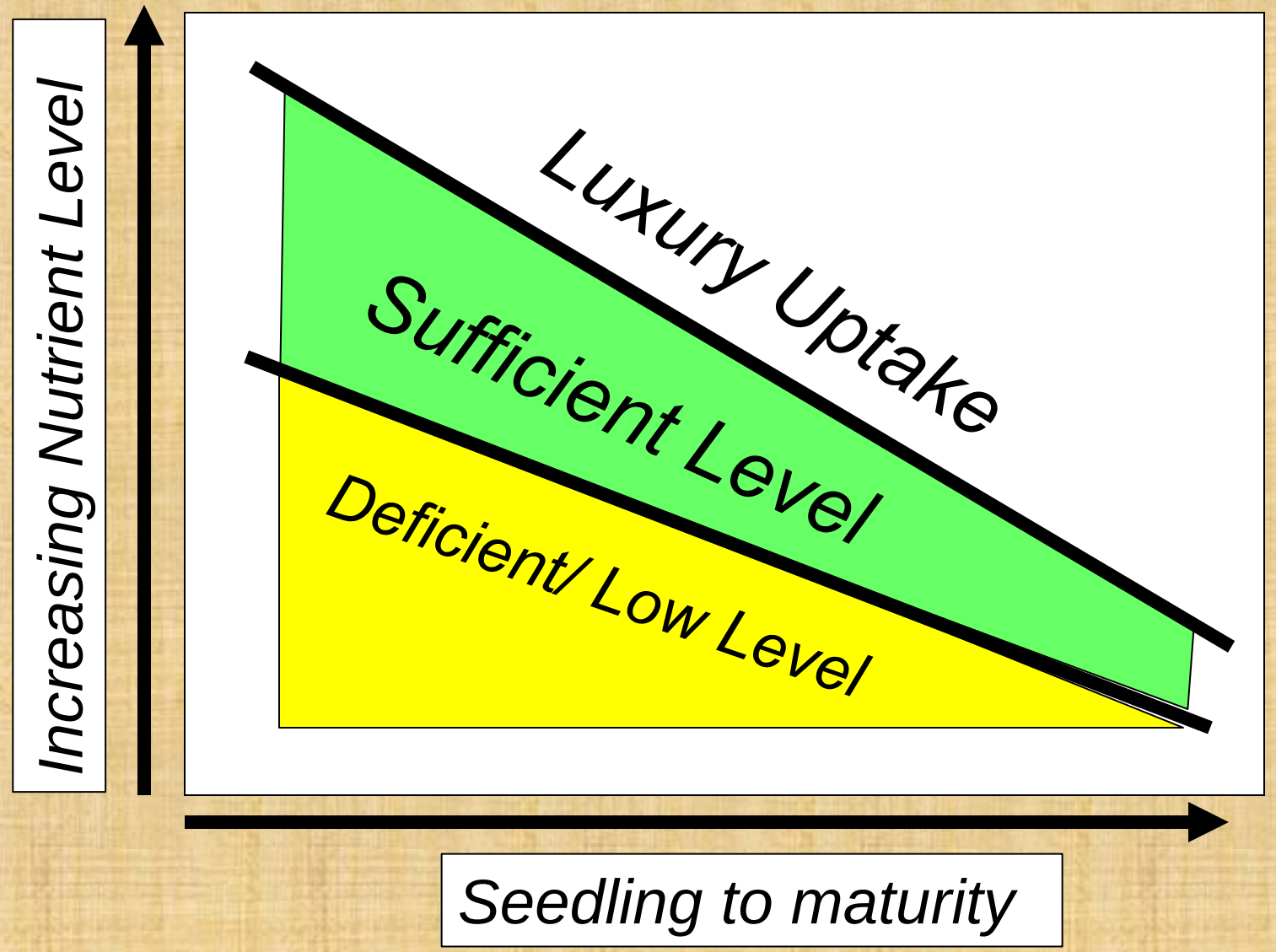
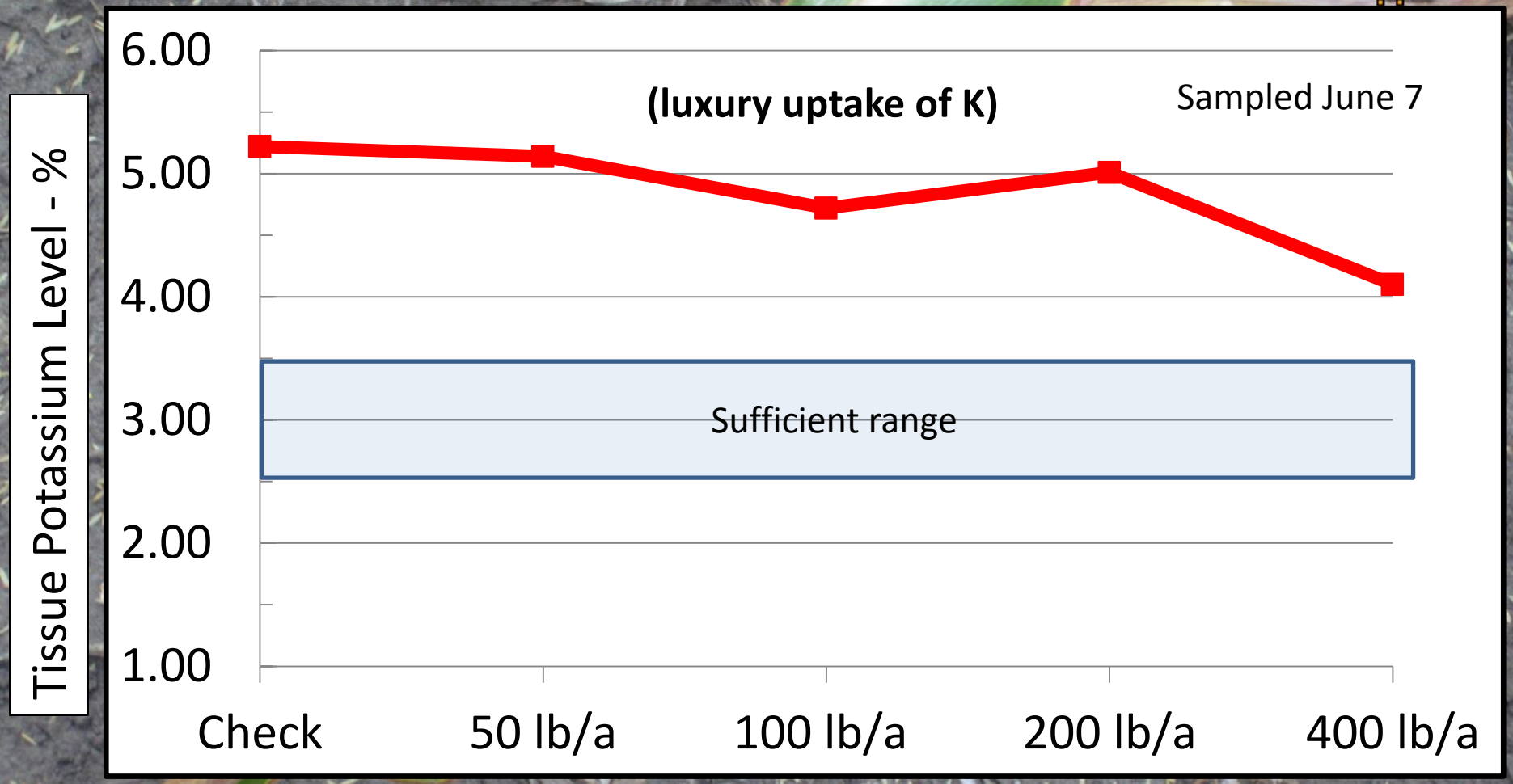
Sufficiency Range Interpretation



Sufficiency Range Interpretation

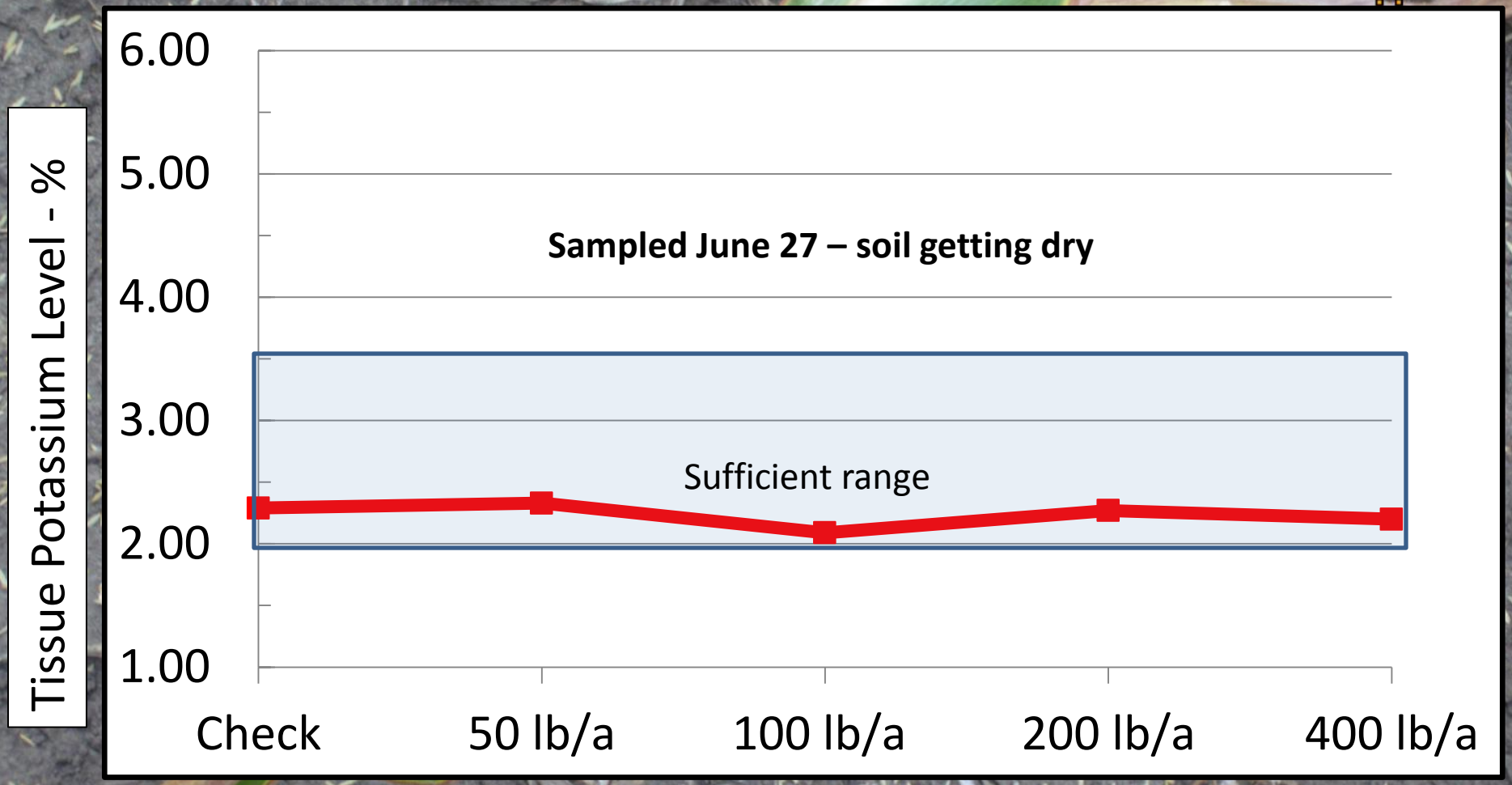


Wheat Tissue K levels
Tillering Stage (whole plant)



Initial K soil Test level – 480 ppm,
K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Wheat K Tissue Levels
Boot Stage (upper Leaves)



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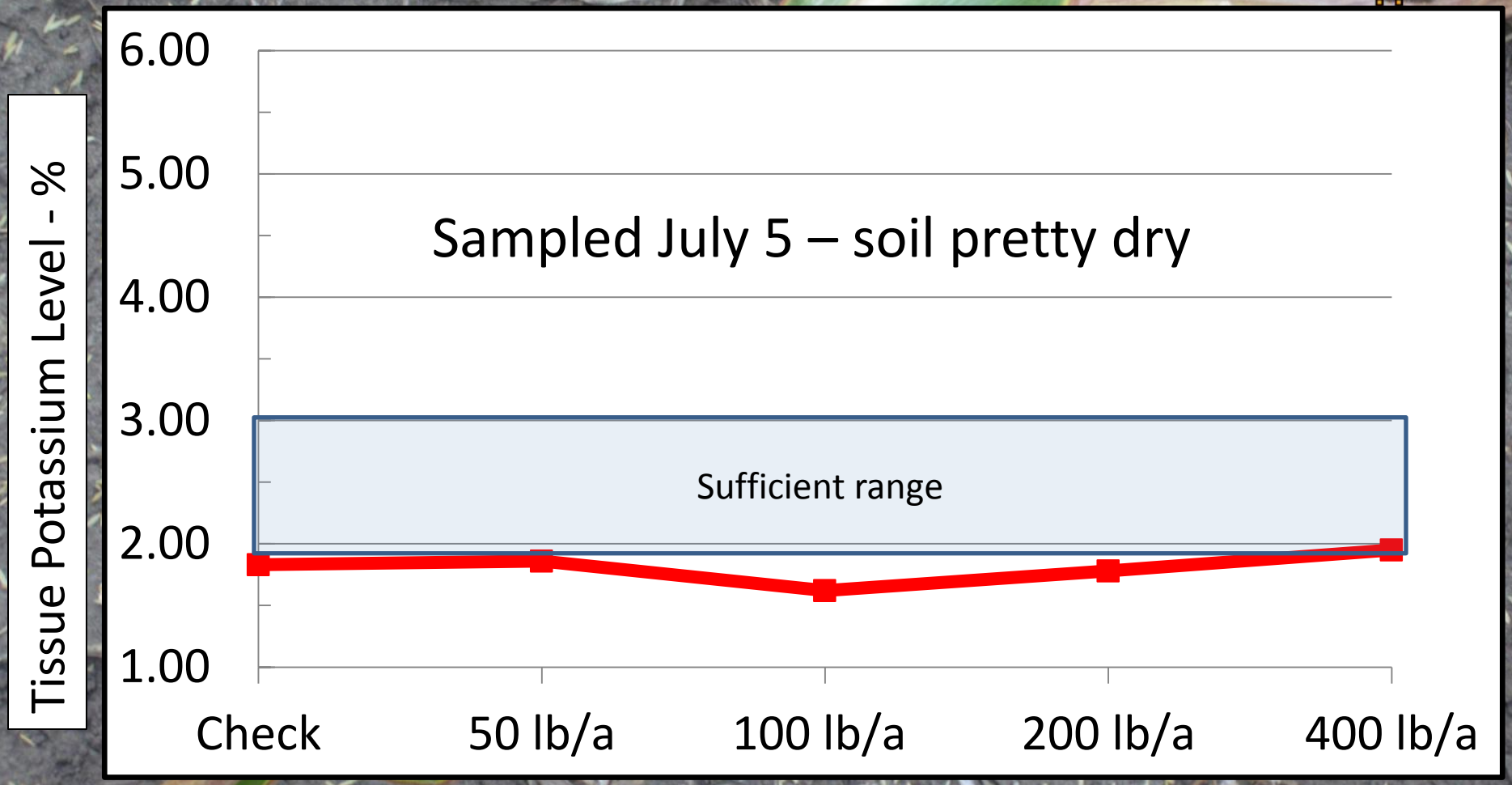
Wheat K Tissue Levels Heading (Flag Leaf)

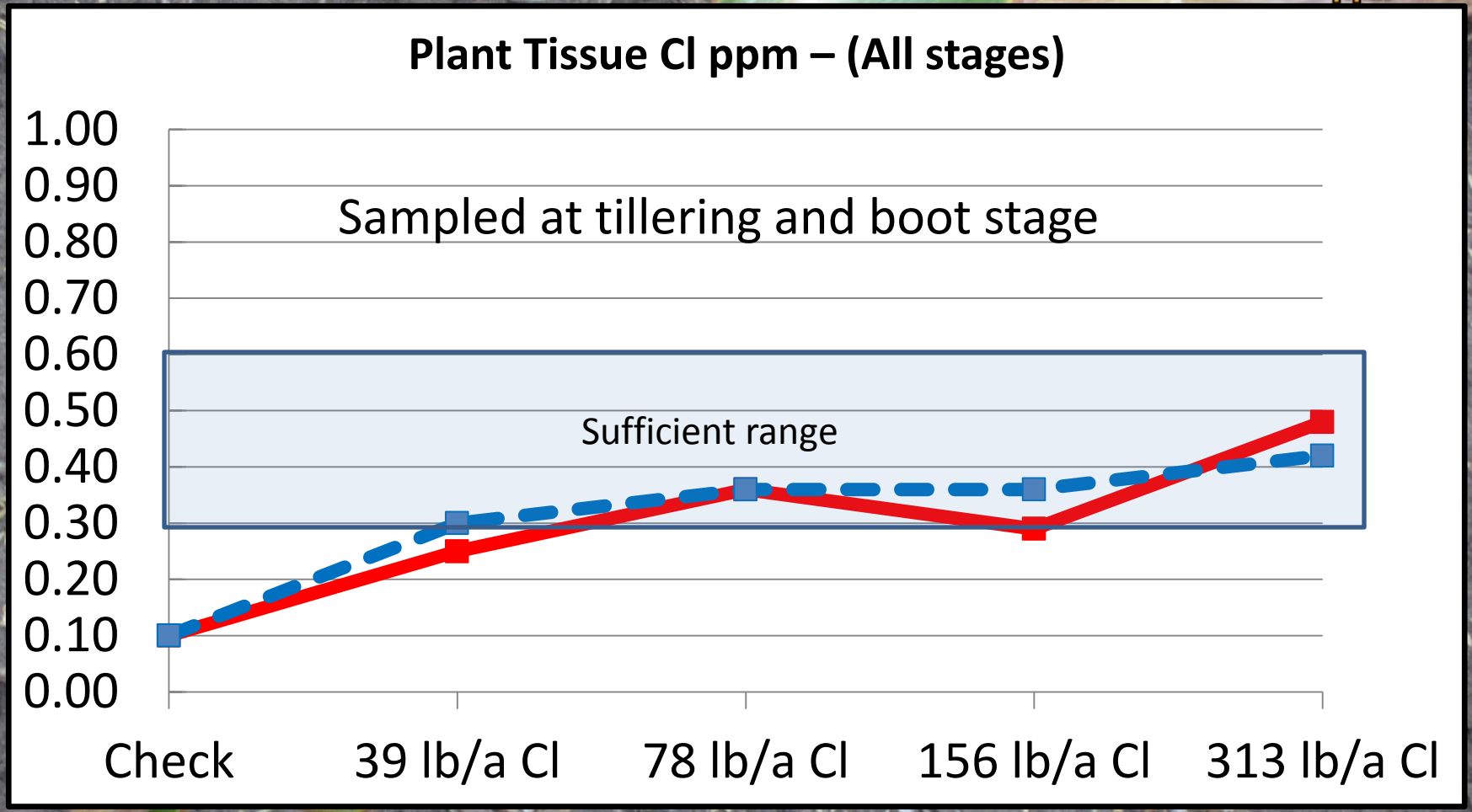


Initial K soil Test level – 480 ppm,
K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Wheat Field – K soil test 480 ppm

- Tillering Stage
  - K tissue levels high at all K fert rates (luxury consumption)
- Boot stage
  - K tissue levels in sufficiency range for all K fert rates
- Heading
  - K tissue levels at low end of sufficiency range for all K rates (sandy loam soil getting pretty dry)

Wheat "Cl" Tissue Levels



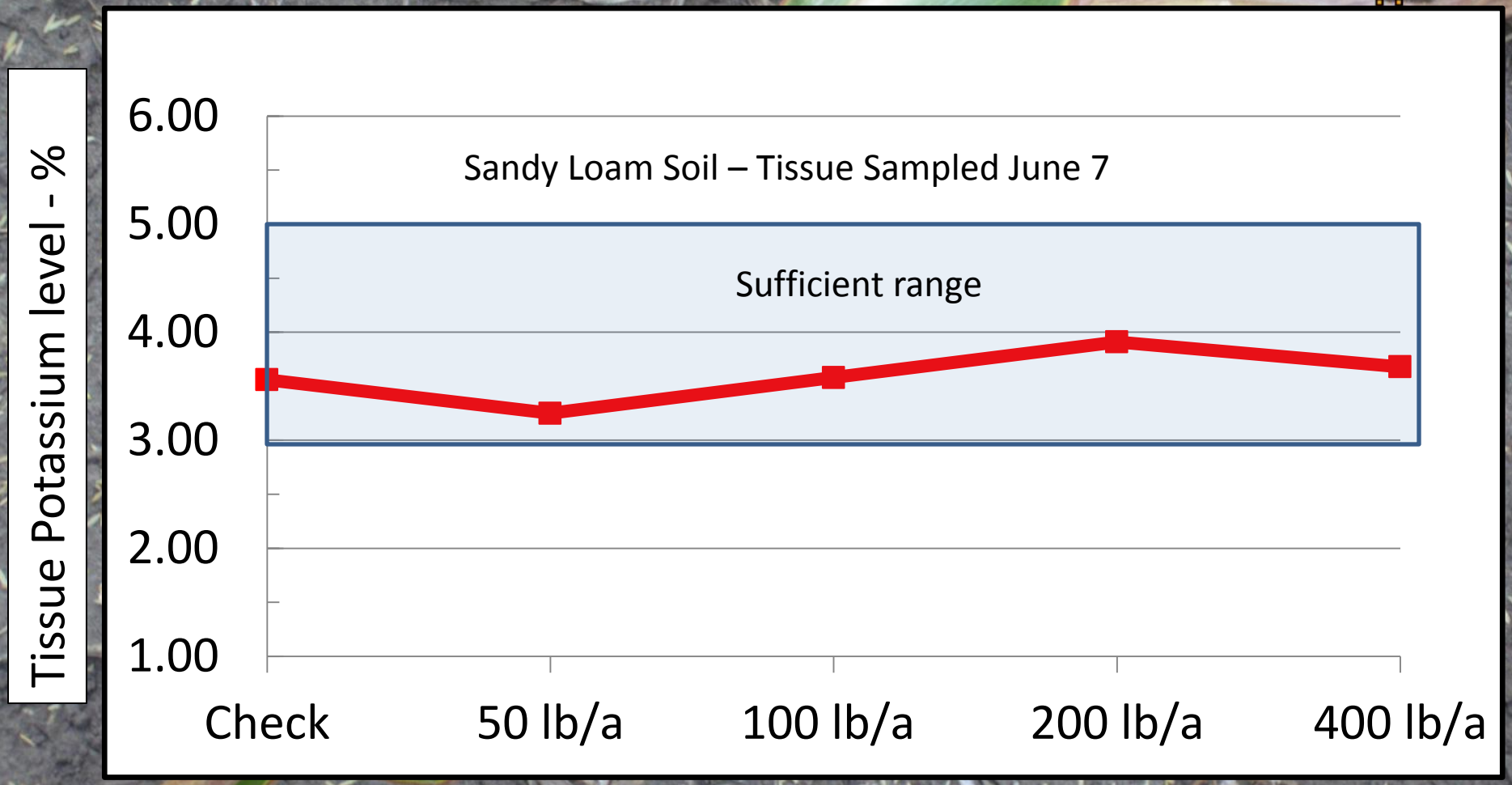
Initial Cl soil Test level – 20 lb/a (40 lb/a is critical level for wheat)
KCl (0-0-60) applied - Fertilizer tilled into soil before planting

Wheat – Chloride Uptake

- Wheat is sensitive to chloride
- Critical soil test level 40 lb/a (20 lb soil test)
- 39 lb/a Cl (50 lb/a K20) brought tissue level into the sufficient range at all stages

Corn K Tissue Levels

<12” stage - (whole plant)

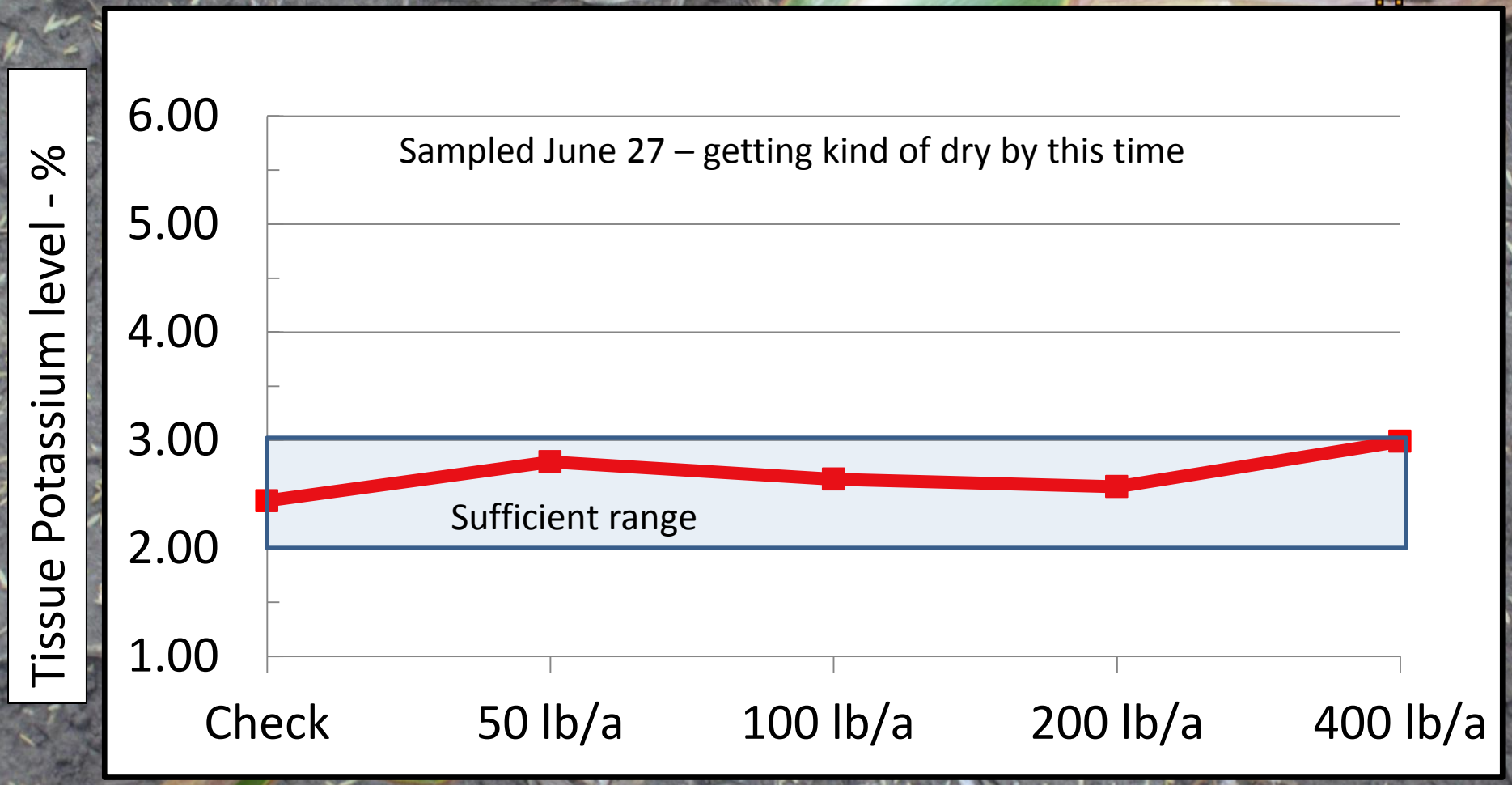


Initial K soil Test level – 198 lb/a

K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Corn K Tissue Levels

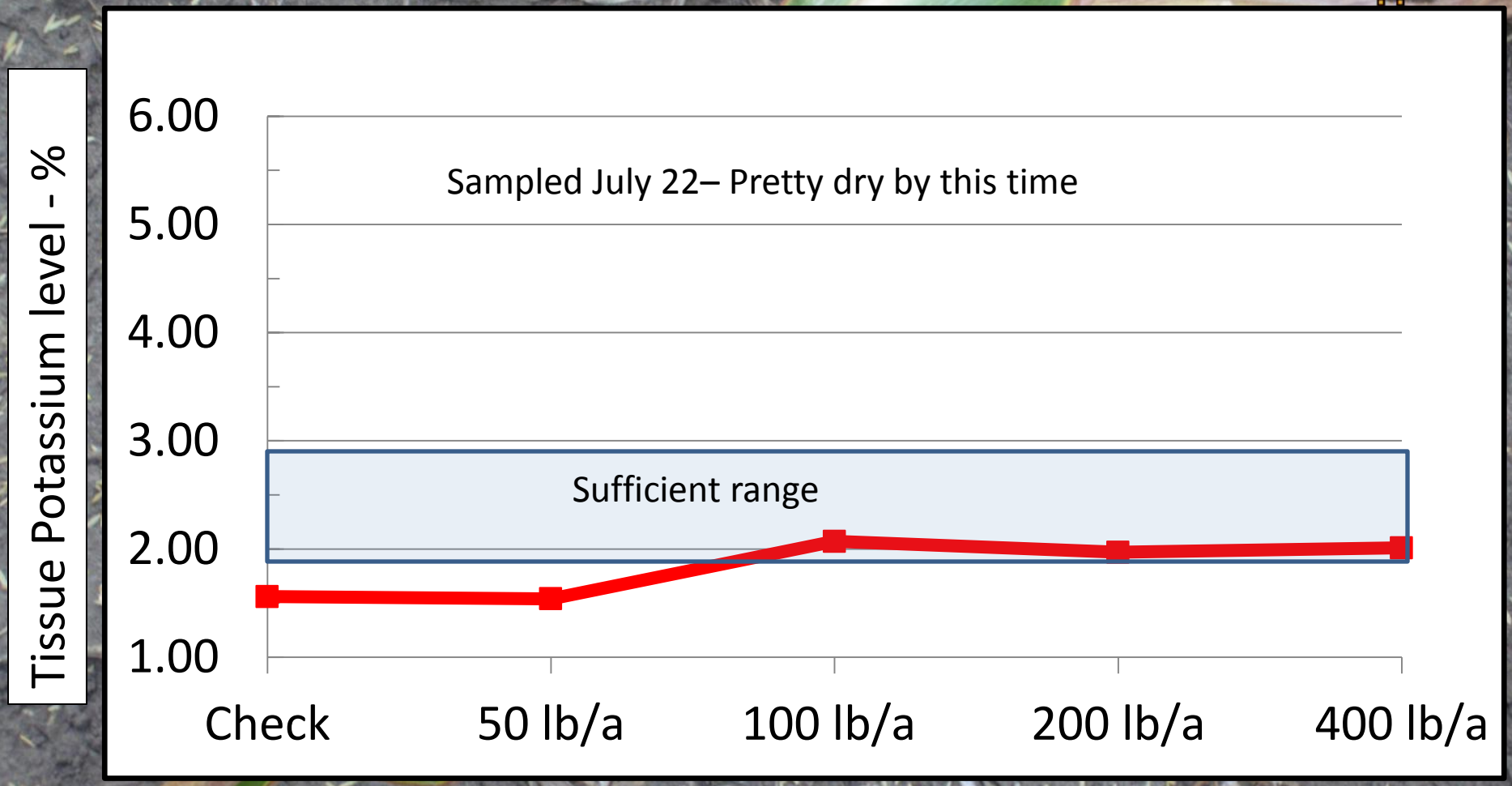
12" to tasseling (mature leaf)



Initial K soil Test level – 198 lb/a (high)
K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Corn K Tissue Levels

Tasseling Stage (Mature Leaf)



Initial K soil Test level – 198 lb/a

K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Nutrient Uptake by Plants

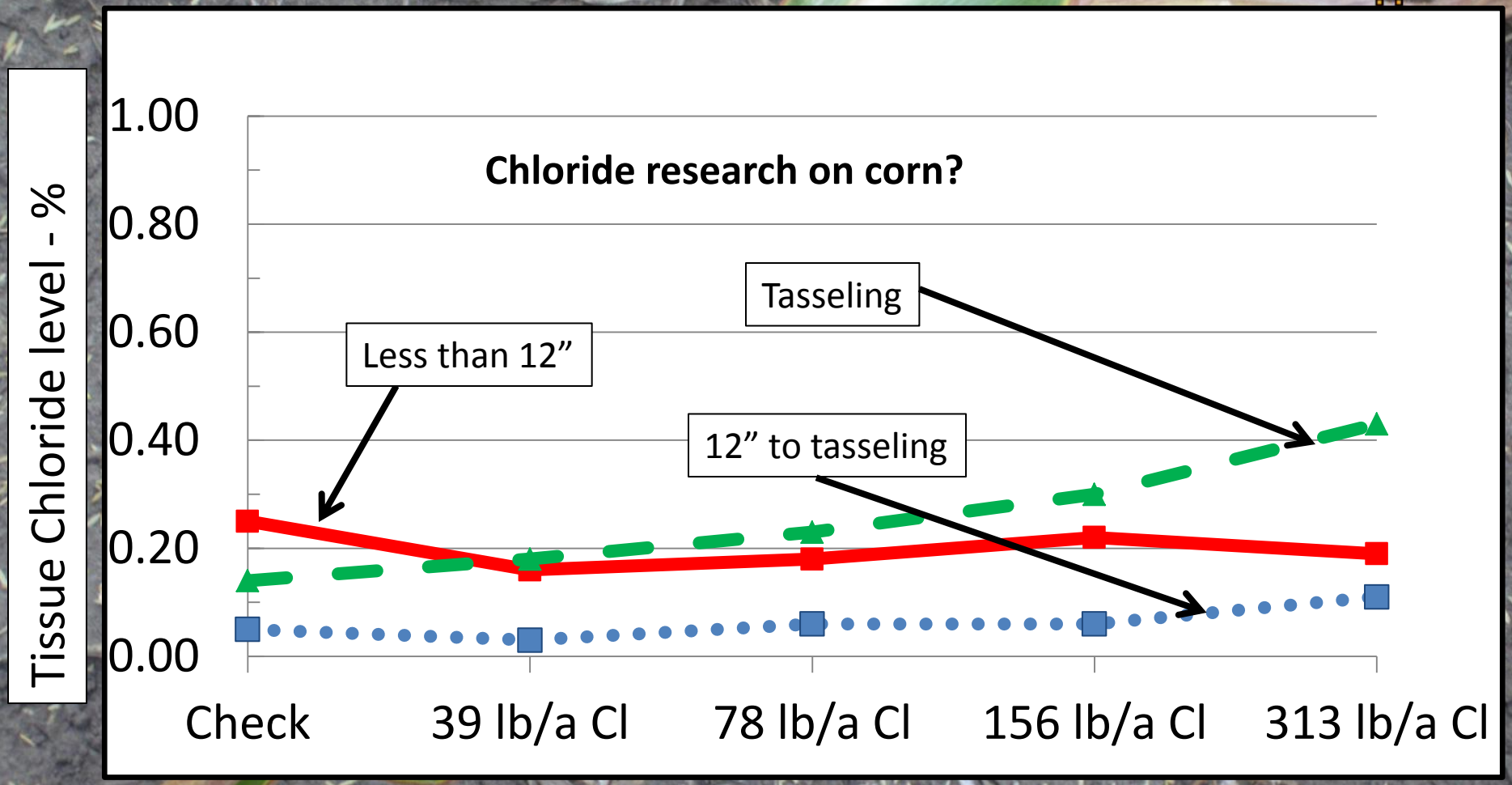
Nutrient	**Root Interception**	**Mass Flow**	**Diffusion**
Nitrogen	**<1%**	**80%**	**19%**
Phosphorus	**2%**	**5%**	**93%**
Potassium	**2%**	**18%**	**80%**

Mass flow – Nutrient transported to the root surface by movement of water.
(Mass flow decreases as soil moisture goes down)

Corn Field – K soil test 198 ppm

- Less than 12”
- K tissue levels remained in sufficient range at all K fert rates
- 12” to tasseling
  - K tissue level remained in sufficient range at all rates of K fertilizer
- Tasseling
  - K tissue level were below the sufficient range until the 100 lb/a rate (sandy loam soil getting pretty dry)

Corn "CL" Tissue Level



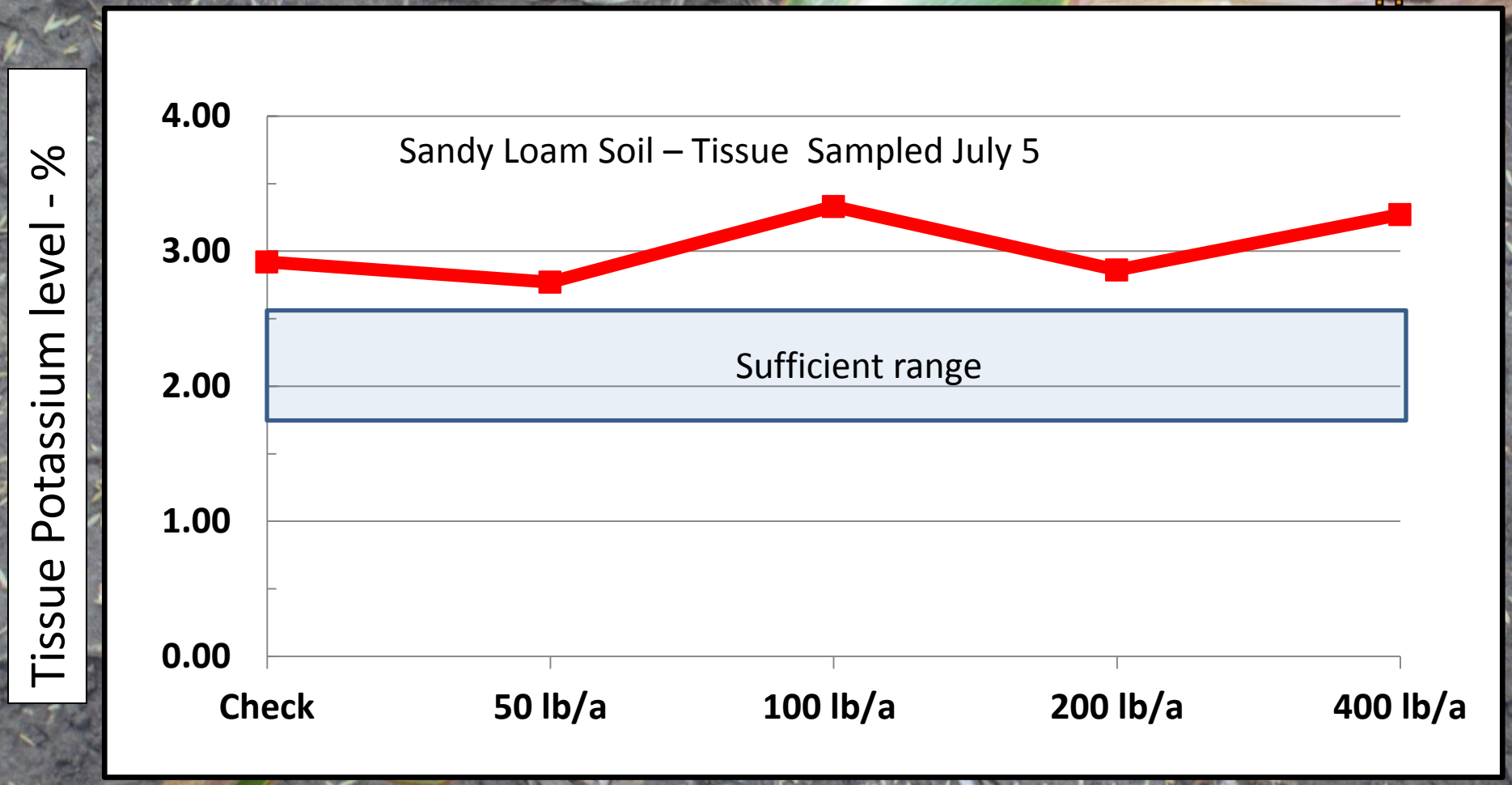
Initial Cl soil Test level – 25 lb/a
KCl applied as (0-0-60) - Fertilizer tilled into soil before planting

Corn – Cl uptake – 20 lb/a soil test

- Corn is somewhat sensitive to chloride
- Critical soil test level? (40 lb/a – wheat)
- Did not see increased uptake of Cl until tasseling stage (early season moisture may have moved chloride below the root zone early in the season

Soybean K Tissue level

Soybean less than 6" tall (whole plant)

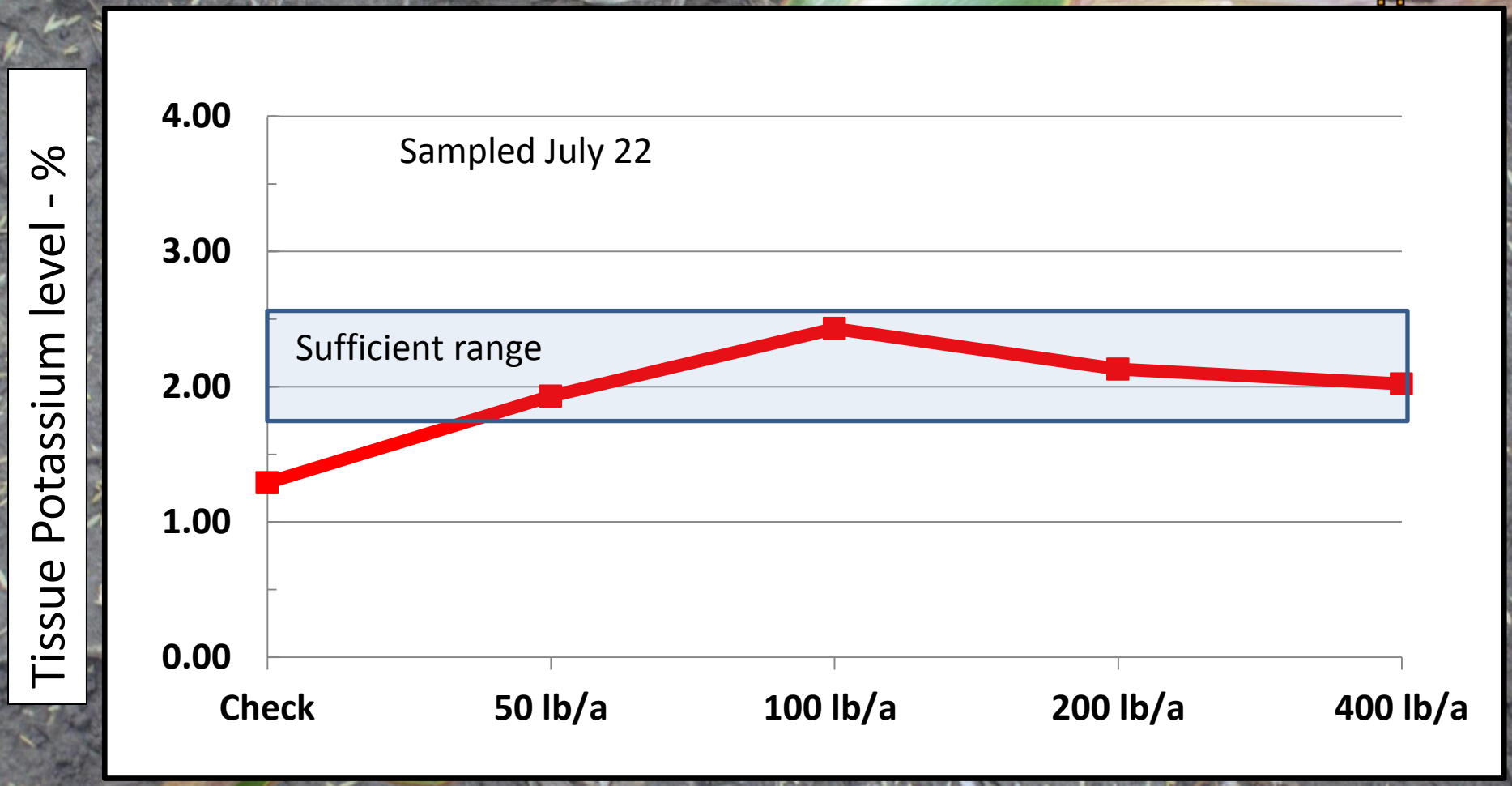


Initial K soil Test level – 130 ppm (medium to High)

K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Soybean K Tissue level

Early Bloom (recently mature leaf)



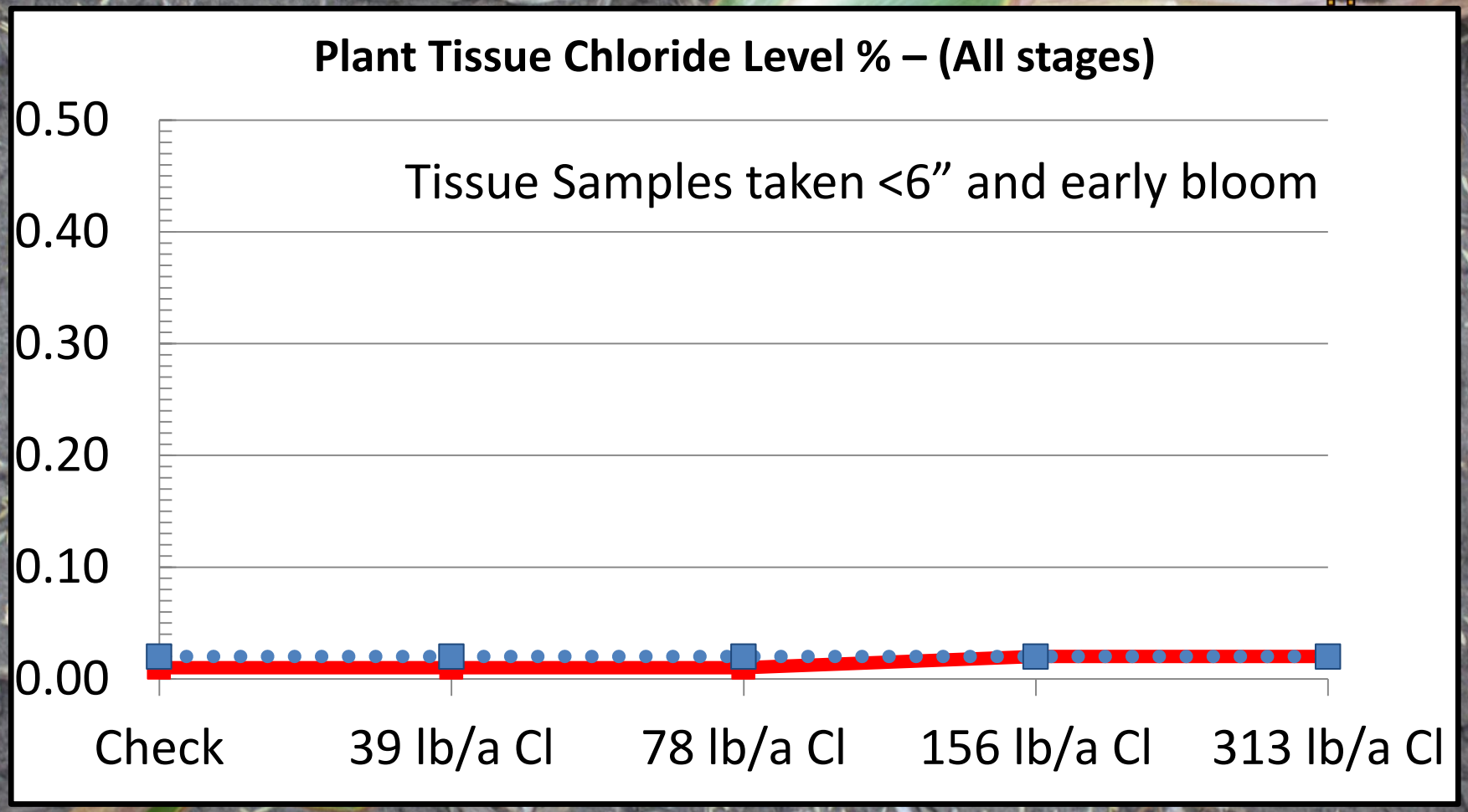
Initial K soil Test level – 130 ppm
K applied as lb/a K_2O, Fertilizer tilled into soil before planting

Soybean Field – K soil test 130 ppm

- Less than 6” (whole plant)
- K tissue levels remained in sufficient range at all K fert rates
- Early Bloom (recently mature leaf)
  - 50 lb/a K_2O rate and higher was required to bring tissue K level into the sufficient range.
  - K soil level may have been limiting
  - Soil moisture was pretty low at this time.

Soybean "Cl" Tissue Levels

K Tissue Project 2013



Initial Cl soil Test level – 10 lb/a

K applied as lb/a K_2O, Fertilizer tilled into soil before planting

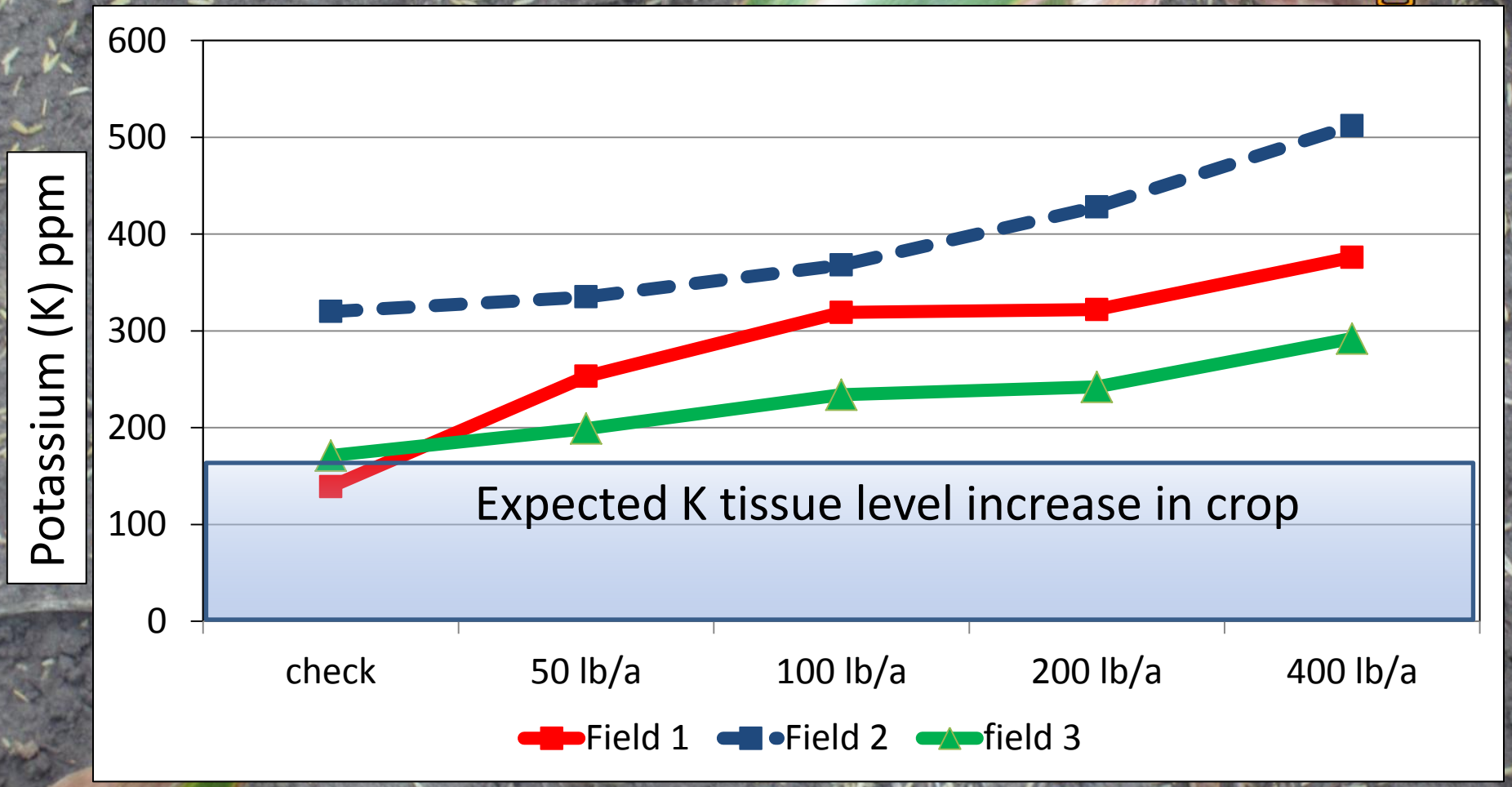
Soybean – Cl uptake – 20 lb/a soil test

- Soybean is not sensitive to low chloride levels in the soil
- Tissue chloride levels at any rate of K fertilizer were very low.

Chloride (Cl-) – Mobile Harvest time soil test level

Rate Cl lb/a	Soybean Site	Corn Site	Wheat Site	Sugarbeet Site
	Cl lb/a 0-24”	Cl lb/a 0-24”	Cl lb/a 0-24”	Cl lb/a 0-24”
Check	4lb	20lb	24	16
39 lb/a	8 lb	20 lb	20	28
78 lb/a	4 lb	20 lb	56	52
156 lb/a	4 lb	24 lb	36	52
313 lb/a	16 lb	20 lb	100	80
Soil Text	Sandy loam	Sandy loam	Silt Loam	Clay Loam

K Soil Test levels



1.8-3 lb/a K2O required to increase soil test 1 ppm (based on 400 lb/a K2O rate)

Potassium (K) Tissue Demonstration Project

- Tissue levels were affected by K soil test level
- Dry soil conditions seemed to decrease the K tissue level regardless of K fertilizer applied
- High soil K levels resulted in luxury uptake by wheat early in the season but not later
- Chloride uptake increased with higher rates on wheat and corn but not for soybeans.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High K Rates
Affect on soil test levels

- *Soil K levels increased as the K fertilizer rates increased*
- *The soil test level increased at different rates, depending on the initial K soil test level*
- *The calculated K% (base saturation) was changed very little, even with 400 lb/a K2O (666 lb 0-0-60 applied)*

K% on Base Saturation
(what happened when high rates of K fertilizer applied?)

Rate K2O lb/a	K Soil Test	K% calculated Base Saturation
	ppm	%
Check	320	3.3%
50 lb/a	335	3.4%
100 lb/a	368	3.6%
200 lb/a	428	4.2%
400 lb/a	512	4.7%

Salts 0.3-0.5 (low), carbonates 0.5% to 1.5% (low), pH 7.7 topsoil , 8.0 subsoil