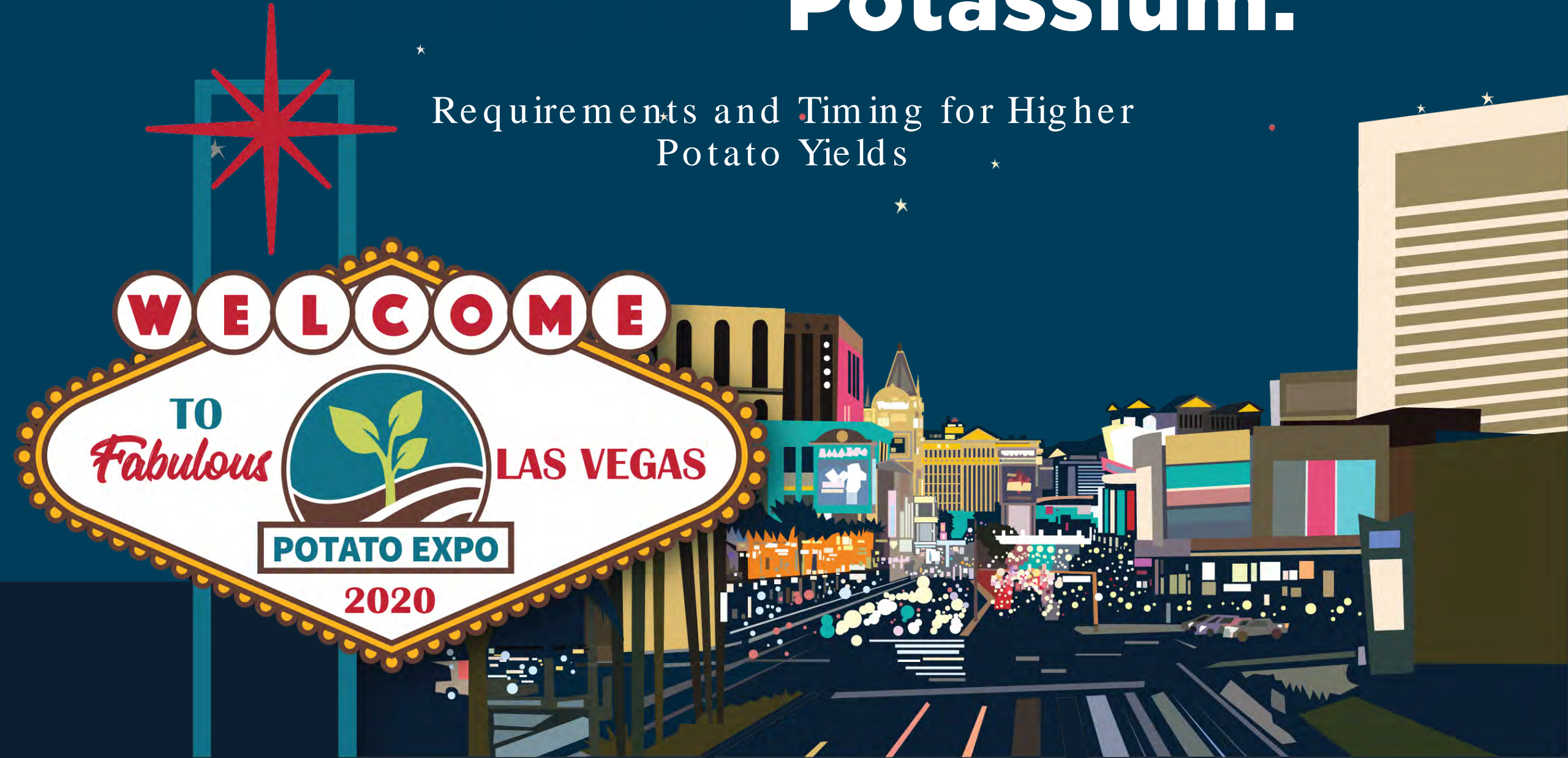


Potassium:

Requirements and Timing for Higher
Potato Yields





Did you know...

During Colonial times, people burned wood and other organic matter in pots to manufacture soap. The ashes were rinsed and the water was allowed to evaporate, leaving a residue of potassium salts. People called the residue “**pot ashes**” or **potash**.





Marschner's

Did you know? Marschner's Mineral Nutrition of Higher Plants

“Potassium is essential for the activation of ATP with a ΔG° of -30.5 kJ mol⁻¹” **

**From: Marschner's

activation of ATP with a ΔG° of -30.5 kJ mol⁻¹” **



THIRD EDITION

Edited by
Petra Marschner



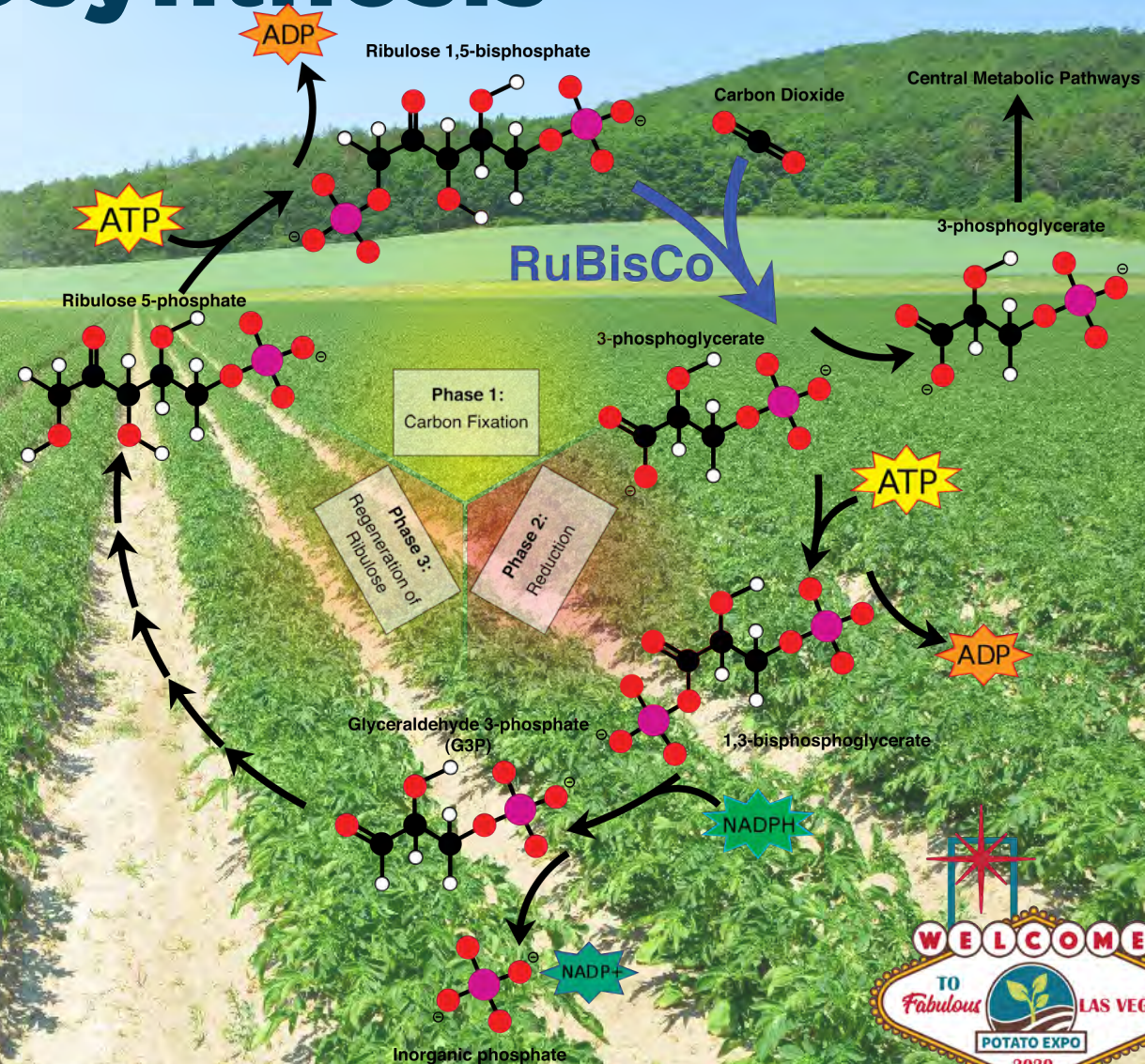
Edited by Petra Marschner,
2012



Potassium - Photosynthesis

LOW K = *less* daytime photorespiration
LOW K = *more* nighttime photorespiration

By Mike Jones - Own work, CC BY-SA 3.0



Potassium - Traffic Flow



- LOW K = LESS nighttime stem expansion + MORE daytime stem shrinkage!
- LOW K = sugars accumulate and growth slows.
- LOW K, excess leaf sugar = less 'sink' demand in new leaves and tubers



Potassium – Enzymes

- Many enzymes are either completely dependent on K or are stimulated in the presence of K.
- Starch Synthetase is one important group of enzymes that regulated the conversion of sugars to starch;

“The activities of starch synthase, phosphorylase and ADPglucose pyrophosphorylase were increased 2–2.5 fold by the presence of 100 mM K⁺.” **

**Starch Synthesis in Developing Potato Tubers, J. Hawker, Et al., in Physiologia Plantarum, 1979

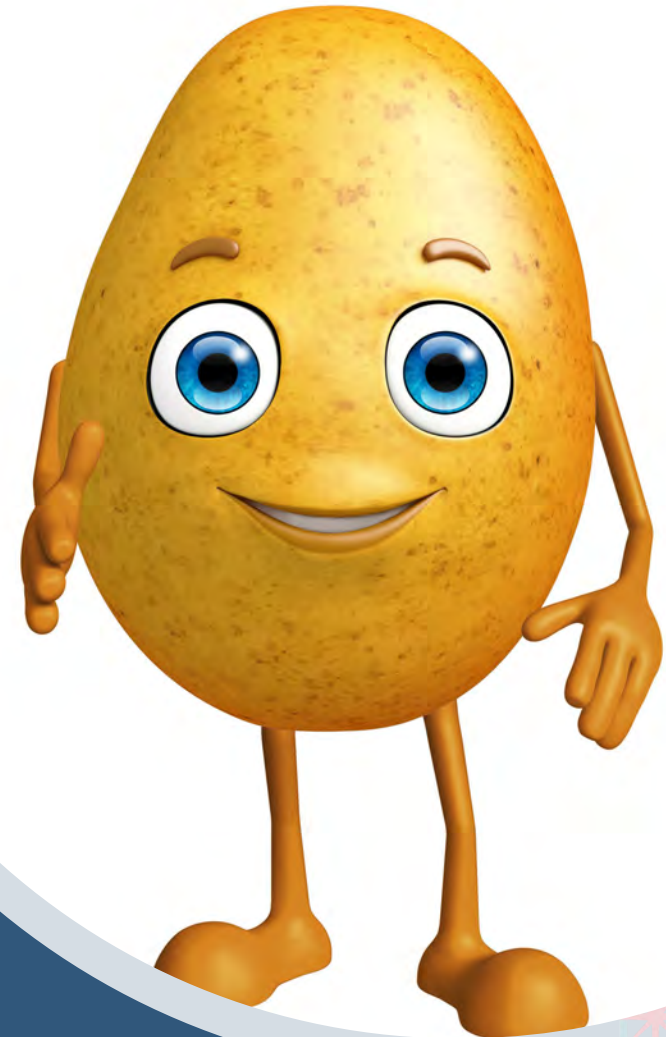


Potassium & Nitrogen are 'partners'

Nitrogen grows the plant...

Potassium helps convert simple amino acids & sugars to complex

Can impact disease & insect pressure



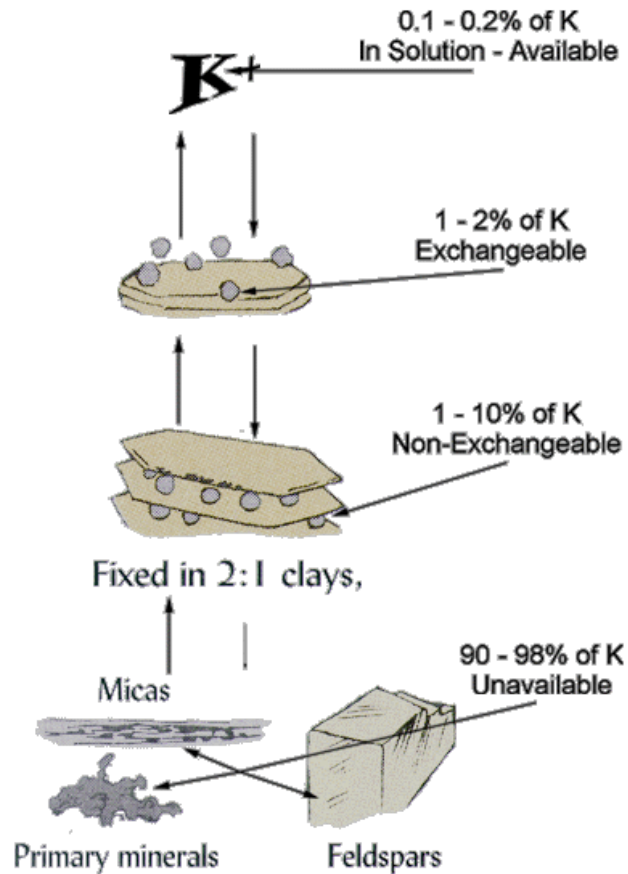
How much K is in a 500-bag crop?

	Vines	Tubers	Total	%
N	140	210	350	37.3%
P	10	29	39	4.2%
K	275	240	515	54.9%
S	12	22	34	3.6%

Stark, J. C., D. T. Westermann, and B. G. Hopkins. 2004. Nutrient management guidelines for Russet Burbank potatoes. Bulletin 840. Moscow, ID: University of Idaho.



Forms of Soil K



Potassium: starts at the soil

- 30,000 to 45,000 lbs/ac K in most soils
- 29,400 to 44,000 Rock - Unavailable
- 300 – 4,500 can be Non-Exchangeable





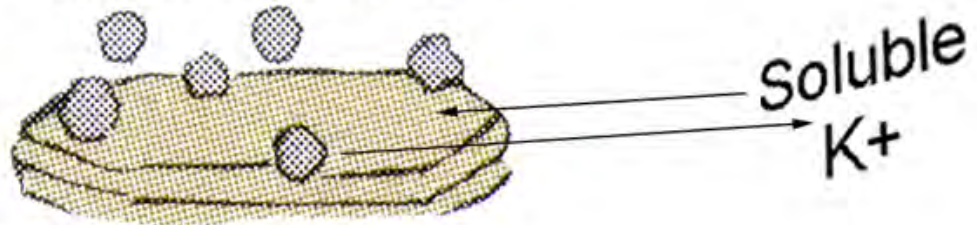
300 to 900 lbs/ac

can be available



Potassium: dependent on clay type...

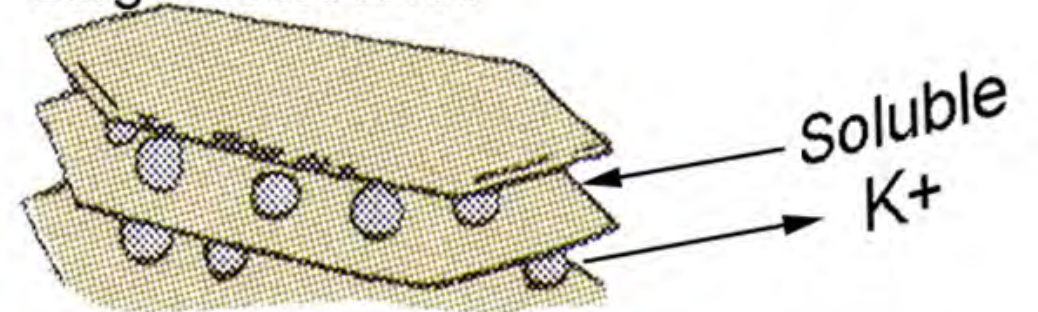
Small K Reservoir



In 1:1 Clay Soils, K is;

- 1) More Leachable
- 2) Late season deficiency
- 3) Early excess (disease pressure?)

Large K Reservoir



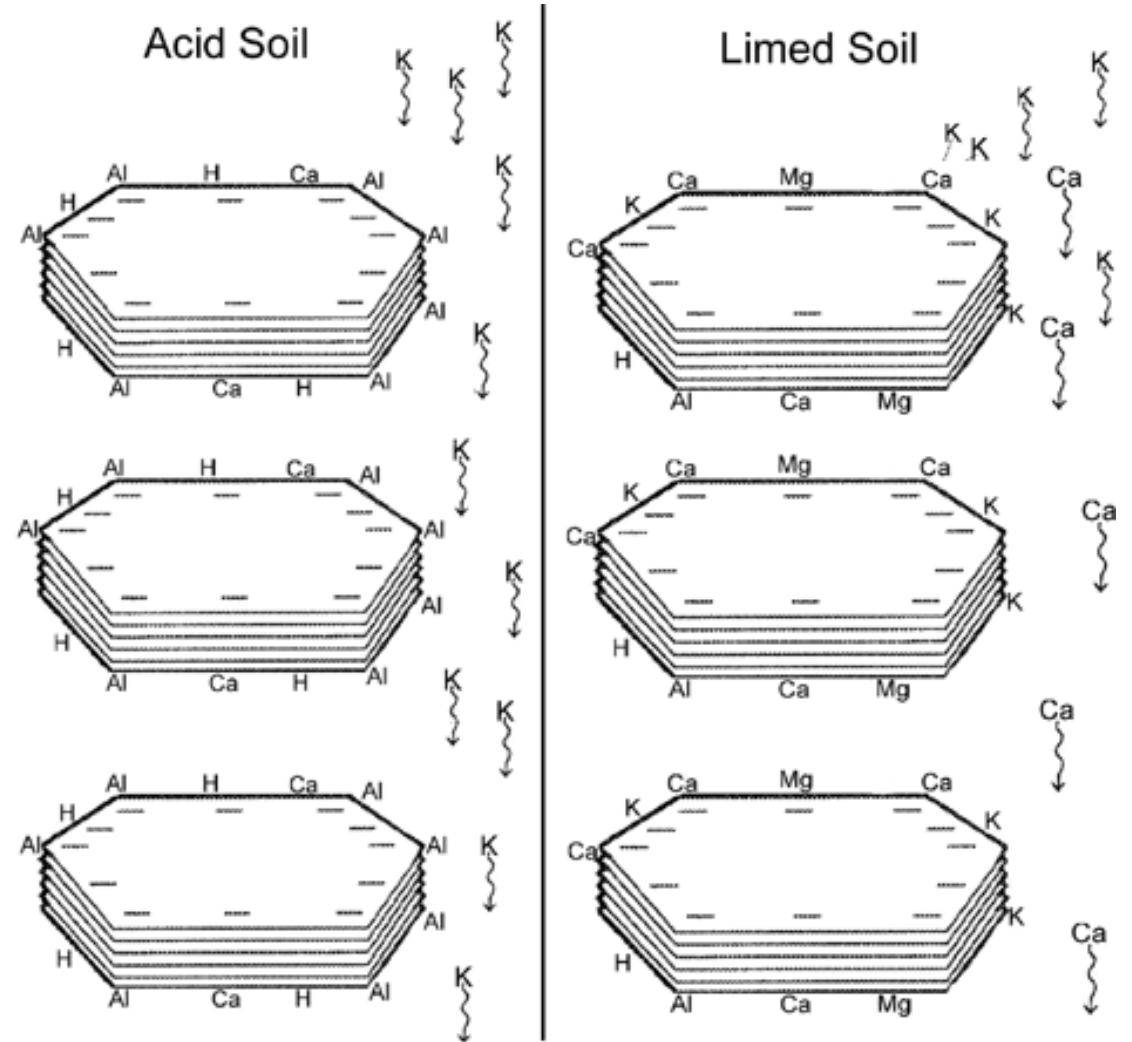
In 2:1 Clay soils, K is;

- 1) Less Leachable
- 2) Better late season availability
- 3) Possible early deficiency



Potassium: IS Leachable

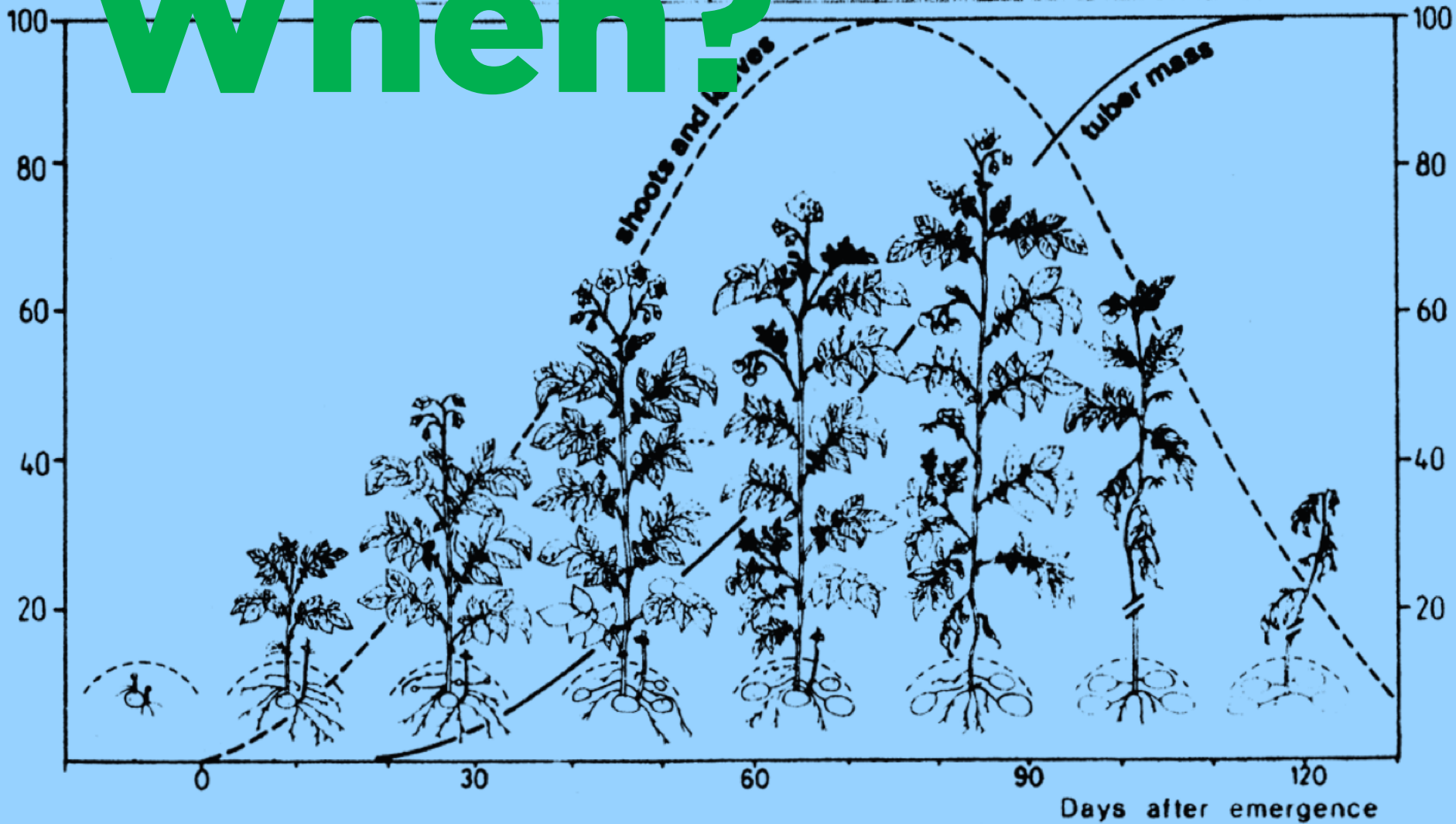
Especially in low pH, low CEC Soils



The 2-digit decimal code

0 Sprouting			1 Leaf development			5 Inflorescence emergence			6 Flowering			7 Development of fruit			8 Ripening of fruit and seed			9 Senescence			
01	05	09	11	15	19	51	55	59	61	65	69	71	75	79	81	85	89	91	93	95	97

When?

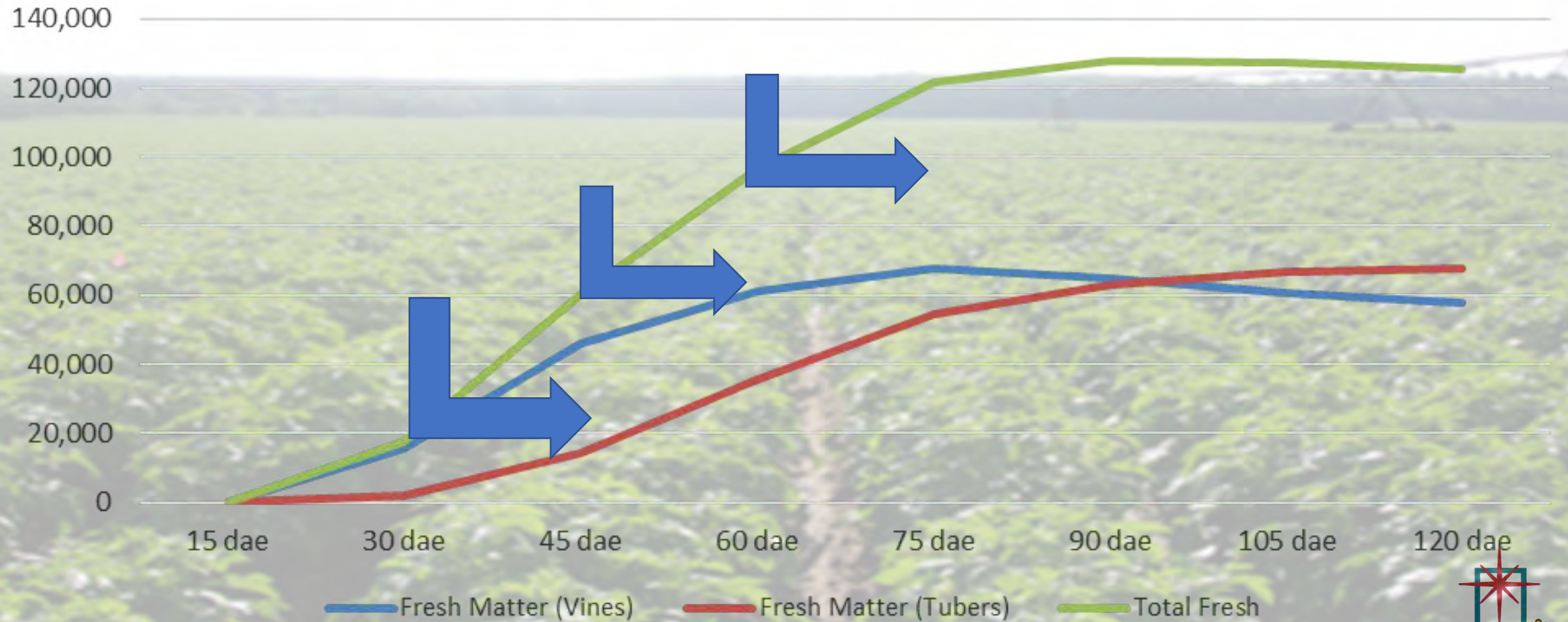


Development, growth and chemical composition of the potato crop (*Solanum tuberosum*). Kolbe & Beckmann, in *Potato Research*, 1997



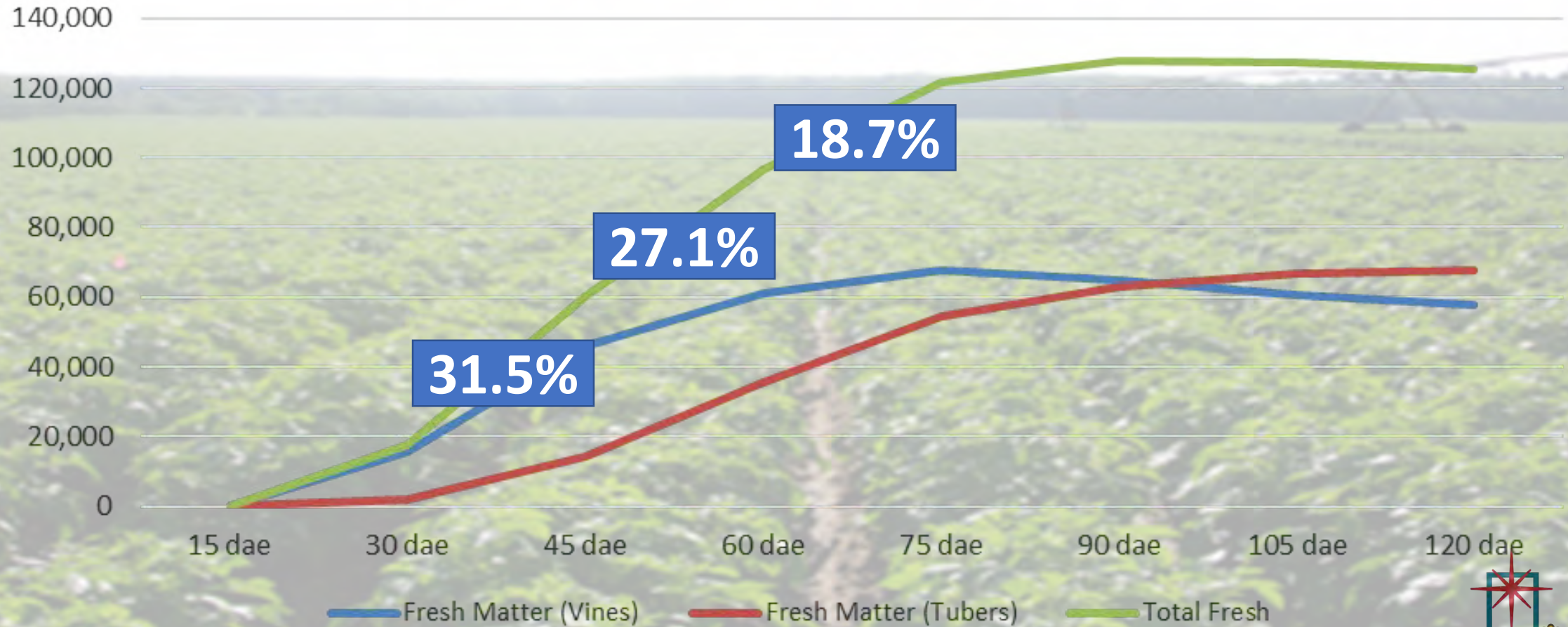


Fresh Matter Accumulation - 675 bags/ac

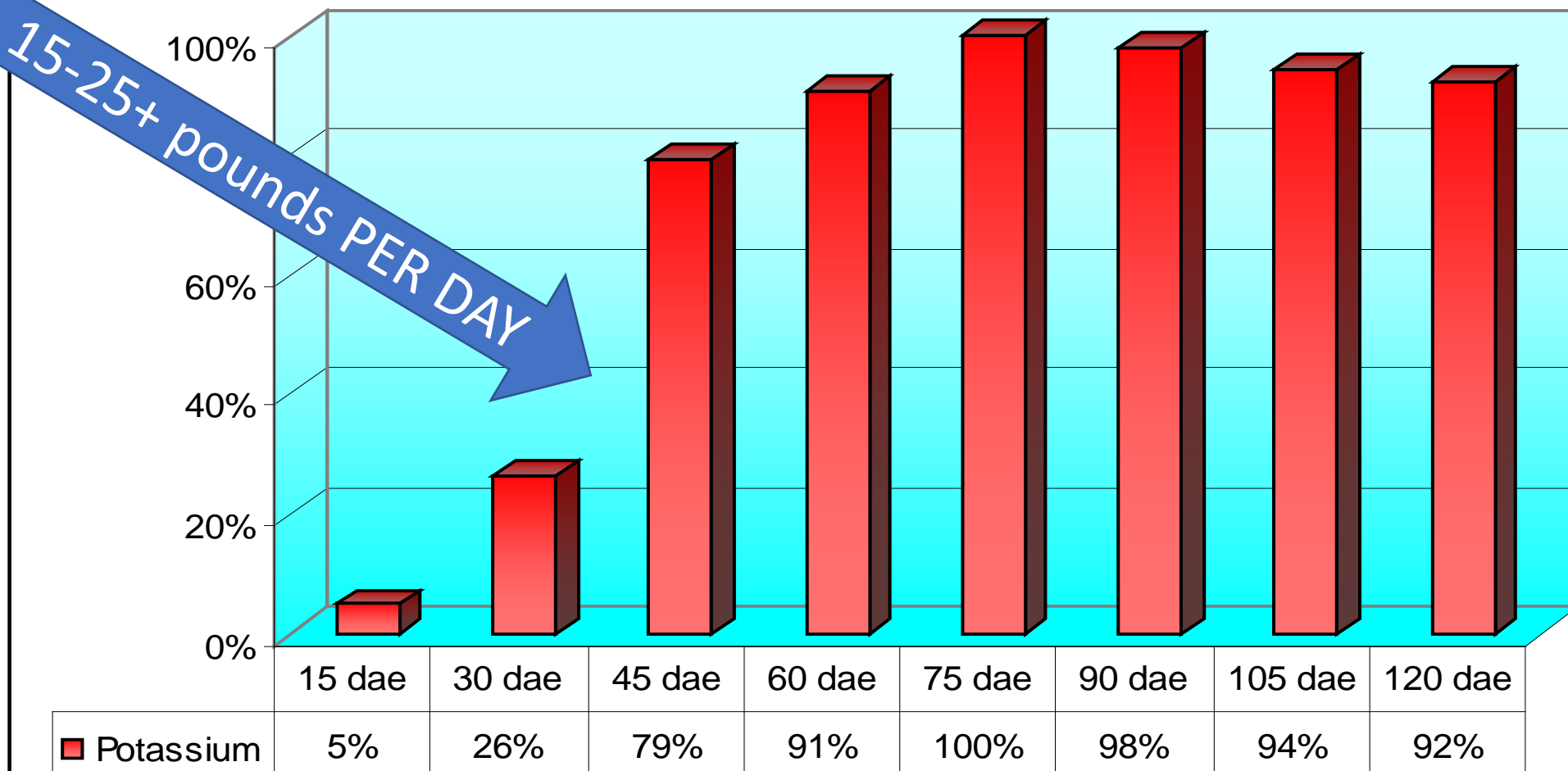




Fresh Matter Accumulation - 675 bags/ac



Potassium Uptake Timing



Potassium – Total and Rate

500 bags

- 500 units potassium
- Peak – **17** units/day

600 bags

- 600+ units potassium
- Peak – **21** units/day

700 bags

- 700+ units potassium
- Peak – **25** units/day





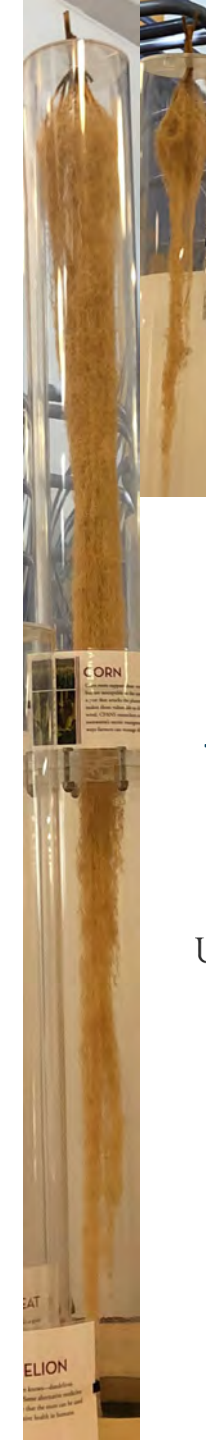
300 to 900 lbs/ac

can be available



Is there a test that is accurate for soil K?





Thanks;



UNIVERSITY OF MINNESOTA
Driven to DiscoverSM



Potassium - Irrigation

Over Watering...

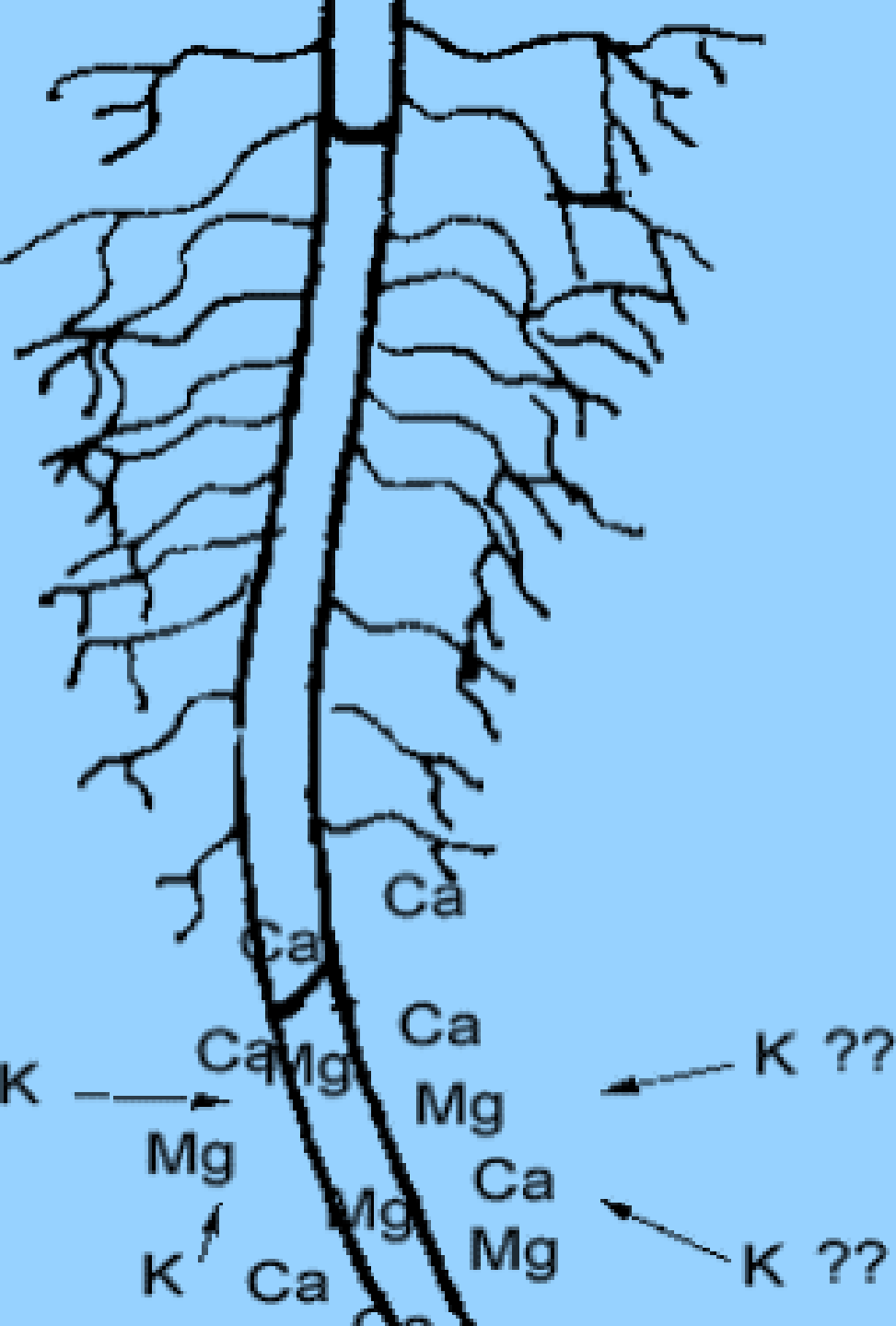
Uptake of K is **MOST**
negatively effected by low soil
oxygen levels, more than **ANY**
other nutrient!





Potassium & 'Bloom'



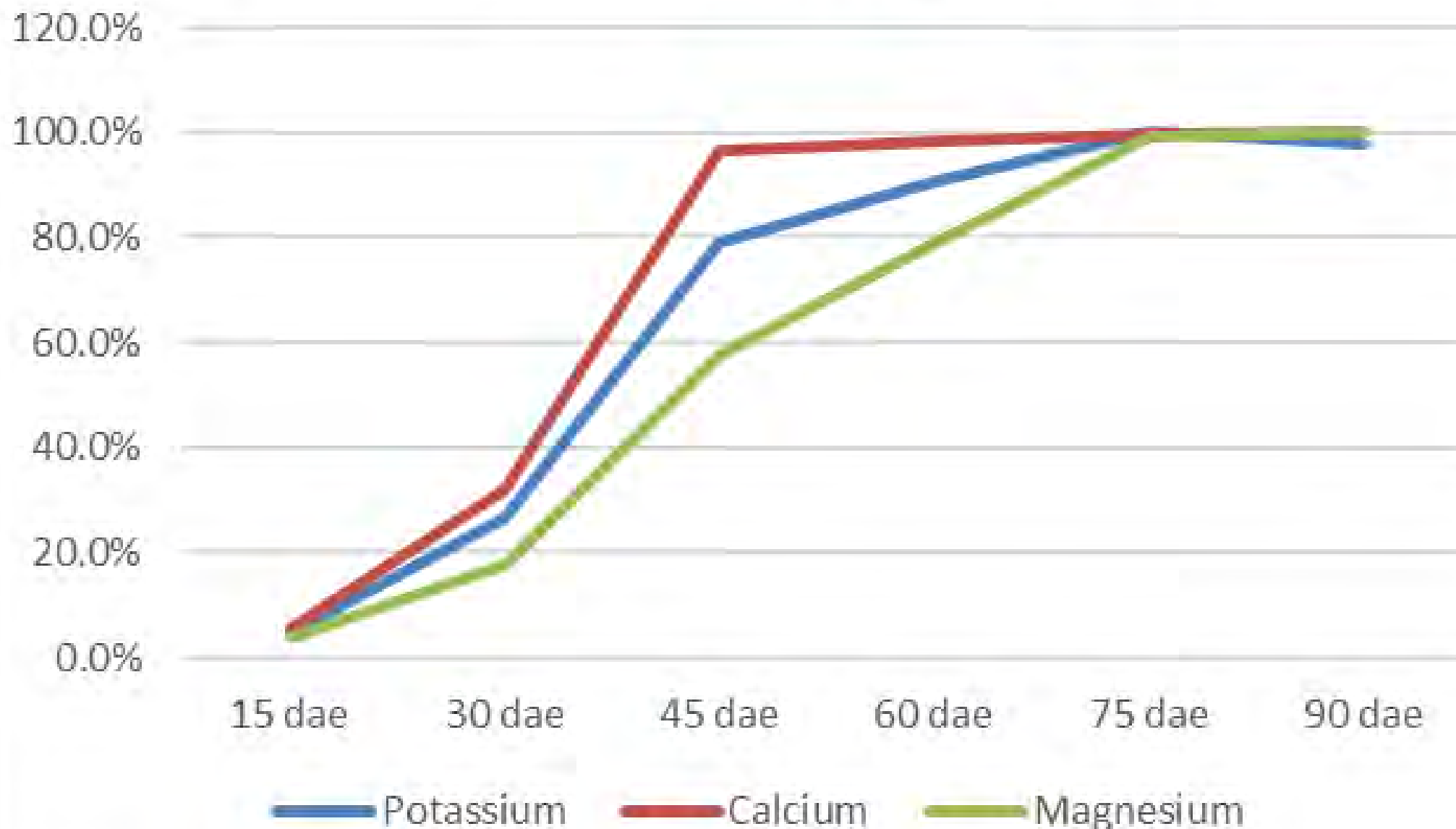


Potassium *verses* Ca & Mg

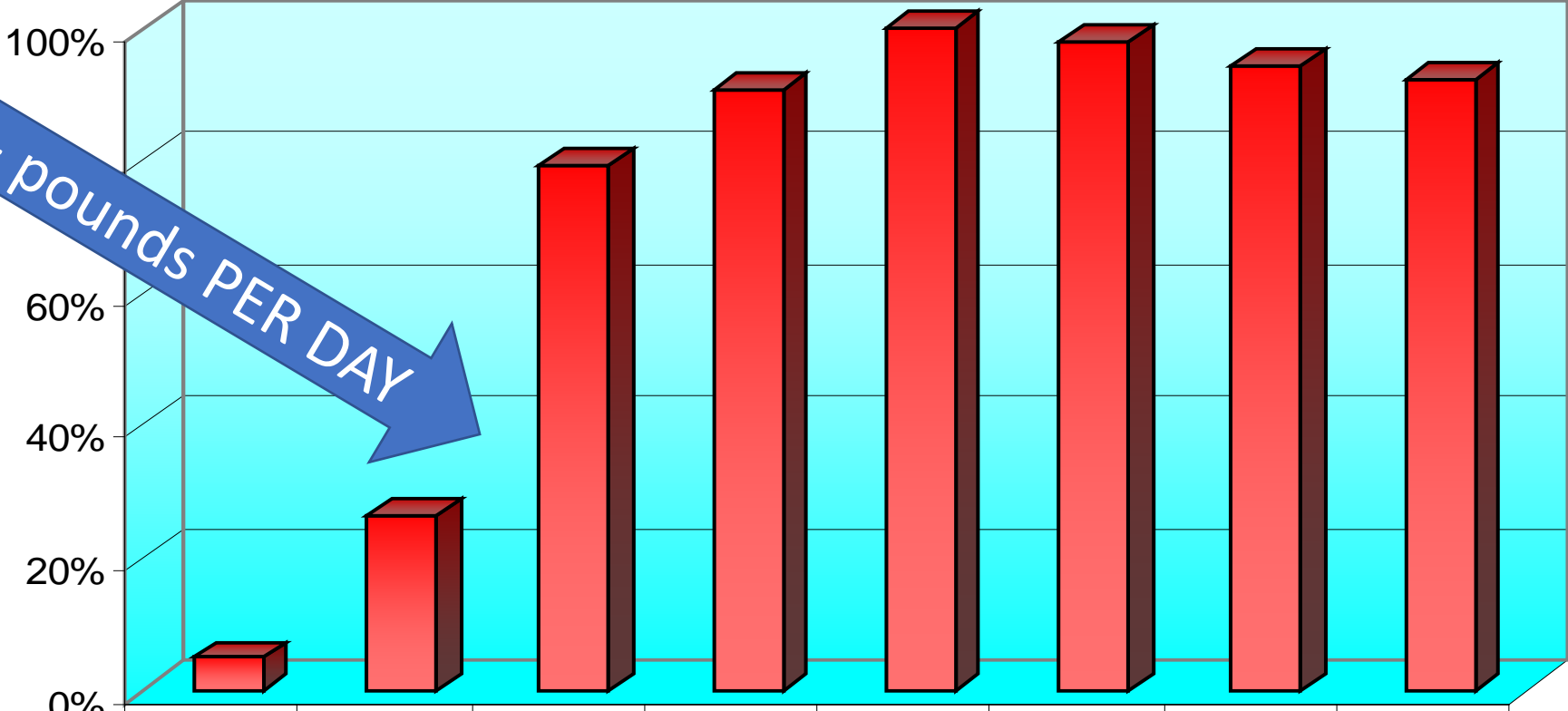
- Calcium Peaks 1st (45 dae)
- Potassium 2nd (60 dae)
- Magnesium 3rd (75 dae)



Calcium - Potassium - Magnesium Peak

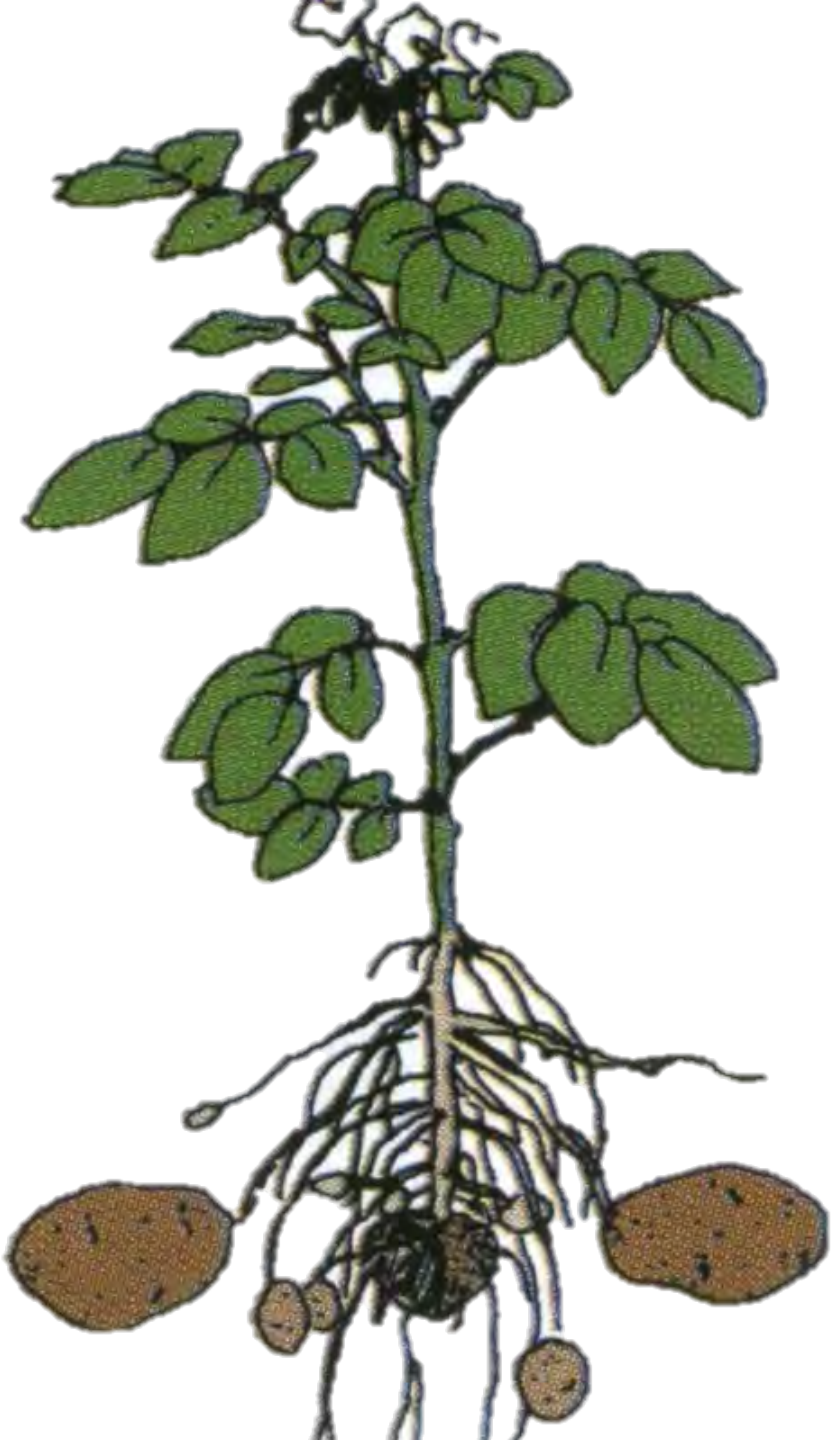


Potassium Uptake Timing



■ Potassium	5%	26%	79%	91%	100%	98%	94%	92%
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Petiole K

- Potassium is very mobile
- Petiole test is new growth
- What is K level in old growth?
- If K in new growth is low, how long has bottom of plant been low?







Summary

- More K – 50 %⁺
- More in shorter window
- Earlier in season
- Many potential negative effects
- Need better K testing
- Put foot on gas...don't let up!

• Questions? Email peter@biogro.com

