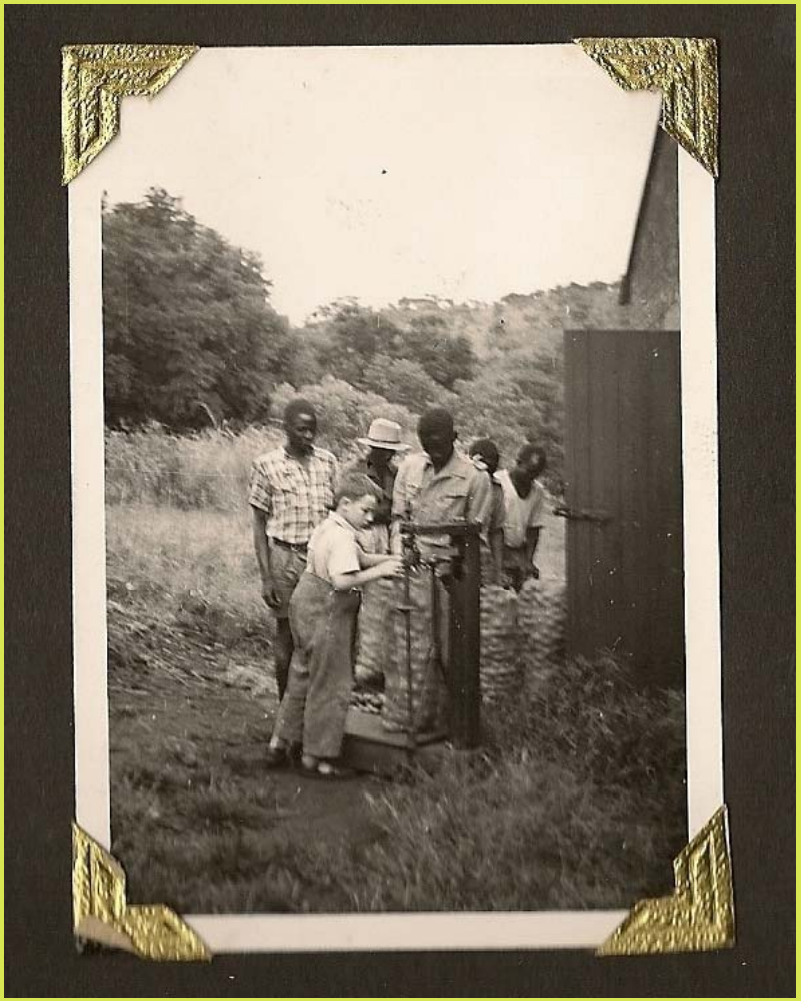
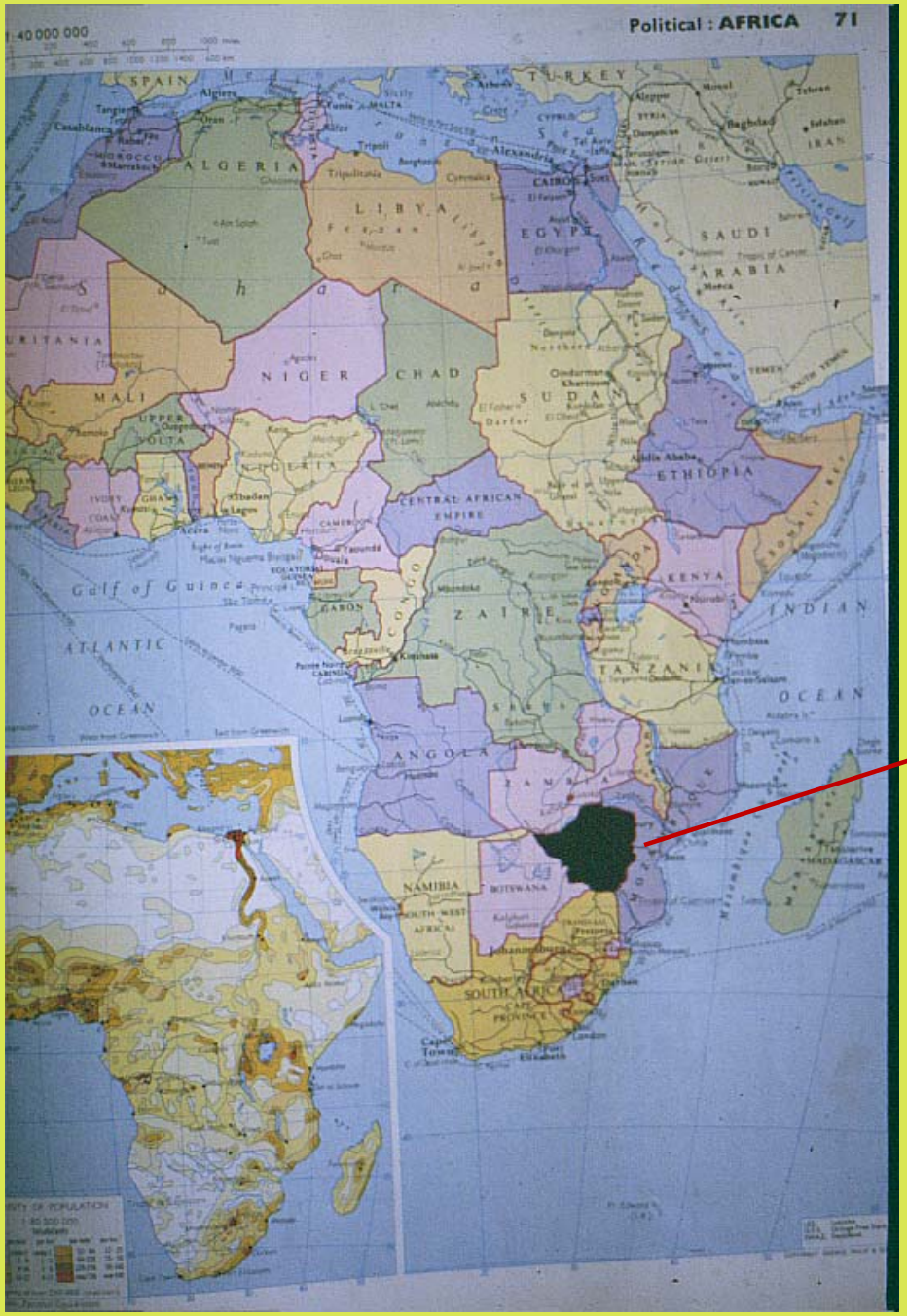
20th Annual
Fertilizer Research and Education Program Conference
&
Western Plant Health Association
Central Valley Regional Nutrient Seminar

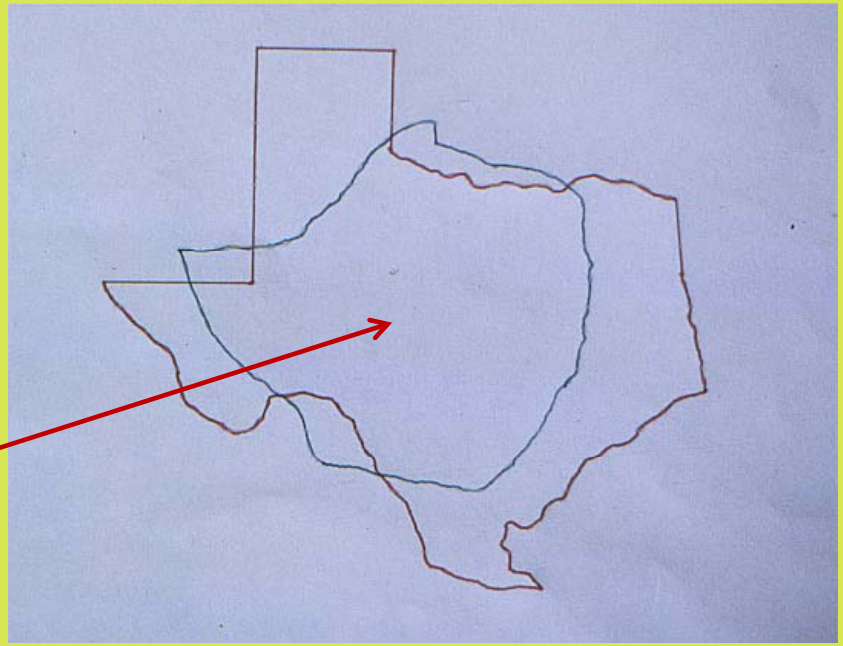
Modesto October Tues 30th – Wed 31st 2012

PLANT TISSUE SAMPLING THROUGH DIFFERENT GROWTH STAGES

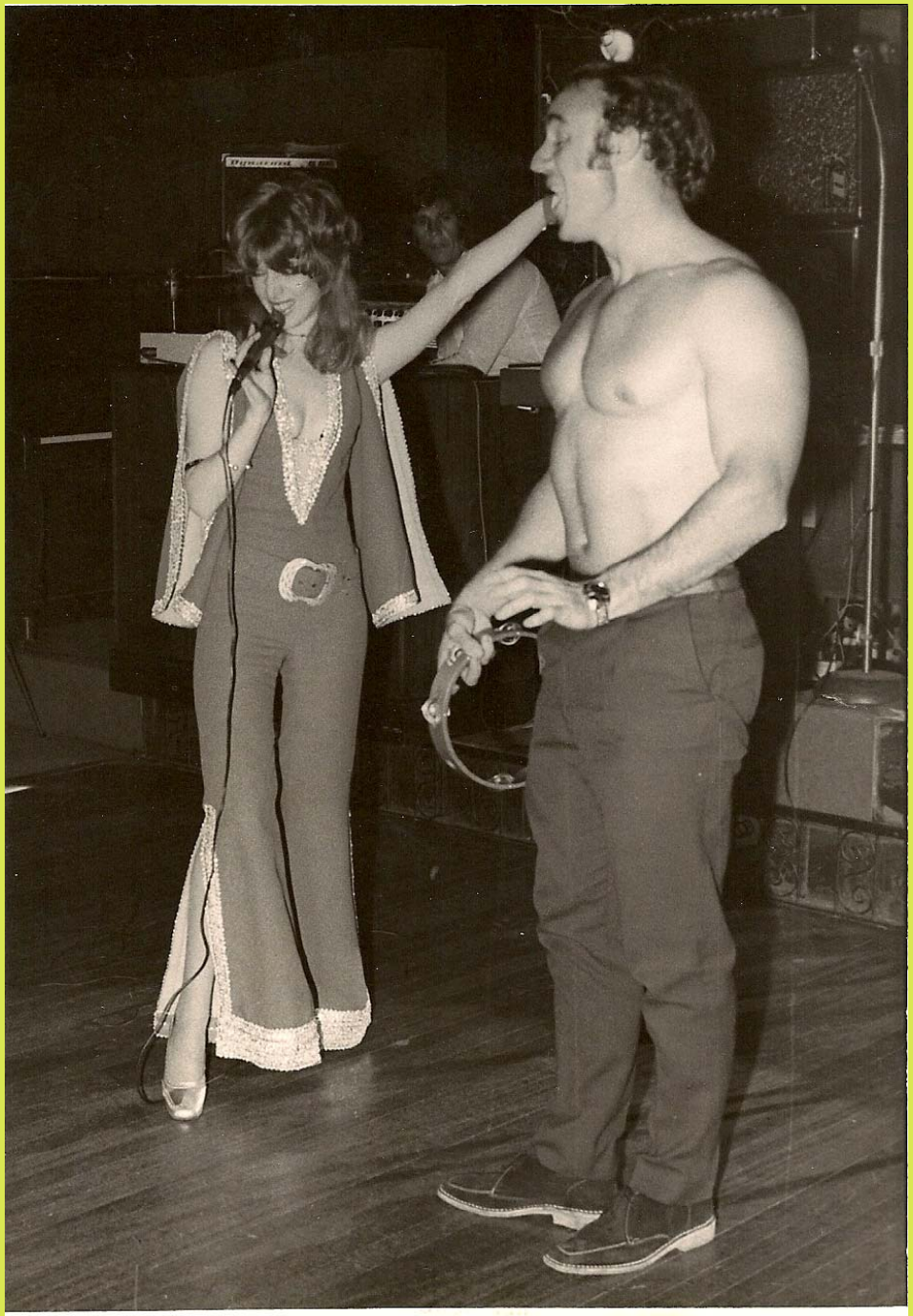
Mike Buttress CPAg A & L Western Agricultural Laboratories







Everything’s bigger in Texas



Commercial Farmers Union Zimbabwe

Agricultural Research Trust Farm Harare, Zimbabwe 1987

INTRODUCTION

- **The Two R's of Plant Tissue Sampling**
  Right Time
  Right Place
  - ❖ Corn
  - ❖ Rice
  - ❖ Tomatoes
  - ❖ Lettuce
  - ❖ Almonds
  - ❖ Grapes

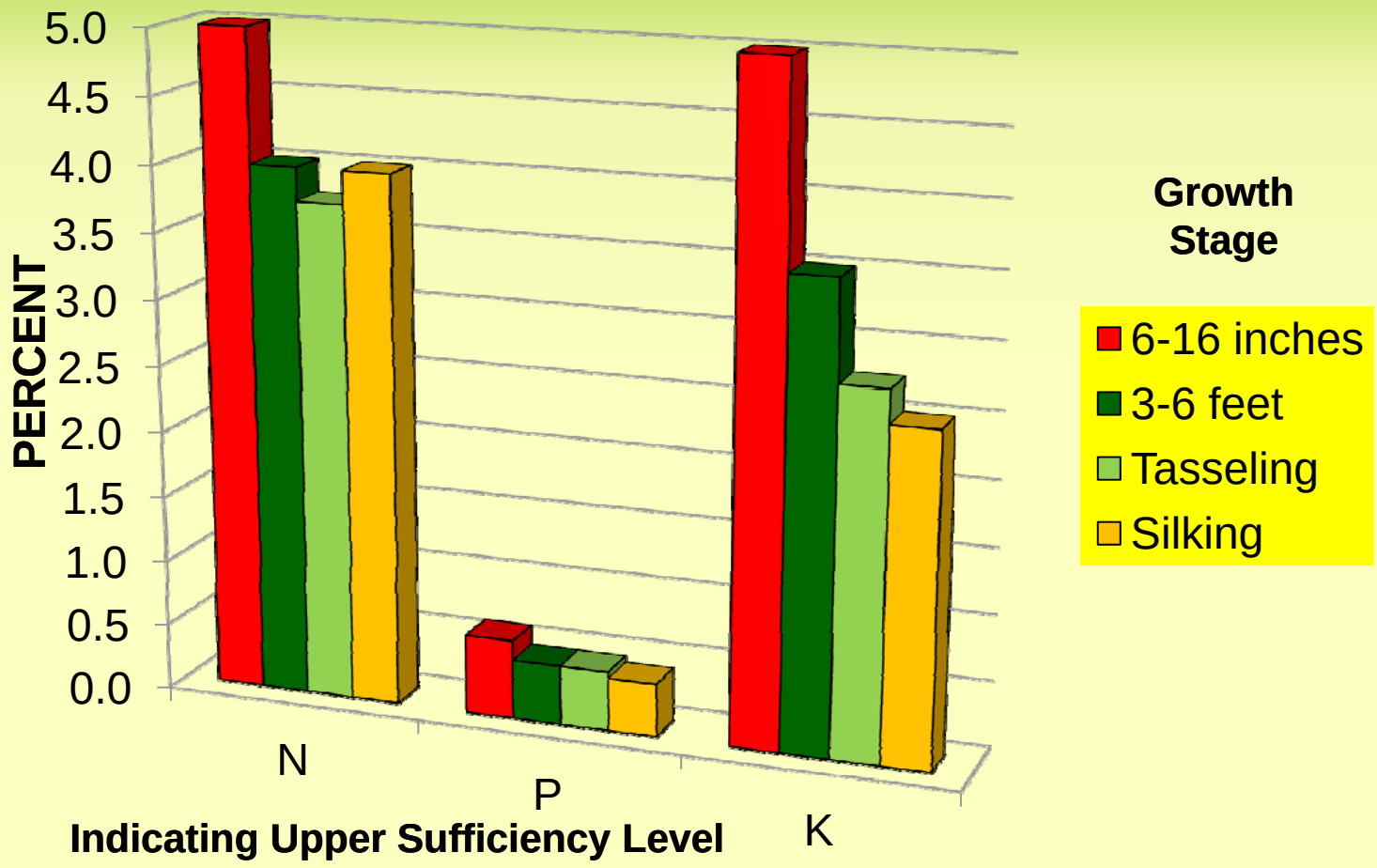
Why this Design?

DEFICIENT?

EXCESSIVE?

SUFFICIENT?

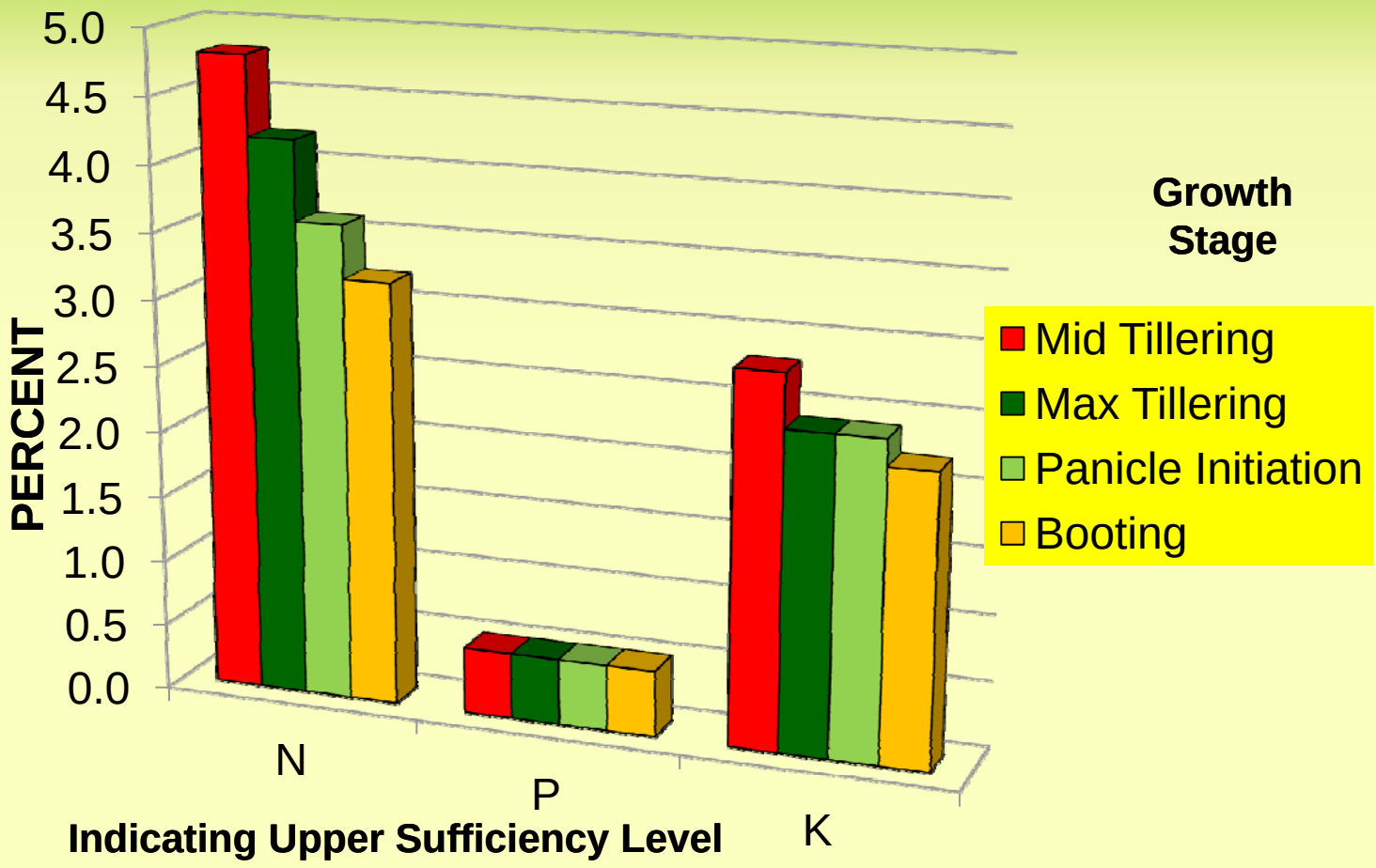
CORN
SUFFICIENCY LEVELS



CORN
TIME AND PLACE

0-16 inches Tall	Whole above ground Plant
3-6 feet tall	First leaf showing collar
Tasseling	Leaf opposite and below primary ear
Silking	Leaf opposite and below primary ear

RICE
SUFFICIENCY LEVELS



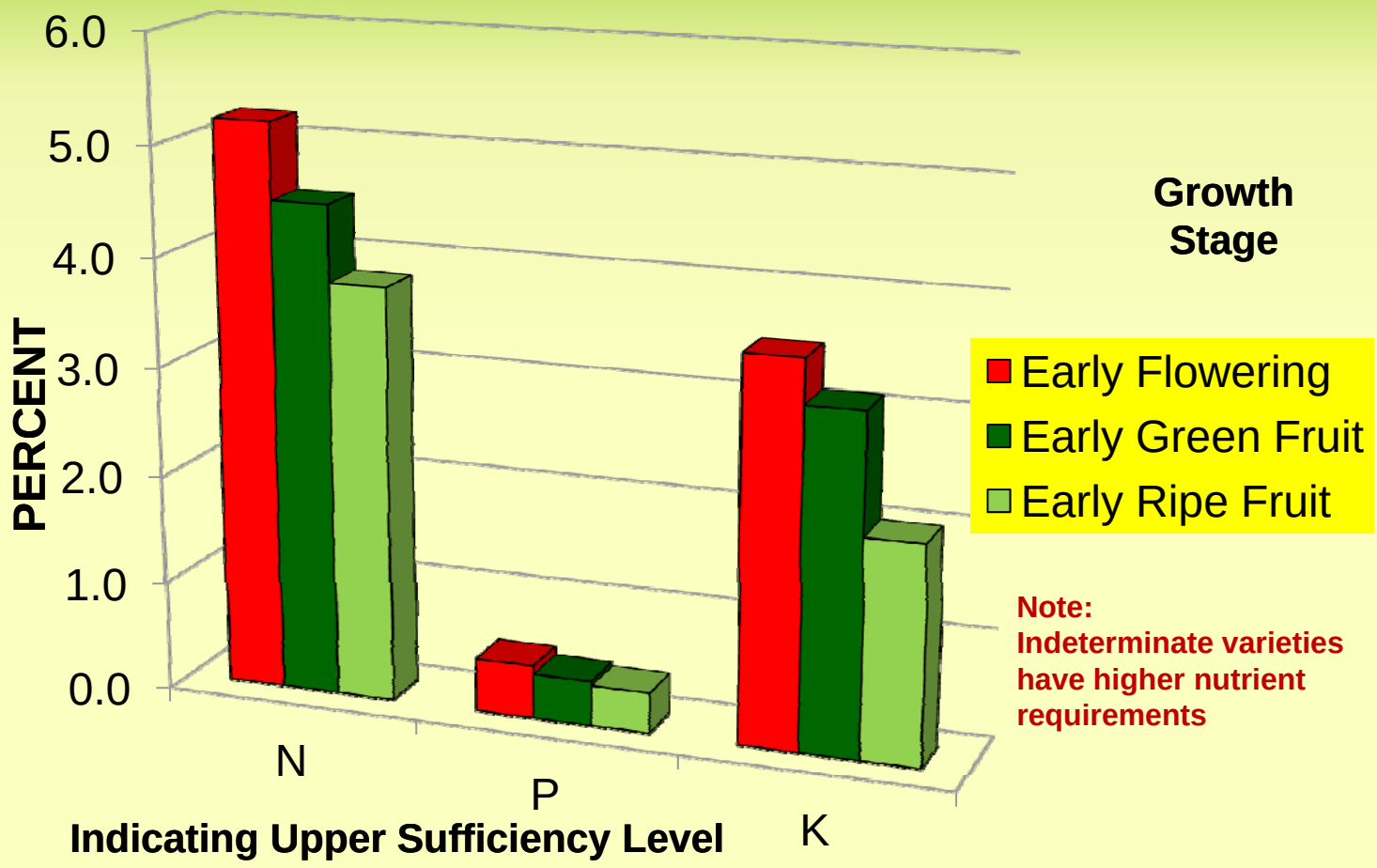
RICE
TIME AND PLACE

Mid Tillering 35-55 days	After 5th leaf stage
Maximum Tillering 55-65 days	MRM "Y" leaf
Panicle Initiation 60- 80 days	MRM "Y" leaf
Booting/ Heading	Flag leaf below ear

"Y" leaf: Collect the most recently matured unrolled leaf and separate at the collar, where it joins the leaf sheath.

Too late! Past booting stage.

PROCESSING TOMATO SUFFICIENCY LEVELS



Note:
Indeterminate varieties have higher nutrient requirements

PROCESSING TOMATO TIME AND PLACE

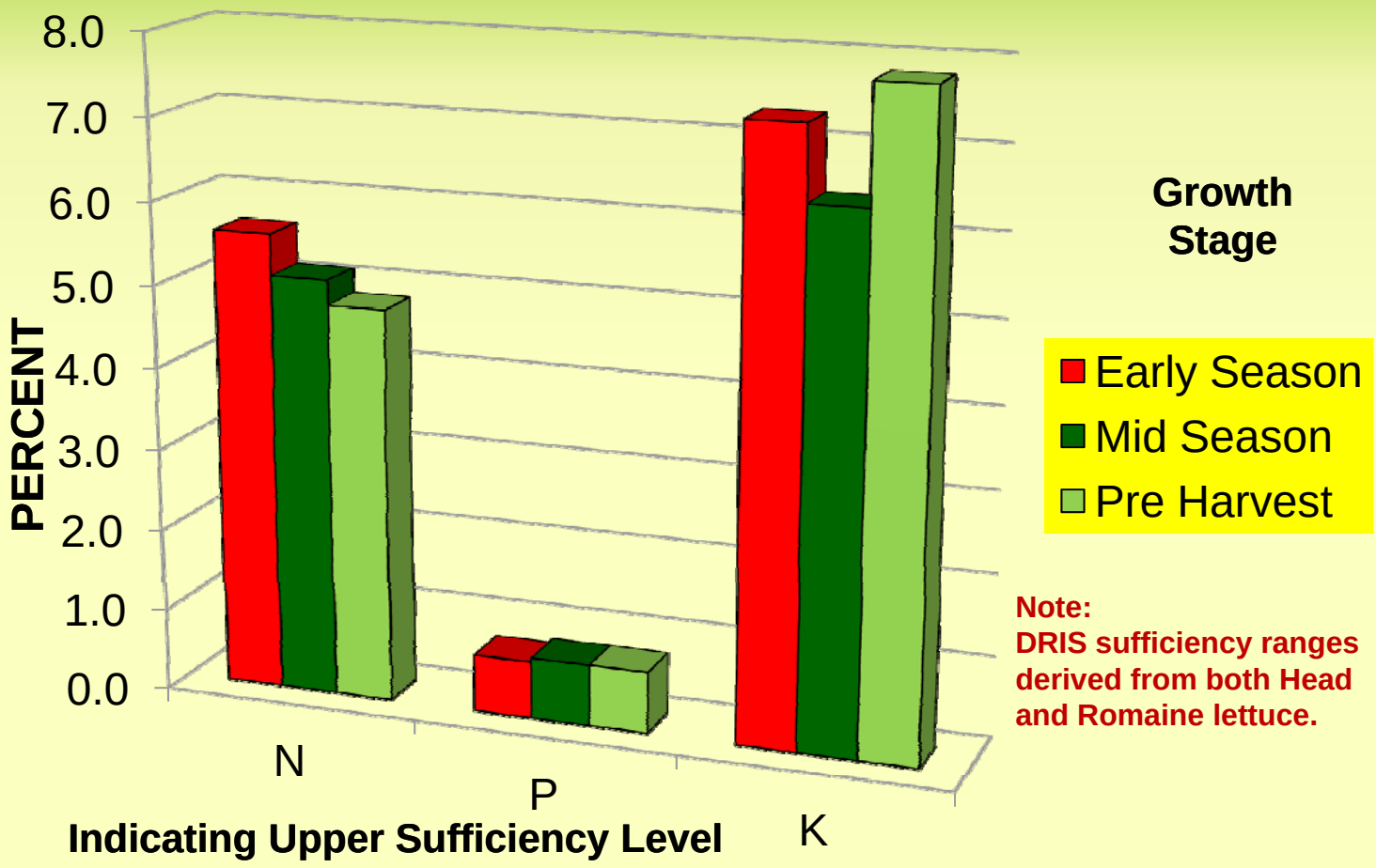
Early Flowering	**4th – 5th leaf from growing tip or opposite top flowering cluster**
Early Green Fruit (1in diameter)	**4th – 5th leaf from growing tip**
Early Ripe Fruit	**4th – 5th leaf from growing tip**

Looking for most recently fully expanded mature leaf.

Different labs will have different coding systems for these different stages of growth. Pay attention to them!

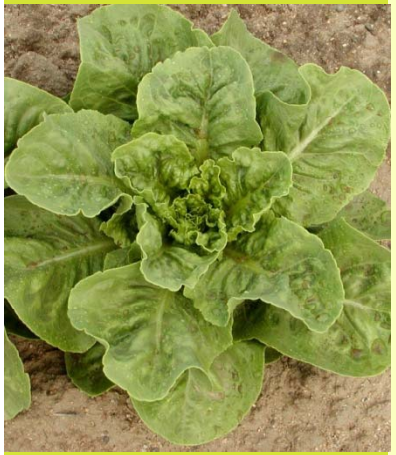
Greenhouse/indeterminate varieties, although sampled the same way, should have a different coding system.

LETTUCE SUFFICIENCY LEVELS



Note:
DRIS sufficiency ranges derived from both Head and Romaine lettuce.

LETTUCE
TIME AND PLACE



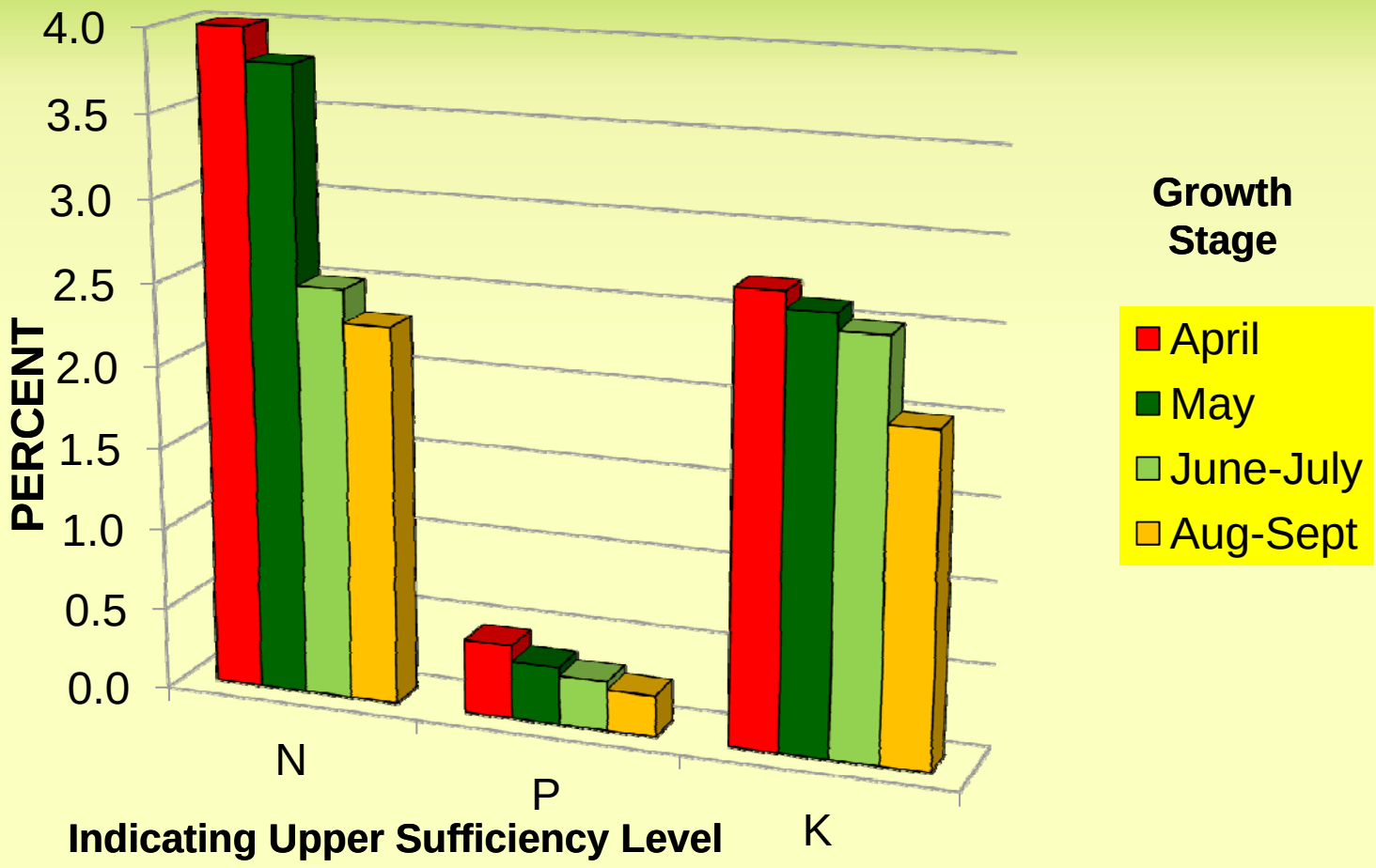
Early Season 4th-5th leaf stage	**Most recently mature leaves**
Mid Season - Heading	**MRM or wrapper leaves**
Pre Harvest - Harvest	**MRM or wrapper leaves**

Reference:
"Reevaluating Tissue Analysis as a Management Tool for Lettuce and Cauliflower" T.K. Hartz and Richard Smith. FREP 2007

A Diagnosis and Recommendation Integrated System (DRIS) approach was used to develop a set of nutrient sufficiency ranges for both head and Romaine lettuce.

Note that different sources of information provide different results. Therefore always view with caution.

ALMOND SUFFICIENCY LEVELS



ALMOND
TIME AND PLACE

April	Good Question
May	Good Question
June-July	Leaves from non-fruiting and
August-September	non-expanding spurs

ASA California Chapter 2012 Conference Proceedings:

"Development of Leaf Sampling and Interpretation Methods for Almond" by Sebastian Saa and Patrick Brown UC Davis.

Results suggest that early season sampling is a viable methodology for predicting the occurrence of [N] nutrient deficiency and that leaves of fruiting spurs may experience deficiencies even when leaves from non-fruiting spurs are apparently sufficient.

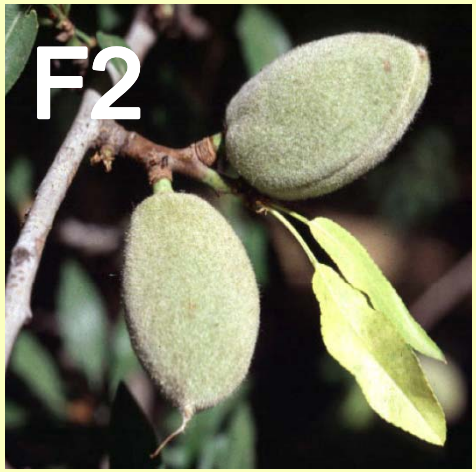
Leaf Sampling Experimental Design

- 100 acre x 4 Sites x 4 years.
- Leaves collected at multiple dates. Yield recorded

(About 1,130 data points)

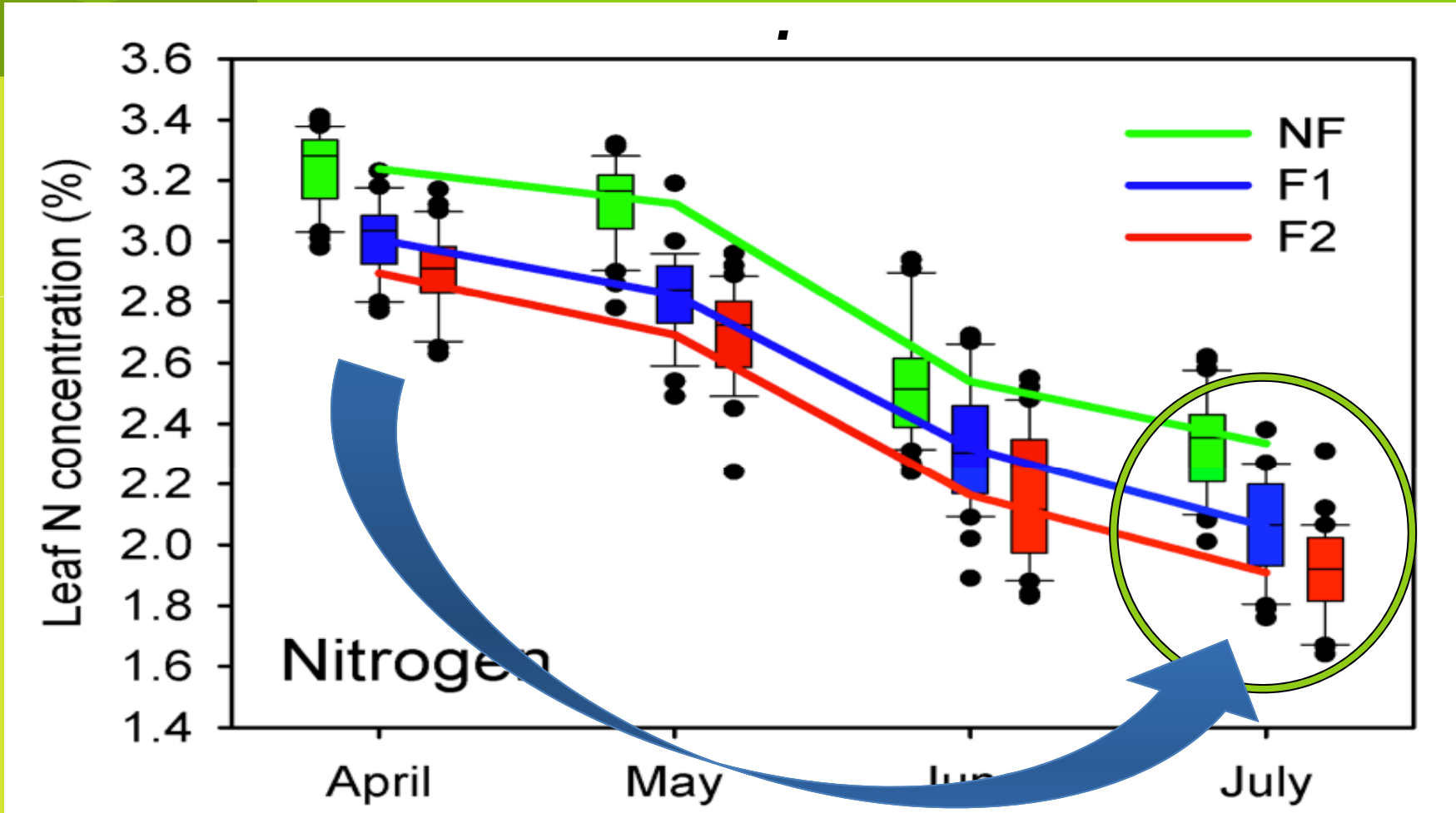
- Model Developed in 2011
- Validated at 6 sites in 2012.

(8,500 x 11 = 93,500 data points)



Can we predict late summer N with spring leaf sample?

Which leaf type should be used?



Leaf Out

Harvest

Mid April 3.5%N

Non-fruiting spur leaves

Mid July 2.49%N 2.53%N

MODELS FOR EARLY SEASON TISSUE SAMPLING AND N PREDICTION

Creators: Sebastian Saa, Emilio Laca, Patrick Brown
UC Davis
Version 1 UC, Davis Last Update: 04/25/2012

NOTE: These models have been developed from 4 years of research conducted in mature Nonpareil almonds grown at four locations. Five separate approaches are shown and each models have been internally validated. The results generated represent our best prediction of July leaf N values but have not been validated under all conditions and hence must be used

Only Complete Yellow Cells
Outputs are displayed in green

Please complete the following:

Nutrient	Units	*Value in April
N	(%)	3.5
P	(%)	
K	(%)	
S	ppm	
B	ppm	
Ca	(%)	
Mg	(%)	
Zn	ppm	
Mn	ppm	
Fe	ppm	
Cu	ppm	

*Note:
1) For greatest accuracy leaves should be collected in mid-April.
2) If you did not conduct the analysis of any of these nutrients please leave that cell empty. The program will automatically correct any values that are missing or contain nutrient concentrations that are indicative of contamination.

****Did you Collect NF or F2 Samples?**

NF

*Note: Enter the leaf type that you collected
NF = Non=fruiting spur leaves
F2= Leaves from spurs with two fruits.

Your Estimated July Nitrogen % is:	**Outputs**
Model 1	2.49
Model 2	2.53
Model 3	N.A
Model 4	2.52
Model 5	2.50

Note: Model 3 only works when the F2 sample is collected

Mid April 3.5%N

Spur leaves with two fruit attached

Mid July 2.60%N

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Mg	(%)	
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*Note:
1) For greatest accuracy leaves should be collected in mid-April.
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****Did you Collect NF or F2 Samples?**

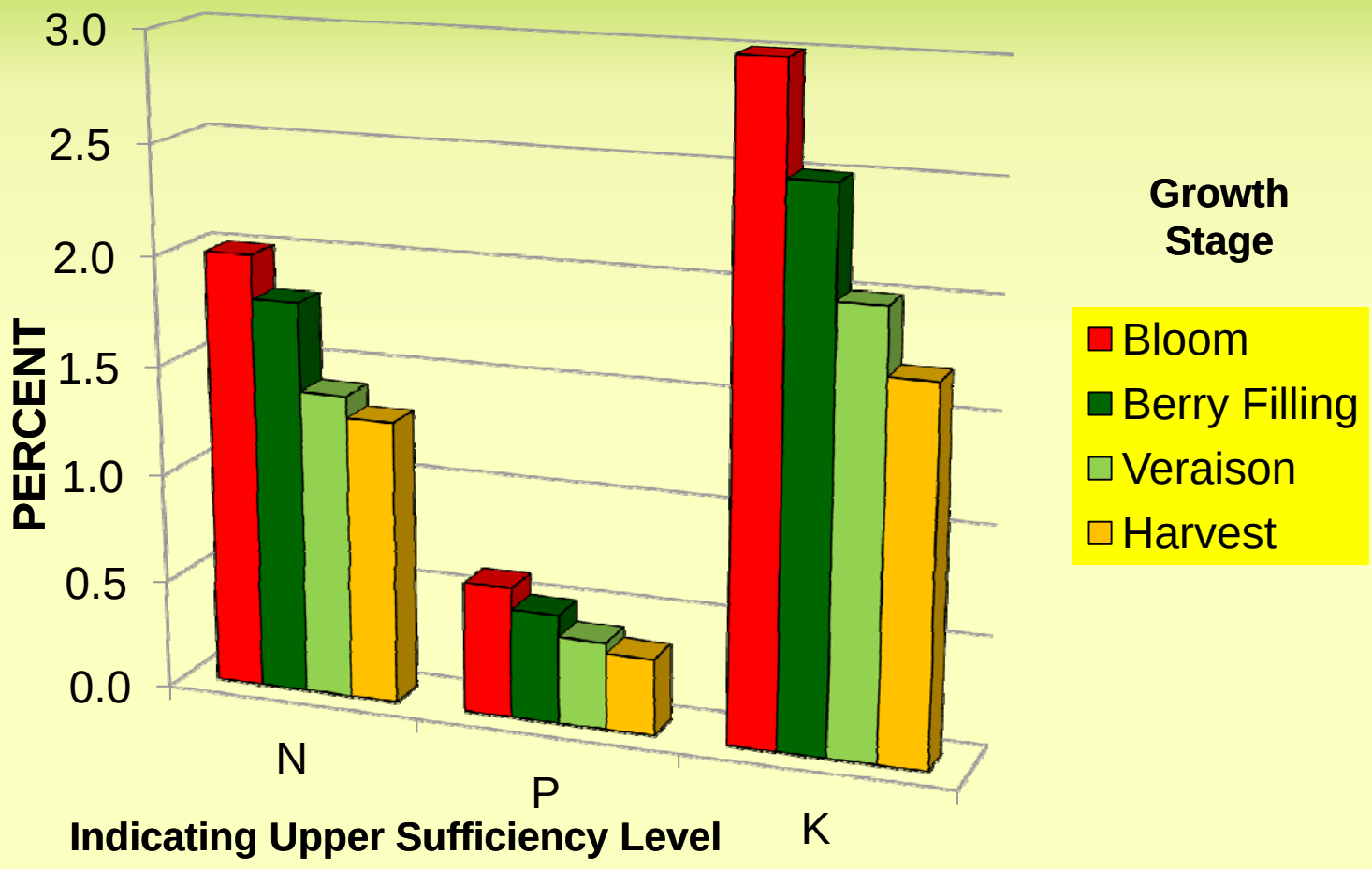
F2

*Note: Enter the leaf type that you collected
NF = Non=fruiting spur leaves
F2= Leaves from spurs with two fruits.

Your Estimated July Nitrogen % is:	**Outputs**
Model 1	N.A.
Model 2	N.A.
Model 3	2.60
Model 4	N.A.
Model 5	N.A.

Note: Model 3 only works when the F2 sample is collected

GRAPE PETIOLE SUFFICIENCY LEVELS



GRAPE
TIME AND PLACE

Bloom Petiole Sampling	**Opposite basal cluster when two thirds of calyptras have fallen off**
Berry Filling	**Petiole of 2nd leaf away from last cluster**
Veraison	**Petiole of 6th to 7th leaf from growing tip (MRM)**
Harvest	**Petiole of 6th to 7th leaf from growing tip (MRM)**

Note:
Studies have shown that nitrogen readings may be unreliable on blades at bloom stage.
Petioles are better for determining sodium and chloride toxicities.
Blades are better for determining boron toxicities.

CONCLUSIONS

THE RIGHT TIME: Plant tissue sampling through different stages of plant growth will certainly provide different results!

THE RIGHT PLACE: It's essential to follow instructions on where to sample from in order to make sense of results.