Harvest Schedule Profoundly Influences Yield, Quality, Water Use Efficiency, Stand life, Weeds, Profitability

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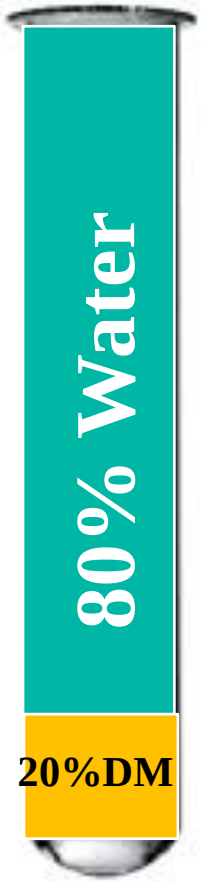
Why so important?

- Yield – Crop Maturity
- Quality – Crop Maturity
- Water Use Efficiency – (yield)
- Stand Life (persistence)
- Weeds (persistence)
- Profitability (yield and quality

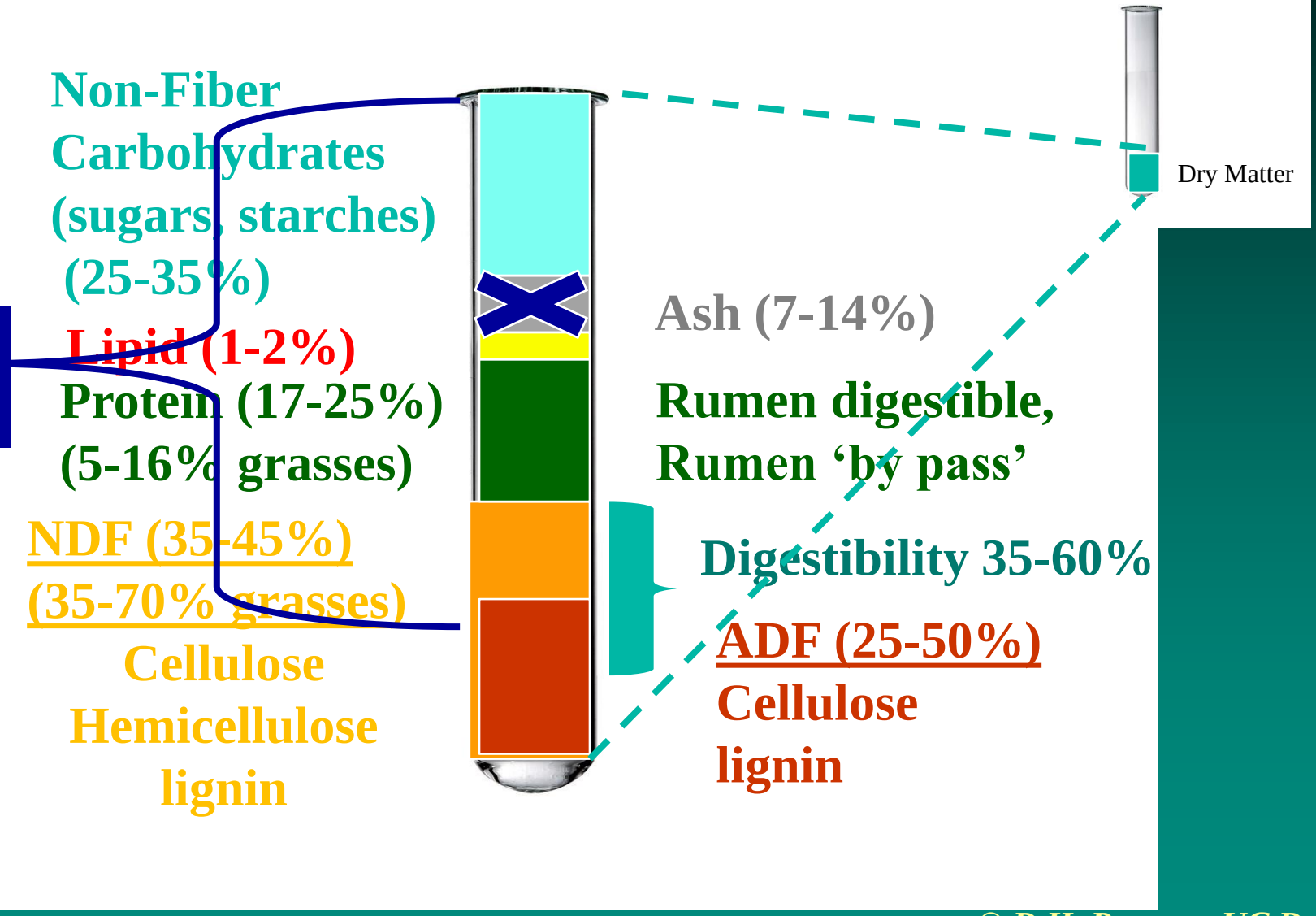
What is the ‘good stuff’ in forages?

What's in a Forage Plant?



What's in a Forage Plant?

TDN?



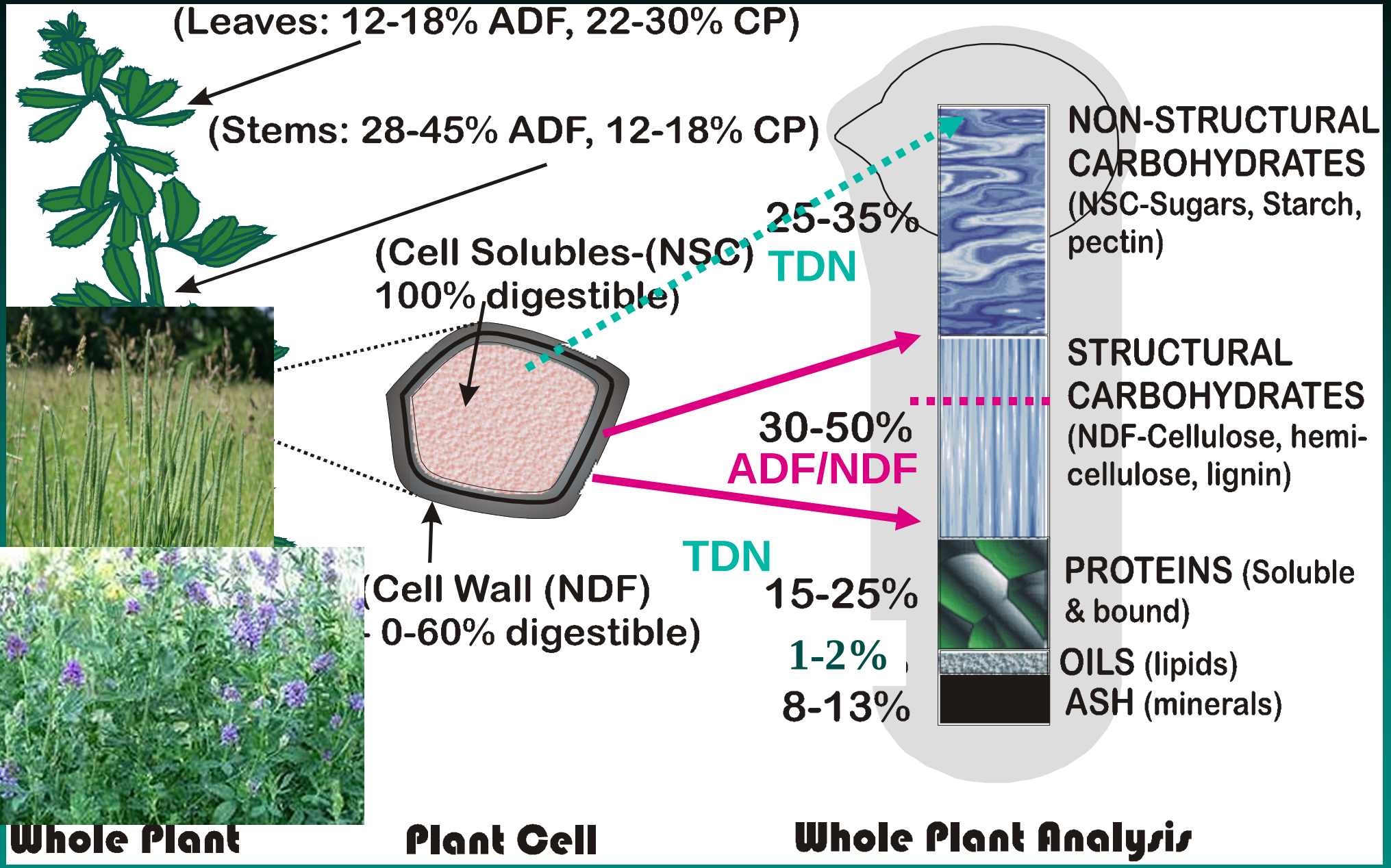

(Leaves: 12-18% ADF, 22-30% CP)
(Stems: 28-45% ADF, 12-18% CP)
(Cell Solubles-(NSC)
100% digestible)
(Cell Wall (NDF)
- 0-60% digestible)
25-35%
TDN
30-50%
ADF/NDF
TDN
15-25%
1-2%
8-13%
NON-STRUCTURAL
CARBOHYDRATES
(NSC-Sugars, Starch,
pectin)
STRUCTURAL
CARBOHYDRATES
(NDF-Cellulose, hemi-
cellulose, lignin)
PROTEINS (Soluble
& bound)
OILS (lipids)
ASH (minerals)
Whole Plant
Plant Cell
Whole Plant Analysis

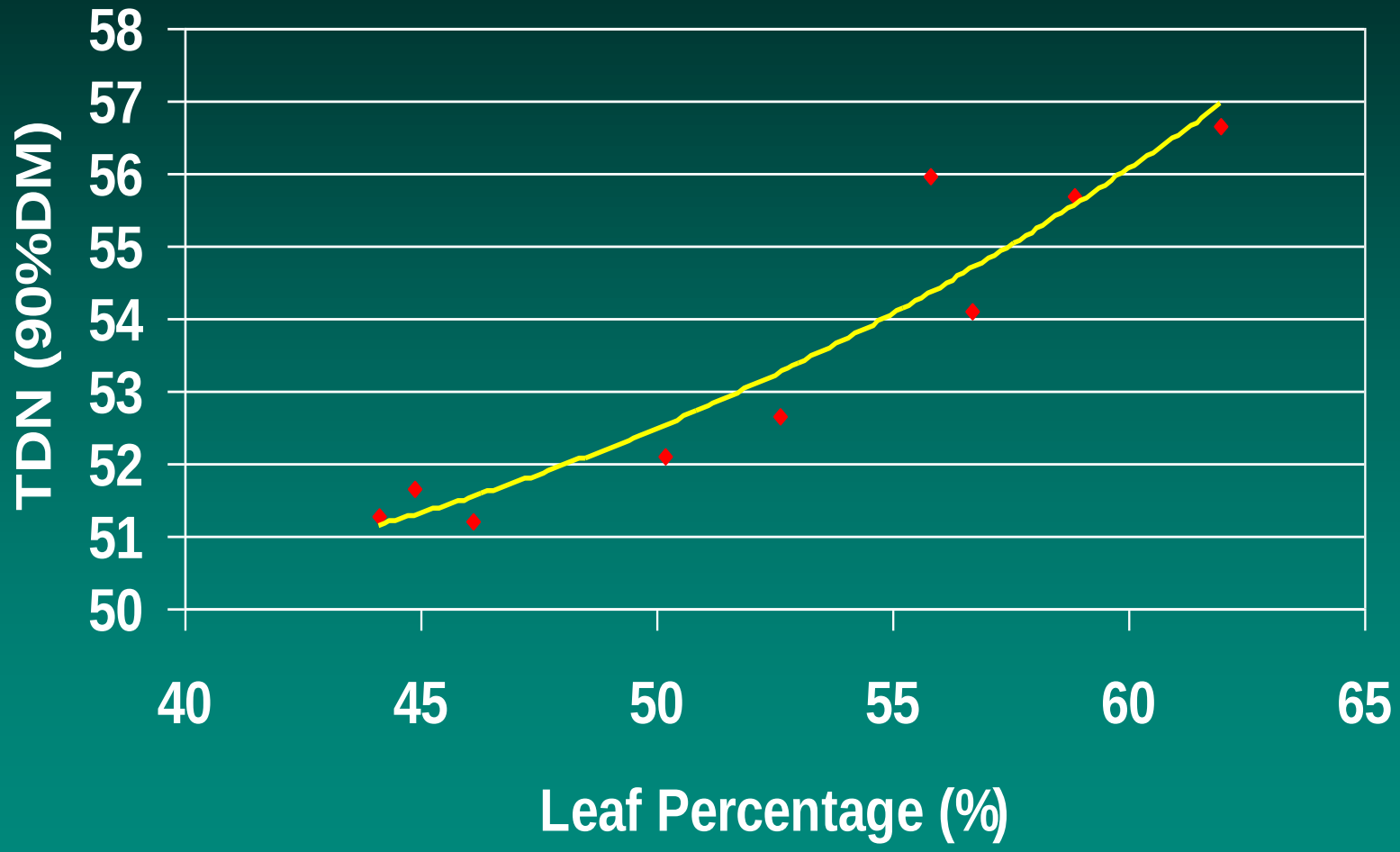
Table 2: Average Quality of Leaf and Stem (% of dry matter)

Plant Part	CP	Ash	NDF	NDFd	RFQ	RFV
Leaves						
Average	29.1	11.2	19.7	60.3	442.3	367.3
S.D.	2.2	0.7	1.4	4.0	36.3	29.5
Stems						
Average	11.8	7.4	60.5	39.4	84.3	78.9
S.D.	1.0	0.8	2.5	3.5	10.4	5.8

Data: David Weakley, Forage Genetics International

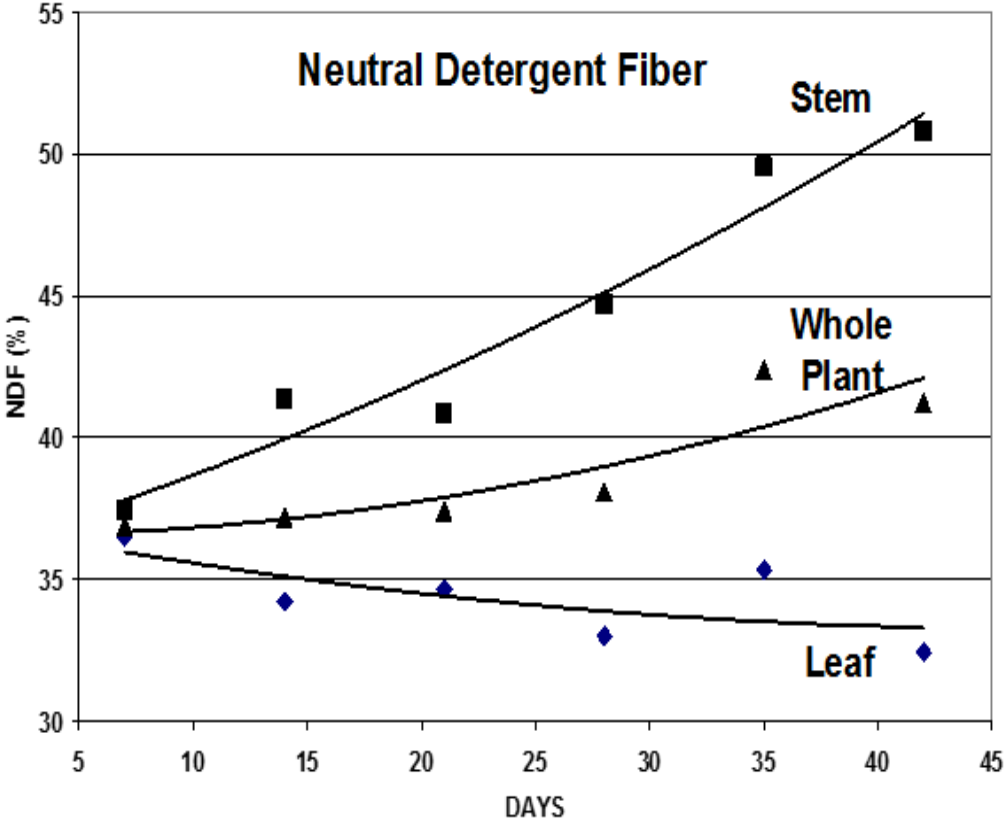
Leaf Percentage and TDN

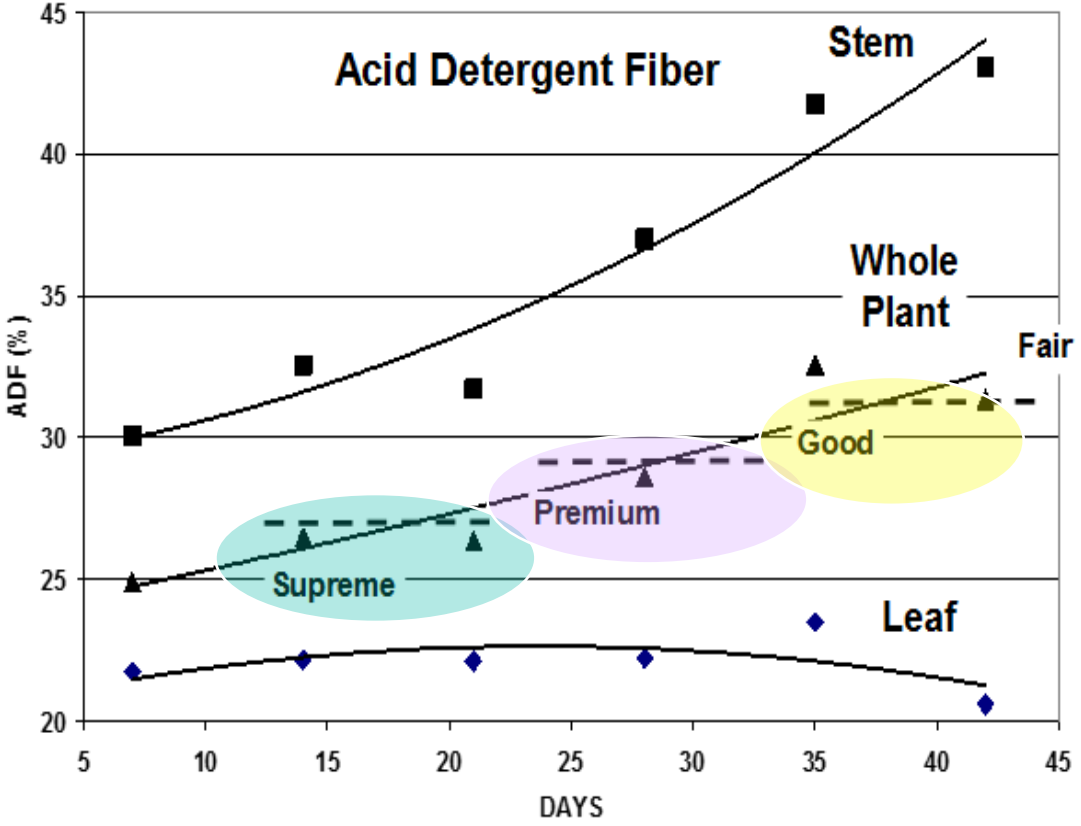
(Whole Plant)



1999 Data – T. Ackerly, UC Davis

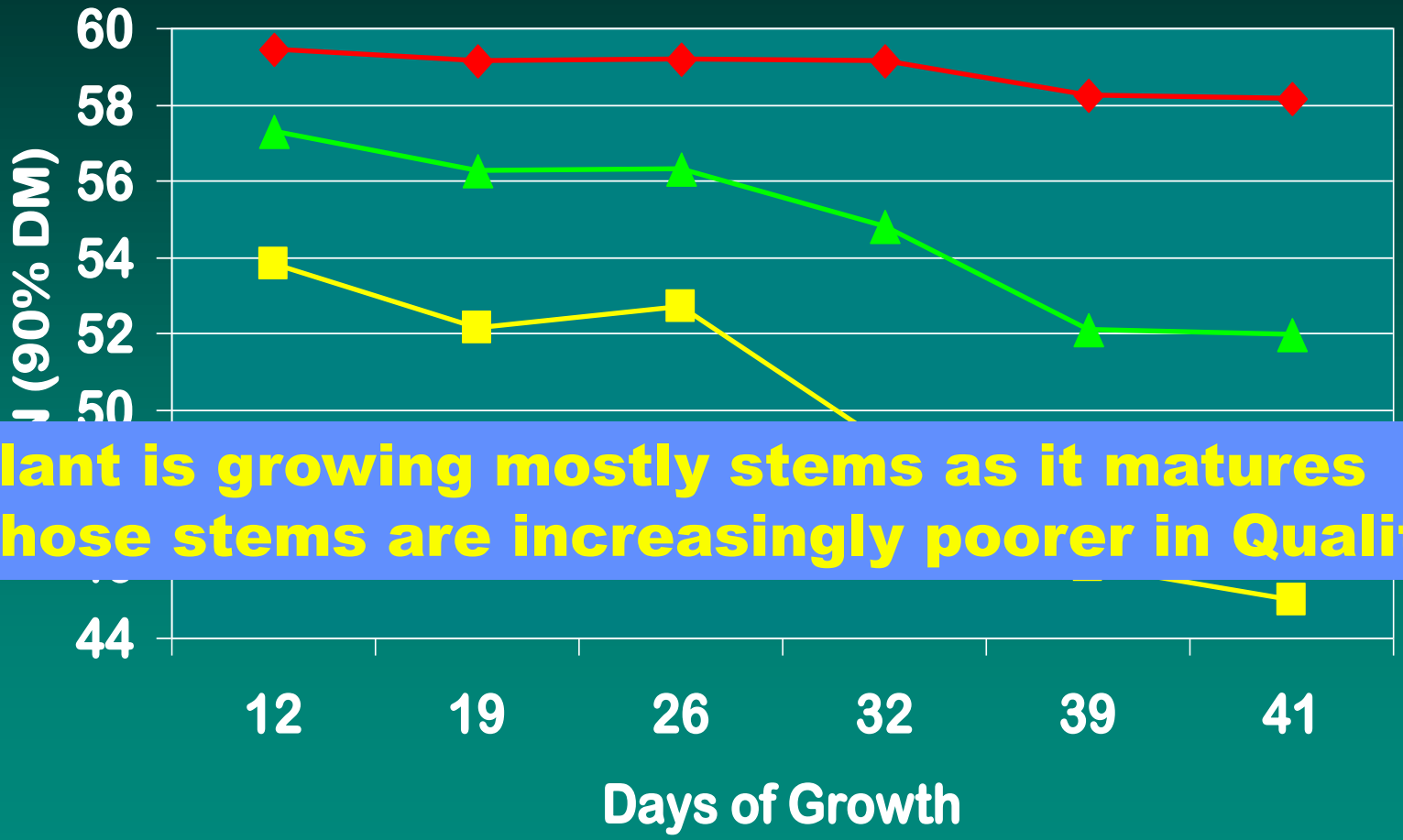
What's the Issue? Fiber content increases each day





Yolo County Data – UC Davis

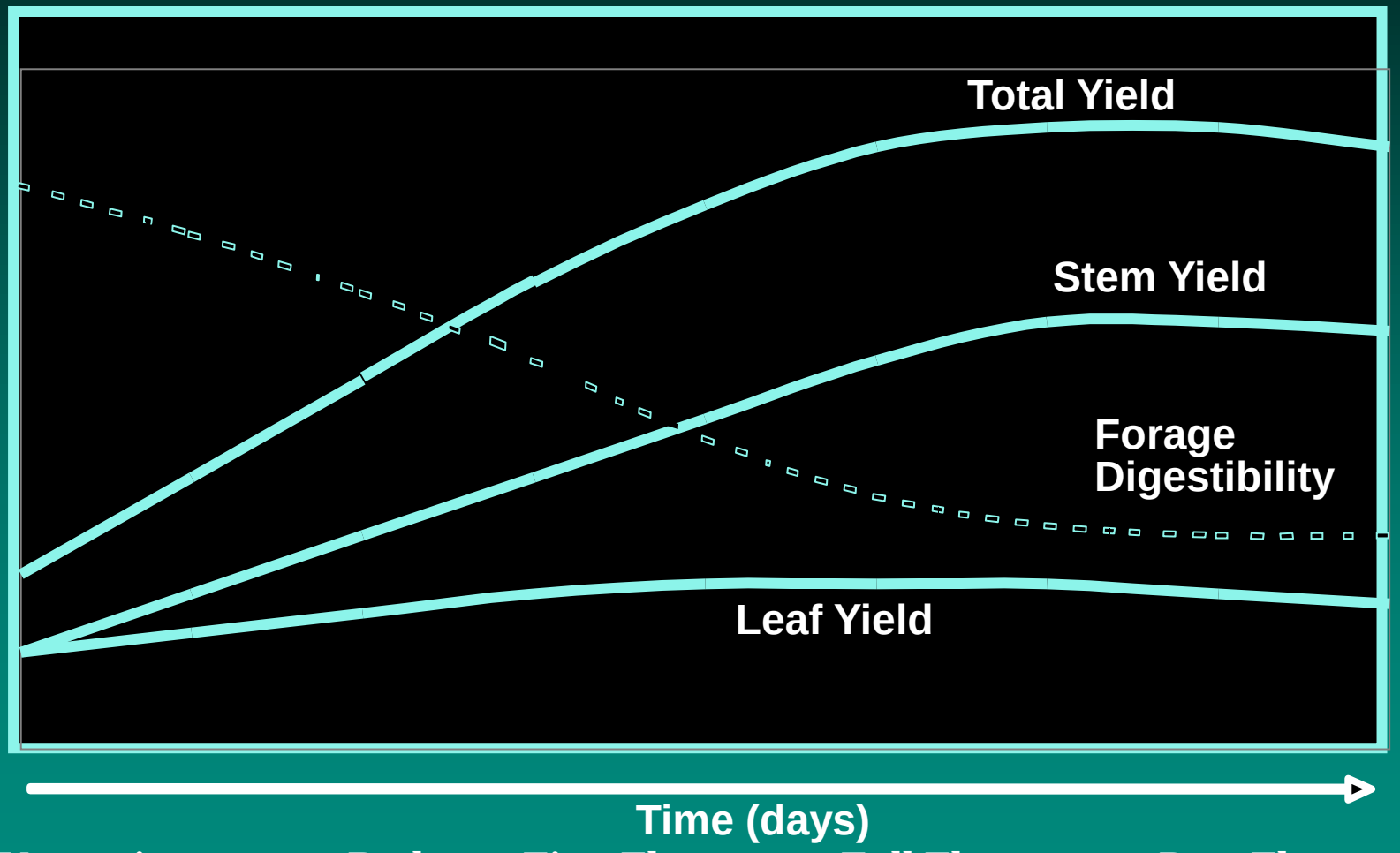
Plant Maturity: Changes in Quality



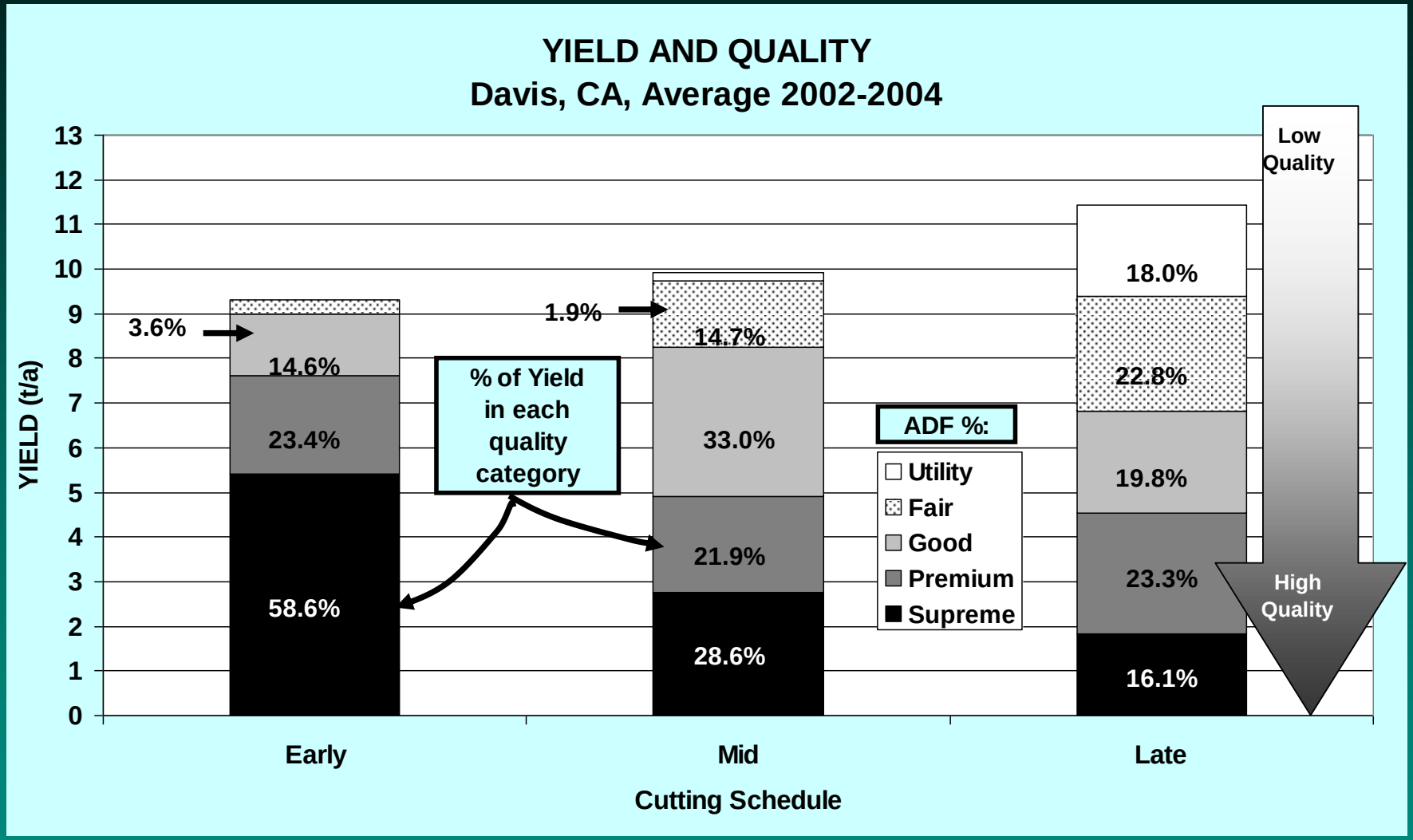
- Plant is growing mostly stems as it matures
- Those stems are increasingly poorer in Quality

1999 Data – T. Ackerly, UC Davis

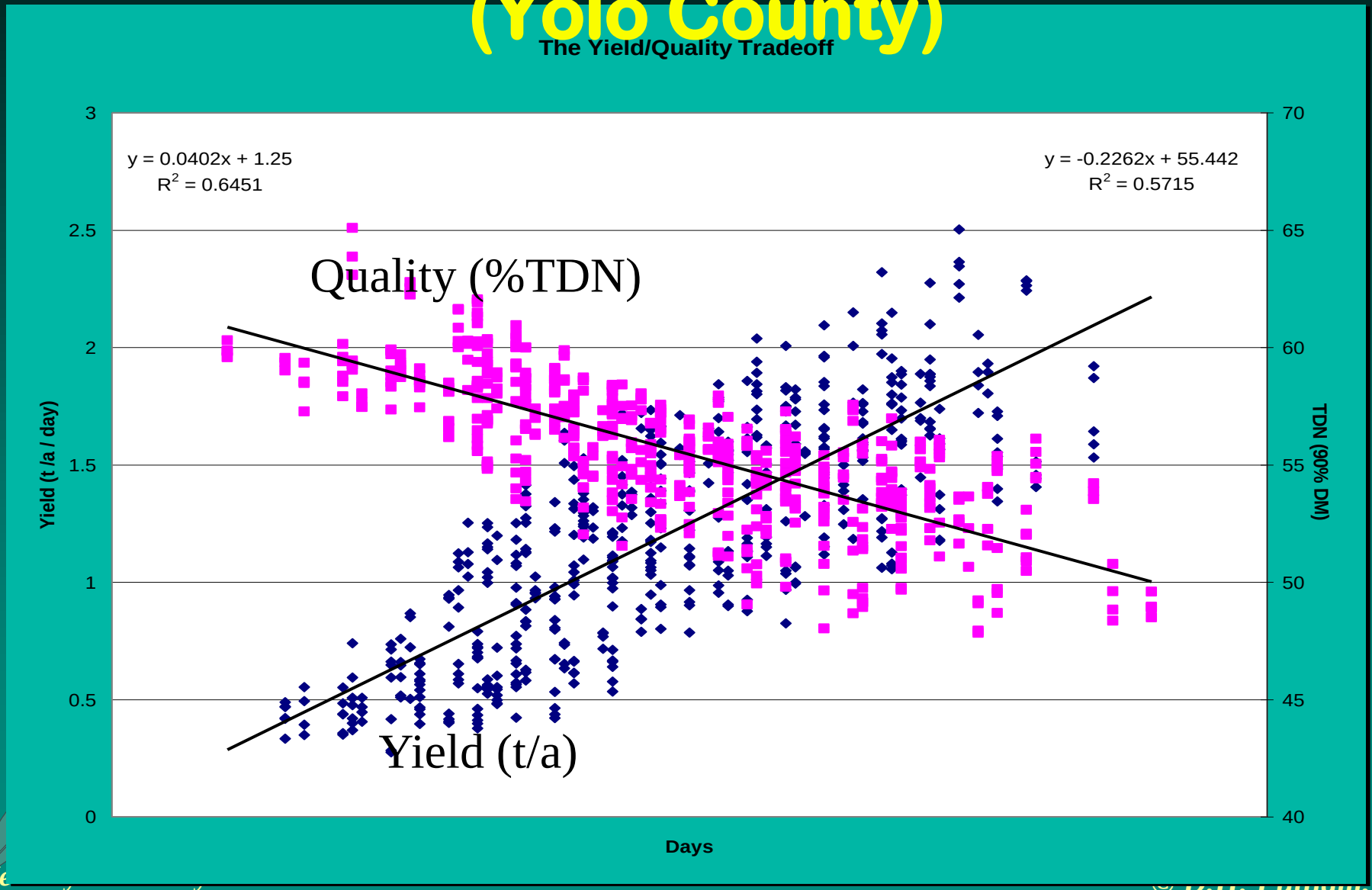
Relationship between yield and quality



Cutting Schedules & Yields



The Yield/Quality Tradeoff (Yolo County)



Plant Maturity:

- The single most important factor influencing forage quality

Immature

Mature

Effect of Harvest Maturity on Yield, Quality and Leaf%

Maturity	Days	Yield	TDN	ADF	CP	Leaf%
Pre-Bud	21	7.5	56.3	26.3	29.1	58
Mid-Bud	25	8.8	54.2	29.5	21.3	56
10%Bloom	29	9.9	52.4	32.2	21.3	53
50%Bloom	33	11.4	52.0	32.7	18.0	50
100%Bloom	37	11.6	50.1	35.5	16.9	47

Data: V. Marble, 1974

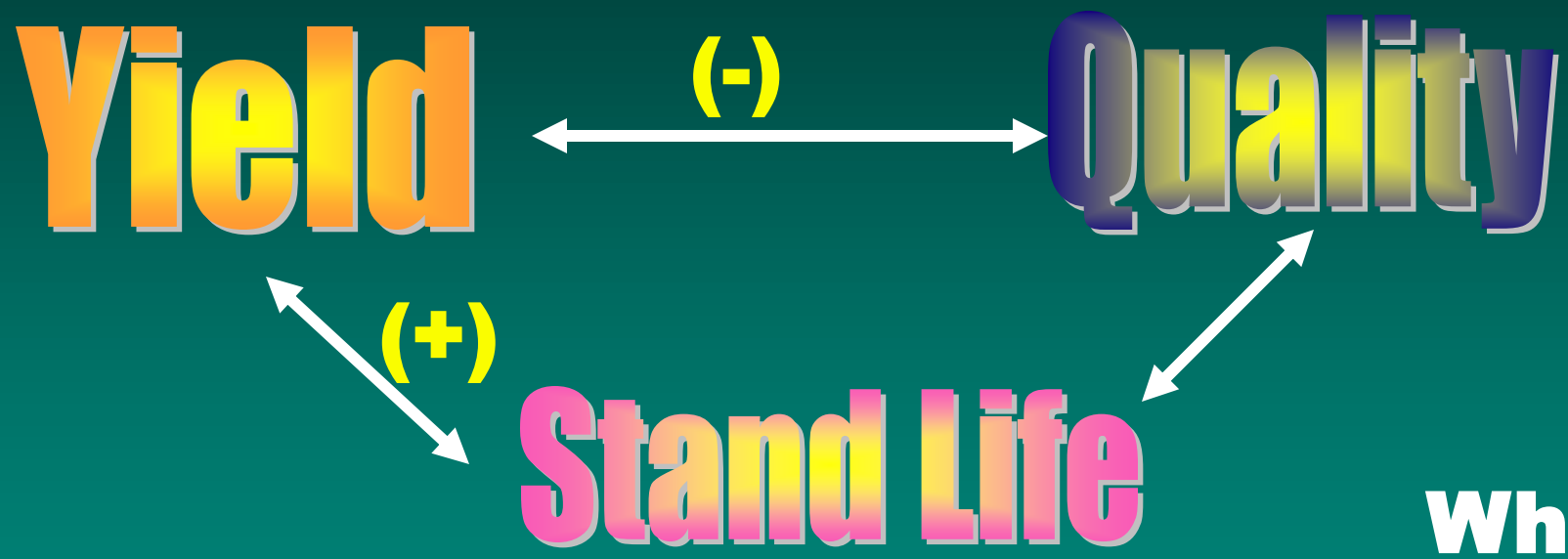
Effect of Harvest Maturity on Weeds and Stand

Maturity	Days	Weeds	Stand
Pre-Bud	21	48	29
Mid-Bud	25	54	38
10%Bloom	29	8	45
50%Bloom	33	0	56
100%Bloom	37	0	50

Data: V. Marble, 1974

Steve Orloff, photo

Alfalfa Quality: Always a Dilemma:



What about $$?

Cutting Schedules:

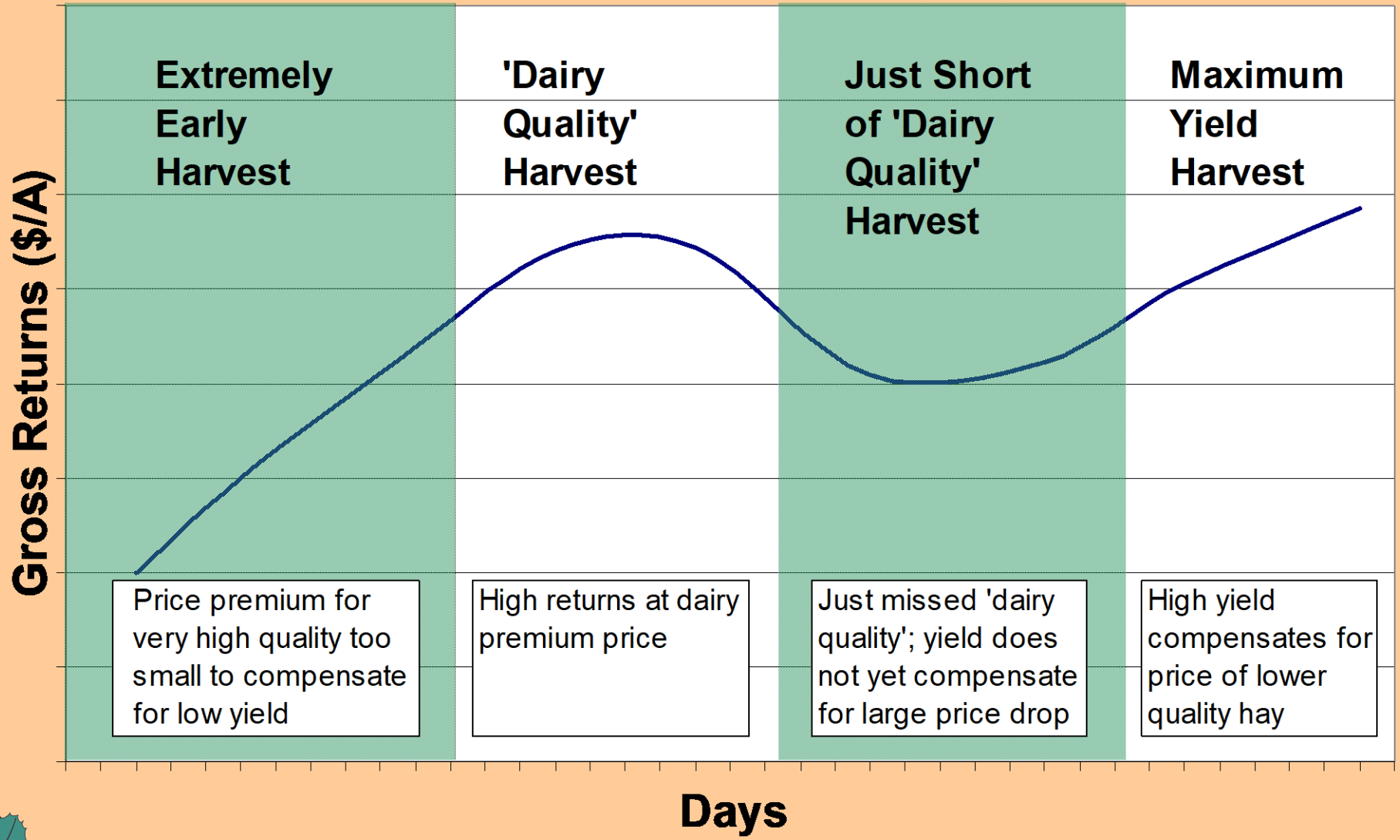
- **THE MAJOR** way to manipulate Quality in Alfalfa & Forages
- And Yield!!
- Yield/Quality/Stand Tradeoff is a complex management issue for growers.
- Are we locked into this tradeoff?
- What about profitability?

When to Harvest for Maximum Profit?

High Price Low Yield Combination	vs.	Low Price High Yield Combination
Short cutting interval		Long cutting interval

Slide: Steve Orloff

Common Hypothetical Return Curve



Slide: Steve Orloff

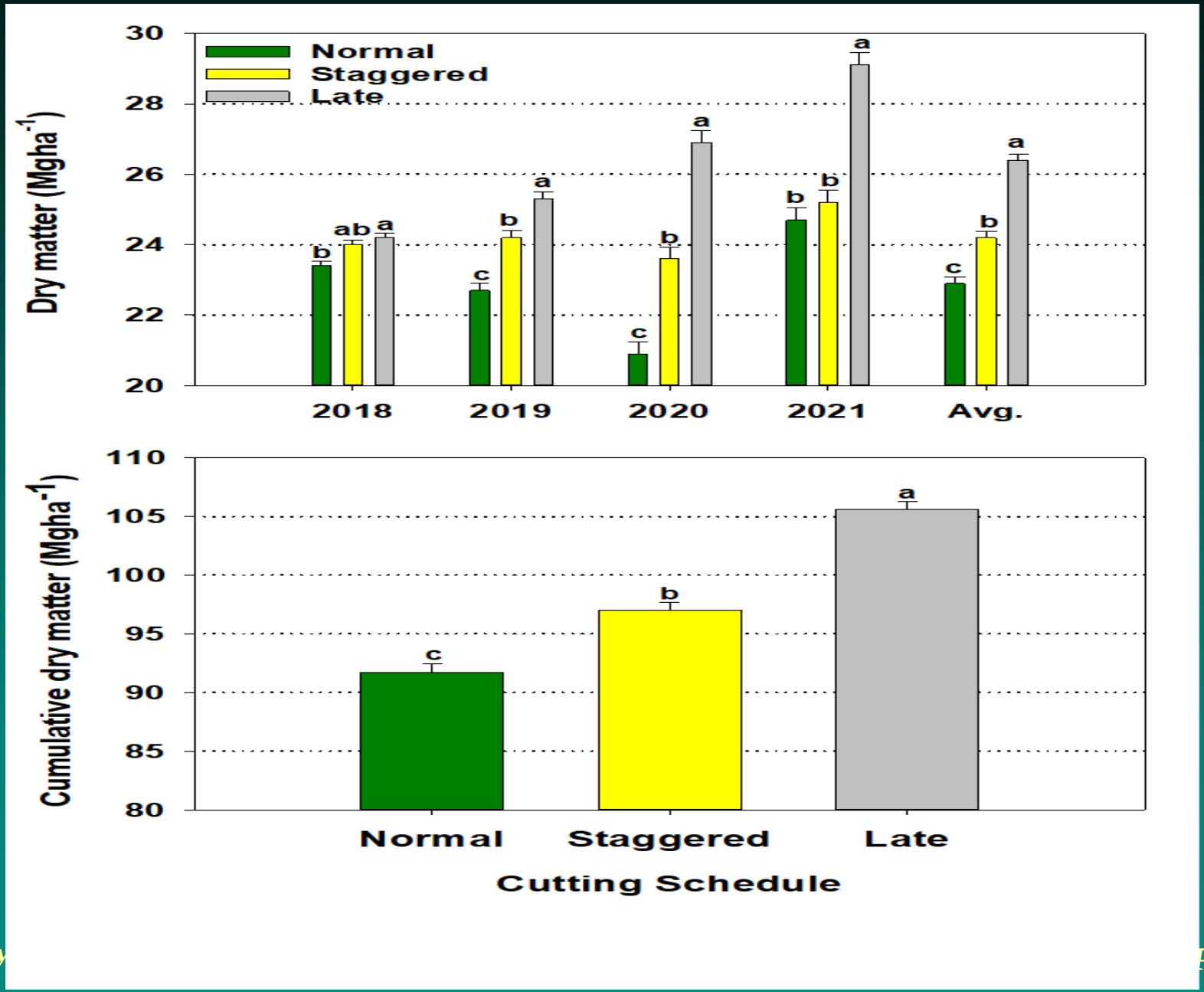
What about Price?

Table 1. Prices for Alfalfa Hay (Sept. 23, 2022, The Hoyt Report). $/ton delivered		
Category	Tulare/Hanford (delivered)	Modesto/Escalon/Turlock
Supreme	$460-470	$450-460
Premium	$444-455	$430-450
Good	$420-445	$420-435
Fair	$390-410	$380-400

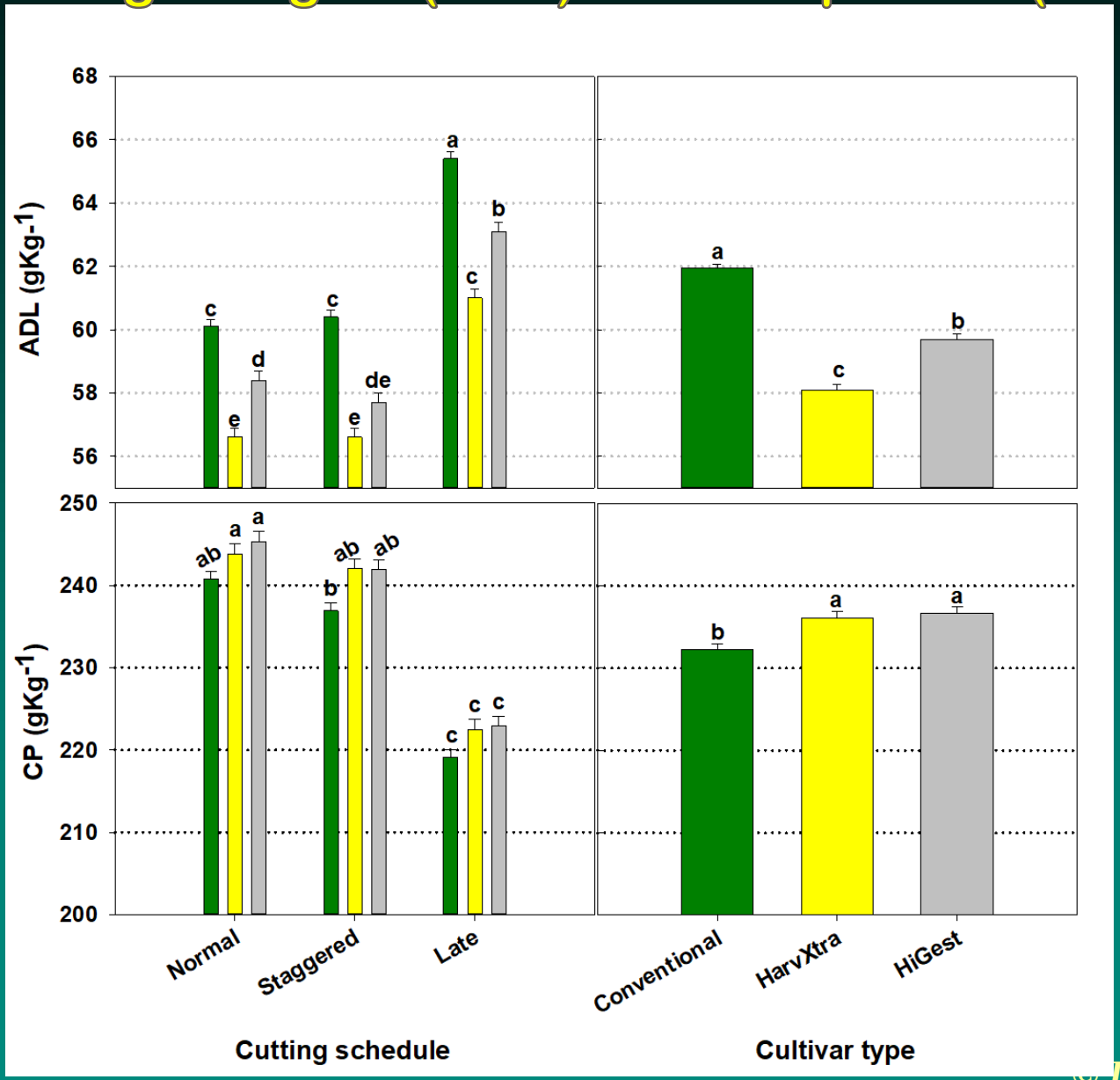
The ‘staggered’ Concept

- Allow several ‘long’ cutting schedules over the season
- Periodically Regenerate root reserves for subsequent regrowth
- ‘high quality’ harvest followed by ‘high yield’ harvest
- e.g. 21 day followed by 35 day (vs. all 28 d or all 35 day)

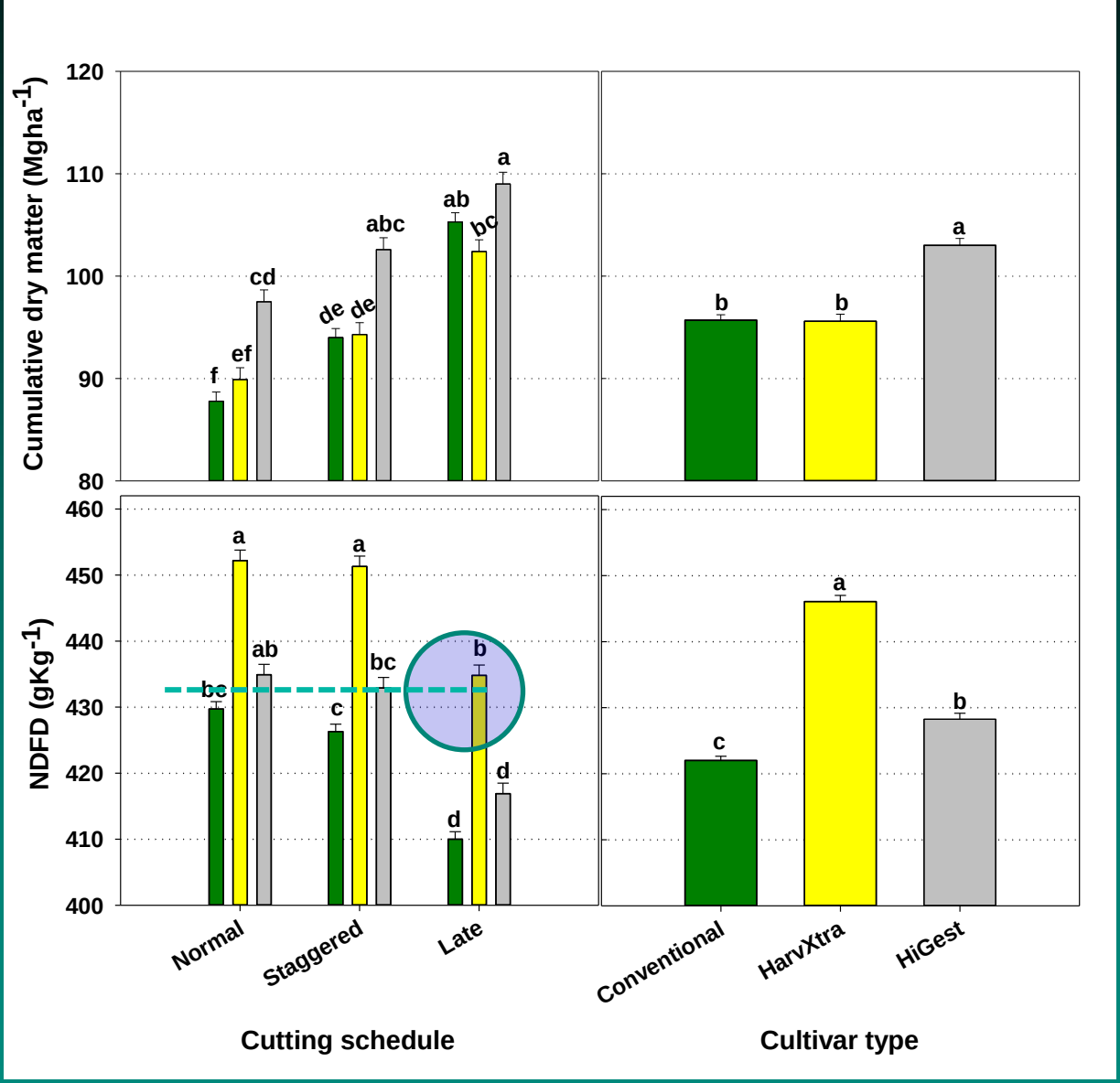
Cutting schedule effect on yearly & 4 yrs. sum yield



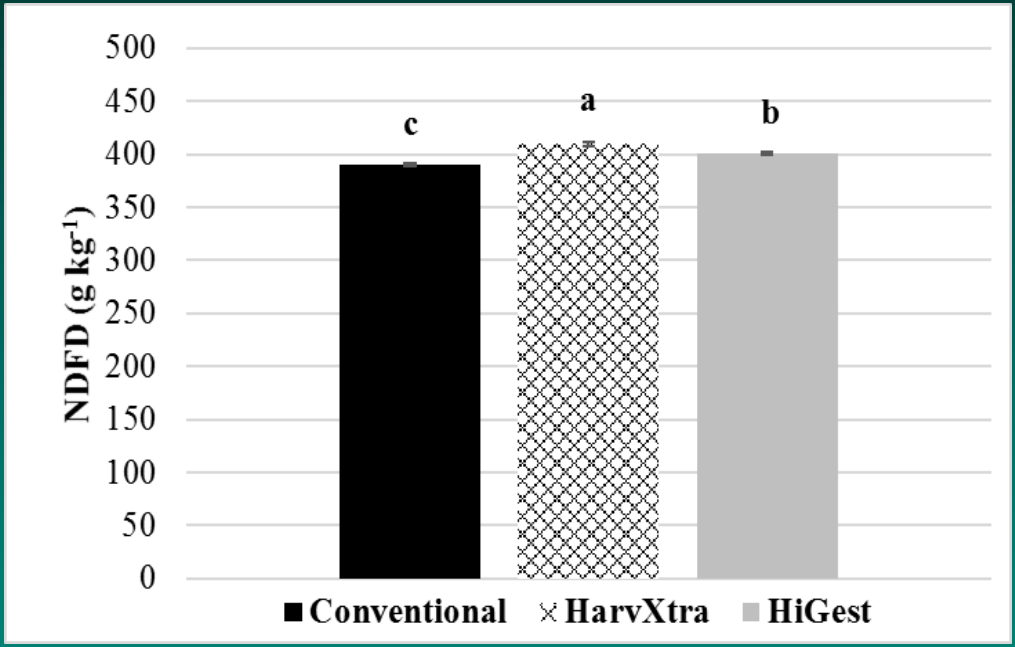
Cutting schedule & cultivar type effect on acid detergent lignin (ADL) & crude protein (CP)

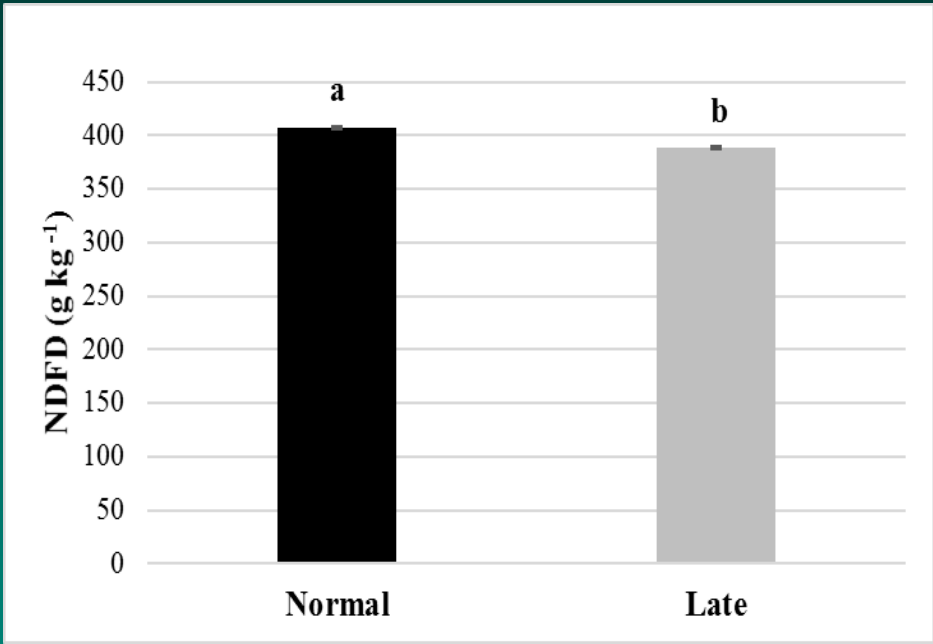


Cutting schedule & cultivar type effect on 4 yrs. sum yield & neutral detergent fiber digestibility (NDFD)



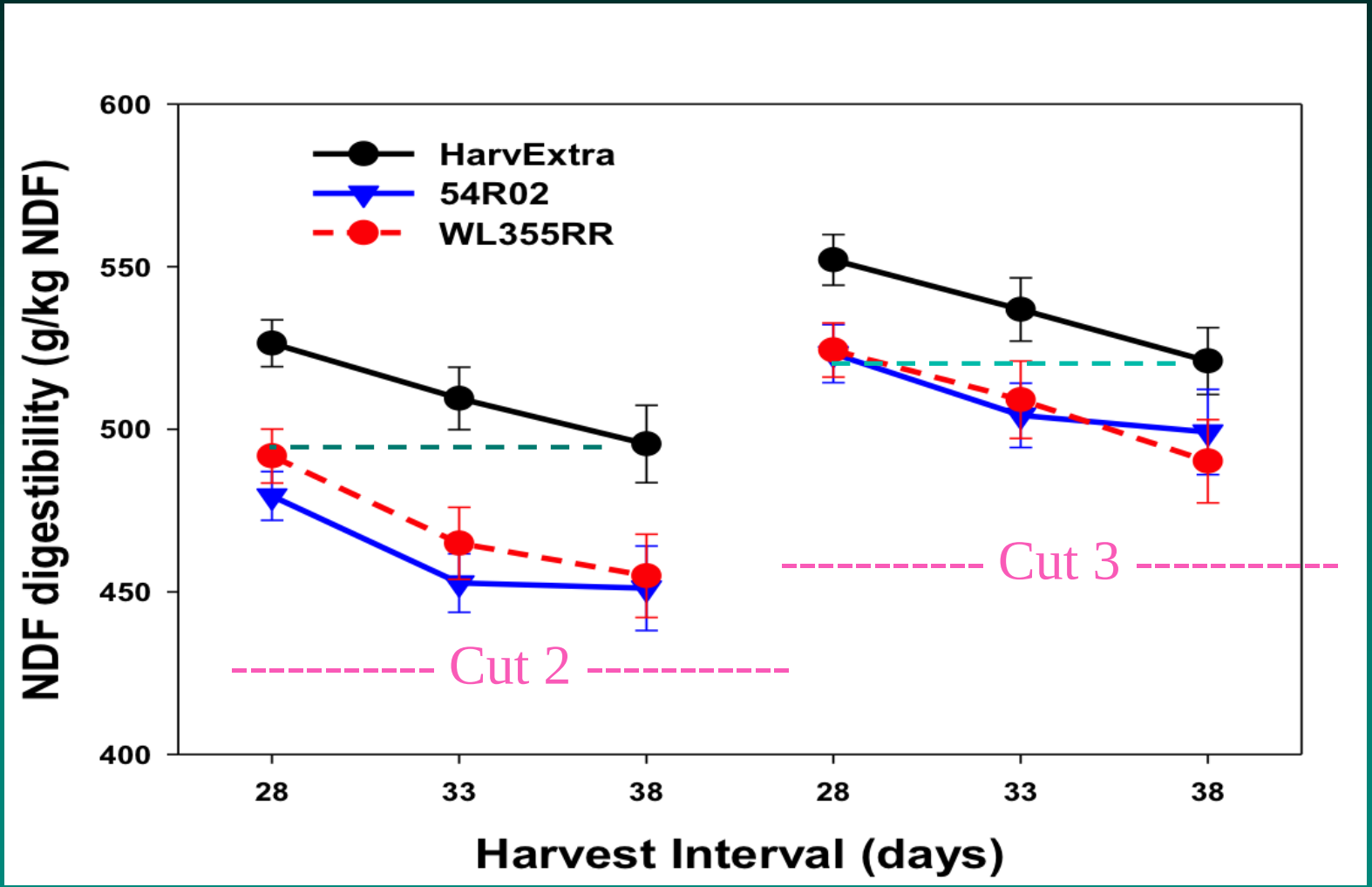
3-year non-dormant data (2017-2019, Davis, CA)



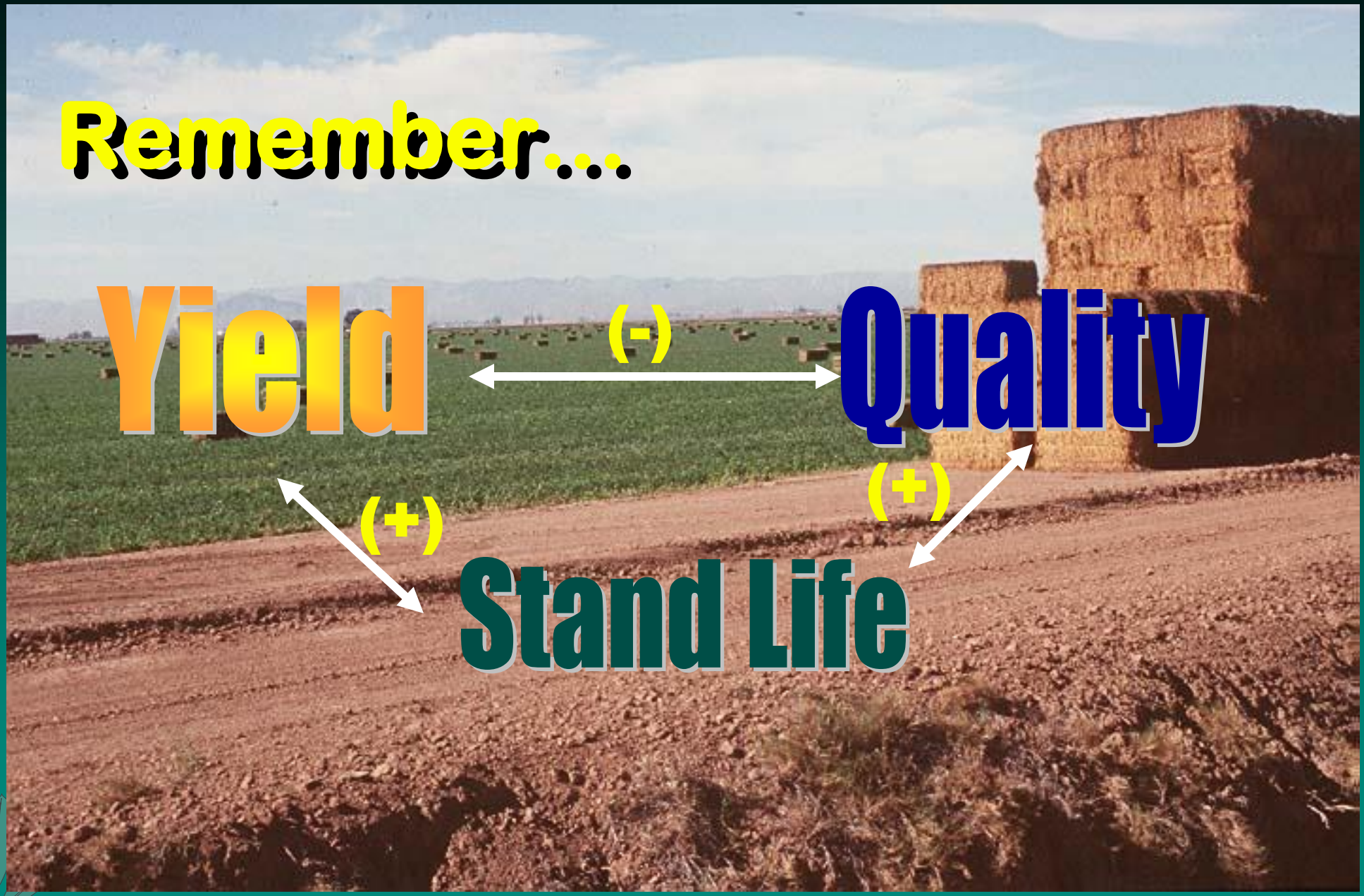


- HarvXtra/HiGest improves Digestibility
- Early Cutting improves Digestibility

Effect of Harvest Schedules – Seeding Year
NDFD (6 location average)



Source: Sulc et al., CA Alfalfa Symposium, 2016



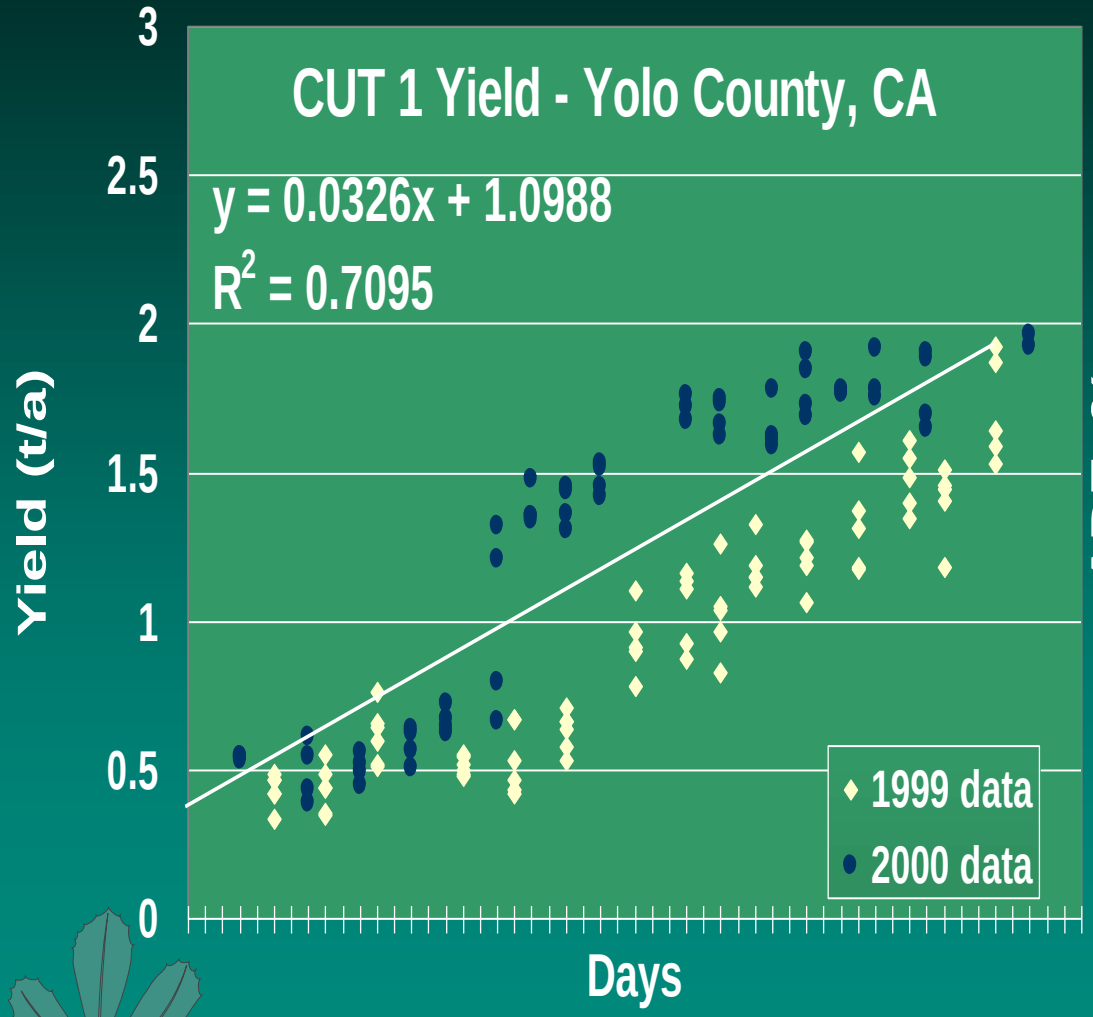
Conclusions:

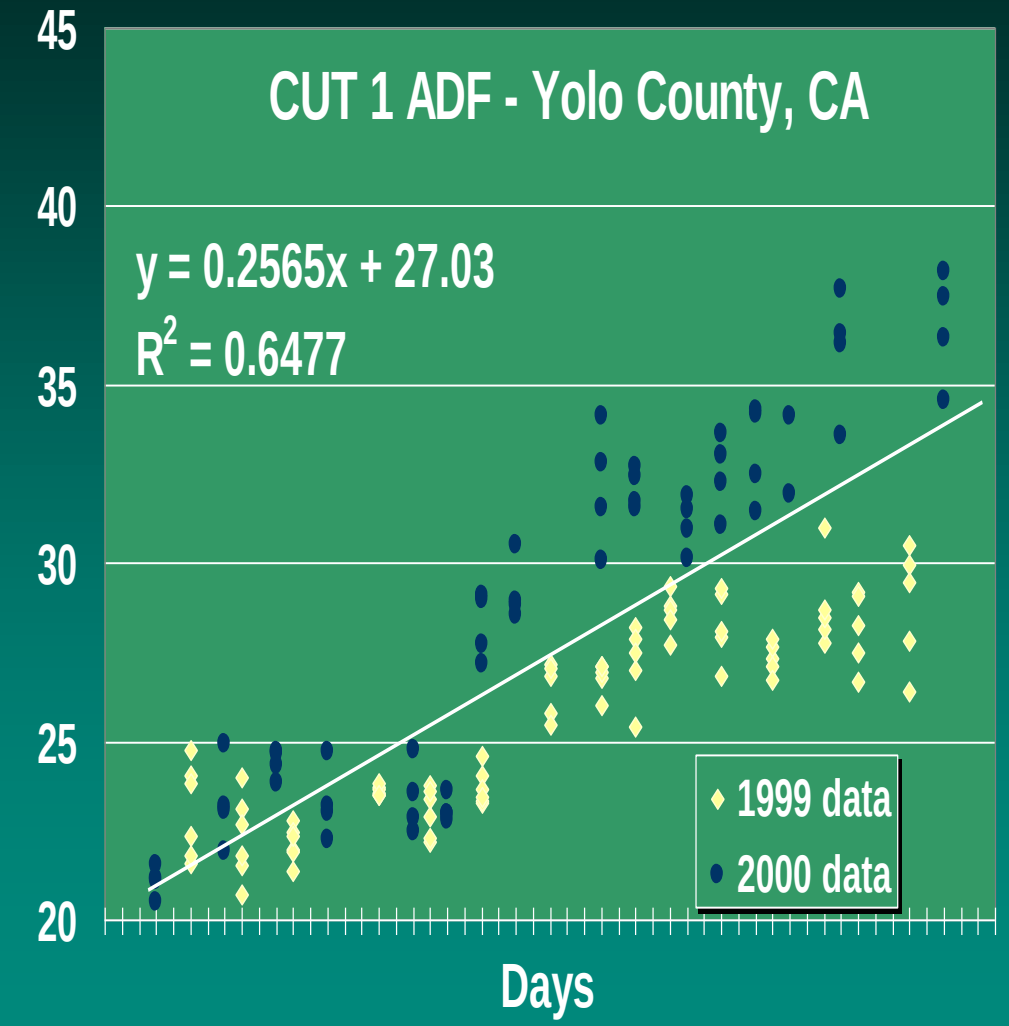
- **In a high-price year:**
  - Extend Harvest Schedule to maximize yield (quality less important!).
- **Consider 'Staggered' Harvest Schedules**
  - Enables high yields and some high quality harvests vs. 28 day. Improves yield vs. 28 day schedule.
  - Higher quality than late schedule
  - Allows plant recovery for stand persistence.
- **HarvXtra/Low Lignin Trait**
  - HarvXtra enables late cuts with less effect on quality
  - Somewhat lower yields at same harvest schedule

World Alfalfa Congress
November 14-17, 2022, San Diego, CA
https://worldalfalfacongress.ucdavis.edu/

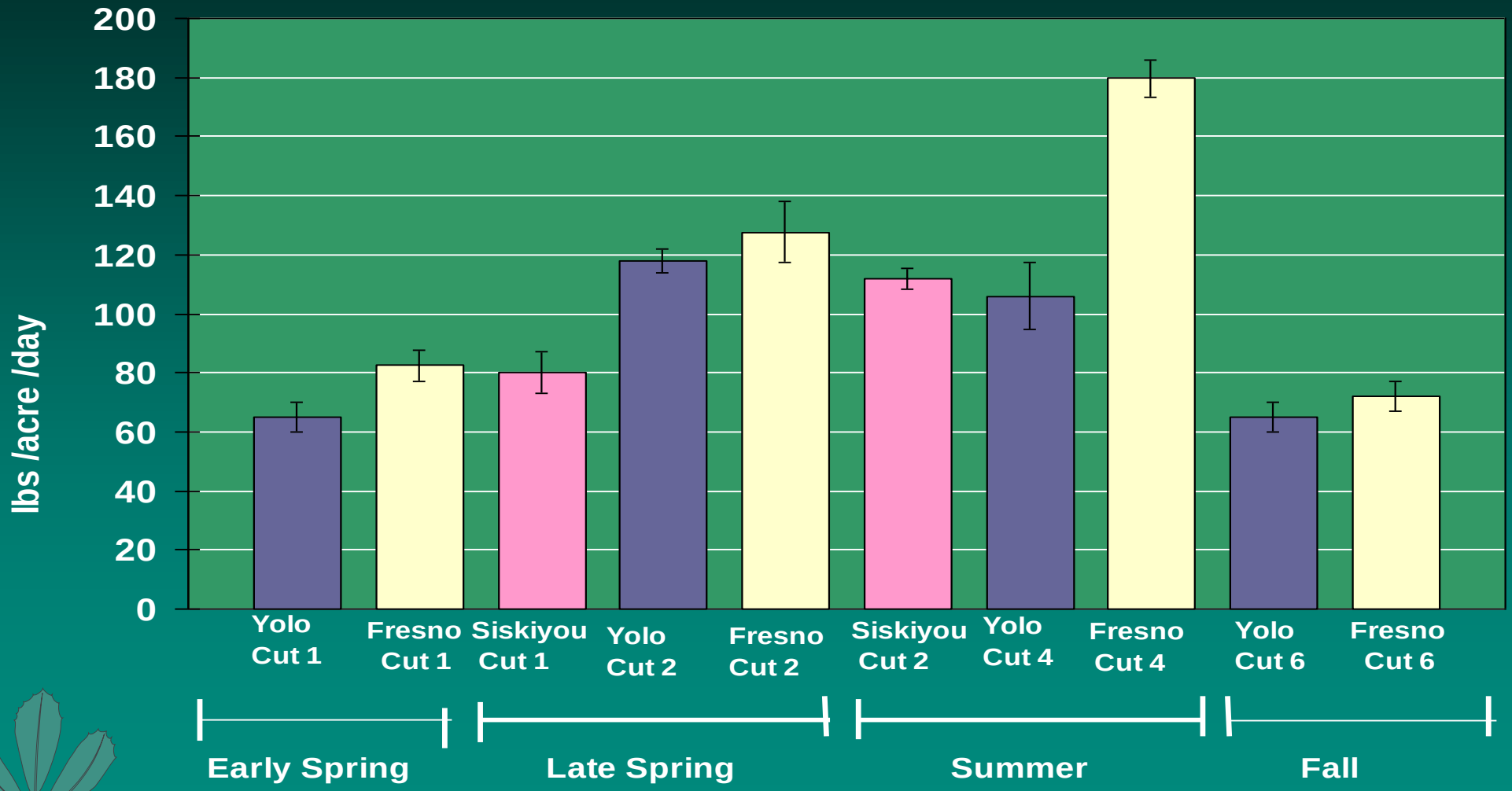
Larry Teuber, photo

Changes in yield & quality for cut 1 averaged over two years for Yolo County, CA.





Daily change in yield for all cuts and locations.



Daily changes in ADF for all cuts and locations.

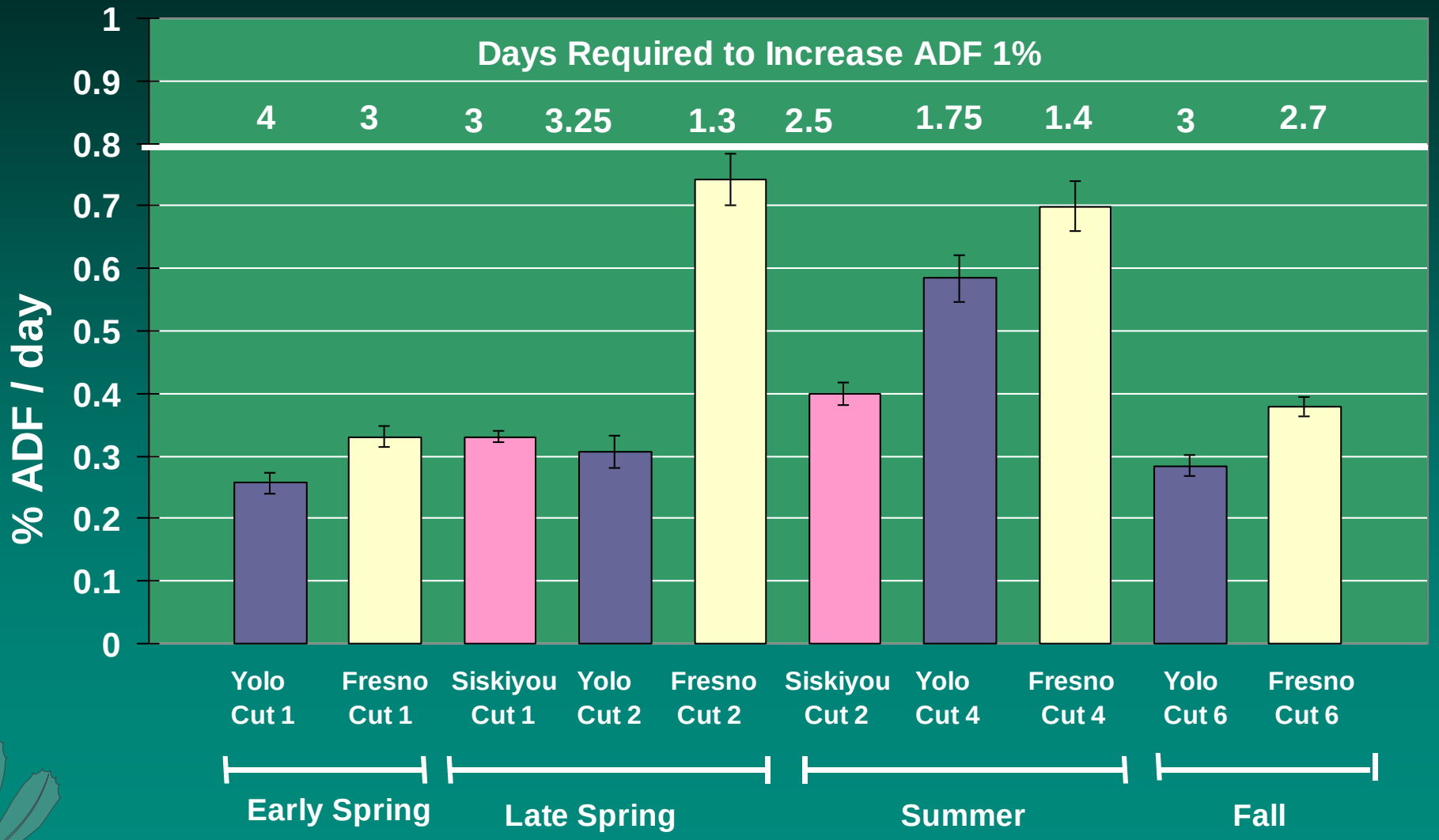
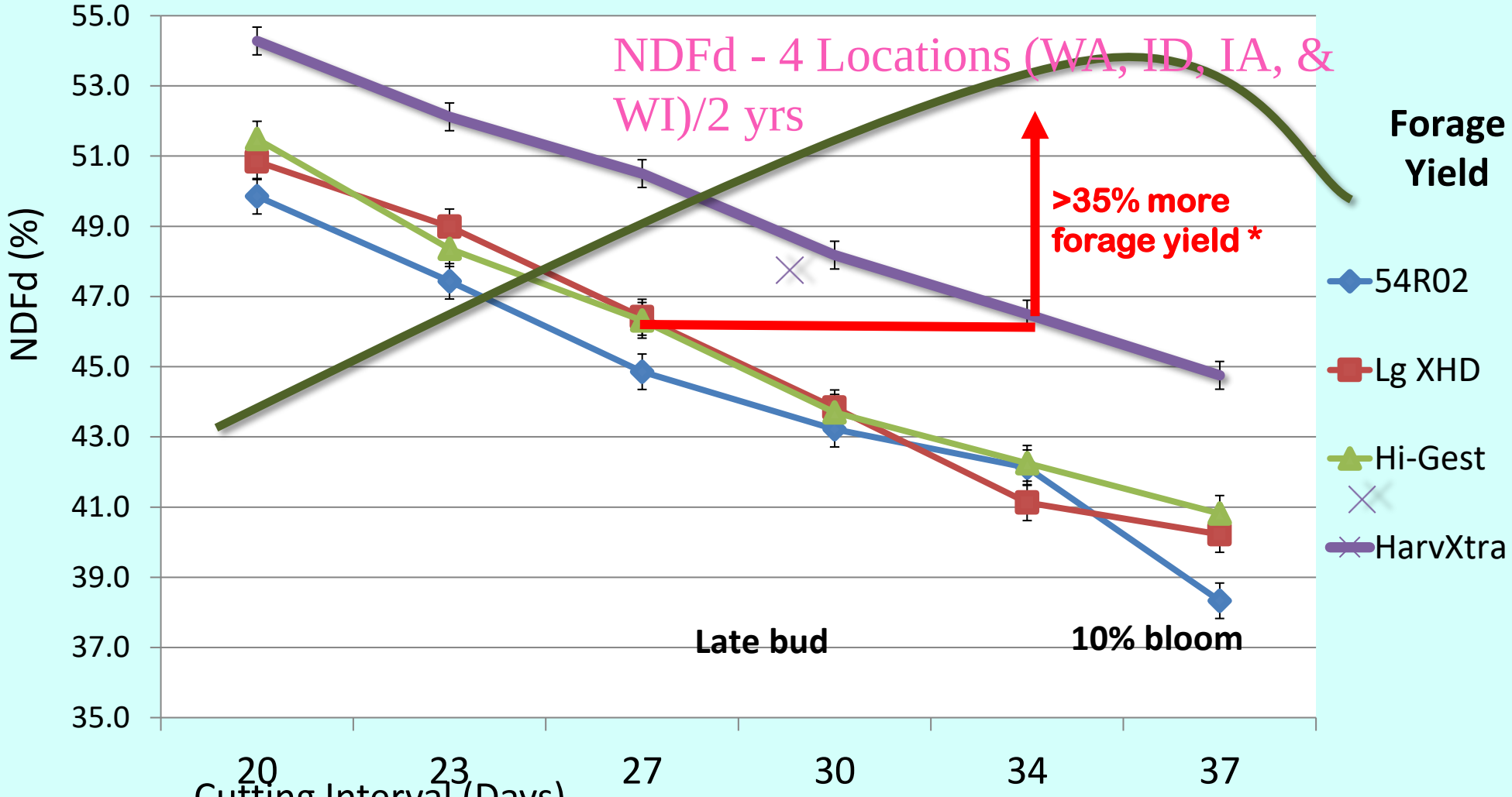


Table 1. Average Composition of alfalfa leaves and stems at harvest (mostly Midwest Data)

Plant Part	Protein (CP)	Fiber (NDF)	Non-Fiber Carbohydraetes (NFC)	Relative Feed Quality (RFQ) (RFV)
	Percent of DM			
Leaves	35	17	41	500
Stems (Prebud)	15	55	23	120
Stems (Flowering)	6	75	11	50

Dan Undersander, Hay & Forage Grower, 2016

HarvXtra: Harvest for Yield or Quality?

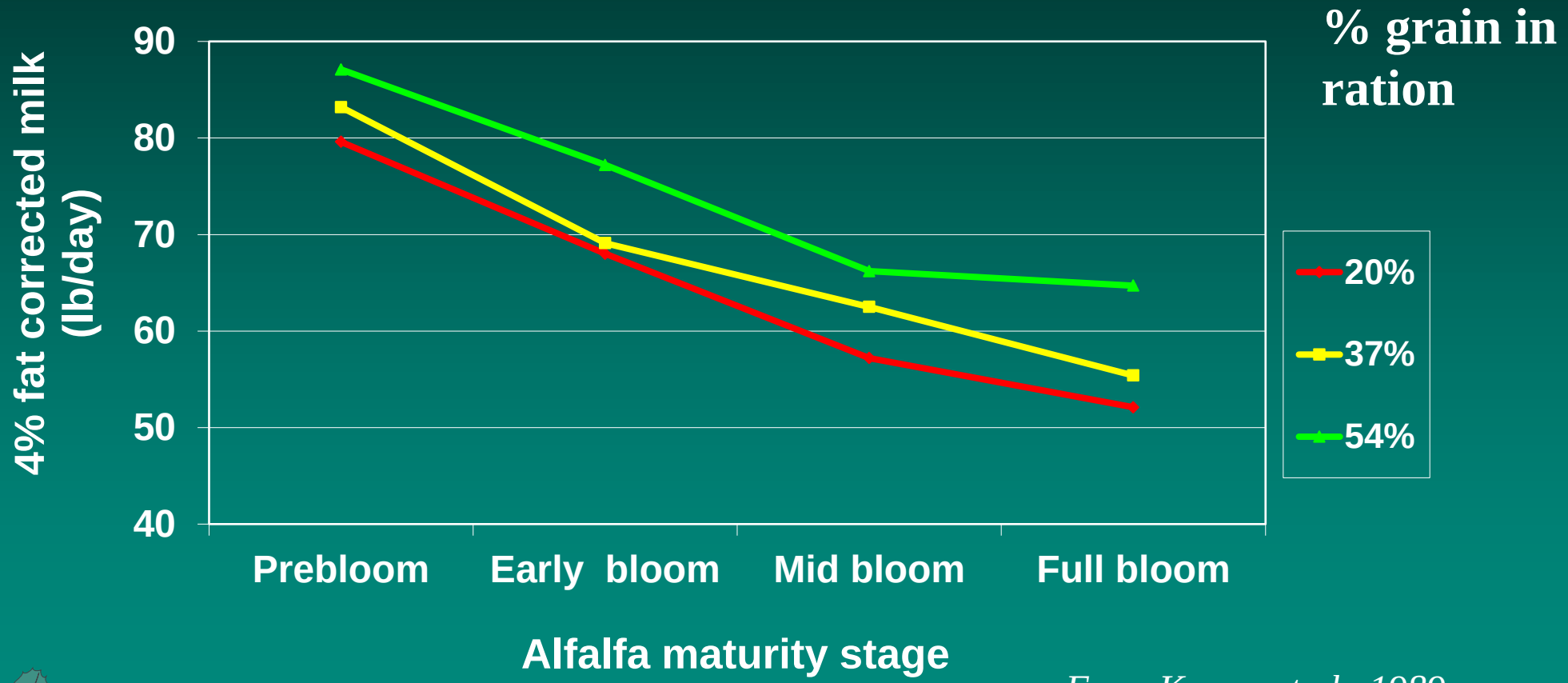


Undersander, et. al. Low lignin alfalfa: Redefining the yield-quality tradeoff, 2009 Western Alfalfa & Forage Conference

Plant Maturity:

- Early harvests (22-28 days) results in highest quality
- However, is that the right time to harvest?
- What about yield?
- What about stand life (persistence)?

Forage quality effects on milk production – grain cannot compensate



From Kawas et al., 1989