NE SARE PDP

Cutting Management of Perennial Hay Crops

Sid Bosworth
Extension Professor
University of Vermont

NORTHEAST SARE
Sustainable Agriculture Research & Education
Professional Development Program

The UNIVERSITY of VERMONT
Plant and Soil Science

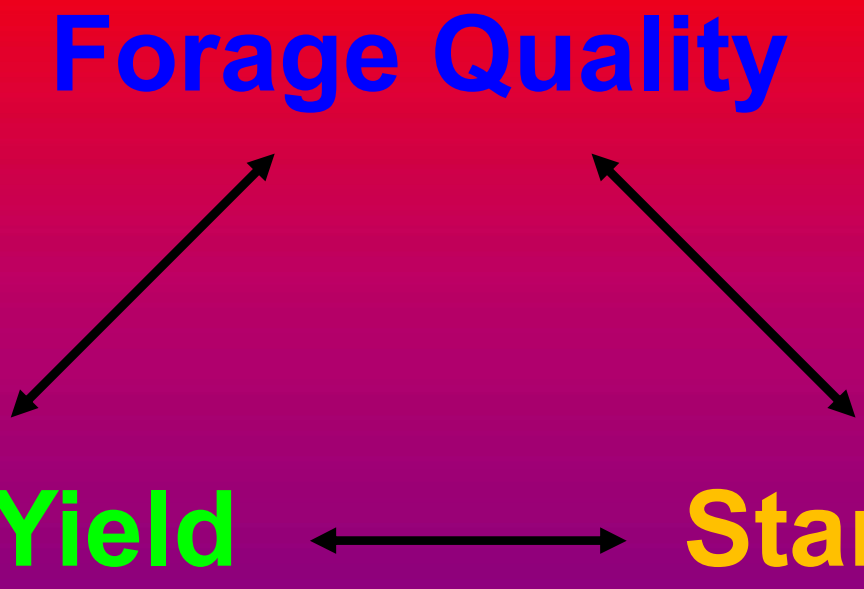
What is Cutting Management?

- Timing of first harvest in a season
- Frequency of harvest (time interval)
- Timing of the last harvest
- Number of harvests per year
- Cutting height

Importance of Cutting Management

- Directly affects quality, yield and stand life
- Which influences animal performance and reproduction
- Which dictates the % of haycrop in diet
- Which affects grain supplementation and costs
- And the reliance on annual forages such as corn silage and/or purchased hay/haylage
- Which affects nutrient Imports on the farm
- Ultimately impacting farm profitability

Importance of Cutting Management



An important goal in most forage programs is to maximize economic yield of nutrients while insuring stand persistence.

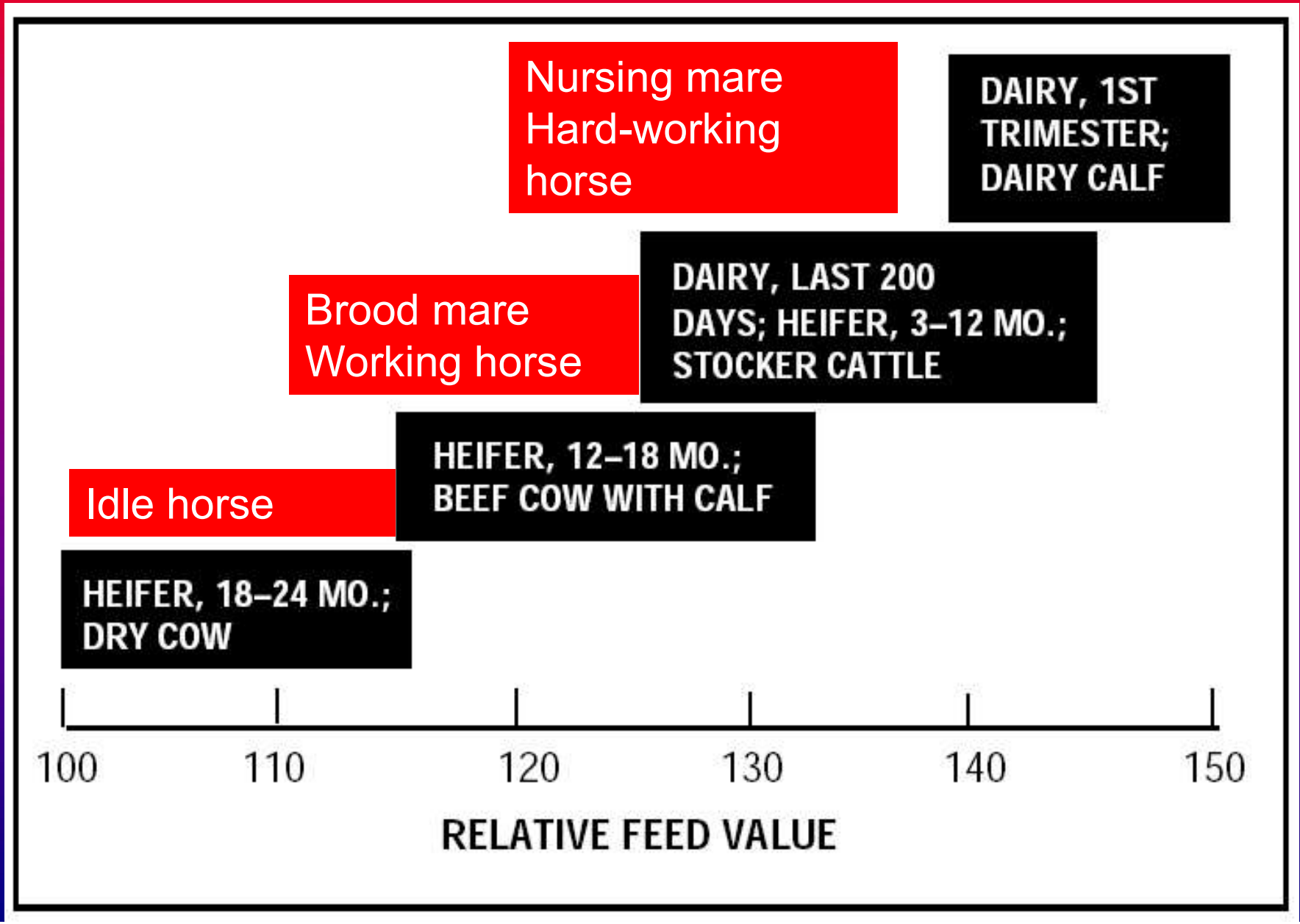
Cutting Management Strategies

Considerations

- Forage quality goals on the farm
- Yield and stand life goals/plans
- Land suitability and soil quality
- Forage species/varieties grown
- On-farm verses custom harvesting
- Machinery/labor availability
- Types of forage and storage systems
- Land availability (takes more land for high quality programs)

Forage Quality Needs of Cattle and Horses

Cutting management should be based on desired quality.



Focus on the First Harvest

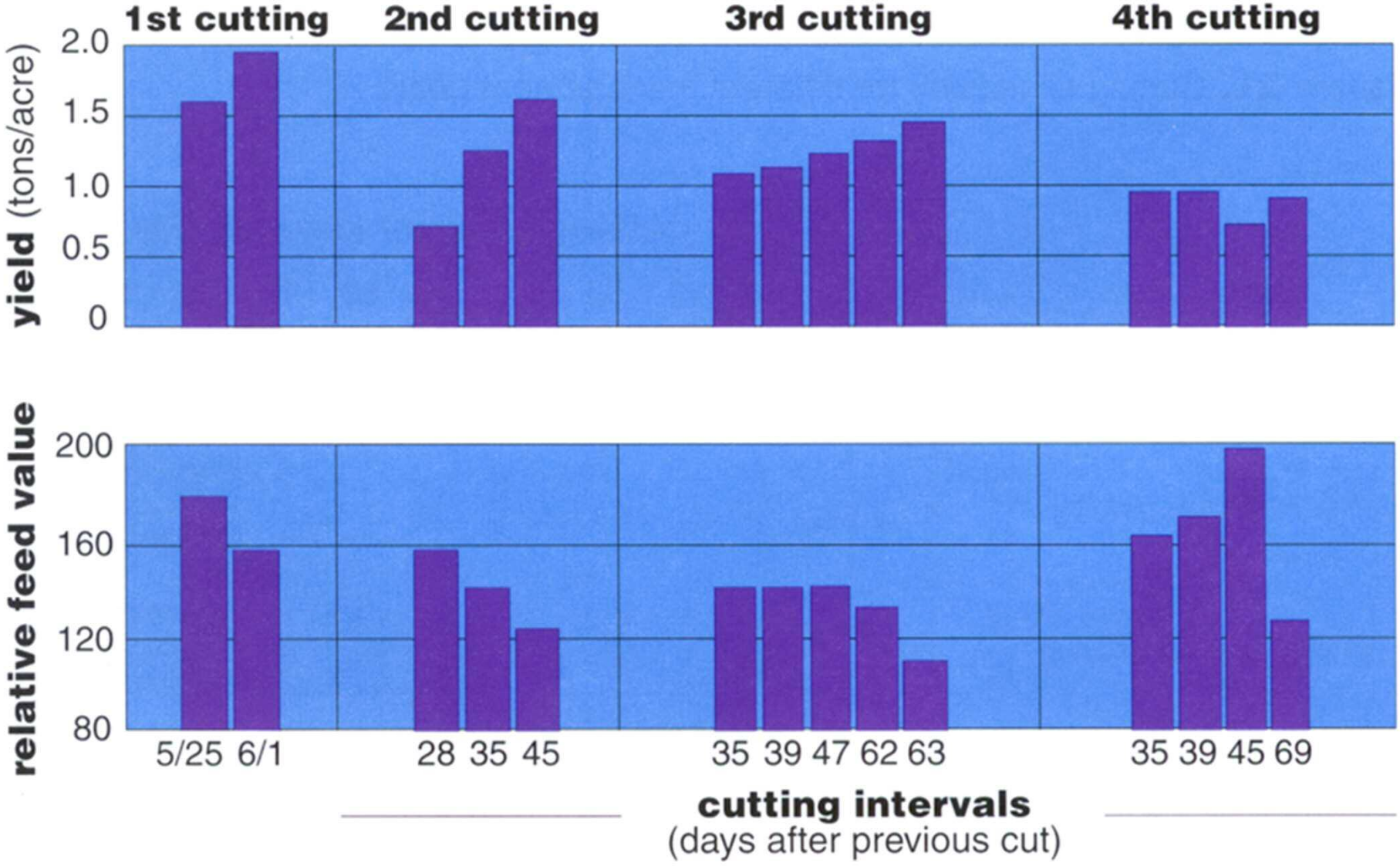
- The first cutting has the highest potential for having the most digestible forage
- It also has the highest risk of loosing quality when cutting is delayed
- Sets the stage for rest of the season
- Must have equipment ready to go!

Most Common Factors Affecting Harvest Decisions

- Calendar date (time)
- Stage of plant maturity
- Weather

Alfalfa Cutting Management

Alfalfa Cutting Management



Source: Adapted from Brink and Marten, University of Minnesota, 1989

Alfalfa Cutting Management

Some Generalizations for New England:

- Quality drops the most rapid during the first two cuttings, so harvest must be timely.
- For high quality, take first cutting by bud stage

- Take the second cutting at bud stage which is often 28 to 33 days after the first.
- Allow a longer interval between 2nd and 3rd harvests to rebuild food reserves (10–25% bloom or about 40 to 45 days interval).

Alfalfa Cutting Management

More on First Cut:

- The maturity rate of alfalfa is very response to temperature so be ready to cut early if an early, warm spring
- If it is a cold, cloudy spring that significantly delays maturity, it may be best to cut by a target date even if the stand has not reached bud stage
- Target dates vary across New England from the end of May in southern, lower elevation regions to the 2nd week in June in northern, higher elevation areas.

Alfalfa Cutting Management

Summer Harvests:

- For summer harvests, cut earlier if conditions such as dry or hot weather promotes early maturity.

- Cut earlier if stand is infested with potato leaf hopper and/or showing signs of “hopper burn” or if there are significant leaf diseases that detract quality

Alfalfa Cutting Management

Summer Harvests:

- Watch for onset of new shoots from the crown even before the previous crop is harvested
- Varieties will vary in this response. Some have less apical dominance than others

- In these situations, it is best to harvest before the next growth gets above the mower height

Alfalfa Cutting Management

Cutting Heights:

- Alfalfa can withstand low cutting heights (2” to 3”) because regrowth starts from crown buds and energy reserves are in the taproot below the crown
- However, too low will reduce quality (higher fiber in lower stems plus high ash due to increased soil contamination)

- A critical time to raise the cutting height is in the fall for the last harvest (4” to 6”) to help catch snow and/or provide a mulch affect to protect the crowns.

Alfalfa Cutting Management

Fall Cutting Management

- Mismanagement in the fall can lead toward winter injury of alfalfa.
- One option is to leave the stand uncut going into the winter
- If making a fall harvest, consider the previous cutting management. When cutting intervals are 35 days or less, it is best to avoid harvesting between early September and mid-October; otherwise, make sure there is 45 days between the late summer and fall harvest.
- Leave a 4 to 6 inch stubble

Alfalfa Cutting Management

Reducing Risk of Winter Injury

- Proper cutting (see previous slide)
- Variety Selection should be for:
  - Winter hardiness
  - Moderate to high disease resistance
- Soil K levels should be adequate to high

Alfalfa/Grass Mixtures

- For hay-only systems, consider late maturing, compatible grasses:
  - Timothy
  - Smooth bromegrass

- For high quality haylage mixtures, consider grasses that tolerate early cutting:
  - Late maturing orchardgrass
  - Tall fescue
  - Meadow fescue
  - Reed canarygrass

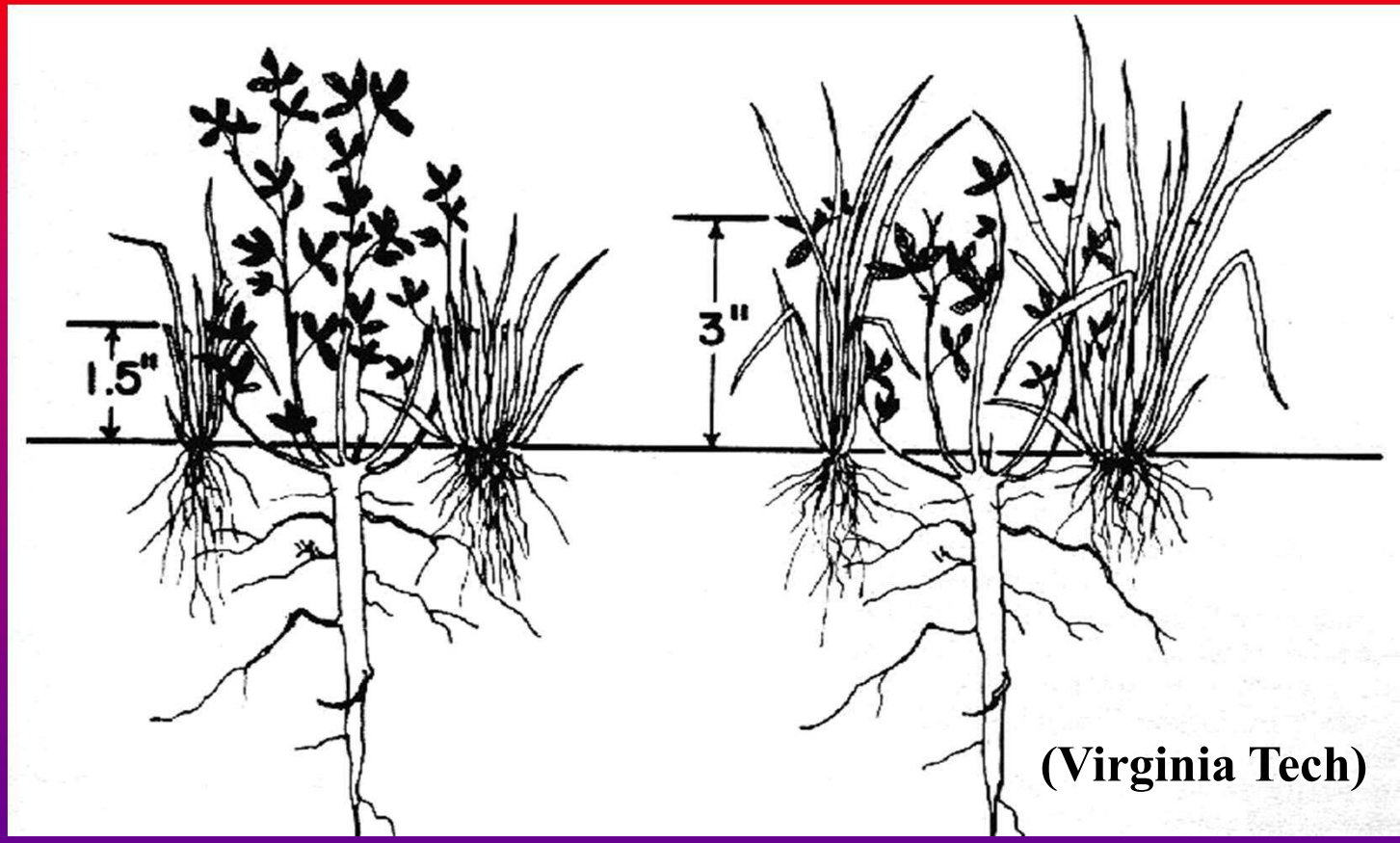
Alfalfa/Grass Mixtures

To maintain and sustain alfalfa in the mixture:

- Grow on moderate to well drained soil
- Maintain soil pH at 6.7 to 7.0
- Make sure soil P and K levels are adequate for alfalfa (grasses are very competitive for K when soil levels are low)
- Set cutting height for alfalfa (2” to 3”)

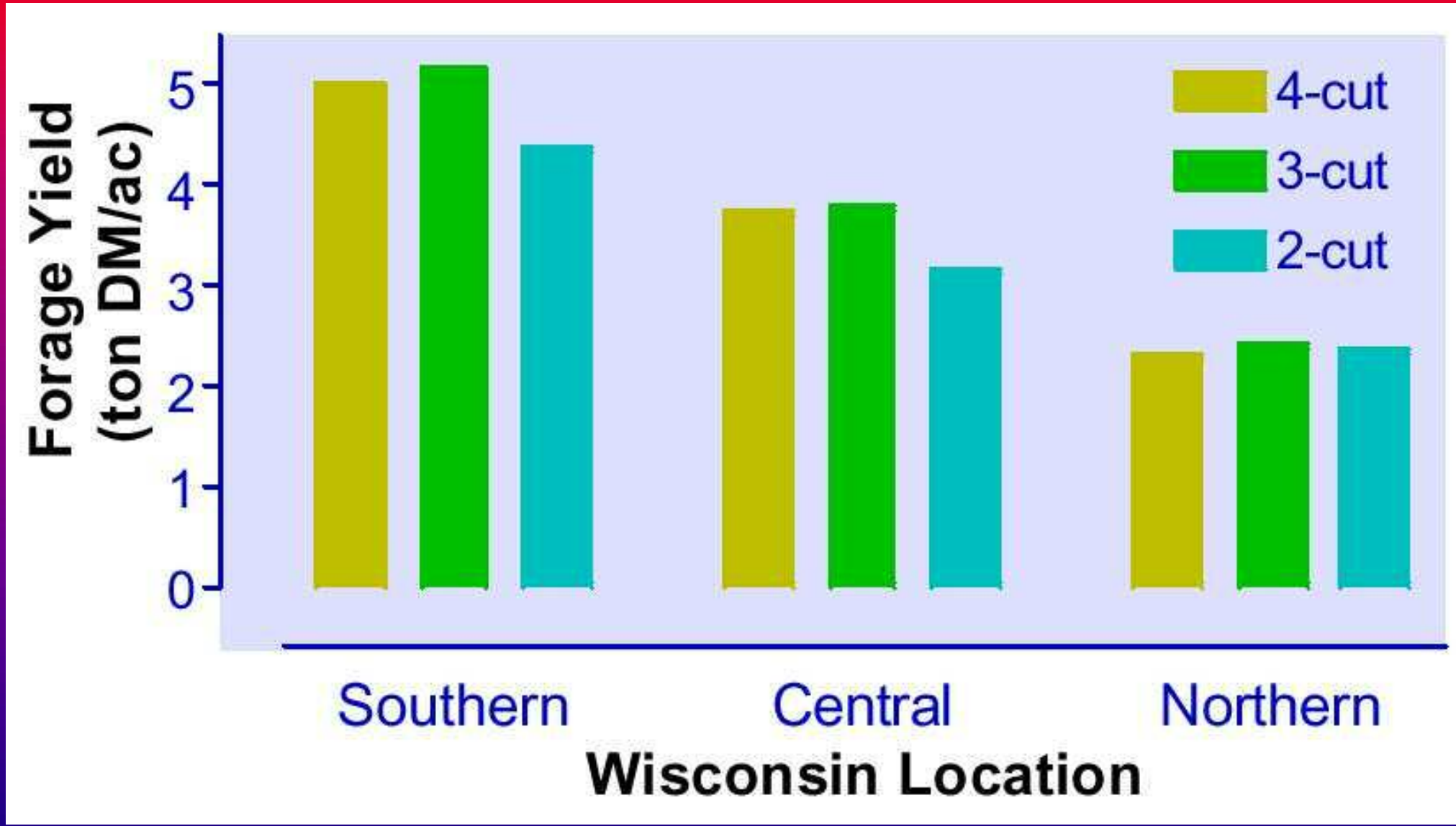
Alfalfa/Grass Mixtures

- A lower cutting or grazing height tends to favor the legume.
- For grasses, a low defoliation height removes more leaf area and part of the stored energy reserves; therefore, their regrowth is reduced relative to the regrowth rate of the alfalfa



Red Clover Cutting Management

Red Clover Cutting Management

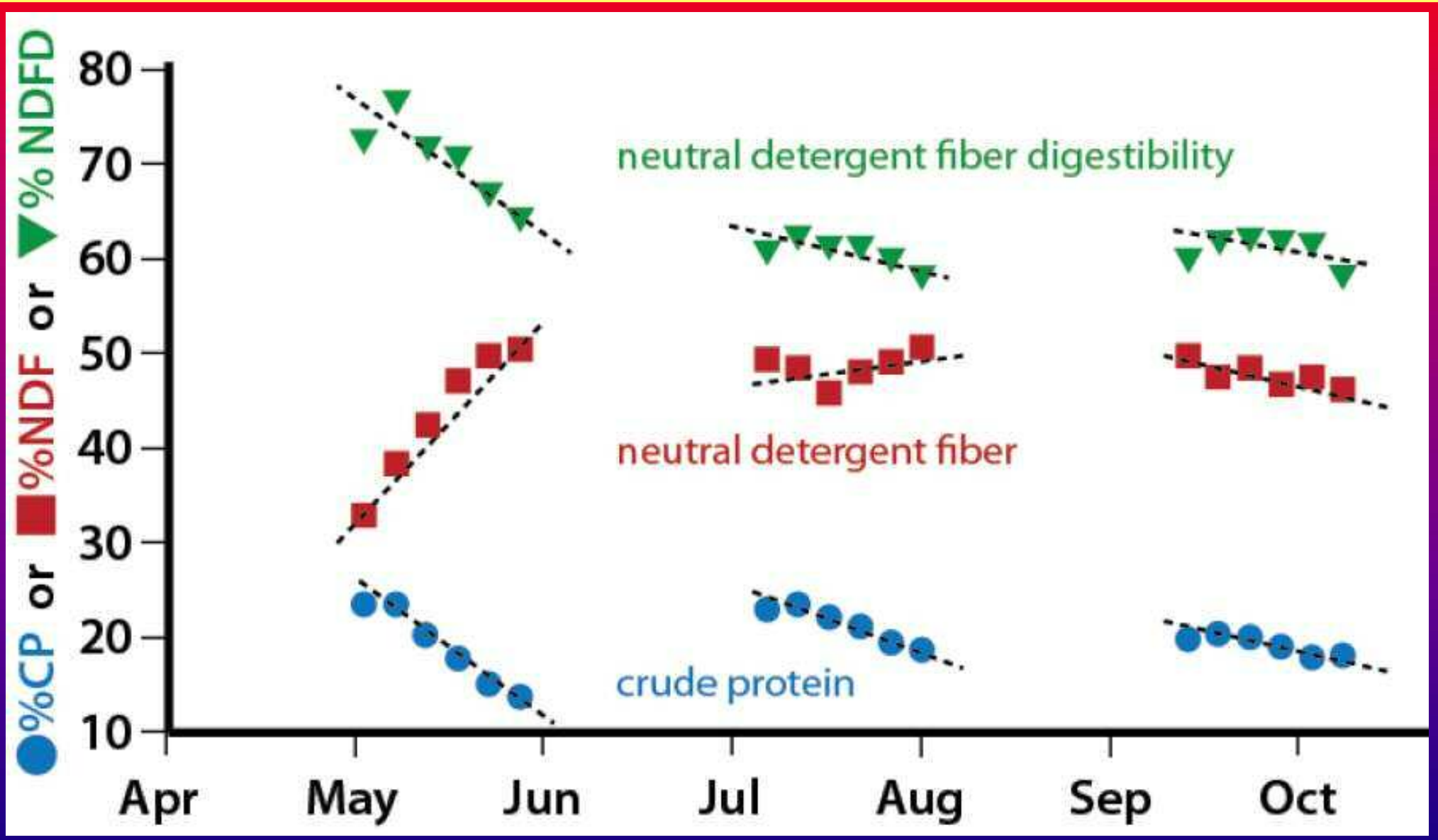


Red Clover Cutting Management

- Established red clover stands should be harvested at pre-bloom or early bloom for a compromise of quality and yield.
- In the first year, the third harvest during early September will help maintain better stands the following season.

Grass Cutting Management

Grass Cutting Management

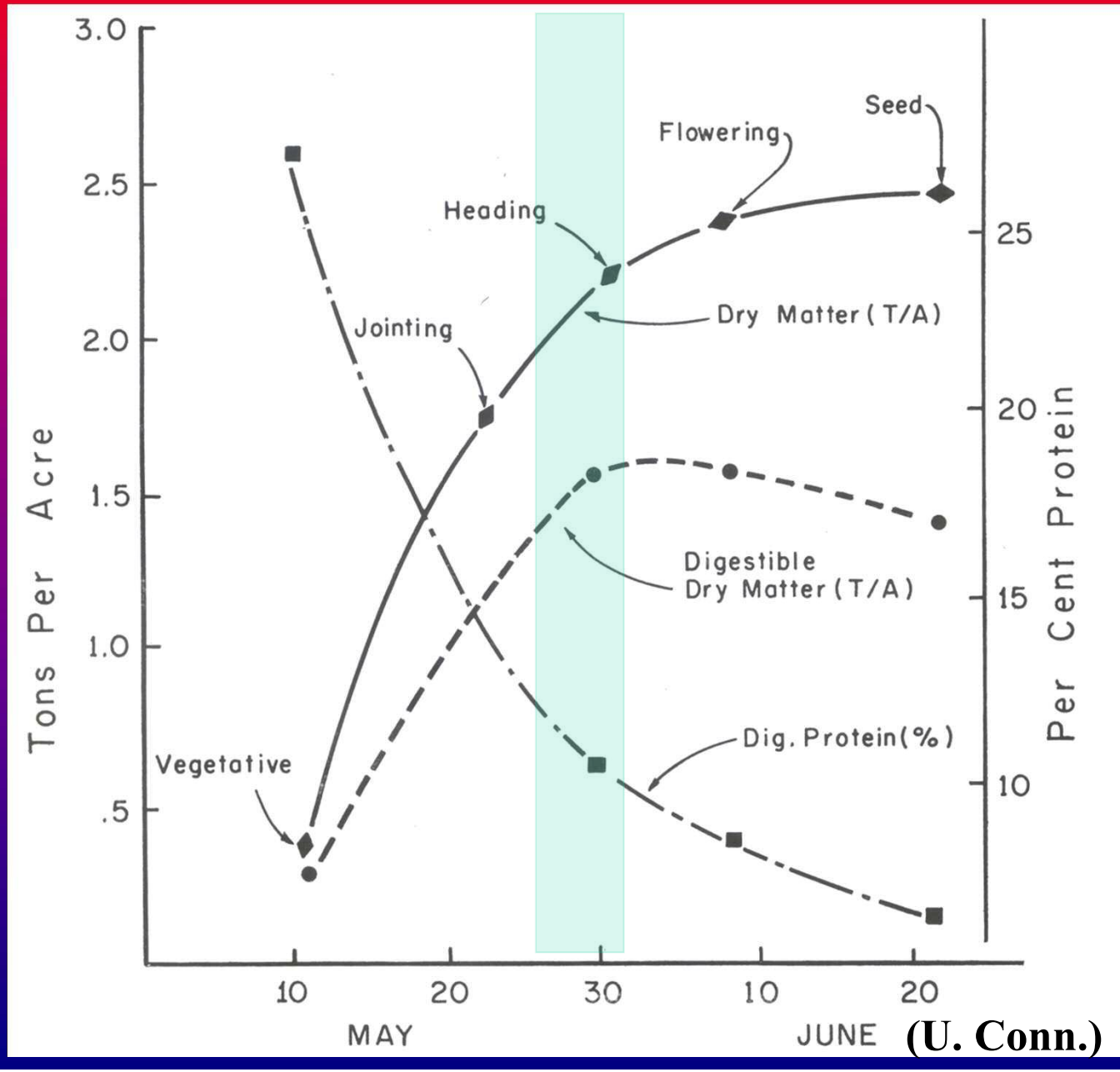


(Brink, USDA- Dairy/Forage Research Lab, 2010)

Grass Cutting Management

Grass Cutting Management

First cutting - Best compromise is to cut at boot to early head emergence



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Grass Cutting Management

Effect of cutting time of the first cut on first cut and aftermath yield

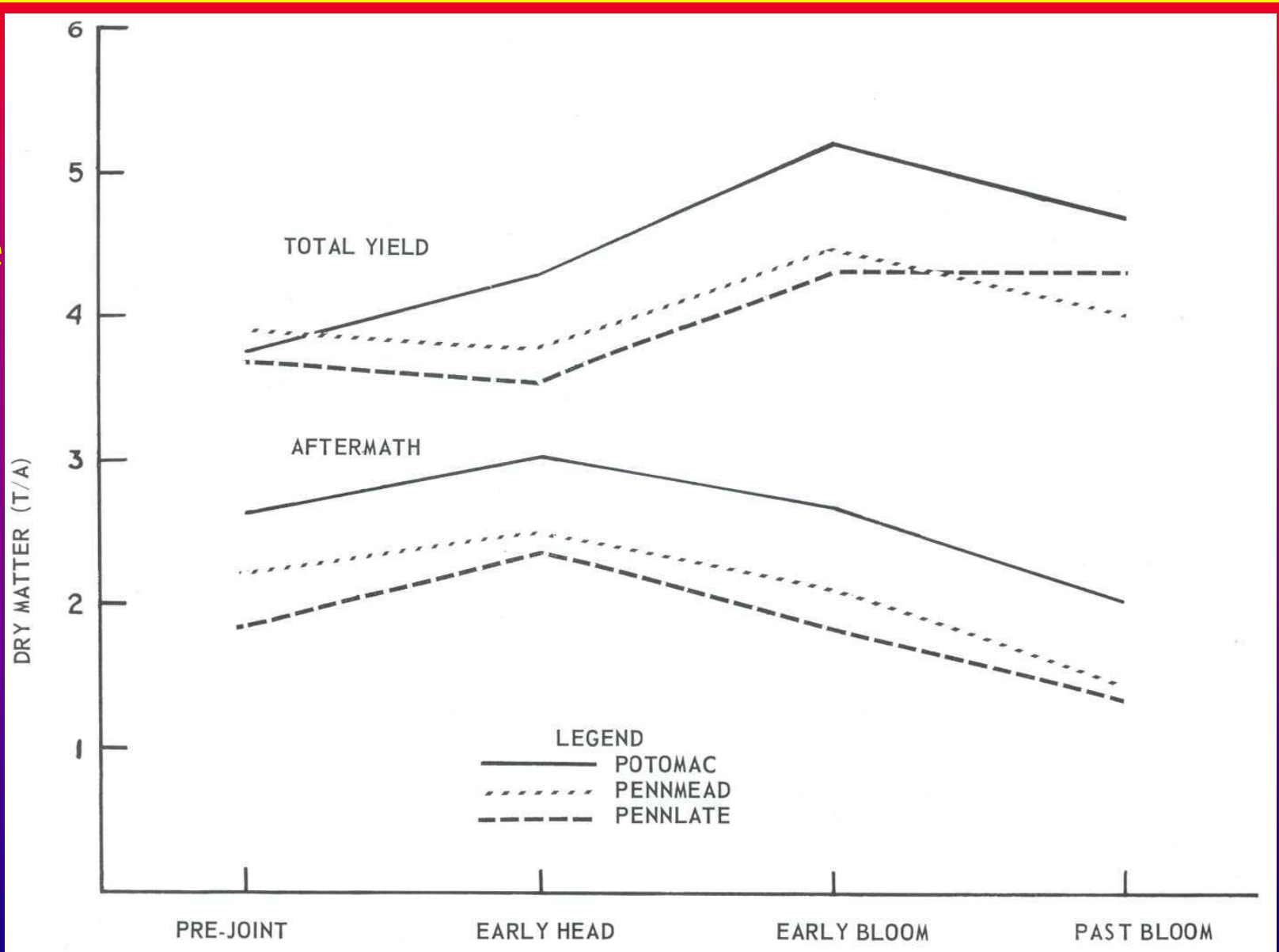


Figure 1. Dry matter yields of three orchardgrass varieties harvested each spring at different stages of growth over a 3-year (1960-62) period at West Virginia.

Grass Cutting Management

Effect of number and frequency of harvests of four cool season grasses on annual DM yield and net economic return under different environmental conditions in PA.

Treatments		Dry conditions†		Normal to wet conditions†	
Species	Harvest schedule	DM	Economic return‡	DM	Economic return‡
	no./yr × interval	ton/acre	$/acre	ton/acre	$/acre
Orchardgrass	2 × 70 d	3.97§	88	5.35	159
	3 × 45 d	3.77	97	5.64	217
	3 × 35 d	3.04	97	--	--
	4 × 35 d	--	--	5.55	258
Reed canarygrass	2 × 70 d	3.78	96	5.48	197
	3 × 45 d	3.63	97	5.86	250
	3 × 35 d	2.87	108	--	--
	4 × 35 d	--	--	5.15	247
Smooth bromegrass	2 × 70 d	4.45	130	6.31	233
	3 × 45 d	3.89	117	6.19	283
	3 × 35 d	2.77	103	--	--
	4 × 35 d	--	--	4.89	252
Timothy	2 × 70 d	4.13	106	5.70	172
	3 × 45 d	3.70	88	5.25	194
	3 × 35 d	2.89	87	--	--
	4 × 35 d	--	--	4.54	172

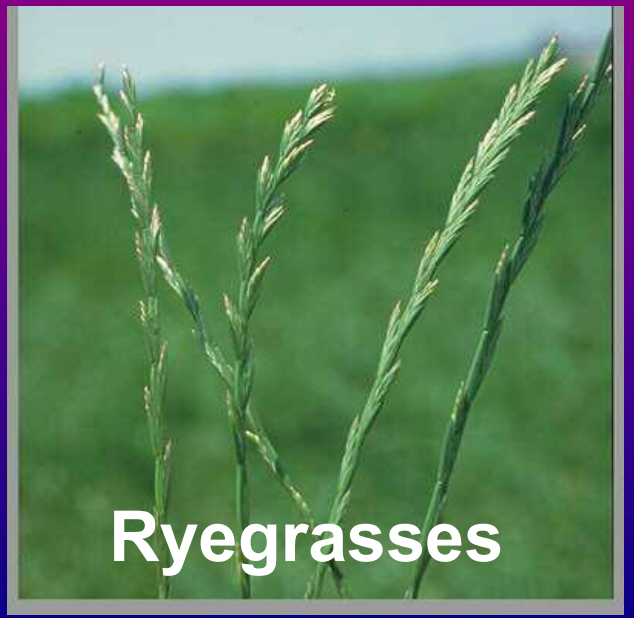
† Dry and wet conditions averaged 70 and 135%, respectively, of normal (29.6 in. by 1 Oct.). Reduced plant growth permitted only three harvests to be made from the four-harvest treatment in dry years.

‡ Based on relative value of the harvested forage ($65/ton hay with a forage quality of 16% CP and 60% DDM) minus costs for harvesting ($28/harvest) and fertilization.

§ All values are the mean from two years.

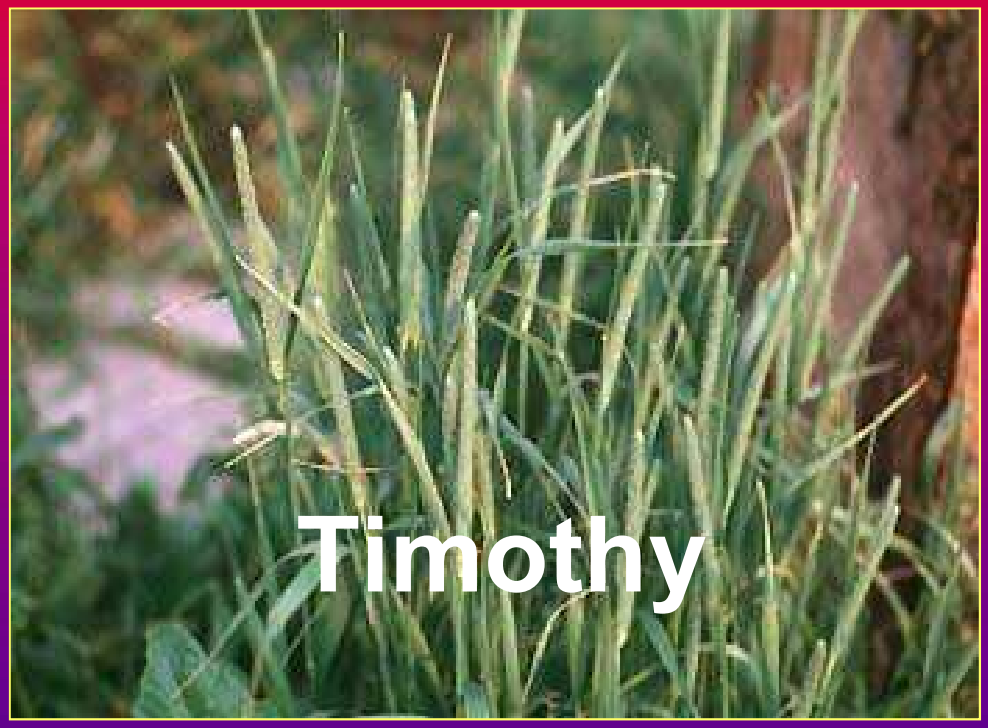
Hall, MH. 1998. J. Prod. Ag. 11: 252 – 254.

High Quality Grass Cutting Management



Tolerant of early first cut

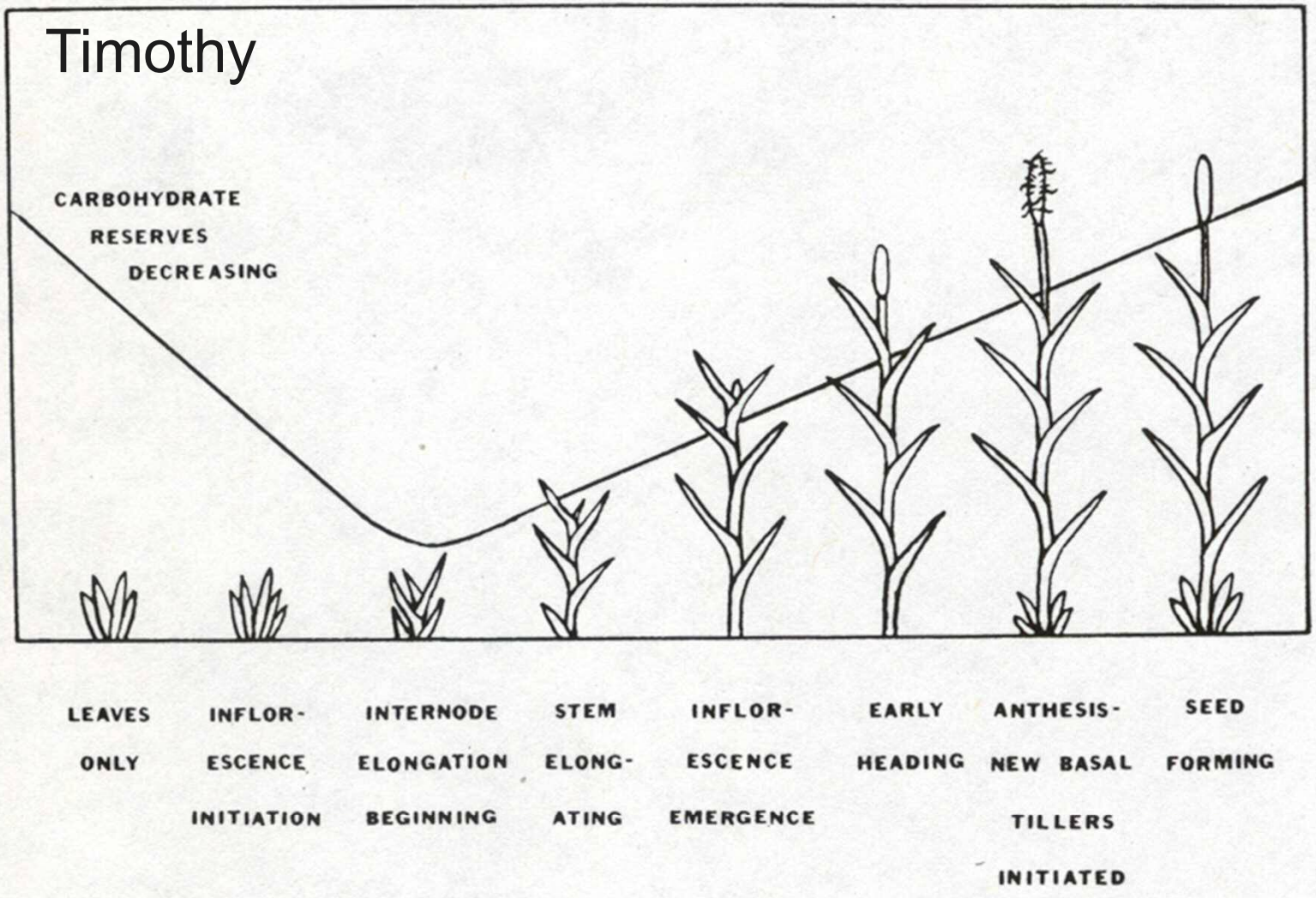
Moderate Quality Grass Cutting Management



Least tolerant of early first cut

Usually need to wait until full head stage

Plant Response to Defoliation Intensity



Grass Cutting Management

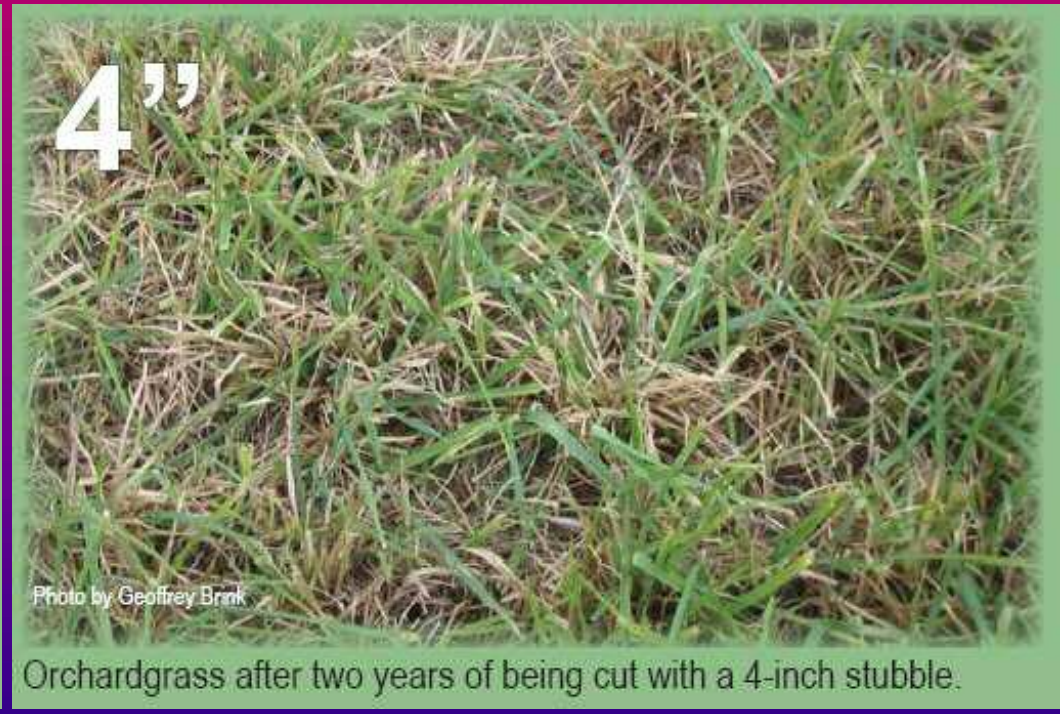
Aftermath Harvests

- Usually 30 to 40 days for OG, RCG, TF, PRG; 40 to 45 days for Tim., SB, meadow fescue
- Nitrogen is key to grass growth either from manure, chemical fertilizer or a combination of both. A shortage of N will drastically slow down growth.
- Growth will also be delayed in periods of hot, dry weather.

Grass Cutting Management

- Low cutting height, especially combined with intensive cutting management, can thin stands relatively quickly.

Orchardgrass after two years of being cut with a 2-inch stubble.



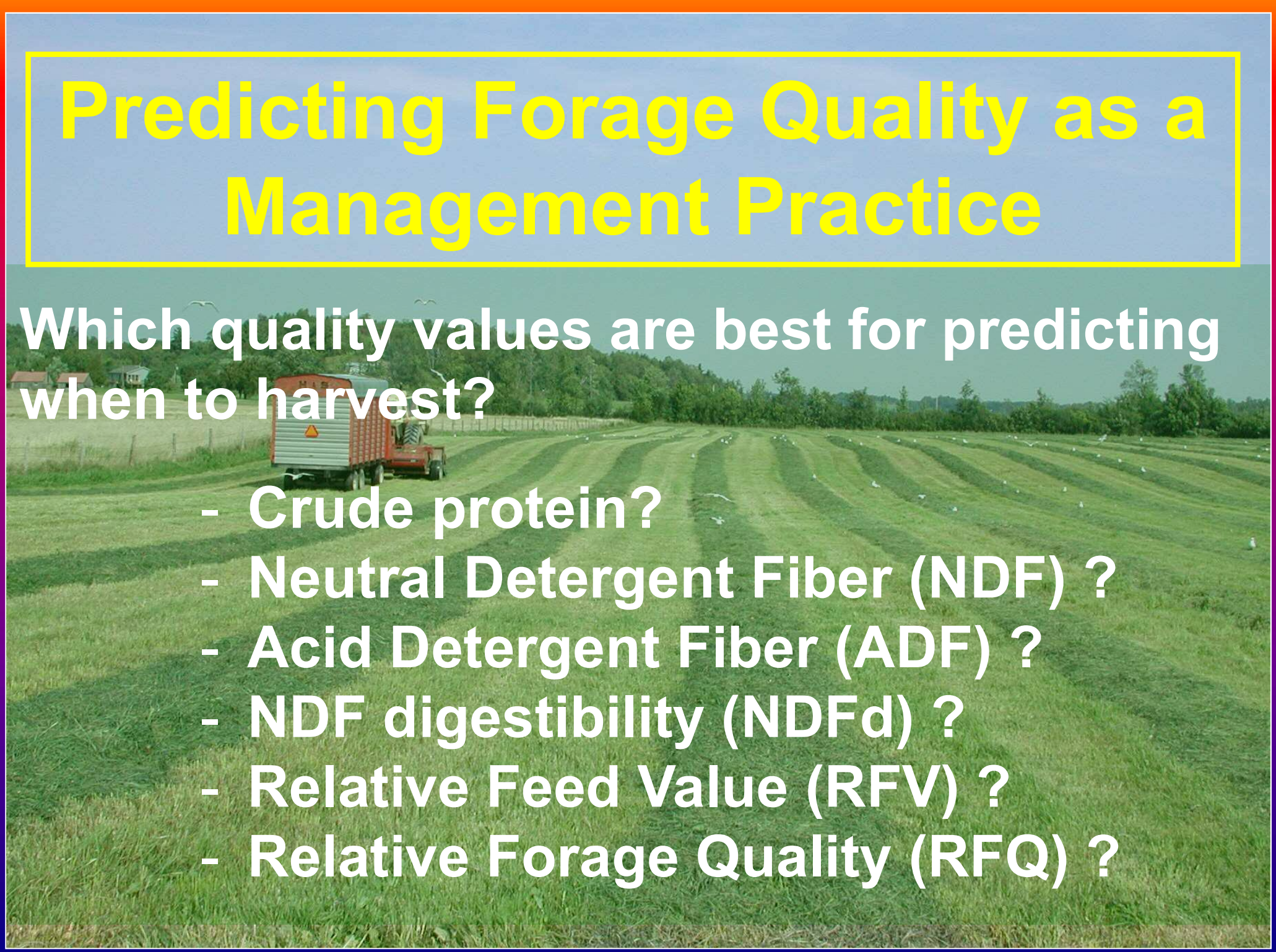
Orchardgrass after two years of being cut with a 4-inch stubble.

(Brink, USDA- Dairy/Forage Research Lab, 2010)

Predicting Forage Quality as a Management Practice

Most harvest management decisions are made with little or no information on actual forage nutritional quality.

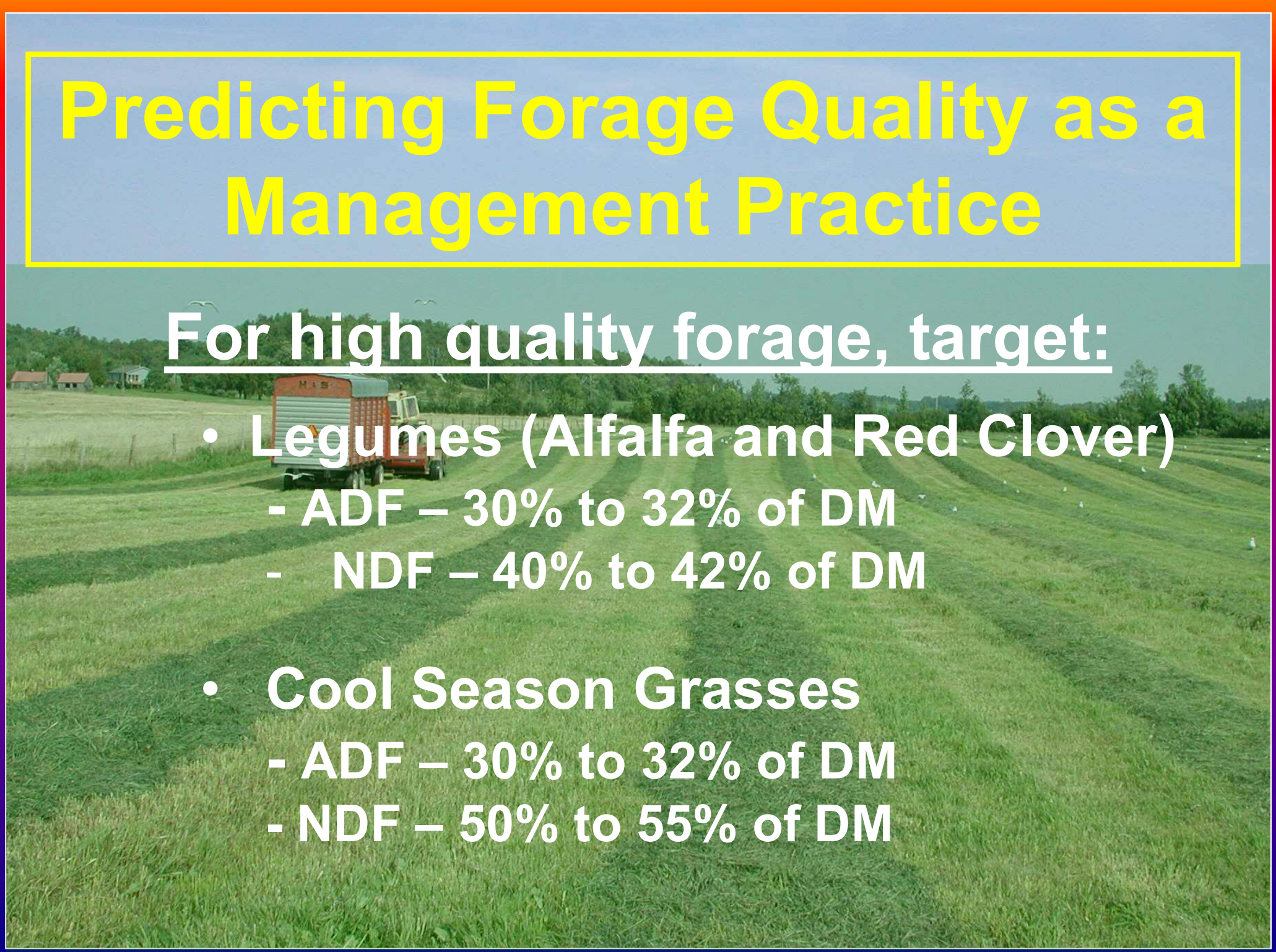
Predicting Forage Quality as a Management Practice



Which quality values are best for predicting when to harvest?

- Crude protein?
- Neutral Detergent Fiber (NDF) ?
- Acid Detergent Fiber (ADF) ?
- NDF digestibility (NDFd) ?
- Relative Feed Value (RFV) ?
- Relative Forage Quality (RFQ) ?

Predicting Forage Quality as a Management Practice



For high quality forage, target:

- **Legumes (Alfalfa and Red Clover)**
  - ADF – 30% to 32% of DM
  - NDF – 40% to 42% of DM

- **Cool Season Grasses**
  - ADF – 30% to 32% of DM
  - NDF – 50% to 55% of DM

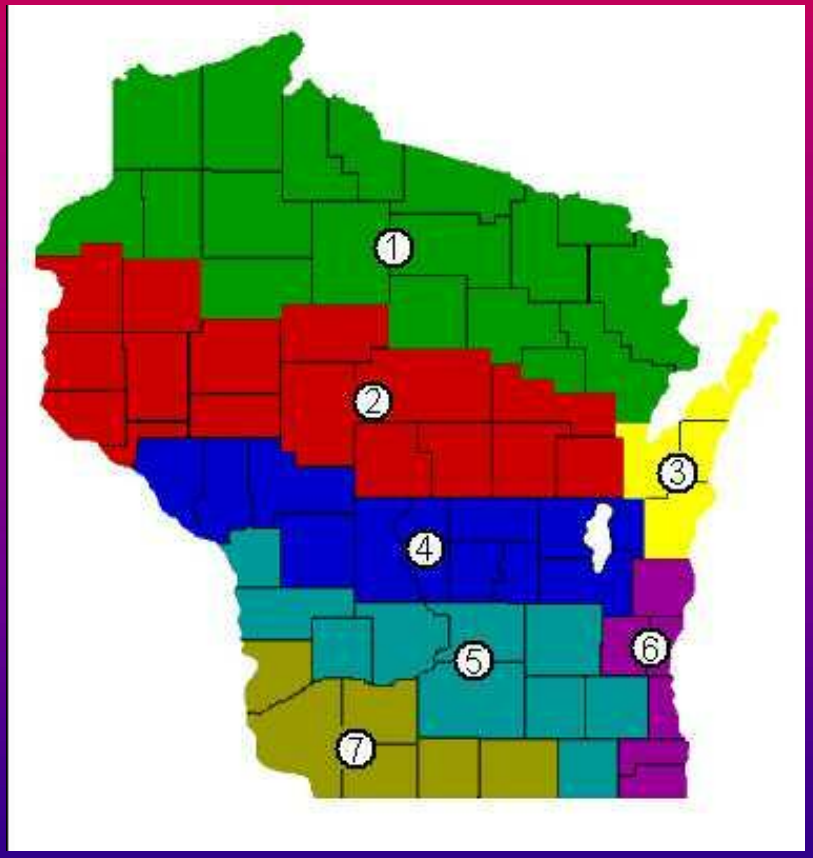
Existing Methods for Predicting Forage Quality in the Field

1. Site-specific forage sampling and testing using NIRS methodology
2. Use of mathematical prediction equations based on plant morphological characteristics and plant height
3. Prediction equations based on weather data especially temperature (growing degree days)

Method 1: Site-Specific Forage Sampling

Method 1: Site-Specific Forage Sampling

- Requires a lot of labor and forage testing
- Expensive
- Potential sampling error
- Best example of use is a scissors-cut program with alfalfa in Wisconsin



Method 2: Prediction equations based on plant morphological characteristics

- Requires some labor but no testing costs
- Several systems have been evaluated

- PEAQ - Predictive Equations for Alfalfa Quality
- Works well with pure alfalfa but not with alfalfa-grass mixtures
- Recent work using methods for predicting alf/grass quality

Method 2: Prediction equations based on plant morphological characteristics

Max. alfalfa	%Grass in the stand (dry matter basis)								
height, in.	10	20	30	40	50	60	70	80	90
14	23.5	26.7	29.9	33.1	36.3	39.5	42.7	45.9	49.1
15	24.3	27.5	30.7	33.9	37.1	40.3	43.5	46.7	49.9
16	25.1	28.3	31.5	34.7	37.9	41.1	44.3	47.5	50.7
17	25.9	29.1	32.3	35.5	38.7	41.9	45.1	48.3	51.5
18	26.8	30.0	33.2	36.4	39.6	42.8	46.0	49.2	52.4
19	27.6	30.8	34.0	37.2	40.4	43.6	46.8	50.0	53.2
20	28.4	31.6	34.8	38.0	41.2	44.4	47.6	50.8	54.0
21	29.2	32.4	35.6	38.8	42.0	45.2	48.4	51.6	54.8
22	30.1	33.3	36.5	39.7	42.9	46.1	49.3	52.5	55.7
23	30.9	34.1	37.3	40.5	43.7	46.9	50.1	53.3	56.5
24	31.7	34.9	38.1	41.3	44.5	47.7	50.9	54.1	57.3
25	32.5	35.7	38.9	42.1	45.3	48.5	51.7	54.9	58.1
26	33.4	36.6	39.8	43.0	46.2	49.4	52.6	55.8	59.0
27	34.2	37.4	40.6	43.8	47.0	50.2	53.4	56.6	59.8
28	35.0	38.2	41.4	44.6	47.8	51.0	54.2	57.4	60.6
29	35.8	39.0	42.2	45.4	48.6	51.8	55.0	58.2	61.4
30	36.7	39.9	43.1	46.3	49.5	52.7	55.9	59.1	62.3
31	37.5	40.7	43.9	47.1	50.3	53.5	56.7	59.9	63.1
32	38.3	41.5	44.7	47.9	51.1	54.3	57.5	60.7	63.9
33	39.1	42.3	45.5	48.7	51.9	55.1	58.3	61.5	64.7
34	40.0	43.2	46.4	49.6	52.8	56.0	59.2	62.4	65.6
35	40.8	44.0	47.2	50.4	53.6	56.8	60.0	63.2	66.4

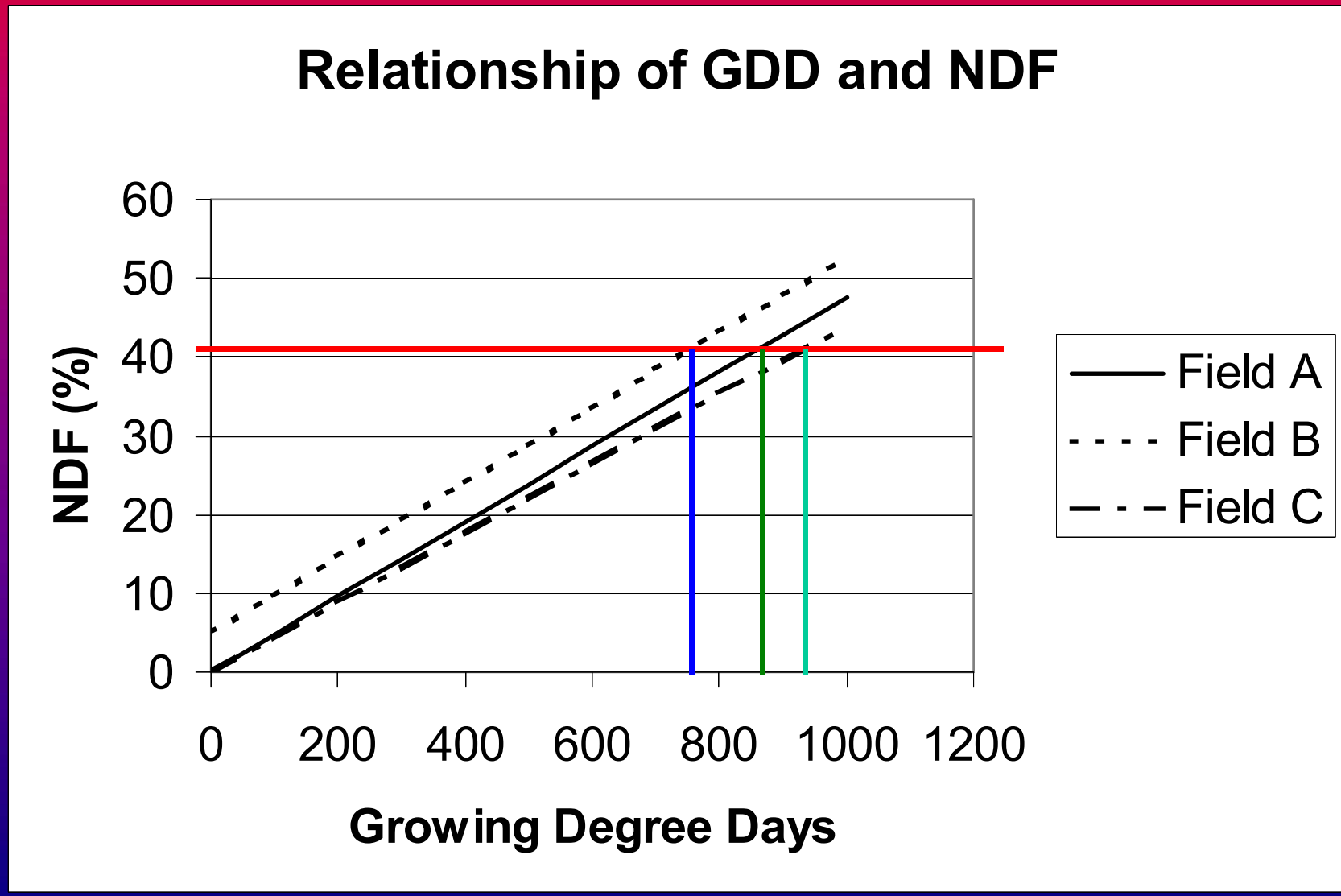
(Cornell Un.)

Method 3: Prediction equations based on growing degree days

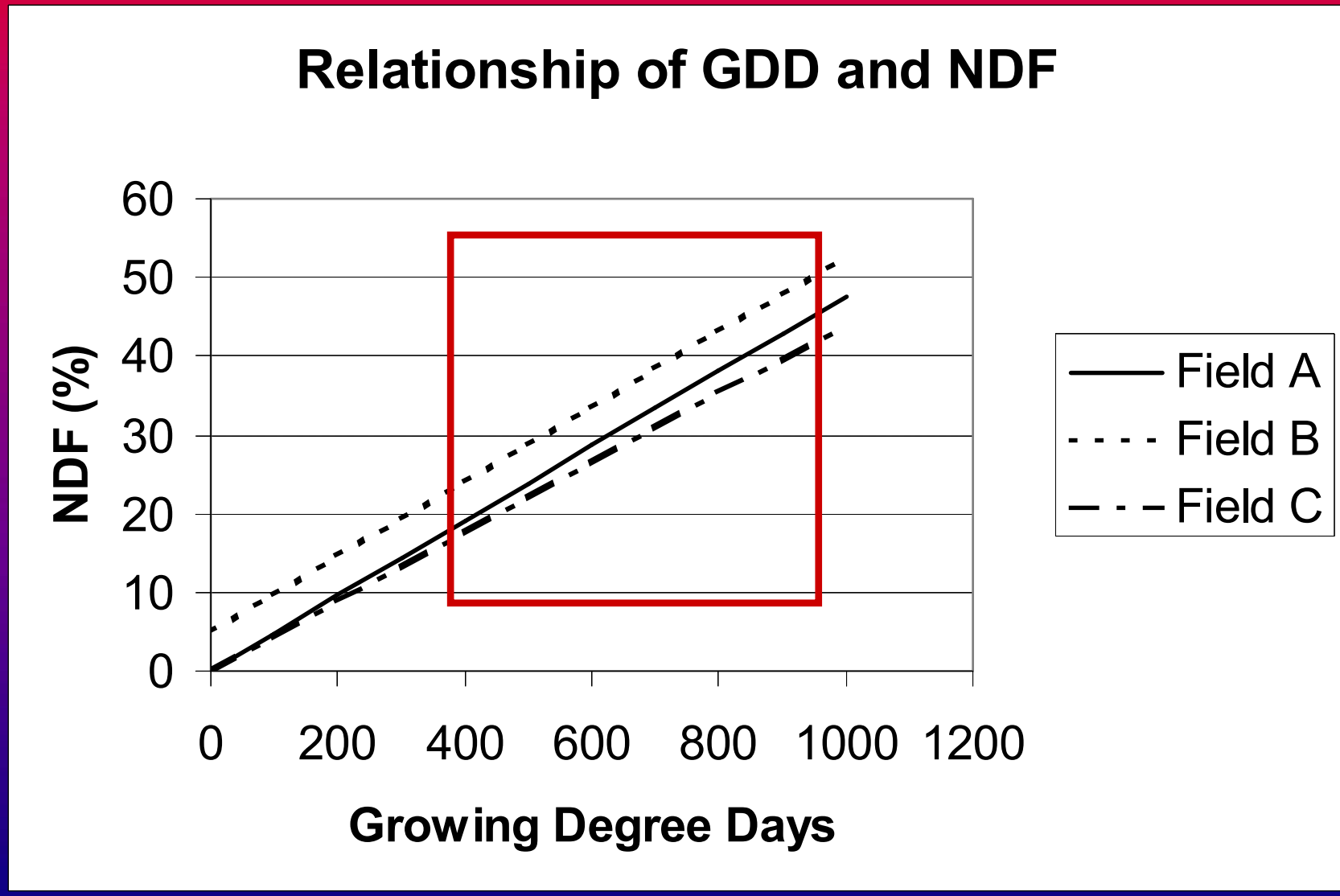
- Can be assessed without field or forage sampling and testing
- GDD is good for first cut but is not reliable when water becomes limiting factor which often occurs in summer growth.

- For alfalfa, found 700 to 750 accumulated $GDD_{41^{o}F}$ to reach a NDF of 40%

Method 3: Prediction equations based on growing degree days



Method 3: Prediction equations based on growing degree days



Combining Methods for Predicting Forage Quality

Step 1: Establish an ADF or NDF baseline by sampling the site 2 to 3 weeks before the "normal" harvest time.

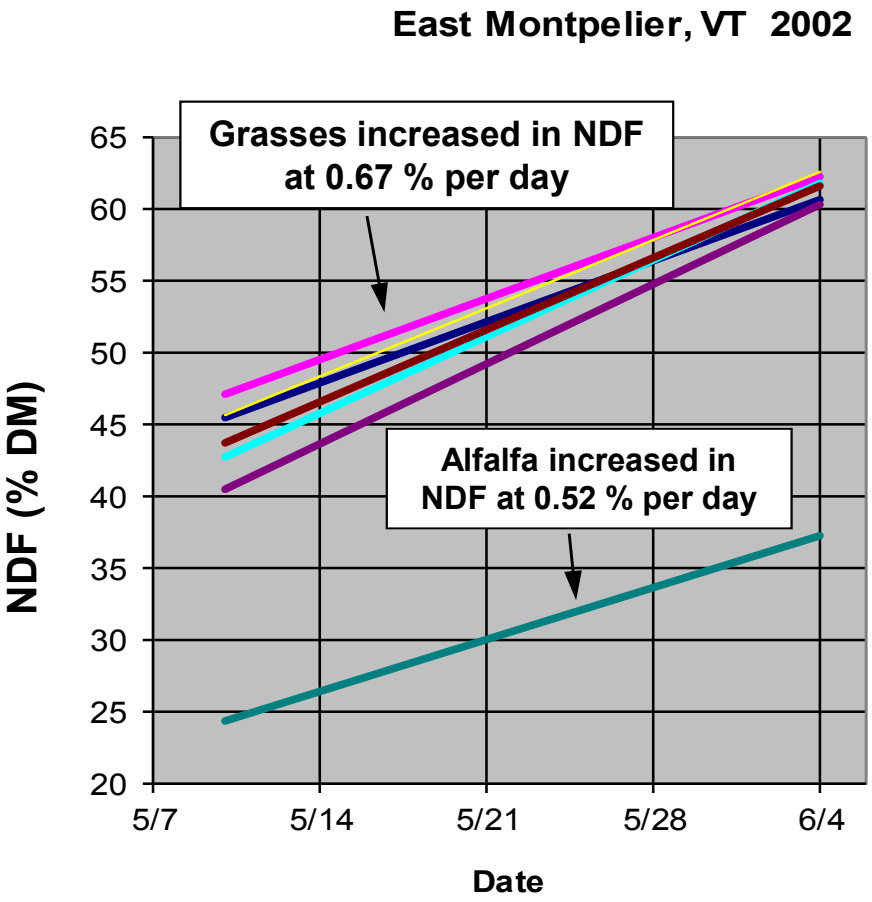
Step 2: Use GDD's in combination with baseline to predict optimum harvest date

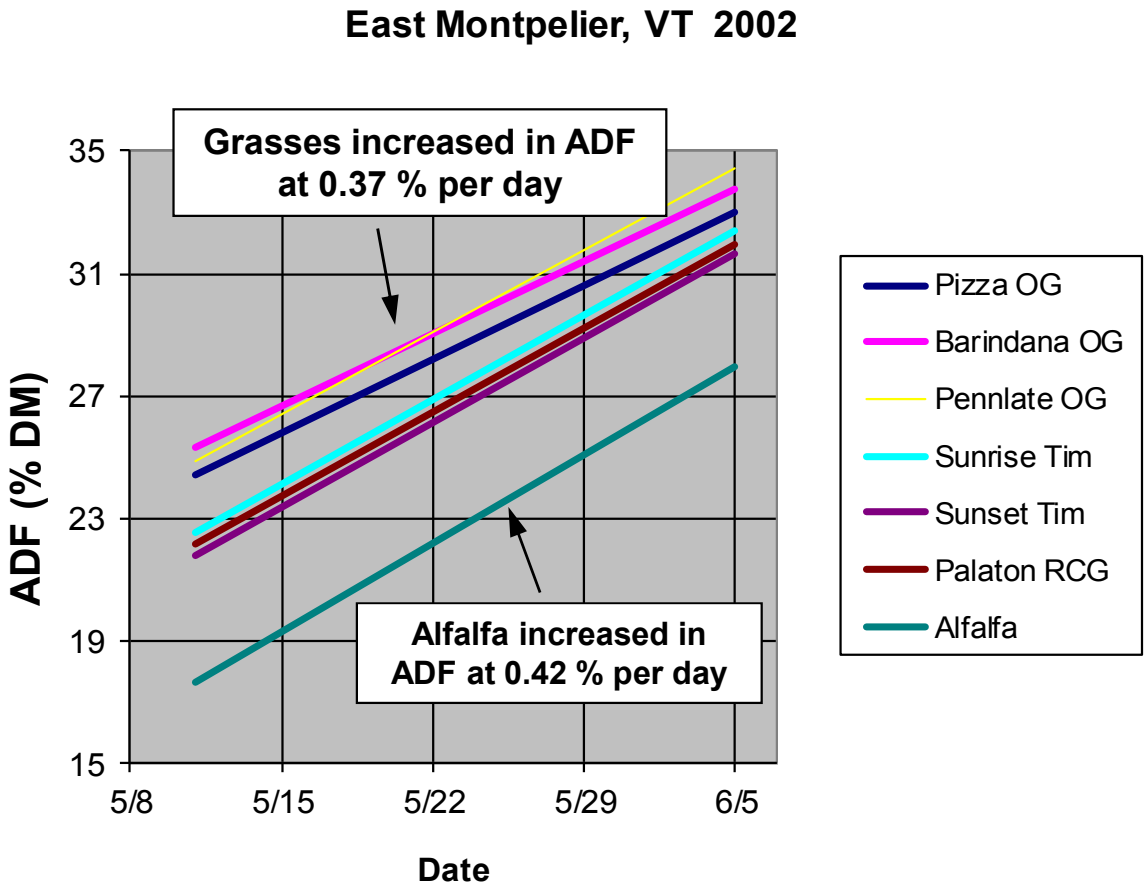
Changes in NDF During Spring Growth

		All Grasses	
Location	**Year**	**NDF/day**	**NDF/10GDD**
S. Burlington	2002	0.70	0.45
	2003	0.92	0.52
E. Montpelier	2002	0.67	0.55
	2003	0.69	0.43
	Average	**0.75**	**0.49**
		Alfalfa	
E. Montpelier	2002	0.51	0.36
	2003	0.54	0.35
	Average	**0.52**	**0.35**

Jimenez-Serrano and Bosworth, 2004 , Un. of Vermont

Changes in NDF and ADF During Spring Growth





Jimenez-Serrano and Bosworth, 2004 , Un. of Vermont

The rate in change of ADF was more consistent than NDF across species and cultivars

Changes in ADF During Spring Growth

		All Grasses	
Location	**Year**	**ADF/day**	**ADF/10GDD**
S. Burlington	2002	0.40	0.28
	2003	0.53	0.30
E. Montpelier	2002	0.37	0.31
	2003	0.46	0.28
	Average	**0.44**	**0.29**
		Alfalfa	
E. Montpelier	2002	0.42	0.30
	2003	0.50	0.32
	Average	**0.46**	**0.31**

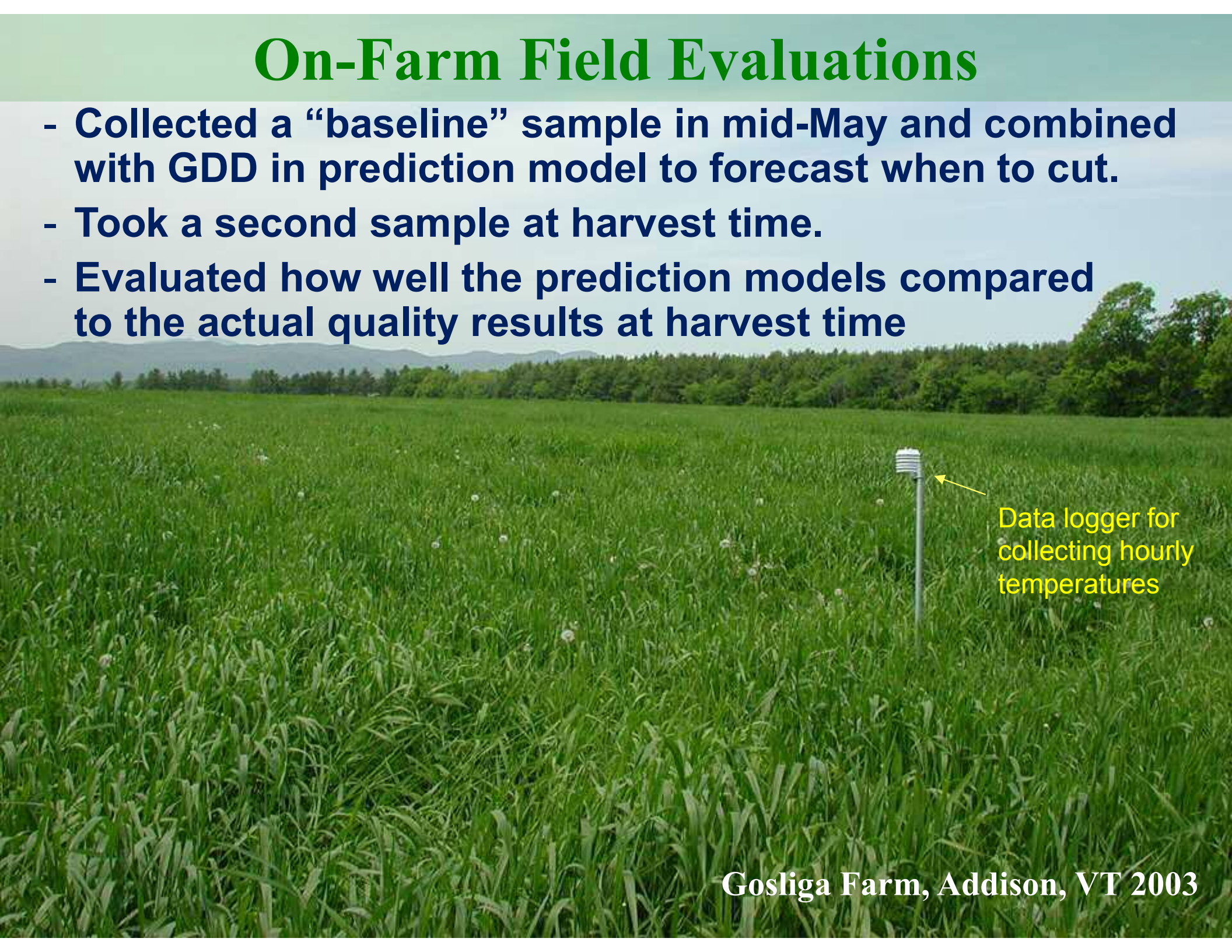
Jimenez-Serrano and Bosworth, 2004 , Un. of Vermont

Predicting Quality of Mixtures

- **ADF**

On-Farm Field Evaluations

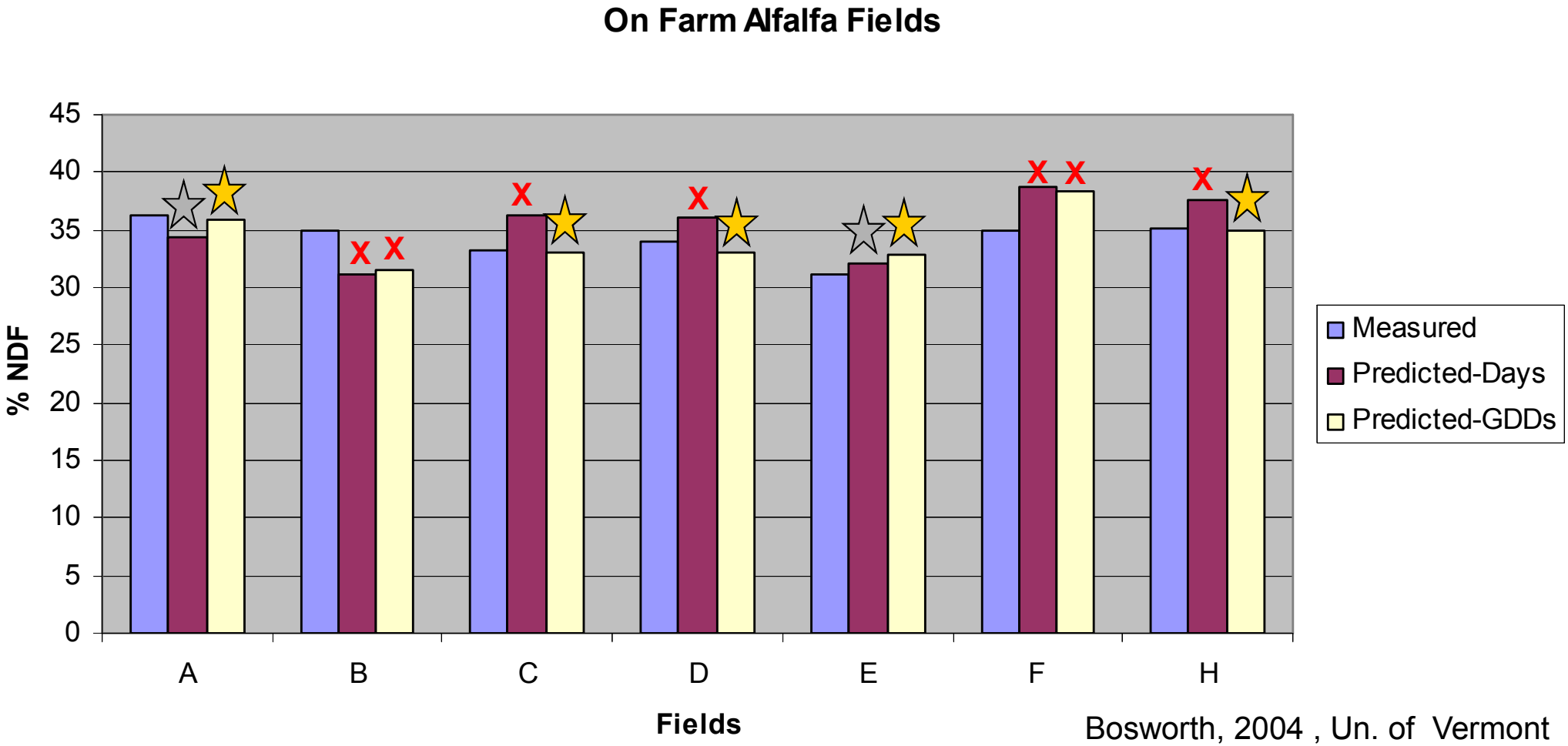
- Collected a “baseline” sample in mid-May and combined with GDD in prediction model to forecast when to cut.
- Took a second sample at harvest time.
- Evaluated how well the prediction models compared to the actual quality results at harvest time



Gosliga Farm, Addison, VT 2003

On-Farm Field Evaluations (2002 – 04)

Predicting NDF for Alfalfa



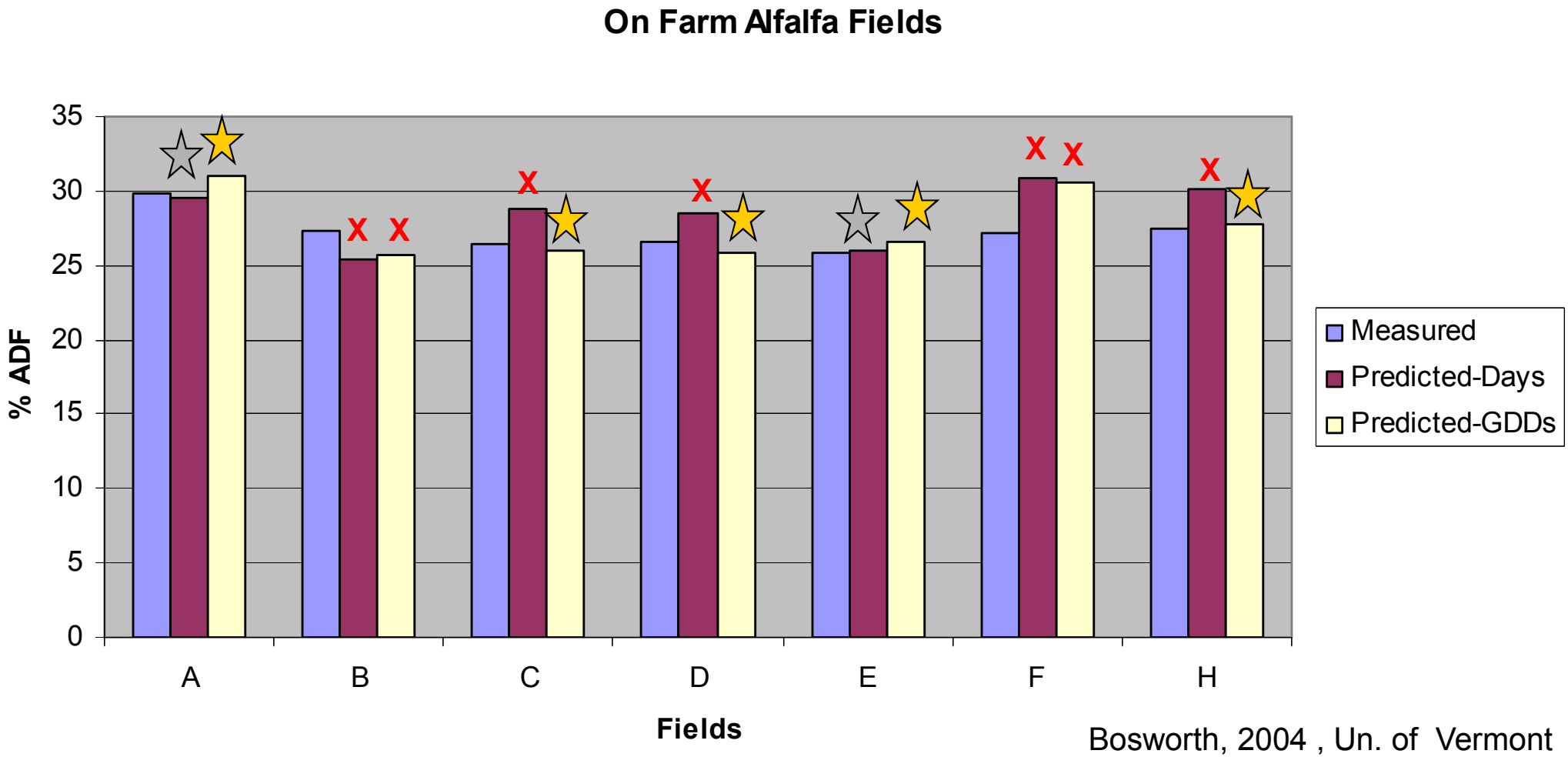
☆ - within 5% of measured NDF using the prediction model based on time (days)

★ - within 5% of measured NDF using the prediction model based on cumulative GDD

X - greater than 5% of measured NDF (unacceptable)

On-Farm Field Evaluations (2002 – 04)

Predicting ADF for Alfalfa



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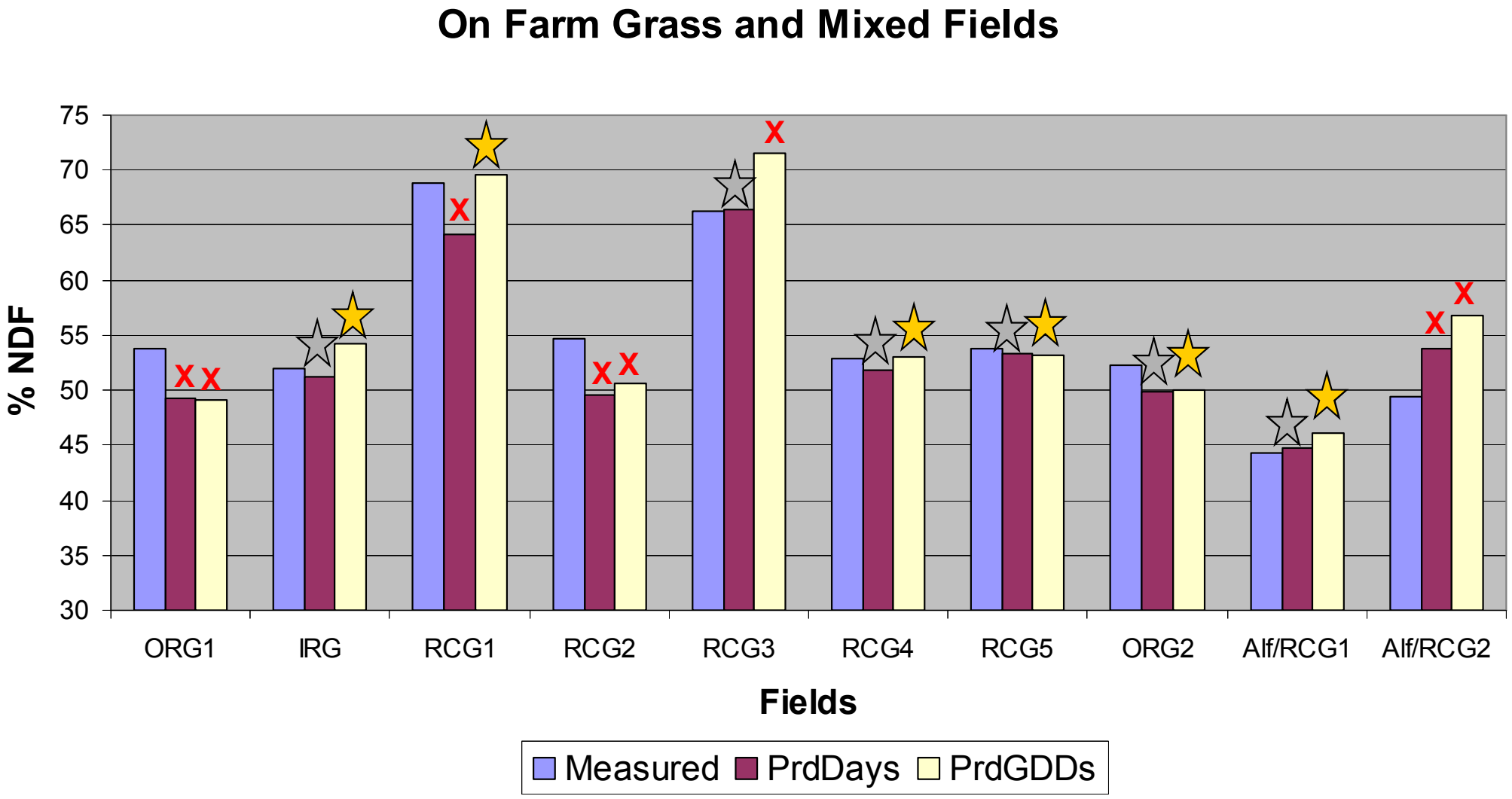
On-Farm Field Evaluations
Predicting NDF for Grasses and Mixtures



☆ - within 5% of measured NDF using the prediction model based on time (days)

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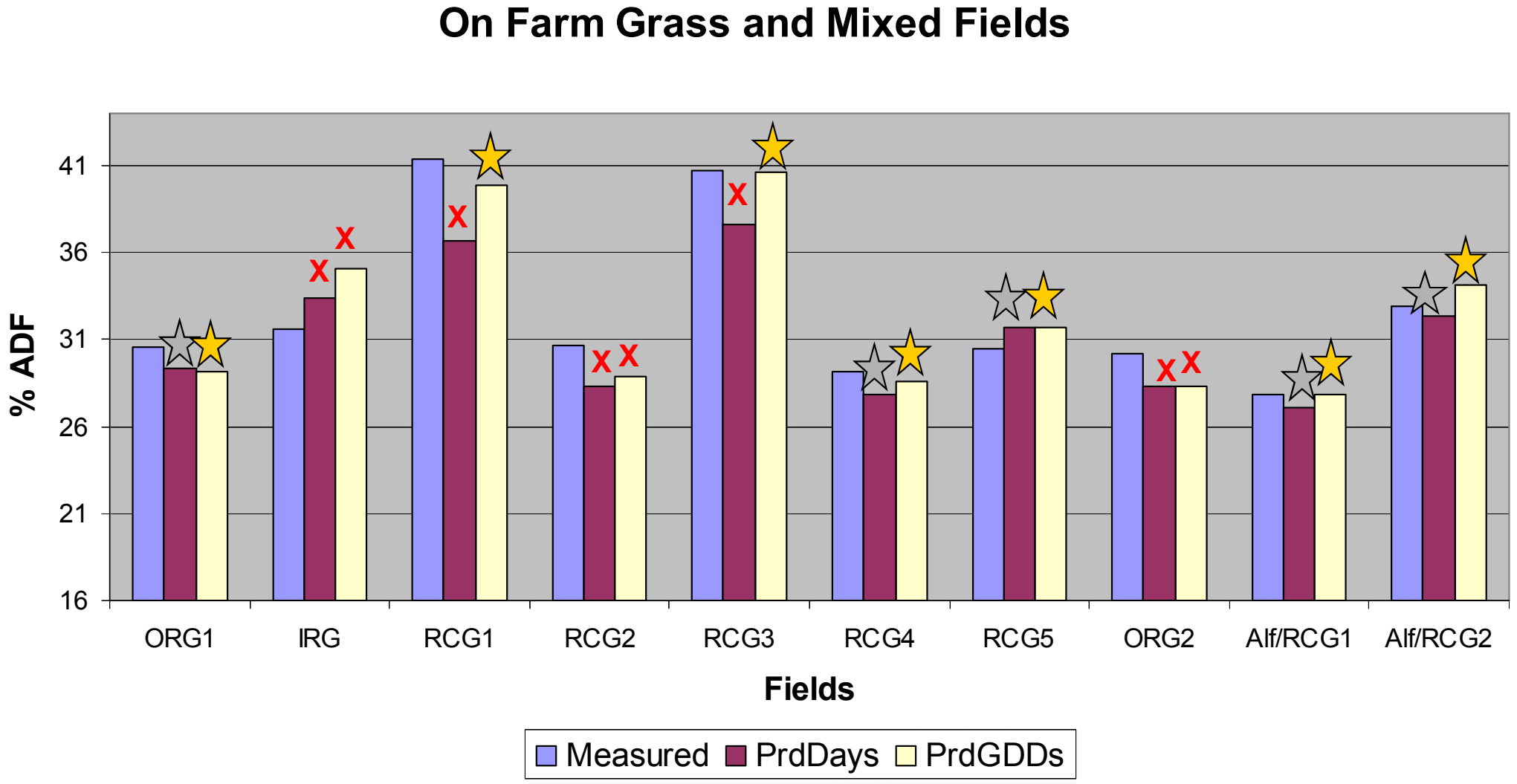
X - greater than 5% of measured NDF (unacceptable)

Bosworth, 2004 , Un. of Vermont

On-Farm Field Evaluations
Predicting ADF for Grasses and Mixtures



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Bosworth, 2004 , Un. of Vermont

Predicting An Optimum Harvest

- The combination method of collecting a baseline sample in mid-May and then using growing degree days to predict the changes in ADF and NDF may be a viable method
- Proper sampling the baseline is critical to minimize error.
- There appeared to be less variation and better predictability using ADF instead of NDF for the legume/grass mixtures.
- Probably the best benefit is just the awareness of how temperature can drastically affect when the forages need to be harvested.