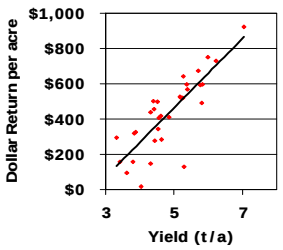
# Alfalfa Management – Don't Stand Still or You'll Get Mowed Over

Dr. Dan Undersander
University of Wisconsin

- Variety selection
- Alfalfa/grass mixtures
- Mowing/conditioning
- Silage making



## Alfalfa Yield and Dollar Return from Wisconsin Green-Gold Program

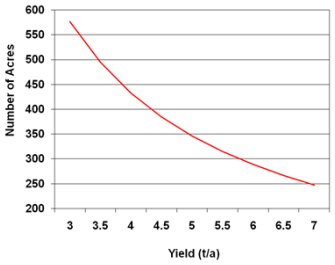



Economic return increases with yield:

- fixed inputs remain constant
- variable inputs increase only slightly with yield.



## Forage acreage needed to produce feed for 500 cow herd with 75 dry cows



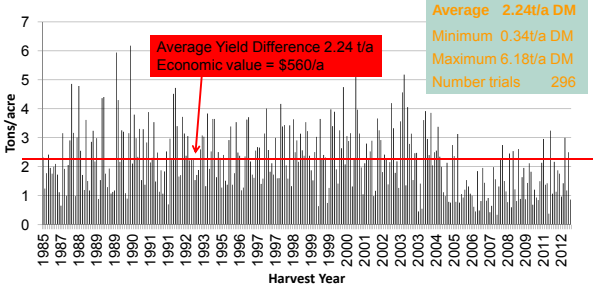

Assumes:

- 500 milking (1300 lb) cows
- 75 dry (1500 lb) cows,
- alfalfa 50% of forage
- 2.1 % body wt intake,

(From Blonde spreadsheet).



## Yield difference between top and bottom alfalfa entries in Wisconsin Alfalfa Trials, 1985 to 2012






## Selecting Alfalfa Varieties

- Yield
- Persistence

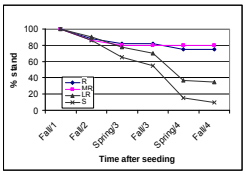
Value of short rotations:

- Older stands yield less
- Increased weed problems in old stands
- Nitrogen credits when alfalfa is plowed down
- Rotational benefit to corn
  - 10 to 15% greater corn yield
- Reduced root worm on corn following alfalfa

## Selecting Alfalfa Varieties

- Yield
- Persistence
- Disease Resistance

Effect of Verticillium Resistance on Alfalfa Persistence







## Selecting Alfalfa Varieties

- Yield
- Persistence
- Disease Resistance
- Winterhardiness

Lack of alfalfa winterhardiness results in:

- Winterkill
- Yield loss
- Uneven spring greenup

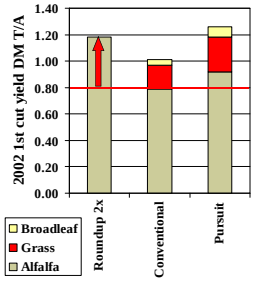


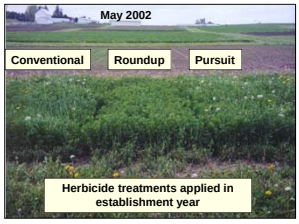
## Winter Survival and Winter Injury
*What can you do?*

- Plant very winterhardy varieties
- Maintain soil fertility and pH
- Let one harvest go to early flower
- Avoid fall cutting
- Mix alfalfa and grass



## Roundup Ready
## UW Trials (2000 to 2006)






## Crop Injury Loss of Alfalfa herbicides

- In 13 trials in MN and WI average yield loss from Raptor or Pursuit was 0.25 t/a for next cutting

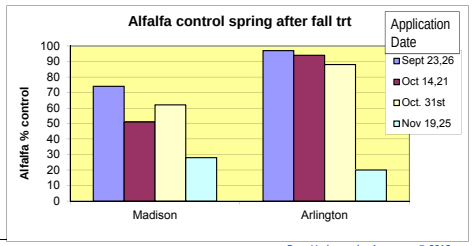
## Development of New Varieties

- Roundup Ready Alfalfa – Another tool in the box
  - Beneficial if:
    - Multiple herbicide applications
    - Unusual weed problems
    - Less alfalfa crop injury than other herbicides
    - Ease of use
  - Not beneficial if:
    - Establish with cover crop
    - Alfalfa/grass mixtures



## Alfalfa Takeout – when to control

- Alfalfa treated with 2,4-D (1 pint/A)
- Note control dramatically reduced at last timing






## Why incorporate some grass into dairy rations?

Agronomic

- Improve yields of seeding year stands
- Faster drying
- Less risk of winterkill
- Manure management

Nutrition

- Higher total fiber with grass/legume mixtures than alfalfa
- Higher proportion of digestible fiber than alfalfa or CS
- Possible good fit with high NFC, low fiber diets
  (i.e. high corn silage diets)?



## Typical composition of high quality grass forages

| Forage | CP | NDF | NDFD | NFC |
|---|---|---|---|---|
| | ----------% | | | |
| Reed Canarygrass | 20 | 55 | 68 | 12.5 |
| Perennial Ryegrass | 18 | 47 | 65 | 22.5 |
| Tall Fescue | 17 | 56 | 60 | 14.5 |
| Annual Rye | 20 | 55 | 60 | 12.5 |
| Orchardgrass | 16 | 60 | 55 | 11.5 |
| Alfalfa | 20 | 40 | 48 | 27.5 |
| Corn Silage | 9 | 41 | 68 | 37.5 |



Rumen pappillae with proper development.

Rumen pappillae With acidosis – high grain with high fermentation

Rumen pappillae NOT developed - too much bulk and low grain.



## Lameness in Dairy Cattle

Midwest United States:

Overall 20-25% of cows are mildly to seriously lame.

Causes: 58 % due to disease or trauma,
42% due to nutrition (excessive grain/inadequate fiber)

Severity influenced by diet, stall design and bedding, stocking density, time in parlor holding area, etc.

## Potential Milk Losses Due to Lameness

| Locomotion Score | 2 (Mild) | 3 (Moderate) | 4 (Severe) | 5 (Severe) |
|---|---|---|---|---|
| DM intake reduction, lb | 1 | 3 | 7 | 15 |
| Milk Yield Loss, lb | 0 | 5 | 15 | 30 |

Adapted from P. Robinson. UC-Davis Cooperative Extension

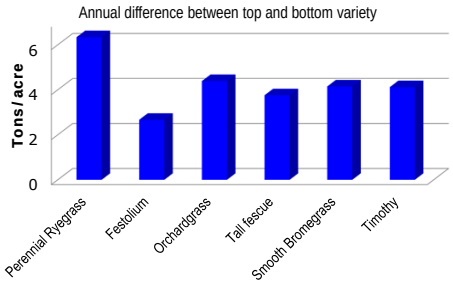


## Select Grass Varieties for

- Yield
- Winterhardiness
- Late maturing varieties
- Consistent yield throughout season (β)
- Rust resistance
  - orchardgrass,
  - tall fescue,
  - ryegrass,
  - festolium



## Selecting Grass varieties -
Yield difference among varieties in UW Trials





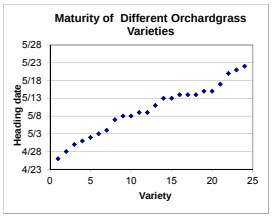

## Selecting Grasses

- Want winterhardy types



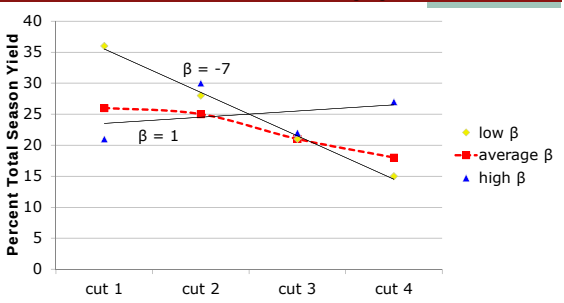
## Selecting Grasses

- Orchardgrass and tall fescue
  - Want late maturing types






## Seasonal variation in Tall Fescue variety yield



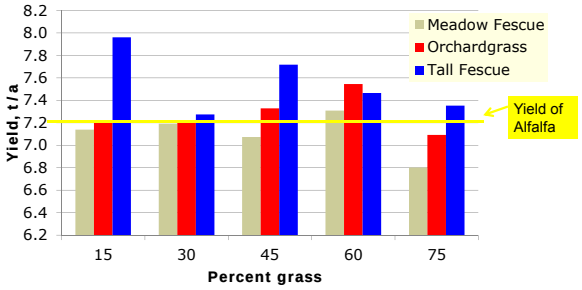
## Select Grass Varieties for

- Yield
- Winterhardiness
- Late maturing varieties
- Consistent yield throughout season (β)

| Economic Value of premium grass varieties | | |
|---|---|---|
| Item | Cost/unit | Cost/value per acre |
| Additional cost | $1.00/lb | $6.00/a |
| Additional yield | 2 t/a @ $100/t | $200/a |



## Yield of alfalfa/grass mixtures






## Alfalfa grass mixes



## Seeding Alfalfa Grass mixtures

– want 30 to 40% grass (as % of DM)

- Alfalfa - orchardgrass
  - 10 lbs/a alfalfa; 4 lb/a orchardgrass

47 alfalfa
18 orchardgrass
65 seeds/sq ft

- Alfalfa – tall fescue
  - 10 lbs/a alfalfa; 6 lbs/a tall fescue

47 alfalfa
23 tall fescue
70 seeds/sq ft

- Alfalfa – meadow fescue
  - 10 lbs/a alfalfa; 6 lbs/a meadow Fescue

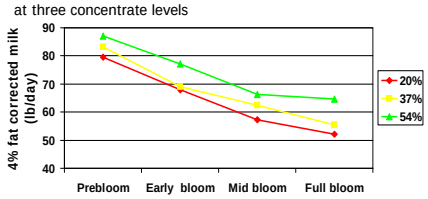
47 alfalfa
27 meadow fescue
74 seeds/sq ft



## Harvesting High Quality Forage

- Start harvesting when forage at desired quality

Effect of forage quality on 4% fat-corrected milk production at three concentrate levels




*From Kawas et al., 1989*



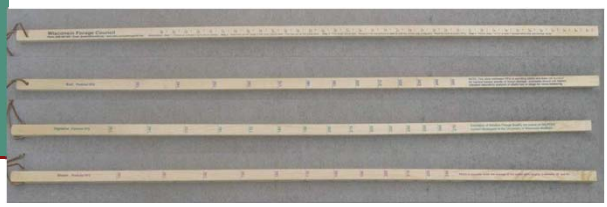
## Rate of Alfalfa Forage Quality Change per Day

| Component | Mean |
|---|---|
| Crude Protein, % DM | -0.25 |
| Acid Detergent Fiber, % DM | 0.36 |
| Neutral Detergent Fiber, % DM | 0.43 |
| Neutral Detergent Fiber Digestibility, % NDF | -0.43 |
| RFQ, points | -3.6 |

With RFQ valued at $1.50/pt, economic value = $5.40/t/day

Source: Undersander, 2009 unpublished

## Forage Quality Stick





Measure from soil surface.

Measure to top of stem tip, not tip of highest leaflet.

Estimates are made at 4 to 5 locations in a field.

The tallest stem may not be the most advanced in maturity.

## Harvest First Cutting by Height

late vegetative — stem is more than 12 inches tall, no visible buds or flowers
early bud — 1 to 2 nodes have visible buds; no flowers or seed pods present
late bud — more than 2 nodes have visible buds; no open flowers or seed pods
early flower — 1 node with at least one open flower
late flower — 2 or more nodes have open flowers

| height of tallest stem (inches) | stage of most mature stem: late vegetative | early bud | late bud | early flower | late flower |
|---|---|---|---|---|---|
| | relative feed value | | | | |
| 16 | 234 | 220 | 208 | 196 | 186 |
| 17 | 229 | 215 | 203 | 192 | 182 |
| 18 | 223 | 211 | 199 | 188 | 178 |
| 19 | 218 | 206 | 195 | 184 | 175 |
| 20 | 213 | 201 | 191 | 181 | 171 |
| 21 | 209 | 197 | 187 | 177 | 168 |
| 22 | 204 | 193 | 183 | 173 | 165 |
| 23 | 200 | 189 | 179 | 170 | 161 |
| 24 | 196 | 185 | 175 | 167 | 158 |
| 25 | 191 | 181 | 172 | 163 | 155 |
| 26 | 187 | 178 | 169 | 160 | 152 |
| 27 | 184 | 174 | 165 | 157 | 150 |
| 28 | 180 | 171 | 162 | 154 | 147 |
| 29 | 176 | 167 | 159 | 151 | 144 |
| 30 | 173 | 164 | 156 | 148 | 141 |
| 31 | 169 | 161 | 153 | 146 | 139 |
| 32 | 166 | 158 | 150 | 143 | 136 |
| 33 | 163 | 155 | 147 | 140 | 134 |
| 34 | 160 | 152 | 145 | 138 | 132 |
| 35 | 156 | 149 | 142 | 135 | 129 |
| 36 | 154 | 146 | 139 | 133 | 127 |
| 37 | 151 | 144 | 137 | 131 | 125 |
| 38 | 148 | 141 | 134 | 128 | 123 |
| 39 | 145 | 138 | 132 | 126 | 121 |
| 40 | 142 | 136 | 130 | 124 | 118 |

Source: Derived from equations developed by R.W. Hintz, V.N. Owens, and K.A. Albrecht at the University of Wisconsin-Madison, Department of Agronomy.

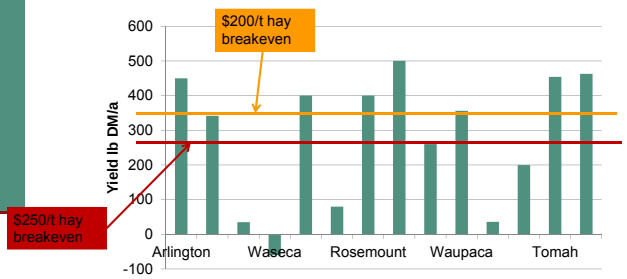
## Headline Fungicide on Alfalfa

Treatment cost of $35/A including the application fee ($8/A).

Is it economic?



## Effect of Headliner on Alfalfa Yield, 2012






## Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath

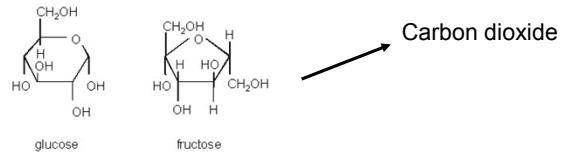
## Wide swath benefits

- Faster drying
- Higher forage quality



## Respiration continues after cutting until plants dries below 60% water

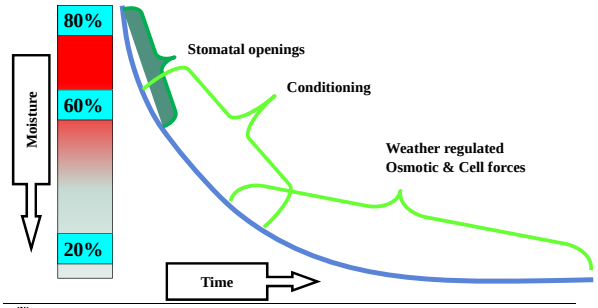
**Breakdown of starch and sugars**




**2 – 8% of Dry Matter loss**



## Sequence of Drying Forages

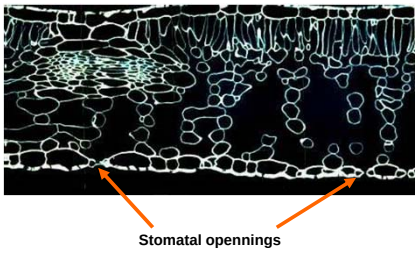





## Leaf Structure

Legumes have 10 times more stomata than grasses

Upper and lower **epidermis** is heavily coated with waxy cutin, conserves water and protects






## Summary

- Wide Swath
  - Increases drying rate
  - Reduces respiratory loss
    - Increases TDN

❖ Conditioning for drying stems!

❖ Wide swath for drying Leaves!



## Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath
- Harvest at appropriate moisture

## Moisture for Baling

| Square bales | | |
|---|---|---|
| Small | Medium (3'x3') | Large (4'x4') |
| -------Moisture for safe baling without mold------- | | |
| <20% | <16% | 14% |
| **Round Bales** | | |
| <5'dia | <6' dia | |
| <18% | <16% | |



## Heating can lead to fire

Sept 24, 2013 A load of hay on a semi caught fire on I-80 in Iowa

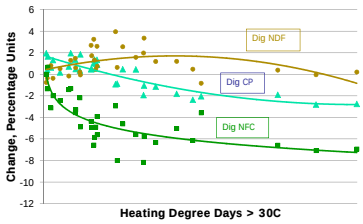


## Heating can lead to fire

Sept 27, 2013
YOLO COUNTY, Calif. —
A massive fire at a hay export business is estimated to have caused at least $6 million in damage so far.



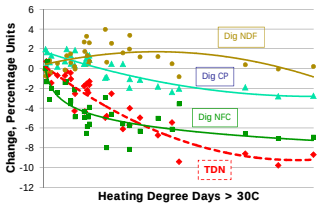
## Hay Preservation – Results of Malliard Reaction






## Hay Preservation – Results of Malliard Reaction

- TDN = dNFC + dCP+ 2.25*FA + dNDF - 7






## TDN losses of farmer submitted samples to forage testing laboratories

| TDN losses (% of DM) | Number of samples | Percent of total |
|---|---|---|
| <0 | 911 | 25 |
| 0-4.0 | 894 | 25 |
| 4.0-8.0 | 1221 | 34 |
| 8.0-12.0 | 517 | 14 |
| >12.0 | 69 | 2 |
| Total | 3612 | |

With corn at $4.50/bu, TDN is 7¢/lb

## TDN losses of farmer submitted samples to forage testing laboratories

| TDN losses (% of DM) | Number of samples | Percent of total | $/ton Loss |
|---|---|---|---|
| <0 | 911 | 25 | 0 |
| 0-4.0 | 894 | 25 | 0 - $5.60 |
| 4.0-8.0 | 1221 | 34 | $5.60 - $11.20 |
| 8.0-12.0 | 517 | 14 | $11.20 - $16.80 |
| >12.0 | 69 | 2 | >$16.80 |
| Total | 3612 | | |

With corn at $4.50/bu, TDN is 7¢/lb



## Making Good Silage

- Harvest at maturity for high quality
- Dry to or harvest at correct moisture
- Chop to correct length
- Pack well
- Fill rapidly
- Cover



## Inoculants

- Silage additives whose main ingredients are lactic acid producing bacteria




## Different Types of Inoculants

- Traditional homofermentative types:
  - *Lactobacillus plantarum*, *L. casei*, *Pediococcus* species, *Enterococcus faecium*
- *Lactobacillus buchneri*, a heterofermenter
- Combination of homofermenters with *L. buchneri*



## End Product Comparison

- Lactic acid - strong acid; weak spoilage inhibitor; fermented in rumen
- Acetic acid - weak acid; good spoilage inhibitor; not fermented in rumen
- Ethanol - neutral; poor spoilage inhibitor; partially fermented in rumen
- Carbon dioxide - lost dry matter



## So…

- If you want to preserve crop quality:
  - Lactic acid
- If you want a silage that doesn't heat:
  - Acetic acid
- In any case, you want to minimize ethanol & $CO_2$

## Making Good Silage

- Harvest at maturity for high quality
- Dry to or harvest at correct moisture
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- Pack well



## Why Is Silage Density Important?

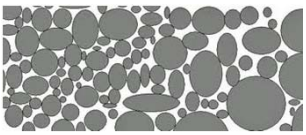
High Density ⟶ less Dry Matter Loss
(Filling, Storage, Feedout)

High Density ⟶ more storage capacity



## Want less than 0.40 porosity

- Porosity is a measure of the air spaces in silage



Less porosity more porosity



## Packing Density

- 15 cm thick layers
- Heavy tractors
  - With added weight
  - Wheels well lugged, high tire pressure
- Fill by progressive wedge method
- Drive over entire surface
- Multiple passes



| | | | |
|---|---|---|---|
| Bunker Silo Wall Height (feet) = | | 9 | 23-Aug-07 |
| Bunker Silo Maximum Silage Height (feet) = | | 11 | Values in yellow cells are user changeable |
| Silage Delivery Rate to Bunker (T AF/Hr) = | | 50 | Typical values 15-200 T AF/hr |
| Silage Dry Matter Content (decimal ie 0.35) = | | 0.35 | Recommended range of DM content = 0.3-0.4 |
| Silage Packing Layer Thickness (inches) = | | 6 | Recommended value is 6 inches or less |
| Packing Tractor - Each Tractor | Tractor Weight (lbs) | | Tractor Packing Time (% of Filling Time) |
| Tractor # 1 | Typical tractor weight is 10,000-60,000 lbs | 25,000 | 100 |
| Tractor # 2 | Typical tractor weight is 10,000-60,000 lbs | 25,000 | 100 |
| Tractor # 3 | Typical tractor weight is 10,000-60,000 lbs | 0 | 0 |
| Tractor # 4 | Typical tractor weight is 10,000-60,000 lbs | 0 | 0 |
| Proportioned Total Tractor Weight (lbs) = | | 50,000 | |
| Average Silage Height (feet) = | | 10.0 | Green cells are intermediate calculated values |
| Packing Factor = | | 493.0 | Values in pink cells are results of calculations |
| Est. Average Wet Density = Bulk Density (lbs AF/cu ft) = | | 44.0 | Wet Density greater than 44 lbs AF/cu ft is recomme |
| Maximum Achievable Bulk Density (lbs AF/cu ft)= | | 73.3 | Wet Density greater than Max. Wet Density is unrea |
| Gas Filled Porosity = | | 0.40 | Gas Filled Porosity less than 0.40 is recommended |
| Est. Average Dry Matter Density (lbs DM/cu ft) = | | 15.4 | Density greater than 15 lbs DM/cu ft is recommende |
| Maximum Achievable DM Density (lbs DM/cu ft)= | | 25.7 | DM Density greater than Max. Achievable is unrealis |

http://www.uwex.edu/ces/crops/uwforage/storage.htm

## Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath
- Harvest at appropriate moisture
- Pack silage well



## Web Resources

UW Extension Forage Resources
www.uwex.edu/ces/crops/uwforage/uwforage.htm

UW Extension Corn Agronomy
http://corn.agronomy.wisc.edu/Extension.htm

UW Department of Dairy Science
http://www.wisc.edu/dysci/