

# Alfalfa Production: Back to Basics

**Sustainable Agric. Conference  
December 17, 2014**

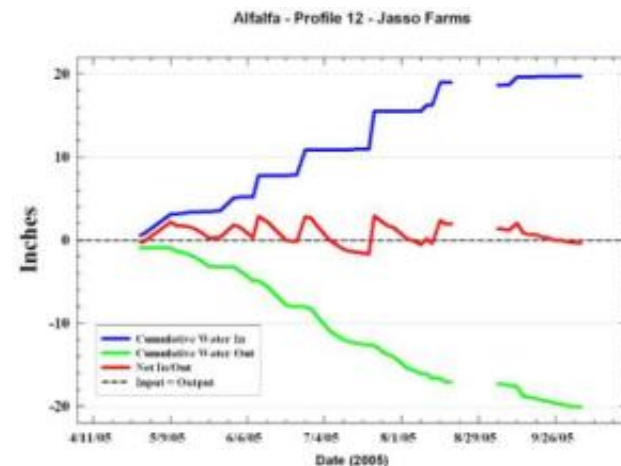


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**NMSU Agricultural Science Center at Los Lunas**



# Irrigating with Limited Water

- What is limited?
  - Not enough to meet crop requirement
  - Unique to each irrigator
- **Focus on maximum growth stage**
  - Highest yield potential
  - Highest quality
- **Consider more drought tolerant crops**
  - Mix of high and lower quality



# Alfalfa Water Use

- What's Your Goal?
  - 8 Tons of Hay
- How Much Water Will You Have?
  - 40 to 50 inches per season (4-5 cuts; *Saz et al., 2014*)
- Water Use
  - Literature: 7.5 inches / ton DM
  - Research (NMSU): 5.0 to 7.0 inches / ton DM



# Alfalfa Consumptive Water Use

- Evapotranspiration (ET)
  - Inches of water used per day
  - 0.35 to 0.40"/day
- Irrigation efficiency (IE)
  - 60-85% range
- Irrigation requirement (IR)
  - »  $ET \div IE$  or  $0.38 \div 0.75 = 0.50"/\text{day}$
  - » Summer = 15"/month
  - » Annual = 60" to 75" or more

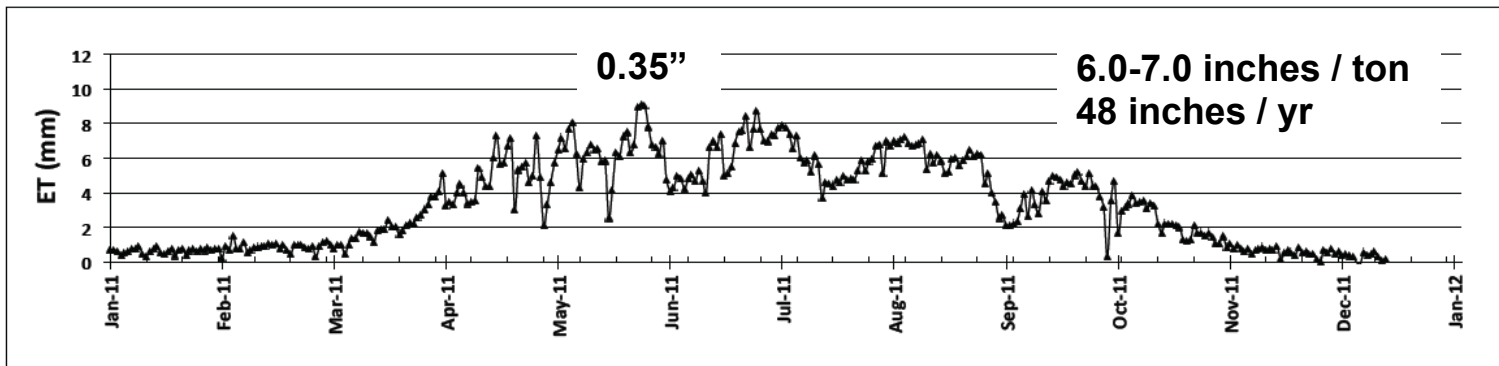
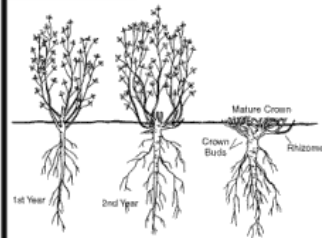
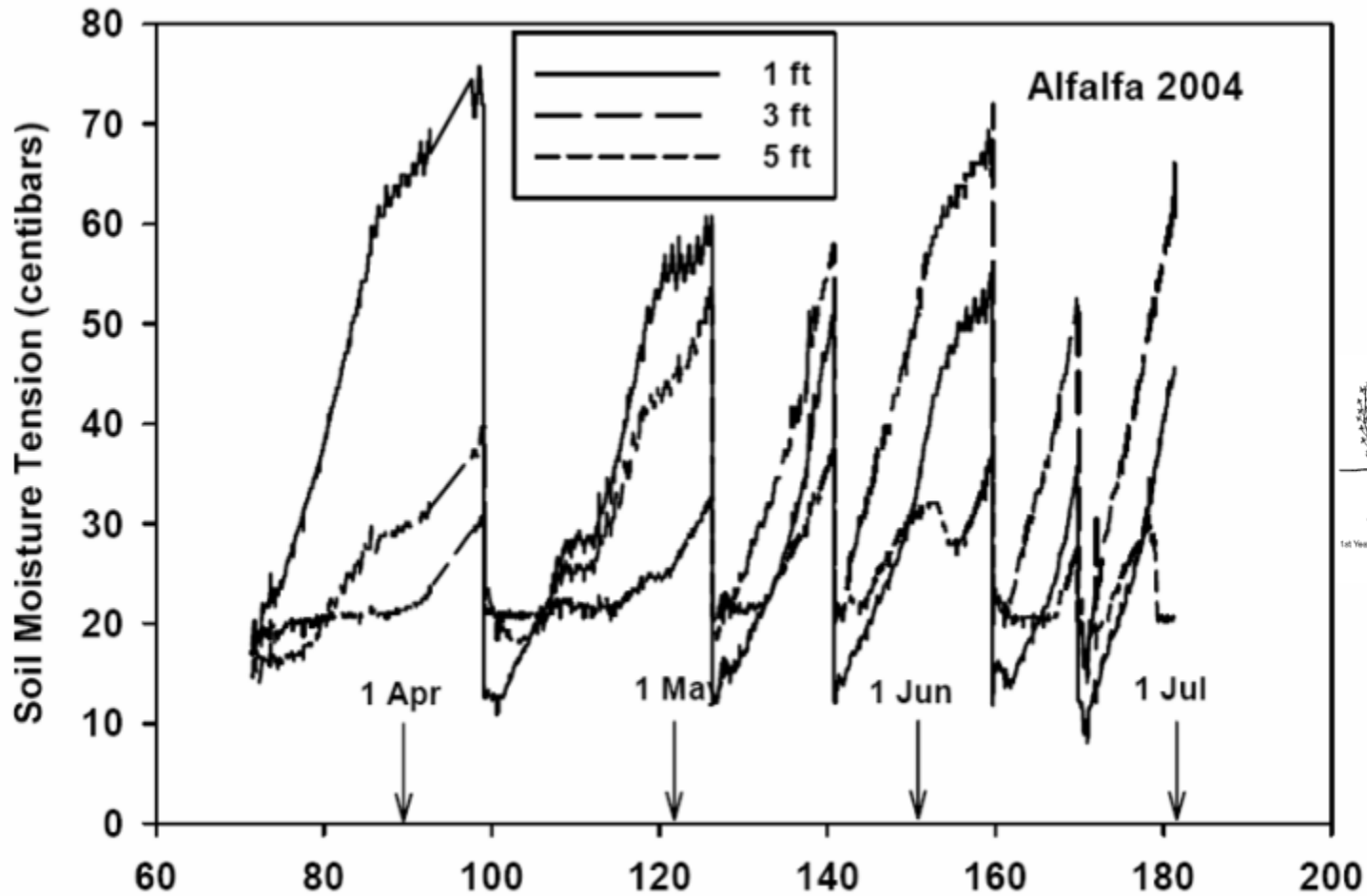


Figure 5. Evapotranspiration of alfalfa measured in 2011 at South Valley Farm C.

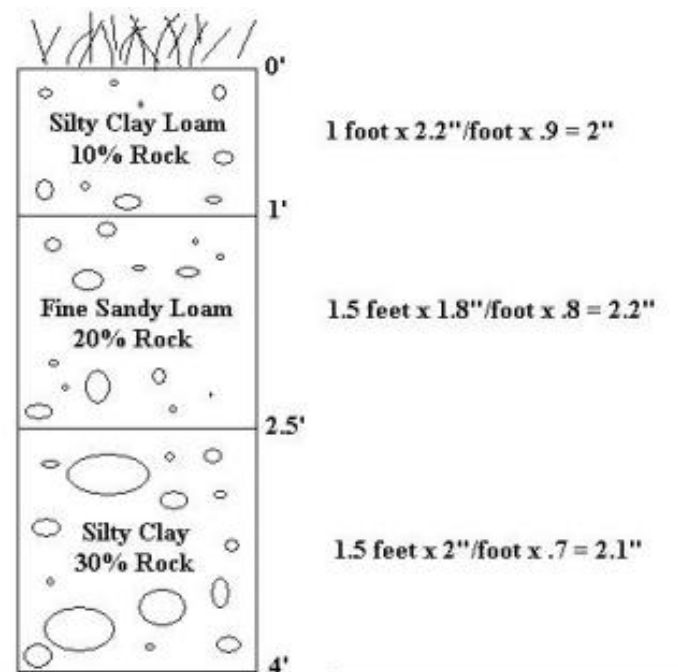
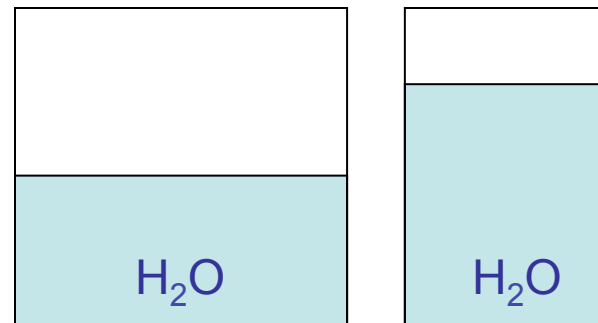


# Soil Moisture Depletions



# Irrigating with Limited Water

- Reduce irrigated land area
  - Utilize more water on less land
- Fill soil profile
  - Prior to heat of summer
  - Less expended energy
  - Manage for maximum residue
- Don't over-irrigate !!!
  - Runoff
  - Deep percolation

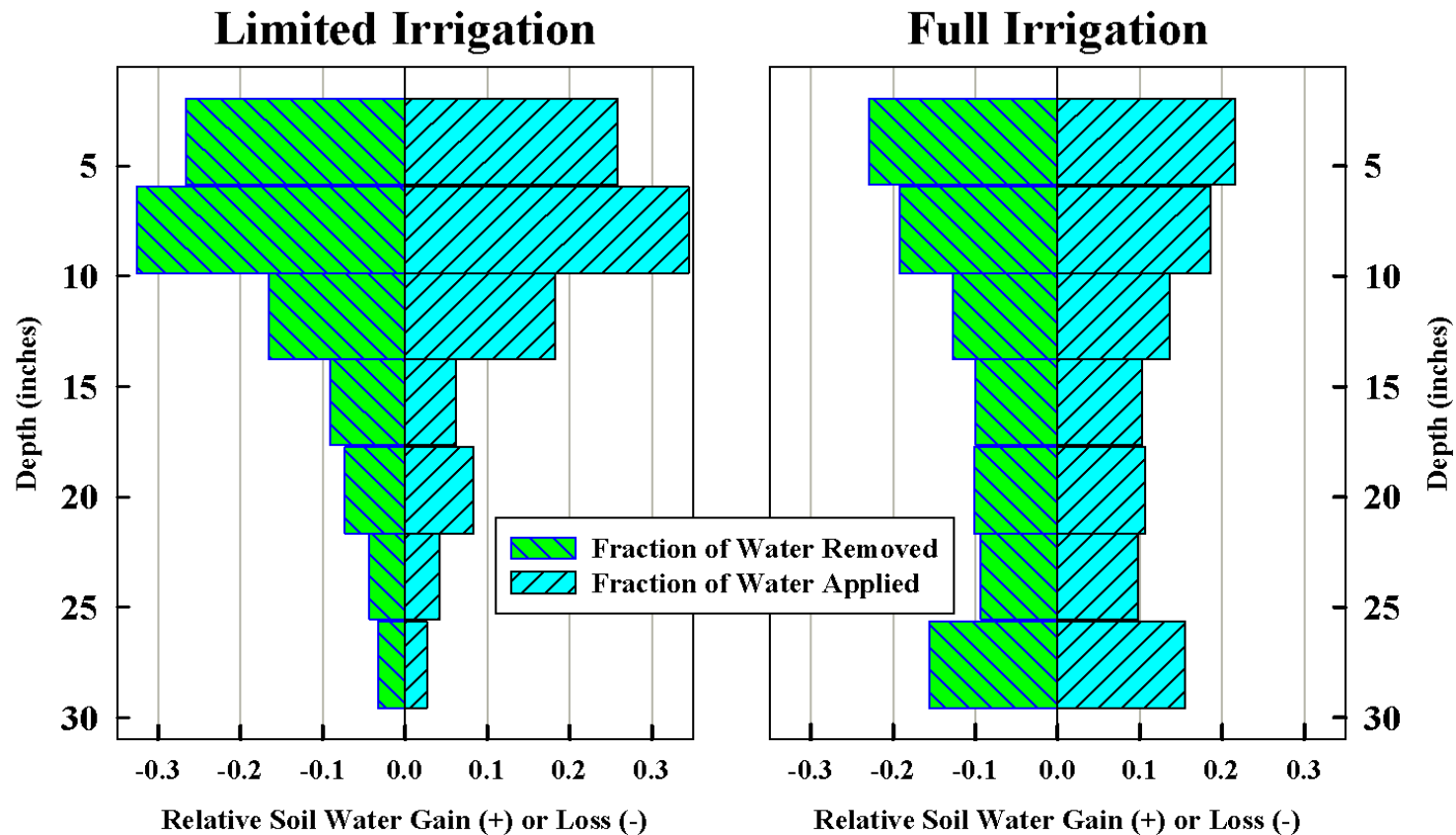


Total Available Water =  $2'' + 2.2'' + 2.1'' = 6.3$



# Soil Moisture Distribution/Extraction

## Artesia ASC



8.8 inches/ton

2.4 tons/acre

6.0 inches/ton

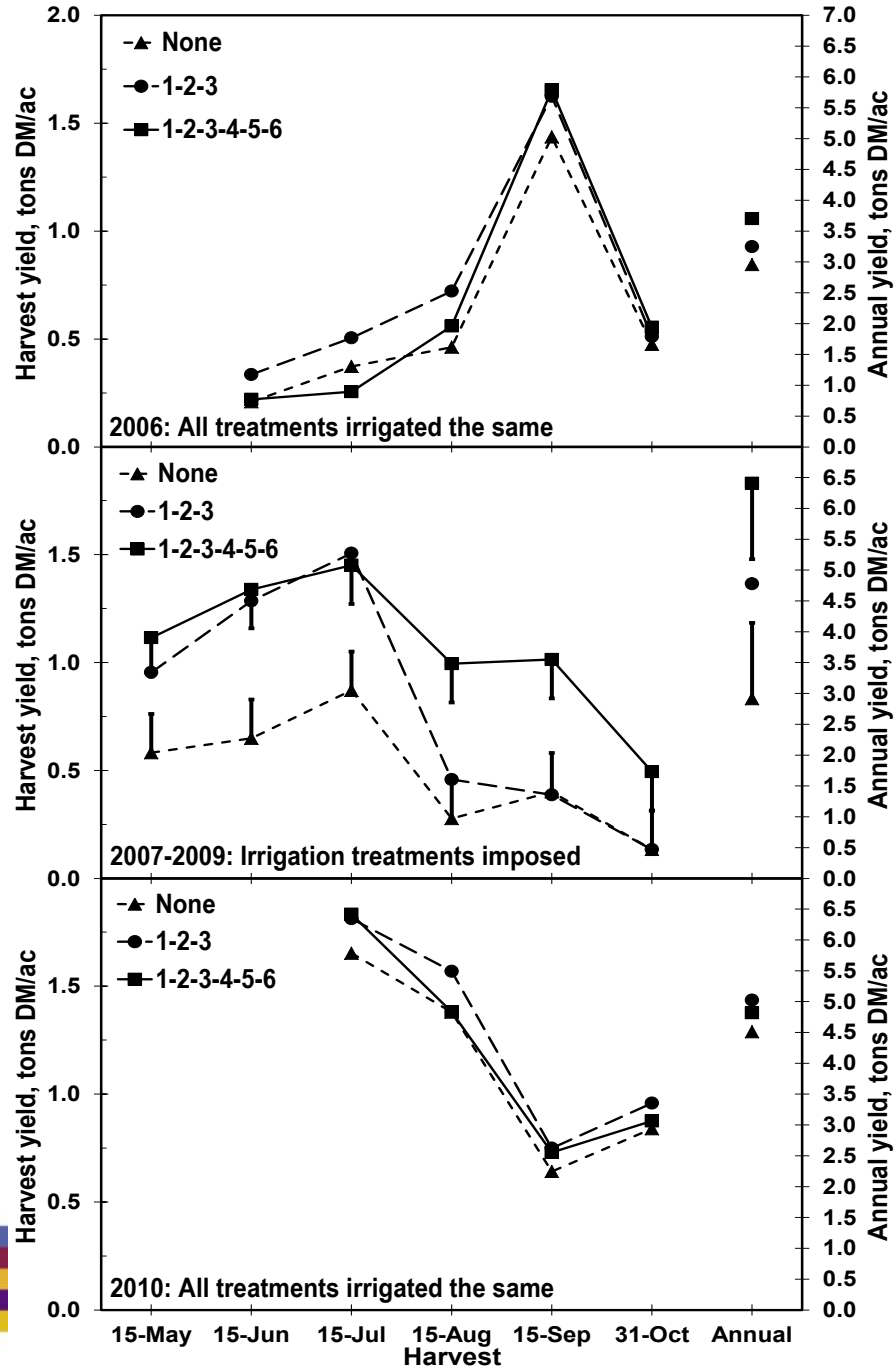
5.4 tons/acre

# Concentrate Water

7-8 GPM/ac









# Picking Your Battles





# Water Loss Mechanisms

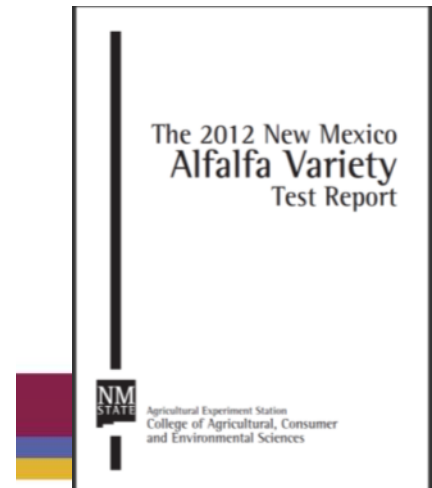
*Are you reaching  
maximum  
efficiency?*



# Alfalfa

## Starting Off Right

- Site Selection & Timing
  - Know the weed history
    - Grasses vs. broadleaves / Perennials vs. annuals
    - When are prominent flushes?
- Soil Characteristics
  - Clay vs. Sandy? Crusting? Proper seedbed?
  - Fertility (Phosphorus)
- Variety Selection
  - **Fall dormancy** rating (wide range in NM)
  - Weed-free seed, inoculated
  - [http://aces.nmsu.edu/pubs/variety\\_trials/welcome.html](http://aces.nmsu.edu/pubs/variety_trials/welcome.html)





# Characteristics of Roundup Ready alfalfa varieties available in 2011

Variety	Proprietor	FD	WS	Pest resistance								
				BW	FW	AN	PRR	SAA	PA	BAA	SN	RKN
54R01	Pioneer HiBred Int'l	4	2	HR	HR	HR	HR	R	R	n/r	R	n/r
6443	Garst Seed	4	2	HR	HR	HR	HR	MR	HR	n/r	R	n/r
DKA41-18RR	Monsanto	4	2	HR	HR	HR	HR	n/r	R	n/r	R	n/r
Liberator	Syngenta	4	2	HR	HR	HR	HR	R	R	n/r	R	n/r
4R100	Trelay Seed	4	2	HR	HR	HR	HR	MR	R	n/r	MR	n/r
WL350LHRR	W-L Research	4	2	HR	HR	HR	HR	n/r	nR	n/r	R	n/r
WL355RR	W-L Research	4	2	HR	HR	HR	HR	HR	R	n/r	R	n/r
YieldMaster	Jung Seed Genetics	4	2	HR	HR	HR	HR	n/r	R	n/r	R	n/r
WL367RR/HQ	W-L Research	5	2	HR	HR	HR	HR	n/r	n/r	n/r	R	n/r
6R100	Eureka Seeds	6	n/r	R	HR	HR	HR	HR	R	HR	R	n/r
R65BD277	Forage Genetics Int'l	6	n/r	n/r	n/r	R	HR	n/r	n/r	n/r	HR	n/r
R65BD278	Forage Genetics Int'l	6	n/r	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r
R65BD279	Forage Genetics Int'l	6	n/r	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r
R65BD280	Forage Genetics Int'l	6	n/r	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r
WL454HQ/RR	W-L Research	6	n/r	R	HR	HR	HR	R	HR	n/r	HR	n/r
DKA84-10RR	Monsanto	8	n/r	R	HR	HR	HR	HR	HR	HR	HR	n/r
Revolution	Syngenta	8	n/r	HR	HR	HR	HR	HR	HR	HR	HR	n/r
WL550RR	W-L Research	8	6	R	HR	HR	HR	R	HR	HR	R	n/r
WL660RR	W-L Research	9	n/r	R	R	R	HR	R	n/r	n/r	R	HR

<sup>1</sup>RR=Roundup Ready if "Y"; WS=Winter Survival (1=No injury, 6=Dead plants), FD=Fall Dormancy (2=Vernal, 3=5246, 4=Legend, 5=Archer, 6=ABI 700, 7=Dona Ana, 8=Pierce, 9-CUF101), 10=UC1887, BW=Bacterial wilt, PRR=Phytophthora root rot, FW=Fusarium wilt, AN=Anthracnose, SAA=Spotted alfalfa aphid, PA=Pea aphid, BAA=Blue alfalfa aphid, SN=Stem nematode, RKN=Rootknot nematode (southern or northern); (S=Susceptible, LR=Low resistance, MR=Moderate resistance, R=Resistant, HR=High resistance).  
n/r indicates either that the variety was not rated for that characteristic or no rating was available.

## Alfalfa seed prices (per lb.) from selected companies in 2012.

Seed class	Non-organic	Organic	Cost 20 lb/ac
RR Cultivar	\$7.00 - \$8.30	-----	\$153
Conventional cultivar	\$2.90 - \$6.00	\$4.76	\$90
Conventional VNS	\$3.60	\$3.80	\$74

**Average varietal yield differences (tons/acre) in New Mexico and value of the difference per year at the average 2012 price of \$271/ton in NM.**

Location	Average of top yielders	Average of bottom yielders	Yield difference	Value of difference (2012)
Farmington, 08-11	9.40	8.72	0.68	\$184.28
Los Lunas, 08-11	7.34	6.78	0.56	\$151.76







# Alfalfa Cutting Frequency





# Weed Control





# Alfalfa Weed Control

## Growth Stage Specific

- Quality Effects
  - Perception
- Toxicity Issues
  - Pigweed, lambsquarters, nightshades
- Compete for resources
  - Water and nutrients
- Pre-plant (Incorporated)
  - Preventative control
- New Stands (Establishment)
  - Seedling alfalfa
    - 2-4 trifoliate leaves
- Established Stands (1 year old +)
  - At least after 1<sup>st</sup> cutting
- Dormant-Season Treatments
- Roundup Ready Alfalfa

# 1<sup>st</sup> Cut Alfalfa

It Doesn't Have To Be This Way !





# Alfalfa Herbicides

**Table 3. Mode of Action Groups for Herbicides Labeled for Alfalfa in New Mexico\***

Mode of Action Group	Herbicides
1 ACCase grasskillers	Clethodim, Poast, Poast Plus, Select 2E, Select Max
2 ALS/AHAS inhibitors	Pursuit, Raptor, Sandea
3 Microtubule assembly inhibitors	Balan DF, Prowl H <sub>2</sub> O, Treflan 4EC, Treflan 4L, Treflan HFP, Treflan TR-10, Kerb 50W
4 Synthetic auxins	Butoxone 200, Butoxone 7500, Butyrac 200, MCPA amine 4
5 Photosynthetic inhibitors – triazines	Lexone 75DE, Sencor 4E, Sencor 75DE, Sinbar, Velpar
6 Photosynthetic inhibitors – nitriles/benzothiadiazoles	Buctril, Buctril 4EC
7 Photosynthetic inhibitors – ureas/amides	Karmex DF
8 Lipid synthesis inhibitors	Eptam 7E
9 EPSP synthase inhibitors	Roundup and other glyphosate products
12 Carotenoid biosynthesis inhibitors	Solicam DF
14 PPO inhibitors	Chateau, ET Herbicide
22 Photosystem I inhibitors	Gramoxone Extra
27 Unknown	K-PAM HL, Metam CLR 42%, Scythe



\*Adapted from Weed Science Society of America, *Weeds Resistance Education and Action Program* (<http://wssa.net/Weeds/Resistance/WREAP.pdf>). New herbicides do not necessarily have a unique mode of action and may fall within the groups listed in the charts. Herbicides that have the same mode of action may not control the same weed spectrum. Other trade names with the same active ingredient may be available on the market.

# Alfalfa Herbicide Options

You Have A Lot of Choices

- In-Season
  - Pursuit / Raptor (post- ; some residual)
  - Prowl H<sub>2</sub>O (pre-)
  - Grass weeds are easy
  - Broadleaf weeds can be difficult
- Dormant Season Products
  - Glyphosate (Roundup; Non-RRA)
  - Paraquat (Gramoxone) : In between cuttings (< 5 days)
  - Pursuit, Karmex, Sencor, Velpar or Velpar AlfaMax, Chateau



\* Always read and follow herbicide label for precautions and restrictions. Check supplemental labels.



**Feb. 11, 2014**



**Dec. 2, 2013**





# Alfalfa Herbicide Options

## Roundup Ready Alfalfa

- Back On The Market
  - Currently deregulated
  - Higher seed cost \$ (technology fee)
  - Variety options increasing
- Benefits
  - Broad-spectrum herbicide
    - Grass & broadleaf weeds
  - Relatively low herbicide cost \$
  - Potentially fewer chemicals used
  - Similar management to conventional





# Alfalfa Establishment

## **Historical Recommendation**

- Don't plant in spring: wrong time
  - Too many weeds and competition
  - Too hot and stressful on small plants
  - Same irrigation as established stand
  - Lower 1<sup>st</sup> year total yield
  - Lose 2 harvests in spring (when alfalfa is more efficient)
  - Recommended against in New Mexico unless irrigation water will likely not be available from late summer into mid-autumn



# Alfalfa Planting Date Studies

May 12

21 DAP

**Glyphosate (41%): 2 qts/ac  
Applied: 14 DAP**

37 DAP



# Plantain –

*[Plantago spp.]*

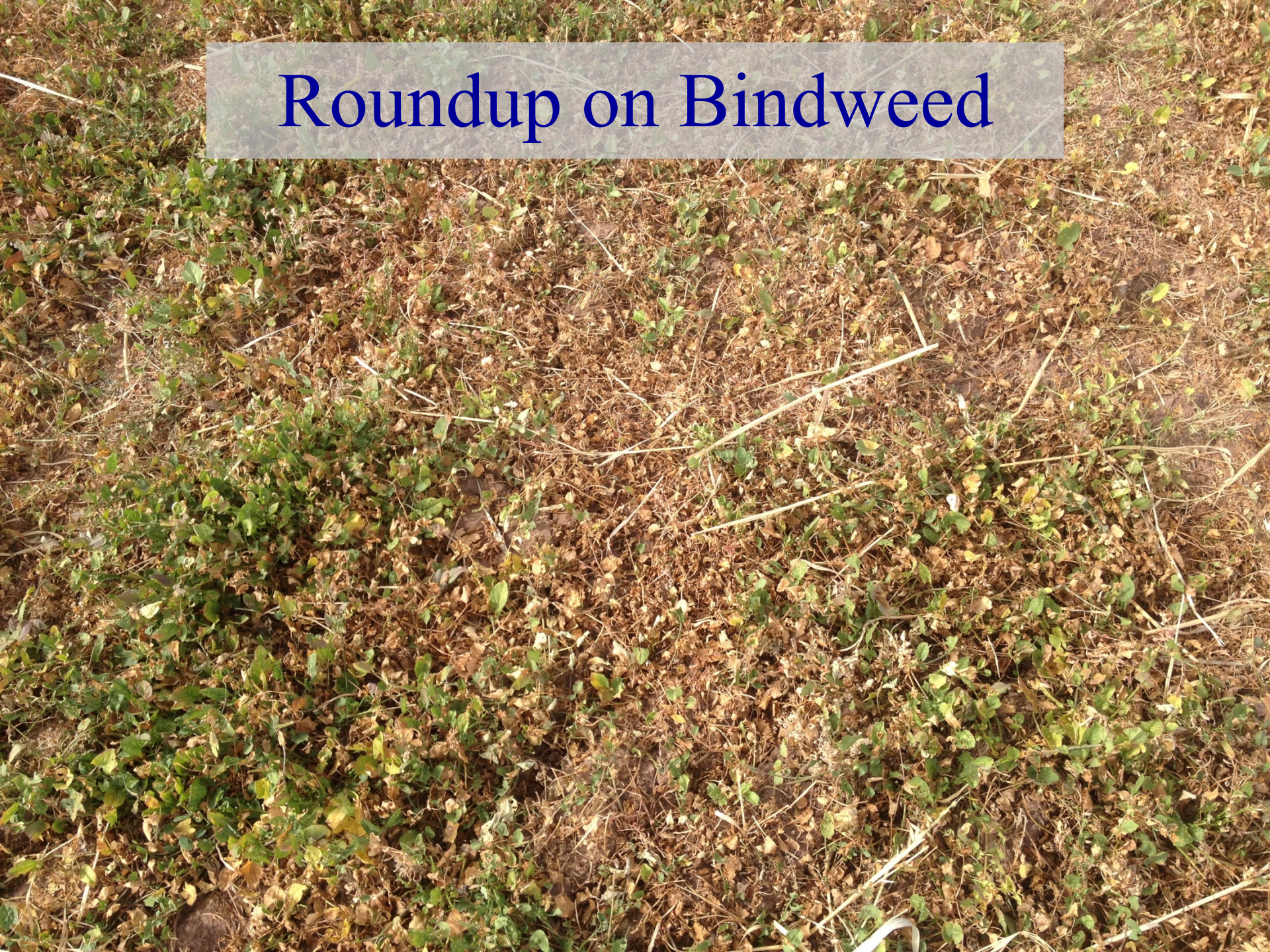
- Perennial weed
  - Buckhorn & Broadleaf species
  - Dense crown, strong taproot
  - Difficult to control (Rotations)
    - Tillage can be effective (deep)
  - Dry conditions favor plantain
- Options (alfalfa)
  - Crop Rotation
    - Cereal crops (wheat)
    - Plow + 2,4-D (multiple applications; fall)
  - Chemical Control
    - Post-: Roundup (Fair to Good): RRA only
    - Pre-: Velpar: Dormant season treatments

\* Always read and follow herbicide label for precautions and restrictions.





# Roundup on Bindweed





# Replacing Alfalfa

- $< 40$  stems/ft<sup>2</sup>





# Replacing Alfalfa





**Table 3. Roundup Ready alfalfa stand removal prior to no-till corn<sup>1</sup>** (From: Dillehay, B.L., and W.S. Curran. 2006 Guidelines for weed management in Roundup Ready alfalfa. Agronomy Facts 65. Crop and Soil Sci., Penn. State Univ. (<http://cropsoil.psu.edu/extension/facts/agronomy-facts-65>)).

Herbicide(s) <sup>2</sup>	Rate	Alfalfa
2,4-D LV4	1 pt/A	7+
dicamba	1 pt/A	8
2,4-D LV4 + dicamba	1 + 1 pt/A	9
2,4-D LV4 + dicamba	1 + 0.5 pt/A	8+
2,4-D LV4 + dicamba	0.5 + 1 pt/A	8
2,4-D LV4 + dicamba	0.5 + 0.5 pt/A	8
Clopyralid (Stinger)	8 oz/A	9

<sup>1</sup> Follow label guidelines.

<sup>2</sup> Herbicide should be applied to alfalfa with at least 10 inches of spring growth or after 6 inches of alfalfa regrowth.

### Alfalfa Control Rating

**10 = 95-100%**

**9 = 85-95%**

**8 = 75-85%**

**7 = 75-65%**

**6 = 65-55%**

**5 = 55-45%**



Declining alfalfa stand prior to the last cutting, and to be removed from the crop rotation. A late summer to early fall preharvest treatment can provide better stand removal than a treatment applied after harvest.

# Alfalfa Re-establishment

Wait 2 mos

1 yr + Haygrazer



Alfalfa planted above in soil from a corn field (no autotoxicity) and below from an alfalfa field (autotoxicity).



2 yr + 2 Haygrazer    Long-term grass





UGA4824043



UGA5319039





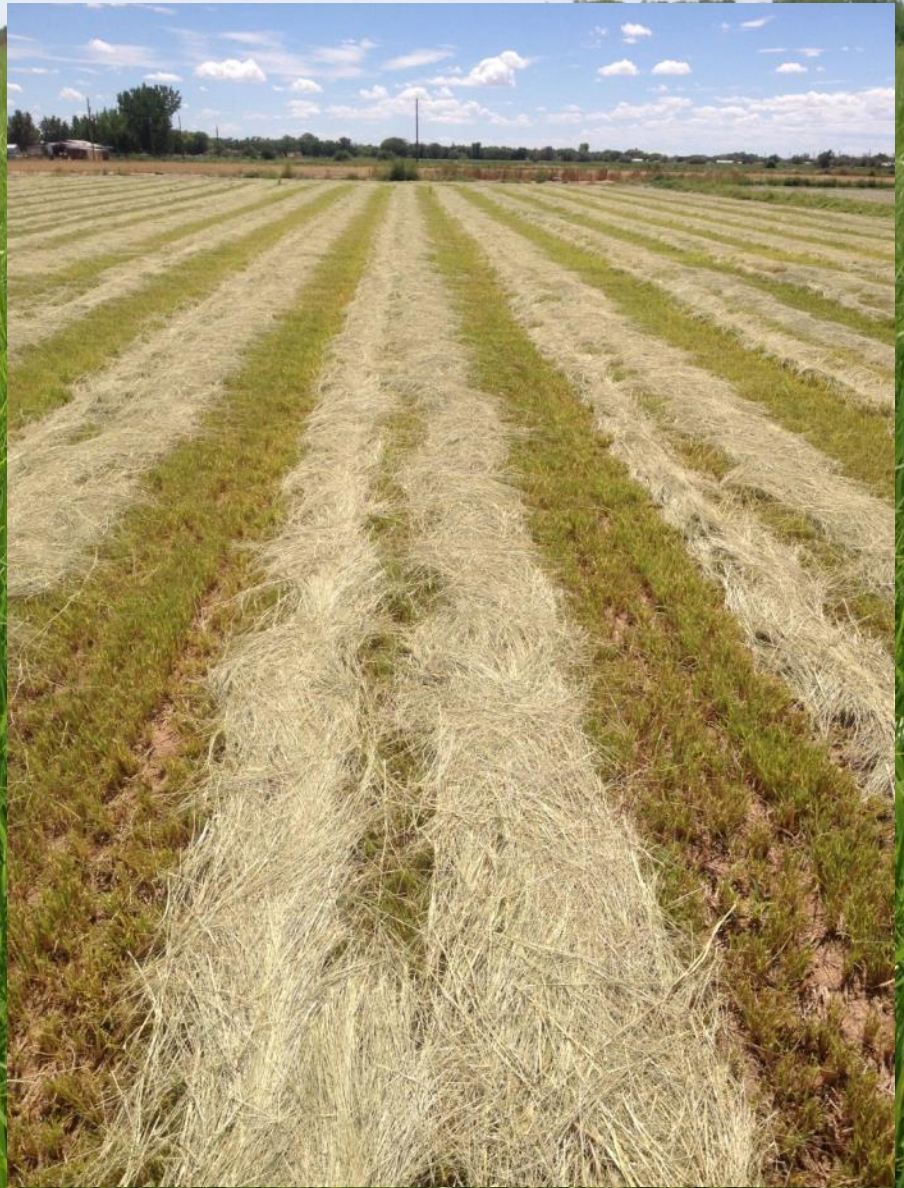
# Teff –

*[Eragrostis tef (Zucc.)]*

- Annual, warm-season forage
- Rapidly growing
- High quality / palatability
- No toxicity\*
- Hay use mainly – horses
- Alfalfa rotations\*
- Killed at first frost









Cotton

Teff

35-ac block (small bales): 1.6 T/ac  
60-ac block (round bales): 1.0 T/ac





# Questions ???

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**<http://loslunassc.nmsu.edu>**



# Nutsedge –

## [*Cyperus spp.*]

- Perennial weed
  - Difficult to control (Rotations)
  - Excessive irrigation
  - Lack of competition
- Chemical Options (alfalfa)
  - Pre-emergence
    - Eptam (EPTC)
    - Zorial (Norflurazon)
  - Post-emergence (suppression)
    - Pursuit/Raptor (BL + Grasses)
    - Roundup (RRA only)

**Gowan®**  
The Go To Company

P.O. Box 5569 • Yuma, AZ 85366-5569 • Phone (928) 783-8844 • FAX (928) 343-0255

FIFRA 24(c) REGISTRATION  
EPA SLN No. NM-110003  
Valid up to 2016

SPECIAL LOCAL NEED REGISTRATION  
FOR DISTRIBUTION AND USE ONLY IN THE STATE OF NEW MEXICO ON ALFALFA

**Sandea®**  
Herbicide

EPA REG. No. 81880-18-10163

ACTIVE INGREDIENT:  
Halosulfuron-methyl

% BY WT.

75.0%

OTHER INGREDIENTS

25.0%

TOTAL 100.0%

KEEP OUT OF REACH OF CHILDREN  
**CAUTION**

- This labeling must be in the possession of the user at the time of pesticide application.
- It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.
- All applicable directions, restrictions and precautions on the EPA registered label are to be followed.

**PREHARVEST INTERVAL**

The required days between last application and harvest are given in ( ) after each crop name.

**APPLICATION RATES AND TIMING**

CROP	OZ/ACRE	COMMENTS
ALFALFA (14)	2/3 – 1	<p><b>Established Fields</b></p> <ul style="list-style-type: none"> <li>• <b>Post Emergence Broadcast</b> – Sandea can be applied as a broadcast application to established alfalfa. Alfalfa should be well established in the field for a minimum of 6 months prior to application of Sandea. Apply uniformly with ground equipment in a minimum of 20 gallons of water per acre. Use a water volume that will provide uniform coverage of plants. It is recommended to make an application as soon as possible after removal of hay from the field and prior to an irrigation to minimize crop injury. Wait for at least 48 hours after application before irrigation.</li> <li>• <b>Post Emergence Spot Treatment</b> – Sandea can be applied as a spot treatment application to only those areas of emerged nutsedge. Application rate should not exceed 3/4 oz product per treated acre in these areas. Use a water volume that will allow for good coverage of the plants.</li> <li>• <b>Post Emergence followed by Post Emergence</b> - To maximize control of nutsedge, it may be necessary to use a second post emergence spot application to those areas where the nutsedge has emerged or re-grown. For these situations, use a spot treatment method treating only those areas of emerged nutsedge. Application rate should not exceed 3/4 oz product per treated acre in these areas. Use a water volume that will allow for good coverage of the plants. This use pattern will result in greater potential of growth and yield reduction.</li> </ul> <p>Research has shown that alfalfa growth and yields will be reduced for one or more cuttings after a Sandea Herbicide application. Application of Sandea to alfalfa where re-growth exceeds 6" will result in greater yield reduction. Symptoms may be temporary. Follow all directions carefully to minimize potential reduced plant growth and yield. Apply uniformly with ground equipment in a minimum of 20 gallons of water per acre. Use a water volume that will provide uniform coverage of plants.</p> <ul style="list-style-type: none"> <li>• Do not apply more than 2 ounces of Sandea per acre per crop cycle, not to exceed 2 ounces per acre per 12-month period.</li> <li>• Consult "Use Precautions" and "For Optimum Results" sections for important usage information.</li> </ul>

NOTE: This product is sold subject to the CONDITIONS OF SALE set forth on the container label.

24(c) Registrant: Gowan Company, P.O. Box 5569, Yuma, AZ, 85366-5569

EPA Reg. No. 81880-18-10163  
EPA Est. No. 065387-AR-003

**Gowan®**  
The Go To Company

Produced For:  
Gowan Company  
P.O. Box 5569  
Yuma, Arizona 85366-5569

\* Always read and follow herbicide label for precautions and restrictions. Check supplemental labels.





# Alfalfa

## Proper Management



- Irrigation
  - Is field level? Low spots in field?
    - Uniform water distribution
    - Ponding = Grass invasion
- Cutting Frequency
  - More frequent = stressed alfalfa
- Wheel Traffic
  - Breaks stems / compacts soils / diseases
  - Later traffic is worse
  - Weeds invade these areas





# Alfalfa Establishment

- Late summer/early fall
  - Mid-August to mid-September (earlier is better)
  - Opportunity to destroy summer weeds after they germinate
  - Summer weeds may germinate post-planting but make little growth and few will produce seed (herbicides available)
  - Irrigate only once or twice in seeding year to establish
  - Allow alfalfa to achieve 25% bloom before harvesting in spring
  - No yield loss in first production year



# NuMex Bill Melton Yield Data Collected at Four Locations under Sprinkler or Flood Irrigation Mgmt.





**NuMex Bill Melton under variable soil moisture trts:**  
**Among the top performing entries at 4 New Mexico locations.**  
**Yielded 13%, 10%, & 5% greater than Wilson, Dona Ana, and**  
**56S82 check cultivars.**

Yield Performance of NuMex Bill Melton Relative to Wilson and Dona Ana (%)										
Location	Year 1		Year 2		Year 3		Year 4		Average	
	Wilson	Dona Ana	Wilson	Dona Ana	Wilson	Dona Ana	Wilson	Dona Ana	Wilson	Dona Ana
Las Cruces										
Normal	12%	17%	17%	7%	25%	9%	23%	9%	19%	11%
Drought <sup>†</sup>	10%		2%		11%				8%	
Artesia										
Normal	3%	-10%	18%	15%	0%	0%			7%	1%
Drought <sup>†</sup>	-1%	0%	11%	28%	18%	9%			10%	13%
Clovis										
Normal	-3%	-7%	9%	4%	8%	4%	8%	11%	5%	2%
Farmington										
Normal	26%	7%	18%	34%	20%	39%			21%	28%

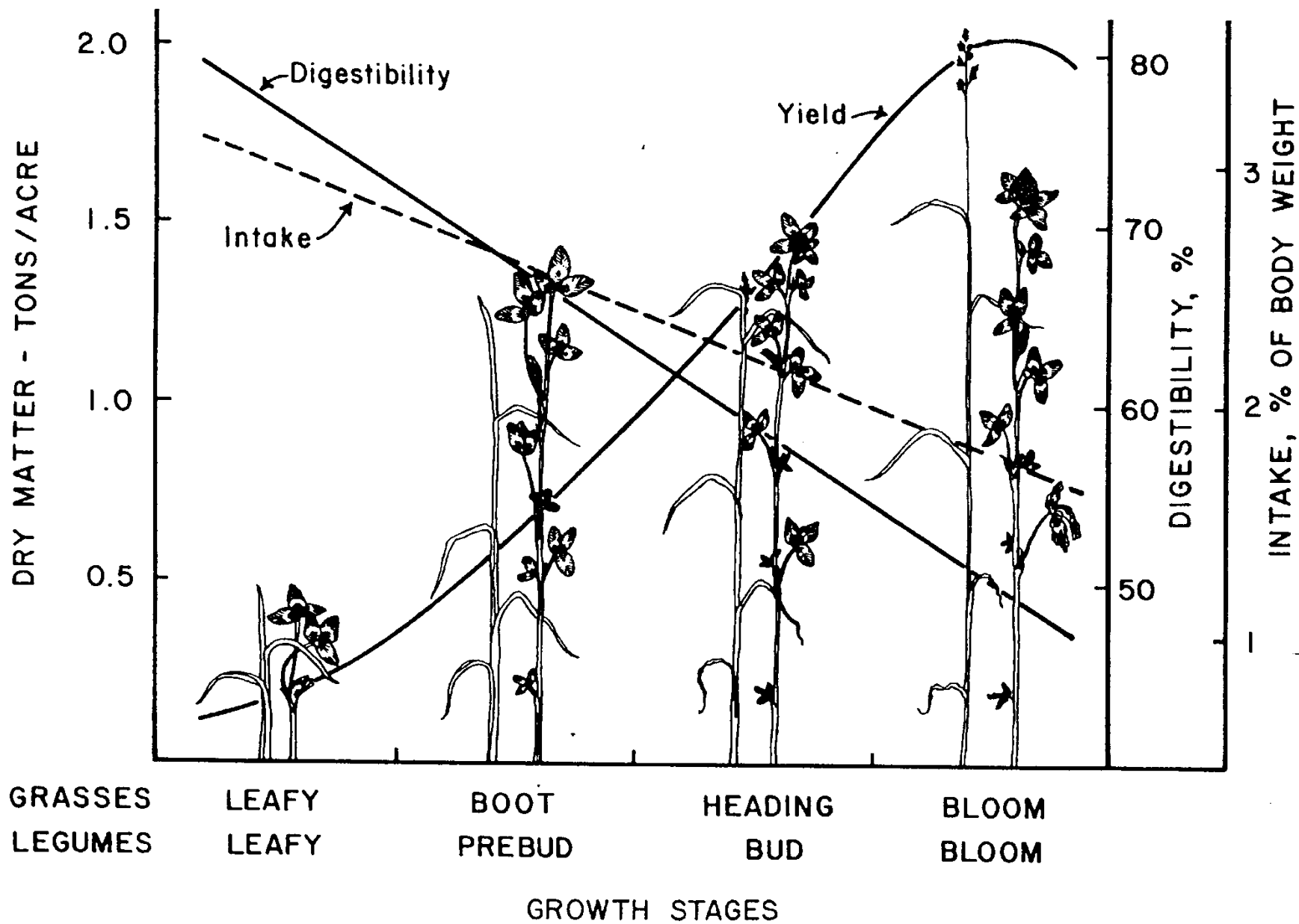
<sup>†</sup>50% of standard irrigation rate



# Hay Quality

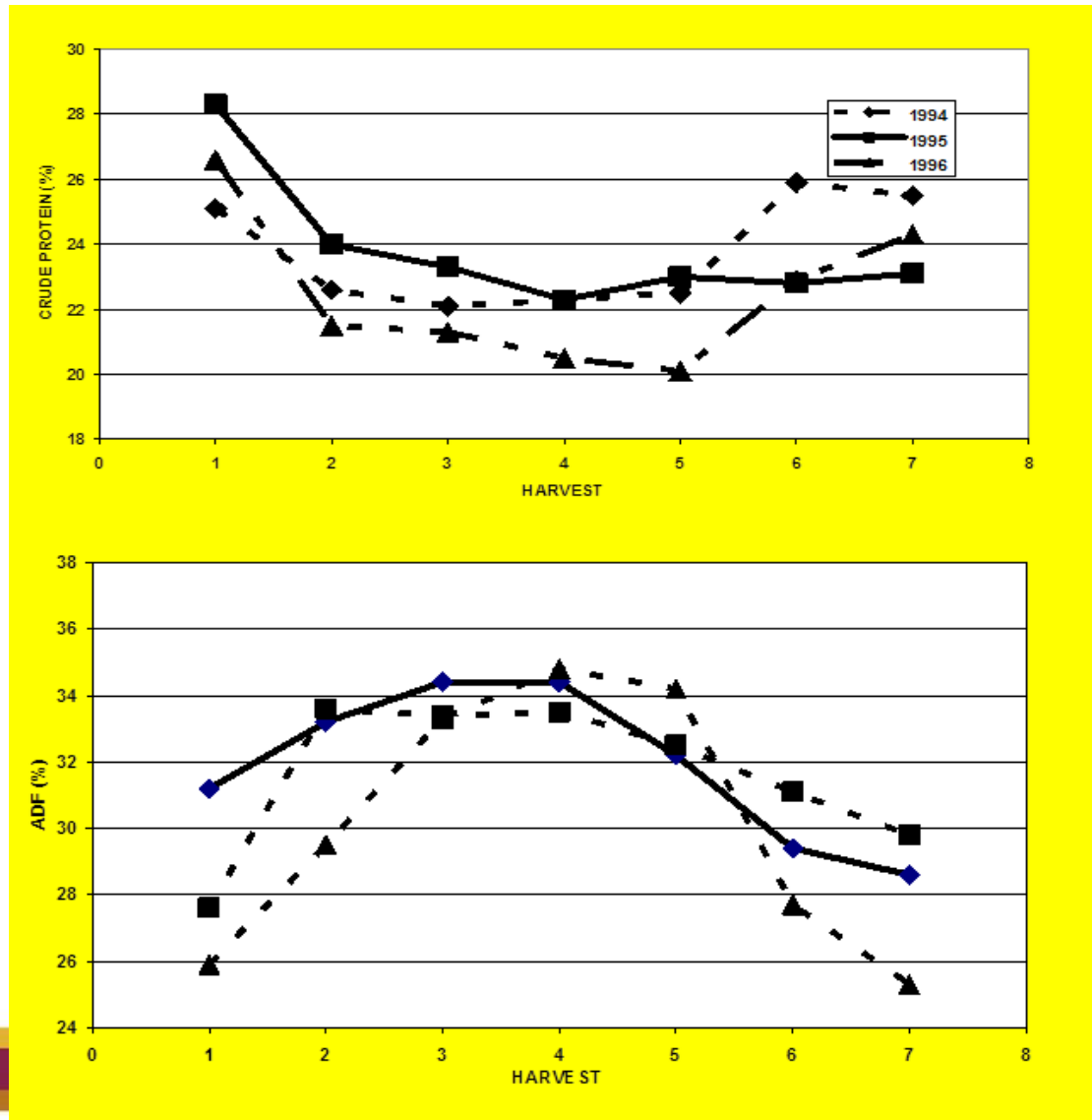








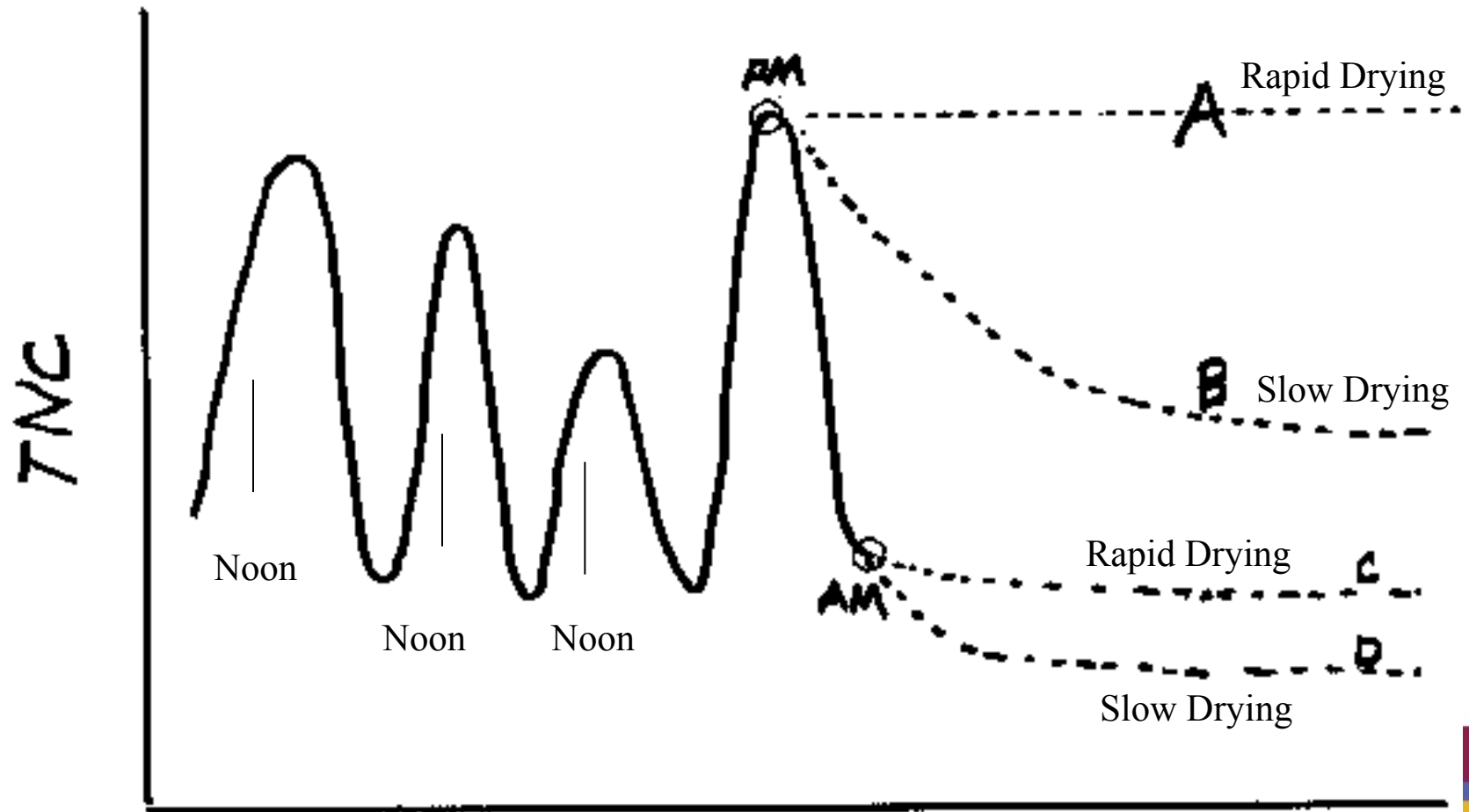
# Seasonal Changes in Nutritive Value



Adapted from: Summers & Putnam, eds. Irrigated Alfalfa Mgmt. Univ. of Calif.



# *Diurnal Fluctuations in Quality*



Source: Mayland and Shewmaker. Optimize forage quality by afternoon harvesting. USDA-ARS, Note 99-01.



## *Diurnal Fluctuations in Quality*

Hay Harvest	ADF	NDF	TNC	Intake
	%			g/meal
Afternoon – 8 July	31.1	40.7	4.29	1022
Morning – 9 July	32.8	42.7	3.49	842
Afternoon – 22 Sept	27.9	36.6	6.55	1320
Morning – 23 Sept	28.5	37.2	5.46	1107
<u>3 Dates</u>				
Afternoon Average	30.3	39.7	5.33	987
Morning Average	31.2	40.6	4.31	758

Source: Mayland and Shewmaker. Optimize forage quality by afternoon harvesting. USDA-ARS, Note 99-01.



# *Hay Sampling*

- Identify A Lot
  - Single Cutting – Don't Mix
  - Single Field/Variety
  - 200 Tons or Less, Regardless of Shape
- Sample Randomly
  - 20 Samples per Lot
  - Need ½ lb of Sample
- When To Sample
  - After 'Sweat'
  - Prior to Feeding or Sale
- Use a Core Probe
  - 3/8 to 3/4" Diameter
  - 12 to 24" Long
- Hand-grab Lower in Quality
  - More Stems, Fewer Leaves



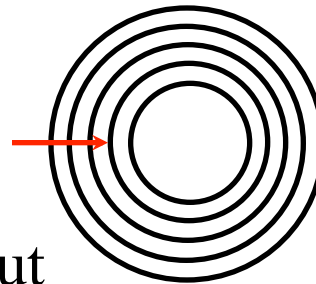


# *Sampling Location on Bale*

- Rectangular Bales
  - Sample on Ends

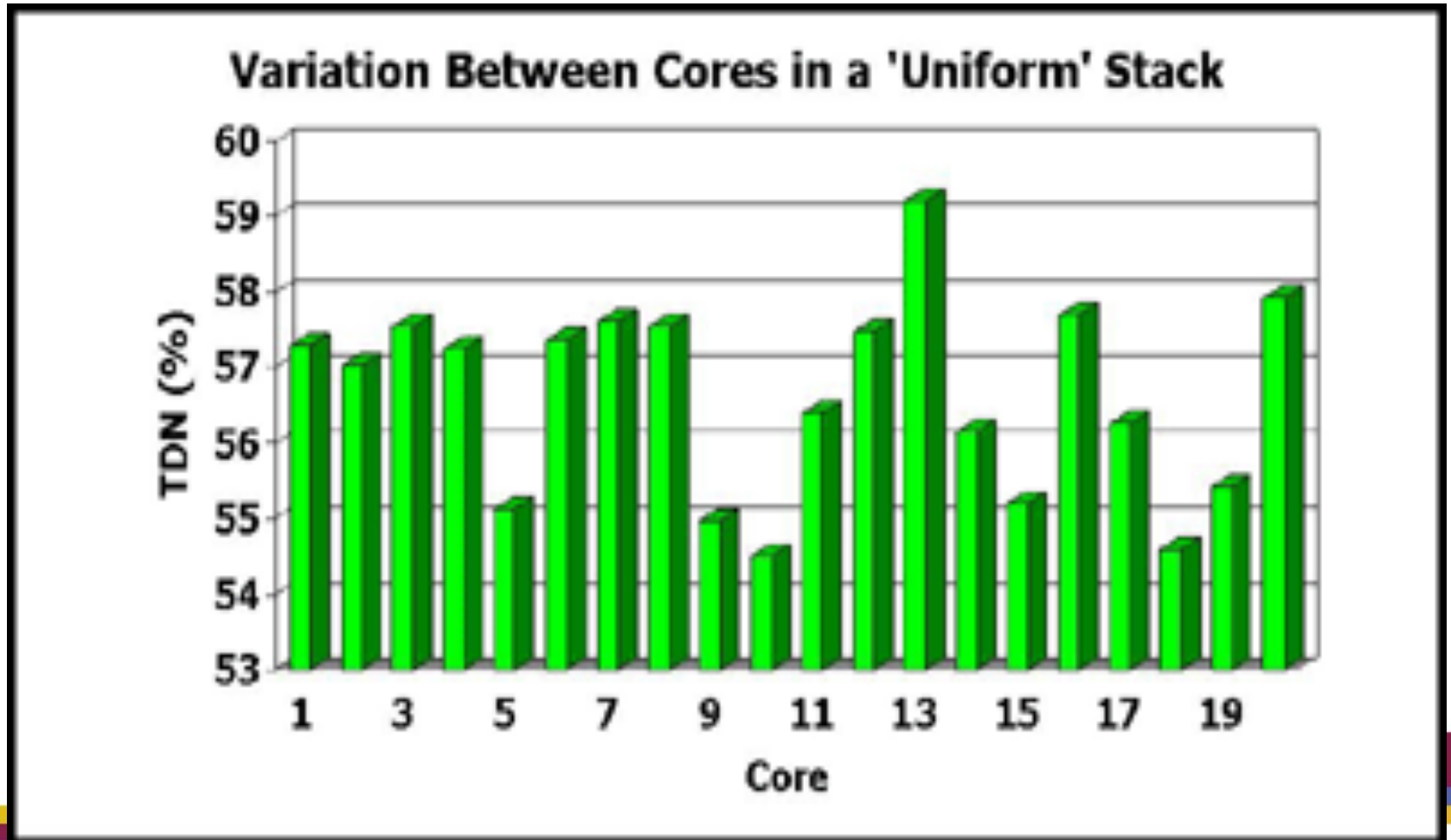


- Round Bales
  - Sample on Curved Side
  - Representative Throughout





## *Quality Variation Among Samples*



Source: Putnam, D. Recommended Principles for Proper Hay Sampling, NFTA Pub.



# Seasonal Changes in Yield

- Early season cuttings
  - Highest WUE
  - Greatest yields ???

