Managing Alfalfa and Other Forages with Less Water

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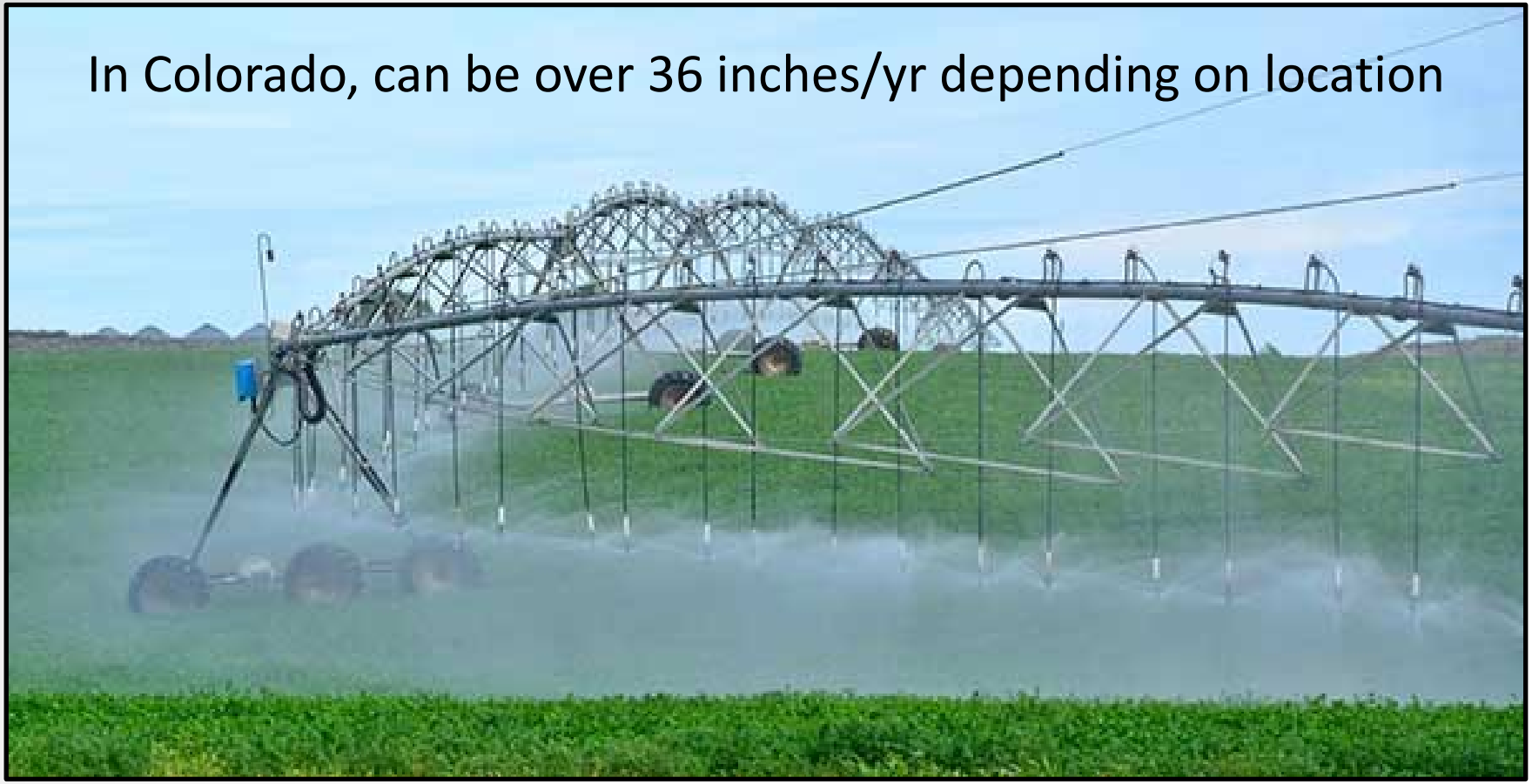
Alfalfa Background

- Thought to have originated in Iran and surrounding countries, the Caucasus mountains, and other areas in Asia Minor
  - Remains of alfalfa found in Iran more than 6000 yrs old

- Significance:
  - Evolved in a dry part of the world
  - Actually, very drought tolerant
  - Reason for autotoxicity trait
    - Produces toxin that does not allow seedlings of alfalfa to establish and survive/be productive when seeded into an existing or recently terminated stand
    - Gives established plants priority for limited resources, especially water

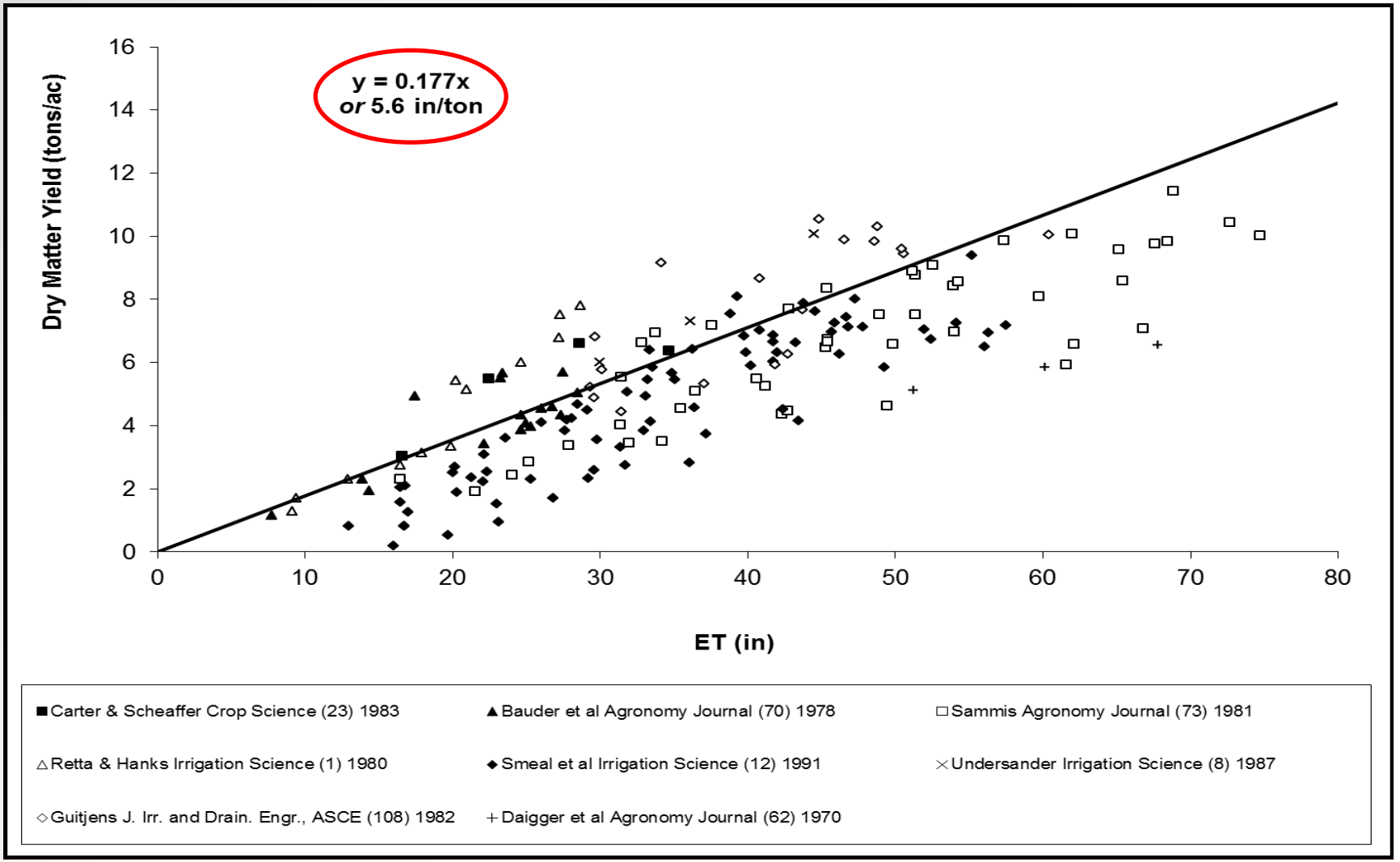
But gets a bad name for its high-water use!



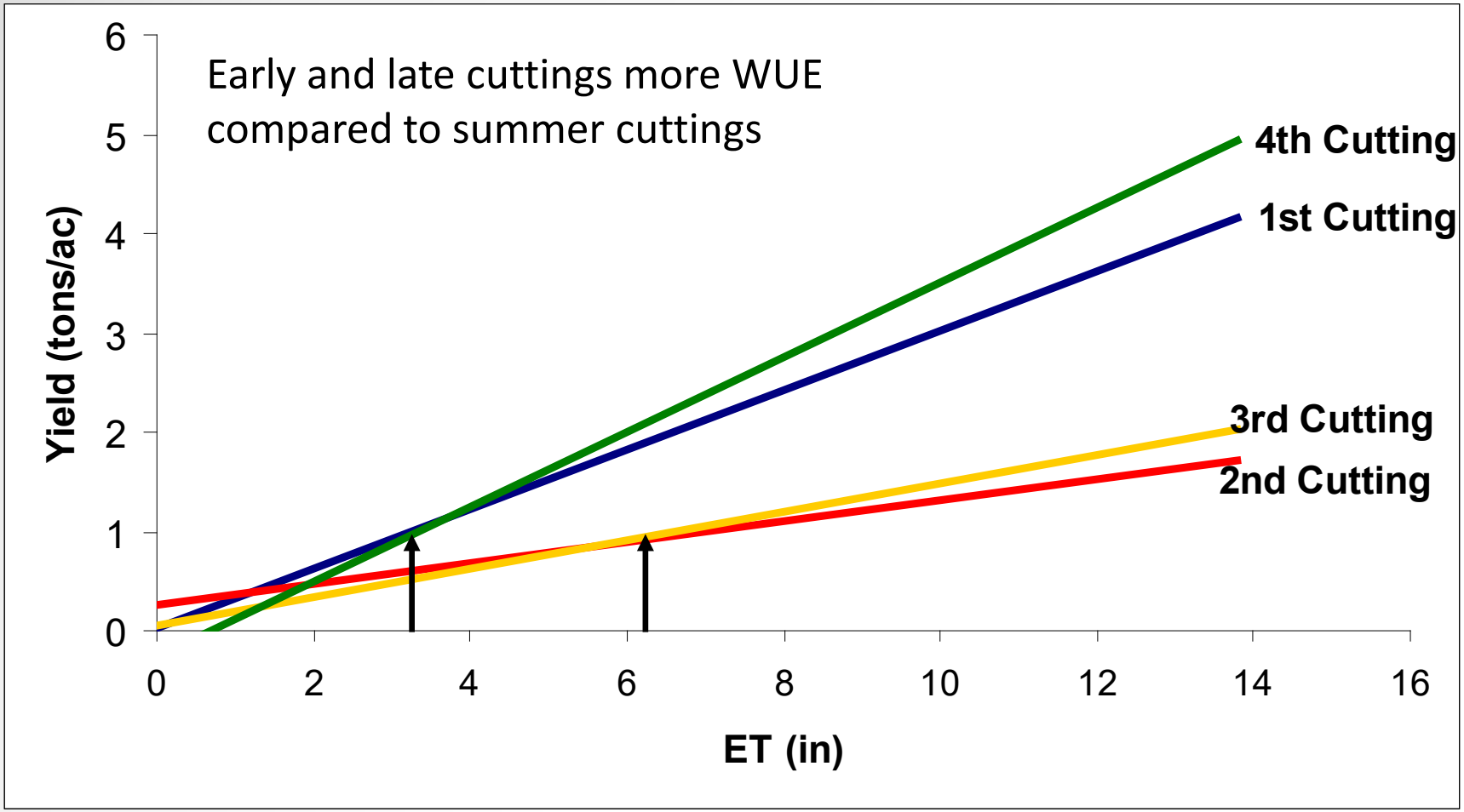
Alfalfa Consumptive Water Use

Location	------- Consumptive Use ------ Grass	Alfalfa	Silage
	---------- inches of water --------		
Cortez	24.7	30.0	18.0
Fruita	31.4	36.2	23.0
Greeley	26.6	31.5	21.7
Meeker	21.4	24.6	17.3
Monte Vista	20.6	23.7	--
Rocky Ford	33.0	37.7	24.2
Sterling	28.0	35.0	20.0
Walden	13.6	15.7	--

Alfalfa Yield vs ET



Alfalfa Yield Response to ET by Cutting



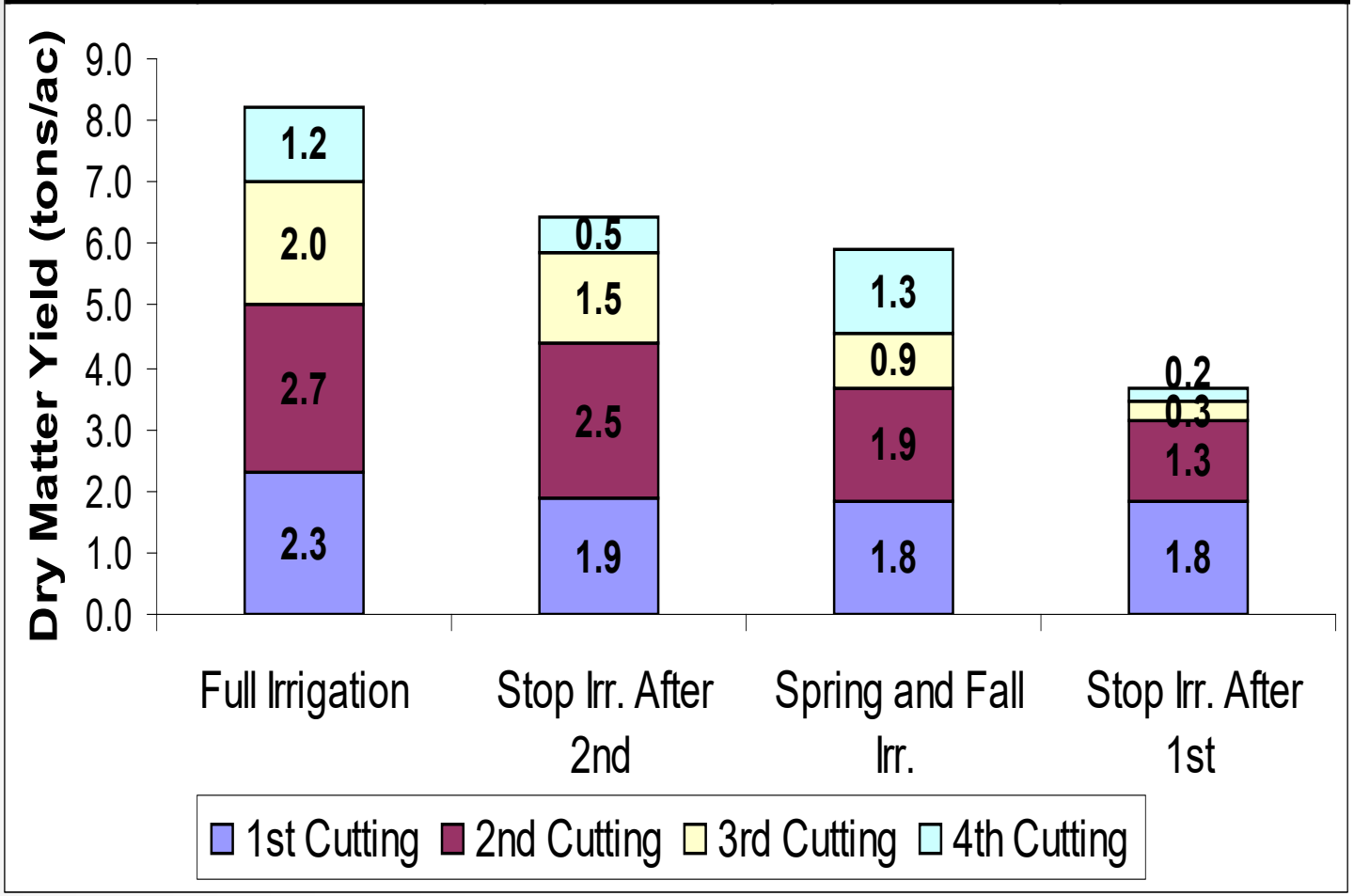
(Adapted from Undersander, 1987)

Strategies for Reducing Water Use by Alfalfa

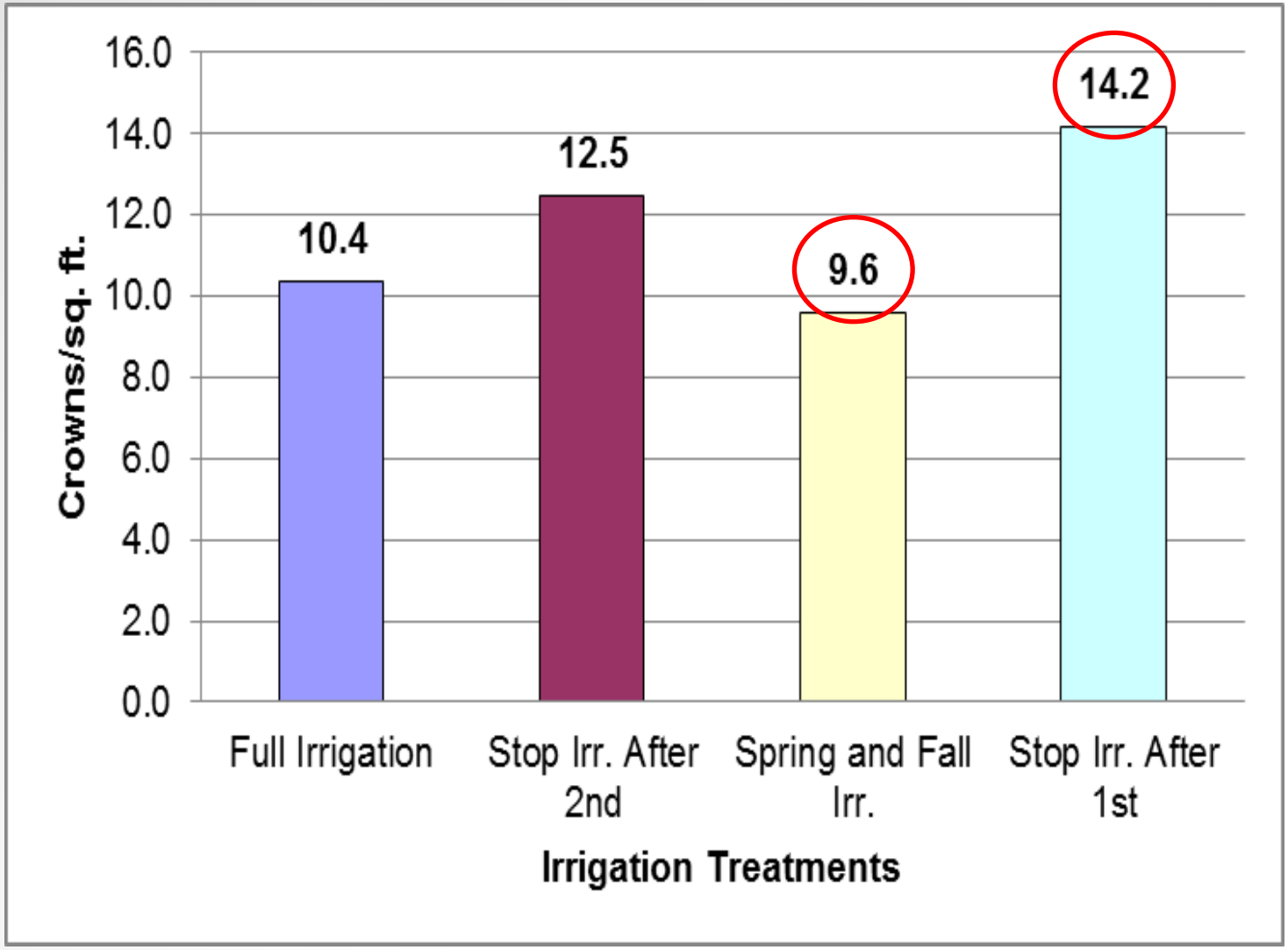
- Limited Irrigation
  - Applying less irrigation water than required for full ET/yield
- Seasonal-Deficit or Partial-Season Irrigation
  - Concentrate irrigation during the spring and limiting or withholding water during hotter periods of the growing season
  - Improves water use efficiency (WUE) more than limiting irrigation uniformly through-out the growing season
  - Can be done with few long-term impacts to alfalfa stand
  - Can allow for significant water savings while maintaining partial crop

2006 Average Alfalfa Yields by Cutting – Berthoud, CO

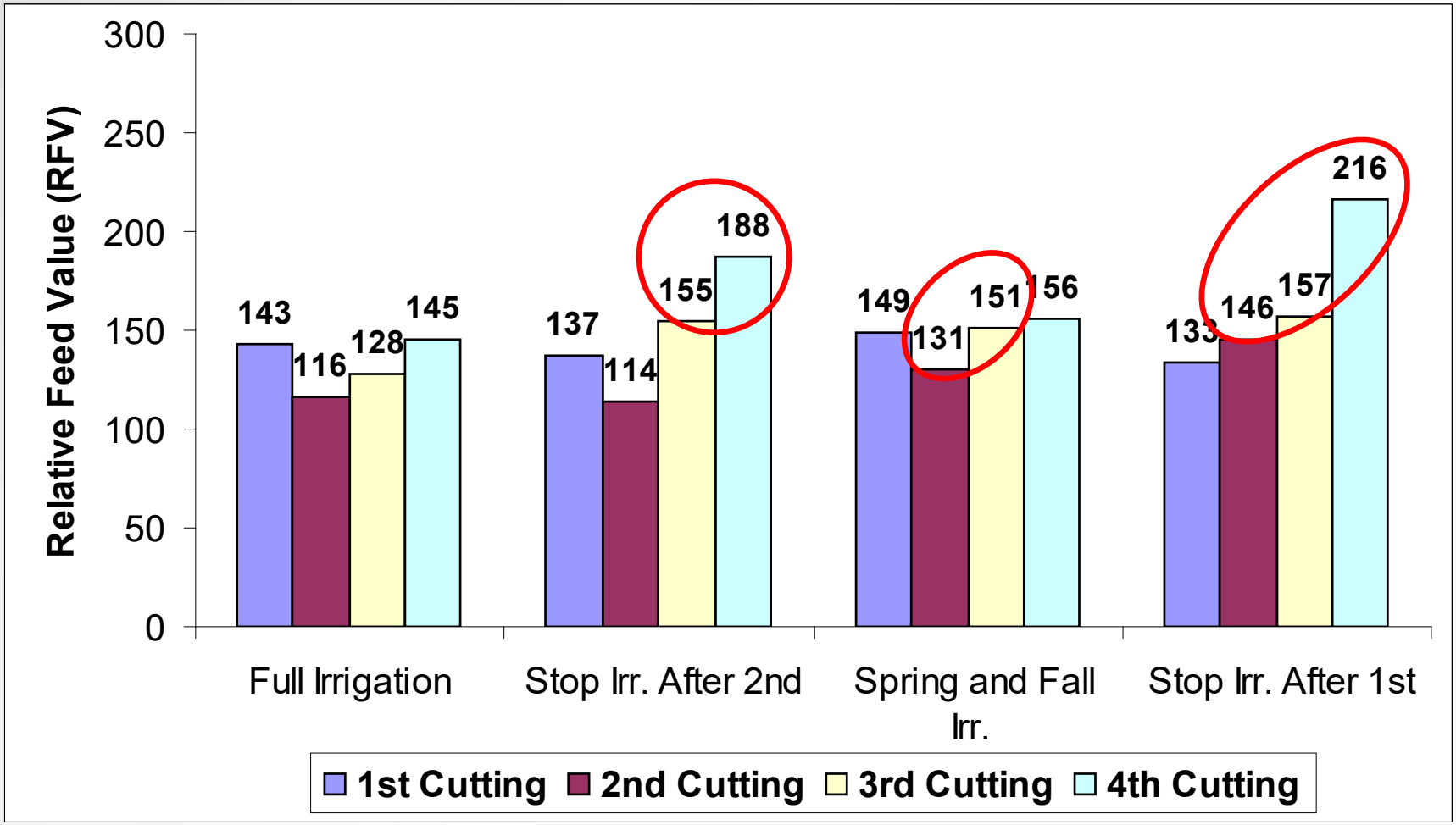
Irrigation	24.0”	12.0”	11.5”	3.6”
Total Yield	8.2 tons/ac	6.4 tons/ac	5.9 tons/ac	3.6 tons/ac



2007 Average Crown Density



2007 Relative Feed Value (RFV) by Cutting – Berthoud, CO



WCRC – Fruita, CO

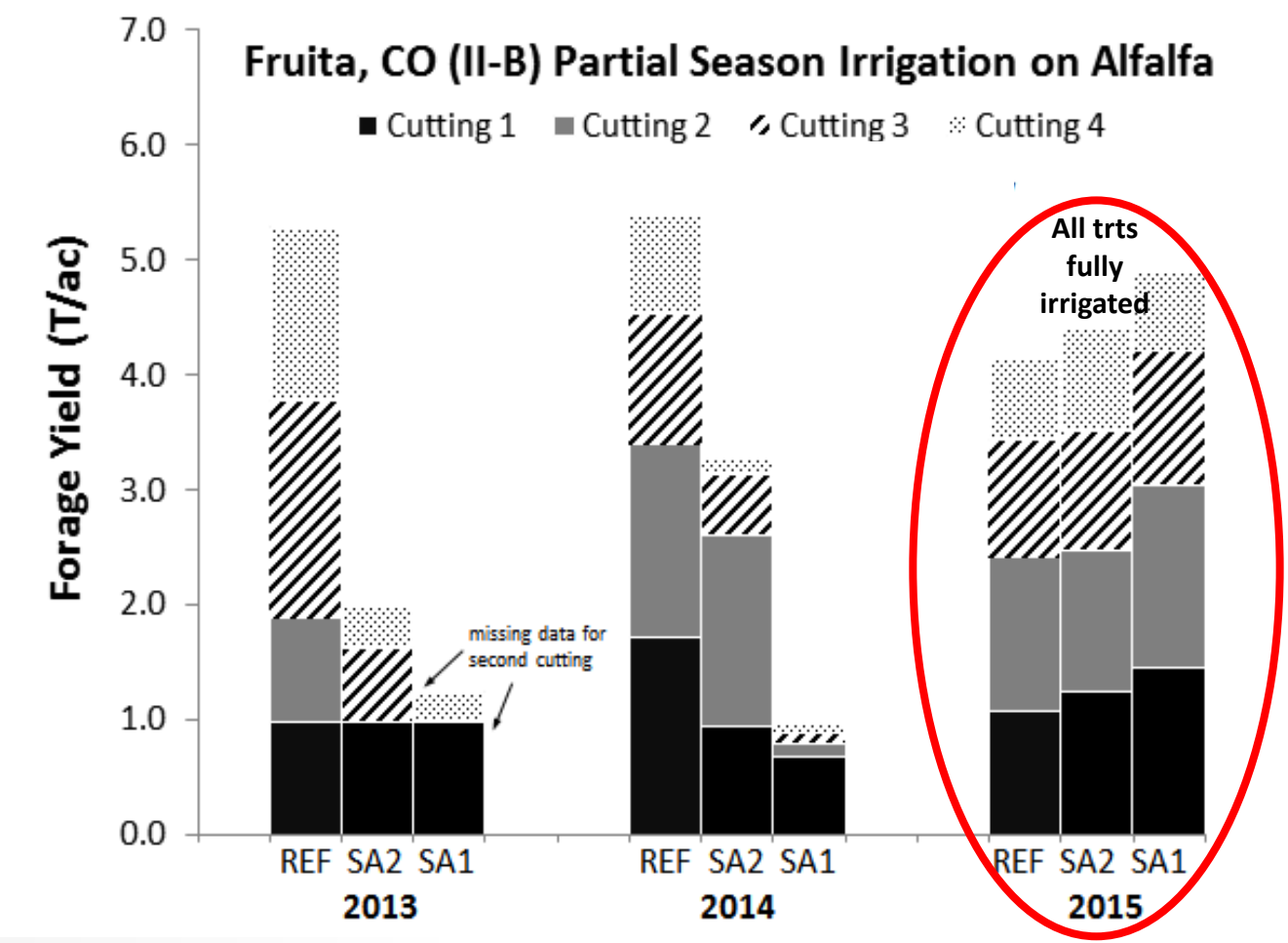
2013

3rd cutting

2014

3rd cutting

Impact of 2 Years of Treatment and 1 Year of Recovery on Alfalfa Yield – Fruita, CO Area



Potential Management Strategies to Reduce Alfalfa Water Use

- Do not water after second cutting
  - 60% total yield in first 2 cuttings in 4-cut system
  - 75% total yield in first 2 cuttings in 3-cut system
  - Forego third cutting, graze any regrowth

- Do not water after first cutting
  - Capitalize on higher first harvest yields
  - Highest water use efficiency (WUE)
  - Potential for small second cutting or graze regrowth
    - Quality incentives

Grass Consumptive Water Use

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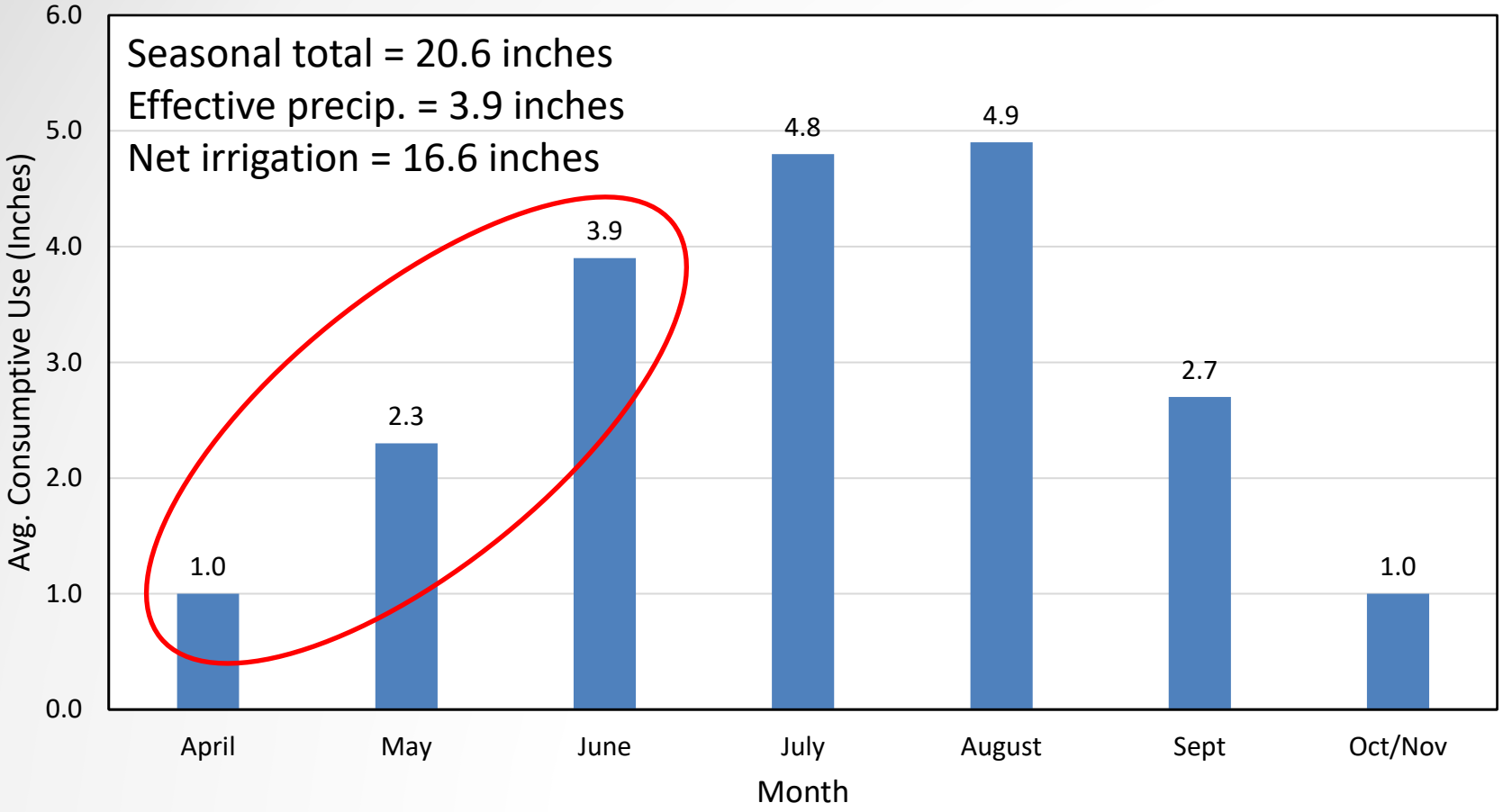
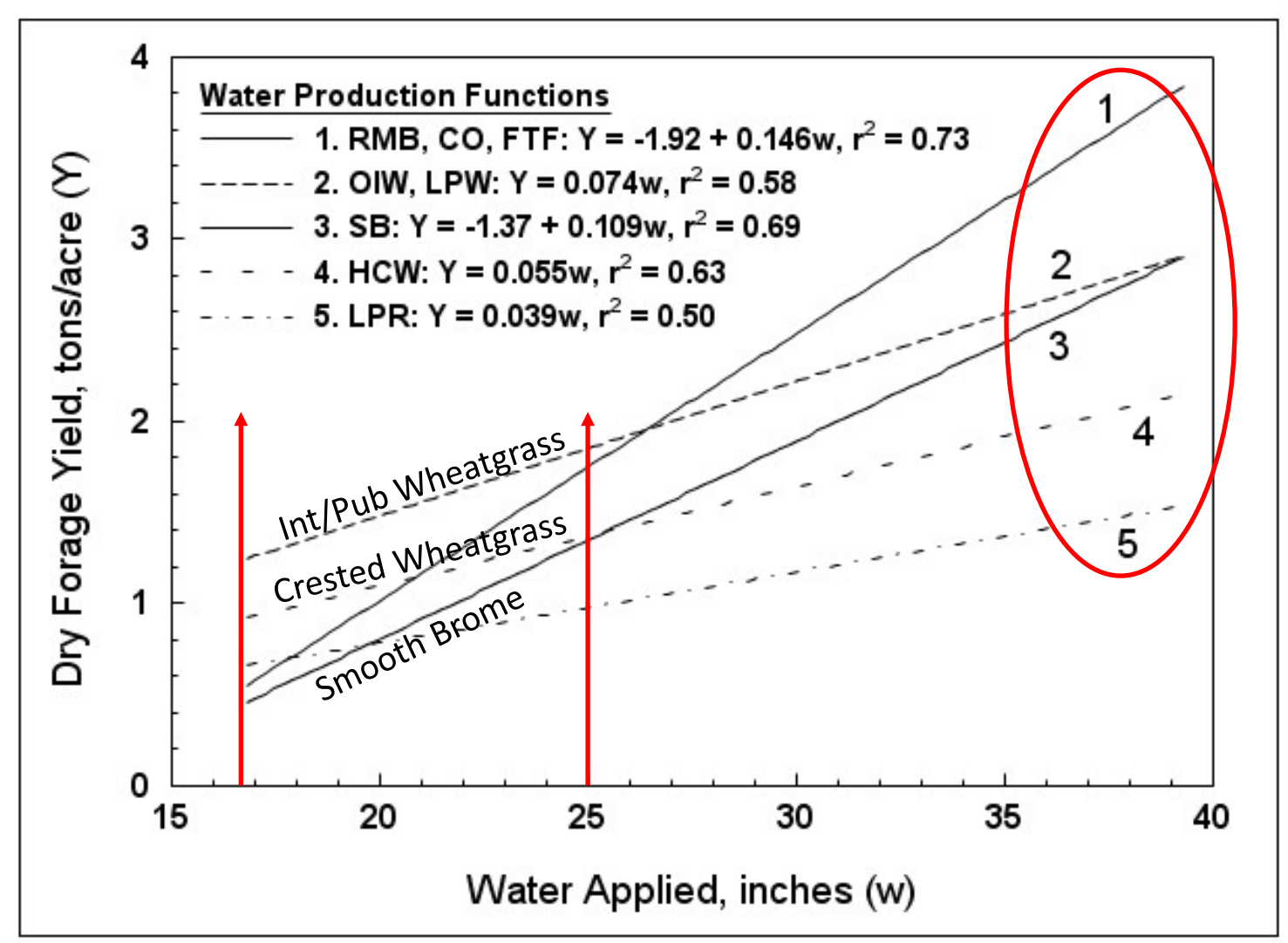
Perennial pasture grass uses between 10 and 15% less water compared to alfalfa

Monthly Pasture Grass Water Use Requirements – Monte Vista

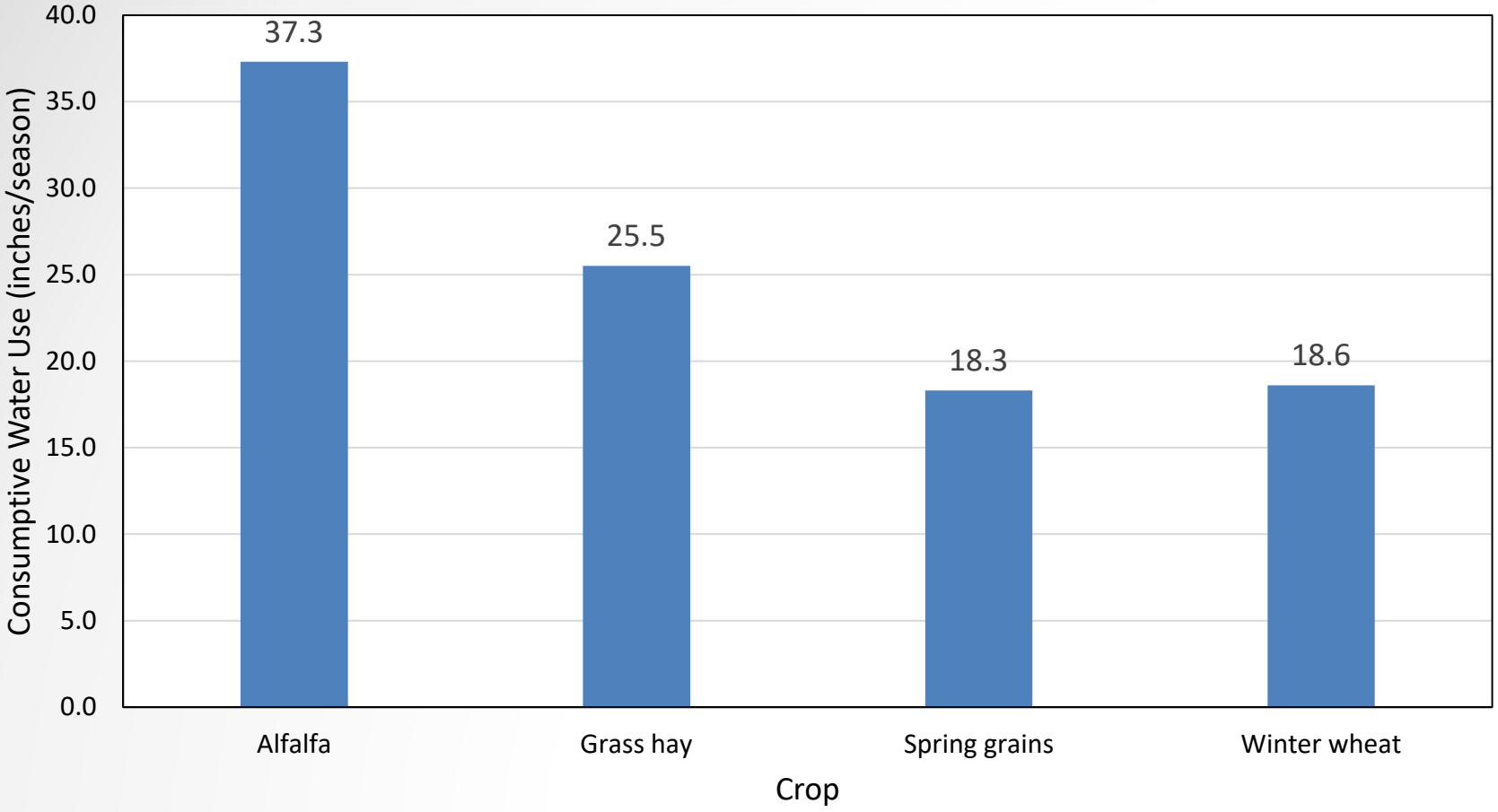


Differences in Yield Response to Applied Water for Different Grass Species



Smeal et al. (2005) – Farmington, NM at 5640 ft elevation

Estimated Seasonal Water Requirement (CU) - Cortez



Schneekloth and Andales (2017) – CSU Extension Fact Sheet No. 4.718

Considerations When Growing Annual Forages

- Warm-season species like millet, sudangrass, and sorghum-sudangrass are more water use efficient, but growth often does not coincide with availability of soil or irrigation water
- Cool-season species are often better choices to take advantage of winter and early spring stored soil moisture as well as early spring runoff water for irrigation
  - Fall planted species like cereal rye and triticale
  - Spring planted species like barley and oats

Considerations When Growing Annual Forages

- Potential for nitrate poisoning
  - Both warm- and cool-season species
    - Sorghums are known nitrate accumulators
  - Especially if you applied any nitrogen fertilizer and crop growth was stunted prior to harvest due to drought /water stress
  - Test the hay before feeding – Does not dissipate
- Potential for prussic acid poisoning
  - Sorghums
  - Primarily associated with grazing, dissipates in hay or silage

Timing of Water Stress in Limited Irrigation is Critical for Grain Crops

- Stress during early vegetative growth can increase root allocation, reduce crop height, but may have less effect on total yield compared to stress applied during reproduction

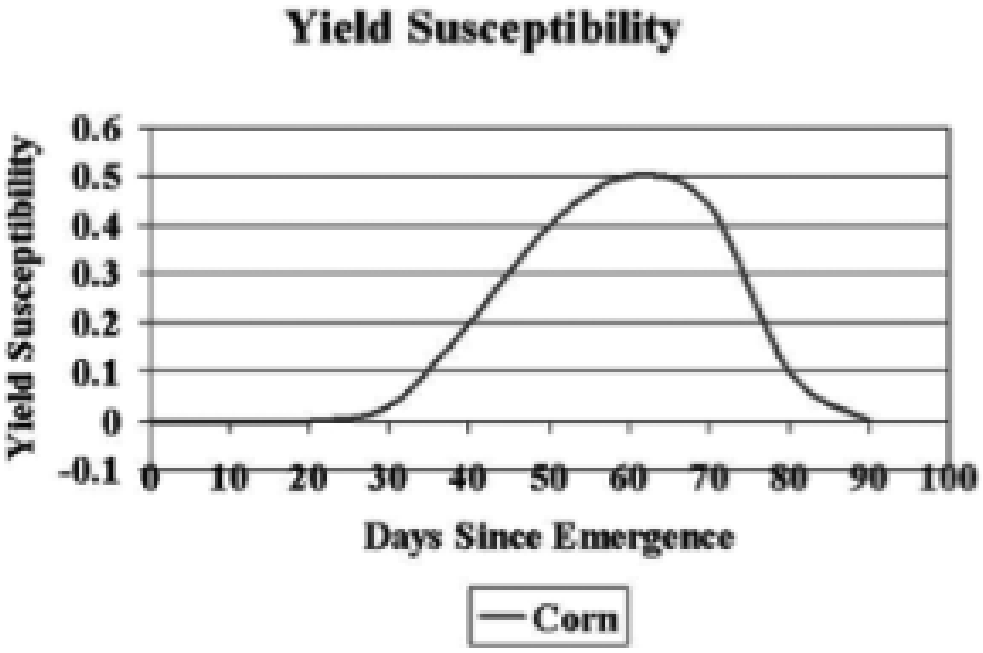


Figure 3: Yield susceptibility to water stress for corn (Sudar et al., 1981).

From Schneekloth et al. 2009, Limited Irrigation Factsheet

Effects of Irrigation on Corn Yields under Severe Drought – Scandia, KS

Average Yield (bu/acre)			
Irrigation Timing	1991*	1980-1991	1991 Irrigation Dates
No Irrigation	3	56	None
Tassel	124	141	7/8
Tassel and 1 Week After Tassel	148	159	7/8, 7/15
Tassel and 1 and 2 Weeks After Tassel	155	164	7/8, 7/15, 7/25
65% Depletion	159	172	7/1, 7/23

Table modified from Corn Production Handbook C-560 2007, Kansas State University Extension.
*1991 demonstrates a year of severe drought prior to pollination.

Summary

- Partial-season irrigation of alfalfa offers potential to save water while maintaining a partial hay crop
  - In previous trials, stopping irrigation after the 2nd harvest was lower risk, but recovery and stand health were excellent when irrigation was stopped after the 1st harvest
- Plant drought tolerant perennial grasses like intermediate and pubescent wheatgrass
  - Irrigate only through first harvest, then let go dormant
- For hay, cool-season annuals may offer better opportunities than warm-season species
- When producing grain crops, the reproductive stage is the most critical time to fully irrigate
  - Plants can be stressed early during vegetative growth without major impacts on grain yield