Management Options for Forages to Reduce Water Use

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Forage vs Grain Crops

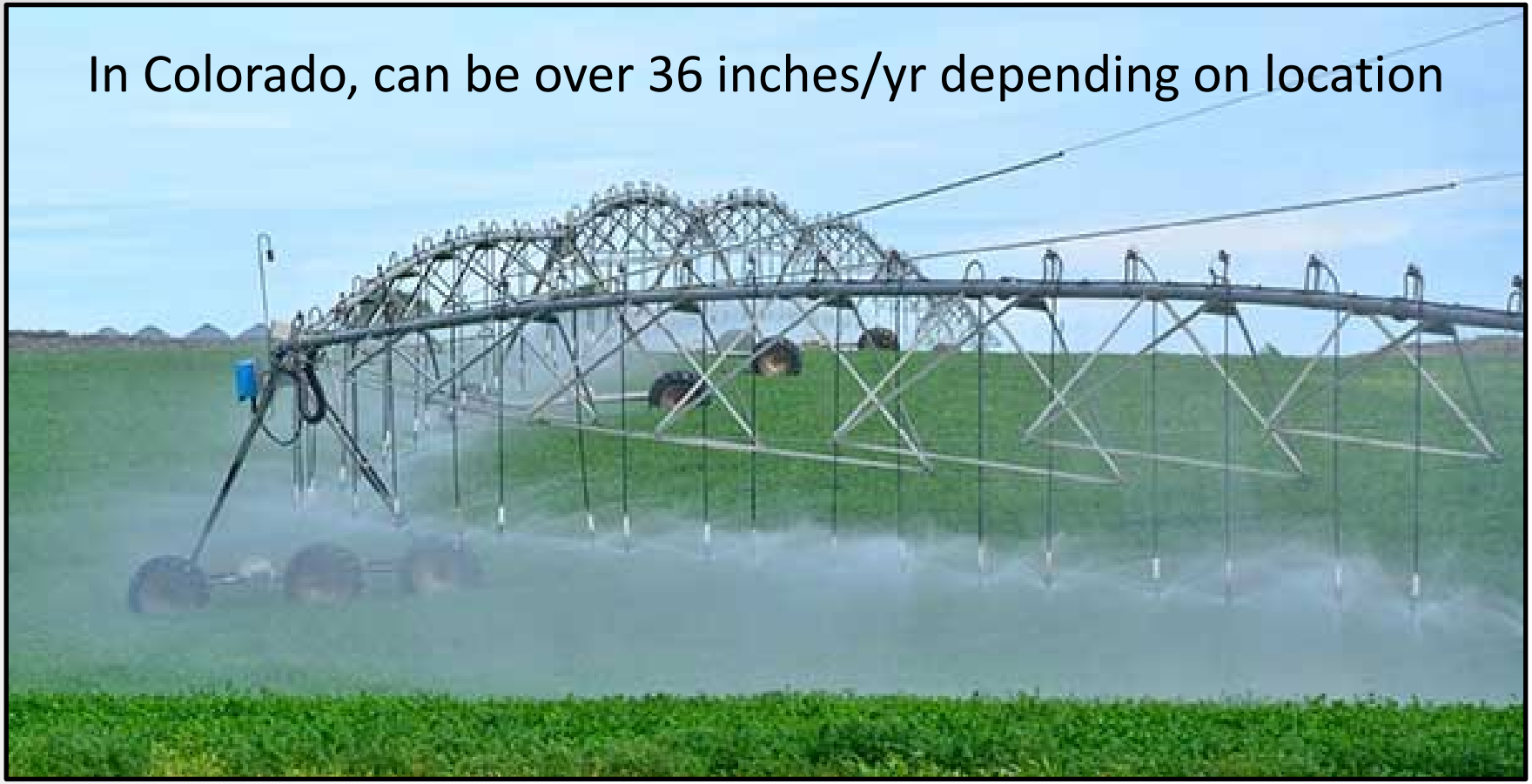
- Unlike grain crops, generally obtain some level of production (i.e., economic return)
- Can be hayed or grazed
  - Grazing further reduces input costs

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

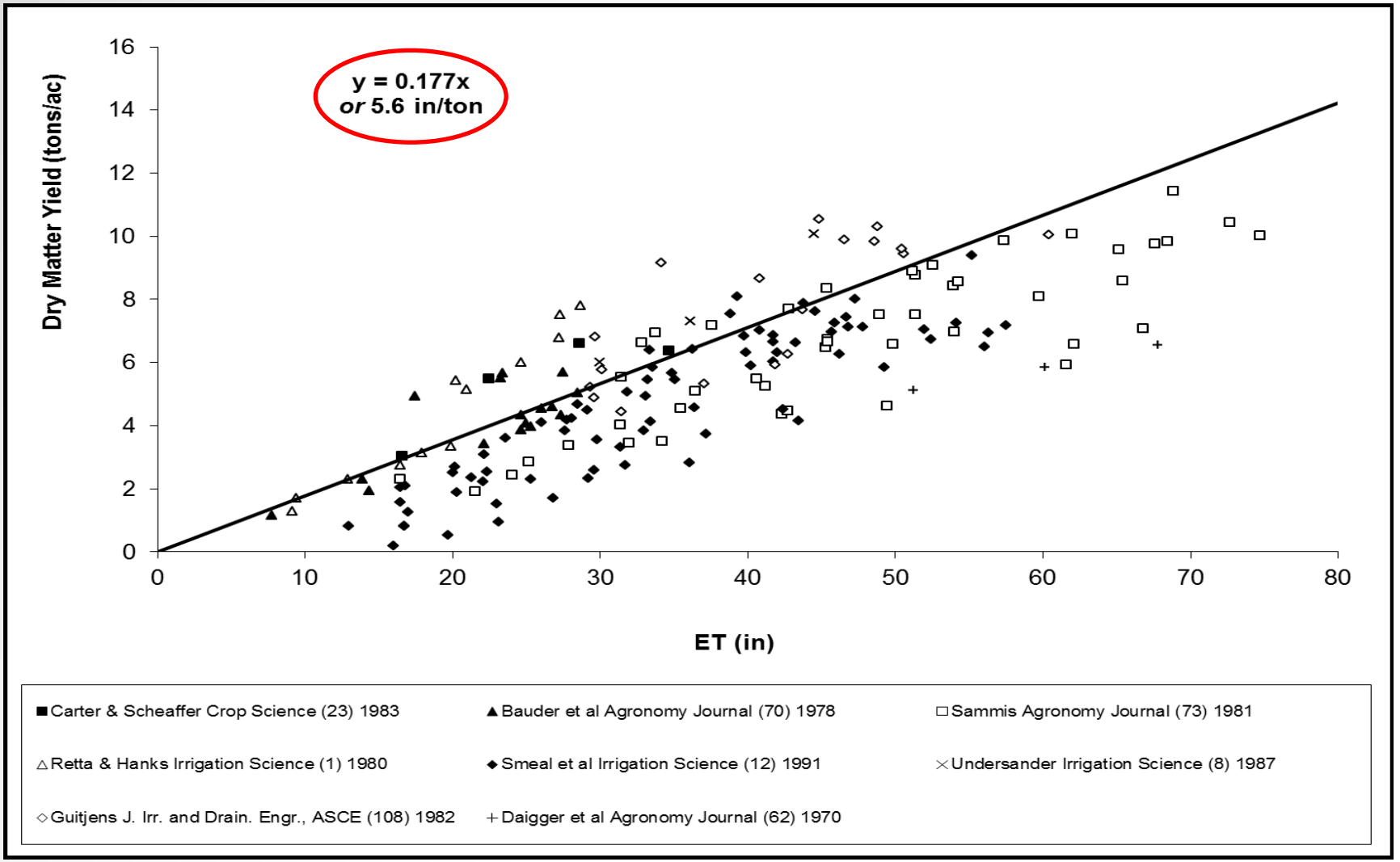
But gets a bad name for its high-water use!



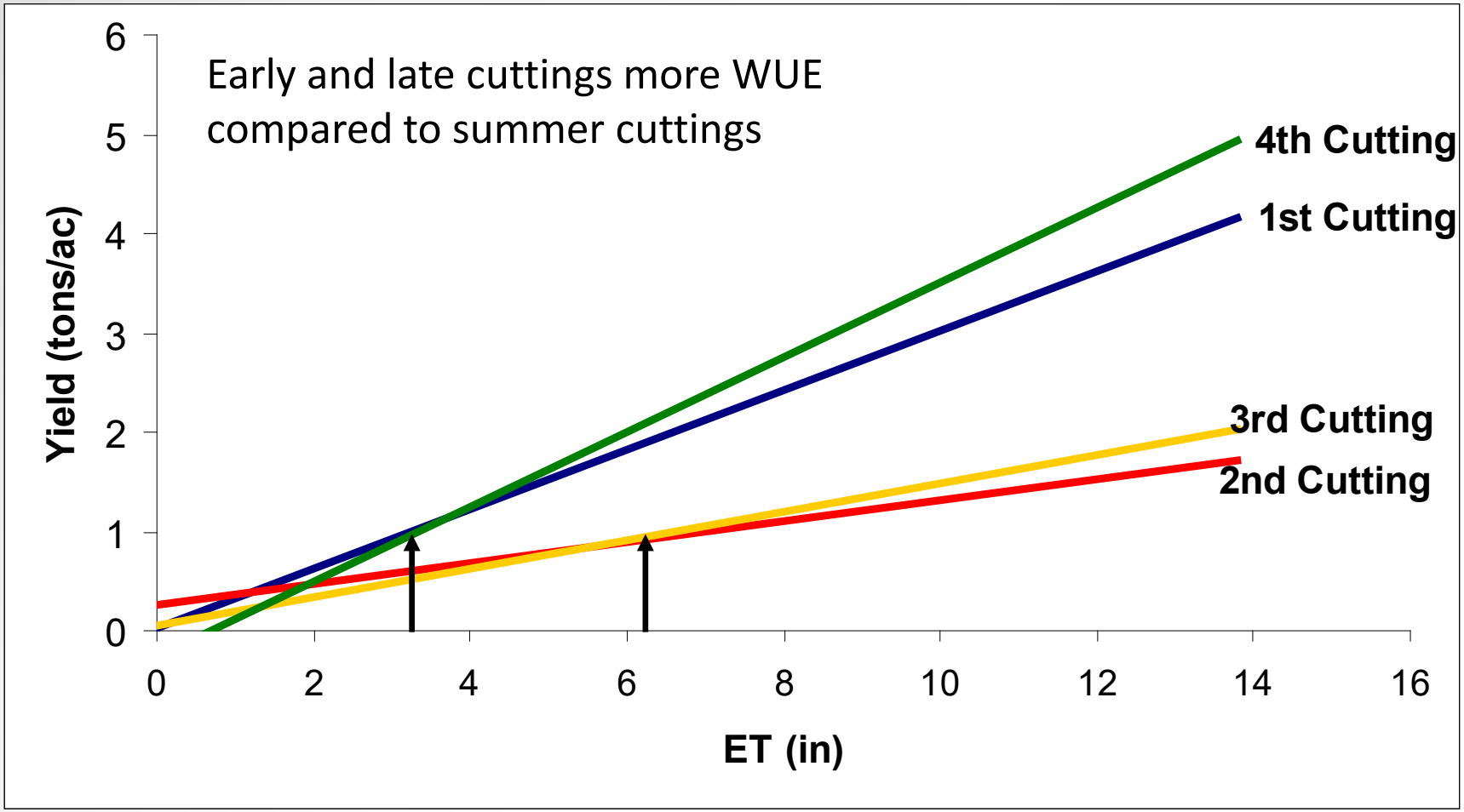
Alfalfa Consumptive Water Use

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



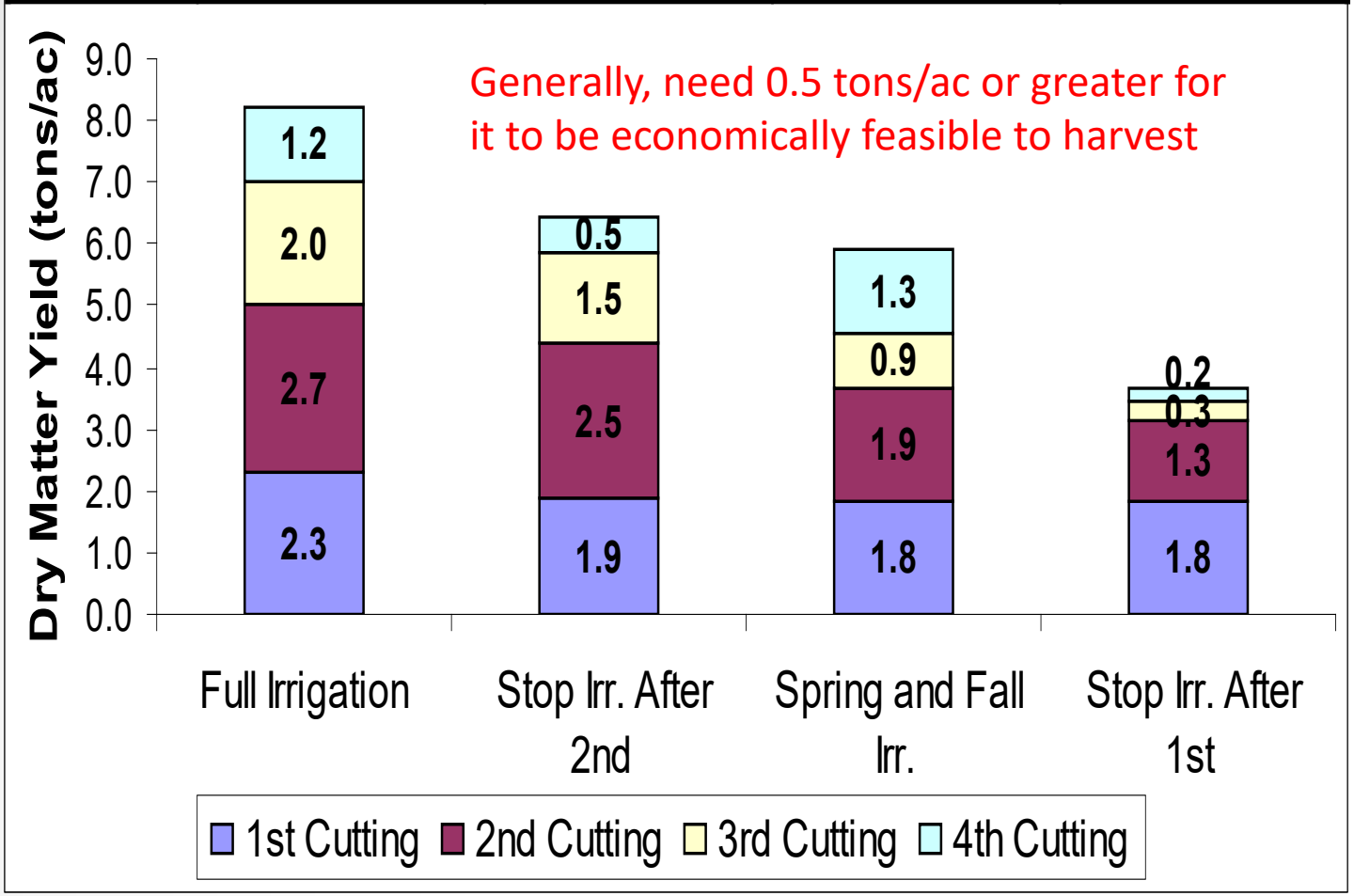
(Adapted from Undersander, 1987)

Strategies for Reducing Water Use by Alfalfa

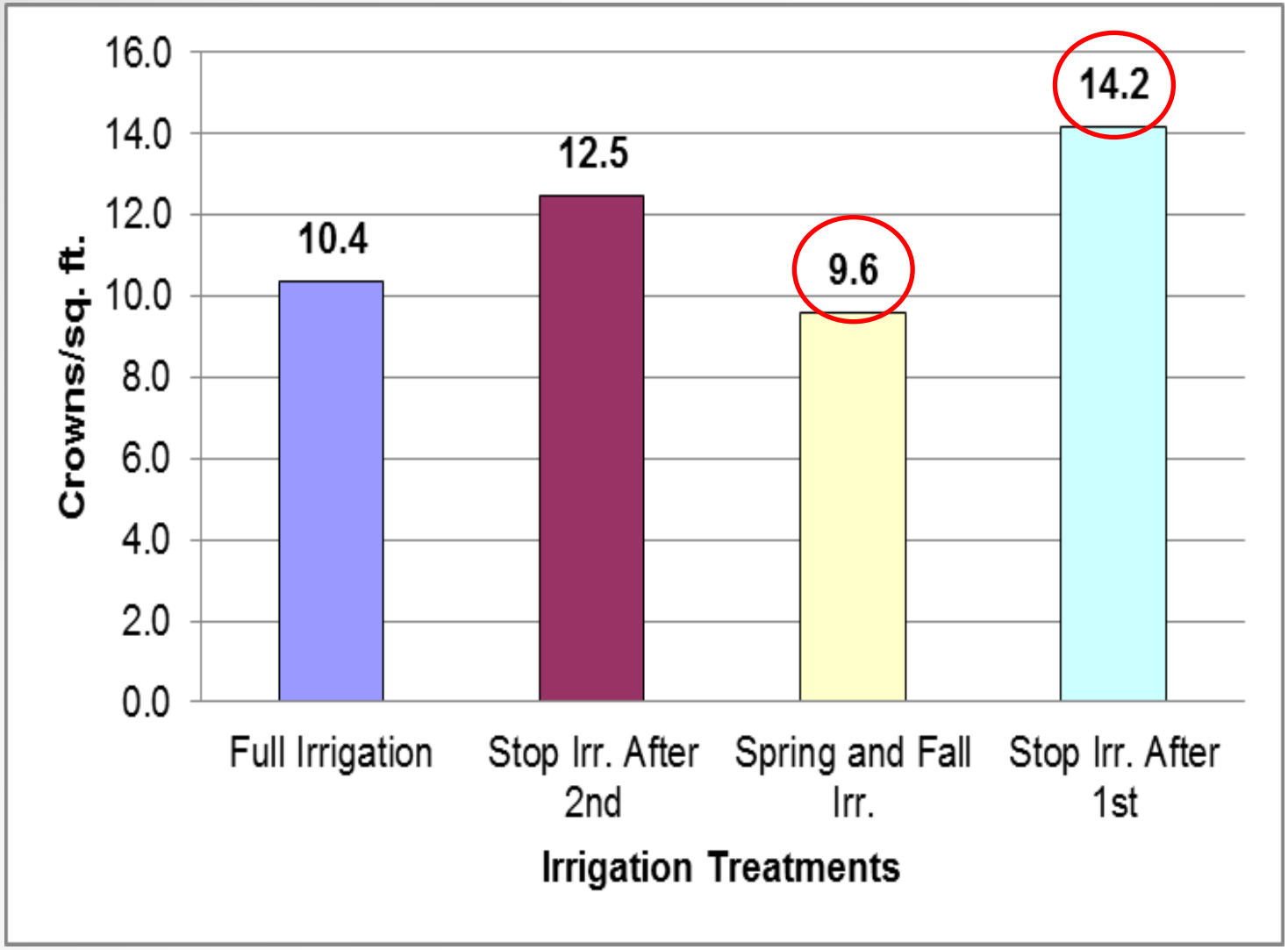
- Limited or Deficit Irrigation
  - Applying less irrigation water than required for full ET/yield
- Seasonal-Deficit or Partial-Season Irrigation
  - Concentrate irrigation during the spring and limiting or withholding water during hotter periods of the growing season
  - Improves water use efficiency (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

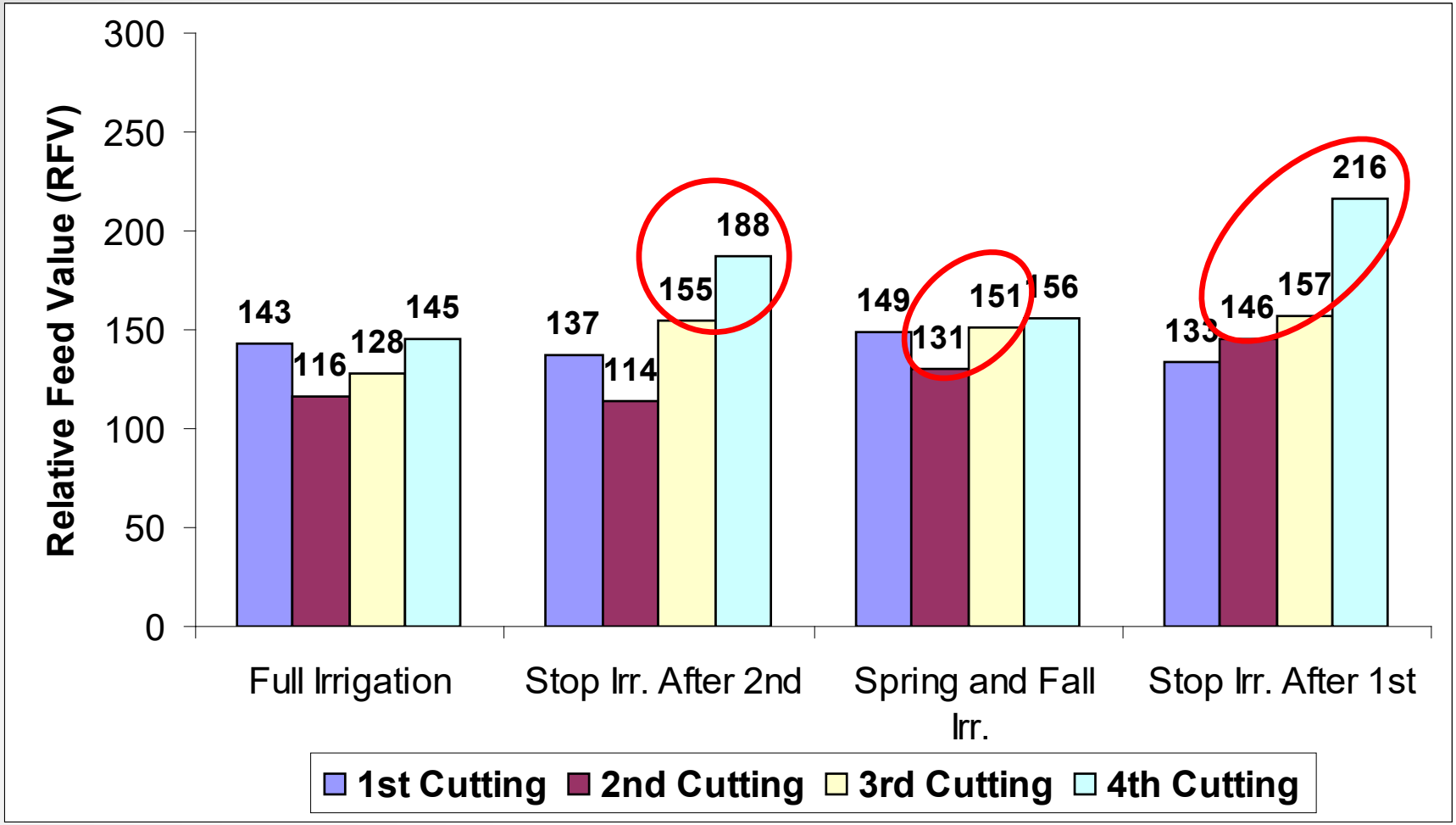
Irrigation	24.0”	12.0”	11.5”	3.6”
Total Yield	8.2 tons/ac	6.4 tons/ac	5.9 tons/ac	3.6 tons/ac



2007 Average Crown Density



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



WCRC – Fruita, CO

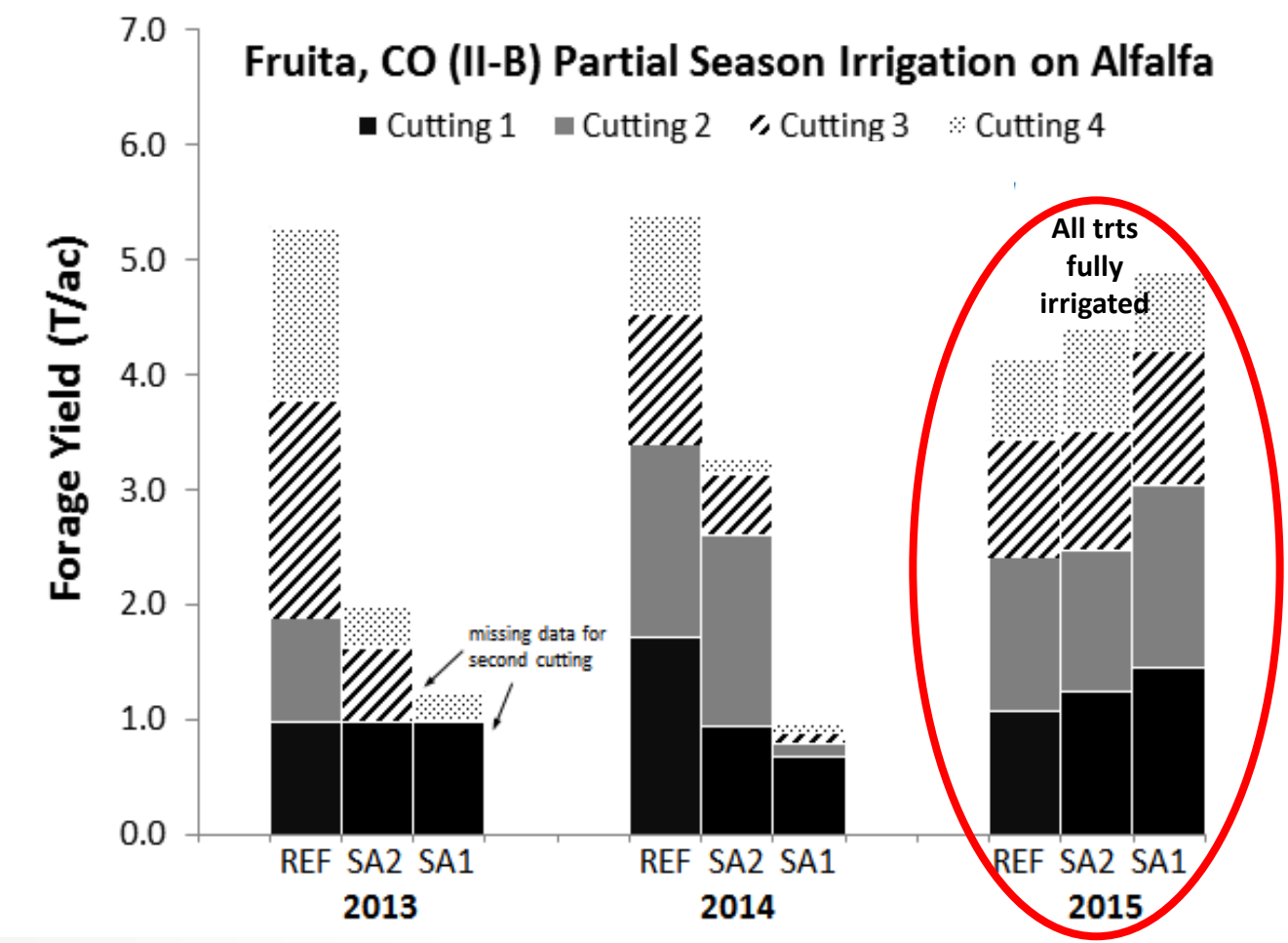
2013

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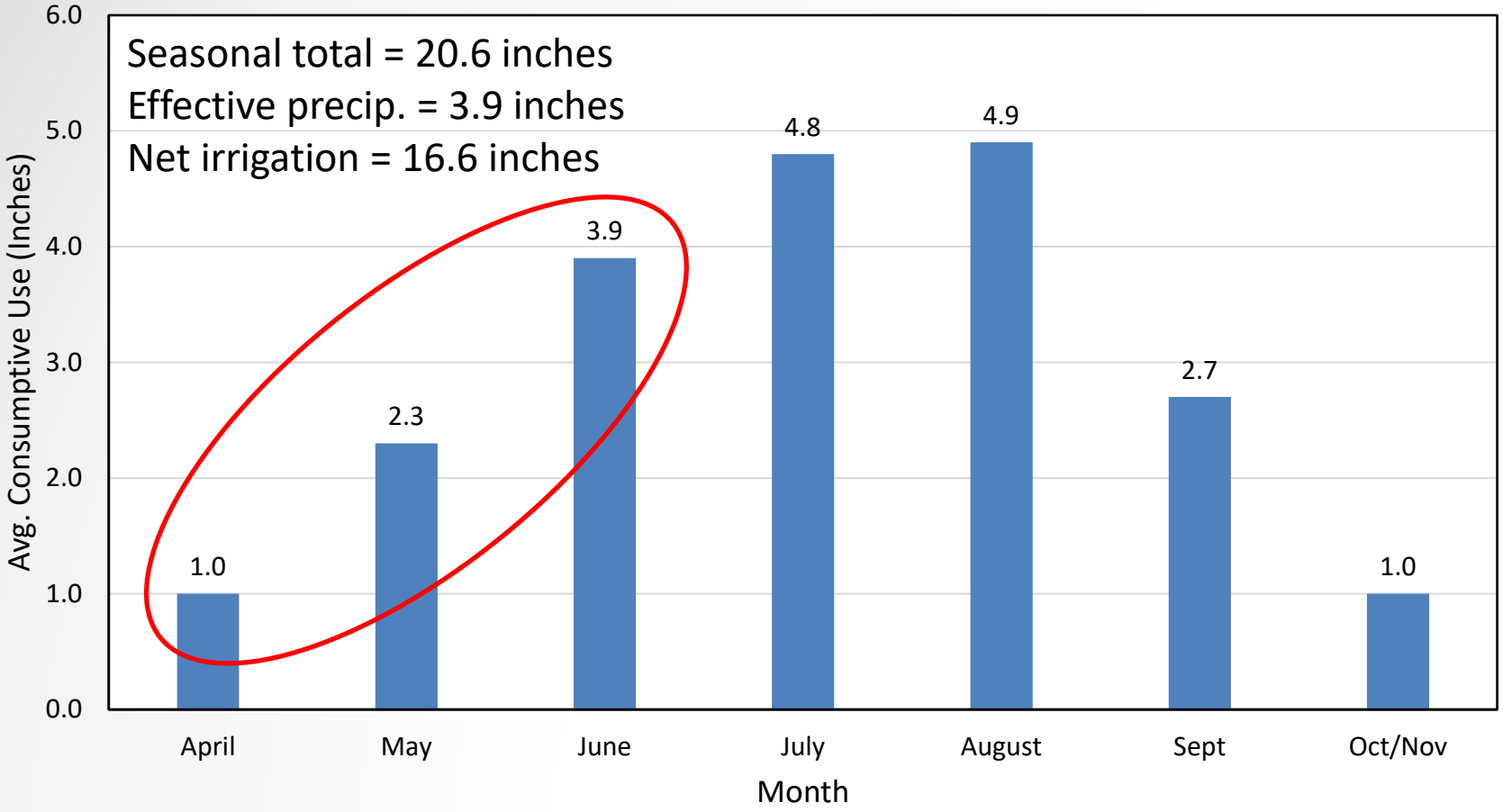
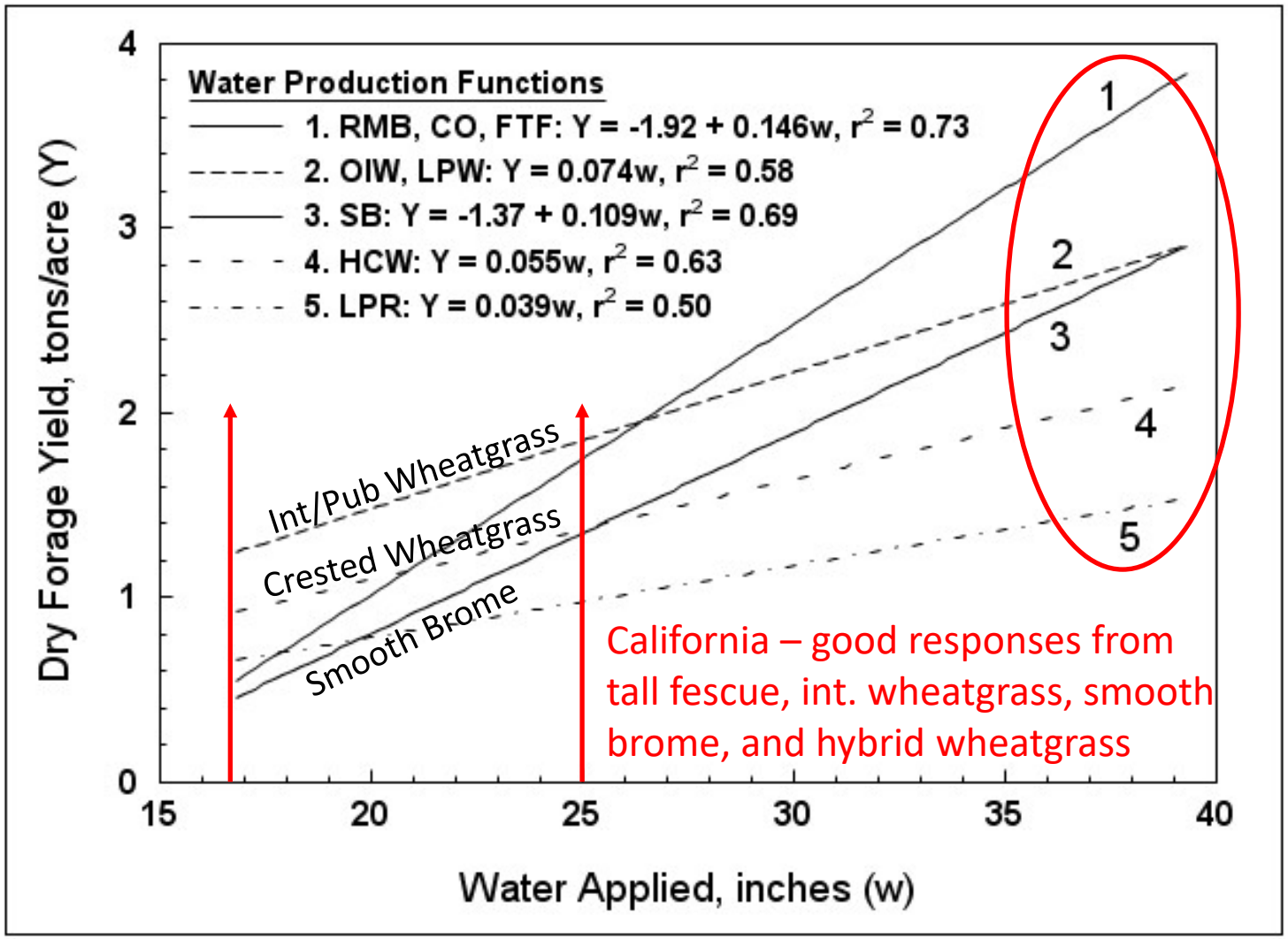
Perennial pasture grass uses between 10 and 15% less water compared to alfalfa

Monthly Pasture Grass Water Use Requirements – Monte Vista



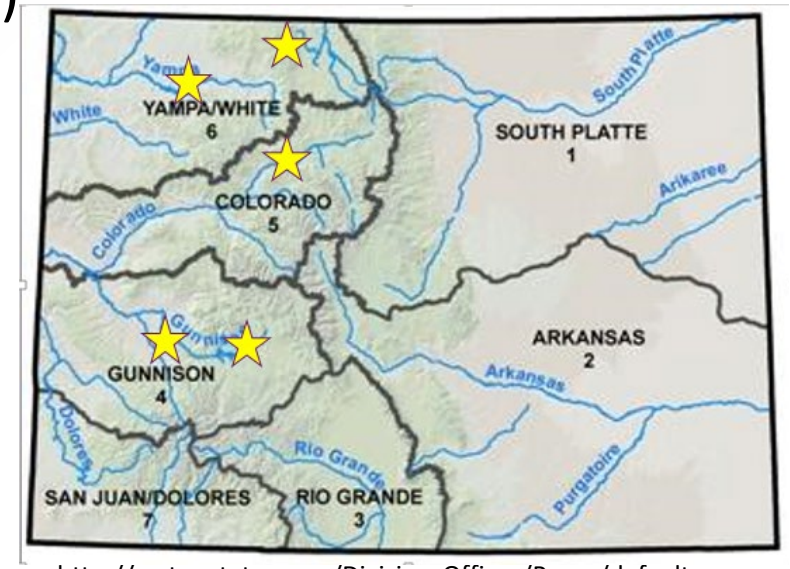
Differences in Yield Response to Applied Water for Different Grass Species



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

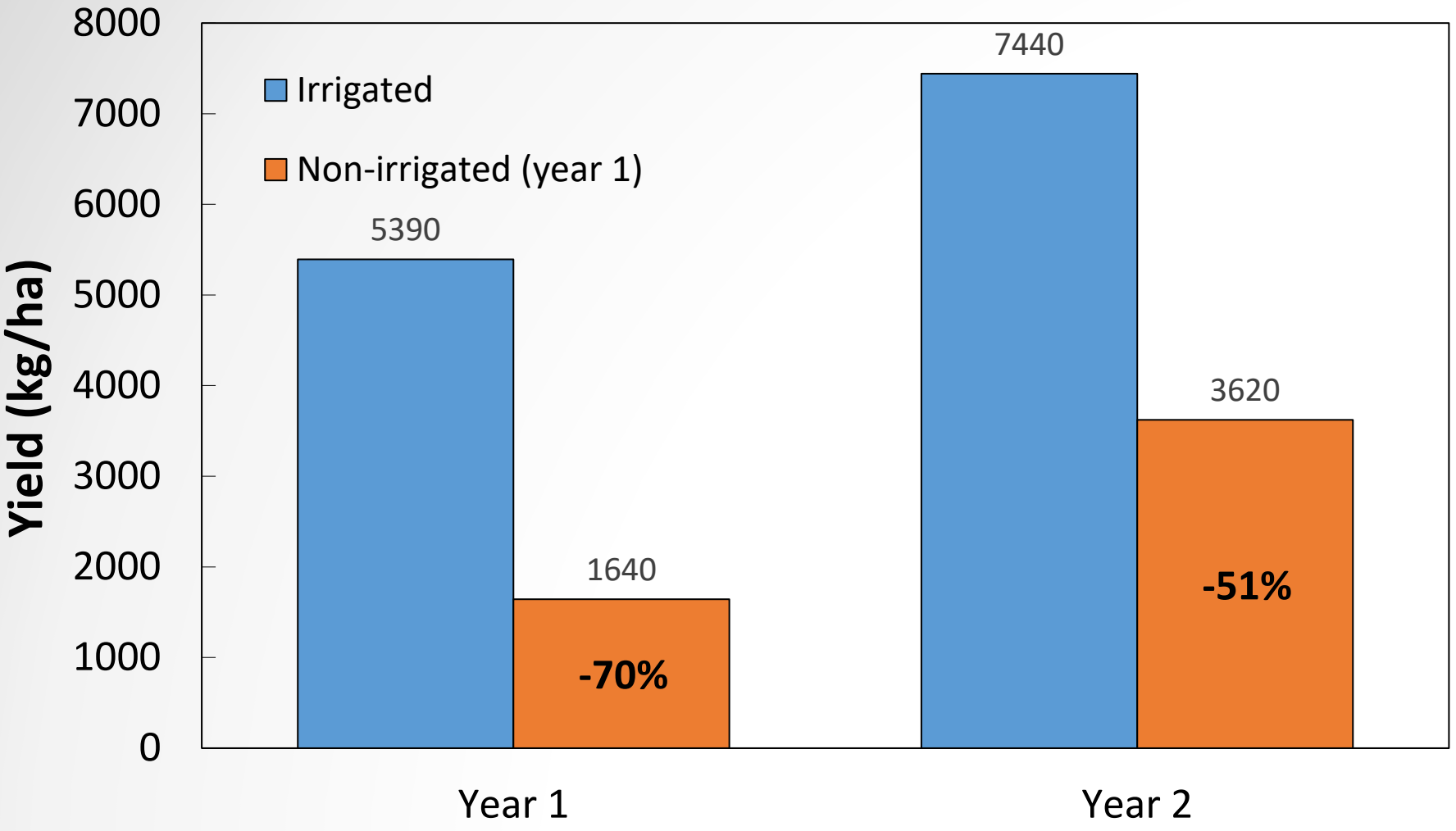
Grass Hayfield Fallowing Trial

- Hayden, CO (Carpenter Ranch)
  - Upper Yampa
- Steamboat Lake, CO (Fetcher Ranch)
  - Upper Yampa
- Kremmling, CO (Blue Valley Ranch)
  - Upper Colorado
- Gunnison, CO (Trampe Ranch)
  - Upper Gunnison
- Cimarron, CO
  - Gunnison
- Doyleville, CO (Razor Creek Ranch)
  - Upper Gunnison



http://water.state.co.us/DivisionsOffices/Pages/default.aspx

Average Grass Dry Matter Yield



Average Grass Forage Quality

Treatment	CP (%)	NDF (%)
Year 1		
Irrigated	7.6	54.9
Non-irrigated	10.8	51.9
Year 2		
Irrigated	8.6	58.0
Non-irrigated (yr 1)	8.0	53.3

Summary of Grass Responses

- Yield
  - Reductions averaged **70%** (range 24% to 93%) during the year of complete fallow
  - Yields still **51%** (range 13% to 83%) below fully irrigated after one year of recovery
  - For the fields with 2 yrs of recovery data, yields were only **7%** (range 0% to 13%) lower than the control

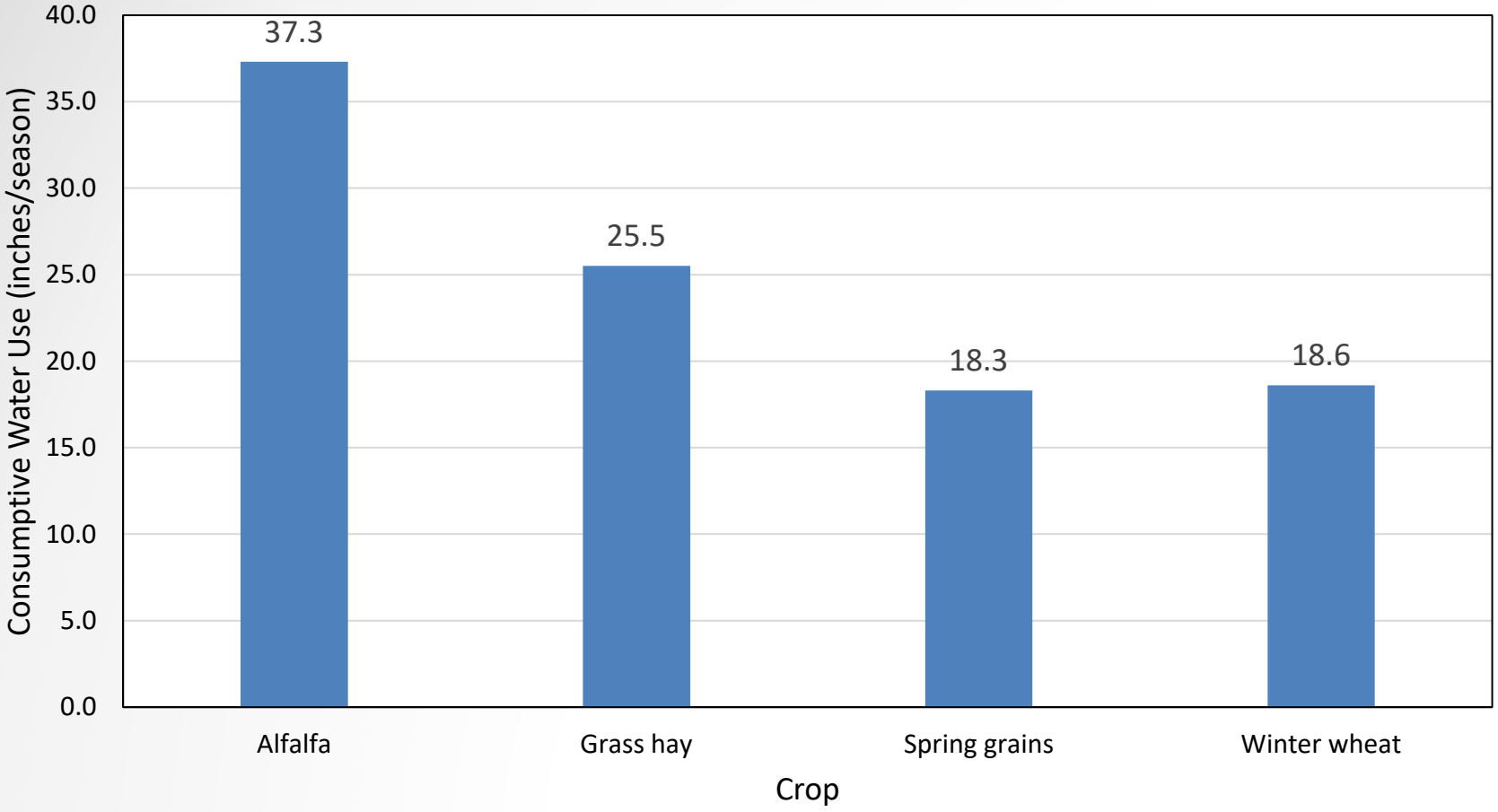
Summary of Grass Responses

- Forage Quality
  - In year 1, neutral detergent fiber (NDF) in fallowed plots was **5.5%** lower (54.9 vs 51.9%) while crude protein (CP) content was **42%** greater (7.6 vs 10.8%) than the control, both indicating higher quality
  - In year 2, NDF in fallowed plots was still **8%** lower (58.0 vs 53.3%) while CP did not differ significantly (8.6 vs 8.0%) from the control

Management Implications

- Grass Hayfields
  - Although there was variability among sites and years, producers can expect significant yield reductions in both the fallow year and 1st year of recovery
  - Based on the data collected to date, it appears that most grass hayfields will recover to near normal productivity following 2 yrs of full irrigation
  - Although producers can expect an increase in forage quality (lower fiber, higher CP) which is a positive outcome from an animal nutrition standpoint, it does not come close to offsetting the loss in production

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

Summary

- Partial-season irrigation of alfalfa offers potential to conserve 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
- Perennial grasses do not recover as quickly as alfalfa when subjected to no or reduced irrigation
  - Average of 50% reduction when returned to full irrigation in year 2
  - Close to full production after 2 years of recovery (i.e., full irrigation)

Summary

- Plant drought tolerant perennial grasses like int/pub wheatgrass, hybrid wheatgrass, smooth brome, and tall fescue
  - Irrigate only through first harvest, then let go dormant
- Annual forages offer flexibility
  - Rotate between forage and grain crop
  - Option to totally fallow if conditions are not conducive for planting
  - For hay, cool-season annuals may offer better opportunities than warm-season species