Alfalfa, Corn and Blackeye Irrigation Strategies for a Short-Water Year

C. A. Frate
UCCE Farm Advisor
Tulare County

Basic Rule!

To get the most of your applied water, everything else needs to be done right:

ground prep
good variety
seeding depth
plant population
nutrition
etc.

ET* of Alfalfa, Corn and Blackeyes In Southern SJV

Approximately*:

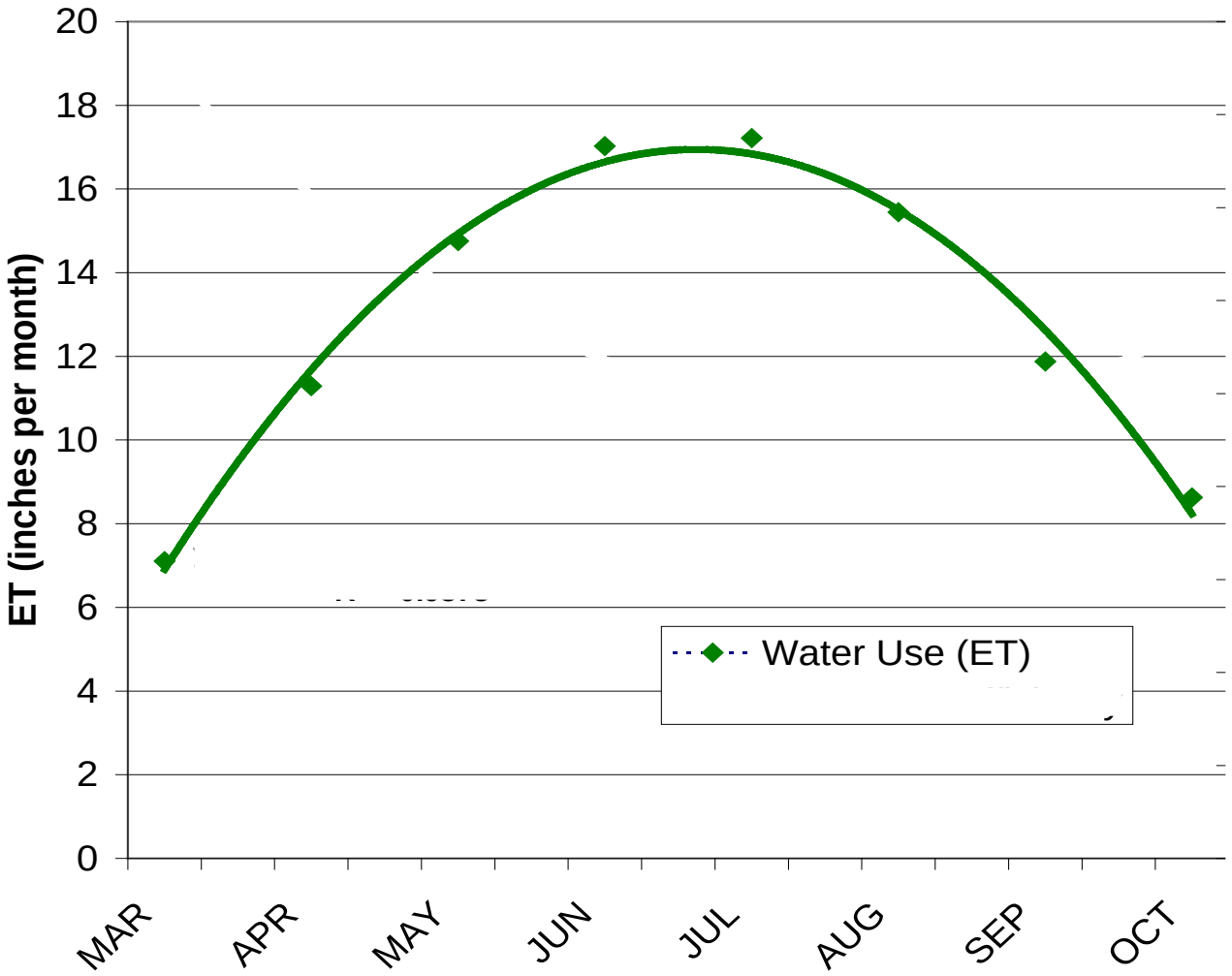
Alfalfa	**50 – 54 acre-in (and higher)**
Corn	**23 – 27 acre-in** Depends on planting data and variety maturity class, silage vs grain
Blackeyes	**22 – 27 acre-in**

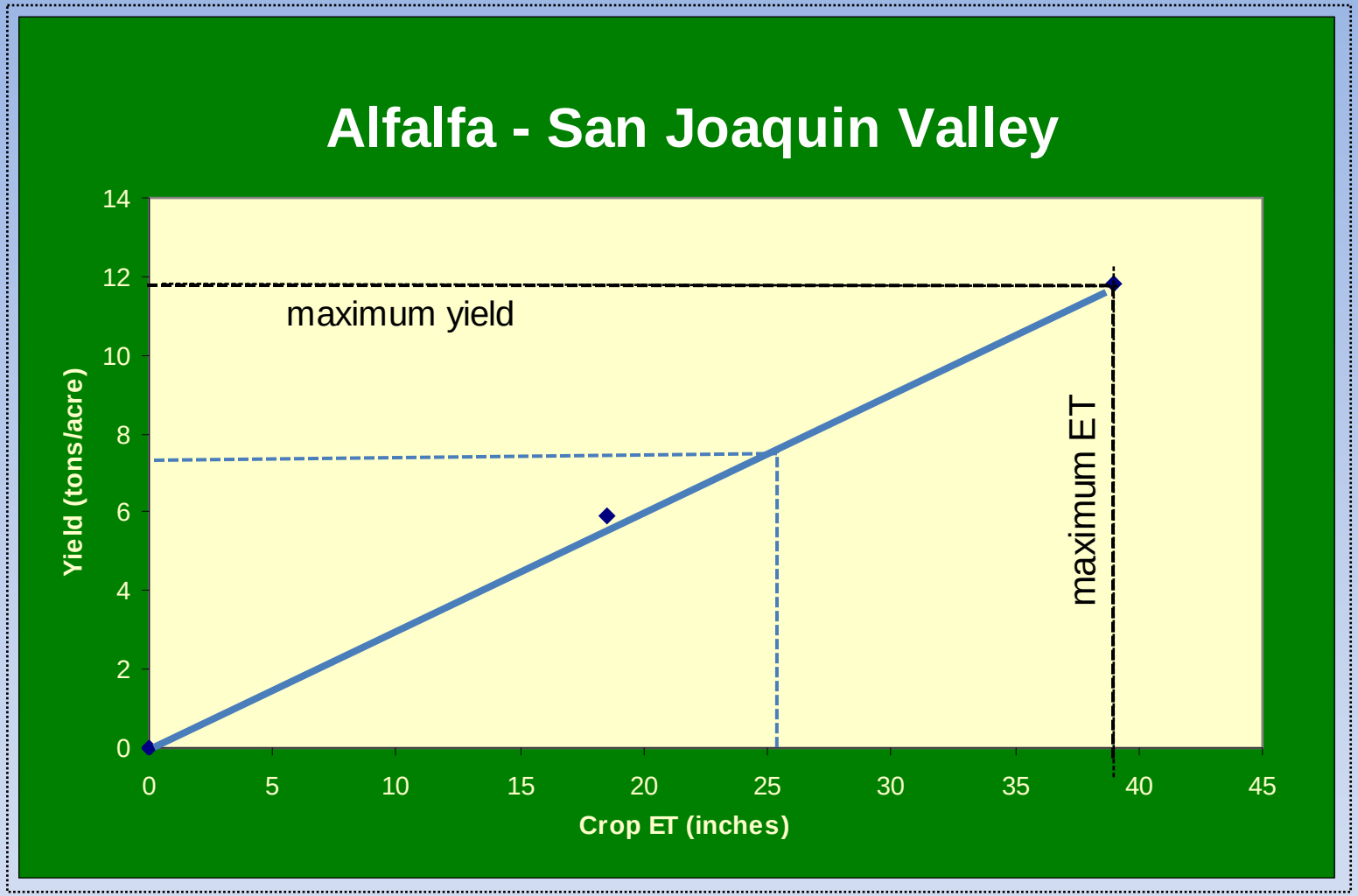
*Depends on the year (hot or hotter, winds, humidity), variety

This does not take into account the inefficiencies of irrigation

ET = evapotranspiration = amount of water a crop uses when it is adequately watered.

Seasonal Changes in Alfalfa ET





For alfalfa hay, we harvest the vegetative portion – directly related to water use. Any water stress reduces yield.

Potential Strategies when water is short in alfalfa:

Irrigate as usual & hope water lasts

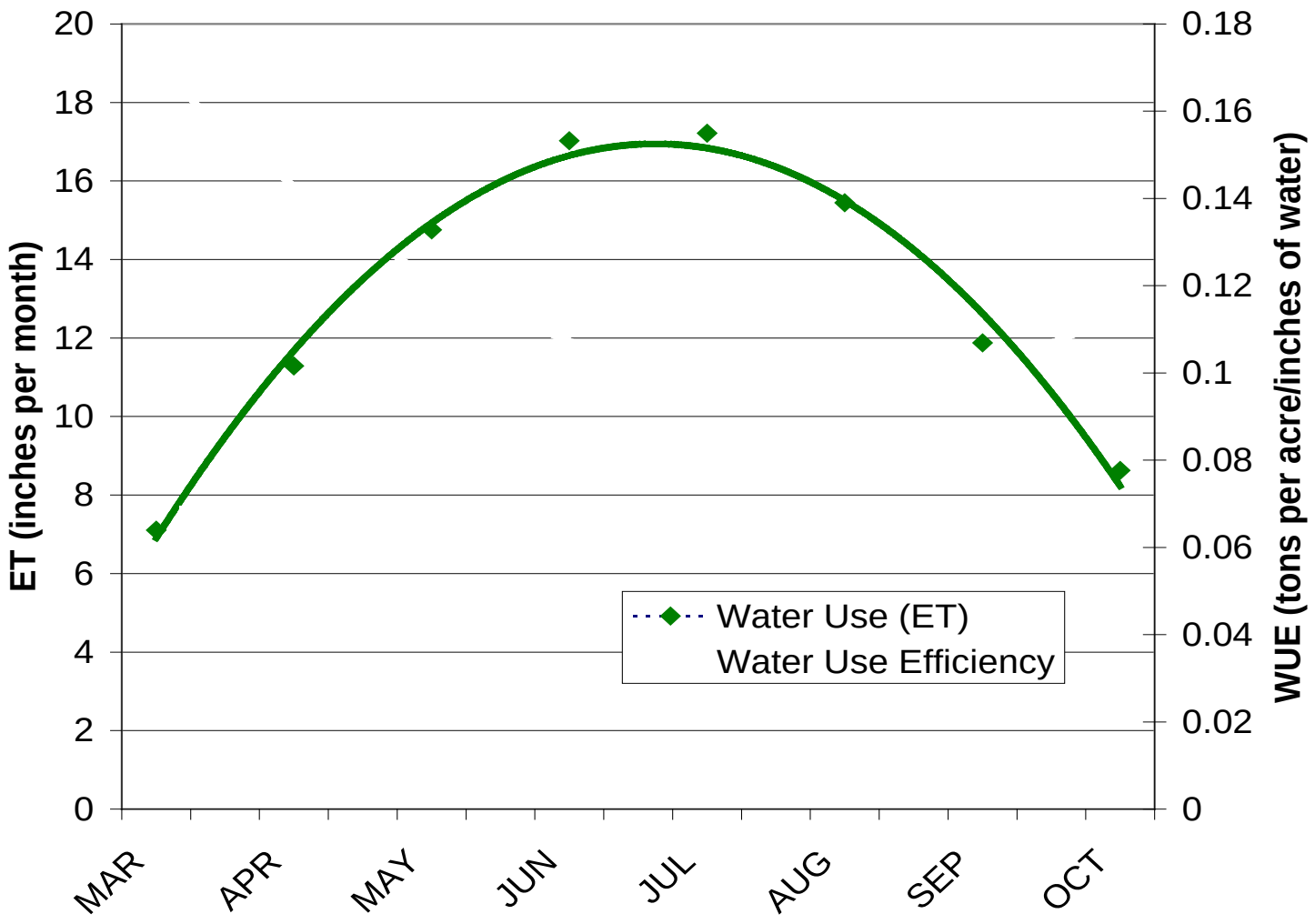
Reduce irrigation to just once/cutting

Reduce acreage up front

Stop irrigating in summer months
"cut-off" strategy
- one month
- multiple months

No water available or not enough to keep up with demands of all crops

Seasonal Changes in Alfalfa ET and Water Use Efficiency



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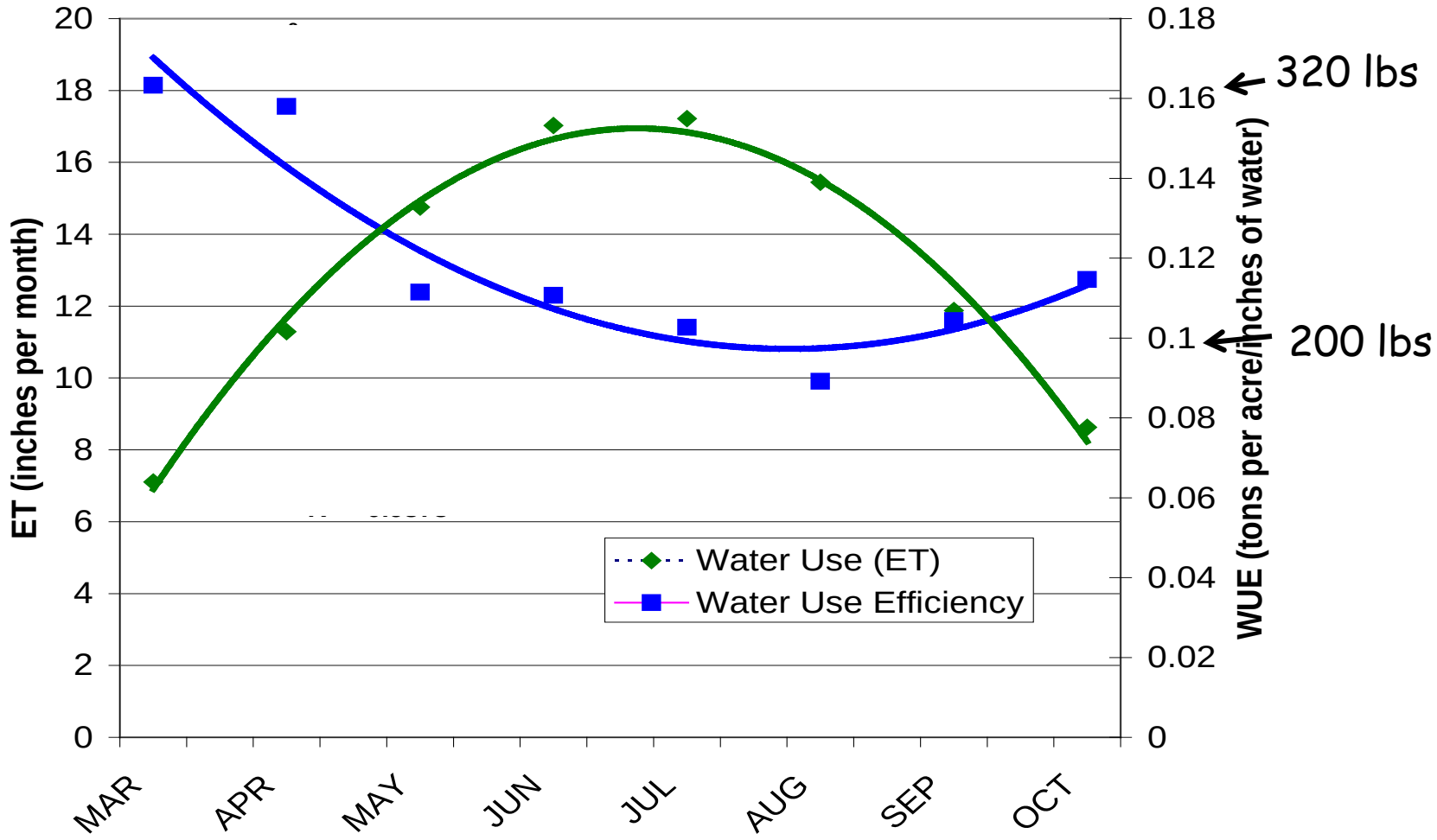
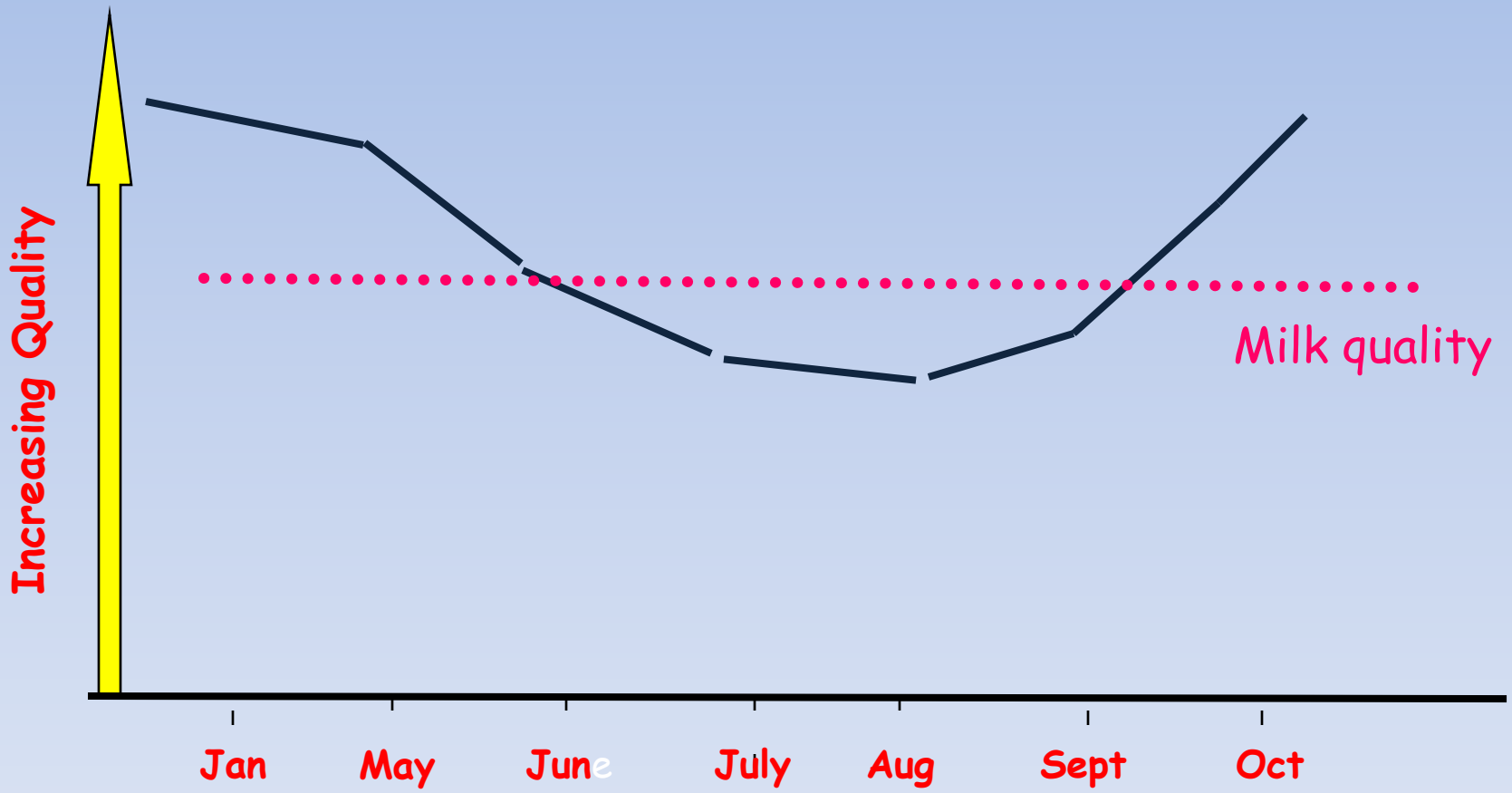
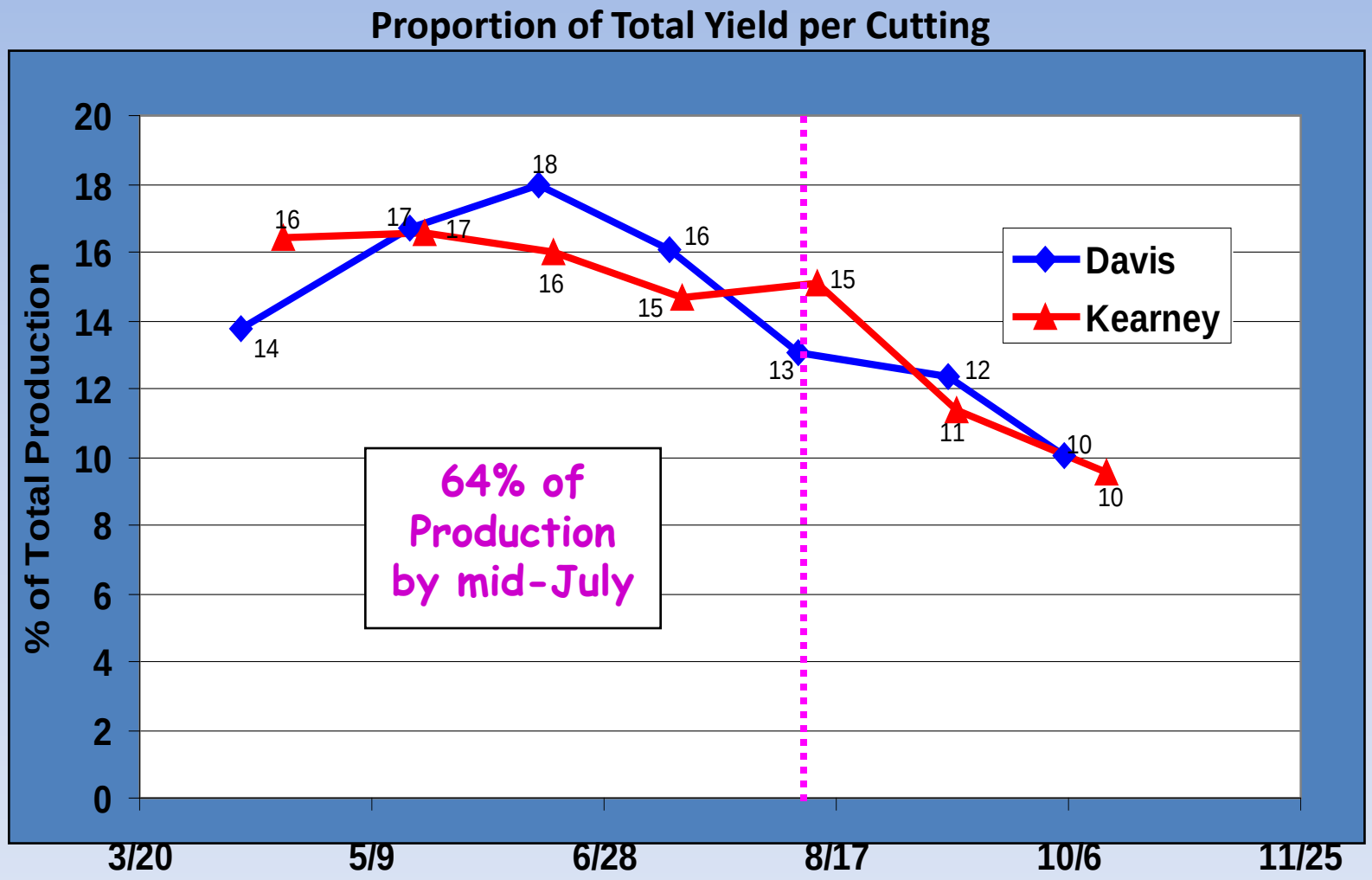


Impact of season on alfalfa quality



Seasonal Yield Patterns



Research on Summer Cut-off Strategy

- Fresno & Kern - Central Valley
- Imperial Valley - Low Desert
- Arizona – Low and High Desert
- Blythe – Low Desert
- Scott Valley – Intermountain

Research on Summer Cut-off Strategy

Didn't irrigate after June or July irrigation. In some treatments irrigation is resumed in fall and in others it is in winter (rain) or the next fall (irrigation).

Research on Summer Cut-off Strategy

Except in cases of very sandy soils, extreme heat, salty soils – alfalfa seems to come back without harm – only reduced yields for unwatered cuttings.

Research on Summer Cut-off Strategy

When field is re-irrigated after cutoff, regrowth is delayed by 7-10 days.

Give the extra time before harvest.

Comparing Costs

Control

Income

higher yield

Expenses

water costs
irrigation labor
harvest costs
weed or insect control

Cut-off Treatments

Income

reduced or none

Expenses

none

Caution!

- Age of stand
- Very sandy soils and very high temperatures (AZ, Imperial Valley studies – stands lost)
- High salts -Imperial Valley
- Insect or other stresses
- Cracking soils – in some cases have been a problem for stand survival

http://ucmanagedrought.ucdavis.edu/

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UC drought management web sit

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Introduction

When there is insufficient irrigation water to meet the water demands of a crop, the available irrigation water must be applied in the most efficient manner possible.

There are available strategies for maximizing irrigation water efficiency.

Agriculture

- Deficit irrigation strategies may be available to make the best use of limited water supplies. Click here for Crop Irrigation Strategies for almonds, pistachios, stone fruit, walnuts, alfalfa, olives, winegrapes, and corn.
- Quality Irrigation Scheduling can be critical to efficient irrigation water use. Evapotranspiration (ET) irrigation scheduling, soil moisture monitoring, and plant-based irrigation scheduling are all discussed.

http://ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/

http://alfalfa.ucdavis.edu/

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Quick Links

- UC Alfalfa & Forage News Blog
- World Ag Expo Forage Challenge
- Plot Plan Creator v1.3
- Alfalfa Educational Fact Sheet
- Irrigated Alfalfa Manual
- UC IPM Pest Management
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Producing Alfalfa

- General Information
- Stand Establishment
- Variety Selection
- Irrigation
- Soil Fertility
- Weed Management
- Insect Management
- Vertebrate Pest Management
- Diseases

News

2013 Western Alfalfa & Forage Symposium

If you missed the 2013 Western Alfalfa & Forage Symposium this year, you can see the papers and videos from the conference in the leisure of your home! The conference was held in Reno, NV from December 11–13, 2013, sponsored by the Cooperative Extension Services of AZ, CA, CO, ID, NV, NM, OR, UT, WA, and WY. There were nearly 600 attendees, >70 exhibitors and 35 speakers. It was a comprehensive conference covering all aspects of forage production including alfalfa and different hay crops, silages, economics, irrigation, and pest management. Click the link below to see videos, papers and powerpoints from this conference.

Symposium Videos, Slidesets, and Proceedings Papers

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The 2012 California Forage & Grains Symposium was held Dec. 11-12 in Sacramento, with 550 registrants, 45 exhibitors, and 31 speakers. In-depth discussion of world-wide trends in alfalfa and small grain economics, fertilizer, pest management and water use issues, as well as 'how to' talks about alfalfa and wheat production were provided. Videos, Powerpoints, and proceedings papers of most of the presentations are provided below. A Western Alfalfa &Forage Symposium is planned for December 2013 in Reno Nevada—Stay tuned. Meanwhile, check out the videos of presentations below, and the proceedings from the 2012 conference.

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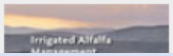

Irrigated Alfalfa Management Publication Site

A new 24-chapter publication designed to provide detailed, scientifically-based

http://alfalfa.ucdavis.edu/

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http://alfalfa.ucdavis.edu/+producing/index.aspx?cat=Irrigation

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Irrigation

Irrigation Management for Wheat (2012)
California Alfalfa & Grains Symposium (2012)
Mike Ottman, Doug Munier, and Steven Orloff

Key Irrigation Mangement Practices for Alfalfa (2012)
California Alfalfa & Grains Symposium (2012)
Blake Sanden

Irrigation Cutoffs with Alfalfa - What are the Implications? (2011)
Western Alfalfa and Forage Conference 2011
Mike Ottman

Comparing Costs and Efficiencies of Different Alfalfa Irrigation Systems (2011)
Western Alfalfa and Forage Conference 2011
Blake Sanden, Karen Klonsky, Dan Putnam, Larry Schwankl, Khalid Bali

Irrigating Alfalfa in Arid Regions (2008)
Irrigated Alfalfa Manual
Blaine R. Hanson, Khaled M. Bali, Blake L. Sanden

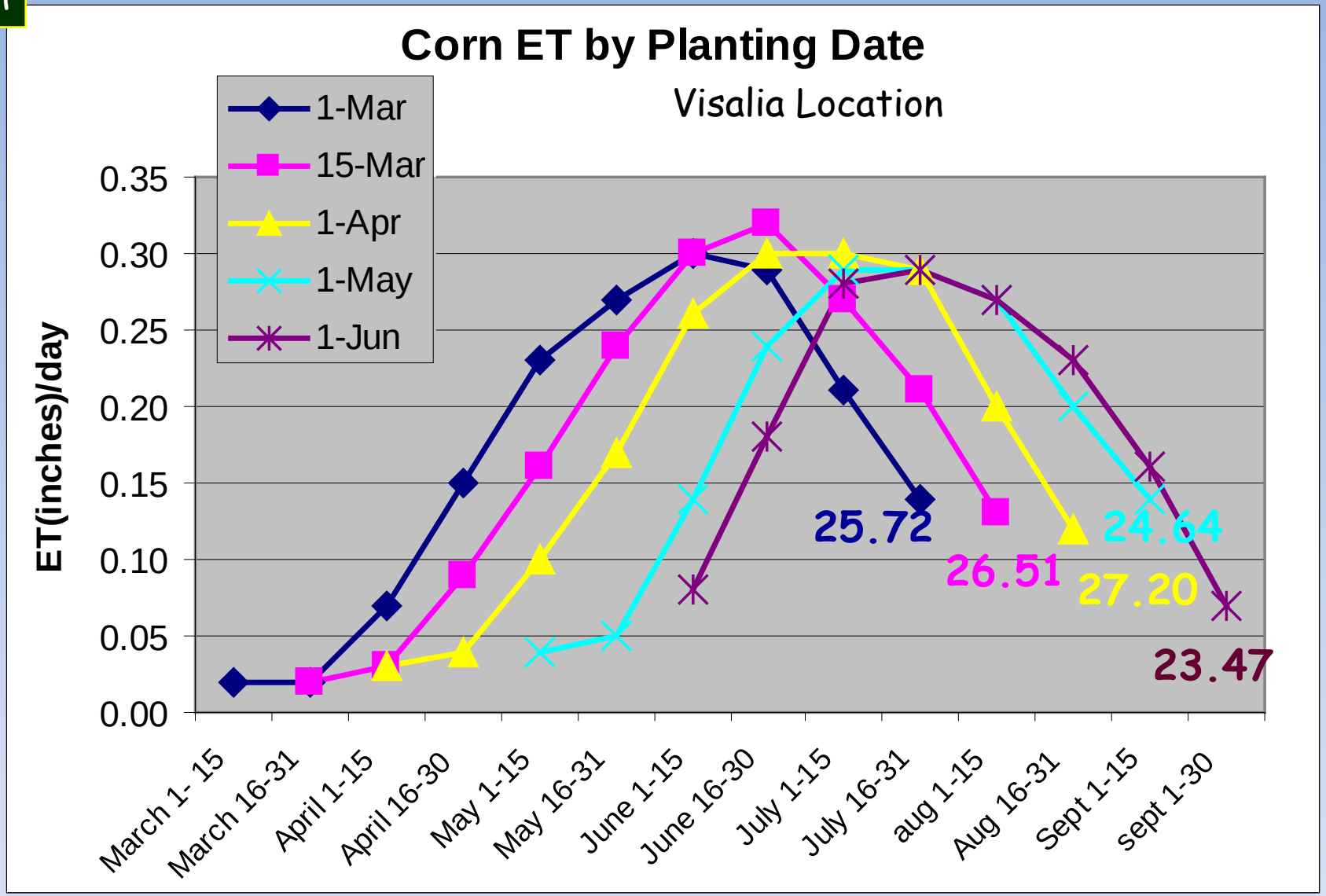
Utilizing Soil-Moisture Monitoring to Improve Alfalfa and Pasture Irrigation Management (2003)
Crop Management Network
Steve B. Orloff, Blaine R. Hanson, Daniel H. Putnam

Soil-Moisture Monitoring: A Simple Method to Improve Alfalfa and Pasture Irrigation Management (2001)
This is a full-color, educational brochure published November, 2001, on how to use soil moisture blocks for monitoring soil moisture in alfalfa or pasture.
Steve B. Orloff, Blaine R. Hanson, Daniel H. Putnam

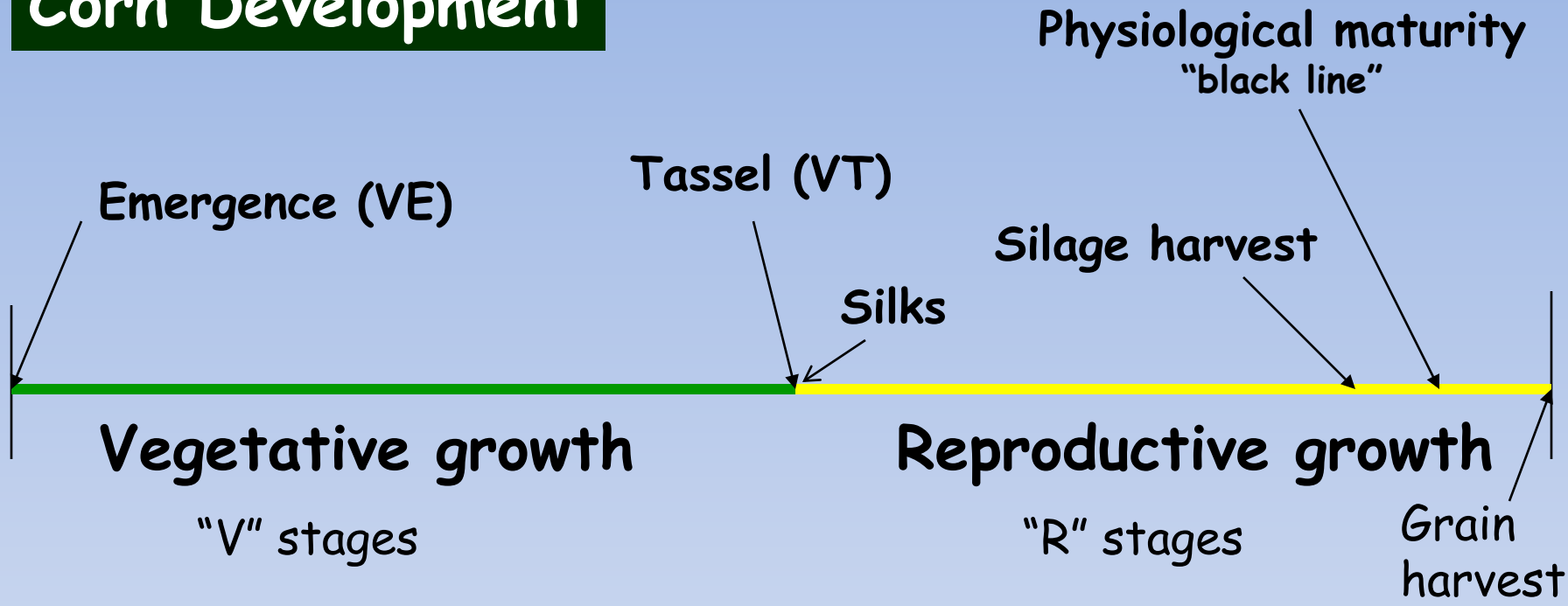
corn

Corn

corn

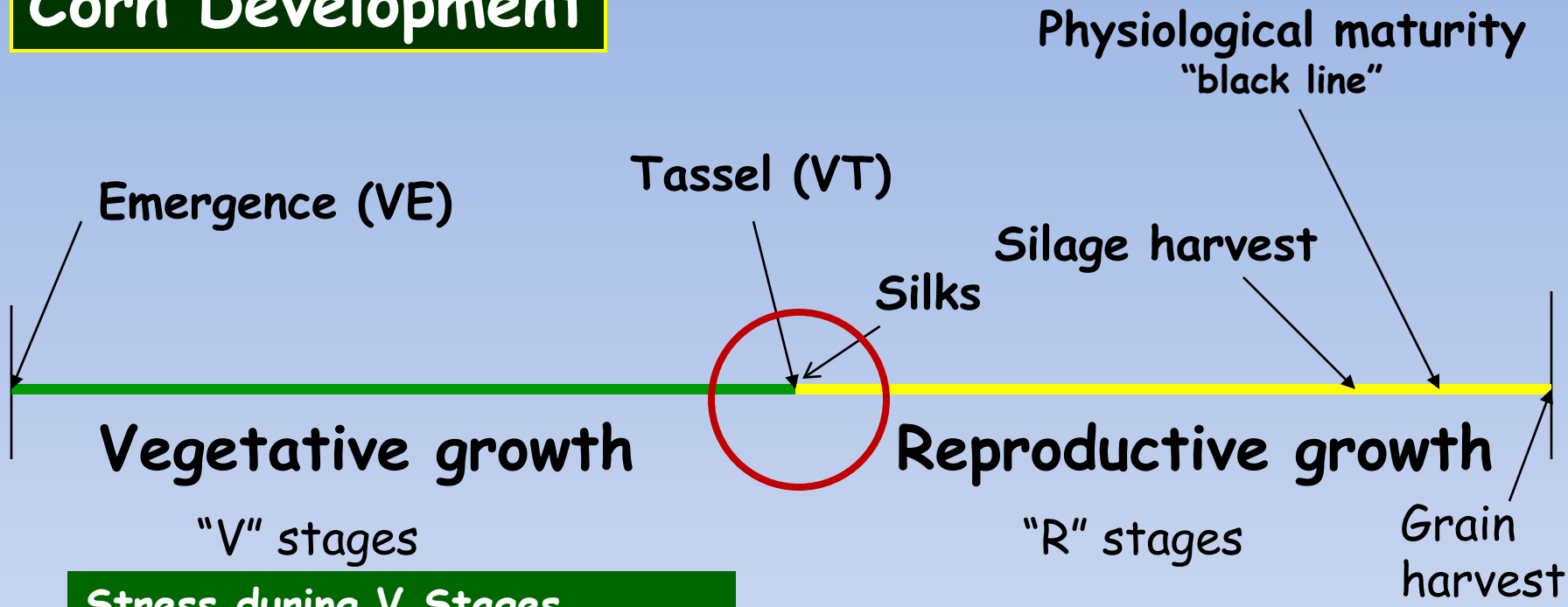

Corn ET by Planting Date
Visalia Location
1-Mar
15-Mar
1-Apr
1-May
1-Jun
ET(inches)/day
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
March 1- 15
March 16-31
April 1-15
April 16-30
May 1-15
May 16-31
June 1-15
June 16-30
July 1-15
July 16-31
aug 1-15
Aug 16-31
Sept 1-15
sept 1-30
25.72
26.51
27.20
24.64
23.47

Corn Development



Length of development depends on: maturity class of hybrid
temperatures
any stress

Corn Development



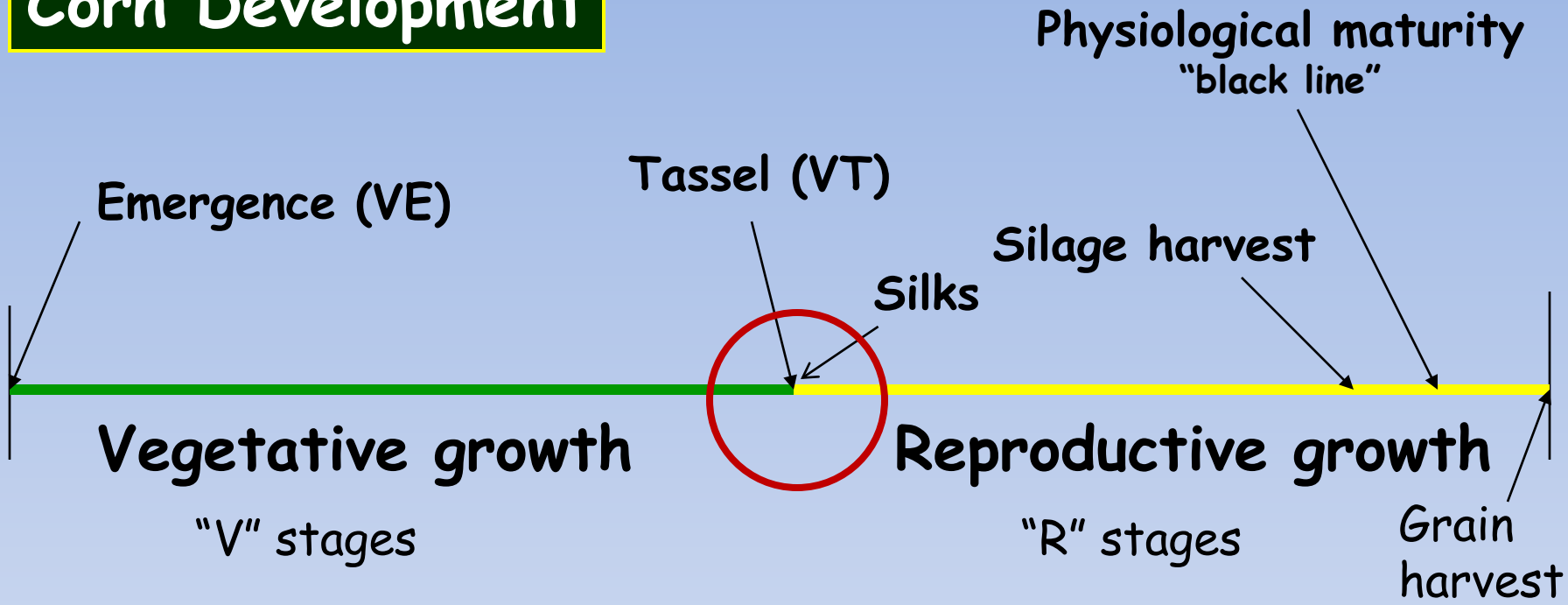
Stress during V Stages

- Slow new leaf appearance
- Reduce leaf area expansion
- Delay crop maturity
- Corn may be shorter
- Can reduce size of the ear
- If prolonged, can reduce roots system

Stress during R Stages

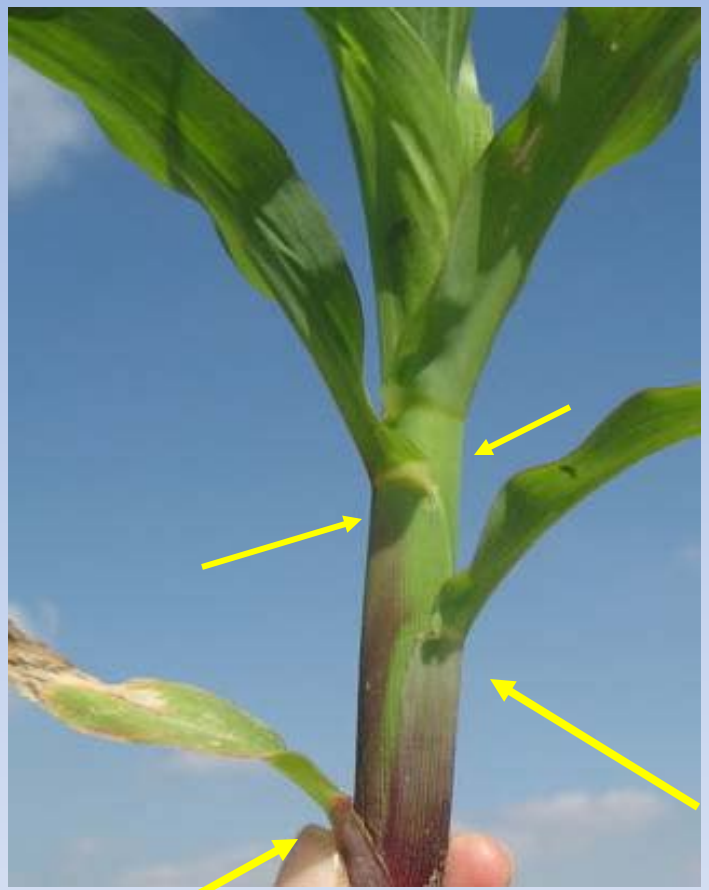
- Reduce kernel size if severe kernels shrivel
- Promote stalk rots

Corn Development



The most critical time for corn to have water and not stress are the 2 weeks before and the 2 weeks after tassel/silking!

V4 Stage



Vegetative stages are defined by the number of leaves with collars showing

By end of V5

- Leaf and ear shoot initiation is complete
- Tassel is just beginning to form
- Shoot apex and tassel are just at the soil surface

Plant is about 8 inches tall

V9

All the leaves have formed

Tassel continues to develop

Stalk starts to elongate rapidly

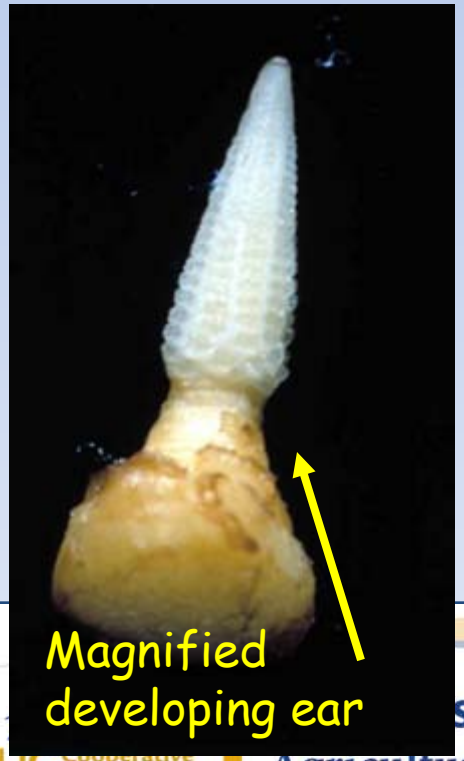
corn

V12 - V17

Number of kernels/row and ear size are determined.

By V17, tip of tassel may Be visible

Getting close to silking.



Water stress or nutrient deficiencies at this time can greatly impact yields!

VT - Tassel

Last vegetative state.

Last branch of tassel is completely visible and silks have not yet emerged.

Pollen shed will begin usually 2-3 days before silking.

Photo: http://www.wisgold.com/teacher_studentinfo.htm

corn

Silk

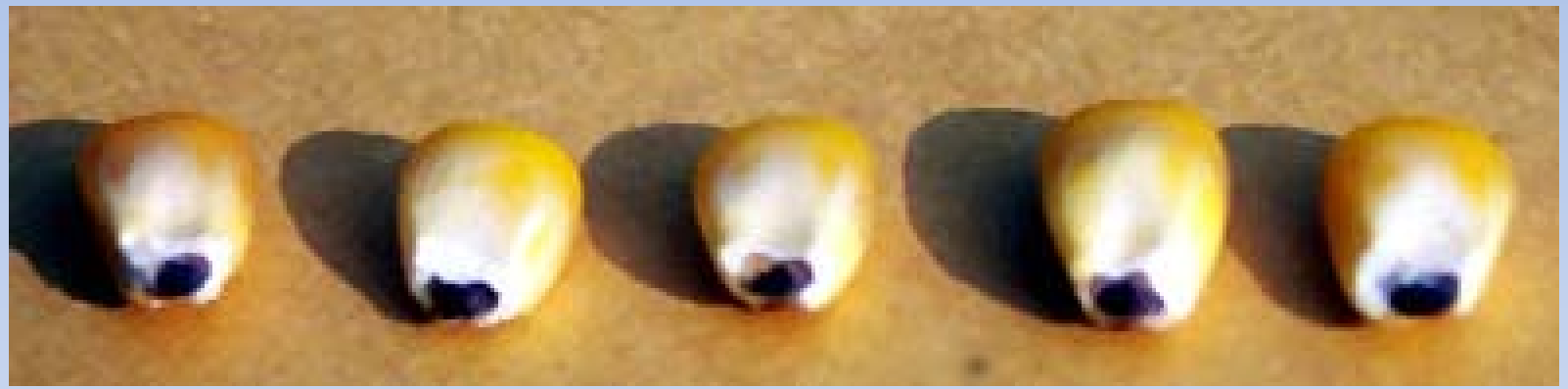
The beginning of the reproductive stages

Reproductive stages

Stage	Name	~ days post silk	Approx. duration
R1	Silk		3 - 5
R2	Blister	10 - 14	8 - 12
R3	Milk	18 - 22	6 - 10
R4	Dough	24 - 28	11 - 18
R5	Dent	35 - 42	20 - 30
R6	Physiological Maturity	55 - 65	

Silage can save one, sometimes two irrigations.

Black layer Physiological Maturity



Once the black layer forms,
there is no more need for water

At black layer, kernel moisture is about 30-35%

(photo: http://msucares.com/crops/corn/corn7.html)

2-Yr Arizona Study

- Sandy clay loam
- First irrigation at 2, 4 or 6 leaf
- With and without irrigation at pollination

A. O. Jama and M. J. Ottman, Timing of the first irrigation in corn and water stress conditioning, *Agron. J. 85 (1993), pp. 1159-1164.*

Arizona Study - Results

Delaying the first irrigation:

- Did not condition the plant for later stress
- Did not improve root development
- Decreased water use
- Did not promote deep water uptake
- Delayed leaf emergence, silking and maturity by a few days
- Decreased biomass (dry matter) up to the milk stage
- And in 1 year out of 2 decreased grain yield

Jama & Ottman, 1993

Arizona Study - Results

Water Stress during pollination:

Reduced kernel weight by ~ 8%

Reduced kernel number by ~ 26%

Reduced grain yields by ~ 35%

Jama & Ottman, 1993

Is there a safe time to stress corn?

- General wisdom is "no"
- Some papers say mild stress in early season "conditions" corn for later stress
  - Not all the literature agrees
  - Many trials conducted in humid locations

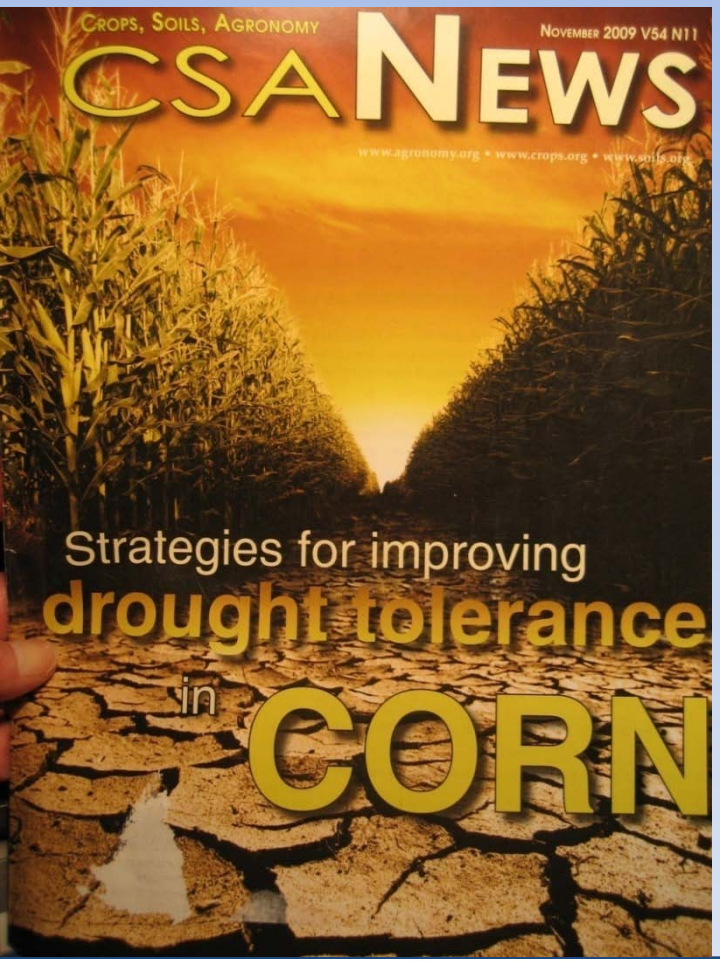
If you are going to stress corn, do not do it 2 weeks before and after tasseling and silking!

Other Strategies ?

- Conservation Tillage?
- Drought tolerant corn?

corn

Improved Genetics



Grain Yield (bu/acre)			
Hybrid	Irrig	Drought	% Loss
tolerant	221	164	26
intermediate	251	133	47
Suscept.	233	110	53

Many companies developing
Not readily available yet
Adapted to CA?

Summary

- There is really no good time to stress corn

But if you must…..the impact of stress on corn is:

  - Greatest the 2 weeks prior to and after silking
  - Less during grain fill
  - Least during vegetative stages

Blackeyes "Beans" (cowpeas)

Estimated ET of Blackeyes

Ranges: 22 – 27 acre-in
Varies by planting date
Varies by season length
one "flush" or two

Blackeyes "Beans" (cowpeas)

Estimated ET of Blackeyes

Single crop – planted May
one flush –harvested
after ~ 100 days

Single crop – planted May
double flush – harvested
after 120-140 days

Double crop – planted June
harvested after ~ 100 days

Blackeyes "Beans" (cowpeas)

Varieties

CB46 – 95% plus of acreage
small plant, small seed

CB 5 - big plant, larger seed

CB 50 – very new

Blackeye yields are very variable

- from year to year
- field to field
- Lygus
- heat at bloom

Estimated ET (acre-in)	Yield (cwt/Acre)	Trial Location
25	53	2005 Shafter
24	42	2007 Shafter
18	36	2012 Kearney
24	20-24*	2013 Kearney

* In 2013 Lygus bugs thought to be the problem

Can blackeyes be water stressed and not hurt yield?

Prior to development of macroscopic flowerbuds

Research on **CB 5** showed that pre-flowerbud stress resulted in smaller plants but yield was not reduced.

CB 46 – no research but experience tells us that early stress results in unacceptably small plants that don't cover the beds and furrows.

Can blackeyes can be water stressed and not hurt yield?

Stress at bloom: reduced pod set and reduced yield

Stress during podfill – small beans, reduced yield

What can be done?

Planting Date

If double flush, no choice but to go early

If single, can play with the planting date
- high temps at bloom
- rain in Sept/Oct

Does It Pay to Go for the Double Flush?

Very little data. Health of the plant makes a big difference.
Vigor of first flush makes a big difference.

Year/location	Single flush Cwt/Acre	Double flush Cwt/Acre	Increase Cwt/Acre
1994/KAC	30.5	39.2	8.7
1995/KAC	25.5	40.5	15
1996/KAC	31.7	47.2	15.5
2006/KAC	13.0	36.6	23.5
2006/Shafter	23.8	27.3	3.6

Single & Double flush trials were planted on different dates.

Trials with single and double flush planted at same date

KAC = Kearney Agricultural Research & Extension Center

2012 Trials
alternate row irrigation throughout season

Location	Every Furrow Cwt/A	Alternate Furrow for season Cwt/Acre	Loss Cwt/Acre
Kearney	40.8	26.9	13.9
Shafter	31.3	21.4	9.9

Shafter: Every furrow: 25 inches
Alternate furrow 16 inches, 9 inches less

Kearney planted 5/21 and cut Sept 15 (117 days)
Shafter planted 5/4 and cut Sept 3 (122 days)

2012 Trials
skipping every other irrigation

Location	Every Furrow 7-10 days Cwt/A	Extended Furrow 14-20 days Cwt/Acre	Loss Cwt/Acre
Kearney	40.8	25.6	15.2
Shafter	31.3	20.2	10.9

Shafter: 7 days: 25 inches
14 days: 16 inches, 9 inches less

Kearney planted 5/21 and cut Sept 15 (117 days)
Shafter planted 5/4 and cut Sept 3 (122 days)

Summary

With CB 46 no good time to stress the plant if you want to cover the furrows

Alternate furrows for first and maybe second irrigation,
then irrigate all furrows - ?

Try to get the best out of the first flush:
no stress at bloom or podfill
good lygus bug control
(cool temps at bloom)
Evaluate the situation


Thank you!
Questions?