Choices, Chances and Consequences

The Risks and Rewards of Pasture Based Dairying

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Remember this is a systems approach

- Cows
- Land/grass
- People
- Buildings/infrastructure

Each has its own set of parameters with a specific goal in mind

- Cows
  - Big, Little, Brown, Black, Red, White?
  - Seasonal, Milk, Dual?
  - “Horses for Courses”
  - “Ford, Dodge, Chevy”

Land/pasture forage (grasses, legumes, other)

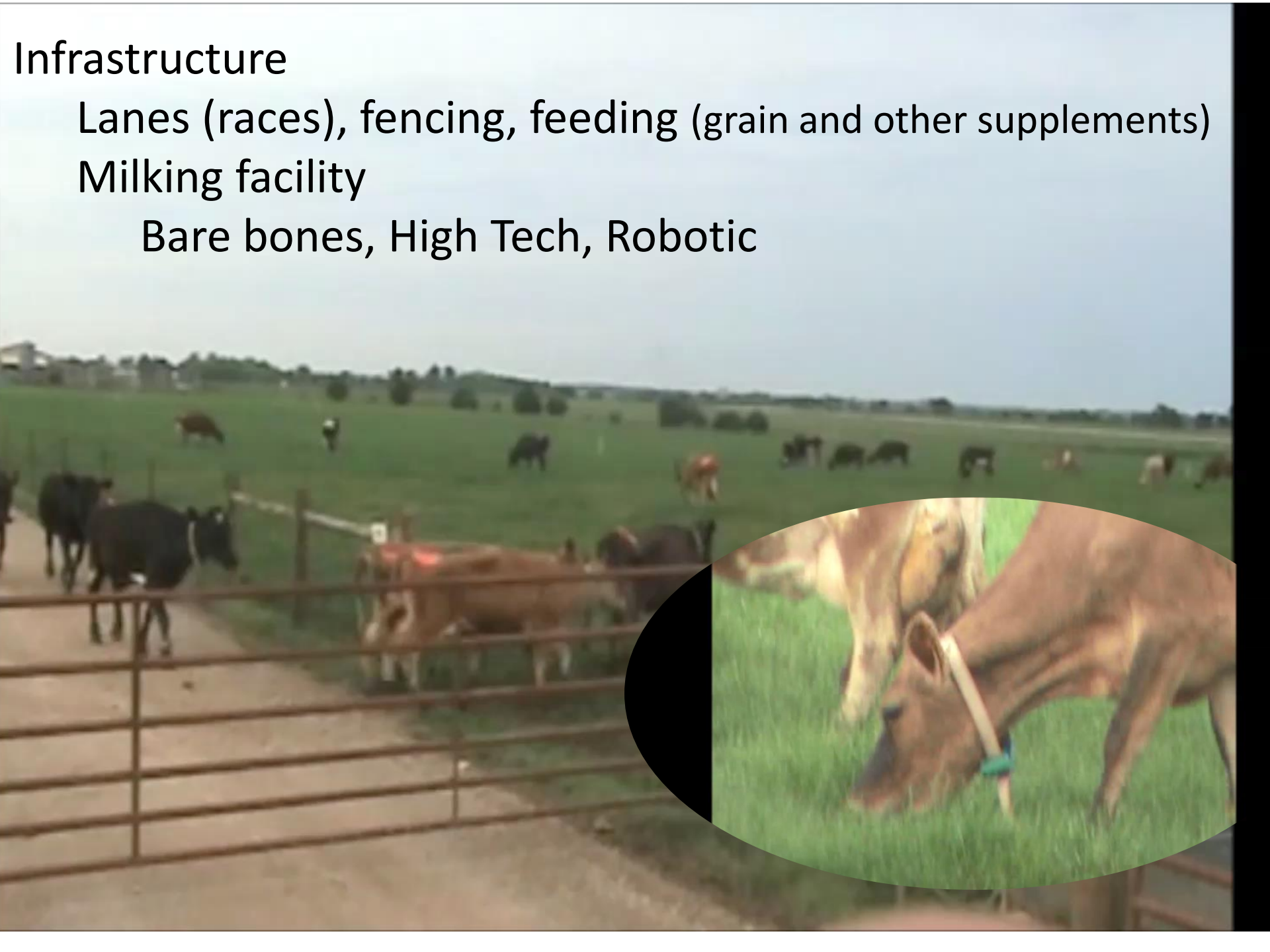
- Hilly, Flat, Wet, Dry, Trees
- Monoculture, Diverse
- “Graze what grows in the ditches”

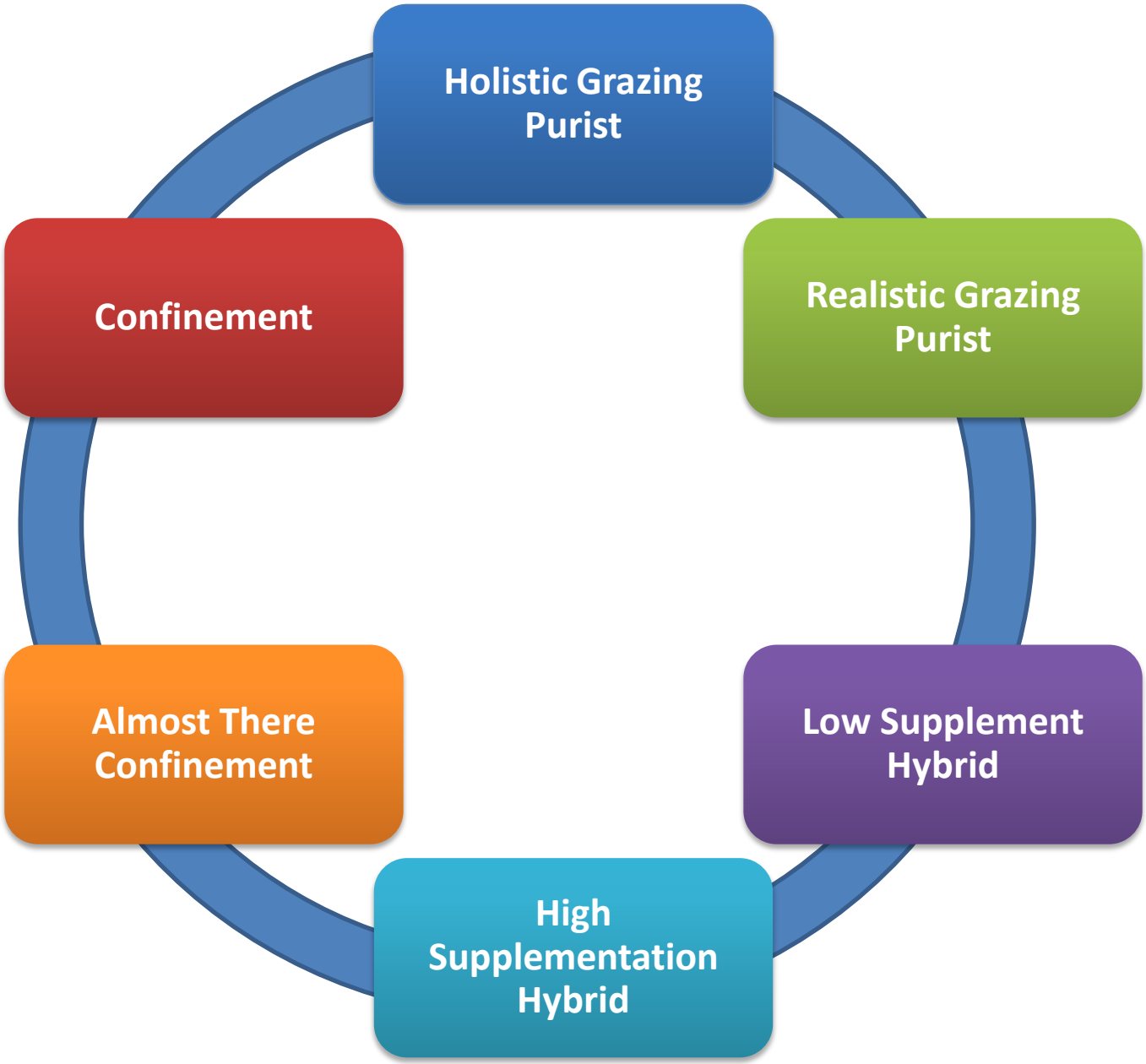
Are you a People person?

- “no one can do it the way I want it done”
- System requires multiple staff

Infrastructure

- Lanes (races), fencing, feeding (grain and other supplements)
- Milking facility
  - Bare bones, High Tech, Robotic




Holistic Grazing Purist
Realistic Grazing Purist
Low Supplement Hybrid
High Supplementation Hybrid
Almost There Confinement
Confinement

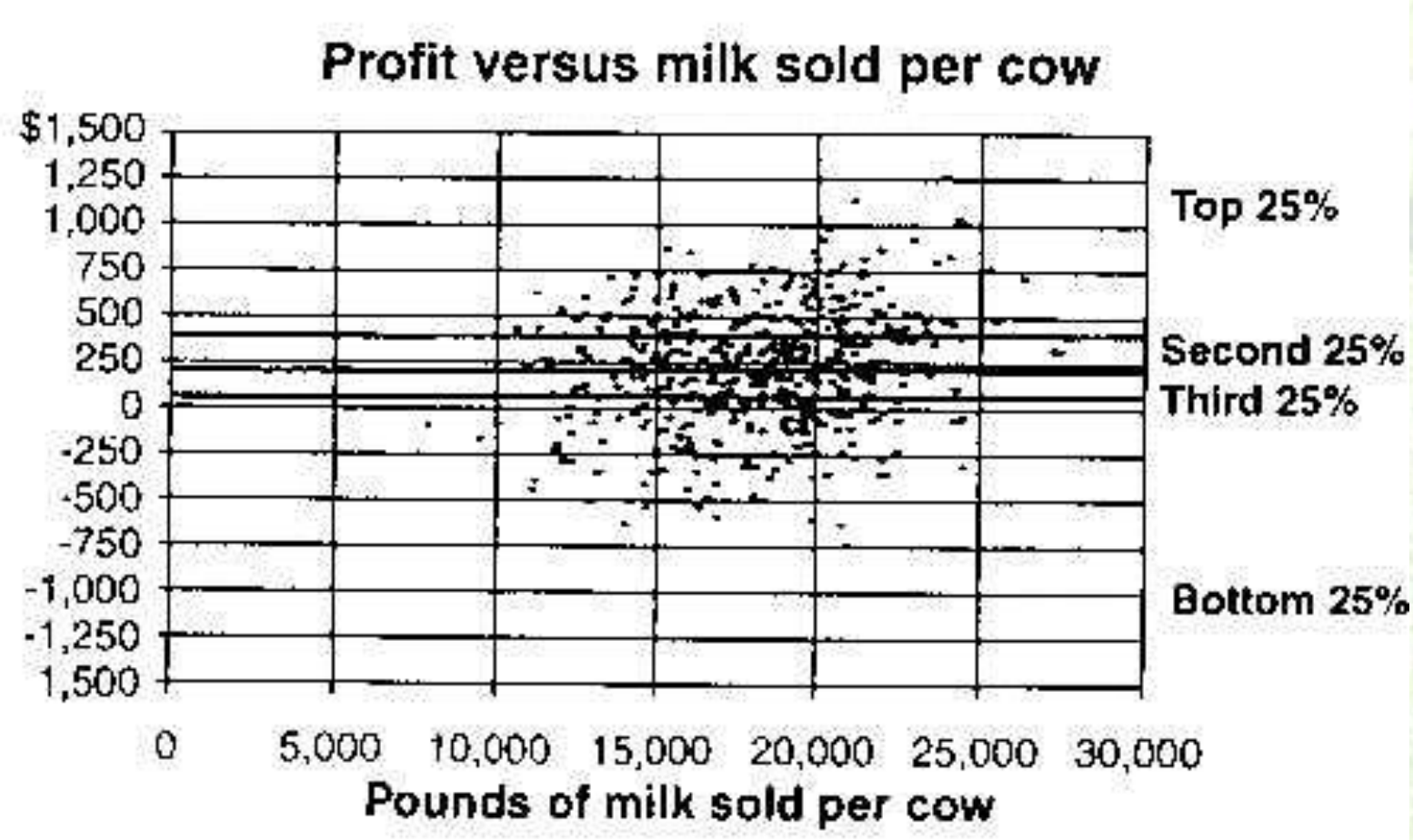
Evolution of Grazing
Where Do You Belong?

- Stacey's Disclaimer!

- This is YOUR system, not mine, not the consultants and not the banks (Maybe!)

- There is no right or wrong but what makes YOU happy

Maximum Milk or Profit?



Holistic Grazing Purist

REWARD

- "All natural" pasture!
- Lowest input (no grain)
- Simple system
- Cows not stressed
- Niche market
- Reproduction

RISK

- Lowest milk production/cow (~7,000) and per acre
- Flexibility can be slow
- Drought
- Pasture management
- Can you take advantage of…

Realistic Grazing Purist

REWARD

- High percentage pasture
- Low input (0-6# grain)
- Simple system
- Cows not stressed
- Reproduction

RISK

- Lower milk production/cow (~9,000) and per acre
- Some flexibility
- Drought
- Pasture management
- Can you take advantage of…

Low Supplement Hybrid

REWARD

- High percentage pasture
- Simple system
- Cows not stressed
- Milk production/cow (~12,500) and per acre
- Flexible
- Reproduction
- Takes advantage of…

RISK

- Drought
- Low input (3-8# grain)
- Pasture management

High Supplement Hybrid

REWARD

- Milk production/cow (~15,000) and per acre
- Flexible
- Cows not stressed
- Takes advantage of…

RISK

- Drought
- Pasture management
- Pasture percentage consumed declining
- Moderate input (8-18# grain)
- System getting complex
- Equipment
- Reproduction

Almost There Confinement

REWARD

- Milk production/cow (~20,000) and per acre

RISK

- Flexibility reduced
- Drought
- Pasture management
- Minimal pasture percentage consumed
- Moderate Input (15-22# grain)
- System getting complex
- Cows not stressed
- Equipment
- Reproduction
- Can you take advantage of…

Confinement

REWARD

- Milk production/cow (~22,000)

RISK

- Flexibility reduced
- Drought
- Pasture percentage consumed nil (unless cut'n'carry)
- Forage management
- High input (20-30# grain)
- Complex system
- Cows stressed
- Equipment
- Reproduction
- Can you take advantage of…

What were the Commonalities?

- Stress?
- Reproduction?
- Takes Advantage of….
- Flexibility?
- Complexity?
- Drought

We are all on the same team to make a living producing Milk!

It is all Perception and Perspective!

Goal is to Grow Grass!

Parameters of the System Types

	Cow Size	Lactation	# Milk	Total DMI	# Grain	# Forage
Purist	850	7,000	23	24	0	24
Realist	900	9,000	30	27	3	24
Low Suppl.	1,000	12,500	42	33	5.5	27.5
High Suppl.	1,100	15,000	50	37	13	24
Almost	1,250	20,000	67	45	18.5	26.5
Confine	1,350	22,000	73	50	25	25

Pasture-Based Dairies
What Will it Take to Meet Your Goals?

	Stocking Rate 1 cow/acre		
	Percent Pasture Provided		
Yield/acre	**3 T/ac**	**4 T/ac**	**5 T/ac**
Purist	63%	85%	106%
Realist	62%	83%	104%
Low Suppl.	55%	73%	91%
High Suppl.	61%	81%	102%

85% utilization rate

Pasture-Based Dairies
What Will it Take to Meet Your Goals?

	Stocking Rate 1.25 cow/acre			
	Percent Pasture Provided			
Yield/acre	**3 T/ac**	**4 T/ac**	**5 T/ac**	**6 T/ac**
Purist	51%	68%	85%	101%
Realist	50%	67%	83%	100%
Low Suppl.	44%	58%	73%	87%
High Suppl.	49%	65%	81%	97%

85% utilization rate

Pasture-Based Dairies
What Will it Take to Meet Your Goals?

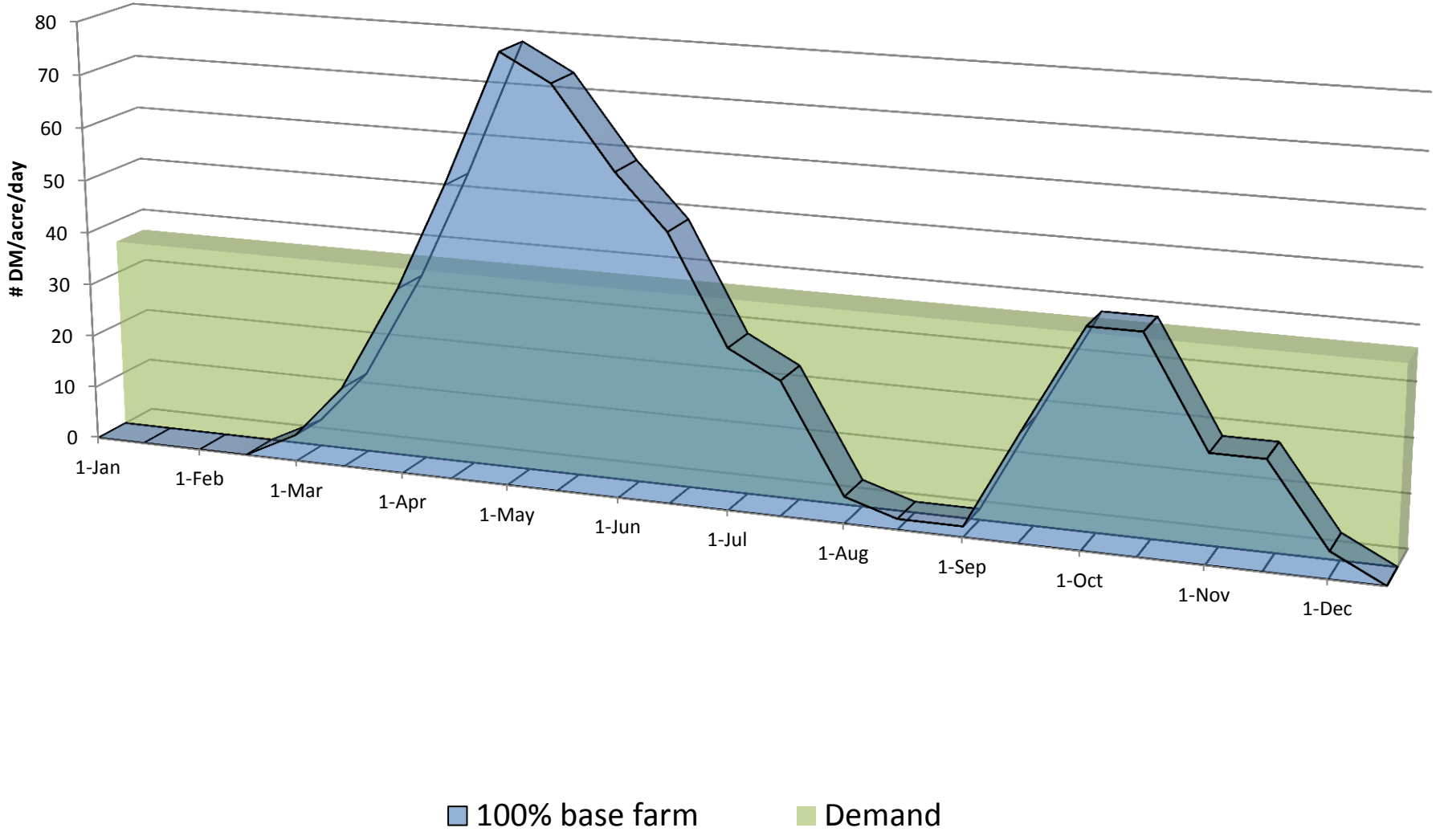
	Stocking Rate 1.5 cow/acre			
	Percent Pasture Provided			
Yield/acre	**3 T/ac**	**4 T/ac**	**5 T/ac**	**6 T/ac**
Purist	42%	56%	70%	85%
Realist	42%	55%	69%	83%
Low Suppl.	36%	48%	61%	73%
High Suppl.	41%	54%	68%	81%

85% utilization rate

So How is Your Farm Designed?

- 100% perennials?
- 70% perennials and 30% annuals?
  - Annuals doubled cropped with winter and summer forages
- 50% perennials and 50% annuals?
  - Annuals doubled cropped with winter and summer forages
- Analysis using parameters:
  - Perennial grasses – 4.2 tons/acre
  - Cool season annual – 3 tons/acre
  - Warm season annual – 3.6 tons/acre
  - Demand – 36# DM/day
    - Stocking rate 1-1.4 cows/acre depending on desired DMI

Dry Matter Yields by Farm System Type



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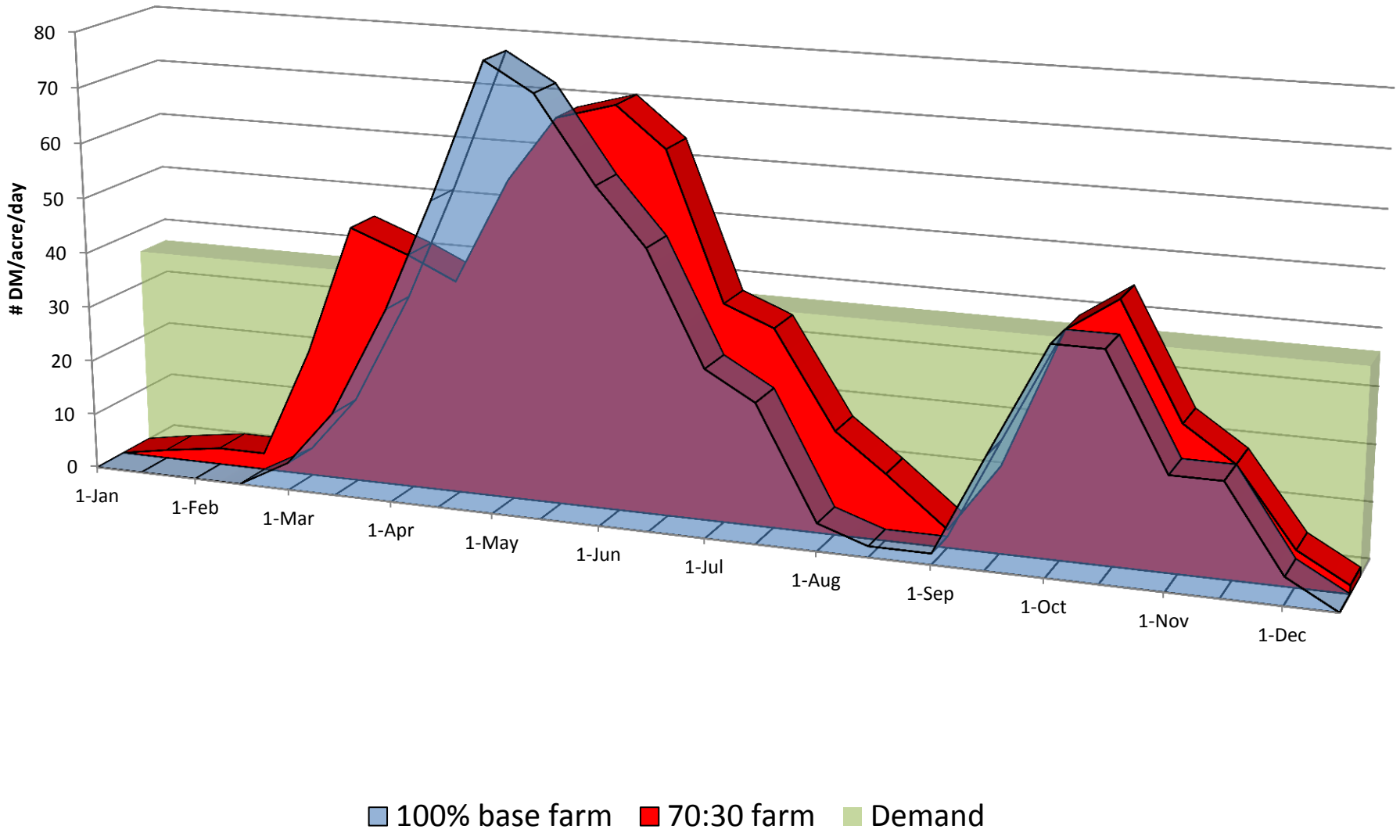

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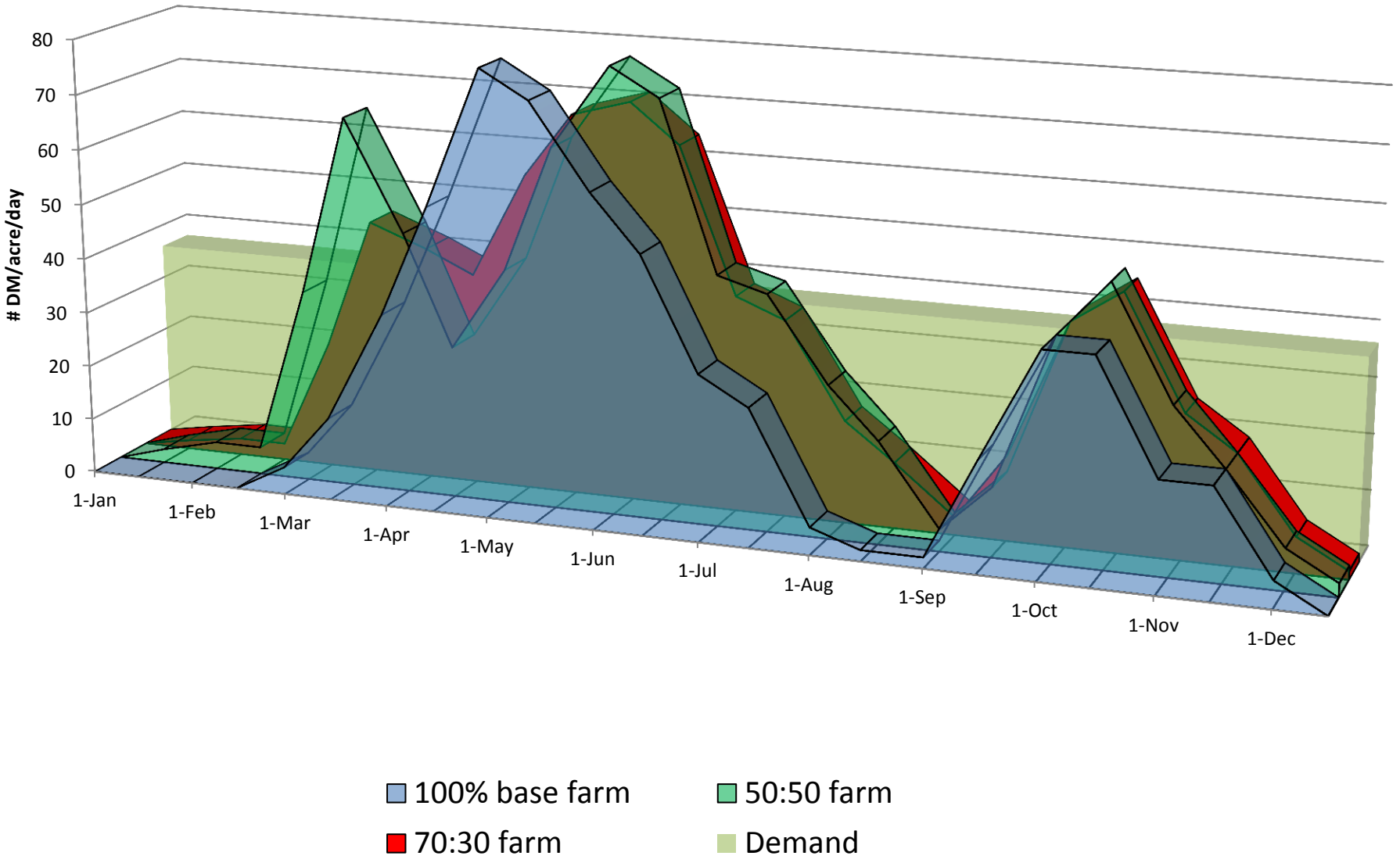


Summary of Farms

- 100% perennial farm
  - 4.2 tons/acre
  - 231 cow days
- 70:30 farm
  - 4.9 tons/acre
  - 272 cow days
- 50:50 farm
  - 5.4 tons/acre
  - 299 cow days

This one, Right????

Risks and Rewards

100% Perennial Farm

- Consistent
- Reliable
- One time establishment in 5-10 years
- Cost/# DM forage less

- Less yield/acre
- Nutritive value less
- Drought

Perennial plus Annuals

- Higher nutritive value
- Higher yield/acre

- Planting twice per year
- Timing
- Time (labor)
- Equipment
- Stand establishment
- Drought

Goal is to Grow Grass!
No matter what type of farm!


B1

- Intermission!

- Questions
- **Where does your farm stack up?**

What Impacts Pasture Growth?

- Rainfall
- Soil type
- Soil water availability
- Fertilization
- Solar radiation
- Growing days (heat units)
- Time of year
- Species
- Management

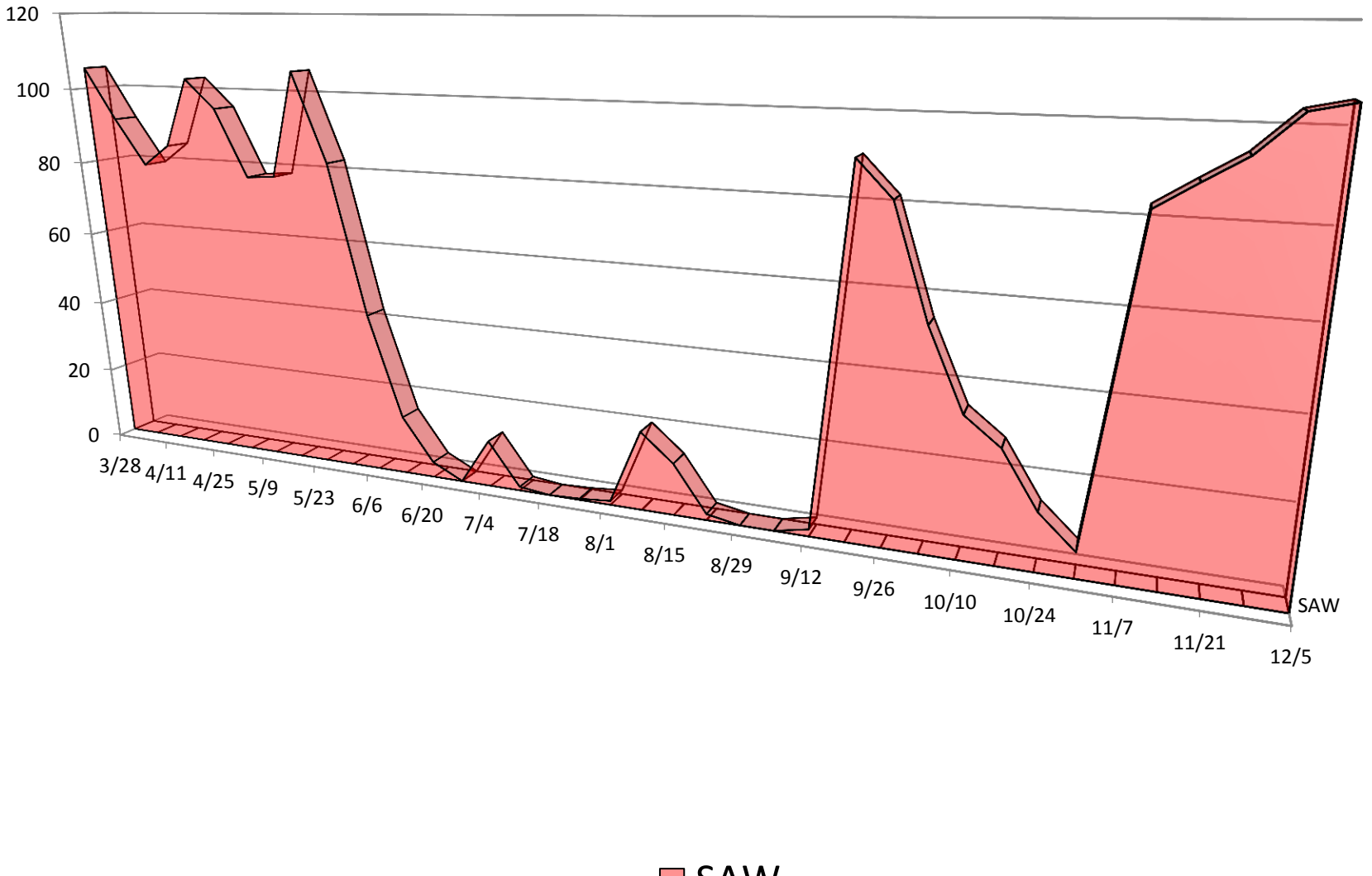
What Can You Impact to Increase Pasture Growth?

- Time (week)
- Soil available water
- Solar radiation
- Growing degree days heat units
- Soil type
- Pasture species selection

How Does Soil Available Water Impact Yield?

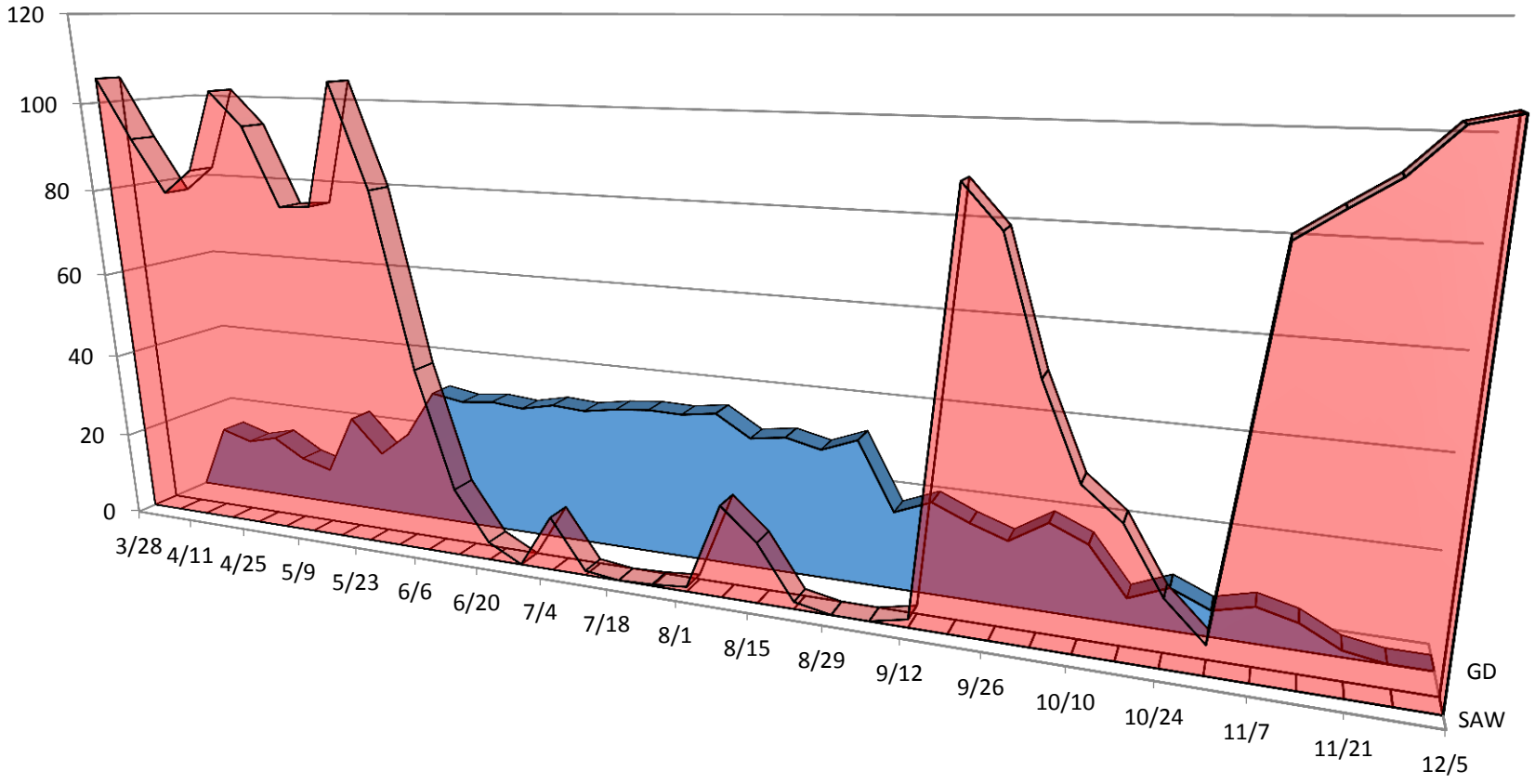
- **Available water** is the difference between field **capacity** which is the maximum amount of **water** the **soil** can hold and wilting point where the plant can no longer extract **water** from the **soil**.

4.1” (104 mm) Soil Available Water



Soil Available Water w Growing Days

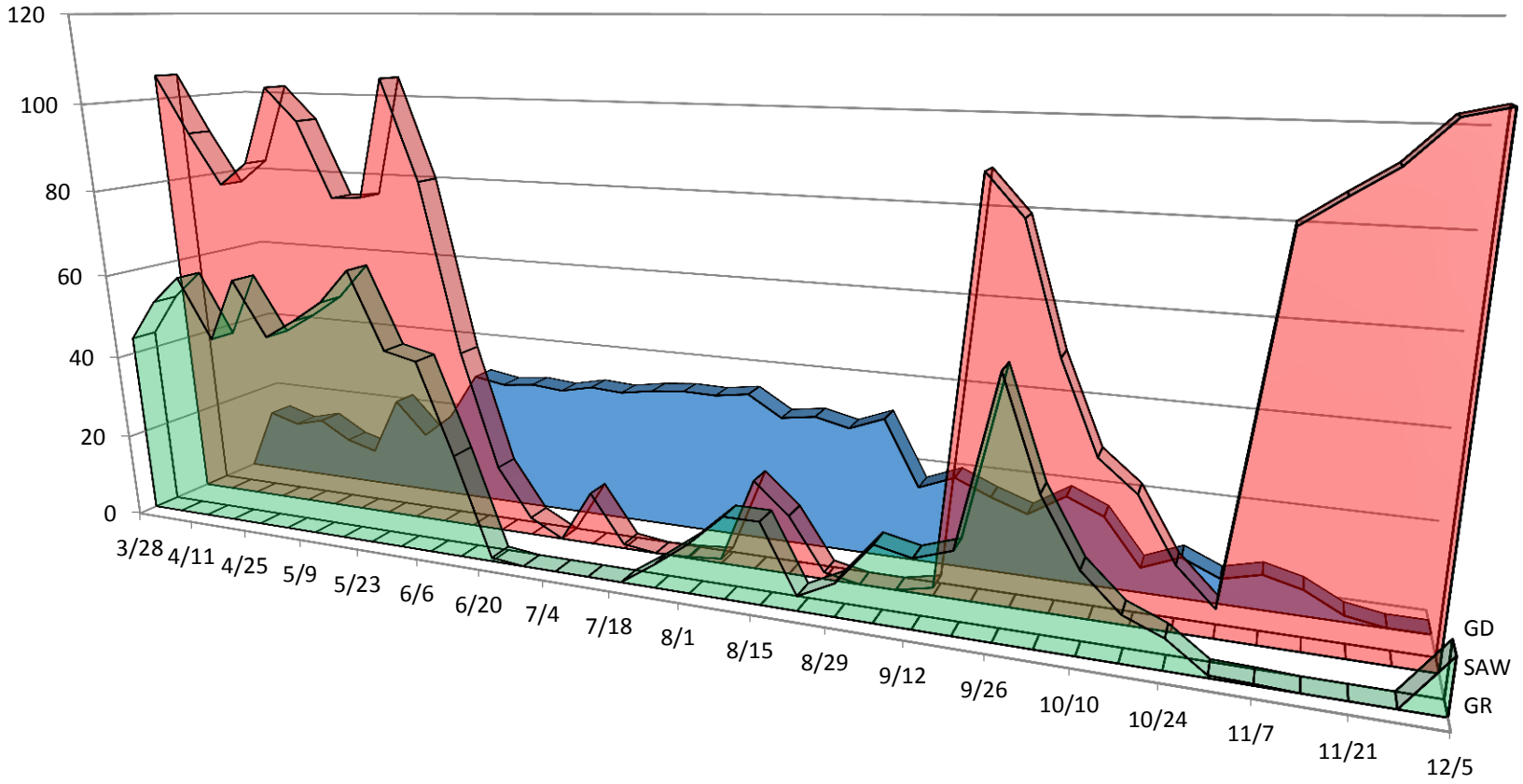
4.1” (104 mm) Soil Available Water



SAW GD

Year 2011

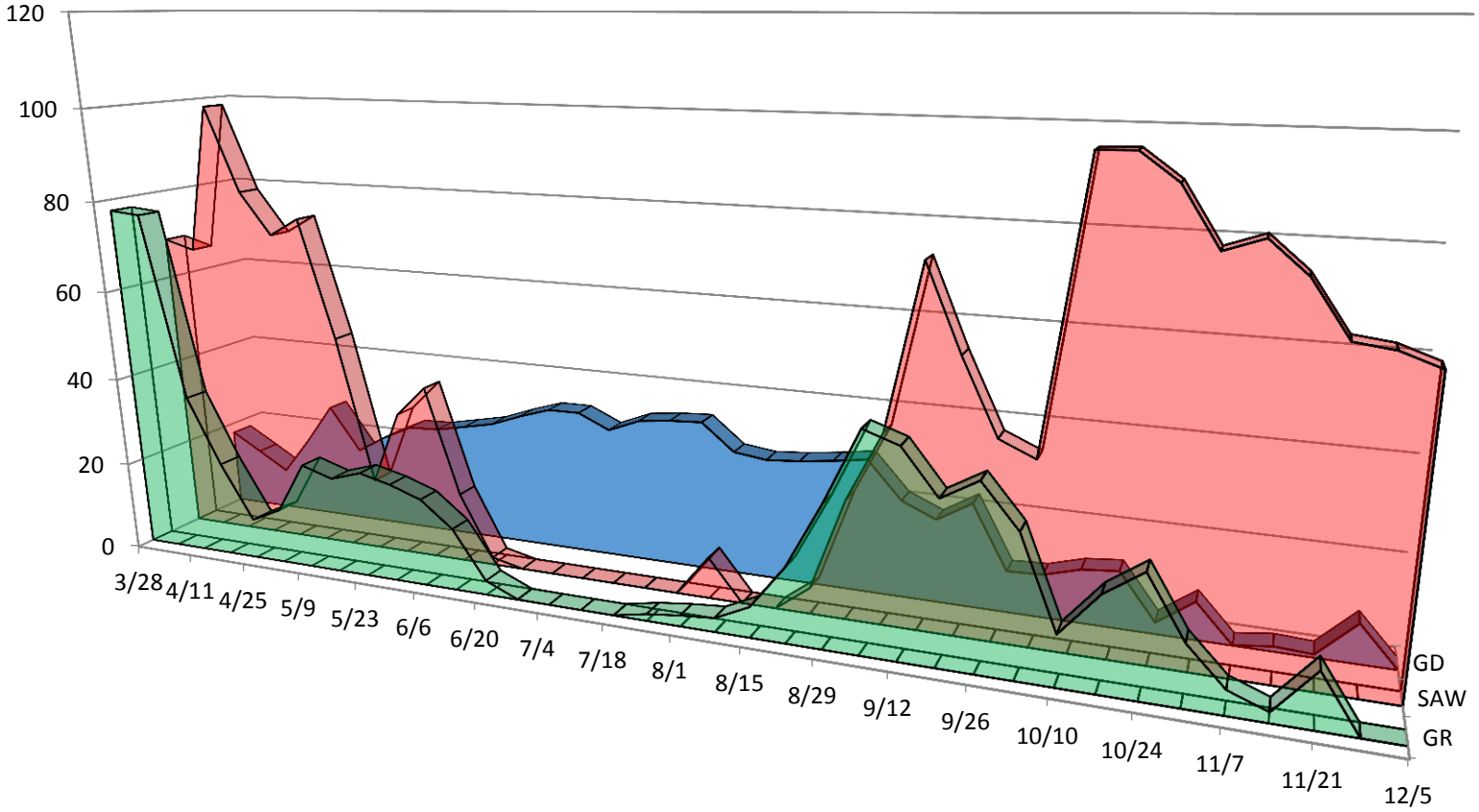
4.1” (104 mm) Soil Available Water



GR SAW GD

Year 2012

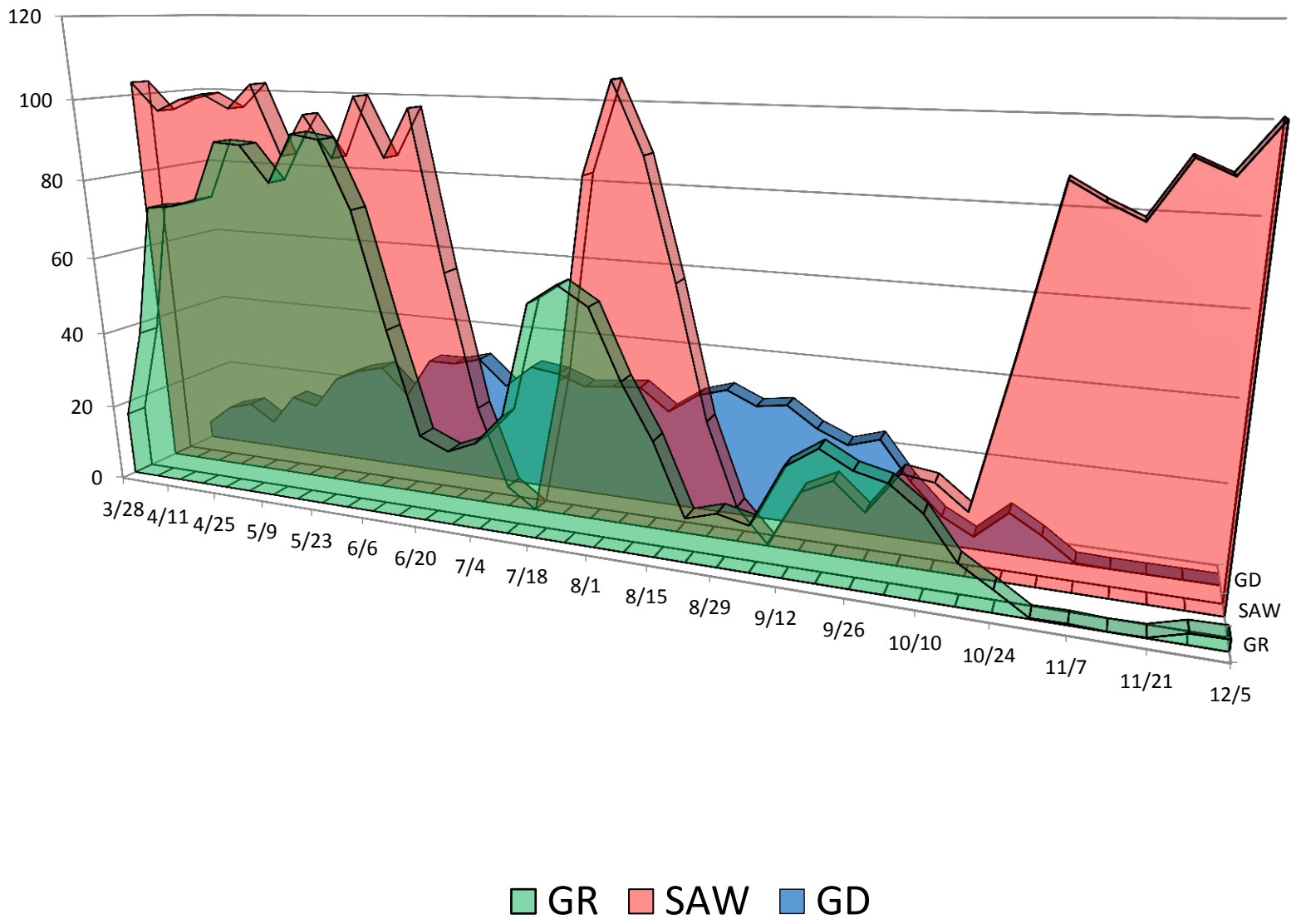
4.1” (104 mm) Soil Available Water



GR SAW GD

Year 2013

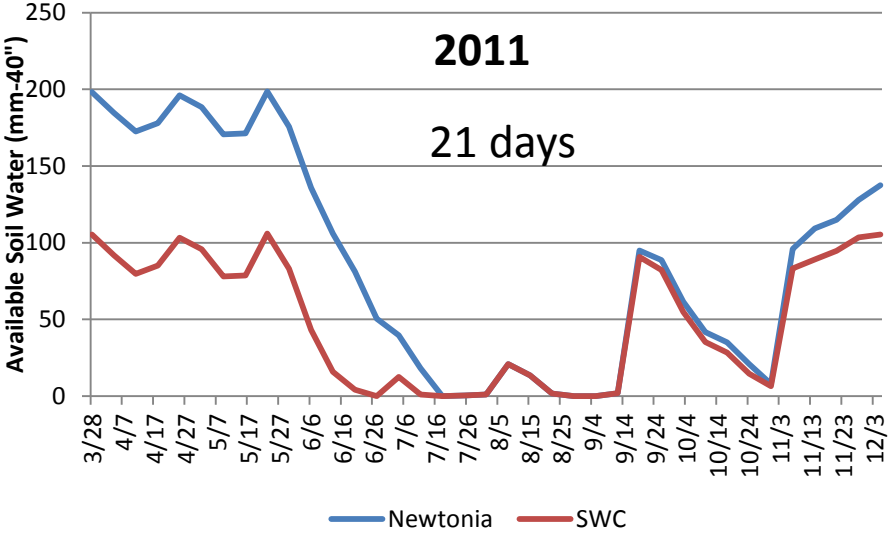
4.1” (104 mm) Soil Available Water

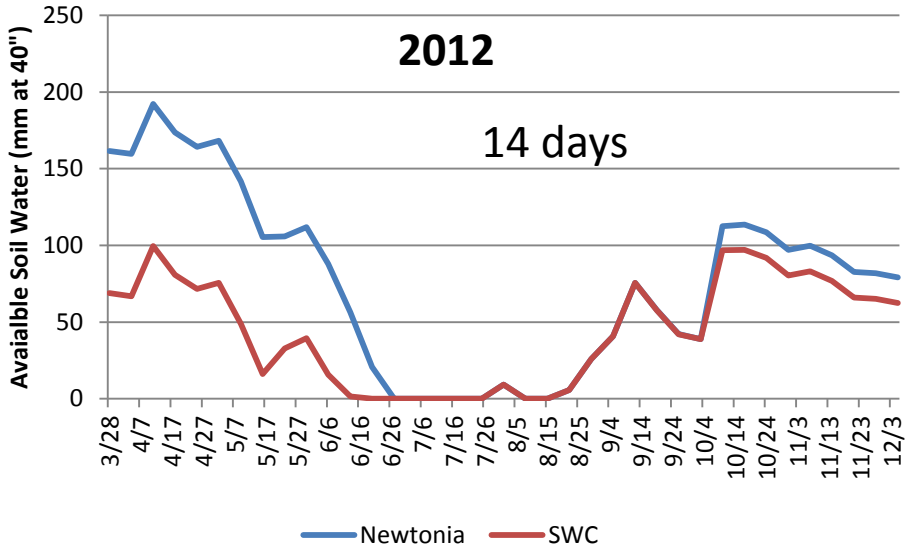


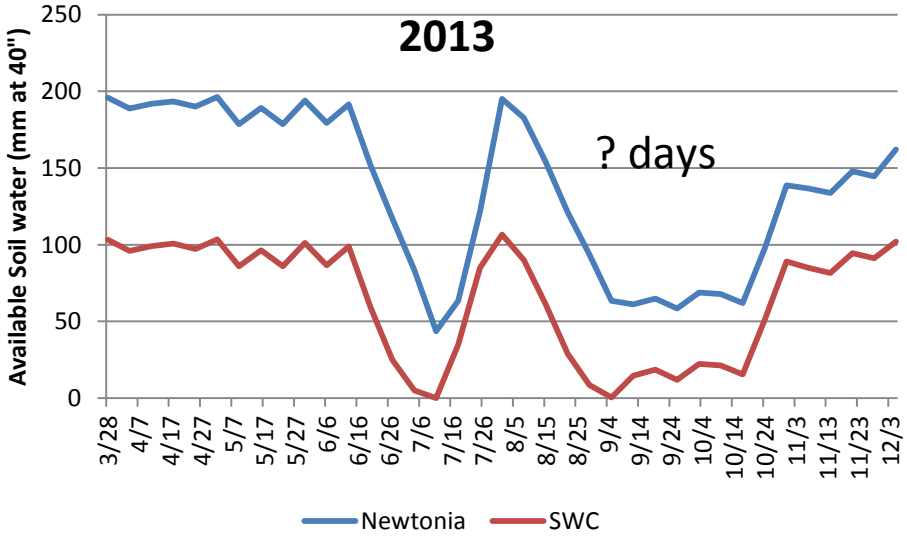
Comparing Soil Types

- Newtonia
  - 7.9 inches soil water availability capacity
- MU Southwest Center(Wilderness, Creldon, Goss, Hoberg, Cedargap, Viraton, Gerald)
  - 4.1 inches soil water availability capacity

Comparison of Soil Available Water







Which Farm would you Buy?

Evapotranspiration

- **Transpiration** consists of the vaporization of liquid water contained in plant tissues and the vapor removal to the atmosphere.

- **Evaporation** is the process whereby liquid water is converted to water vapor (vaporization) and removed from the evaporating surface (vapor removal).

- The combination of two separate processes whereby water is lost on the one hand from the soil surface by evaporation and on the other hand from the crop by transpiration is referred to as **evapotranspiration (ET).**

	2011 Inches	2012 Inches	2013 Inches	Average 3 year
1-Apr	0.06	0.11	0.12	0.10
8-Apr	0.14	0.13	0.09	0.12
15-Apr	0.14	0.14	0.11	0.13
22-Apr	0.11	0.16	0.09	0.12
29-Apr	0.10	0.16	0.13	0.13
6-May	0.13	0.15	0.11	0.13
13-May	0.15	0.20	0.17	0.18
20-May	0.14	0.22	0.15	0.17
27-May	0.12	0.21	0.16	0.16
3-Jun	0.21	0.21	0.13	0.19
10-Jun	0.22	0.23	0.21	0.22
17-Jun	0.19	0.23	0.20	0.21
24-Jun	0.22	0.28	0.25	0.25
1-Jul	0.22	0.25	0.21	0.23
8-Jul	0.21	0.22	0.25	0.23
15-Jul	0.23	0.26	0.23	0.24
22-Jul	0.24	0.25	0.16	0.22
29-Jul	0.21	0.23	0.13	0.19
5-Aug	0.21	0.22	0.11	0.18
12-Aug	0.14	0.16	0.15	0.15
19-Aug	0.18	0.21	0.18	0.19
26-Aug	0.20	0.14	0.19	0.18
2-Sep	0.24	0.16	0.16	0.19
9-Sep	0.16	0.13	0.17	0.15
16-Sep	0.12	0.13	0.12	0.12
23-Sep	0.10	0.11	0.13	0.11
30-Sep	0.15	0.09	0.12	0.12
7-Oct	0.17	0.08	0.11	0.12
14-Oct	0.13	0.12	0.07	0.11
21-Oct	0.11	0.08	0.08	0.09
28-Oct	0.11	0.07	0.05	0.08
4-Nov	0.11	0.09	0.07	0.09
11-Nov	0.07	0.06	0.06	0.06
18-Nov	0.09	0.07	0.07	0.08
25-Nov	0.04	0.06	0.04	0.05
2-Dec	0.04	0.05	0.02	0.04
9-Dec	0.03	0.06	0.02	0.03
16-Dec	0.03	0.05	0.04	0.04
23-Dec	0.03	0.03	0.03	0.03

Evapotranspiration rate 0.20 inches/day

SW Center Soils	Maximum	75%	50%	25%
Soil available water(inches)	4.10	3.08	2.05	1.03
Days to empty	21	15	10	5

Newtonia Soil Type				
Soil available water(inches)	7.9	5.9	4.0	2.0
Days to empty	40	30	20	10

- Folks in the Ozarks like to say…
  - "2 weeks from a drought"
- It's TRUE!

Is Irrigation an Opportunity or Risk?

Multiple Regression Analysis

Regression Statistics	
Multiple R	0.875813
R Square	0.767049
Adjusted R Square	0.751166
Standard Error	11.04325
Observations	48

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	17668.74	5889.582	48.29369	5.7E-14
Residual	44	5365.952	121.9534		
Total	47	23034.7			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	52.7017	22.33453	2.359651	0.022794	7.689412	97.71399	7.689412	97.71399
Week	-0.388	0.396727	-0.978	0.33342	-1.18755	0.411551	-1.18755	0.411551
Average of Available Soil Water (mm)	0.516395	0.053104	9.724145	1.57E-12	0.40937	0.62342	0.40937	0.62342
Average of GD adjusted	-1.09443	0.452329	-2.41954	0.01974	-2.00604	-0.18282	-2.00604	-0.18282

Just to show I did it and didn't make this stuff up!

Multiple Regression Equation for Irrigation

- Growth Rate = (Week x -0.39) + (SAW x 0.52) + (GD units x -1.09) + 52.7
  - Week = week of the year
  - SAW = soil available water
  - GD unit = growing day heat units
  - June 1- Sept 15
  - $R^2 = 0.75$

Dry Matter Yield Response to 5 Irrigation Levels

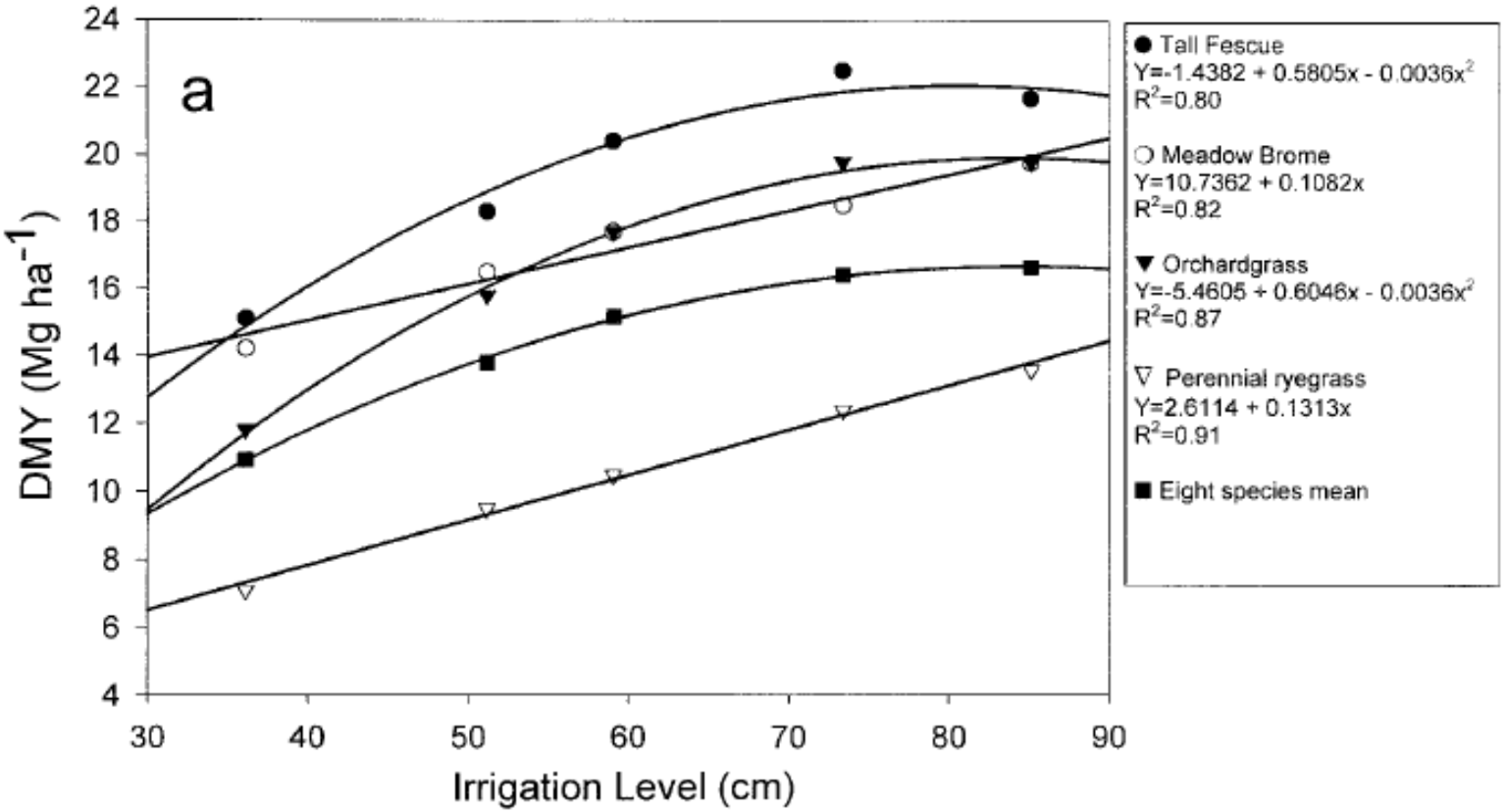
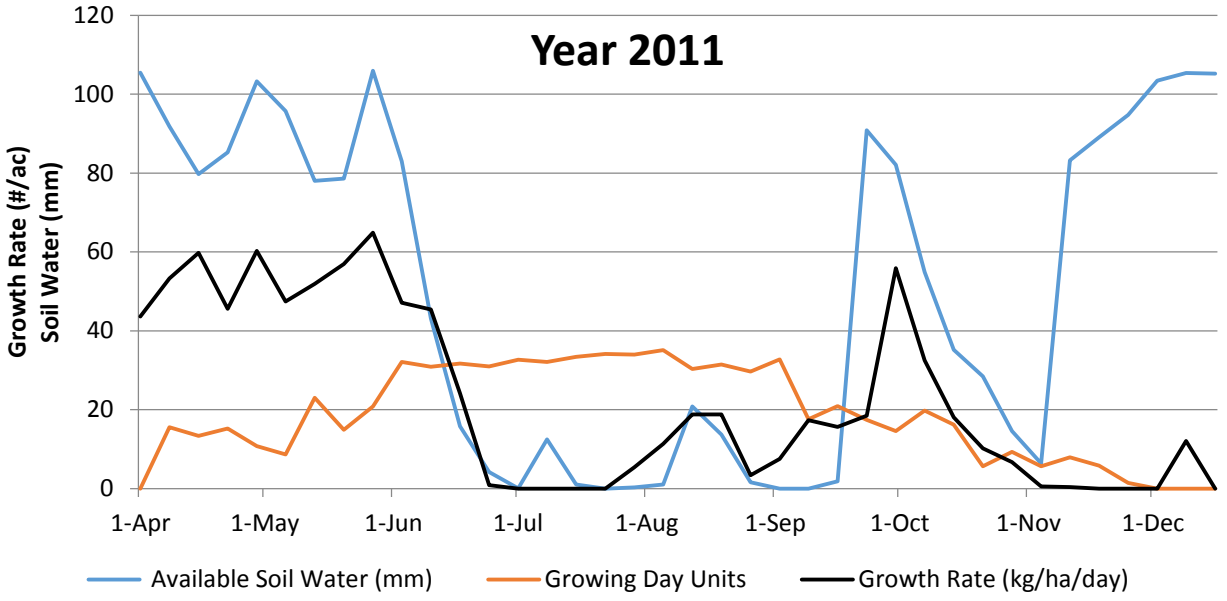


Fig. 1. Yearly mean (1996–1998) dry matter yield (DMY) response of eight cool-season grass species to five irrigation levels. Two plots are shown (a) standard pasture species and (b) less typical and/or more drought tolerant pasture species. The eight species average DMY is plotted in both graphs to aid in comparison. Only perennial ryegrass and meadow brome did not have a significant curvilinear response.

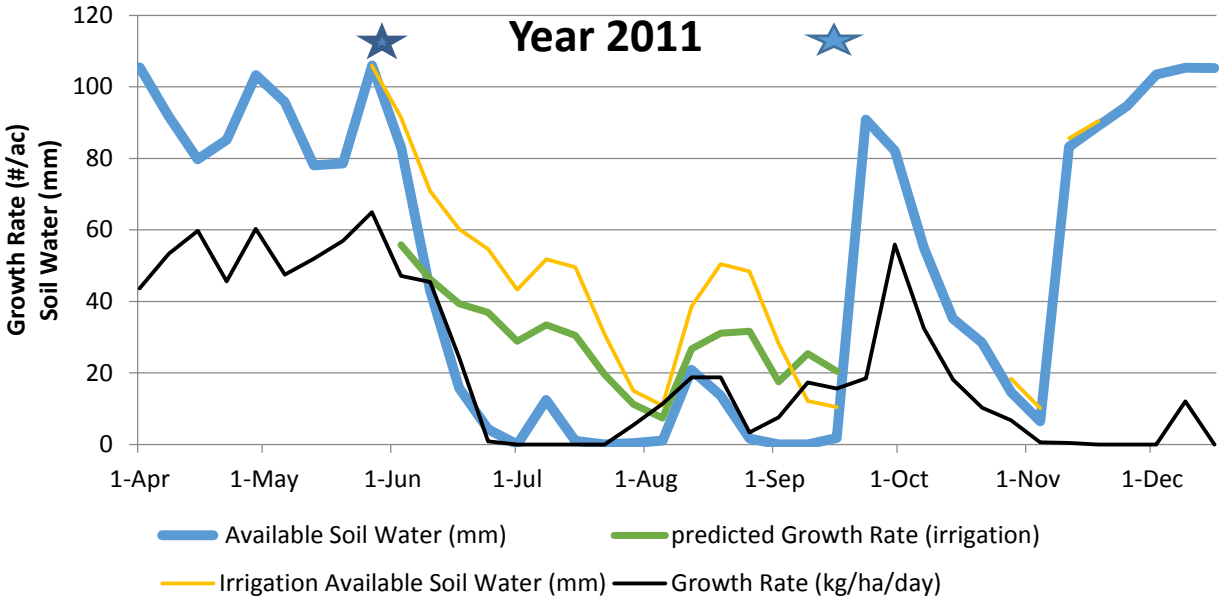


2.99 ton/ac

29% increase

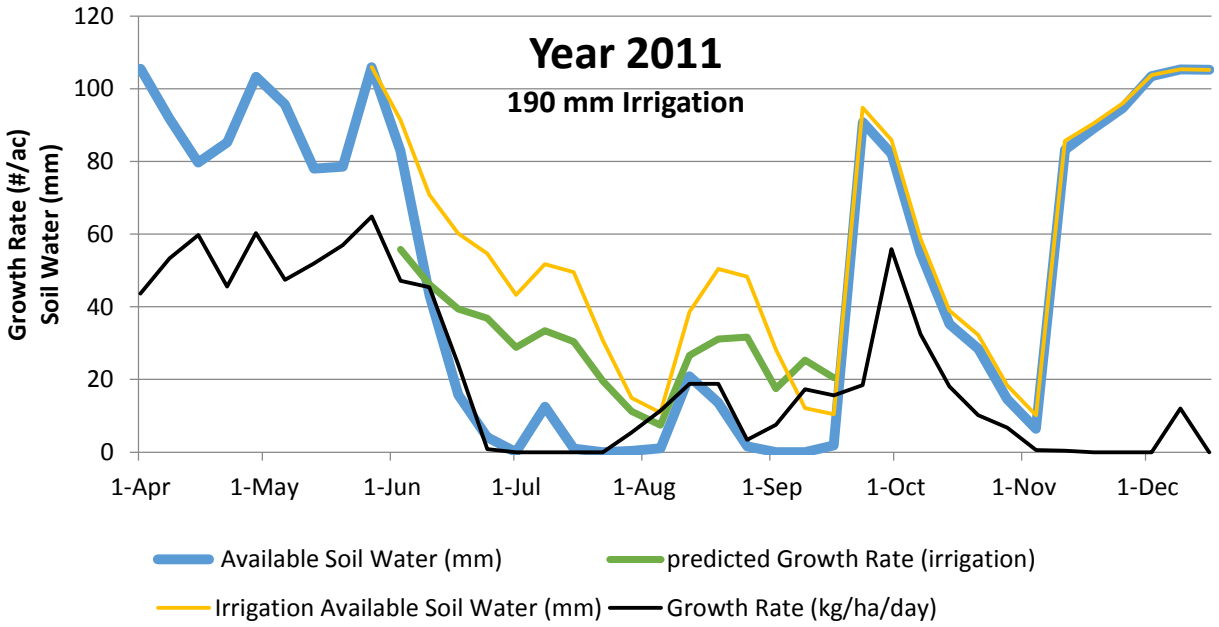
Irrigation
June 3-Sept 15

0.75 inches
Water/week



3.85 ton/ac

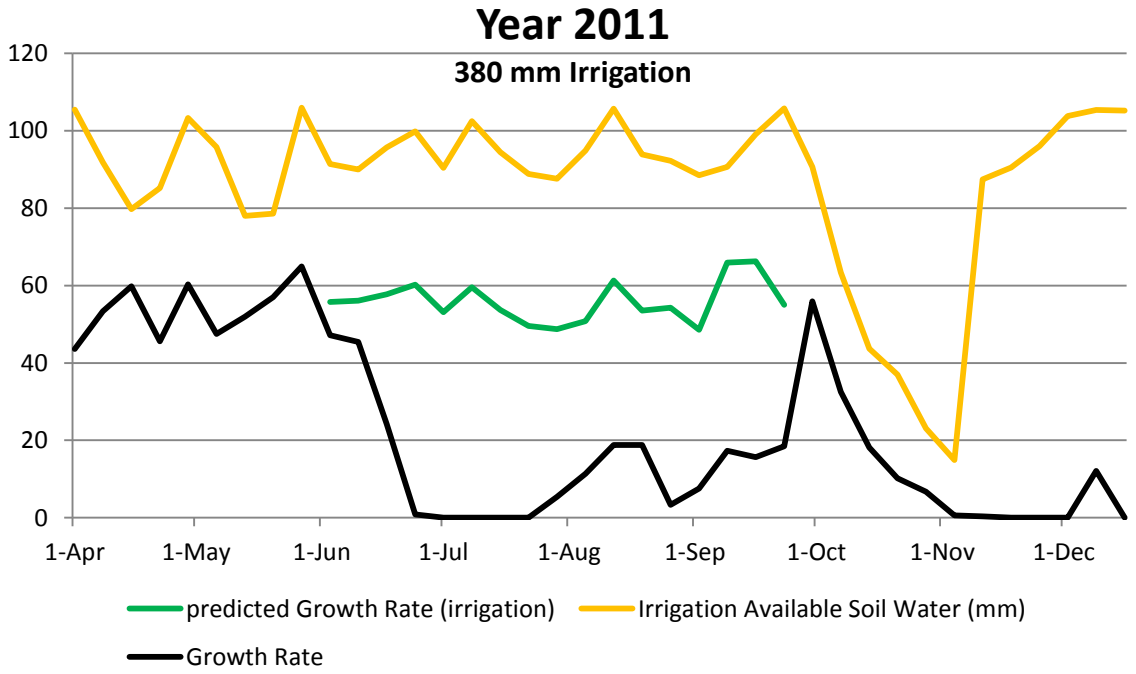
0.75 inches Water/week



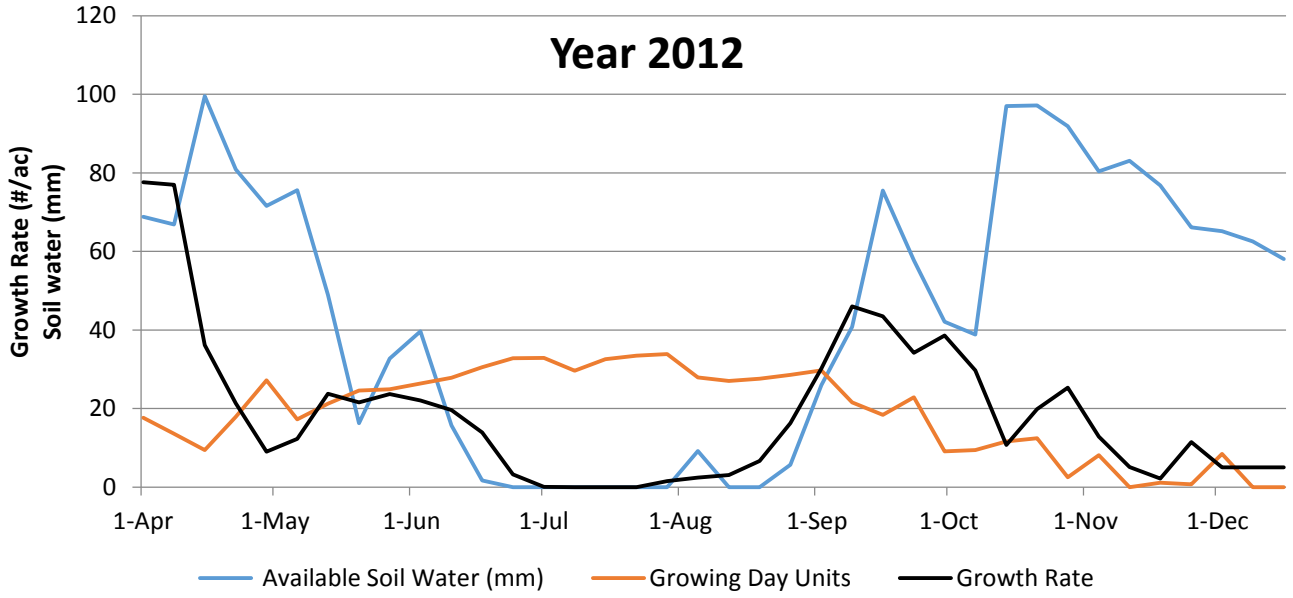
3.85 ton/ac

78% increase

1.5 inches Water/week



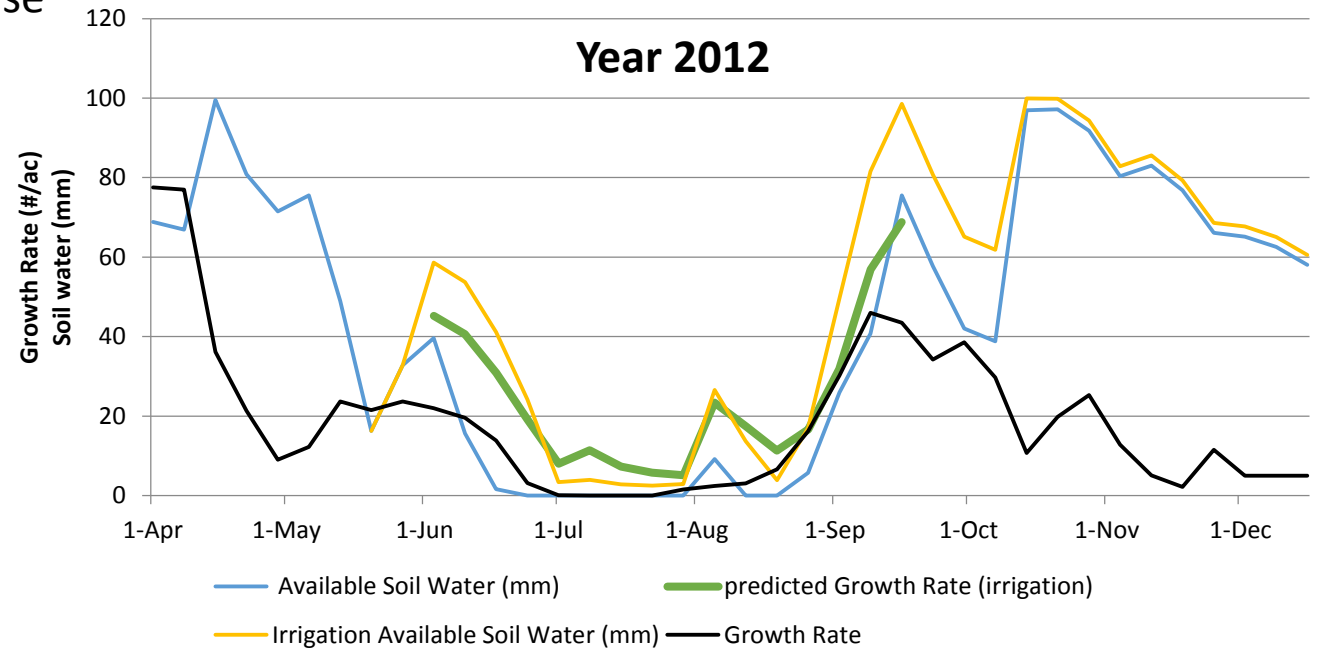
5.37 ton/ac



2.45 T/ac

27% increase

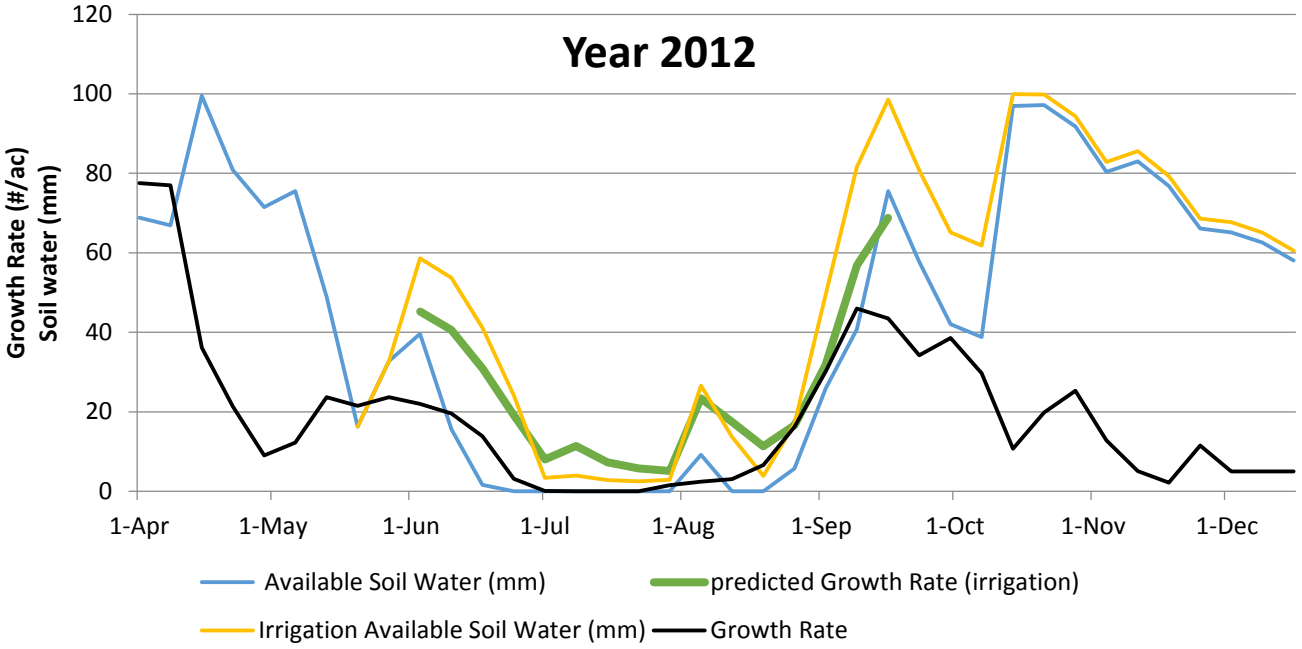
Irrigation
June 3-Sept 15



3.2 T/ac

0.75 inches
Water/week

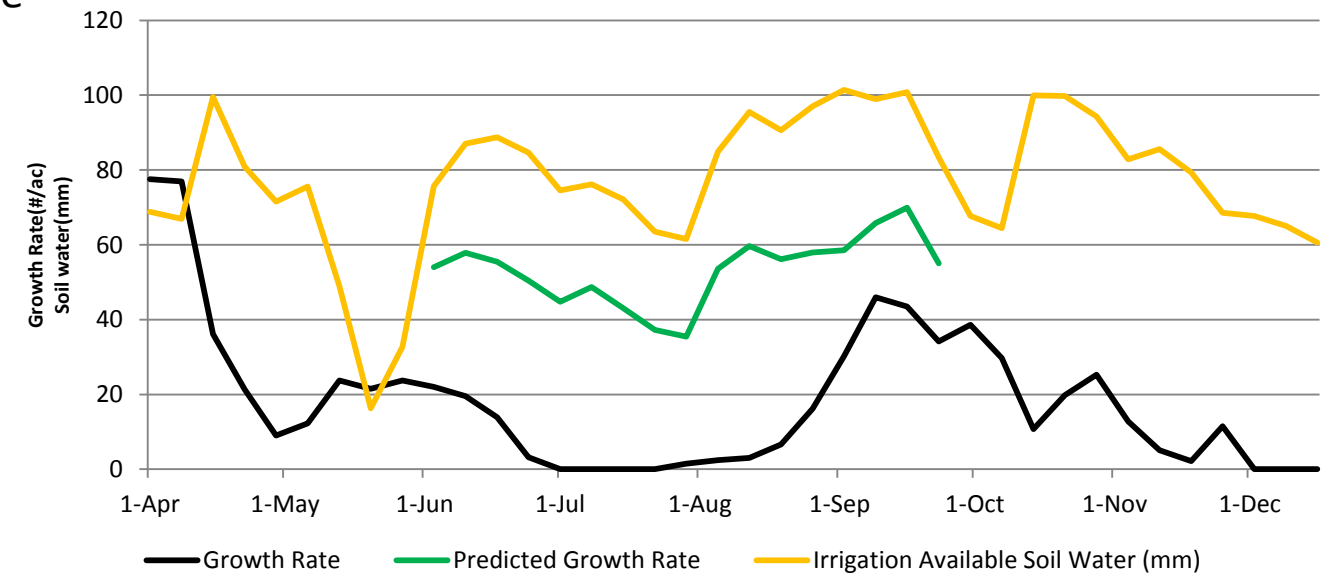
0.75 inches Water/week



3.2 T/ac

91% increase

Irrigation June 3-Sept 15



4.7 T/ac

1.5 inches Water/week

Is Irrigation Cost Effective?

- What are the “replacement” costs for feed if you don’t grow the “extra” pasture?

Annualized Cost per Ton of Dry Matter Forage for Different Irrigation Systems

Response Rate (Pounds DM Forage per acre inch water applied)

	200	300	400	500	600	700	800	900
Pod-line	$145	$97	$73	$58	$48	$41	$36	$32
Spider	$72	$48	$36	$29	$24	$21	$18	$16
Traveling gun	$122	$81	$61	$49	$41	$35	$30	$27
Pivot and well(electric)	$142	$94	$71	$57	$47	$40	$35	$31

Cool Season Forages

Warm Season Forages

Which should we grow?

What are the Risks and Rewards?

Irrigation
Risks and Rewards

- Upfront Costs
  - Could be over $1000/acre depending on scale and source
- Labor
  - Needs vary by system
- Maintenance
- Cost-effective
  - What is your return per acre inch?
  - Response rates per acre inch?
- Insurance program
- Nutritive value can be slightly reduced
- PICK YOUR FORAGE WISELY!

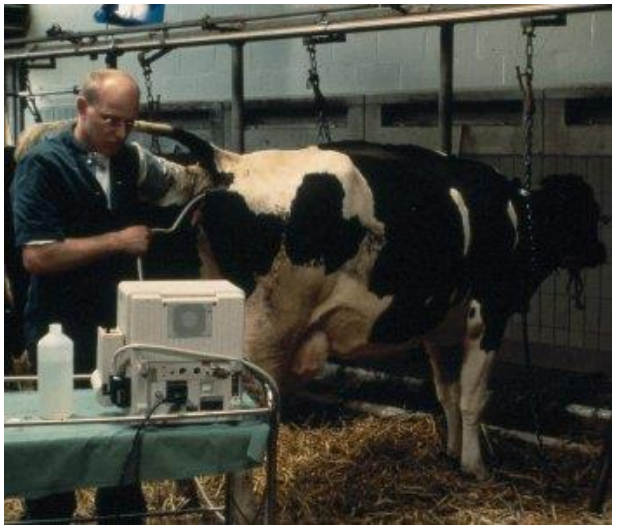
Intangibles?

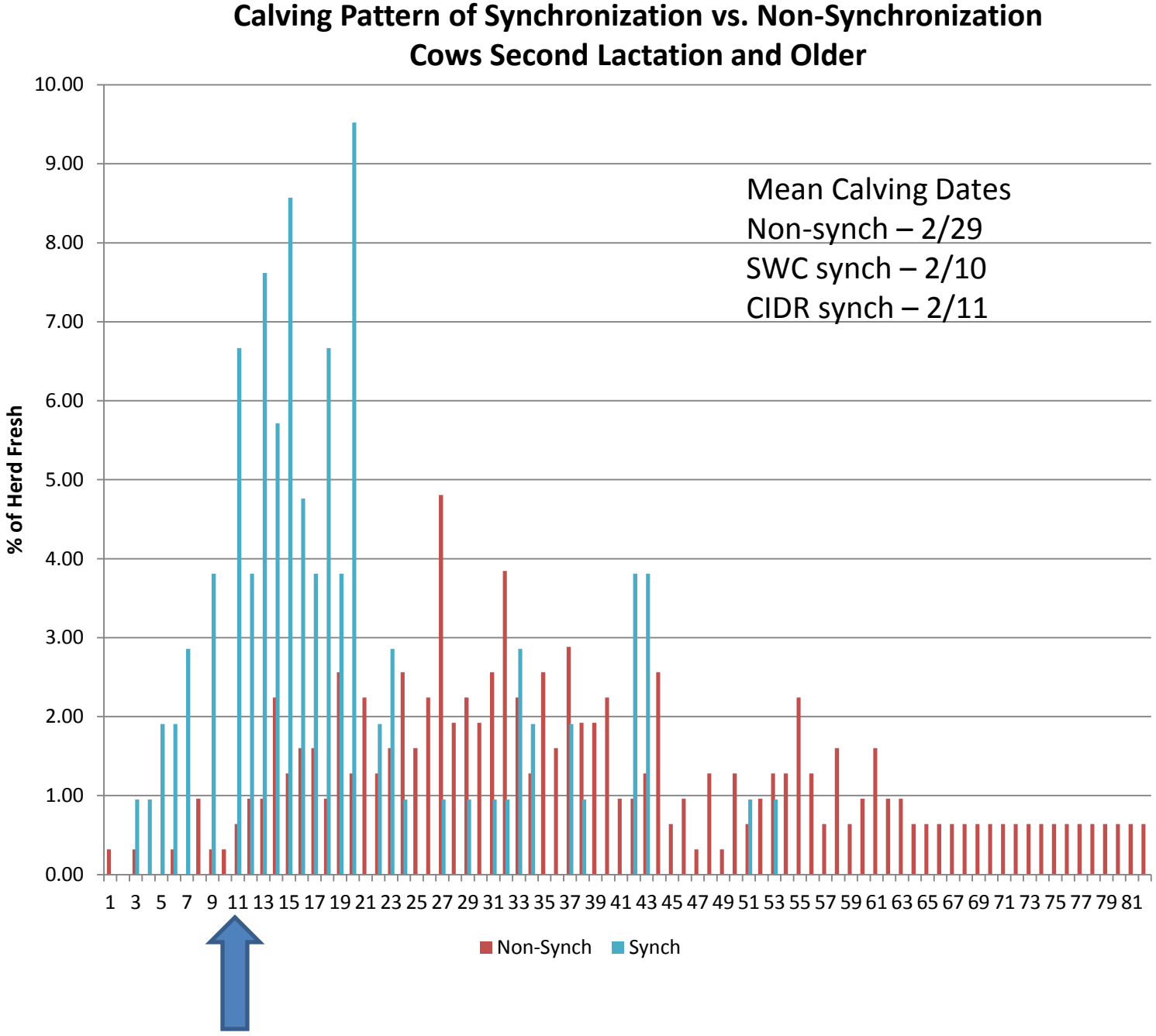
- Intermission!

- Questions
- **Is Irrigation a Viable Option for you?**

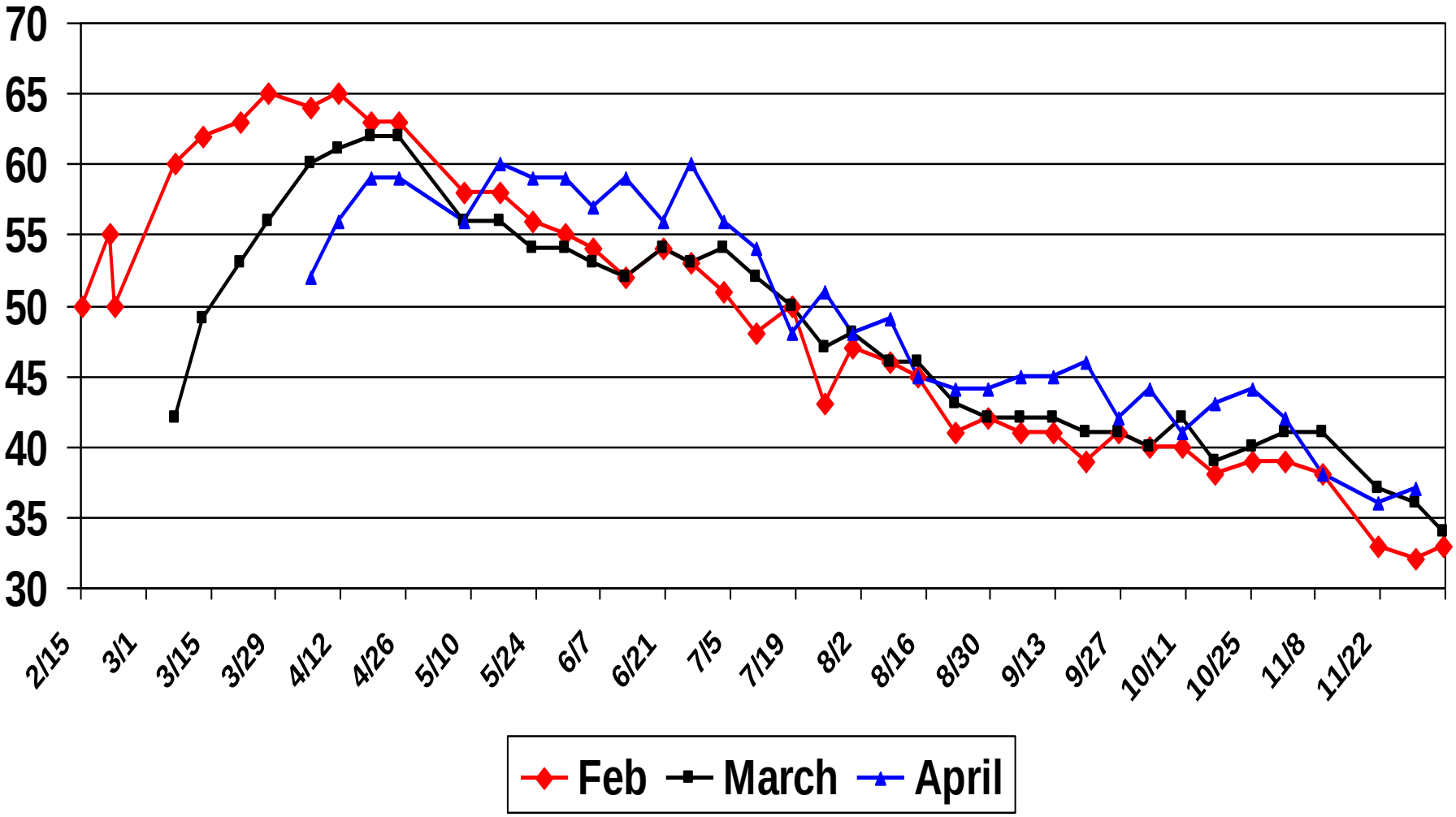
Reproduction
Risks and Rewards

This is What We Want, Right?




Calving Pattern of Synchronization vs. Non-Synchronization
Cows Second Lactation and Older
% of Herd Fresh
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81
Mean Calving Dates
Non-synch – 2/29
SWC synch – 2/10
CIDR synch – 2/11
Non-Synch
Synch

Lactation Curves of Cows Freshening in February through March

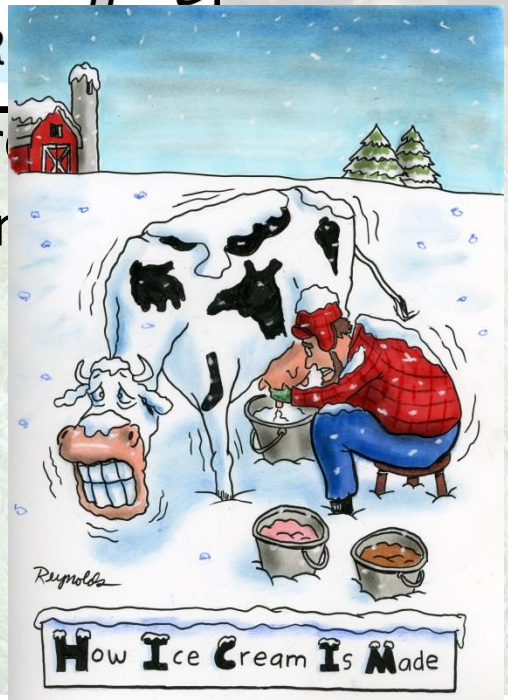


Modeling Synch vs. Non-Synch – 100 Cows

NON SYNCH	Annual Per Herd (lbs.)	SYNCH	Annual Per Herd (lbs.)
Feed Cost Summary		*Feed Cost Summary*	
Grain	329,649	Grain	335,648
Dry cow hay	143,223	Dry cow hay	119,585
Lactating cow hay	41,736	Lactating cow hay	53,603
Silage	257,817	Silage	278,105
Baleage	17,000	Baleage	17,000
Pasture	452,077	Pasture	451,275
Total	1,241,501	Total	1,255,216
Economic Summary	**Annual**	Economic Summary	**Annual**
Gross milk sales	$247,462	Gross milk sales	$253,511
Income over purchased feed & forage	$163,432	Income over purchased feed & forage	$167,196
Annual milk produced	1,302,429	Annual milk produced	1,334,269

Difference	**$3,765**
With cost of synch products	**$2,365**

$2,365 advantage



- Synch
  - Costlier
  - Labor efficient
  - Chance of a major screw up
  - Tighten calving window
  - More lactating feed
  - More milk
  - Weather event could be fun
  - Propagating infertility?

Pasture Management

- Inexpensive feed source
  - If done right!
  - Very expensive if done WRONG!
- Constant vigilance
  - Monitor!
- Can be species specific
  - Bunch grasses vs. jointed
  - Cool season vs. warm season
  - Root/stubble reserves vs. all photosynthetic
- If you mess it up you better fix it!
  - DMI, yield and nutritive value effected
- Evaluate the next 7 slides!

Pasture Management

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Cutting Height Impact on Total DM Yield

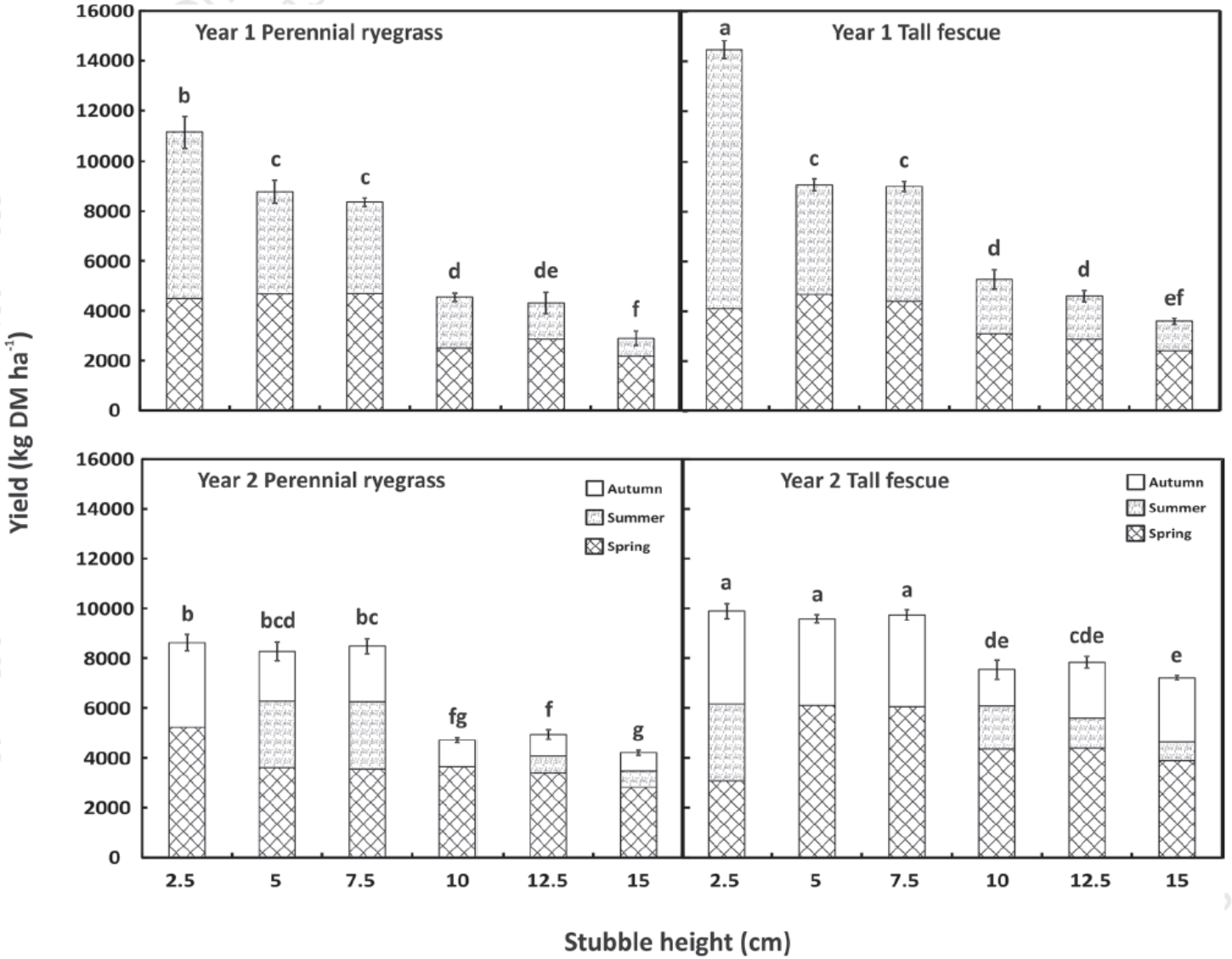


Fig. 1. Total annual dry matter (DM) yield in 2002 and 2003 of tall fescue and perennial ryegrass when repeatedly mowed to different stubble heights. Contributions of seasonal yields are differentiated by background fill of histogram bars. Mean separation was conducted on total DM yield. Within years, bars with common letters do not differ at $\alpha = 0.05$ probability level. Error bars represent two times the standard error of the mean.

Impact of Cutting Height on Stand Counts

Table 4. Final stand counts of perennial ryegrass and tall fescue stands after 2 yr of repeatedly mowing to various stubble heights.

Species	Stubble height	Stand density
	cm	tillers m^{-2}
Perennial ryegrass	2.5	1100d†
	5	821d
	7.5	1437cd
	10	2822ab
	12.5	3280a
	15	2488abc
Tall fescue	2.5	1389d
	5	1326d
	7.5	1279d
	10	1453cd
	12.5	1831bcd
	15	1768bcd
	SEM‡	378

† Means with common letters within a column are not significantly different using Fisher's protected LSD ($\alpha = 0.05$).

‡ Standard error of the mean.

Why the Hang-up on Residual?

- **Risks and rewards**
- **Dry matter intake may be limited**
- **Nutritive value impacted**
- **Stand longevity?**

Forage Selection

Production per Acre

	Fescue 2010	Ryegrass 2010	Fescue 2009	Ryegrass 2009
Grazing to July 1	3,773	4,228	4,600	4,510
July 1-Sept 1	476	0	1,211	882
Sept 1-Dry Off	2,646	1,148	1,575	1,757
TOTAL(pounds)	**6,895**	**5,376**	**7,386**	**7,149**

<u>2009</u>
Spring very cool, wet
Summer cool, above normal rainfall
Fall cool and very dry

<u>2010</u>
Spring cool, normal rainfall
Summer very hot, extreme drought
Fall normal temperature, drought extends

Total Milk Production by Species

	2010		2009	
	Fescue	**Ryegrass**	**Fescue**	**Ryegrass**
Milk/Cow	9,513	10,277	9,785	10,531
Milk/Acre	11,576	12,294	11,916	12,619

Milk production from beginning of study to dry off
2009 grazing began March 25
2010 grazing began April 8

Milk Production by Species

	2010		2009	
	Fescue	**Ryegrass**	**Fescue**	**Ryegrass**
% Feed	41%	28%	48%	47%
# Milk (Energy based)	3580	2607	4429	4753

Milk production from beginning of study to dry off
2009 grazing began March 25
2010 grazing began April 8

Stay The Course!

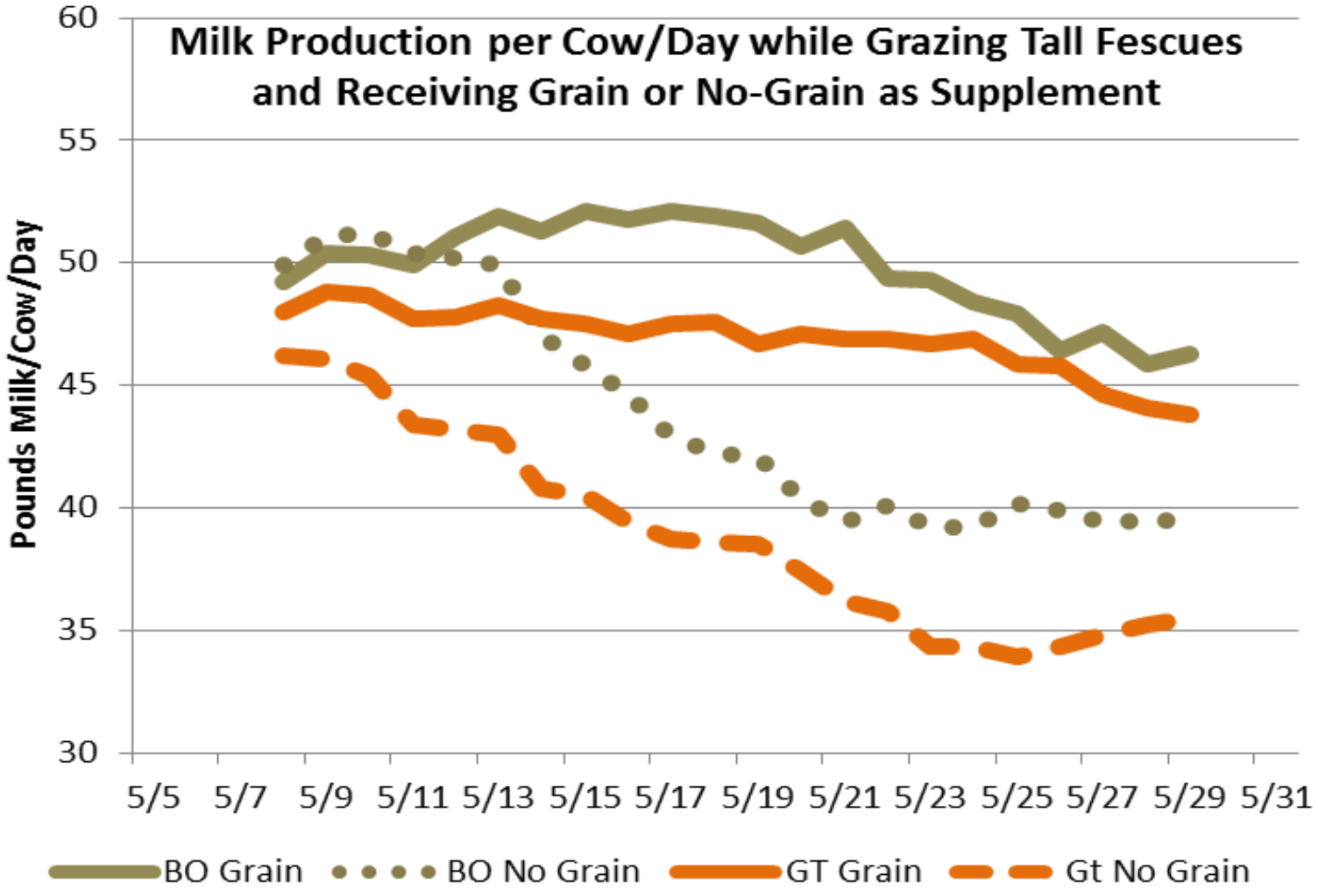
Know Your Goals!

Be Flexible

Focus on What's Important


Let the Grazing Begin!

Grain Feeding?



Grain Feeding?

- Response rate
- Bang for your buck
- Increased milk vs. weight gain vs. fertility
- Substitution rate
  - The Good, the bad and the ugly
- Does it fit YOUR SYSTEM?