

Using annual forages for livestock – management considerations

Jaymelynn Farney
Beef Systems Specialist
Kansas State University

**GREAT PLAINS
GRAZING**
CATTLE, CLIMATE, CULTURE & CHANGE



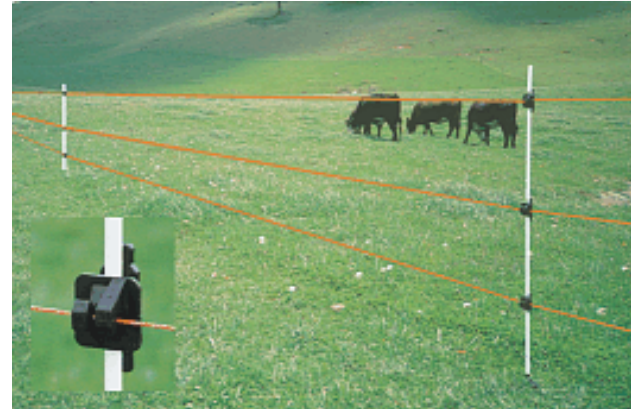
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Research and Extension

Integrated Crop-Livestock Systems

- “Encourage sustainable farming and generate positive interactions between crops and livestock with environmental and economic benefits” Allen et al., 2007
- Benefits:
 - Reduce risk of raising single product
 - Increase water infiltration
 - Resist soil erosion
 - Build soil organic carbon
 - Manure from livestock increases within-farm nutrient cycling = less synthetic fertilizers

Issues with cattle grazing crops

- Compaction??
- Water
- Fencing
- Toxicities



Cattle Performance

Measure	Tillage ¹	Winter CC ²	Summer CC ³
Calf daily gain (lb/hd/d)	CT	4.61	1.81*
	NT	5.00	2.05*
Cow daily gain (lb/hd/d)	CT	0.55	2.00
	NT	2.98	2.16
Cow/calf pair daily gain (lb/hd/d)	CT	3.17*	3.22
	NT	4.32*	3.64
Calf gain (lb/a)	CT	157*	206
	NT	213*	230
Cow gain (lb/a)	CT	38*	54
	NT	149*	77
Cow/calf pair gain (lb/a)	CT	182*	247
	NT	312*	289

¹ CT = conventional till and NT = no-till

² Summer grain (Sorghum 2002-2004) or corn (2005) and winter cover crop (Rye)

³ Winter grain (Wheat) and summer cover crop (pearl millet)

* Indicates difference in tillage treatment

Economics - \$/acre

System	Tillage	Grazing	Total Cost	Crop Value	Calf gain value	Total crop and calf value	Net return over variable costs
Sorghum (corn) + rye	CT	Ungrazed	159.62	122.13	0.00	122.13	-37.49
		Grazed	160.00	131.75	117.57	249.32	89.32
	NT	Ungrazed	160.59	153.13	0.00	153.13	-7.46
		Grazed	159.16	117.50	159.66	277.16	118.00
Wheat + pearl millet	CT	Ungrazed	122.96	100.17	0.00	100.17	-22.79
		Grazed	118.58	103.25	154.31	257.56	138.98
	NT	Ungrazed	129.71	95.50	0.00	95.50	-34.21
		Grazed	127.75	97.83	172.35	270.18	142.43

No cost associated for fence in this analysis



WHAT DO WE KNOW ABOUT COVERS
AS AN ANNUAL FORAGE?

Type and common annuals

Fall/Winter

- Grasses
 - Rye, barley, oat, triticale, wheat, rye, ryegrass
- Broadleafs
 - Brassicas, buckwheat
- Legumes
 - Winter pea, clovers

Summer

- Grasses
 - Sorghums, sudans, millets, corn, teff
- Broadleafs
 - Sunflowers, buckwheat
- Legumes
 - Sunn hemp, forage soybeans, cowpeas, mungbean

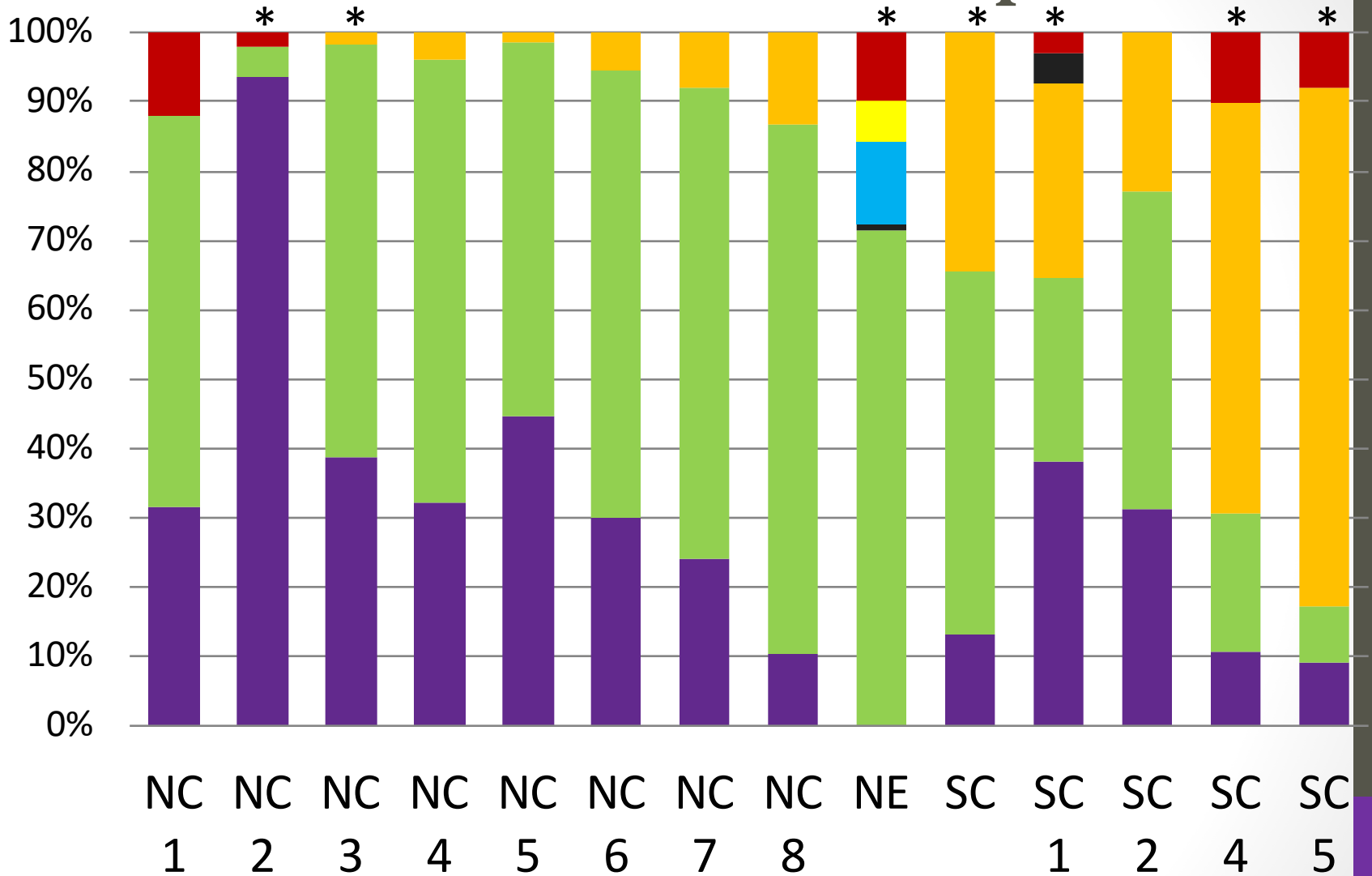
What do we plant?

- Perennial systems diversity is the best (Gunter et al., 2012; Gadberry et al., 2015; Keyser et al., 2016)
 - Bermuda/bahiagrass pastures addition of wheat+ryegrass, wheat+ryegrass+red clover, wheat+ryegrass+white clover+crimson clover
 - Calf weaning weight greater – cow effects no difference
- Legumes in meadow or tall fescue cattle gains improved (Schaefer et al., 2014)
- In an already diverse perennial pasture – addition of 3, 5, or 8 additional plant species did not affect cattle performance (Tracy and Faulkner, 2006)

What do we plant?

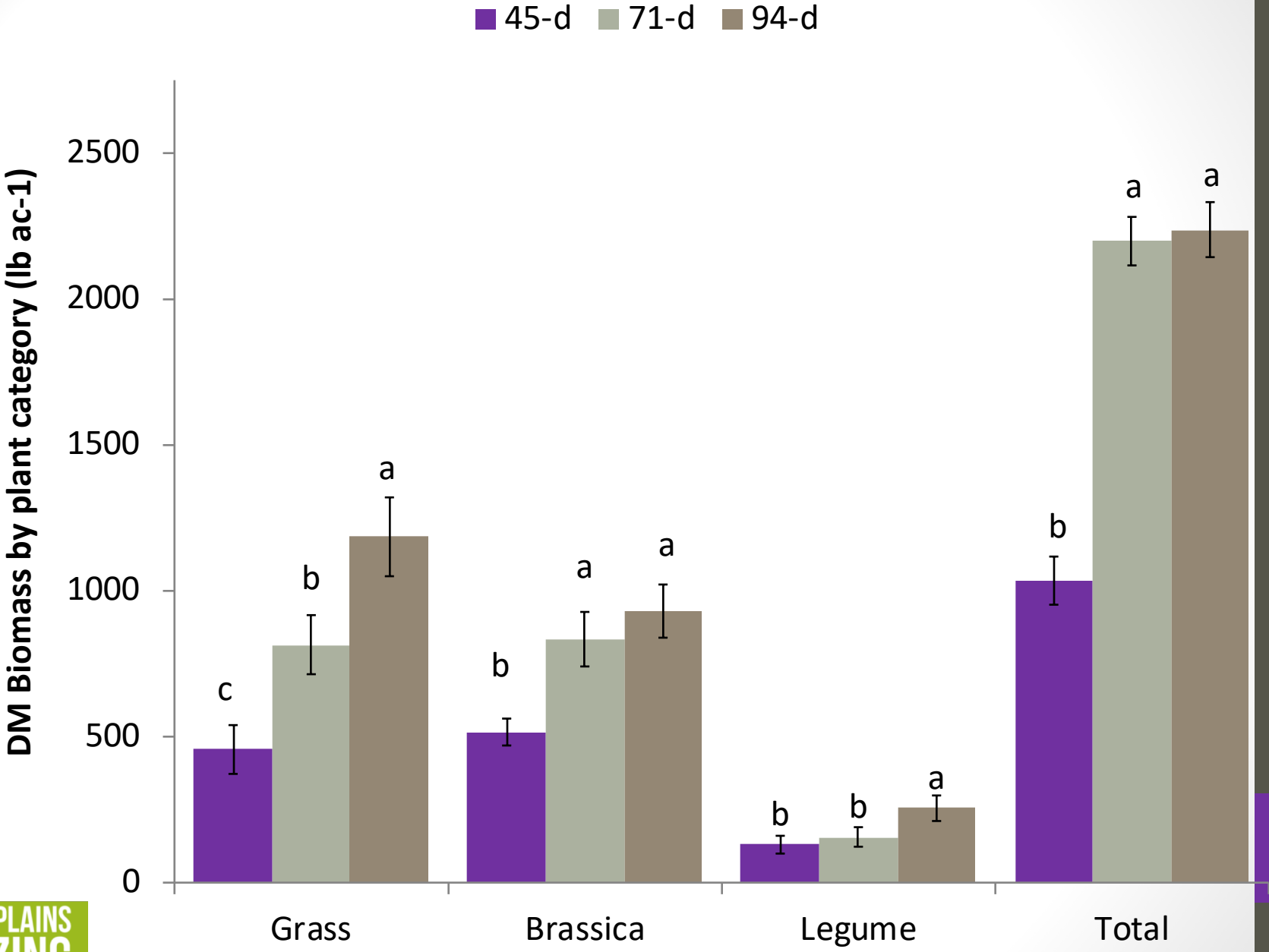
- Annual forages – few head to head between grass only and mixture
- Florida study addition of triticale into ryegrass did not improve cattle gains and was more expensive (Vendramini et al., 2016)
- Gains: Oat-ryegrass mixture = rye-ryegrass-oat mixture > rye-ryegrass mixture (Mullenix et al., 2012)
- Gains: Wheat = wheat+radish (Farney et al., unpublished)

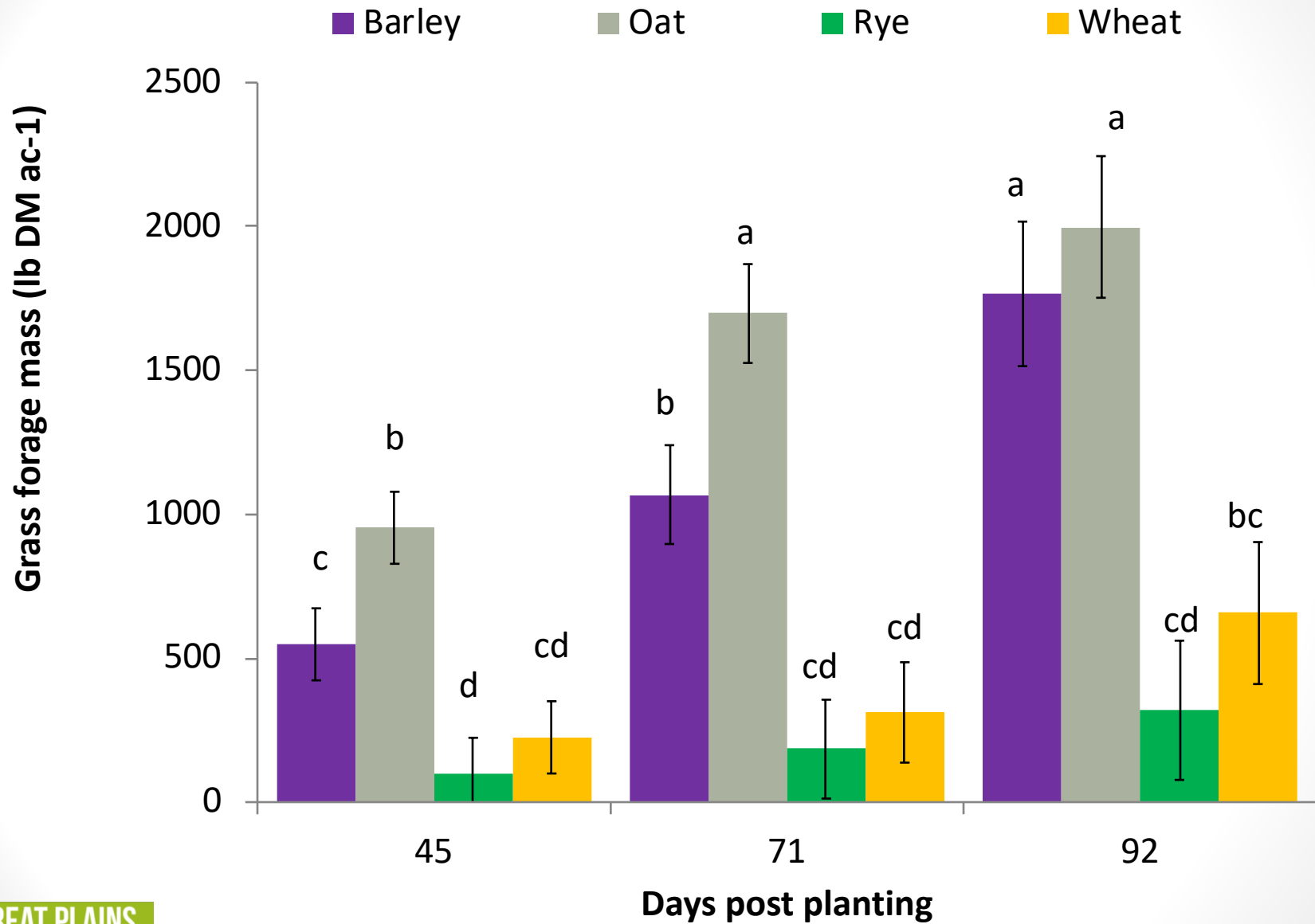
Statewide 2014 Fall samples



Statewide 2014 Fall samples

Species #	Region	Average (DM lb/ac)	Range (DM lb/ac)	n
2	NC	2125	1108-4754	5
3	SC	895	625-1163	4
4	NC	1450	--	1
5	SC	675	--	1
6	--	--	--	--
7	NE	654	--	1
TOTAL		1393		12





Plant production by category

Item	Barley	Oat	Rye	Wheat	SEM	Trt
Forage mass production (lb DM/ac)	1127.57 ^b	1549.80 ^a	200.54 ^c	397.86 ^c	137.39	< 0.0001
Cost/lb DM (\$/lb)	0.10 ^b	0.34 ^b	2.70 ^a	1.13 ^b	0.45	< 0.001
Item	Radish	Turnip			SEM	Trt
Forage mass production (lb DM/ac)	1006.74 ^a	506.80 ^b			73.05	< 0.0001
Cost/lb DM (\$/lb)	0.90 ^b	1.52 ^a			0.20	0.04
Item	Clover	Pea			SEM	Trt
Forage mass production (lb DM/ac)	1.27 ^b	359.78 ^a			40.0	< 0.0001
Cost/lb DM (\$/lb)	7.43 ^a	1.10 ^b			0.34	< 0.0001

^{abc} Within a row means followed with different letters are significantly different at $P < 0.10$.

	Grass (% DM)		
Mixture Combo [†]	2014	2015	P – value
Barley/radish/clover	29.18 ^b	60.08 ^a	0.10
Barley/radish/pea	14.33 ^b	46.15 ^a	0.10
Barley/turnip/clover	73.47	81.93	0.64
Barley/turnip/pea	66.4	58.92	0.63
Oat/radish/clover	28.63 ^b	83.50 ^a	< 0.0001
Oat/radish/pea	34.06 ^b	68.44 ^a	0.07
Oat/turnip/clover	77.91	89.09	0.53
Oat/turnip/pea	60.07	76.45	0.37
Rye/radish/clover	3.37 ^b	47.78 ^a	0.02
Rye/radish/pea	1.09	1.09	0.79
Rye/turnip/clover	18.71	50.13	0.11
Rye/turnip/pea	20.68	5.66	0.40
Wheat/radish/clover	7.29 ^b	54.01 ^a	0.02
Wheat/radish/pea	4.147	14.63	0.55
Wheat/turnip/clover	44.22 ^b	82.21 ^a	0.05
Wheat/turnip/pea	17.93	33.00	0.40
SEM	12.04	12.71	

Percentage of grass was greater in 2015, when there was a difference

2014 more rain and more days above 60° than in 2015

P – values are for each category (grass, brassica, or legume) comparing percentages composition between years.

^{ab} Within a row means followed with different letters are significantly different at $P \leq 0.10$.

[†] Barley = winter barley (*Hordeum vulgare*); Oat = winter oat (*Avena sativa*); Rye = cereal rye (*Secale cereal*); Wheat = winter wheat (*Triticum aestivum*); Radish = tillage radish (*Raphanus sativus*); Turnip = purple-top turnip (*Brassica rapa*); Clover = berseem clover (*Trifolium alexandrinum*); Pea = Austrian winter pea (*Pisum sativum* subsp. *arvense*).

	Grass (% DM)			Brassica (% DM)		
Mixture Combo [†]	2014	2015	P – value	2014	2015	P – value
Barley/radish/clover	29.18 ^b	60.08 ^a	0.10	71.25 ^a	16.90 ^b	< 0.0001
Barley/radish/pea	14.33 ^b	46.15 ^a	0.10	83.87 ^a	4.91 ^b	< 0.0001
Barley/turnip/clover	73.47	81.93	0.64	25.25 ^a	5.00 ^b	0.05
Barley/turnip/pea	2014 more rain and more days above 60° than in 2015			26.05 ^a	0.00 ^b	< 0.001
Oat/radish/clover				71.36 ^a	2.016 ^b	< 0.0001
Oat/radish/pea				64.71 ^a	15.31 ^b	< 0.0001
Oat/turnip/clover				23.20 ^a	1.11 ^b	0.02
Oat/turnip/pea				34.05 ^a	0.57 ^b	< 0.0001
Rye/radish/clover				94.47 ^a	34.37 ^b	< 0.0001
Rye/radish/pea				97.21 ^a	12.69 ^b	< 0.0001
Rye/turnip/clover				80.89 ^a	37.90 ^b	0.0001
Rye/turnip/pea				59.61 ^a	11.21 ^b	< 0.0001
Wheat/radish/clover				92.35 ^a	28.46 ^b	< 0.0001
Wheat/radish/pea				93.49 ^a	15.30 ^b	< 0.0001
Wheat/turnip/clover	44.22 ^b	82.21 ^a	0.05	53.91 ^a	4.53 ^b	< 0.0001
Wheat/turnip/pea	17.93	33.00	0.40	66.59 ^a	4.63 ^b	< 0.0001
SEM	12.04	12.71		8.10	8.94	

Percentage of brassica was greater in 2014 for all mixtures

P – values are for each category (grass, brassica, or legume) comparing percentages composition between years.

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[†] Barley = winter barley (*Hordeum vulgare*); Oat = winter oat (*Avena sativa*); Rye = cereal rye (*Secale cereal*); Wheat = winter wheat (*Triticum aestivum*); Radish = tillage radish (*Raphanus sativus*); Turnip = purple-top turnip (*Brassica rapa*); Clover = berseem clover (*Trifolium alexandrinum*); Pea = Austrian winter pea (*Pisum sativum* subsp. *arvense*).

	Grass (% DM)	Brassica (% DM)	Legume (% DM)		
Mixture Combo [†]			2014	2015	P – value
Barley/radish/clover			0.03	0.02	1.00
Barley/radish/pea			2.09 ^b	35.16 ^a	<0.0001
Barley/turnip/clover			1.28	0.30	0.87
Barley/turnip/pea			7.55 ^b	32.86 ^a	<0.0001
Oat/radish/clover			0.01	0.00	1.00
Oat/radish/pea			1.75	12.96	0.07
Oat/turnip/clover			0.00	0.00	0.99
Oat/turnip/pea			5.34	9.6	0.48
Rye/radish/clover			0.00	0.36	0.95
Rye/radish/pea			1.61 ^b	69.71 ^a	<0.0001
Rye/turnip/clover			0.16	1.07	0.89
Rye/turnip/pea			19.07 ^b	73.30 ^a	<0.0001
Wheat/radish/clover			0.03	0.82	0.90
Wheat/radish/pea			2.19 ^b	48.18 ^a	<0.0001
Wheat/turnip/clover			0.03	0.58	0.93
Wheat/turnip/pea			13.14 ^b	50.81 ^a	<0.0001
SEM			4.08	4.43	

Percentage of peas was greater in 2015

Except for oat/turnip/pea mixture

2014 more rain and more days above 60° than in 2015

P – values are for each category

^{ab} Within a row means followed

[†] Barley = winter barley (*Hordeum*

(*Triticum aestivum*); Radish = tillage radish (*Raphanus sativus*); Turnip = purple-top turnip (*Brassica rapa*); Clover = berseem clover

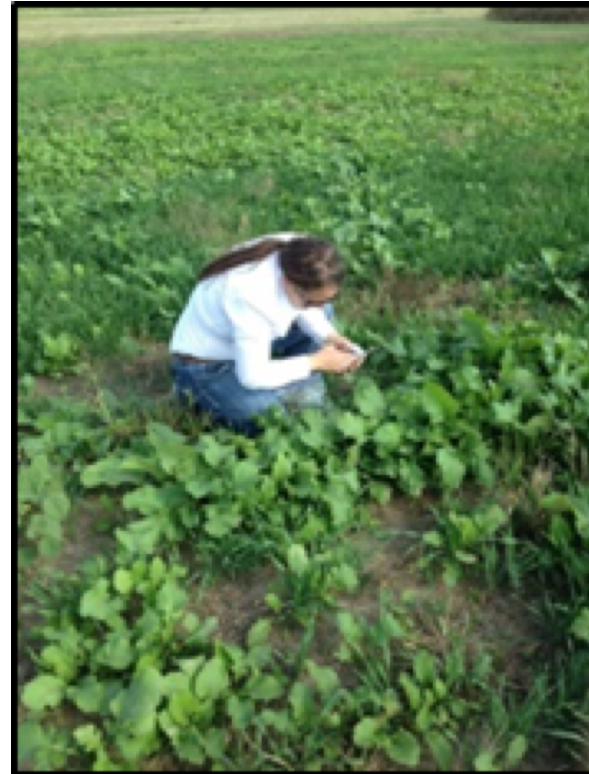
(*Trifolium alexandrinum*); Pea = Austrian winter pea (*Pisum sativum* subsp. *arvense*).

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ereal); Wheat = winter wheat

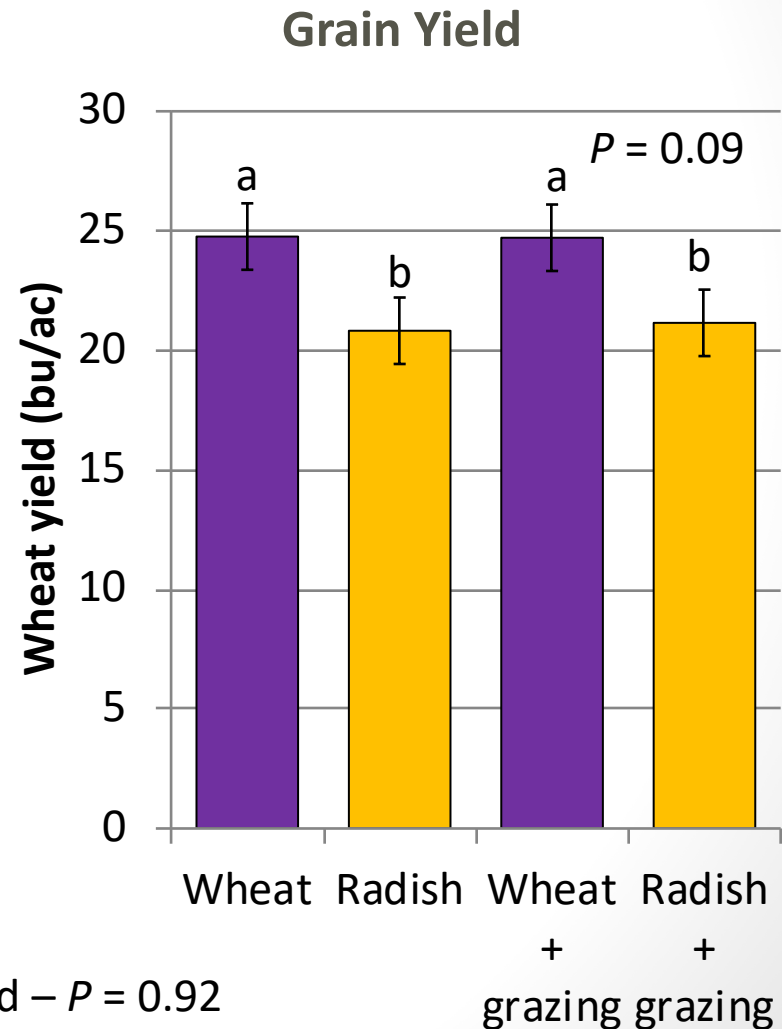
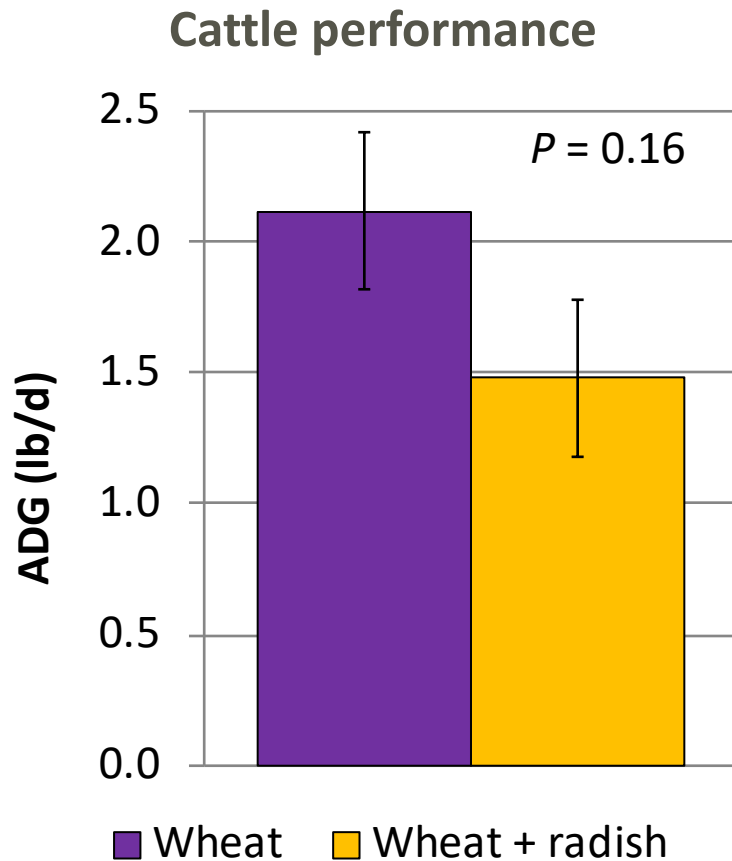
Winter legume emerged or not

- Columbus study **NO** difference in winter cover if legume emerged or did not
 - Biomass
 - Crude protein
 - TDN
 - ADF
 - NDF
 - Carbon
 - Nitrogen



C:N

Radish to break-up compaction in dual purpose wheat



Grazing did not impact wheat yield – $P = 0.92$



HOW DO WE USE ANNUAL FORAGES FOR CATTLE?

Know purpose - Cattle

- **Are gains a priority?**
 - Might need to include supplement
- **Is maximizing land a priority?**
 - What class of animal maximizes the acreage
- **What are the land priorities?**



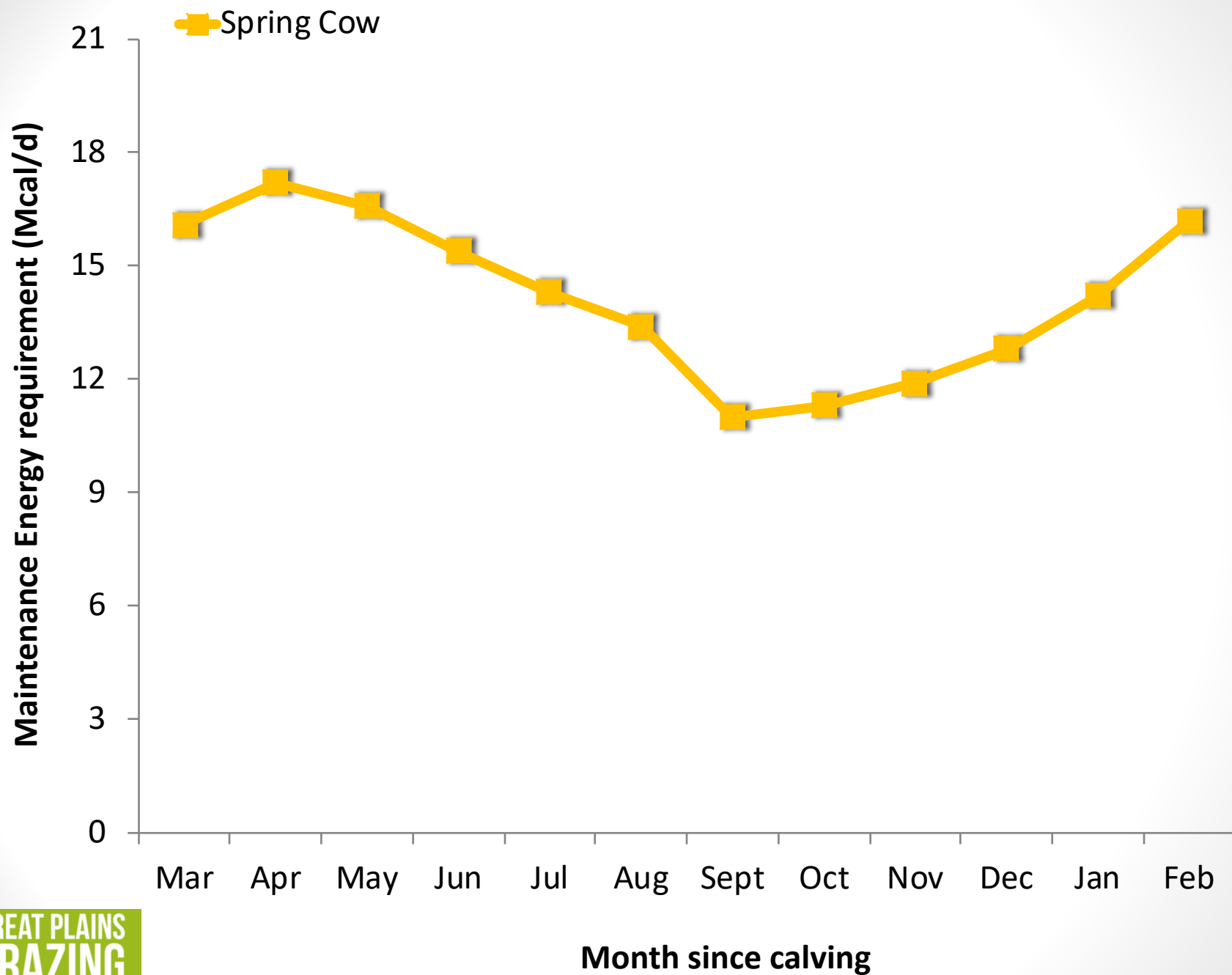
Forage Quality

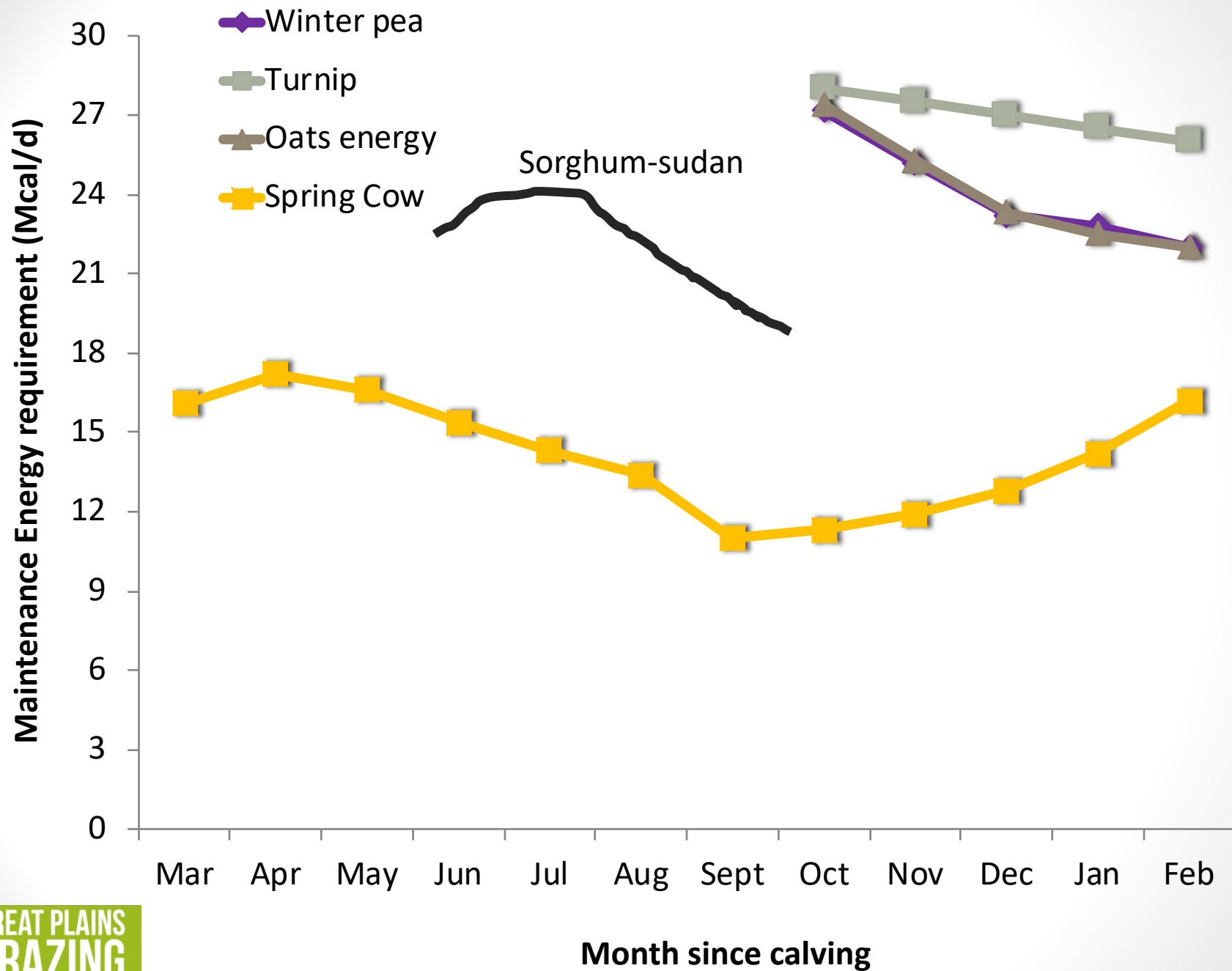
Species	NDF %	ADF %	Calculated TDN
Barley	40.6	13.9	79.9
Black Oats	42.0	24.0	73.3
Purple Top Turnip Bulb	—	13.8	79.9
Purple Top Turnip Leaf	17.6	10.3	82.2
Radish Bulb	18.0	14.9	79.2
Radish Leaf	20.3	12.1	81.2
Tillage Radish Bulb	14.0	12.0	81.1
Tillage Radish Leaf	22.0	18.1	77.1
Rye	33.6	12.7	80.7
Cow Pea/Soybean	36.0	16.3	78.3
Triticale	38.4	15.4	78.9
Triticale/Oats	36	14.7	79.3
Turnip/Radish/Brassica Bulb	18	10.6	82.0
Turnip/Radish/Brassica Leaf	--	17.7	77.4
Wheat	39.5	15.7	78.7
Winter Pea	21.6	15.7	78.7

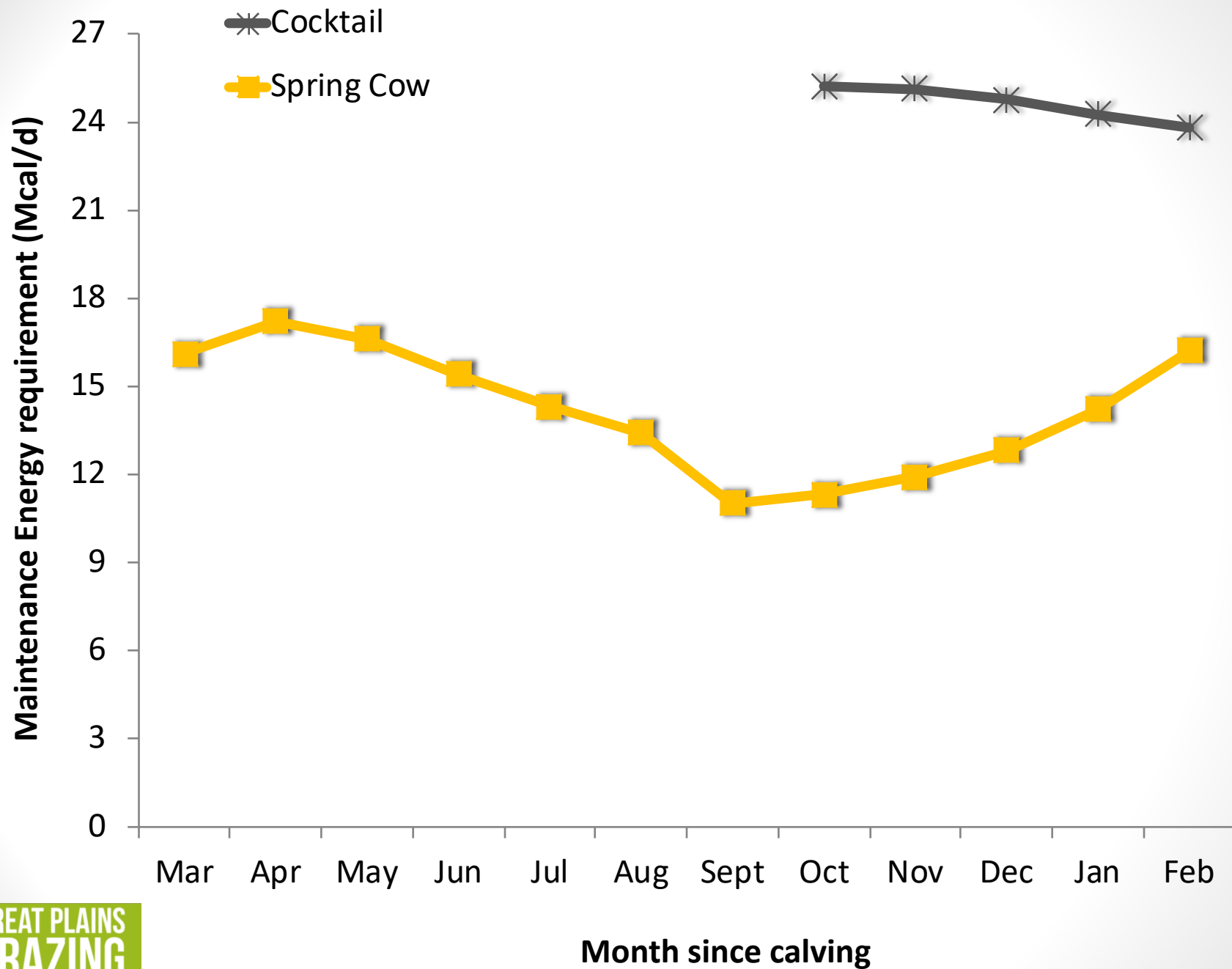
Winter Annuals and Cows

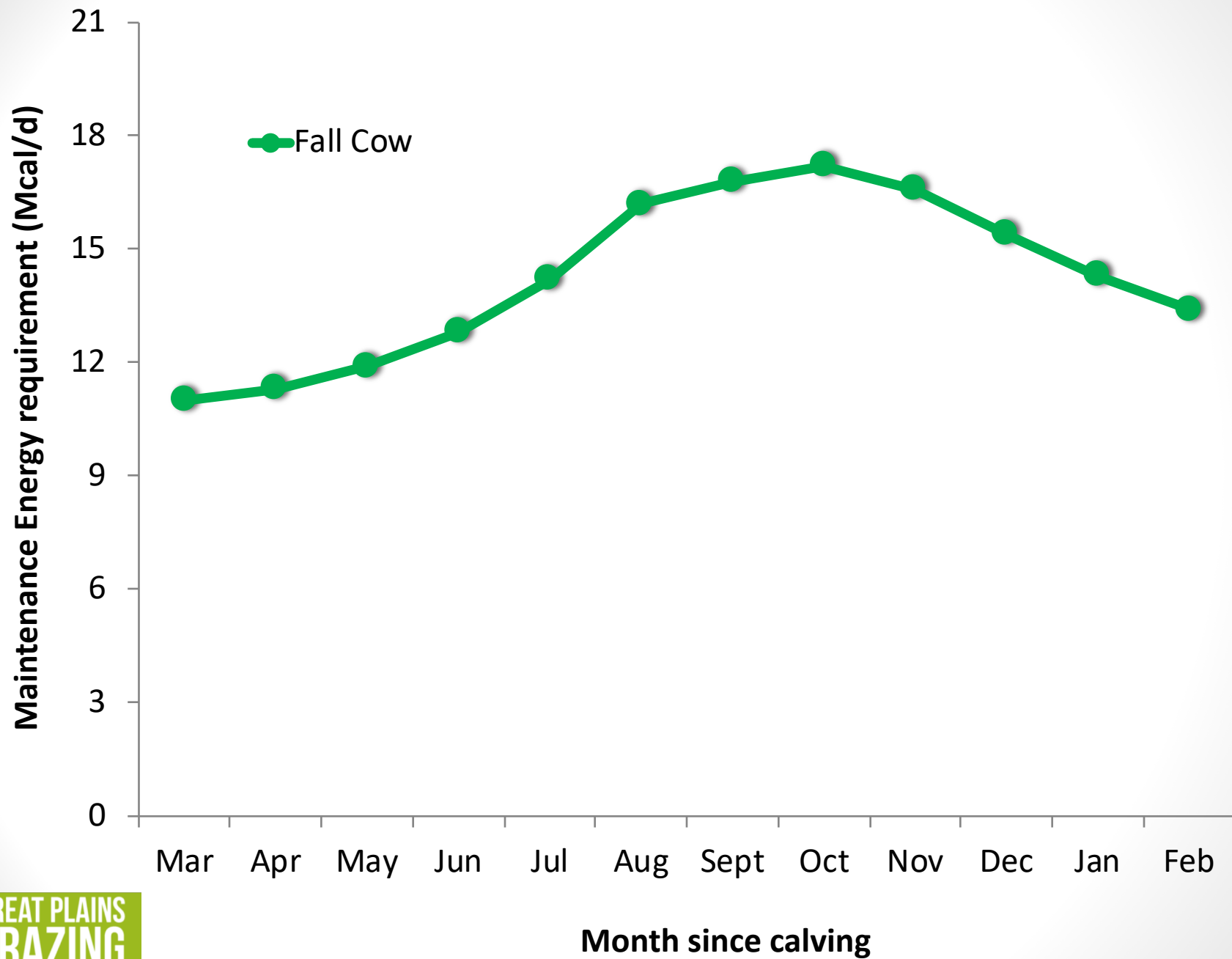


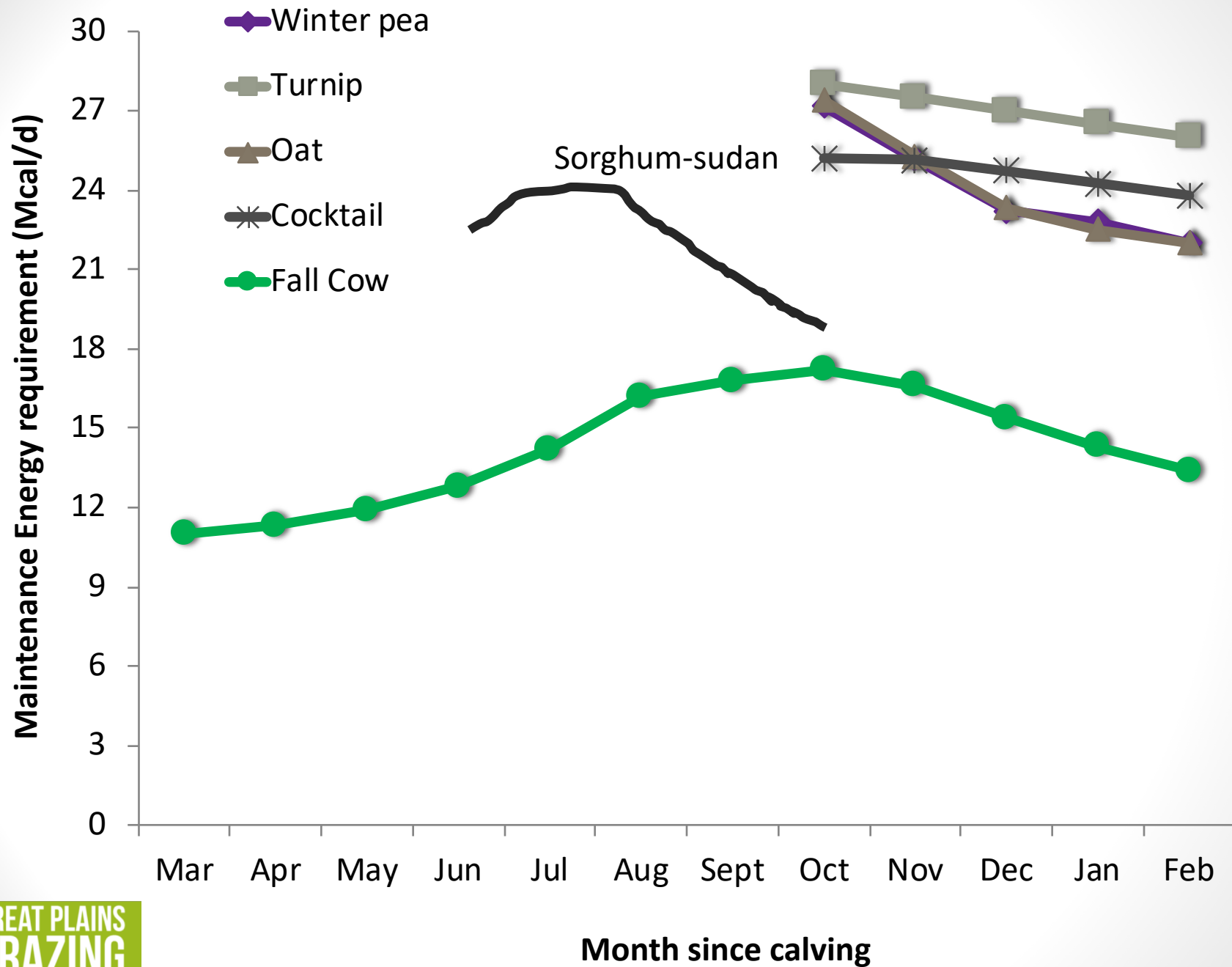
- Cow requirements, especially if dry, pregnant is much, much lower than what is offered by the winter annuals

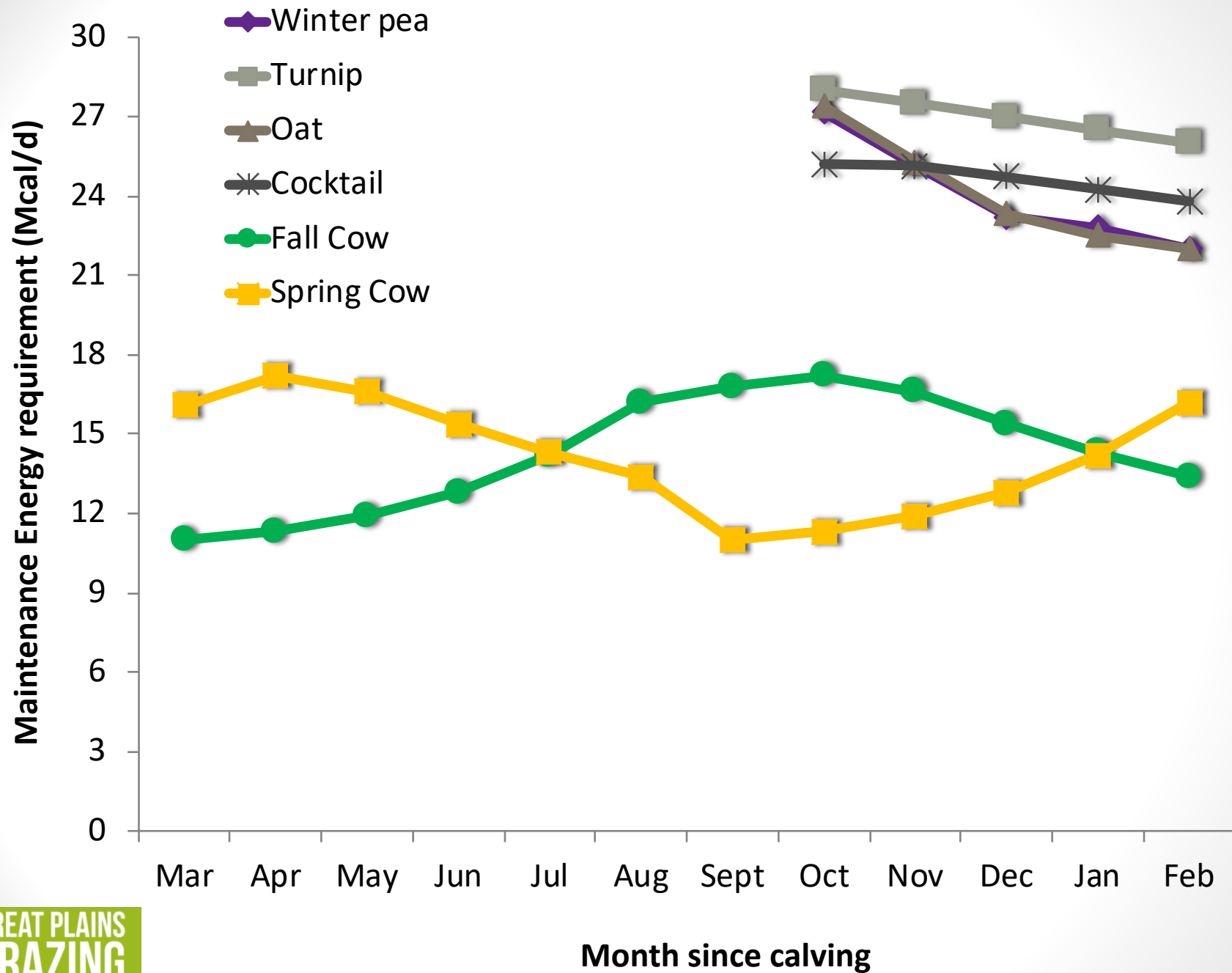












Winter Annuals and Cows

- Issues
 - Too much body condition
 - Inefficiency in production system
 - Loss of potential revenue
- Practices to manage for this:
 - Short term grazing on high quality forage
 - Combination paddock



Limit grazing

- Allow cows a couple of hours/d to graze high protein, high energy forage at least 3x/week

Combination paddock

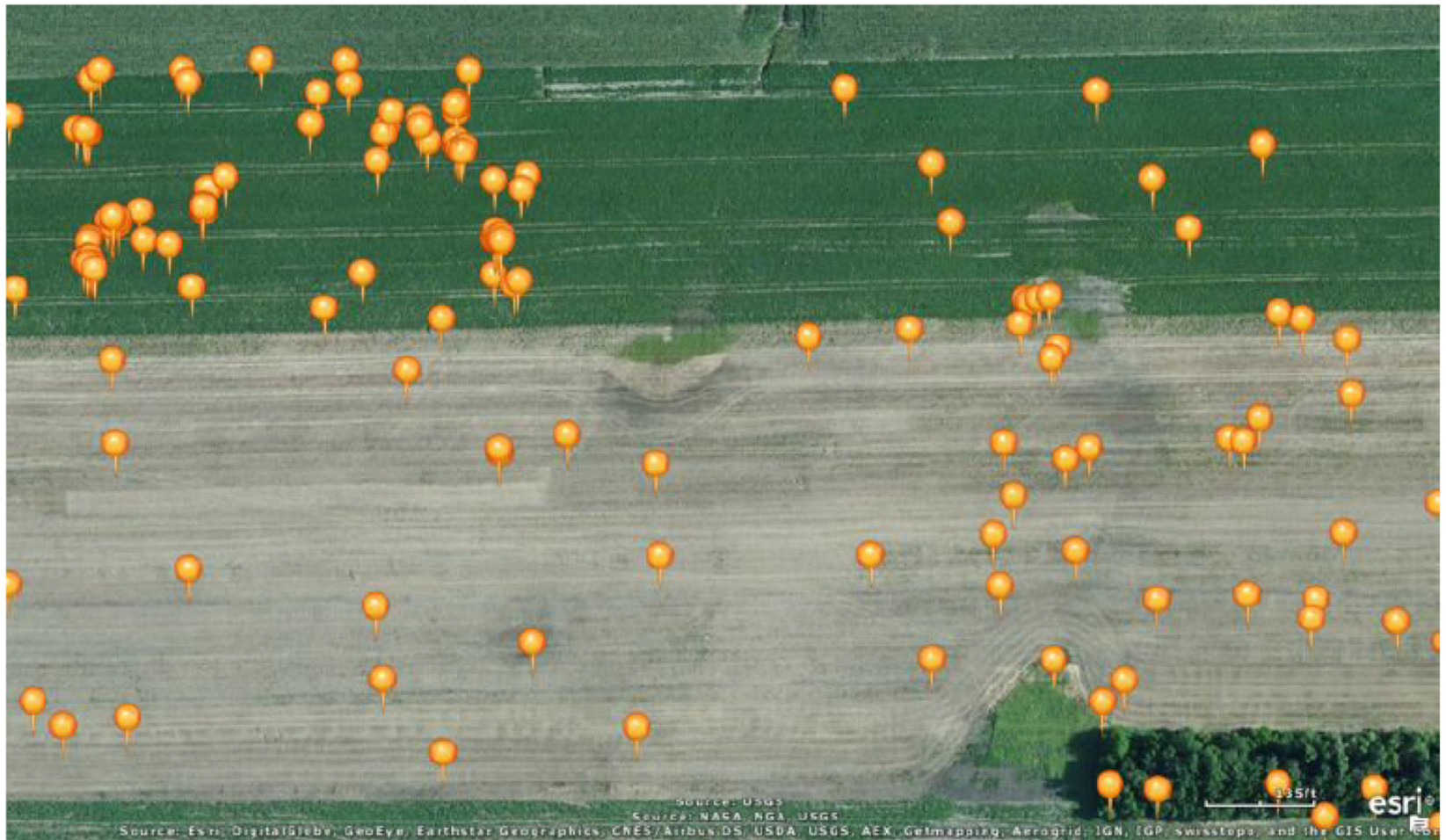
- Portion of pasture is low quality roughage or other portion is high quality annual
 - Planting corners of circles with high quality forage
 - Fencing both types of forage

Flying on annuals into residue??

B19 wheat stalks 2016 2



B19 wheat stalks 2016 1



1312 wheat stalk 2016



Weaned Calves

- Most of the time, we still are offering too much protein (much higher than requirements)
- Need another source of dry forage/feed
- Maximize gain potential want to make protein to energy ratio optimal
- Maximize gain = maximum dry matter intake

Value of winter cover crops - stockers

- Nebraska data showed that calf gains are VERY variable with cover crop mixtures
- Over 10 studies
 - ADG ranged from 0.8 lb/d up to 2.3 lb/d
 - Same cocktail in back-to-back years
 - 2.3 lb/d one year and 1.3 lb/d next year

Calf gains on cereal grains

Cereal type	Cattle Type	Gain	Location
Oat	Heifer	1.96	North Dakota
Barley	Heifer	1.96	North Dakota
Barley	Heifer	1.75-1.96	South Dakota
Barley	Steers	3.0	Canada
Oat	Steers	2-3.5	Canada
Rye	Steers	2.25-2.6	Canada
Triticale	Steers	1.7-2.4	Canada
Wheat	Steers	1.87	Canada
Oat-Ryegrass	Steers	3.06	Alabama
Oat-Rye-Ryegrass	Steers	2.78	Alabama
Rye-Ryegrass	Steers	2.50	Alabama
Ryegrass	Calves	1.96	Florida
Ryegrass-triticale	Calves	1.68	Florida

Palatability from cattle side

- Offered 8 fall/winter covers to cattle – two days in a row to determine selectivity and adversity to the plants



Winter annuals – pre-freeze

Pea = Austrian winter pea

Barley = winter barley

Kale = Bayou Kale

Rape = Trophy rape

Forage Radish = Graza forage radish

Collard = Impact collard

Turnip = purple top turnip

Selectivity

Barley	Pea	Forage Radish	Mustard	Collard	Turnip	Rape	Kale
6	17	17	34	35	37	39	43

Pea = Austrian winter pea

Barley = spring barley

Kale = Bayou Kale

Rape = Trophy rape

Forage Radish = Graza forage radish

Collard = Impact collard

Turnip = purple top turnip

Lower number means more preferentially selected

Winter annuals – post-freeze

Pea = Austrian winter pea

Vetch = common vetch

Barley = winter barley

Oat = winter oat

Rape = Trophy rape

Forage Radish = Graza forage radish

Turnip = purple top turnip

Selectivity

Oat	Barley	Forage Radish	Vetch	Pea	Rape	Turnip
12	16	25	27	29	36	44

Pea = Austrian winter pea

Vetch = common vetch

Barley = winter barley

Oat = winter oat

Rape = Trophy rape

Forage Radish = Graza forage radish

Turnip = purple top turnip

Lower number means more preferentially selected

Summer annuals

- Pearl millet
- Mungbean
- Okra
- Sunflower
- BMR forage sorghum
- Safflower
- Sunn hemp
- Sorghum-sudan



Selectivity

BMR	SS	Millet	Sunflower	Sunn hemp	Okra	Mungbean	Safflower
13	15	25	37	41	51	52	55

BMR – brown mid-rib forage sorghum – Silo Pro

SS – sorghum-sudan – SorGrow 80

Millet – pearl millet

Sunflower – black oil sunflower



Lower number means
more preferentially
selected

Summary

- Planning important with using annual forages
 - GOALS
- Grasses and brassicas predominate winter mixes
 - Legumes don't compete well in fall/winter mixes
- Warm and wet will cause brassicas to really grow and might have competitive effects
- Radishes added into dual purpose wheat can reduce wheat yield
 - Cattle gains might be reduced as well
- Cattle will select grasses 1st in annuals

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jkj@ksu.edu

620-820-6125



Thanks!!
Questions