Spices and Beef Cattle

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Introduction

- Essential oils name derived from *Quinta essential*, of the fragrance (essence) of that plant
- EO considered safe for human and animal consumption and categorized as GRAS (FDA, 2004)
- Results of EO in livestock studies have been vary variable possibly because
  - Composition of EO can vary among different parts of the plant
  - Plant species changes EO composition
  - Age and environmental growing conditions of plant

Introduction

- Across all studies – there is not clear cut mode of action, gain or production effects observed
  - % composition of active oil ingredients are often not reported or analyzed
  - Within controlled in vitro studies – results WIDELY variable
    - Several studies show that rumen adaptation occurs and benefits of EO diminish within 6 days in several studies
- Most consistent results are that some EO can alter rumen VFA to more proprionate and less acetate and an increase in butyrate
  - Want to say a similar mode of action as ionophore, but it is not

EO and Feedlot

EO	Feeding amt	DOF	Location	Effects	Citation
Carvacrol (oregano) – cinnamaldehyde (cinnamon) - eugenol (clove) – capsain (pepper plants)	75 g/d	112	Canada	No difference in any measures of performance as compared to control, addition of encapsulate NO3	Alemu et al. 2019. Animals. 9(21)
Encapsulated blend EO	150 mg/kg	208	Brazil	EO = Monension performance and carcass characteristics. Mon+EO tended to improve carcass-adjusted performance as compared to Mon. Tylan was successfully replaced with EO+Mon. increase performance without changes in liver abscess	Araujo et al. 2019. App. Anim. Sci. 35(2)
CRINA Ruminants (blended essential oils cresol, resorcinol, thymol, guaiacol, eugenol)	90 mg/kg	93	Brazil	EO=Mon for gains CP total digestibility increased EO as compared to Mon.	Meschiattti et al. 2019. J. Anim. Sci. 97(1)
Clove or cinnamon	3.5 or 7 g/d	187	Brazil	Clove or cinnamon EO increased ADG, DMI, and final BW with higher level having greater effect. No changes in carcass, digestibility of nutrients, temperament, or animal feeding behavior.	Ornaghi et al. 2017. Anim. Feed Sci. Tech. 234
Control Rosemary EO Protected blend eugenol+thymol+vanillin Clove+blend Clove+Rosemary+blend	 4 g/hd/d 2 g/hd/d 2+2 1.33+1.33+1.33			ADG and feed efficiency: Tied for #1: Clove+blend and Clove+rosemary+blend Same as #1 and #2 : protected blend #2 : Control diet #3 : Rosemary No impacts on carcass measures	Souza et al., 2019. Livestock Sci. 220

Spices and Grazing

- CinnaGar (Provimi North America Inc.) 1.6 g/kg of mineral (SPER) wheat pasture
- CinnaGar 2.4 g/kg mineral Sand Sagebrush rangeland
- 200 mg/d hand fed daily (NextEnhance, Novus International) oat-ryegrass or rye-ryegrass pastures.

- No difference in gain as compared to control for EO or monensin or the blend (cool-season annuals or on sand sagebrush rangeland) no difference in EO or monensin on wheat pasture (Beck et al., 2016)

Spices and Insects – Pour-On

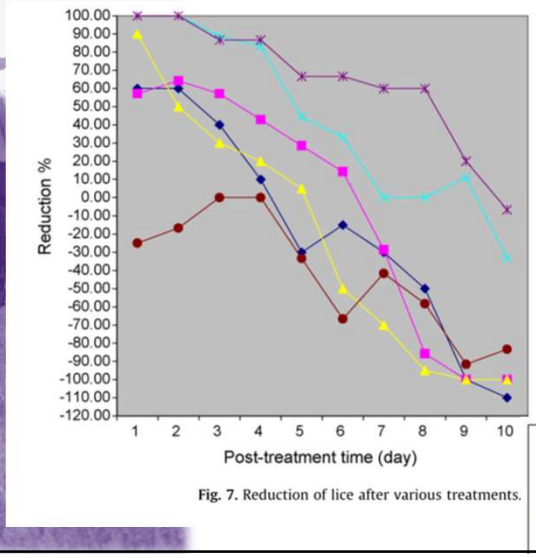


Fig. 7. Reduction of lice after various treatments.

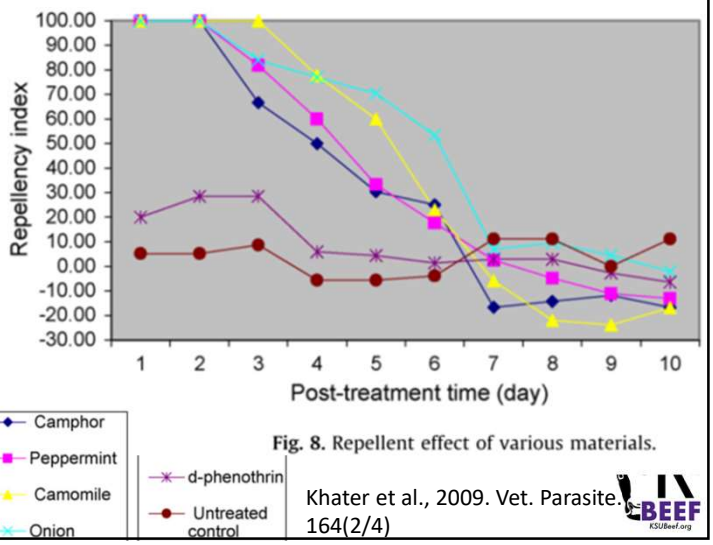


Fig. 8. Repellent effect of various materials.

Khater et al., 2009. Vet. Parasite. 164(2/4)

Spices and Intake - insects

- Garlic in dairy cows
  - Reduced ticks up to 11 days after ingestion
  - No effect on flies
- Other studies shown some effect on ticks
- Some effect on flies
  - Not been replicated

K-State projects

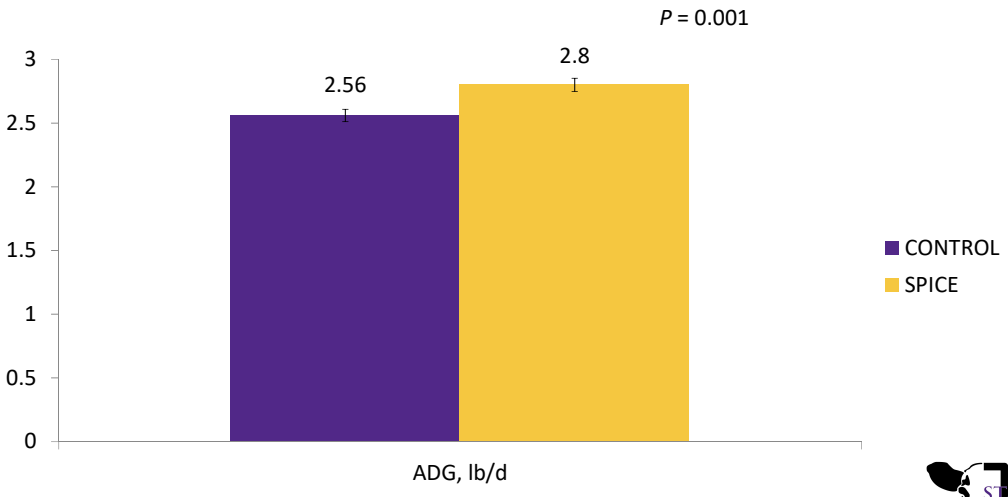
2018 – Tall grass Native Range

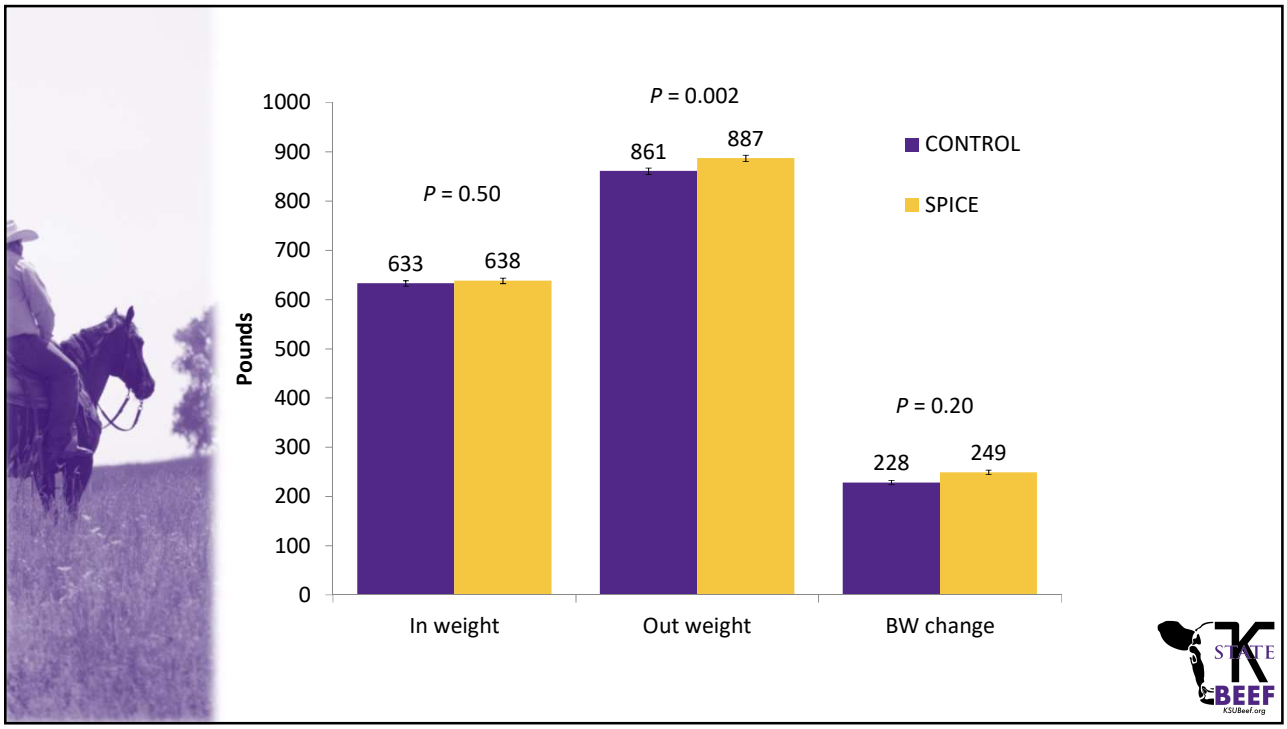
- 281 steers were assigned to 8 pastures at Bressner research pastures in Yates Center
- Calves were weighed on April 30 and August 1 (2018)
- 4 pastures were offered a free choice mineral that included 50% organic zinc, copper, magnesium, and manganese (CONTROL)
- 4 pastures were offered a free choice mineral that was the same base as control with addition of ThinkFly (ThinkAnimal™, DeSoto, KS; SPICE)

2018 – Tall grass Native

- 266 steers were used in analysis
  - 9 were not captured at weigh date
  - 6 were removed because they were in wrong pasture at one point in the study
- Weekly 33% of calves in the pasture were photographed between 8 am and 10 am
  - Photos were used to count the number of flies

2018 Results





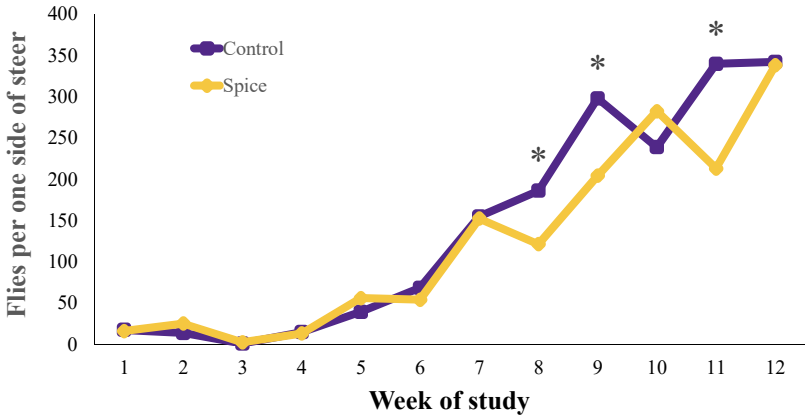
ECONOMIC FEASIBILITY

- ThinkFly added $800/ton to mineral cost
  - $0.10 per head per day more for the ThinkFly on top of $0.10/hd per day base mineral (essentially double cost of other stocker mineral)
- Resulted in 21 pounds more per calf
- $112 average price in August
- $23.52 increased revenue per calf
- Extra cost of ThinkFly = $9 per calf for 90 days
- Difference in cost was $14.52 per calf added revenue above control mineral

FLIES

Treatment: $P = 0.78$
Con: 162 flies vs SPICE: 142 flies

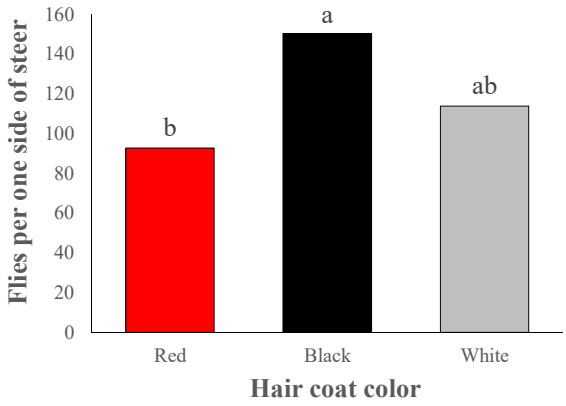
Figure 5: Average number of flies on one side of steer, by week and mineral treatment



* Indicates treatment different in that week with $P < 0.05$. Control treatment was typical stocker mineral provided free-choice to cattle. Spice treatment was the same mineral that had the addition of spices (ThinkFly™).

FLIES

Figure 6: Average number of flies based on hair coat color



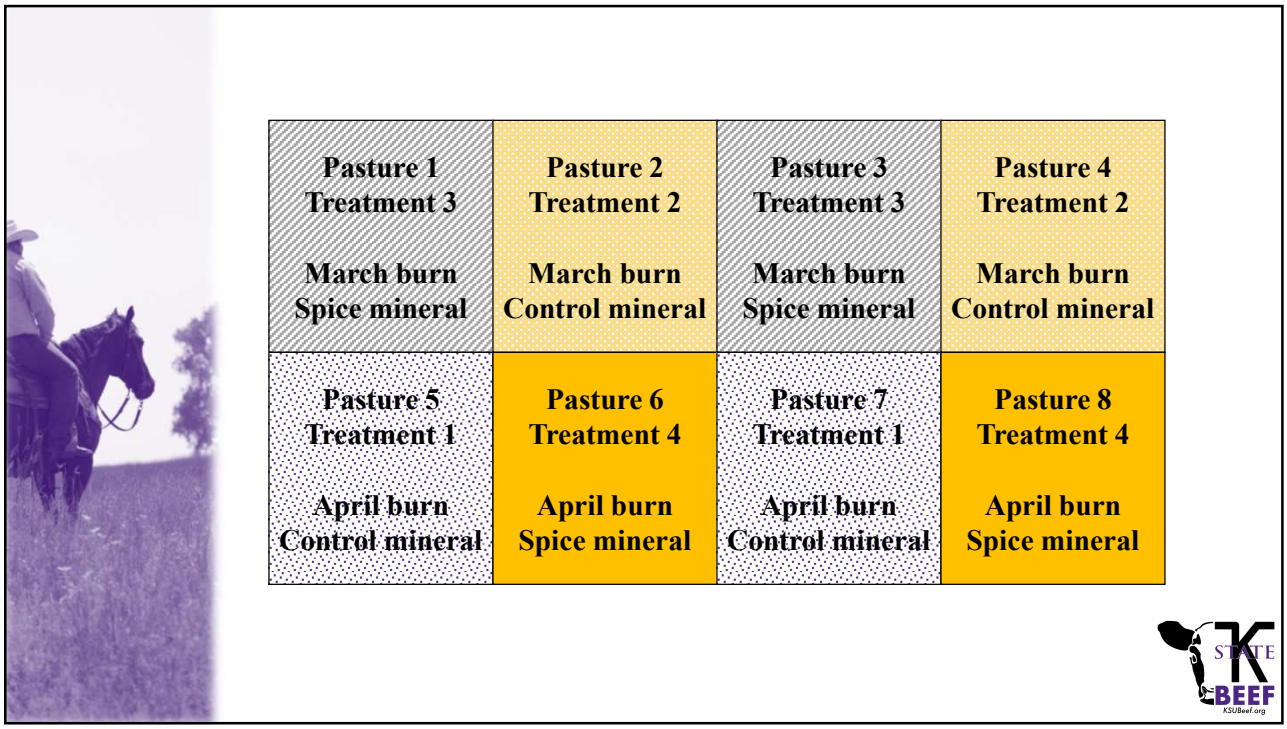
ab - different letters indicate differences in effect
Hair coat colors were based on the main body color. Hair coat had a significant effect on the number of flies ($P < 0.001$) where black had more than red and white hair coats were in the middle.

Spice and burn 2019-2021

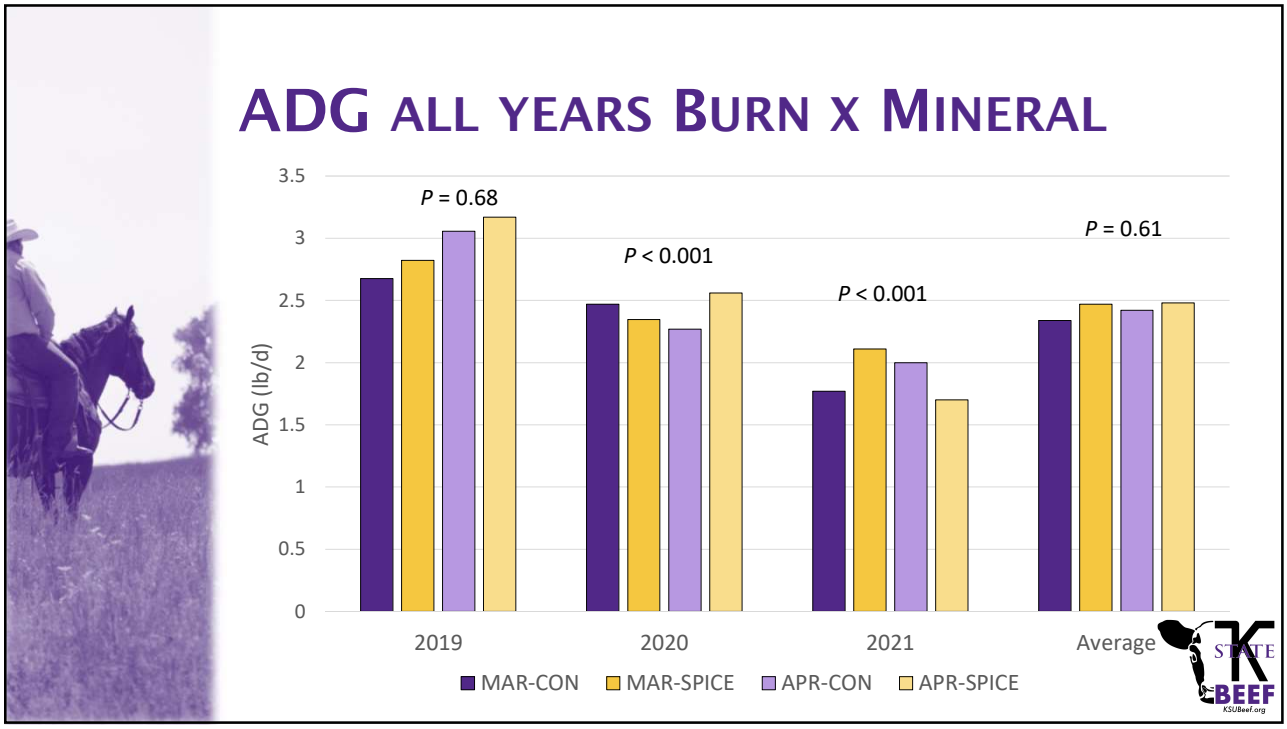
- Same 8 pastures as previous study with 281 head randomly assigned to pastures
- 2 x 2 factorial design to be replicated 4 years
  - Burn – March and April
  - Mineral – Control or Spice

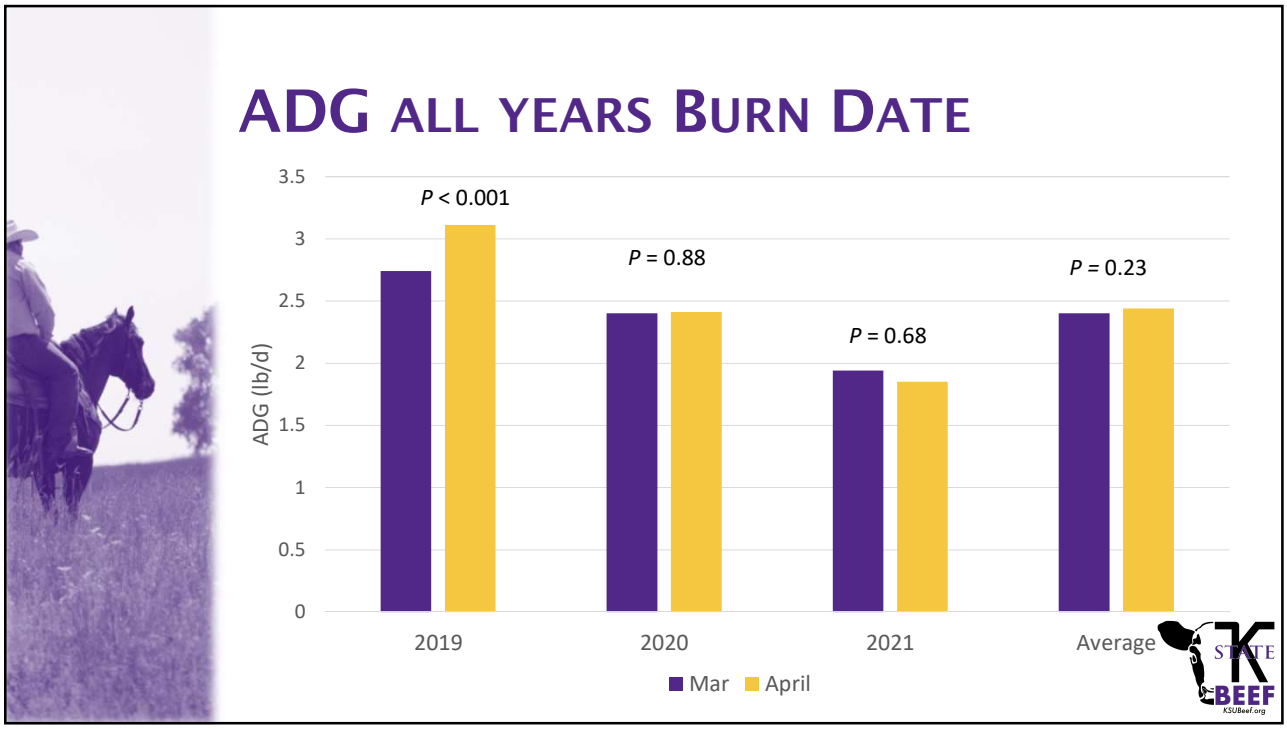
Spice and burn

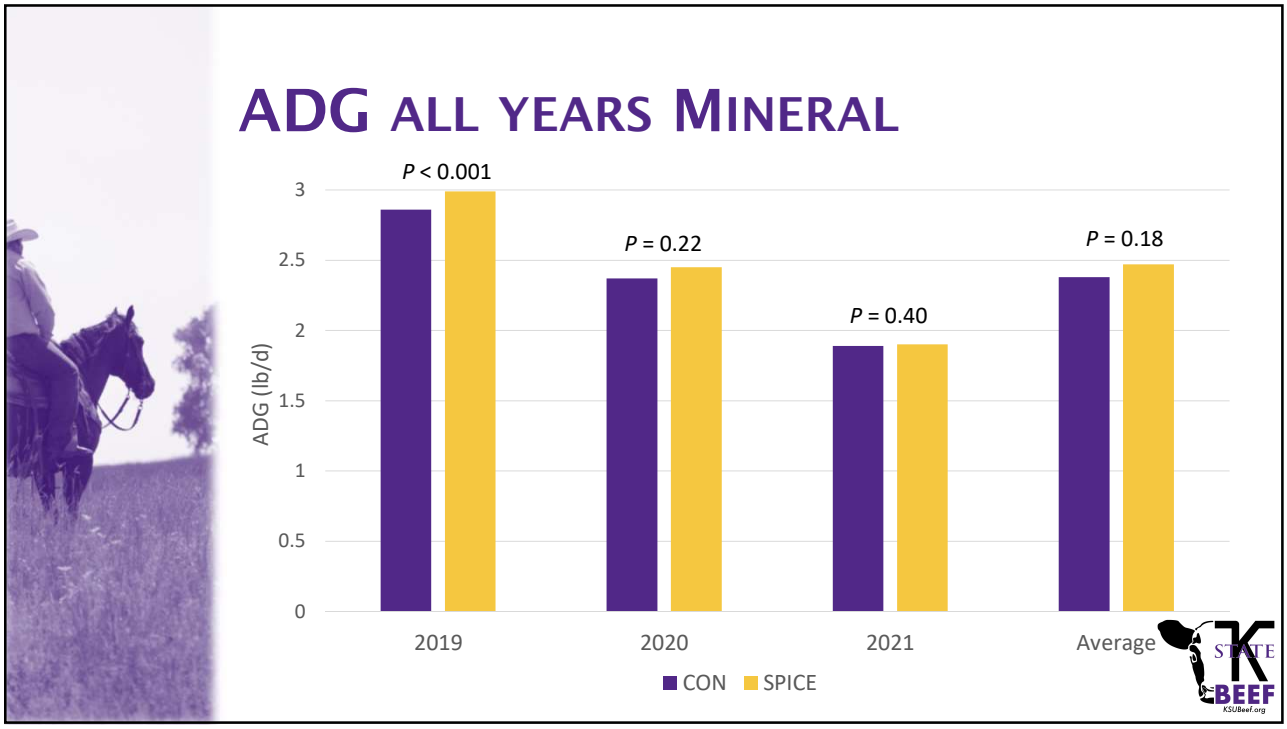
- Free choice mineral with 25% chelated magnesium, copper, zinc, and managenese formulated for 4 oz/hd/d intake (**CONTROL**)
- Free choice mineral with 25% chelated for 4 oz/hd/d intake with addition of 3 pounds per ton of garlic oil product and 18 pounds per ton of Solus® (blend of 4 proprietary spices; **SPICE**)

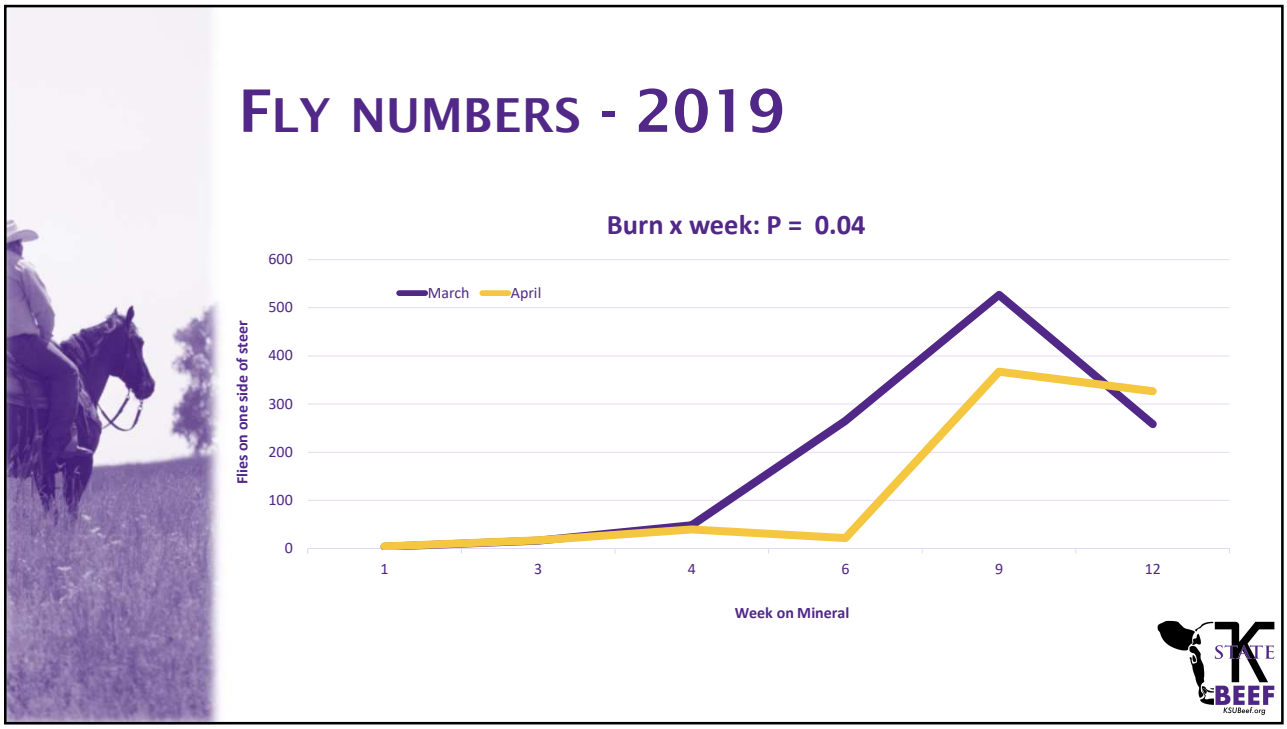


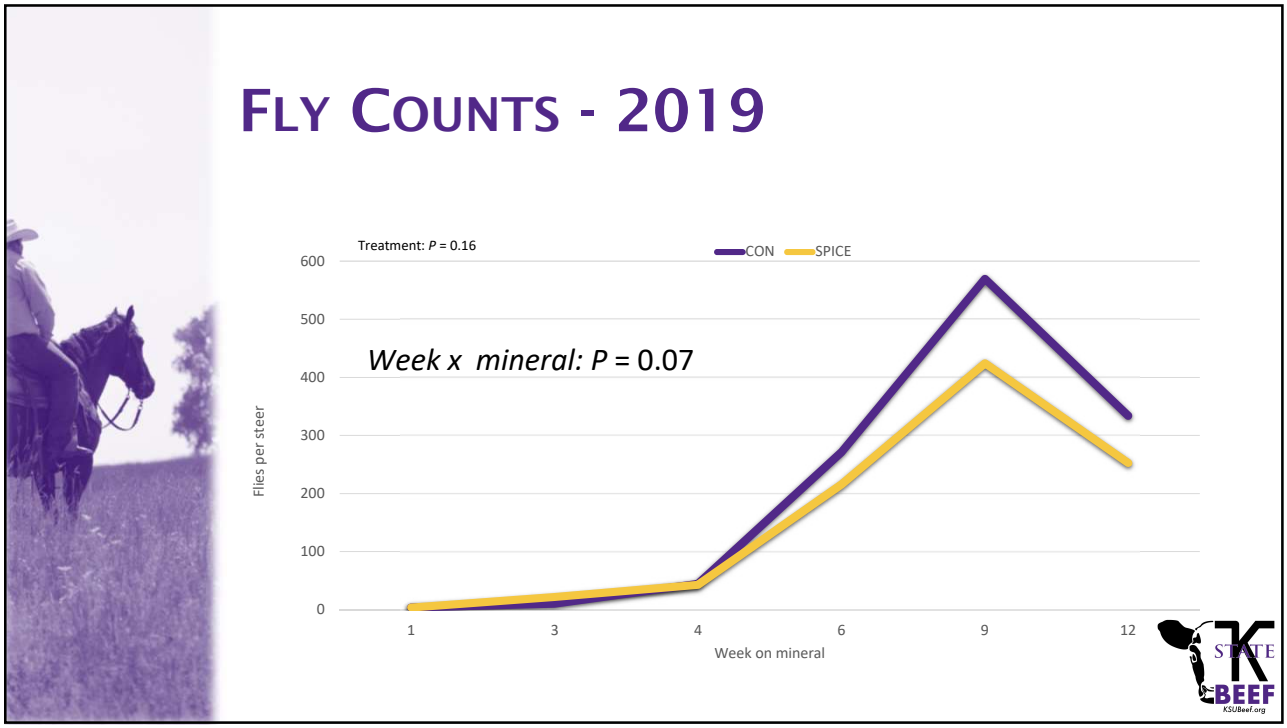
Pasture 1 Treatment 3 March burn Spice mineral	Pasture 2 Treatment 2 March burn Control mineral	Pasture 3 Treatment 3 March burn Spice mineral	Pasture 4 Treatment 2 March burn Control mineral
Pasture 5 Treatment 1 April burn Control mineral	Pasture 6 Treatment 4 April burn Spice mineral	Pasture 7 Treatment 1 April burn Control mineral	Pasture 8 Treatment 4 April burn Spice mineral

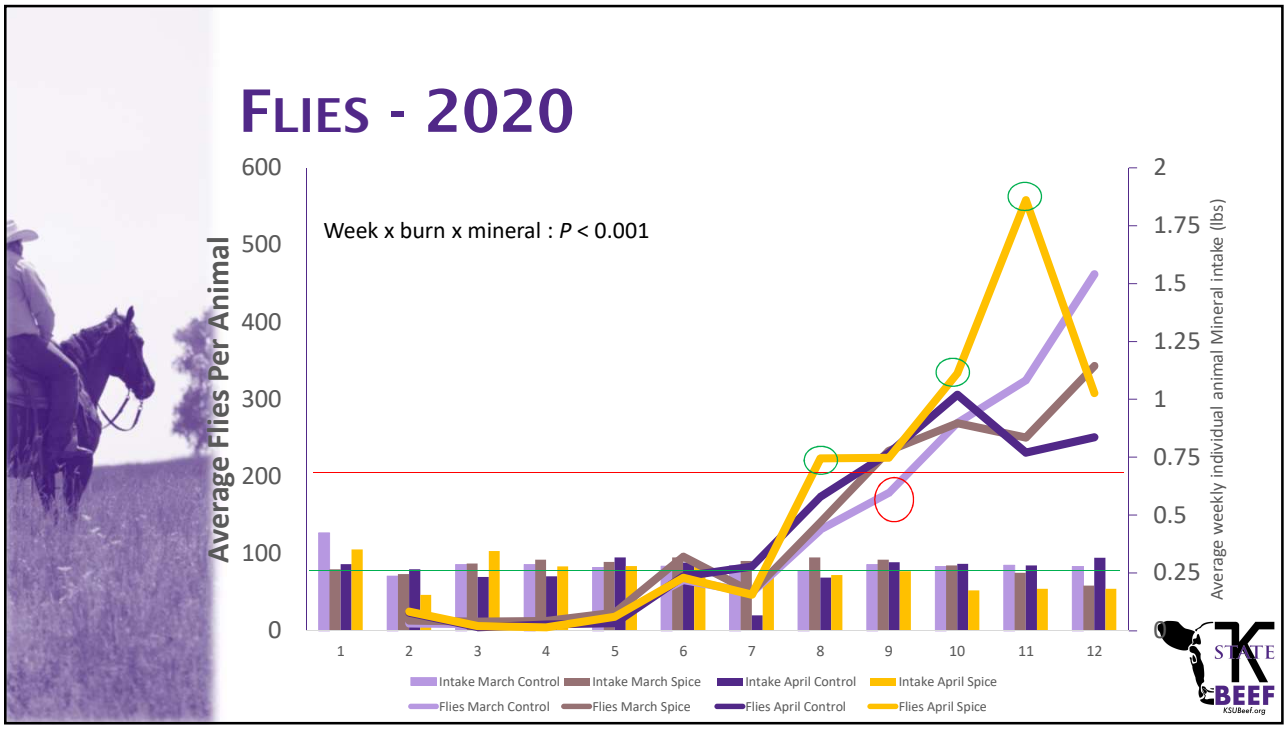


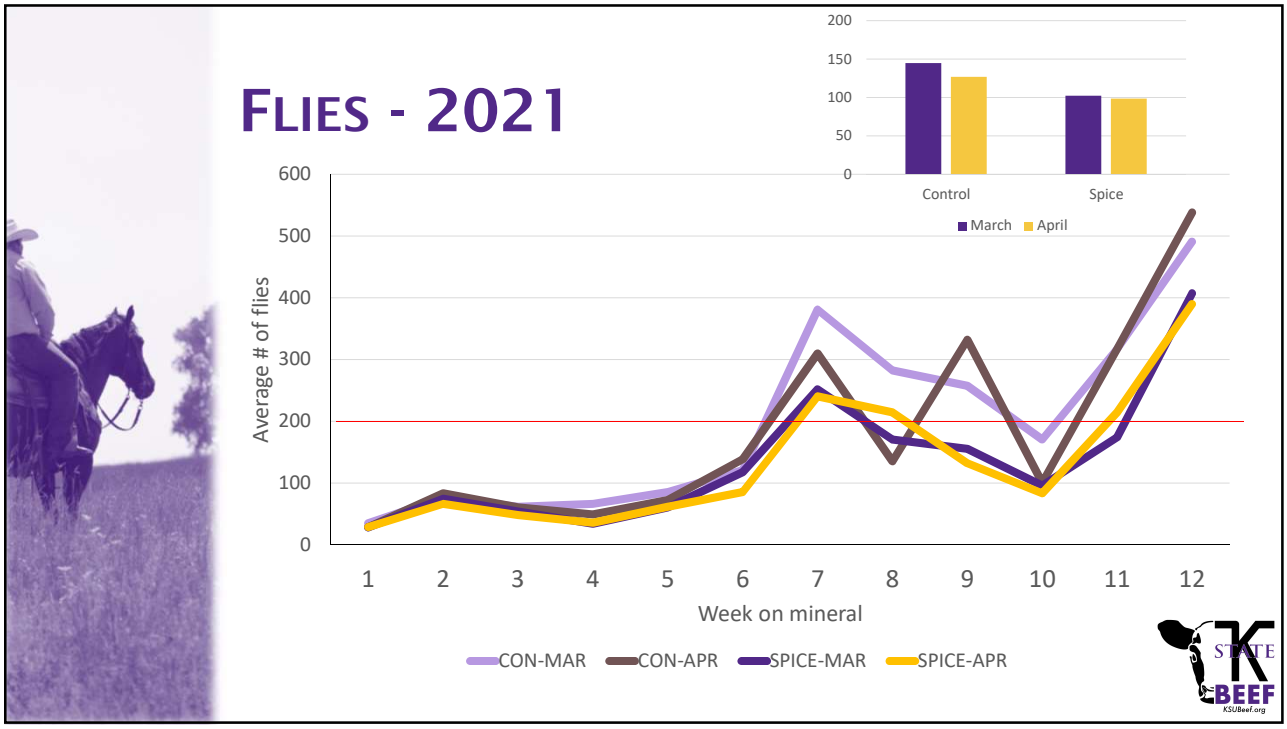

ADG all years Burn Date
3.5
3
2.5
2
1.5
1
0.5
0
ADG (lb/d)
P < 0.001
P = 0.88
P = 0.68
P = 0.23
2019
2020
2021
Average
Mar
April


ADG all years Mineral
3
2.5
2
1.5
1
0.5
0
ADG (lb/d)
P < 0.001
P = 0.22
P = 0.40
P = 0.18
2019
2020
2021
Average
CON
SPICE


FLY NUMBERS - 2019
Burn x week: P = 0.04
600
500
400
300
200
100
0
March
April
Flies on one side of steer
1
3
4
6
9
12
Week on Mineral
STATE
BEEF
KSUBeef.org


FLY COUNTS - 2019
Treatment: P = 0.16
CON
SPICE
Week x mineral: P = 0.07
600
500
400
300
200
100
0
Flies per steer
1
3
4
6
9
12
Week on mineral
STATE
BEEF
KSUBeef.org


FLIES - 2020
Week x burn x mineral : P < 0.001
Average Flies Per Animal
Average weekly individual animal Mineral intake (lbs)
600
500
400
300
200
100
0
2
1.75
1.5
1.25
1
0.75
0.5
0.25
1 2 3 4 5 6 7 8 9 10 11 12
Intake March Control
Intake March Spice
Intake April Control
Intake April Spice
Flies March Control
Flies March Spice
Flies April Control
Flies April Spice


FLIES - 2021
200
150
100
50
0
Control
Spice
March
April
Average # of flies
600
500
400
300
200
100
0
1 2 3 4 5 6 7 8 9 10 11 12
Week on mineral
CON-MAR
CON-APR
SPICE-MAR
SPICE-APR

Talk about money

- Spice added $200 per ton to mineral mix
  - Intake was 20% higher than formulated
  - Daily cost of mineral was $0.105/hd/d
  - Cost for 90 days was $9.45/hd
- Control mineral costs
  - Intake was 20% higher than formulated
  - Daily cost was $0.075/hd/d
  - Cost for 90 days was $6.75

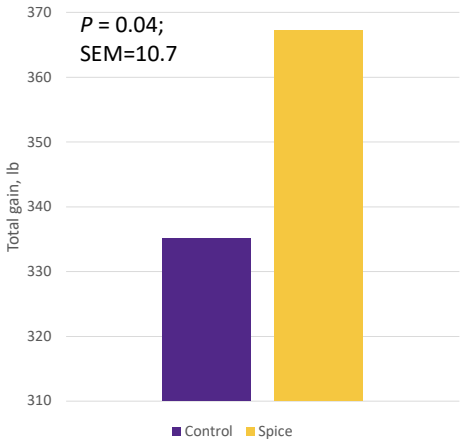
Talk about money

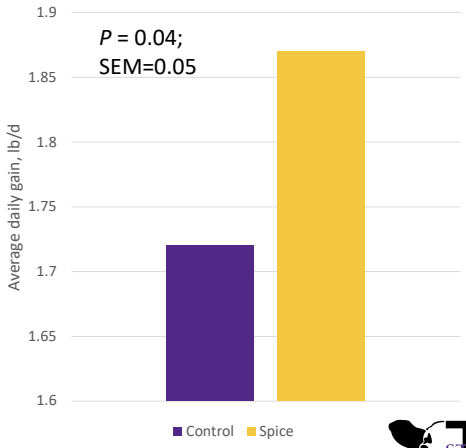
- Spice cattle
  - 20.5 pounds more gain off of grass
  - At $135.87 cwt sold for $27.85 more per head
  - Cost $2.70 more for spice mineral
- **Netted $25.15 more**

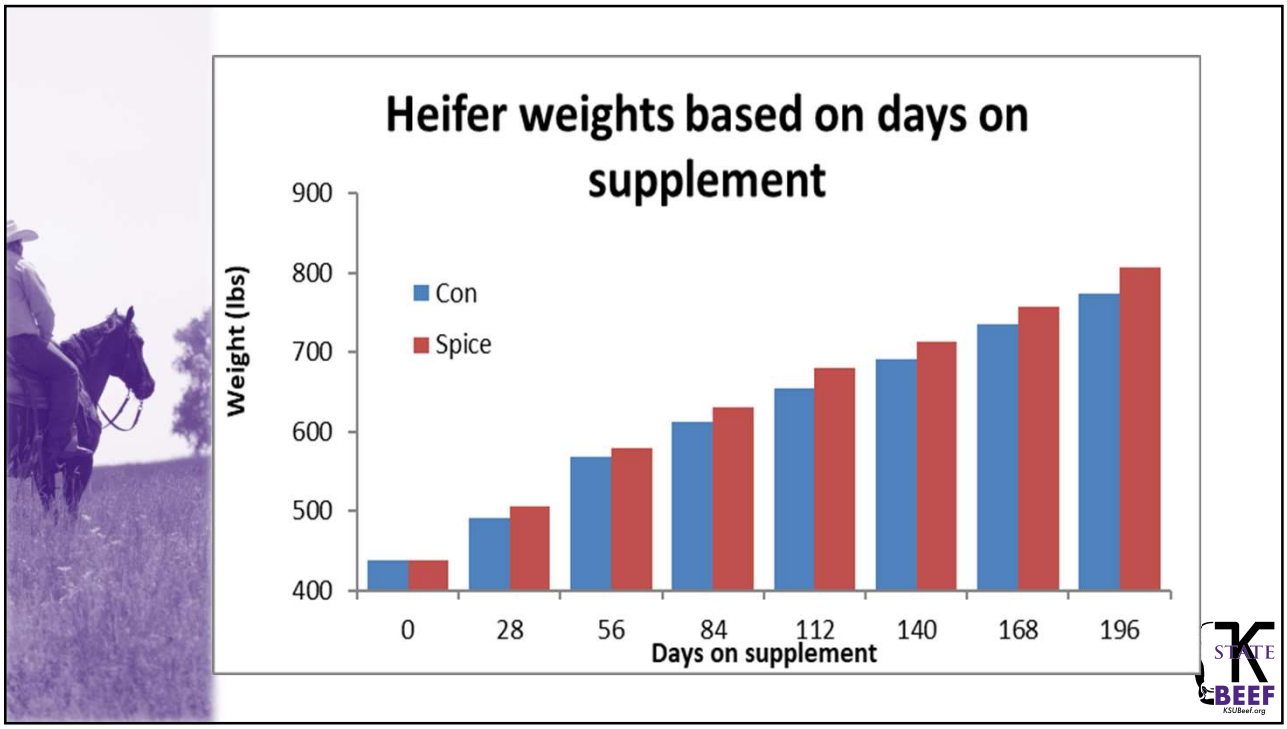
Brome and spice study

- 8 pastures of bromegrass at the Parsons station used the same minerals as Bressner pasture but hand-fed through daily DDG supplement (0.5% of BW on DM basis)
  - 4/9/2019 to October
- Weights every 28 days
- Counted ticks weekly for 10 weeks
- Weekly fly photos

Brome and spice gains

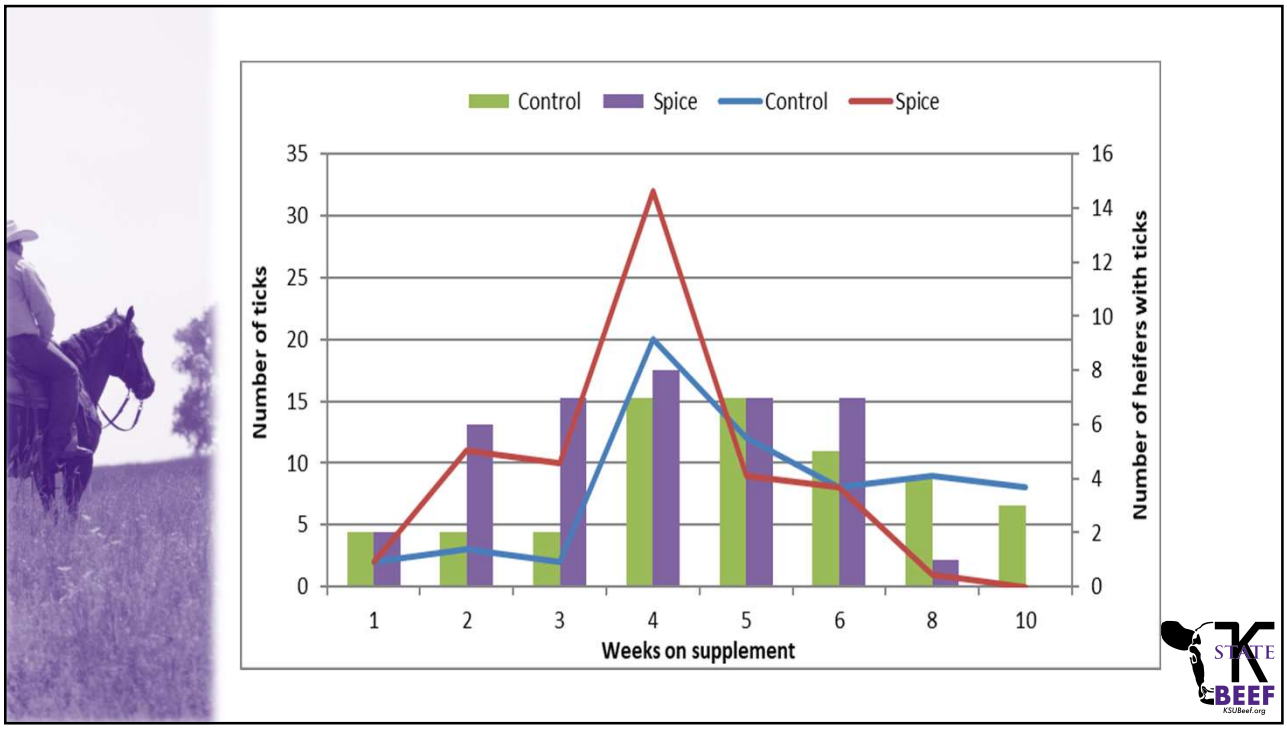


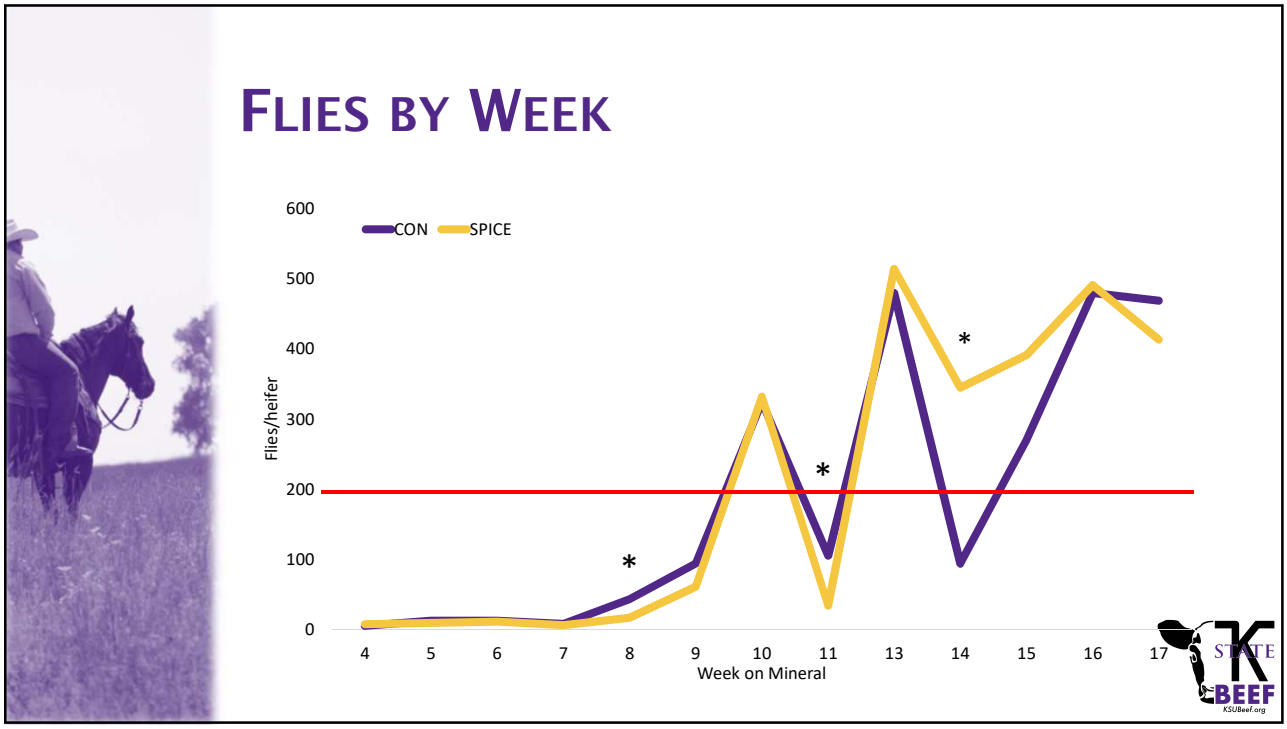




TICK COUNTS

	# head w/ticks		Total # ticks		# Ticks engorged		# of ticks/heifer	
Week	Con	Spice	Con	Spice	Con	Spice	Con	Spice
1	2	2	2	2	0	1	1.00	1.00
2	2	6	3	11	0	0	1.50	1.83
3	2	7	2	10	0	0	1.00	1.43
4	7	8	20	32	9	4	2.86	4.00
5	7	7	12	9	2	1	1.71	1.29
6	5	7	8	8	3	1	1.60	1.14
8	4	1	9	1	0	0	2.25	1.00
10	3	0	8	0	0	0	2.67	0.00
Totals	32	38	64	73	14	7	2.00	1.92


Control
Spice
Control
Spice
Number of ticks
Number of heifers with ticks
Weeks on supplement
35
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
8
10


FLIES BY WEEK
CON
SPICE
Flies/heifer
Week on Mineral
600
500
400
300
200
100
0
4
5
6
7
8
9
10
11
13
14
15
16
17
*
*
*

SUMMARY

- Spice on brome and heifers resulted in 0.15 lb/d improvement in ADG
  - 33 more pounds of heifer over grazing period (198 days)
- Spice did not appear to work on total tick numbers until after consuming for a month
- Number of engorged ticks were lower with Spice mineral
- Variable response to spice for fly repellency

SUMMARY

- Essential oils/spices in mineral
  - Overall on grass increased gain
- Ingestion of essential oils/spices does not consistently reduce fly populations on cattle
- Spices show promise for tick control

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QUESTIONS?