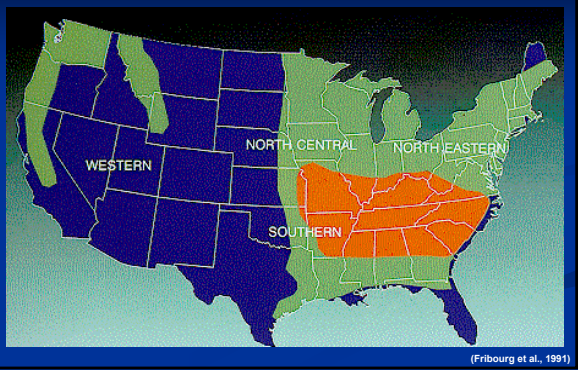
CENTER OF ADVANCED REPRODUCTIVE STUDIES

Animal Reproduction Laboratories

Why Can't my Beef Cows get Pregnant when Grazing Endophyte-Infected Tall Fescue?

Dr. Neal Schrick
Department of Animal Science
University of Tennessee

Tall Fescue



(Fribourg et al., 1991)

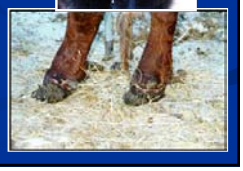
Characteristics of Fungus

- ✓ Produced by *Neotyphodium coenophialum*
- ✓ Peptide ergot alkaloids
  - o ergovaline
- ✓ Concentrations of ergovaline increase in spring and fall

(Porter, 1995; Belesky et al., 1988)

Tall Fescue Toxicosis Reduces Performance in Cattle

- ✓ Reduces forage intake
- ✓ Increases respiration rates
- ✓ Reduces serum prolactin
- ✓ Excessive salivation
- ✓ Fescue foot



(Porter, 1995, Browning et al., 1997; Oliver, 1997; Burke et al., 2001; Browning, 2004)

Tall Fescue Toxicosis Reduces Performance in Cattle

- ✓ Less time spent grazing
- ✓ Rough hair coats
- ✓ Reduces weight gain

(Strickland et al., 1993; Oliver et al., 1997; Saker et al., 2001; Waller et al., 2001)

Tall Fescue Toxicosis Reduces Performance in Cattle

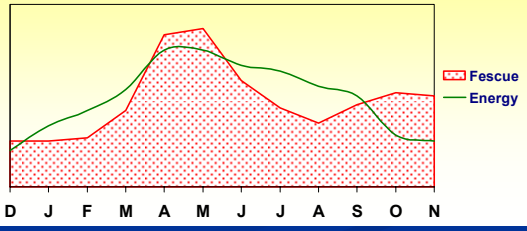
- Reduced milk production

- Lowered fertility

(Porter and Thompson 1992; Porter, 1995; Browning et al., 2001; Jones et al., 2003)

…Why Graze with Tall Fescue?

Tall Fescue Growth and Energy Demand in Spring-Calving Cows



(Information provided by Dr. Bates)

Benefits of Endophyte-Infected Tall Fescue

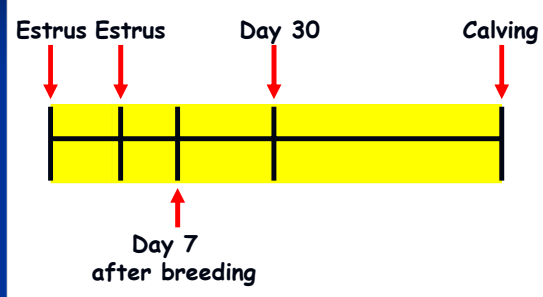
Tall fescue is able to withstand:

- ✓ Drought
- ✓ Poor soil condition
- ✓ Intensive defoliation
- ✓ Insects

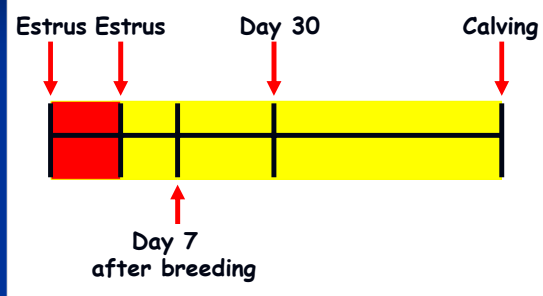
(Hill et al, 1994)

Detrimental effects produced by consumption of endophyte-infected tall fescue on female reproduction are well known…

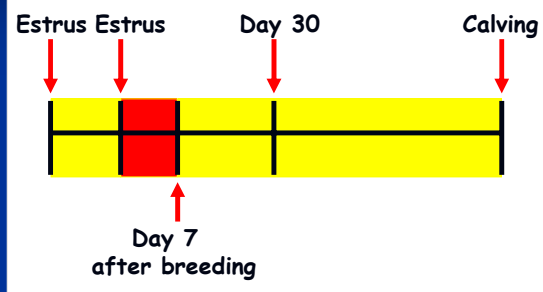
Timing of Reproductive Losses



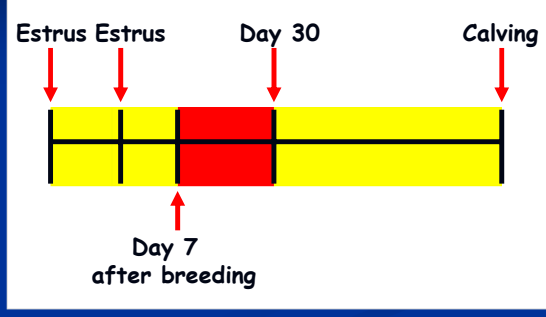
Timing of Reproductive Losses



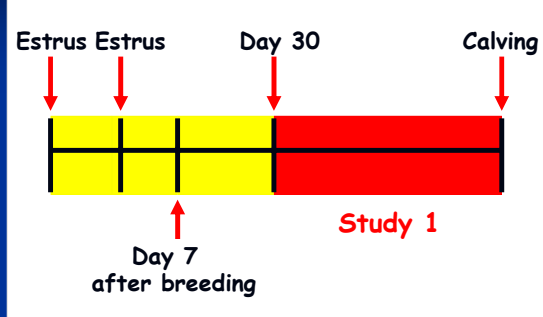
Timing of Reproductive Losses



Timing of Reproductive Losses

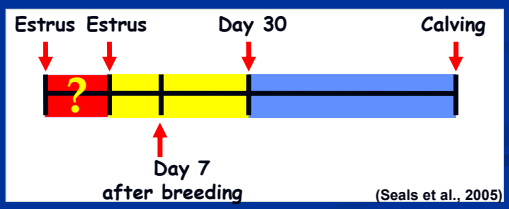


Timing of Reproductive Losses



Study 2

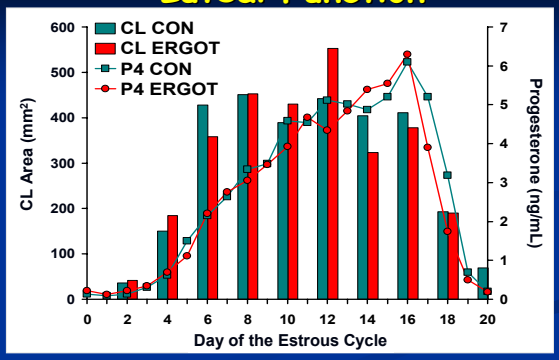
Determine if ergotamine tartrate administration prior to estrus altered follicular and luteal dynamics and pregnancy rates



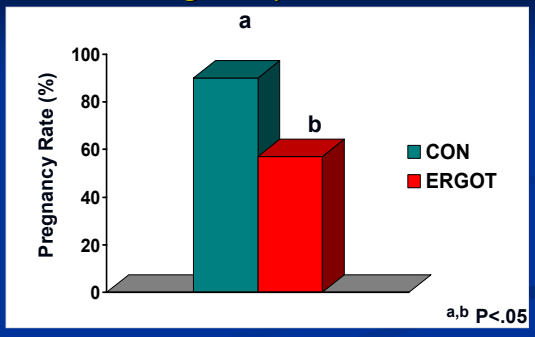
Follicular Dynamics

Variable	Control	Ergotamine
Ovulatory size (mm)	15.1 ± 1.2	15.5 ± 1.2
Age (d)	9.1 ± 1.2	9.8 ± 1.2
E_2 at estrus	9.8 ± 0.9	9.1 ± 0.9
Estrus to ovulation (h)	40.5 ± 5.9	40.2 ± 6.3
Dominance (d)	3.6 ± 1.1	5.0 ± .9

Luteal Function



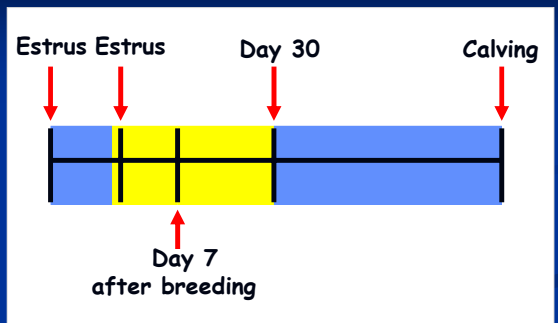
Pregnancy Rates



Summary of Study 2

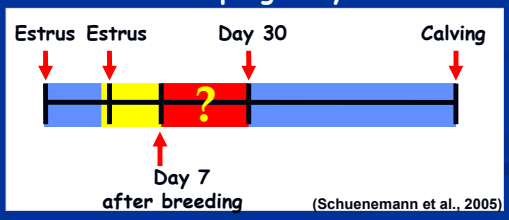
- ✓Follicular and luteal dynamics were not affected in heifers administered ergotamine tartrate
- ✓Pregnancy rates and prolactin were significantly decreased

Timing of Reproductive Losses

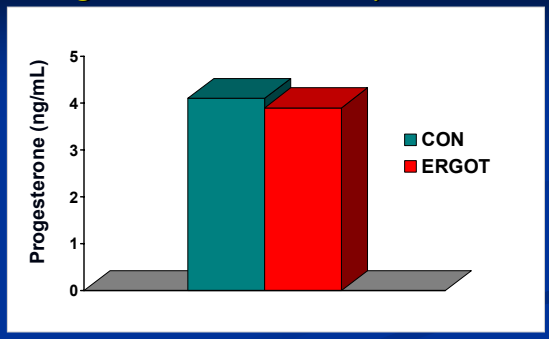


Study 3

To determine if the uterine environment, in heifers consuming ergotamine tartrate, was suitable for maintenance of pregnancy



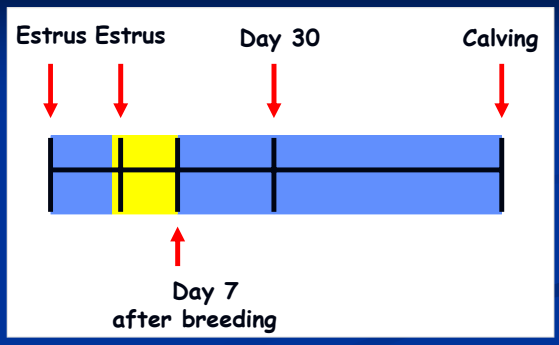
Progesterone at Embryo Transfer



Summary of Study 3

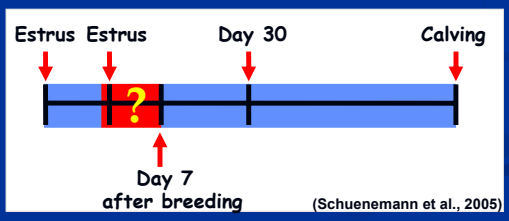
Uterine environment was capable of maintaining pregnancy after day 7 in heifers consuming ergotamine tartrate

Timing of Reproductive Losses



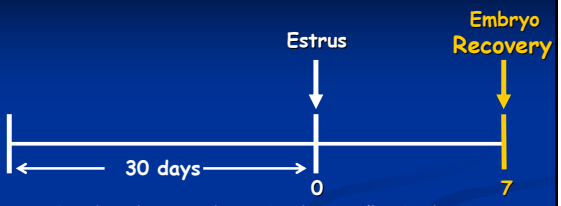
Study 4

To determine if administration of ergotamine tartrate to simulate fescue toxicosis affected embryo development



(Schuenemann et al., 2005)

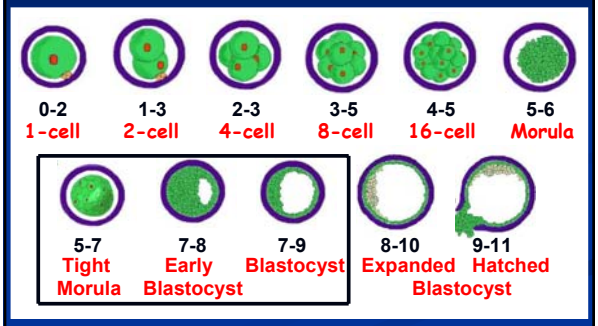
Materials & Methods



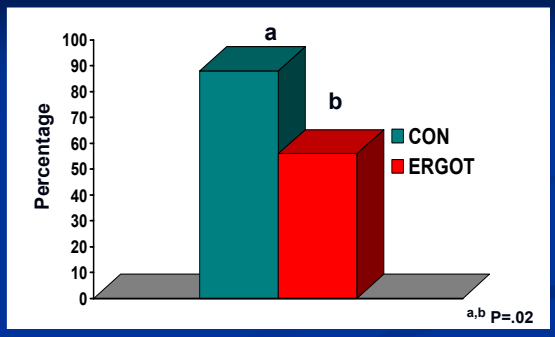
← Feed with or without ET (40 μg/kg BW) →

- Single embryo recovery
- Embryo evaluation

Embryonic Development



Embryo Development



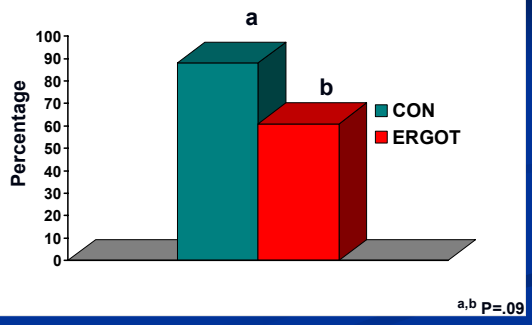
Embryo Quality

- ✓Quality 1=Excellent
- ✓Quality 2=Good
- ✓Quality 3=Fair

Transferable Embryos

- ✓Quality 4=Poor (Degenerate)

Transferable Embryos

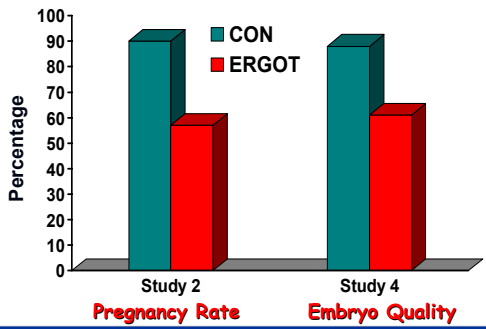


a,b P=.09

Summary of Study 4

- ✓ Lowered prolactin concentrations
- ✓ Decreased embryo development
- ✓ Decreased embryo quality

Comparison Between Study 2 & 4



Conclusions

- ✓ Pregnancy rates are reduced due to decreased embryo quality and development
- ✓ Effects of ergotamine tartrate (fescue simulation) may be to the developing oocyte or early embryo

Future Studies and Solutions

Focus on the period before day 7

- ✓ Oocyte toxicity
- ✓ Oviductal/early uterine environment

- ✓ Remember, Clover is our friend
- ✓ Supplemental feeding is beneficial
- ✓ Avoid the heat!

Detrimental effects produced by consumption of endophyte-infected tall fescue on female reproduction are well known…

However, limited studies have examined whether fescue toxicosis affects reproductive performance in the male

Experimental Design

Grazing Study

2 years

ERGOT Study

1 year (n=16)

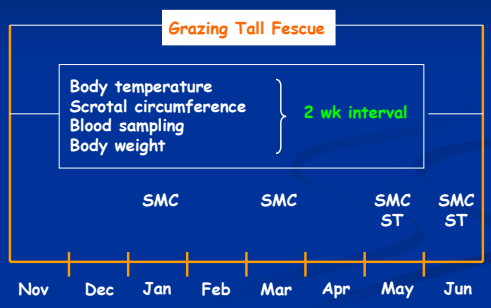
Grazing Fescue
E+ (New & Old)
E+Clover
MaxQ

350 kg and an average of 270 days of age (n=80; 40/year)

Control

Treated

Timeline of Experimental Period



* ST = Scrotal Temperature; SMC = Semen Collection

Semen Collection

Collected using an electroejaculator

- ✓ Motility
- ✓ Morphology
  - Primary Abnormalities
  - Secondary Abnormalities
- ✓ IVF

Experimental Parameters

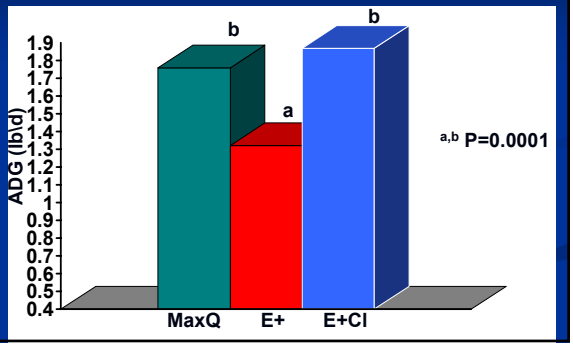
Performance	Fertility Parameters	Oocyte Development
ADG	Motility	Motility
RT	Morphology	% Cleavage
HC	SC - ST	% 8-16 Cell
Prolactin	Testosterone	% Blastocyst
	Arginine	Nuclei #

Materials & Methods

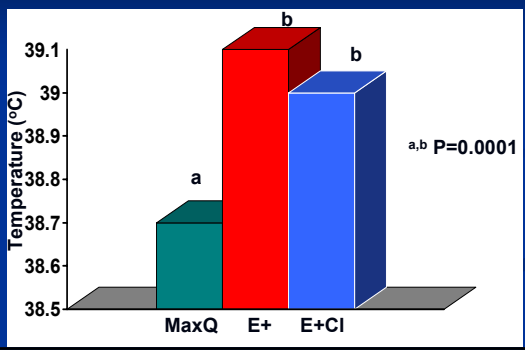
- Concentrations of ergovaline (EV):

Treatment	EV (ppb)	Endophyte %
E+Old	360	90
E+New	340	92
E+Cl	395	94
MaxQ	< 50	52

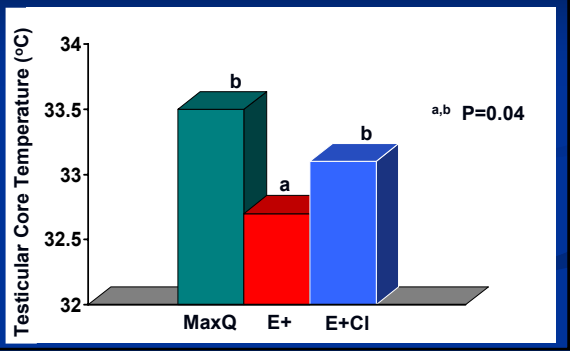
Average Daily Gain



Rectal Temperatures



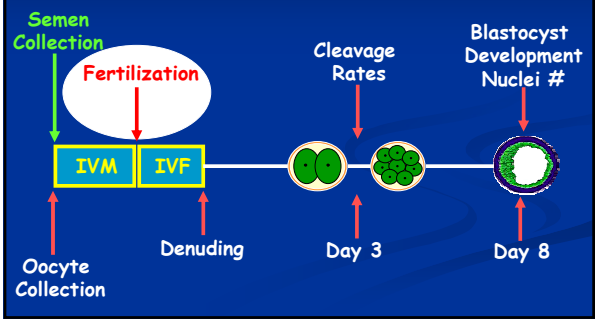
Testicular Core Temperature



Field Evaluation of Semen

Treatment	Normal Morphology (%)	Primary Abnormality (%)	Secondary Abnormality (%)
MaxQ	84.6 ± 2.4	6.5 ± 0.8	6 ± 1.2
E+	85.5 ± 1.7	5.4 ± 1.1	9.1 ± 1.6

Experimental Design for IVF



IVF Fertility Assessment (ERGOT)

Treatment	# Oocytes	Cleavage %	8-16 Cell %	Blastocyst %
CON	200	69.2[a]	75.2	29.6
ET	200	51.1[b]	64.4	34.0

[a,b] P=0.001

IVF Fertility Assessment (Grazing Study)

Treatment	# Oocytes	Cleavage %	8-16 Cell %	Blastocyst %
MaxQ	850	84[a]	82.3	30.1
E+	873	73.5[b]	85.4	32.4

[a,b] P=0.02

Conclusions

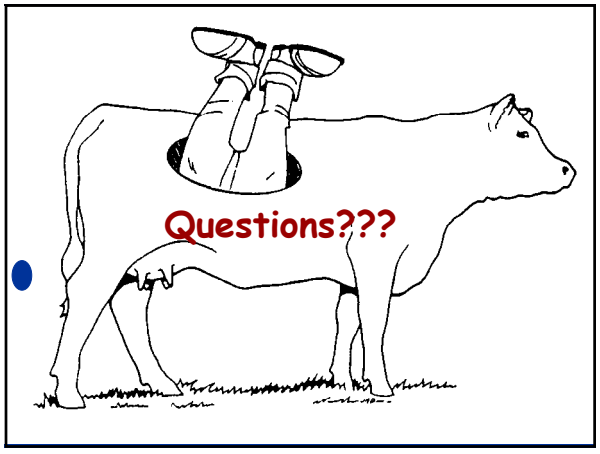
Results suggest that while gross motility and morphology of semen remained unchanged, ability of oocytes to cleave following fertilization was affected, implying that alkaloids may damage sperm in ways undetectable under normal semen inspection

Future Studies and Solutions

- ✓ AI breeding of heifers with semen collected from bulls grazing E+ or MaxQ tall fescue
- ✓ Timing of Breeding Season
- ✓ Supplement Feed (energy)
- ✓ Pastures and clover
- ✓ Don't forget the Bulls

Acknowledgements

- Dr. Jack W. Oliver
- Dr. John C. Waller
- Dr. Fred M. Hopkins
- Dr. Lannett Edwards
- Dr. A. M. Saxton
- Dr. Sherry Cox
- Dr. H. S. Adair
- Dr. Mitch Hockett
- Mark Davis
- Dr. G. Schuenemann
- Dr. Gina Pighetti
- Nancy Rohrbach
- Dr. J. Klotz
- Dr. F. Scenna
- HRES Beef Crew
- Eddie Jarboe
- Dr. Ricky Seals
- Clay Riggins


Questions???