ARTIFICIAL INSEMINATION IN WHITETAILS: The science behind the practice

Dr. James C. Kroll, Institute for White-tailed Deer Mgmt. & Research
Stephen F. Austin State University





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Special Thanks To:

F. Kenneth Bailey

We all owe him thanks!

Jason Sellers
Alex Smalling
Ben Koerth
Paul Stewart

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Thanks also to the Boar Goat!







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Let's Start With The Basics

- What triggers breeding?
- How did we determine timing?
- How do you synchronize estrus?
- What is the procedure for AI?

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What triggers the rut?

- Moon position and phase?
- Sunspots?
- Cold weather?

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Rut triggered by:

- Day length
- Melatonin

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Rut is genetically determined

Cross	Place of Breeding	Av. Fawning Date
MI/MI	Michigan	May 22
MI/MS	Michigan	July 4
MS/MS	Mississippi	August 5

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Tapetum lucidum



- **Magnifies 1,000,000 times!!!**

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Fact:

- Melatonin inhibits, not stimulates gonadal activity

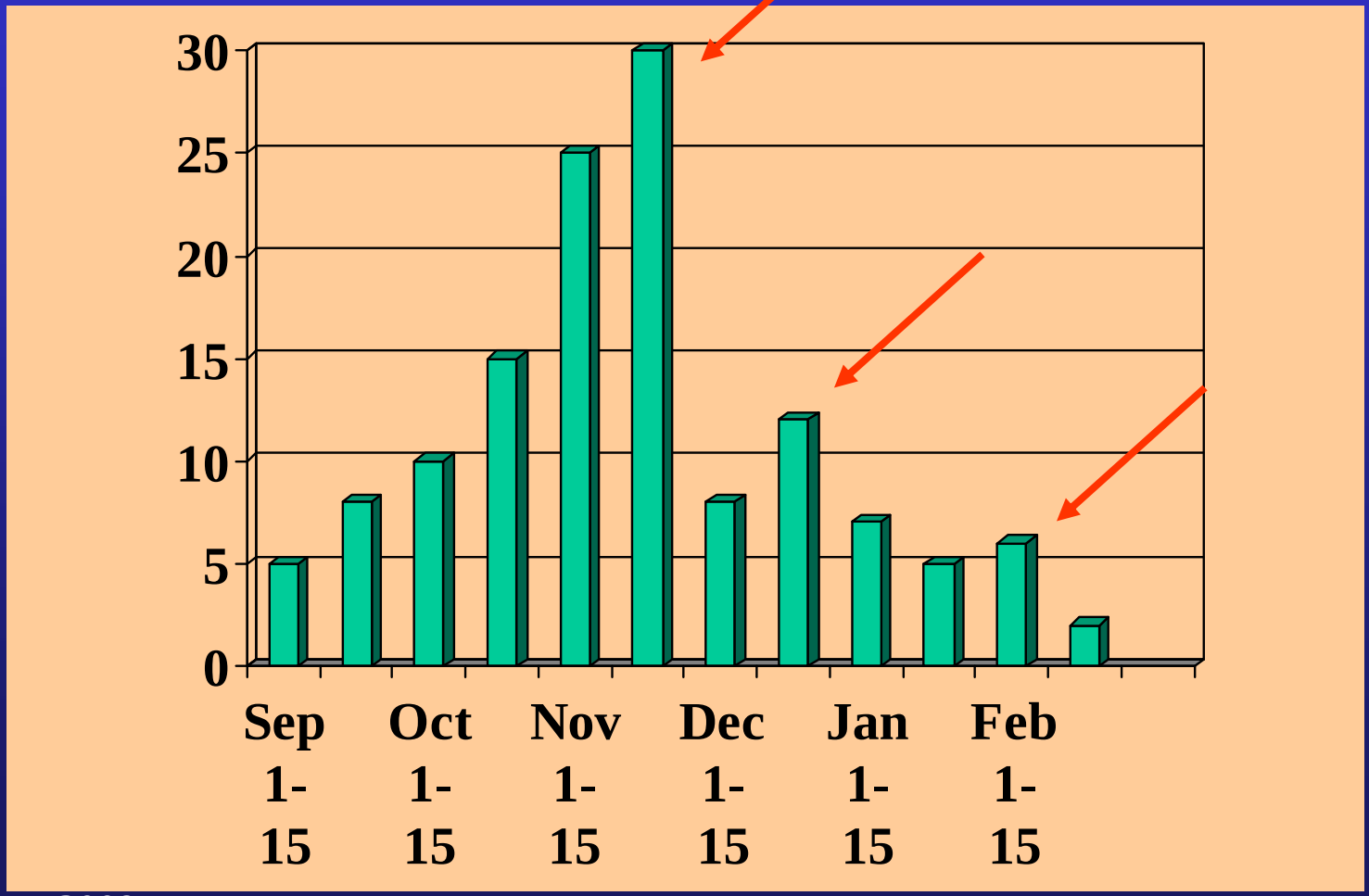
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Timing the rut



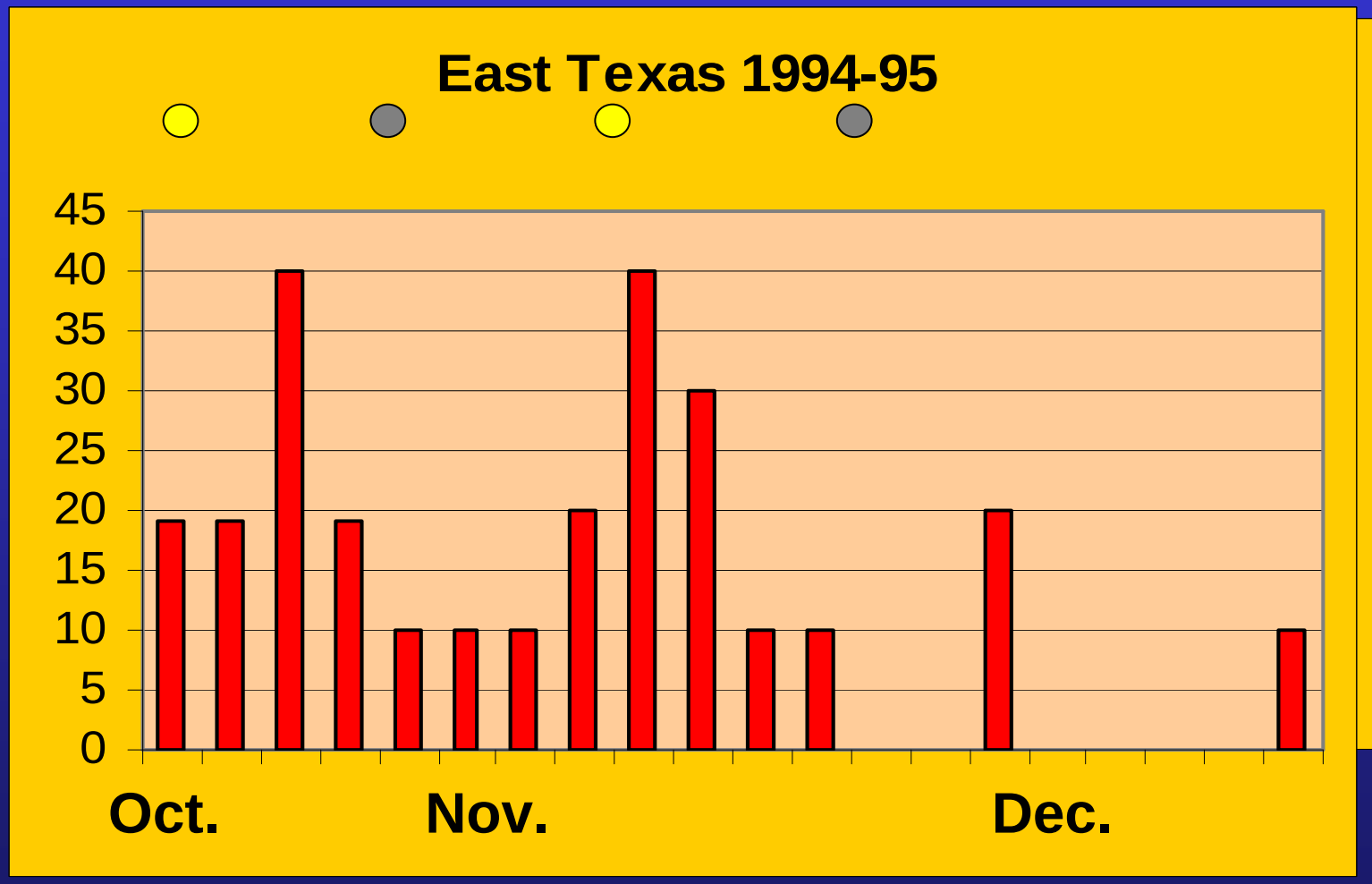
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The Rut Cycle



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What triggers the rut?



Avery Island and South Texas Whitetails!

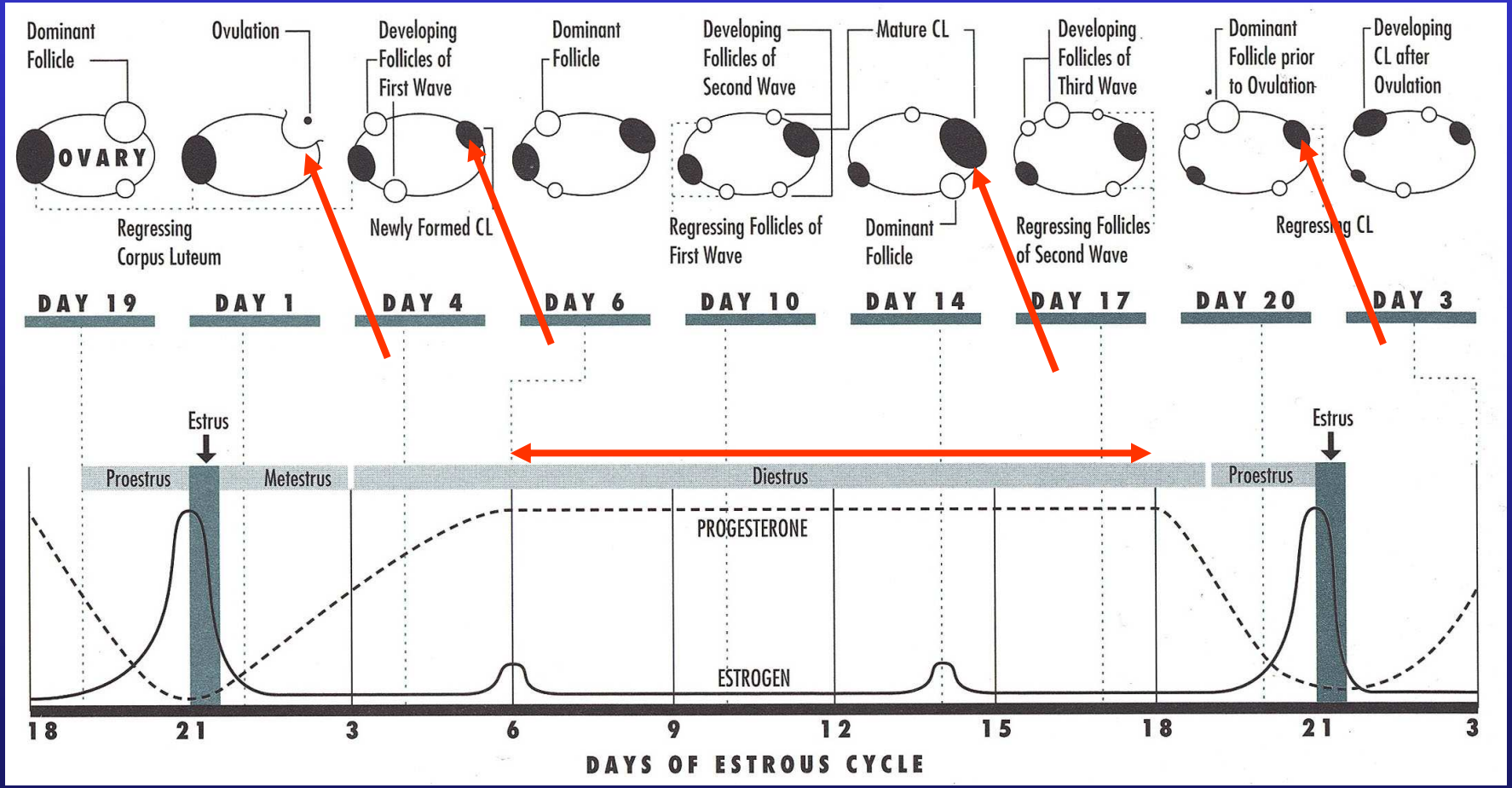
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Rut is genetically determined

Cross	Place of Breeding	Av. Fawning Date
MI/MI	Michigan	May 22
MI/MS	Michigan	July 4
MS/MS	Mississippi	August 5

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The Estrous Cycle



Let's Start With The Basics

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- How do you synchronize estrus?
- What is the procedure for AI?

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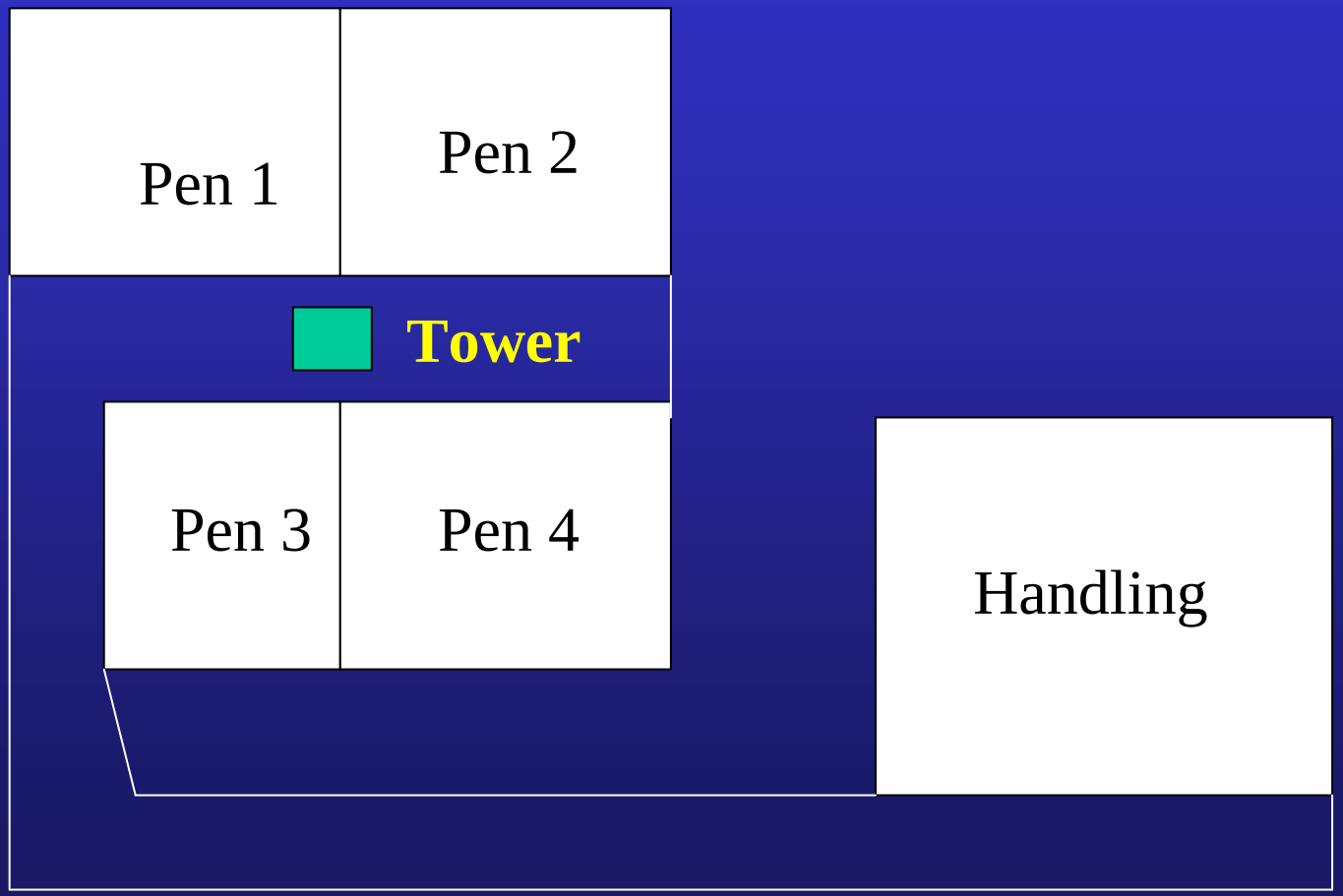
How Did We Determine Time To Breed?

- Four Canyon Experiment



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Pen Design

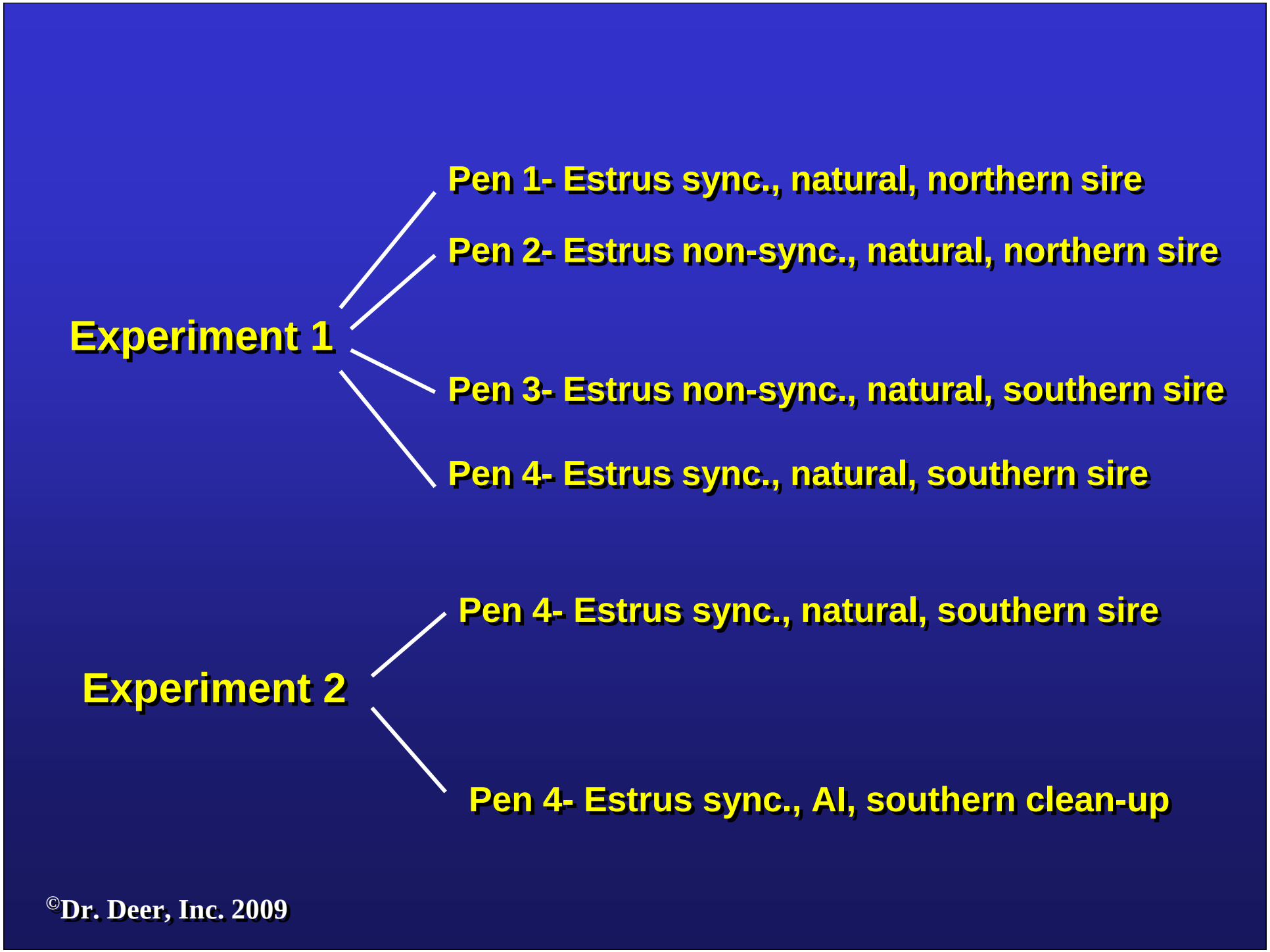


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Experimental Design

- 5 groups of does (10)
- One group of does (13)
- Each allocated randomly to one of 6 treatment groups.

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Two Experiments:

- Experiment One: Designed to determine timing for later artificial breeding (Exp. 2)
- Experiment Two: Compare breeding for natural and artificially bred groups.

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Treatments

Experiment One:

- Natural breeding.
  - Synchronized:
    - 10 Northern- 4.2 years, 46.6 Kg
    - 10 Southern- 4.2 years, 46.3 Kg
  - Non-synchronized:
    - 10 Northern- 4.2 years, 46.4 Kg
    - 10 Southern- 4,2 years, 46.4 Kg

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Treatments

Experiment Two:

- Natural breeding
  - 10 Synchronized- 5.5 years, 46.7 Kg
- Artificial breeding
  - 13 Synchronized- 5.3 years, 45.5 Kg

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24/7 Observation

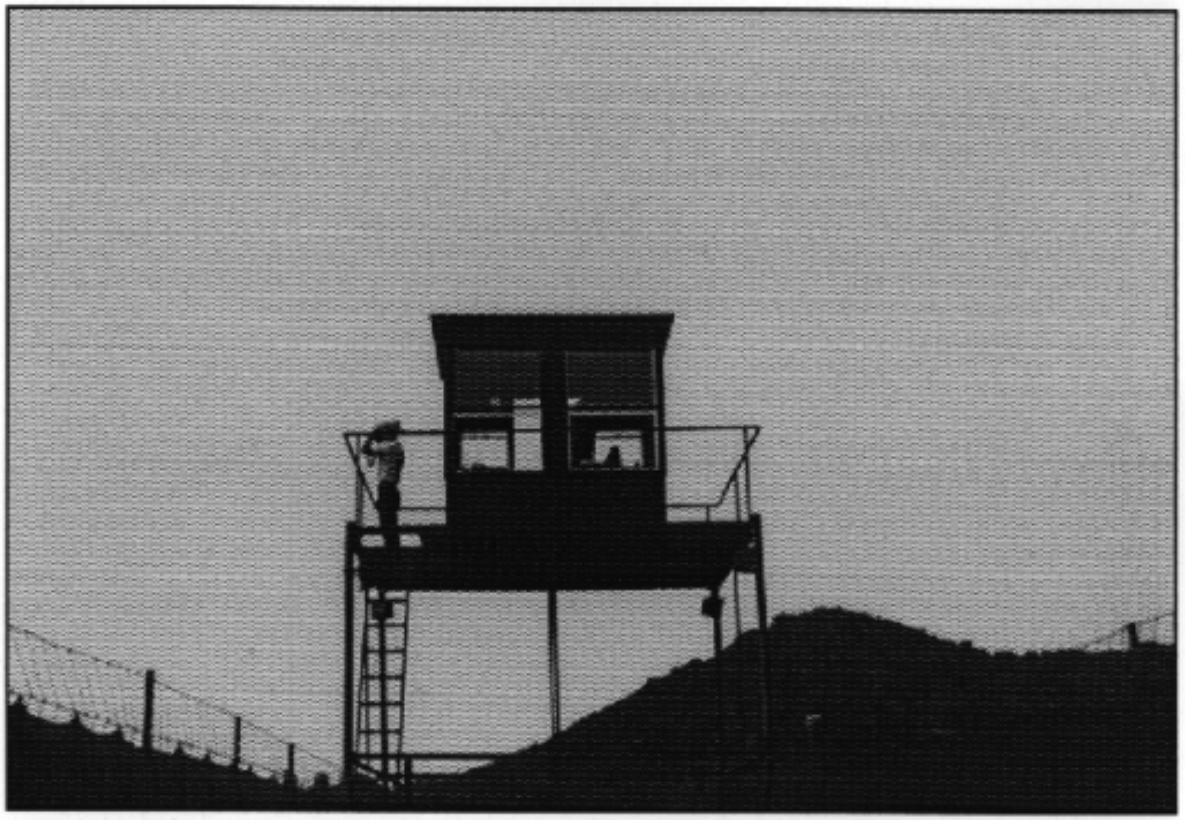


Figure 5. Tower used for 24 h continuous observation of research enclosures on 4-Canyon Ranch, Uvalde, Co., TX.

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Observations?

- Time to first stand (doe assumes a rigid stance and allows buck to mount).
- Time to last stand.
- Number of copulations.
- Time between copulations.

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Sychronization Methodology

- Used Synchromate B (Norgestomet) ear implants (1/2 implant)
- Maintained for 14 days.
- Removed on day 14.
- Does placed back in pen and immediately introduced buck.
- Deer observed continuously for entire breeding season!

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Synchronization Results

- Previous information?
  - Fallow deer synchronized using CIDRs, with follow-up injection of PMSG (500 i.u.) reached estrus in 48-76 h after CIDR removal/PMSG
- Our whitetails?
  - Ranged 50 h 30 min. to 68 h 41 min.
  - Breeding was complete within 4 days.

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Breeding Observations



- 43 estrus synchronized, 20 non-synchronized.
- 27 days.
- Prior to estrus, does avoid contact.
- Onset of estrus, increased activity (24 h).
- Does approaching estrus typically rub urinated frequently.
- Small percentage approached and groomed buck.

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Breeding Observations

- 2 does pulled hair from bucks.
- Copulation observed for 34 of 50 does.
- After copulation, does assumed posture similar to urination. (Often accompanied by tail twitching)

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Confirmation of Estrus Cycling?

- **Blood collection.**
- **Serum P4 (progesterone) concentration above 1 ng/ml indicates an active *corpus luteum* in whitetails.(Pregnancy testing!)**
- **Concentrations ranged 1.39-2.94 ng/ml**
- **69.2% of test does were estrus cycling by 17 October.**

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Breeding Observations (Non-Synchronized)

Sire	Standing Heat (min)	Copulations
Northern	367(+/-228)	2.0(+/-0.9)
	176	2
Southern	216(+/-74)	2.4(+/-0.6)
	146	2

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Breeding Observations (Synchronized)

Sire	First Stand (min)	Standing Heat (min)	Copulations
North	3029(+/-221)	617(+/-96)	2(+/-0.3)
	3207	402	2
South	3711(+/-575)	432(+/-59)	2.1(+/-0.2)
	3207	402	2

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North vs. South?

- **Southern Does**
  - Range= 34 h 14 min to 180 h 20 min
  - Average= 68 h 41 min
  - Median= 52 h 43 min
- **Northern Does**
  - Range= 34 h 9 min to 70 h 9 min
  - Average= 50 h 29 min
  - Median= 51 h 26 min

Note: There is a difference between "standing heat" and ovulation!

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Semen Deposition Site?

- Intra-cervix= 58.3%
- Intra-uterine= 41.7%
- No significant difference in conception rate!
- No infections.

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Condition of Cervix at Insemination?

- Very Swollen= 16.7%
- Swollen= 41.7%
- Some Swelling= 25.0%
- No Swelling= 16.6%



58.4

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Ultrasonography?



- Rectal ultrasonography= 58.3% Pregnancy rate.
- Conservative and prone to error.
- Best at 45 days, as early as 30-35 days.
- Blood test better if you do not use a “clean up” buck.

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Long-term Conception Rate?

- Timed AI Average= 67.7%,
  - 8 does produced 16 fawns (1.8 fawns per doe)
  - 7 produced by 5 does, clean-up.
  - Long-term Range= 30.7-95% (6,023 does!)
- Using “marker” bucks, 75% conception, intra-vaginal (Jacobson et al. 1989)
- First service conception rates with <u>natural</u> breeding:
  - Synchronized= 72%
  - Non-synchronized= 55%, 1.6 fawns per doe.

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Sex Ratios of Fawns?

Estrus synchronization and AI both do not have significant effect on fawn sex ratios

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Fawn Survival?

No significant difference due to treatment, but…

Significant difference by sire!

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Fawn Survival?

- Survival of fawns produced by southern bucks on synchronized does was significantly lower than those produced by southern buck on non-synchronized does. (May have been husbandry problem, however.)
- No such effect for northern sires.

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Fawn Weights?

- Northern sires
  - 18.9 kg weaning weight
- Southern sires
  - 15.9 kg weaning weight
- AI versus natural
  - No significant difference.

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Initial Conclusions

- Artificial insemination should occur 57(+/-6.2) h post-implant removal.
- Mean standing heat was 500(+/- 54) min., suggesting an 8 h window of opportunity for AI.

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Basis for timed insemination

- Based on observations, standard time of 60 h post implant removal selected.
- Due to transportation problems, actual insemination time occurred at 65 h 22 min. (serendipitous!)
- Asher et. al. (1992) reported 67% conception in fallow deer at 65 h.

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The Basics

- What triggers breeding?
- How did we determine timing?
- **How do you synchronize estrus?**
- What is the procedure for AI?
- How do you confirm conception?

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Synchronization of Estrus

- ✓Progestin (Norgestimet) implant
- ✓Estradiol injection
- ✓PMSG & FSH

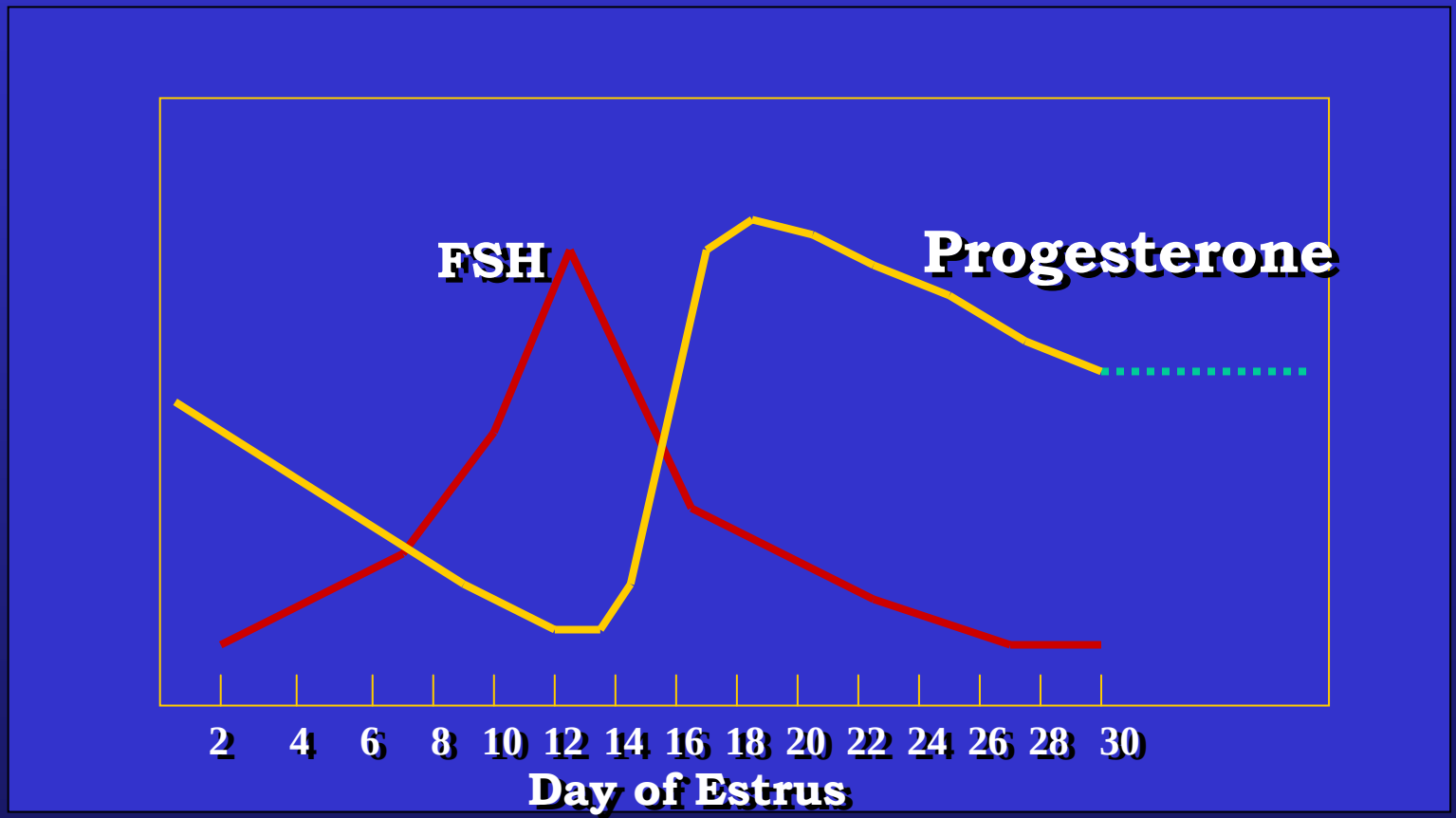
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Other Estrus Synchronization Methods:

- CIDR (Vaginal Implants)
- Cloprostenol injection
- Luteolyse injection
- MGA

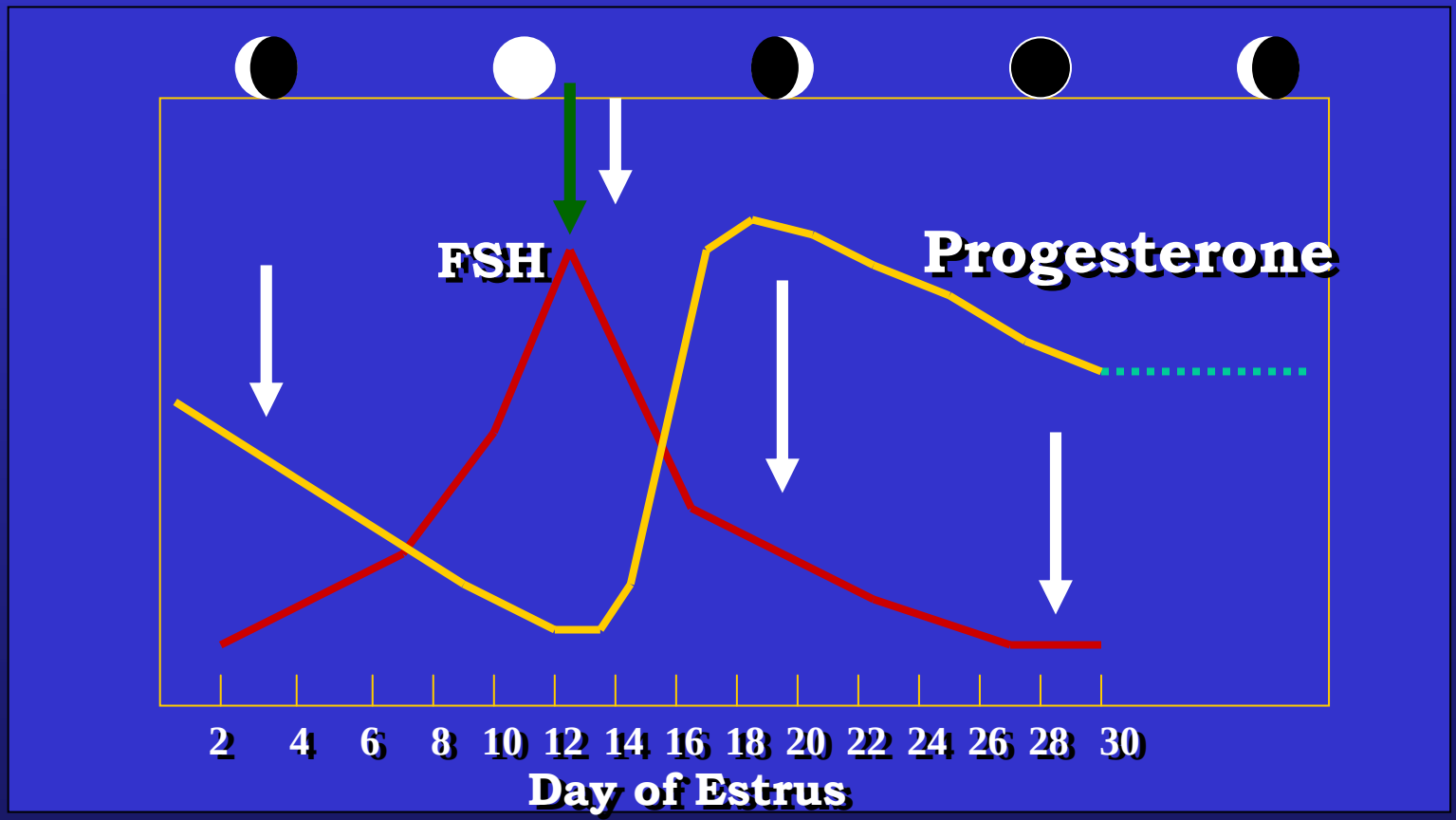
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Timing is Everything!



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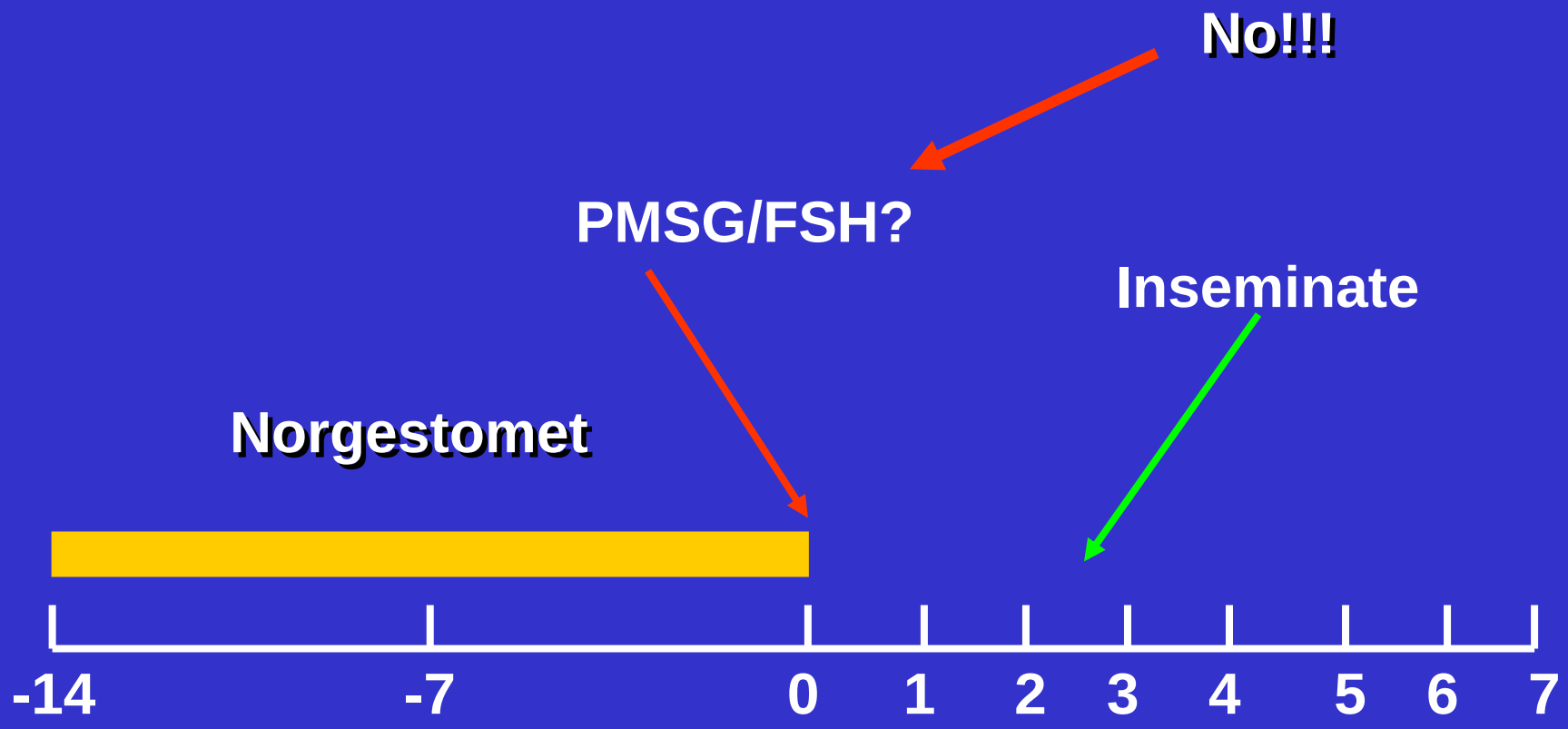
Timing is Everything!



We have had better success by timing to normal breeding!

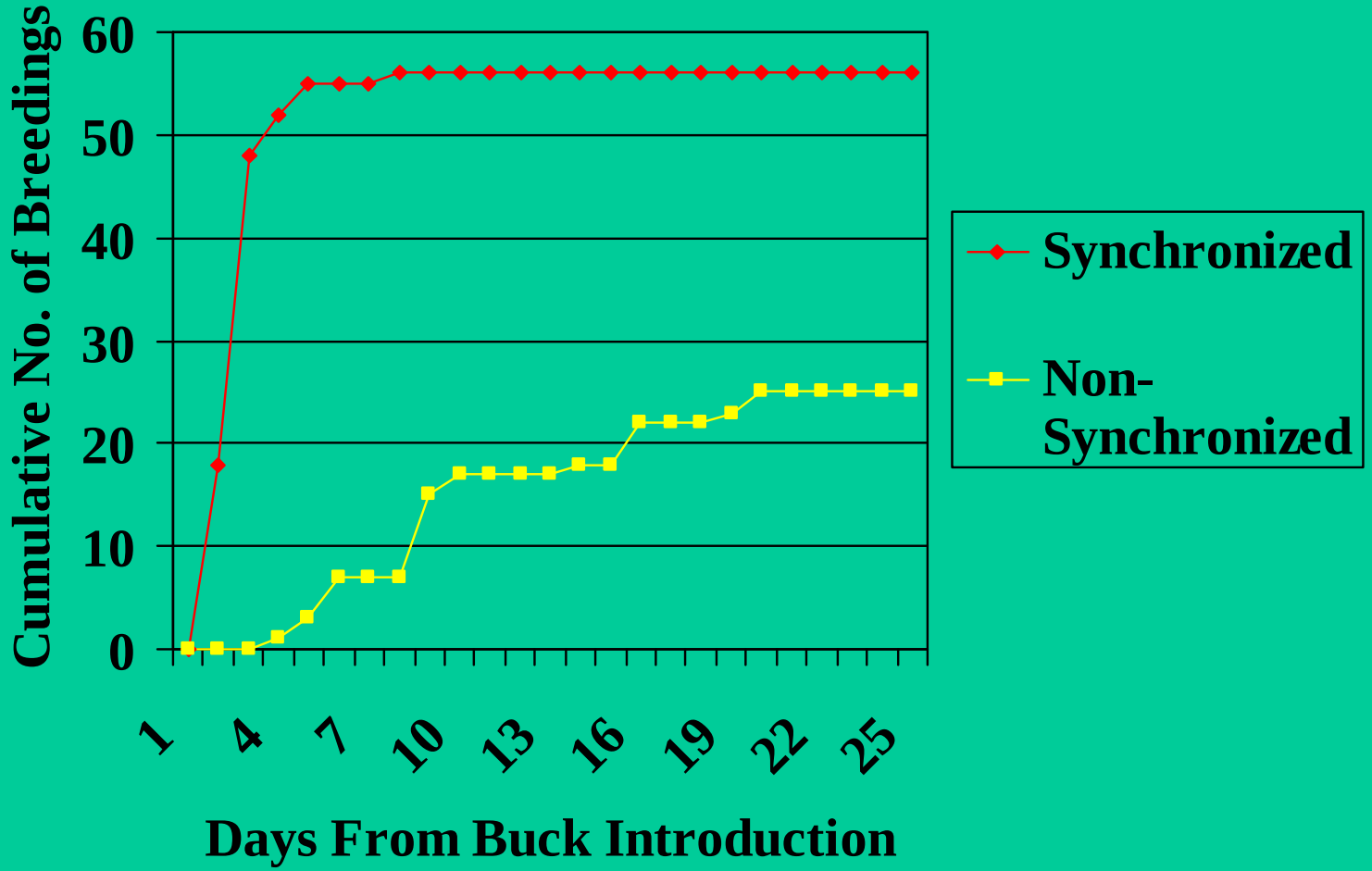
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Synchronizing Estrus



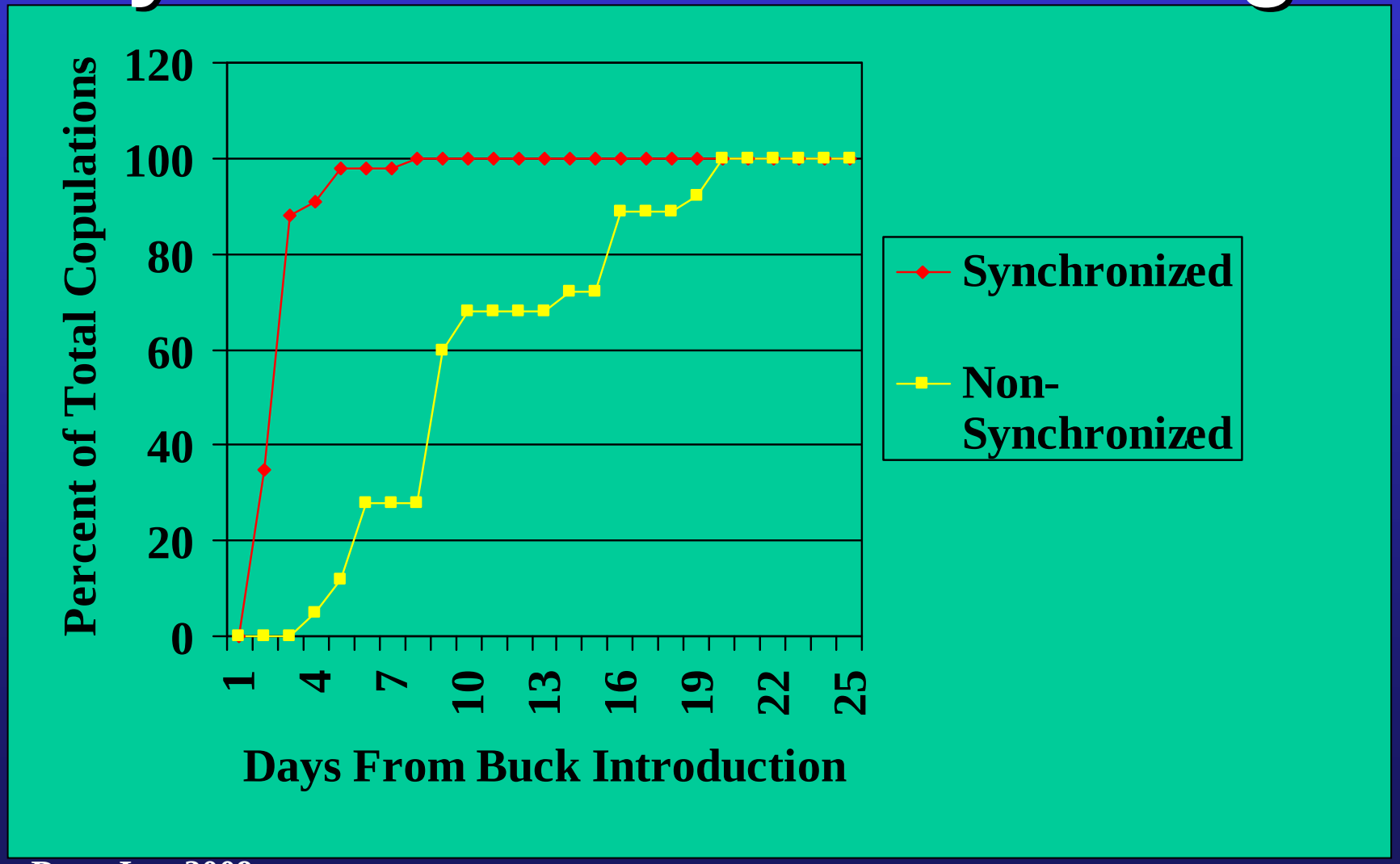
Important note: This is experimental and Dr. Kroll does not at this time warrant this procedure! Use at your own risk!!!

Advantages of Synchronization? Breeding



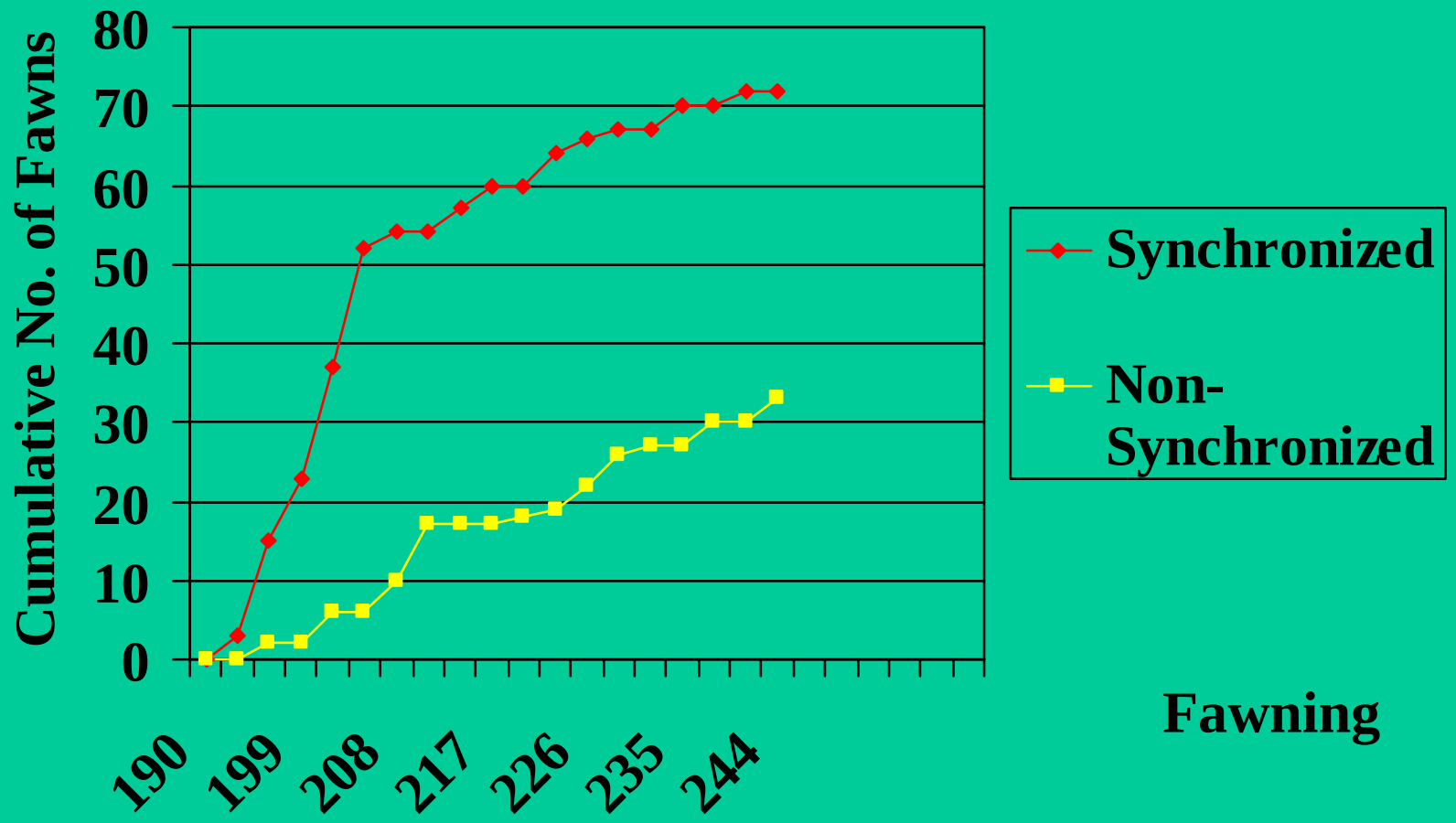
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Advantages of Synchronization? Breeding



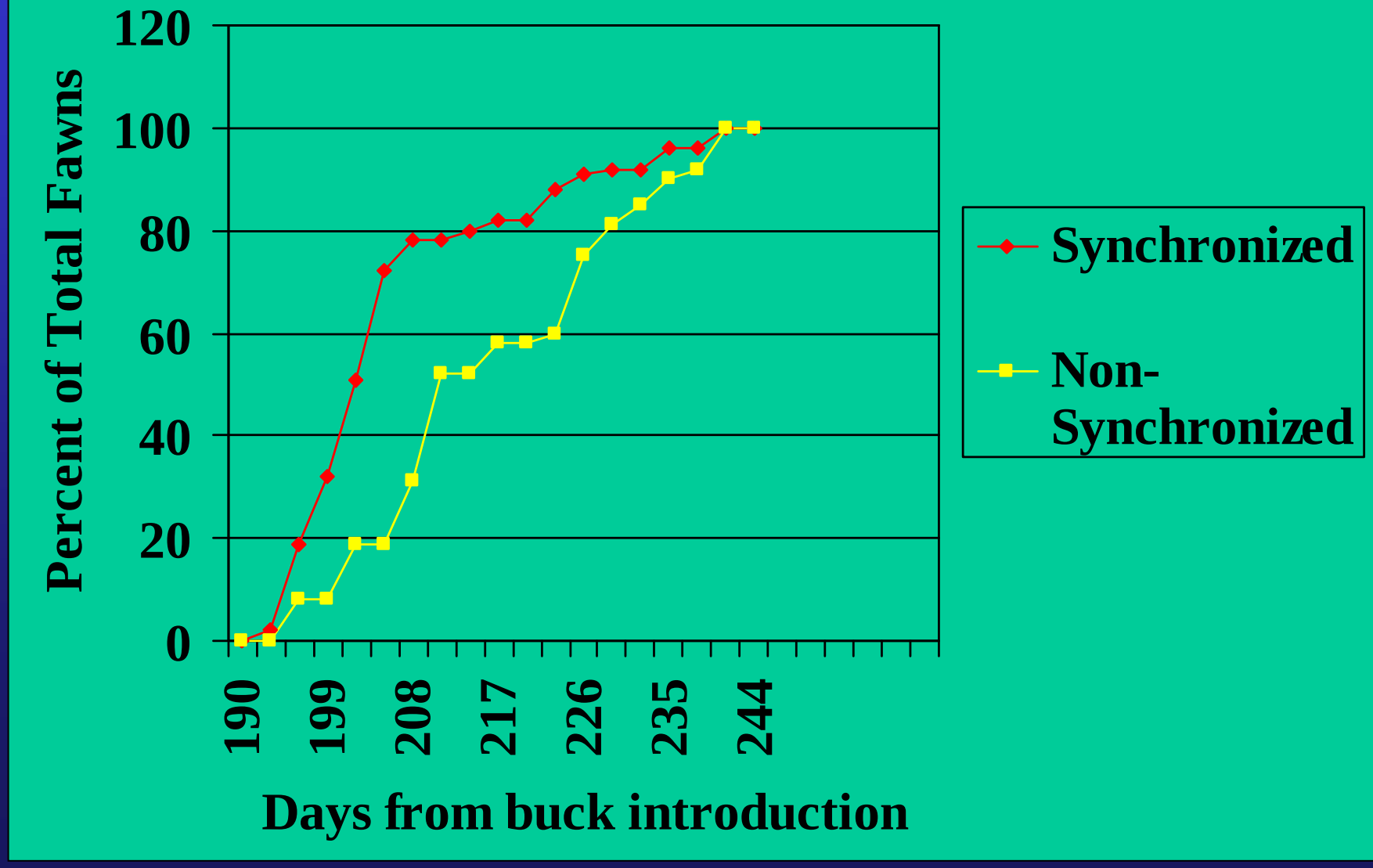
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Advantages of Synchronization? Fawning

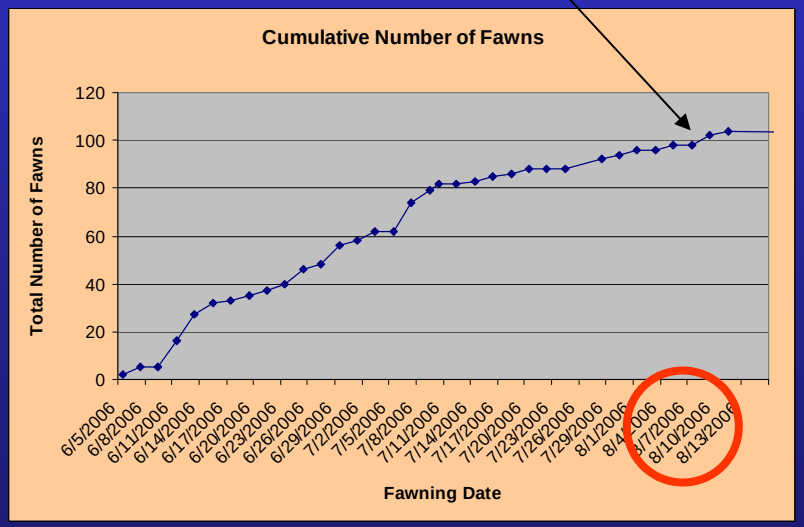


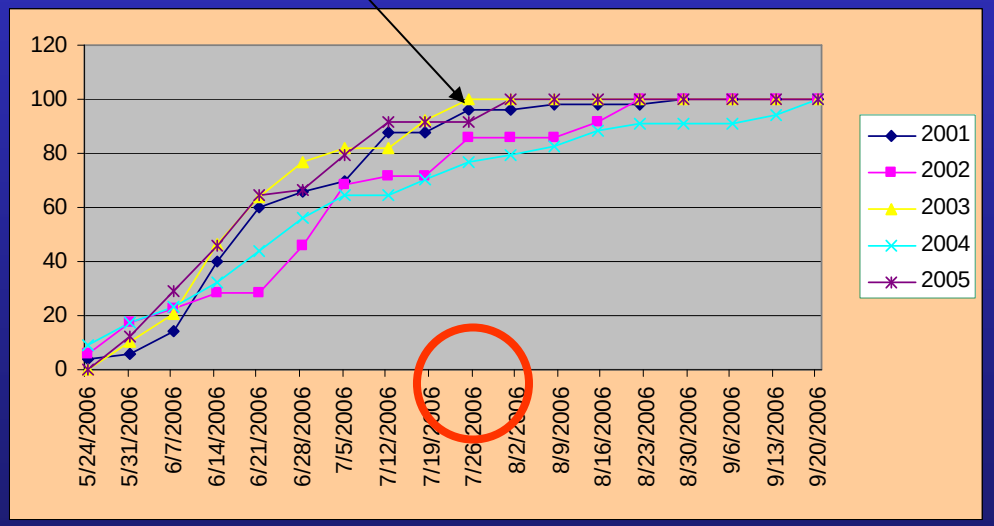
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Advantages of Synchronization? Fawning



Let's Compare Operators!





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Advantages of Synchronization? Fawning

- 50% of fawns produced by ES does were born by day 202
- 50% for ENS born b y day 210
- 75% of fawns born to ES does by day 205
- 75% of fawns born to NES does by day 227
- 22 day difference!
- More yearlings with larger antlers= $

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Advantages of Synchronization? Fawning

- On 10 does,
- Less stress on breeder buck!
- Lost less weight.

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How can we detect heat?



Heat Detection Aids are only Aids.

What about “marker” bucks?

- They work fine, depends on you!
- Labor intensive.
- Can produce stress (depends on situation)
- In a small operation, probably a good way to go!
- AI within 12 hrs after standing heat



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The Basics

- What triggers breeding?
- How did we determine timing?
- How do you synchronize estrus?
- **What is the procedure for AI?**
- How do you confirm conception?

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We wish!!



- What is a realistic goal?
- What is the value?

©Dr. D

AI Methods

- ✓Laparoscopy?
- ✓Intracervical?





No Difference!

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To Lap or Not to Lap!

What are you trying to do?

Breed doe and sell her as AI'd

Split straw of expensive semen.

Capture DNA.

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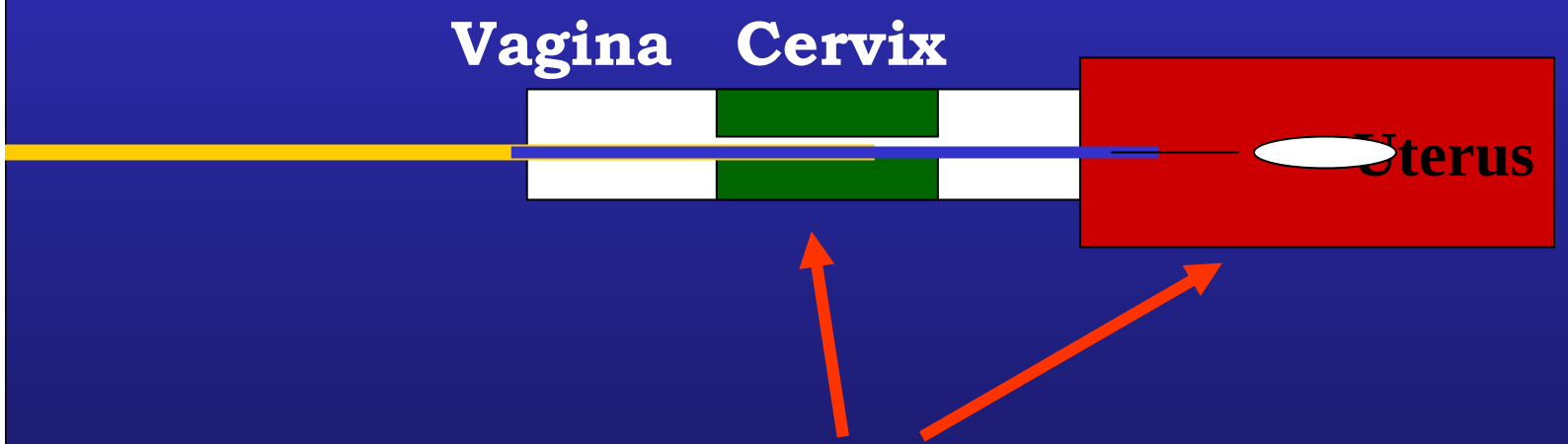
Artificial Insemination







Insemination Technique



4 Canyon Study: No significant difference!

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Artificial Insemination





What can you expect?

30 to 80%

6,869 deer, 68%

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Artificial Insemination



Let's Talk About:

Mucus!



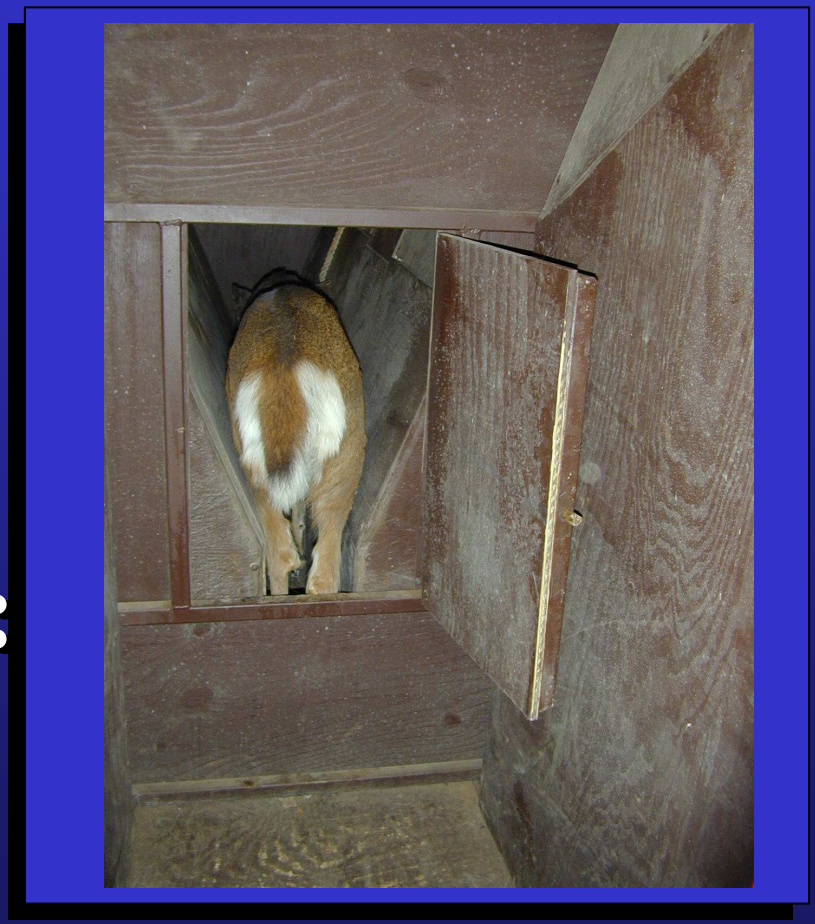
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Artificial Insemination



Let's Talk About:

Stress!



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Artificial Insemination





Records:

- **Stress score (1-5)**
- **Condition score (1-7)**

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How can you increase conception?

- Reduce stress.
- Records, records, records!!!
- Misconception: synchronization starts estrous cycle.
- PMSG will increase conception.

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Reducing Stress?

- Training your deer.
- Being with your deer.
- Bottle reared vs. natural reared.
- Culling your does. (RECORDS!)

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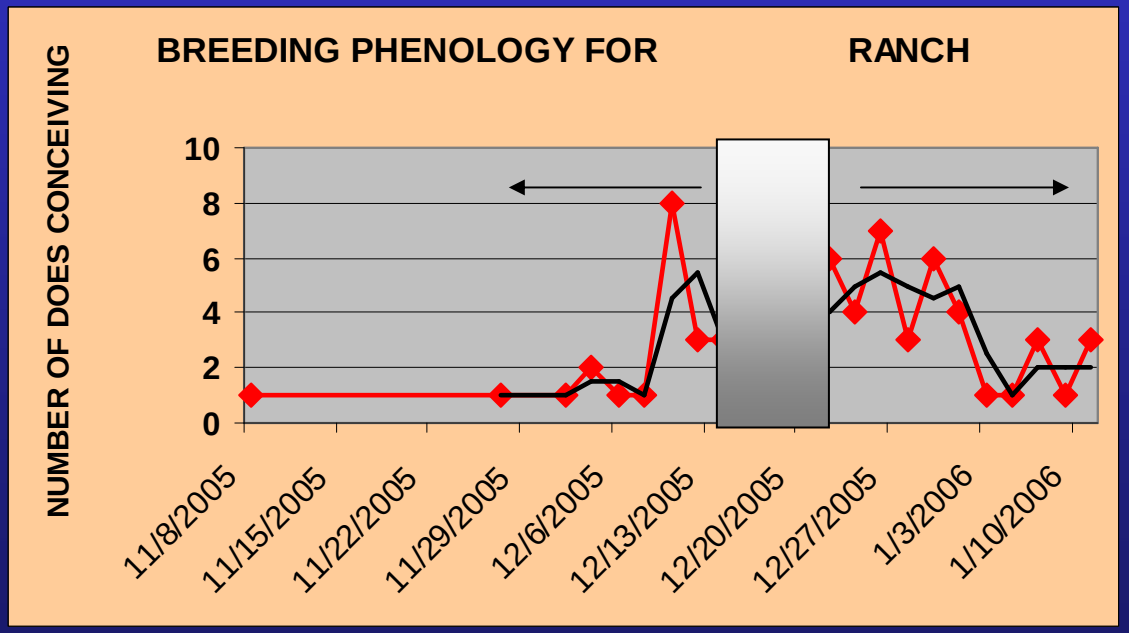


What about tranquilization vs. handling cradle?

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What will records do?

- **Operator “X” First Year= 12.5%**

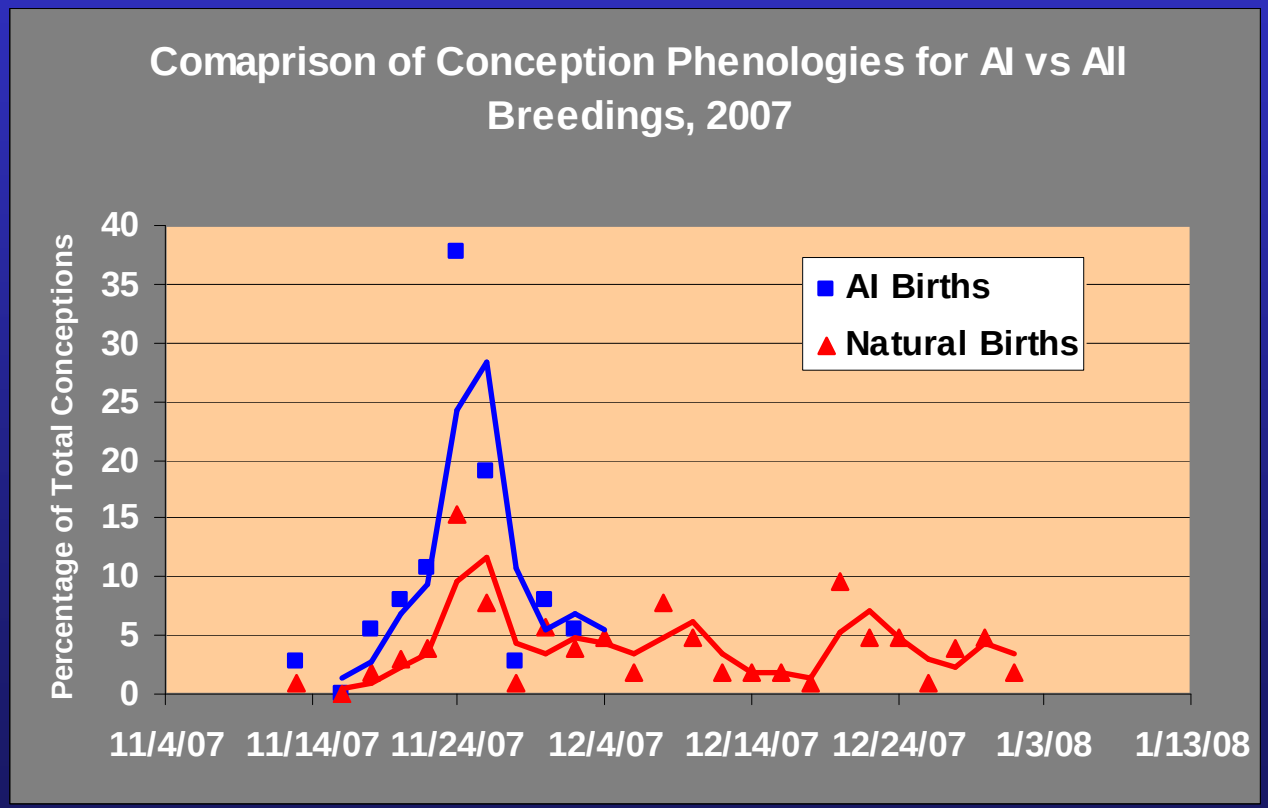


- **Operator “X” Second Year= 75%**

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What will records do?

- **Mustang Creek Ranch**



Point? Breed when YOUR deer breed!

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Let's Start With The Basics

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- How do you synchronize estrus?
- What is the procedure for AI?
- How do you confirm conception?

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Blood Test



Figure 9. Jugular venepuncture performed on a doe restrained in the deer cradle on 4-Canyon Ranch, Uvalde Co., TX.

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ULTRASOUND AT 45-60 DAYS





30-35 days might be safe.

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Let's Start With The Basics

- What triggers breeding?
- How did we determine timing?
- How do you synchronize estrus?
- What is the procedure for AI?
- How do you confirm conception?
- The value of records.

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Record Keeping?



- ✓Culling does
  - ✓AI performance
  - ✓Genetics
- ✓Culling bucks
  - ✓EPDs

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A doe culling strategy that works!

- First cull (physical)
  - Those that consistently produce good bucks
  - Those that do not
- Second cull (on paper)
  - Those that AI consistently (AI group)
  - Those that do not (natural group)

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Heritability?

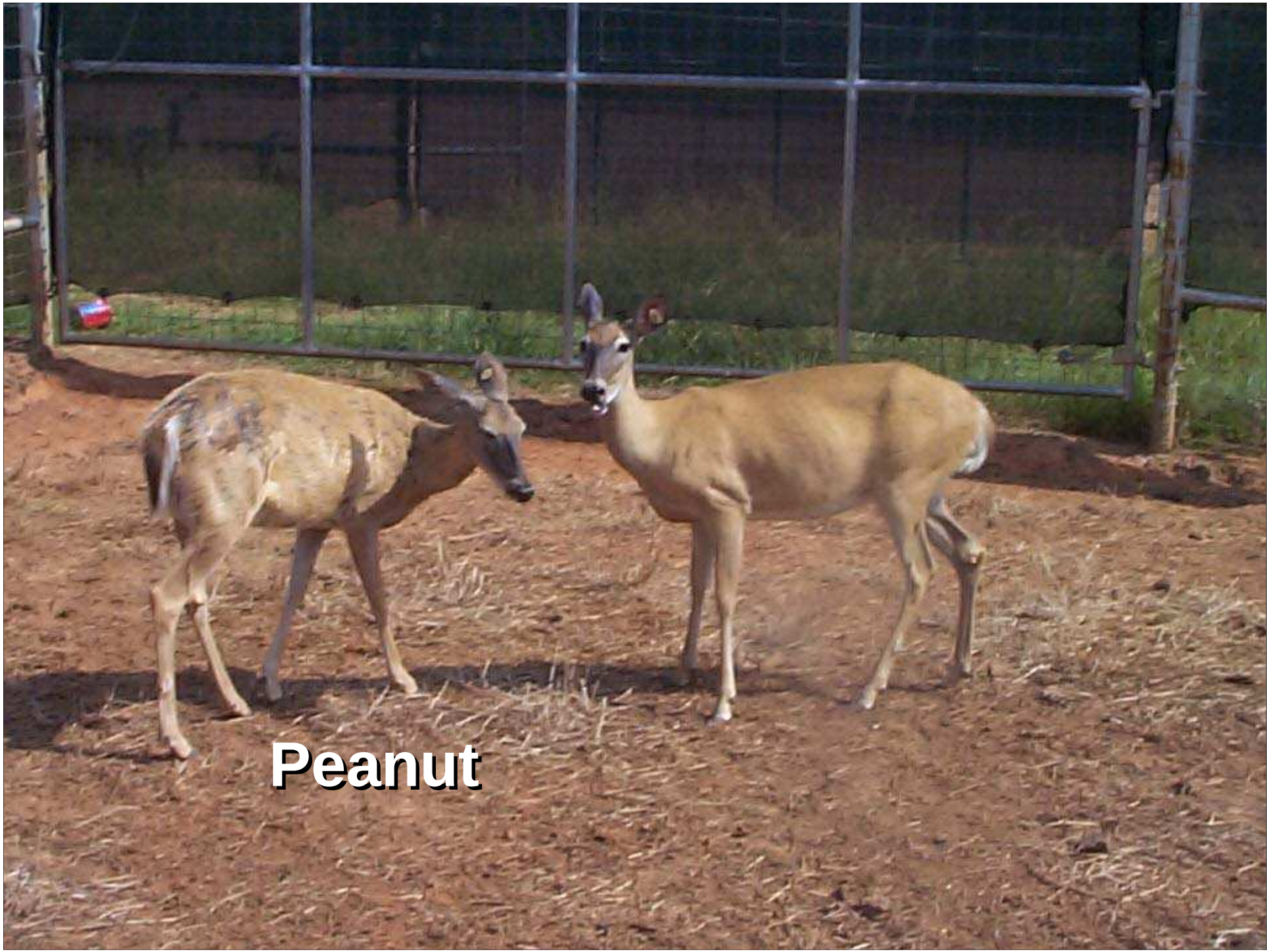


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Effect of Dam?



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Peanut







©D

Deer have one purpose!



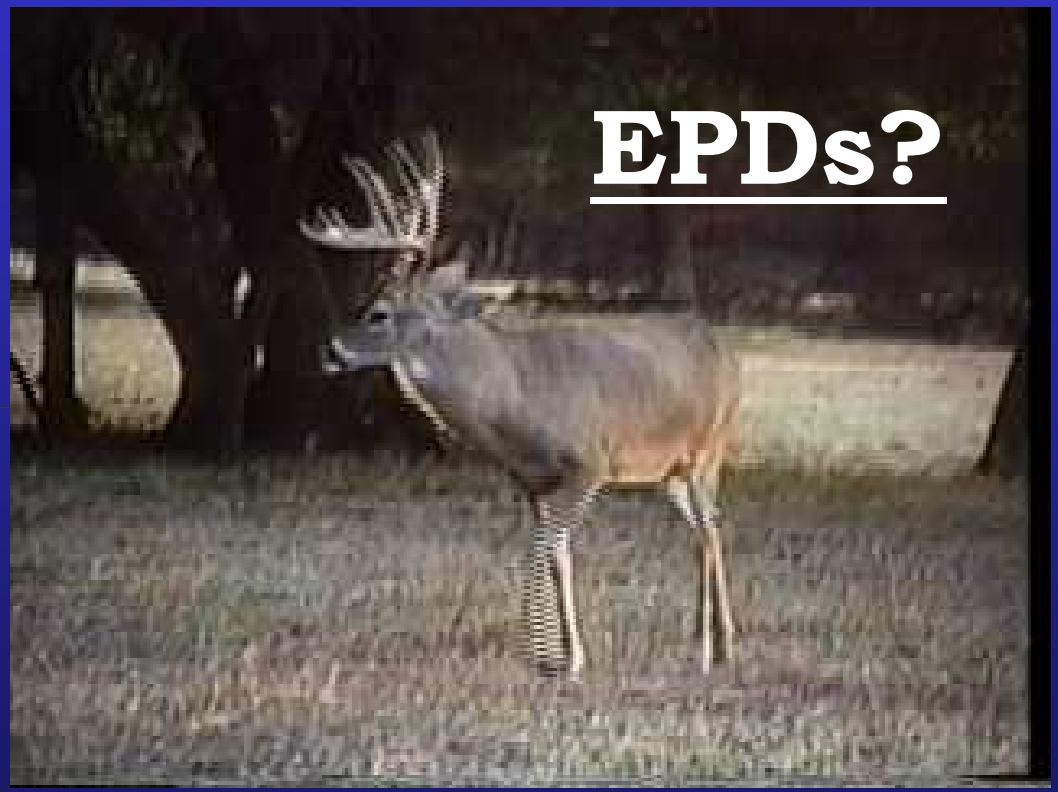
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Yearlings!



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Heritability?



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Predictability of Wild Deer?

TRAIT	Lukefahr & Jacobson 1998	Williams et al. 1994	Lukefahr 1997
Points	0.06	0.22	0.00
Spread	0.00	0.03	0.00
Mass	0.09	0.71	0.00
Beam Circ.	0.25	0.5	0.00
Beam Length	0.00	0.49	0.05

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Can we predict from yearling antlers?



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Can we predict from yearling antlers?



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Consistency!



"Benito"



Improving Genetics? Fact vs. Fantasy!

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70% Trophies!

DNA?



Not a substitute for good record-keeping!
Used to solve pedigree questions.
Use before the sale!

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Mark Fawns ASAP!



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Not always sure!



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Watch your does!



Tell-Tale Signs:

- ✓Swollen bag (24-36 hrs)
- ✓Pacing and calling.
- ✓Irritability!
- ✓Past records.
- ✓Current records.

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Tag Each Fawn Immediately!



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What to do?



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What to do?

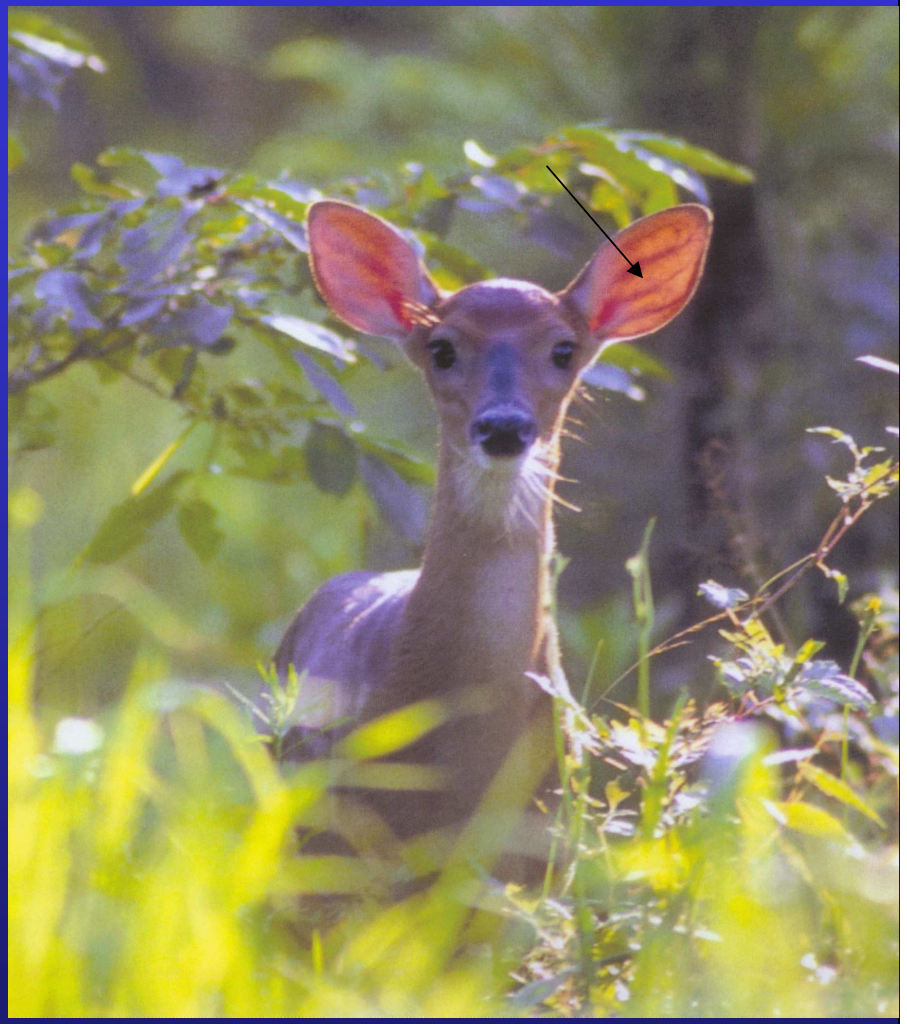


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What to do?







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What to do last?





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That's <u>all</u> I do!

Keys to 21st Century Deer Breeding

- Pedigreed herds
- Tb tested
- CWD Status
- Proof of heritability (EPDs)
- Handling facilities
- Nutrition
- Disease & parasite protocols
- Proven performance
- Hunting operations

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Our Industry Challenges?

- Surplus animals?
  - Meat
  - “Shooter” bucks
- Favorable regulatory environment!
- Public image!

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Thanks So Much
Gracias!

Questions?

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