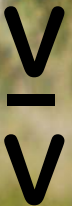


# Detection of pregnancy in Arizona range cattle using near infrared spectroscopy of feces.



D.R. Tolleson and D.W. Schafer



# Literature Review:

**2000.** Tolleson, Wilson, Randel, Neuendorff, Lewis, and Stuth. Discrimination between physiologically different groups of cattle via near infrared reflectance spectroscopy of feces. *Journal of Animal Science* 78:14 (Suppl. II).

**2001.** Godfrey, Dodson, Bultman, Tolleson, Stuth, and Norman. Use of near infrared reflectance spectroscopy to differentiate pregnancy status and gender of hair sheep in the tropics. *Journal of Animal Science* 79:26 (Suppl. II).

**2001.** Tolleson, Randel, Stuth, Willard, and Gandy. Detection of pregnancy in cattle using near infrared reflectance spectroscopy of feces. *Journal of Animal Science* 79:21 (Suppl. II).

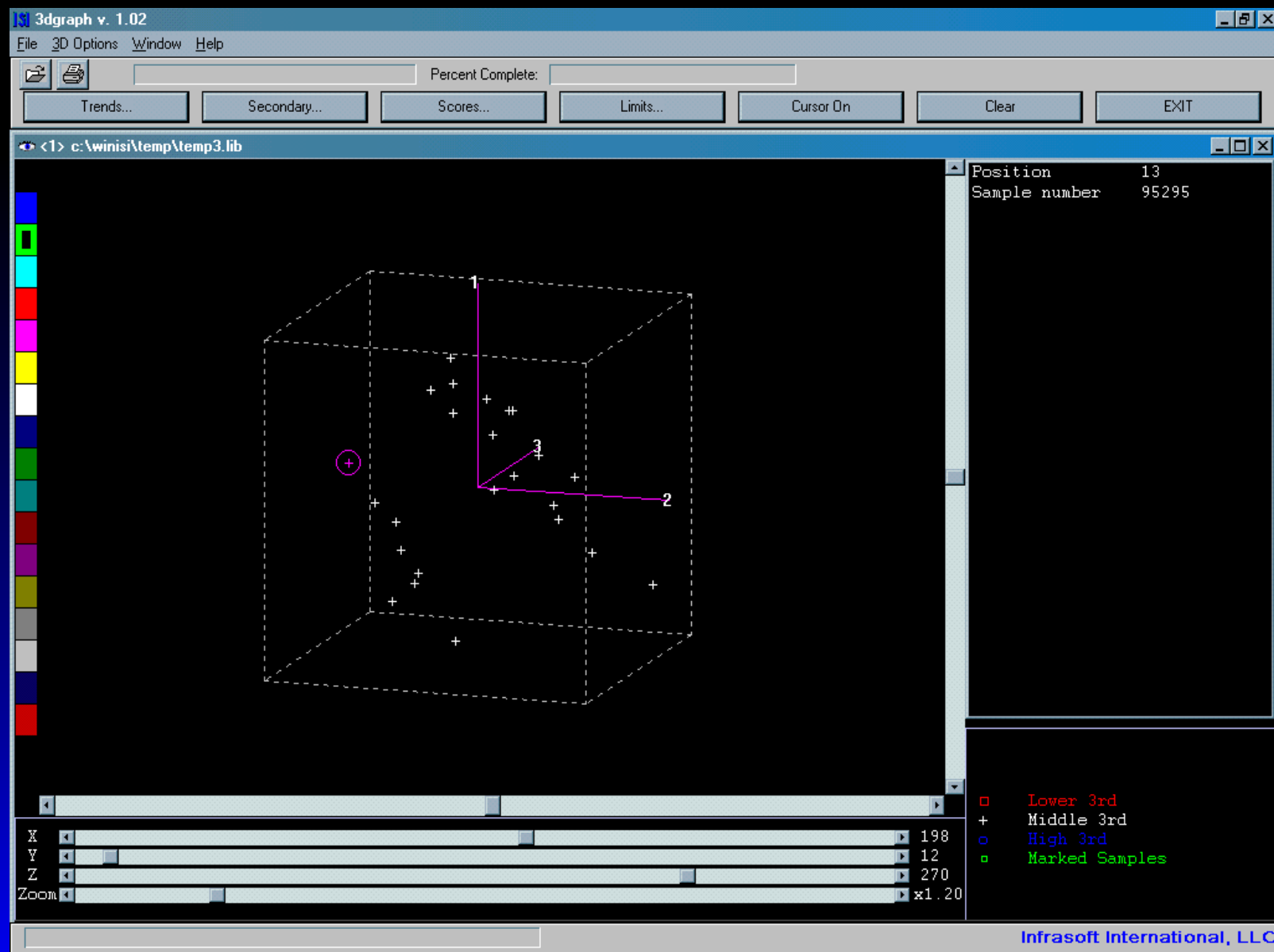
**2001.** Tolleson, Willard, Gandy, and Stuth. Determination of reproductive status in dairy cattle using near infrared reflectance spectroscopy of feces. *Journal of Animal Science* 79:21 (Suppl. II).

**2001.** Tolleson, Wilson, Randel, Neuendorff, Lewis, and Stuth. Near infrared reflectance spectroscopy of feces did not reliably predict serum progesterone (P4) in cows. *Journal of Animal Science* 79:21 (Suppl. II).

**2003.** Tolleson, Rabbe, Randel, Stuth, and Busch. Prediction of blood plasma progesterone via near infrared transmittance spectroscopy. *Journal of Animal Science* 81:16 (Suppl. II).

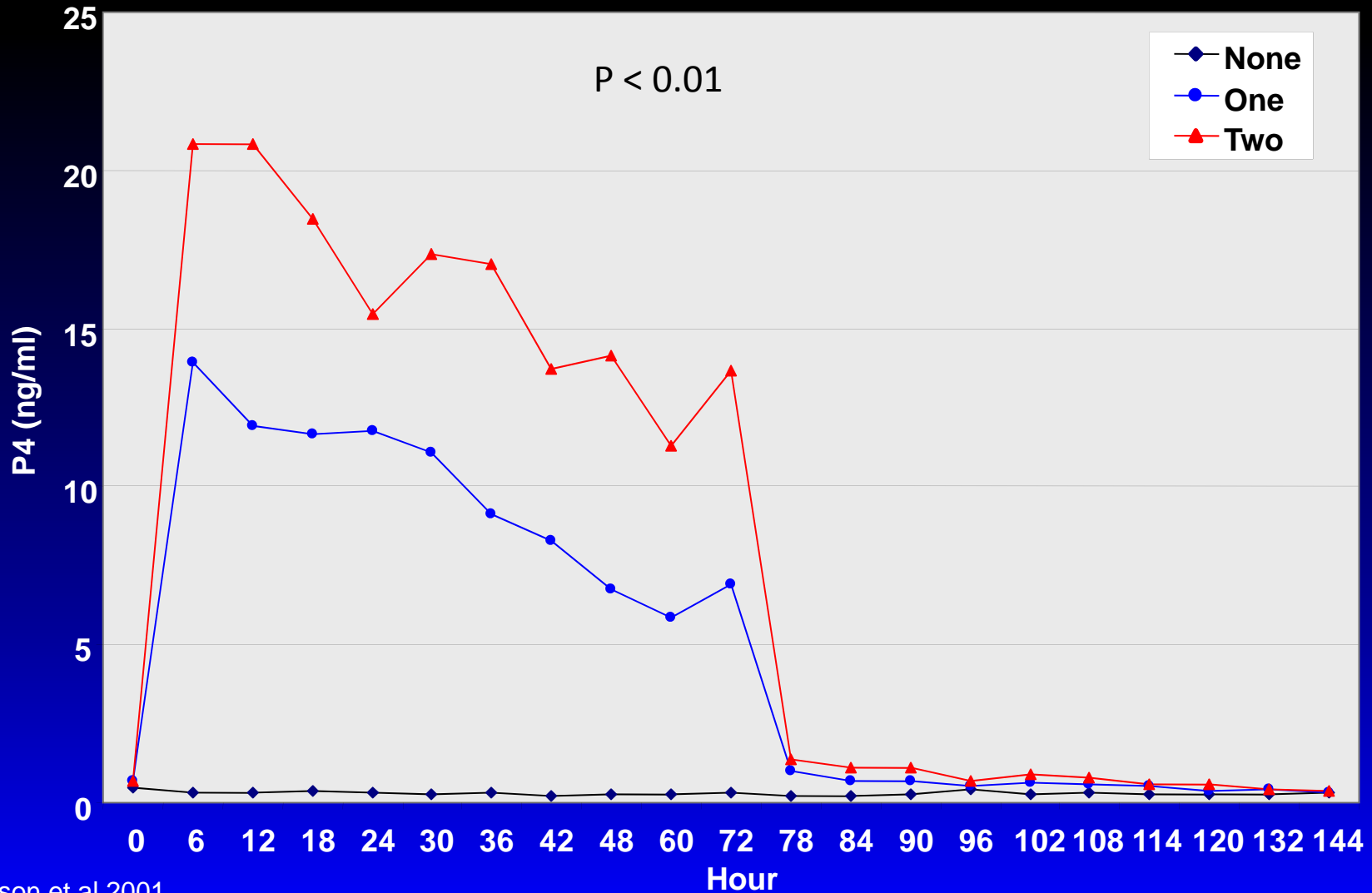
# Ovariectomized vs. Pregnant Brahman Cows

## 1<sup>st</sup> 3 principal component scores



# Effect of Treatment on Serum P4 Concentration

CIDR inserted at 0, removed at 72 hrs



# Plasma Progesterone in CIDR-treated Brahman Cows via Fecal NIRS

295 samples, PLS regression  
serum paired with fecal @ hr = n+18  
 $R^2 = 0.63$  SE calibration = **2.52 ng/ml**

# Plasma Progesterone in CIDR-treated Brahman Cows via Fecal NIRS

## Validation Group 1

50 random samples from calibration set

P4 =  $5.17 \pm 1.16$  ng/ml

$R^2 = 0.11$

SEP = 7.7

## Validation Group 2

20 samples from estrous cycling

Brahman x Hereford heifers

P4 =  $3.27 \pm 0.5$  ng/ml

$R^2 = 0.15$

SEP = 13.9

# Pregnancy in Dairy Cows via Fecal NIRS

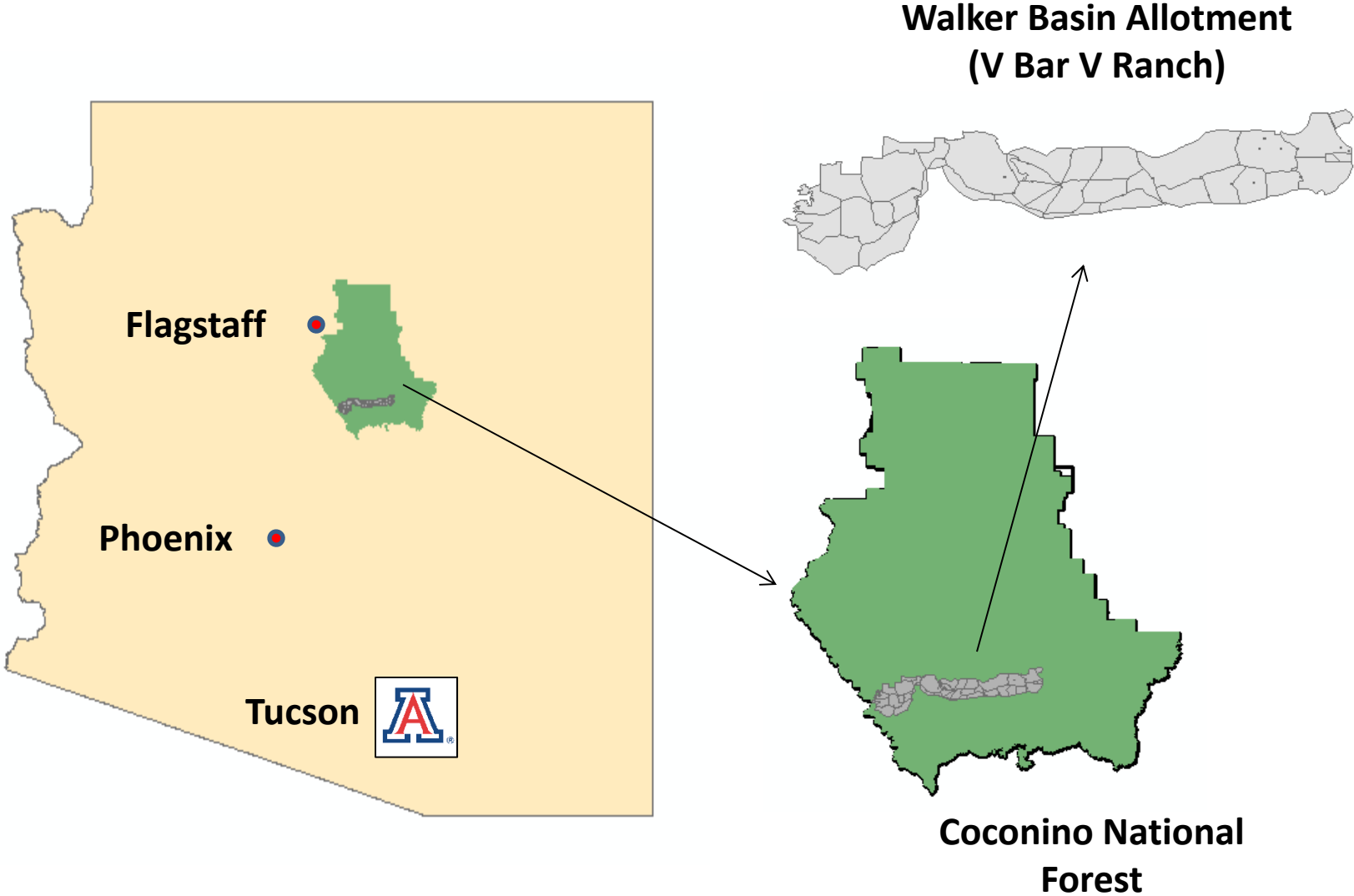
“...No significant correlation was found prior to 30 days post-AI. However, **at 30 days**, a regression equation utilizing 12 PC's (n = 25,  $R^2 = 0.66$ ,  $P < 0.13$ ) accurately classified 9/12 samples from pregnant animals and 12/13 from those that were non-pregnant...”

# Objective

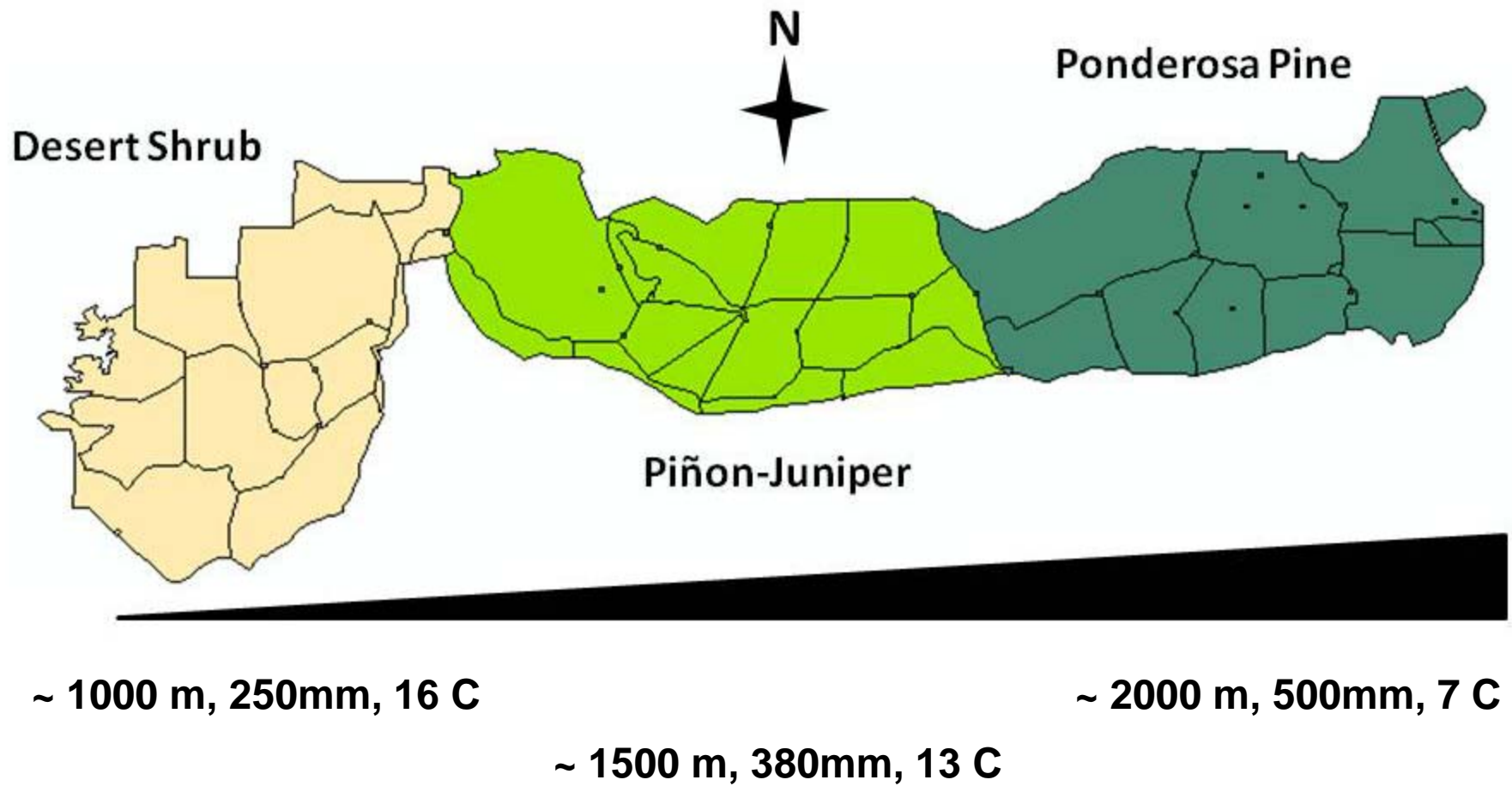
**Evaluate the ability of fecal NIRS to determine pregnancy in range cows under commercial ranch management conditions**



# Location of V Bar V Ranch



# Elevation and Vegetation Types V Bar V Ranch





# Materials and Methods

- ✓ 5-d CO-Synch+CIDR protocol in mid-June of 2011
- ✓ Timed AI, then turned out with bulls for 75 days
- ✓ Rectal palpation mid-September
- ✓ Assign days pregnant at sample collection
- ✓ Fresh fecal samples ( $300 \pm 50\text{g}$ ) from individually

identified cows collected off the ground in the pasture on:

- the day of AI
- 2 weeks later
- ~ monthly until mid-September

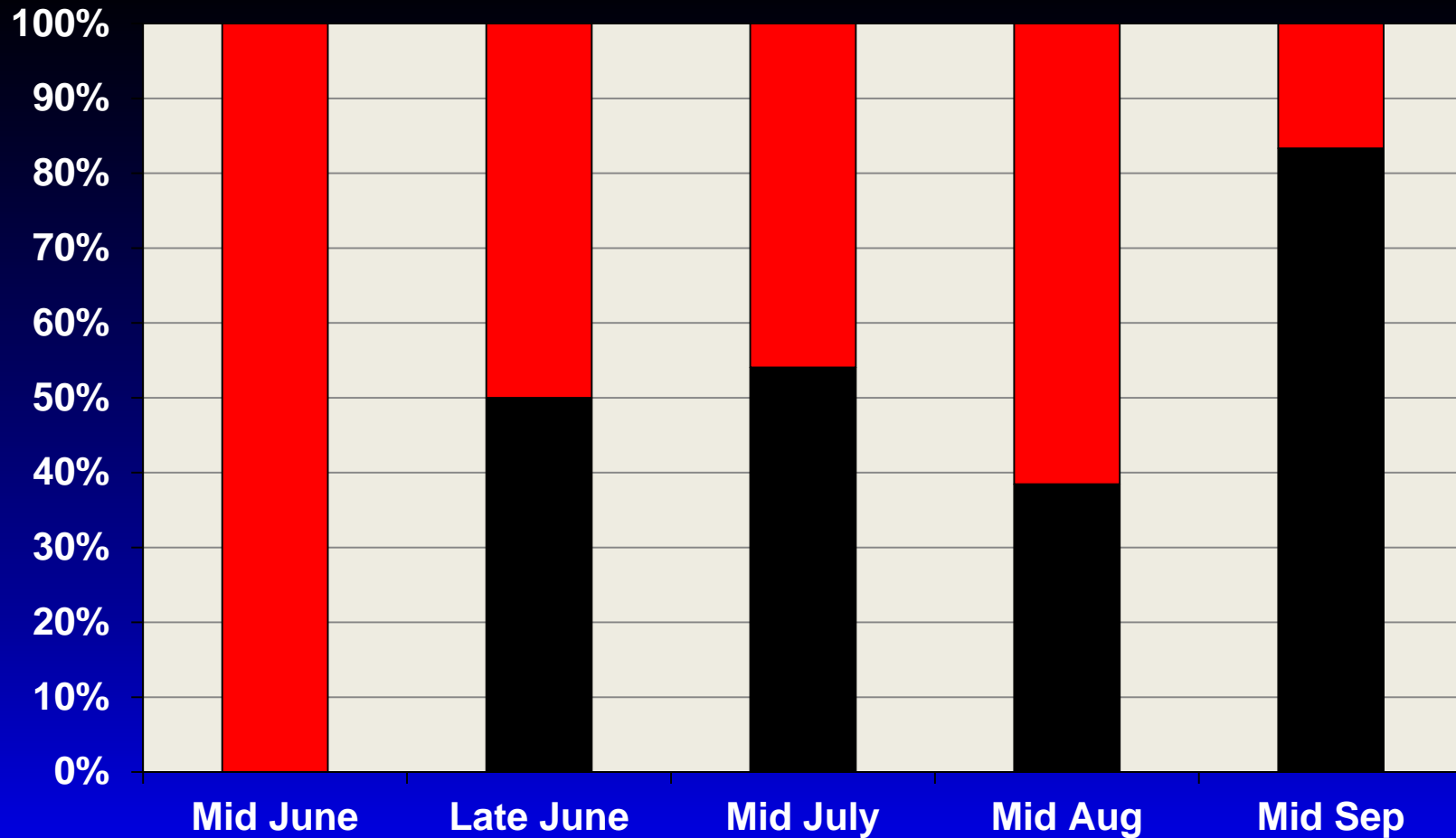
# Materials and Methods

## Continued...

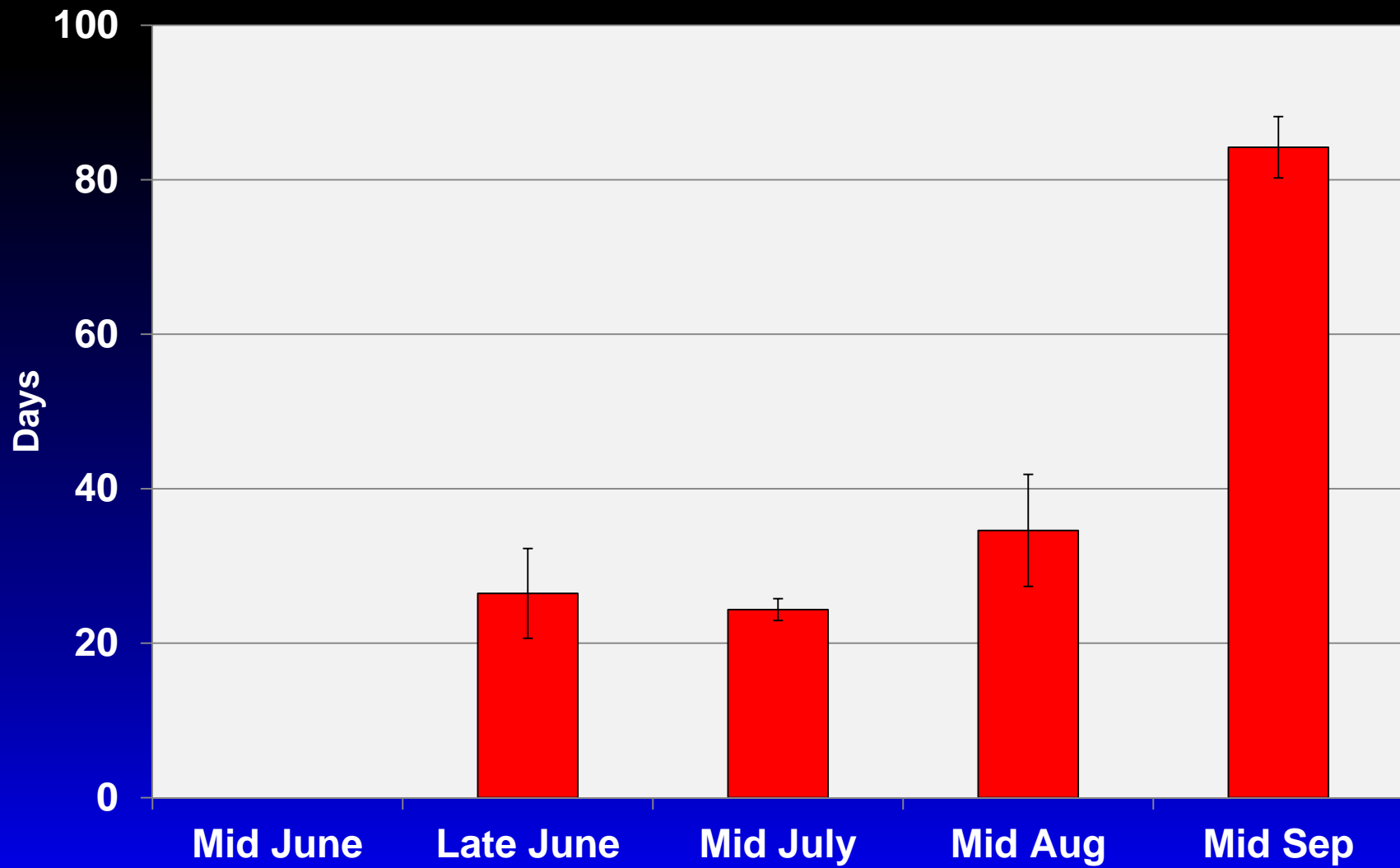
- ✓ Samples (n = 78) were frozen and later analyzed by NIRS
- ✓ Spectra (1100 to 2500nm) paired with the corresponding pregnancy values
- ✓ Discriminant calibration via SAS discriminant procedures
- ✓ Validation with ~25% of the samples (n = 17) randomly selected/removed
- ✓ Validation performance determined by simple regression
- ✓ Differences in proportion of correct vs incorrect ID by  $\chi^2$  procedures
- ✓ Randomly assigned arbitrary groups (A vs B) also used for discriminant calibration/validation

# Percent of Samples from Pregnant versus Non-pregnant Animals by Date Sampled

Pregnant ■ Non-pregnant



# Days Pregnant by Date Sampled



# Discriminant Results

## Biological Comparison

### Calibration

Group	Correct / Total	% Correct	P vs "50/50"
Non- / < 30d Preg	30 / 37	81	< 0.01
Preg > 30d	18 / 24	75	0.08



# Discriminant Results

## Biological Comparison

### Validation

<b>Group</b>	<b>Correct / Total</b>	<b>% Correct</b>	<b>P vs "50/50"</b>
<b>Non- /&lt; 30d Preg</b>	<b>8 / 12</b>	<b>67</b>	<b>&gt; 0.1</b>
<b>Preg &gt; 30d</b>	<b>4 / 5</b>	<b>80</b>	<b>&gt; 0.1</b>

# Discriminant Results

Arbitrary Comparison

Calibration

Group	Correct / Total	% Correct	P vs "50/50"
A	21 / 34	62	> 0.1
B	6 / 27	22	0.05

# Discriminant Results

Arbitrary Comparison

Validation

Group	Correct / Total	% Correct	P vs "50/50"
A	1 / 5	20	> 0.1
B	7 / 12	58	> 0.1

# Discriminant Results

Biological vs Arbitrary

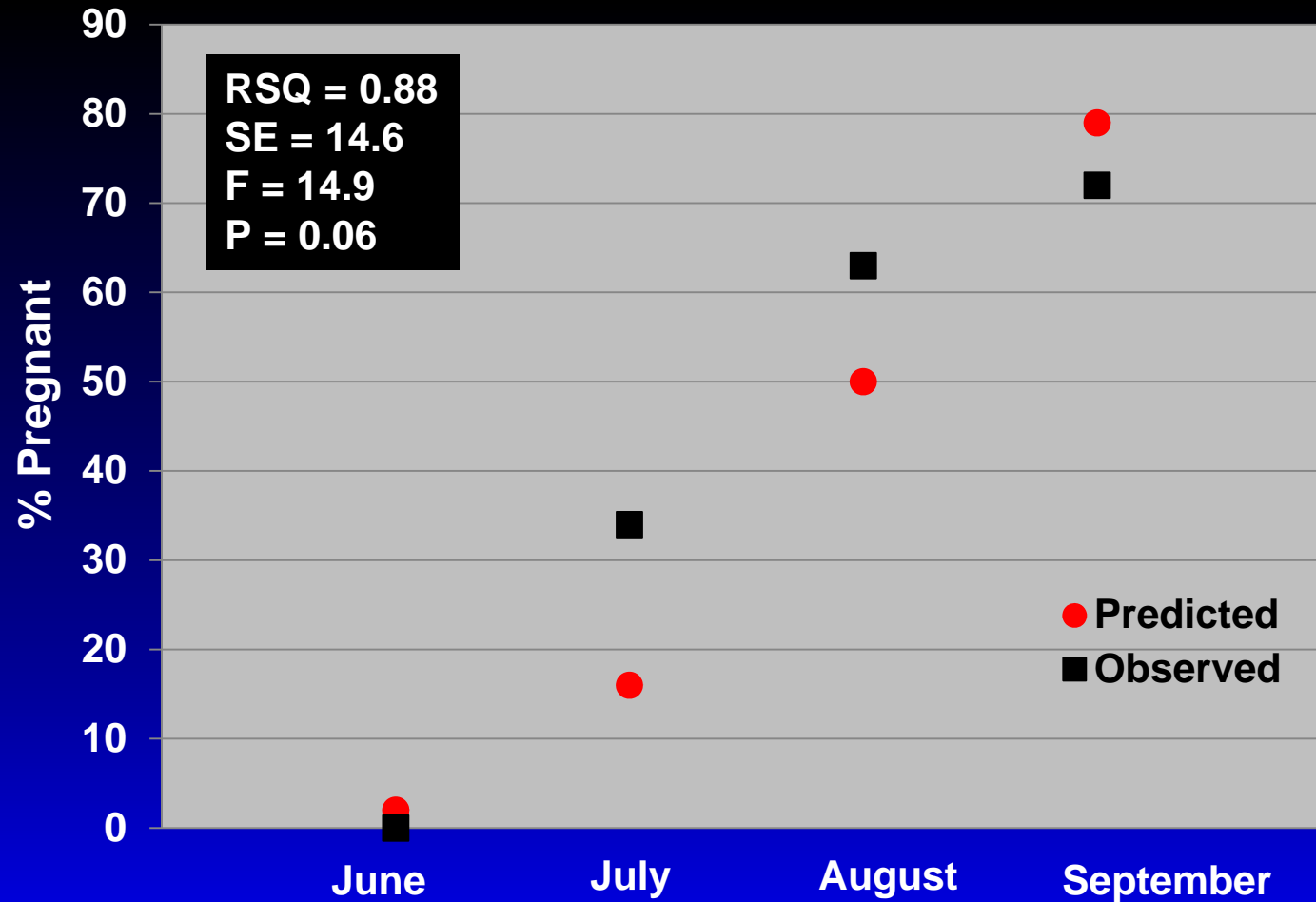
## Percent Correct Identification

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**Calibration** 79 vs 44  $X^2 = 15.3$   $P < 0.01$

**Validation** 71 vs 47  $X^2 = 1.94$   $P = 0.16$

# Observed versus FNIRS Predicted Herd Pregnancy Proportion by Month



# Summary

- Fecal NIRS discriminant equation correctly identified pregnancy status at 79%
- Validation group pregnancy status correctly identified at 71%
- Randomly selected arbitrary groups correctly identified at 44% (calibration) or 47% (validation)
- Fecal NIRS predicted progression of herd pregnancy status was similar to observed

# Conclusions

- **Herd pregnancy status of range beef cows was predicted well enough to inform forward planning for reproductive management.**
- **Further validation is required to fully determine the value of the technique in practical ranch management settings.**



# Acknowledgements:

**V Bar V Ranch Staff**

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**Grazingland Animal Nutrition Lab**