Fate of Hormones in Waste from Concentrated Broiler Feeding Operations

July 1, 2007 – June 30, 2010

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Overall Objectives

- Hormones in broiler litter (Obj. 1)
- Transformation and transport (Obj. 3, 4)
- Effect of management (Obj. 2, 5, 6)

Objective 1

- **Determine the variability of hormone and metabolite concentrations in broiler litter.**
  - Kissel, Fairchild, Hassan, Huang, Cabrera

Objective 1- Approach 1

- **Obtain 300 broiler litter samples from AESL to represent:**
  - Litter treatment (Alum, no Alum)
  - Number of flocks
  - Type of litter (cake or full cleanout)
  - Freshness (fresh, stacked, composted)
- **Analyze samples for estradiol, estrone, testosterone, and metabolites**.
- First 120 samples analyzed by July 2008
- Second 180 samples analyzed by July 2009

Objective 1- Approach 2

- **Obtain samples from houses used to grow broilers to 42, 49, or 56 days**
  - Three houses for each broiler age
  - Five samples taken from each house
  - 45 samples in total
- **Analyze samples for estradiol, estrone, testosterone, and metabolites**.
- Samples analyzed by December 2009
- Submit article for Obj. 1 by April 2010

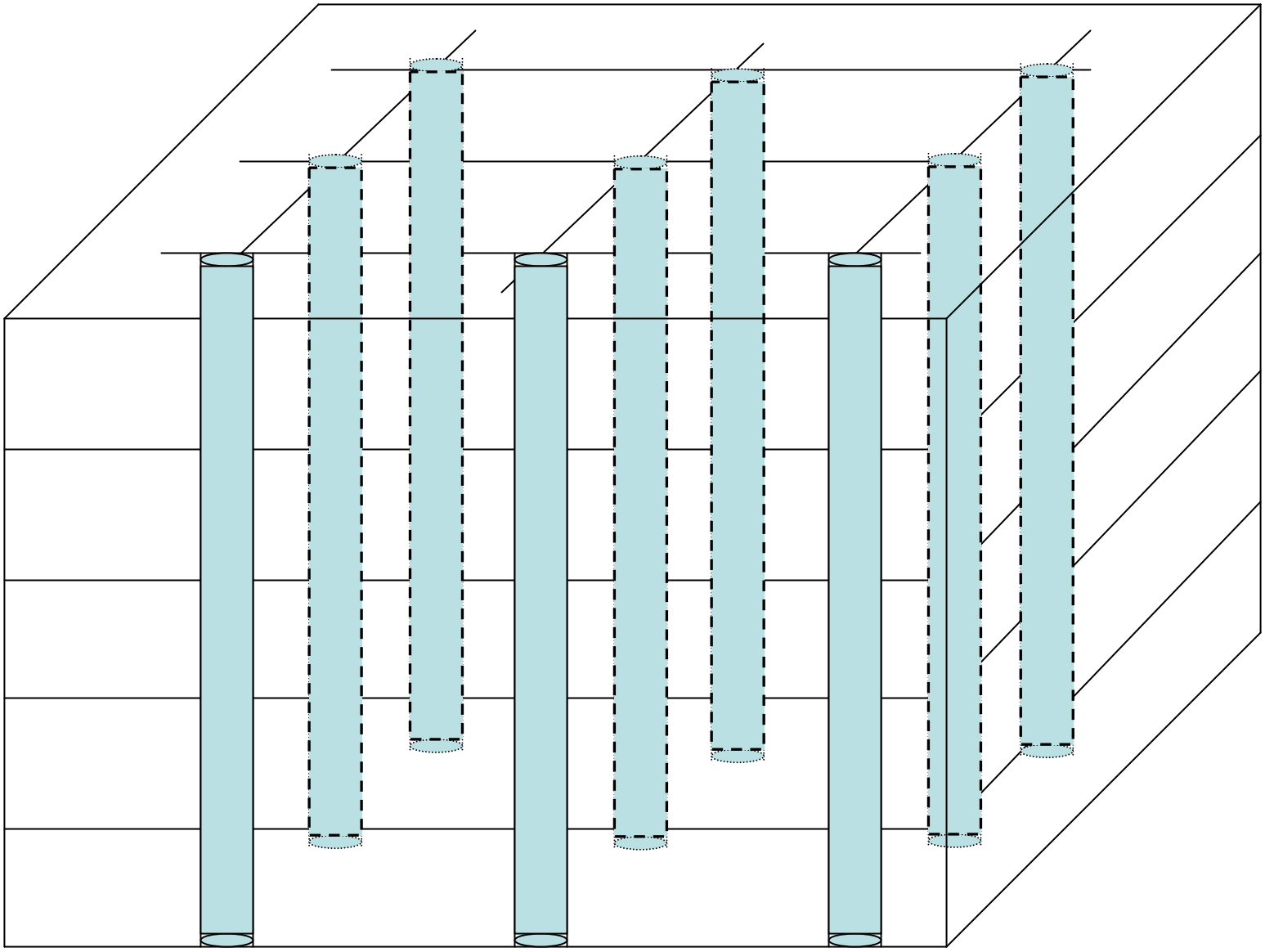
Objective 2

- Determine the effect of storing broiler litter in stack houses on hormone and metabolite concentrations.

- Fairchild, Hassan, Huang, Cabrera

Objective 2- Approach

- **Five stack houses**
  - Dataloggers installed to measure temperature every 30-cm in depth
  - Samples taken at the time of litter storage and at time of removal
  - Nine samples taken in a grid pattern
  - Samples taken every 30 cm (5 samples)
  - 90 samples from each house
  - 450 samples in total



Objective 2- Approach

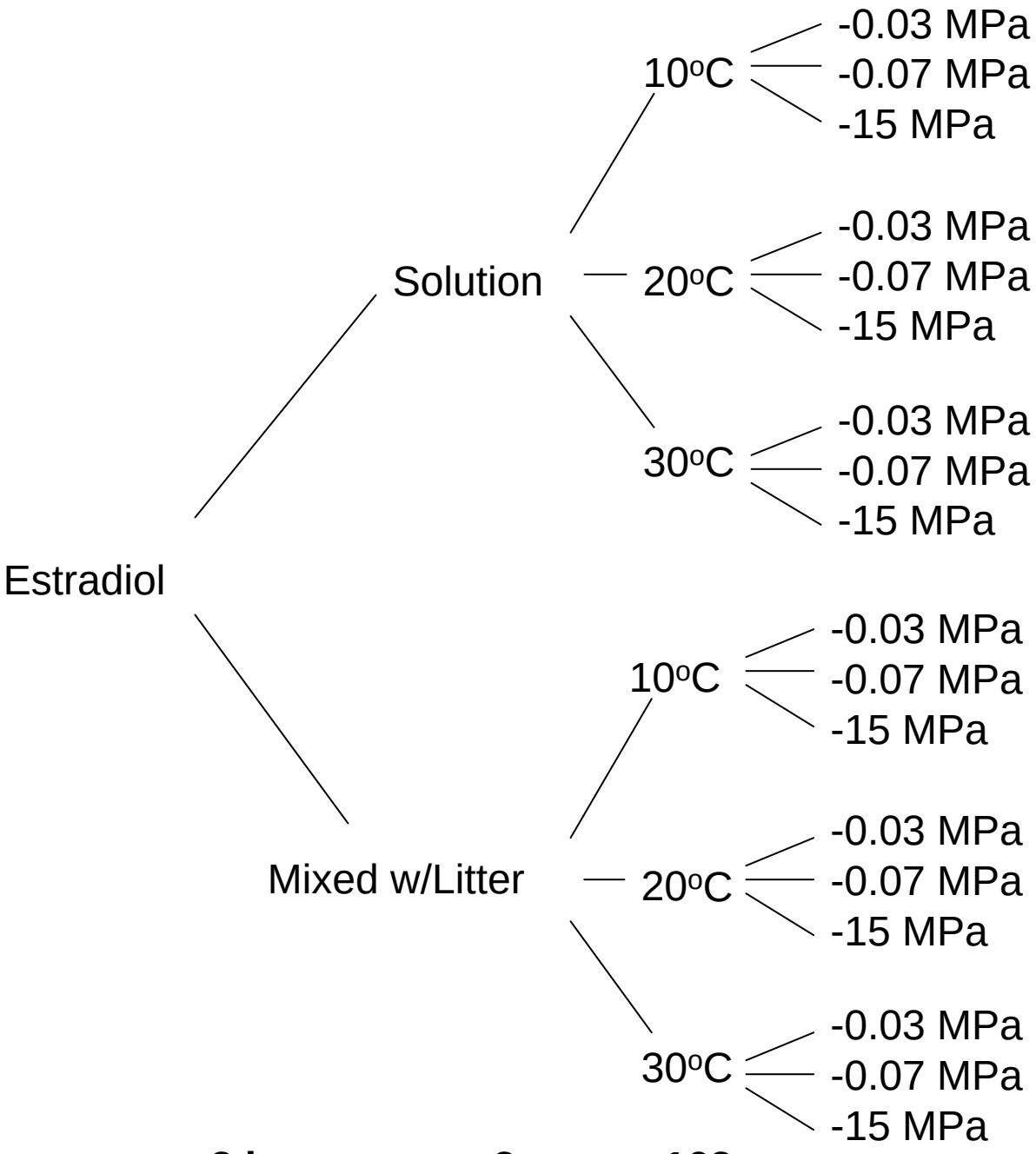
- Complete sampling and analysis of first 2 houses by July 2008
- Complete sampling and analysis of second 3 houses by July 2009
- Submit journal article by Sep 2009

Objective 3

- **Evaluate the effect of soil temperature and water potential on the decomposition of estradiol, estrone, and testosterone in soil when applied in pure solution or in solution mixed with litter.**
  - Hartel, Vencill, Hassan, Huang, Cabrera

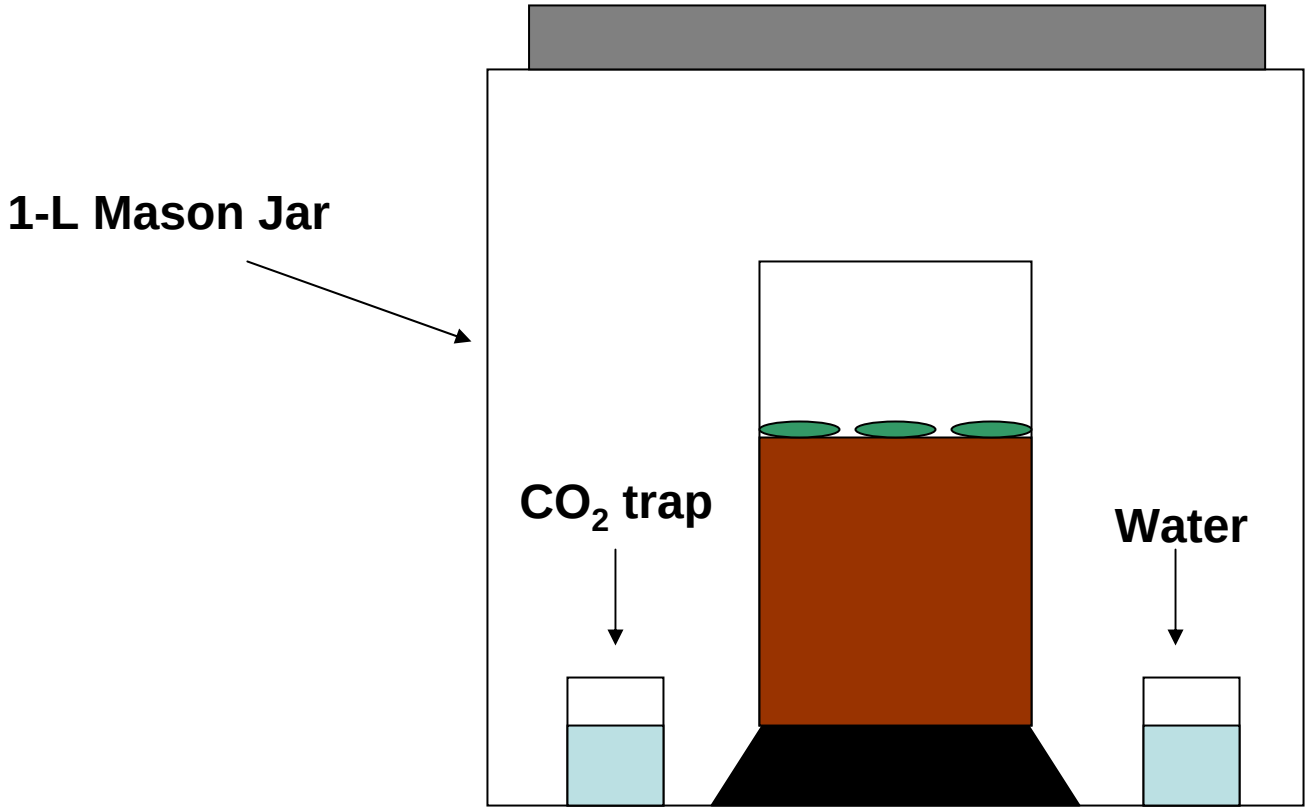
Objective 3 - Approach

- Soil samples collected from upper 10 cm of pasture soils that have received litter
- Temperatures: 10, 20, 30^{o}C
- Water Potential: -0.03, -0.07, -1.5 MPa
- 14-C labeled estradiol, estrone, or testosterone
- Pure solution or mixed with litter
- Applied on the soil surface
- Soil control (no litter); Litter control (unlabeled litter)
- Three replications



- **18 trts/hormone x 3 hormones x 3 reps = 162**

Objective 3 - Approach



- **Incubation time: 6 months**
- **Radiolabel in CO_2 measured with liquid scintillation counter**
- **Soil extracts will be passed through HPLC to separate radiolabeled compounds, which will be analyzed by GC/MS or LC/MS**

Objective 3 - Approach

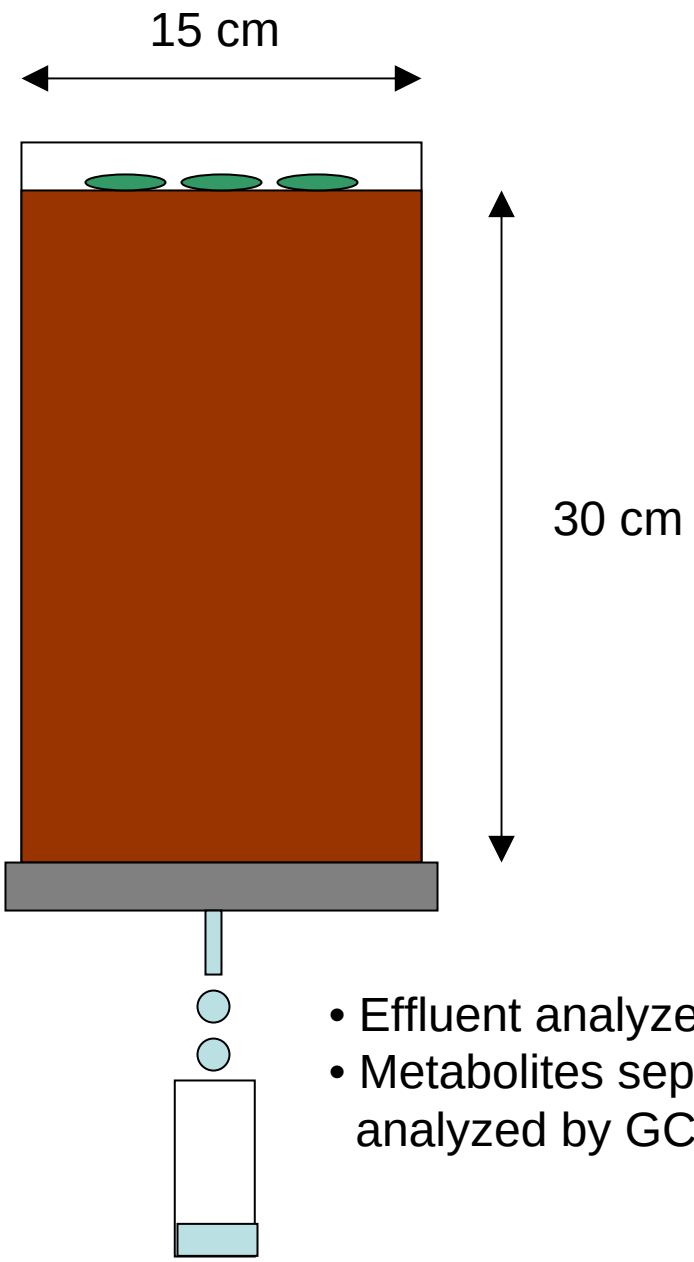
- Incubation study completed by July 2008
- Journal article submitted Sep 2008

Objective 4

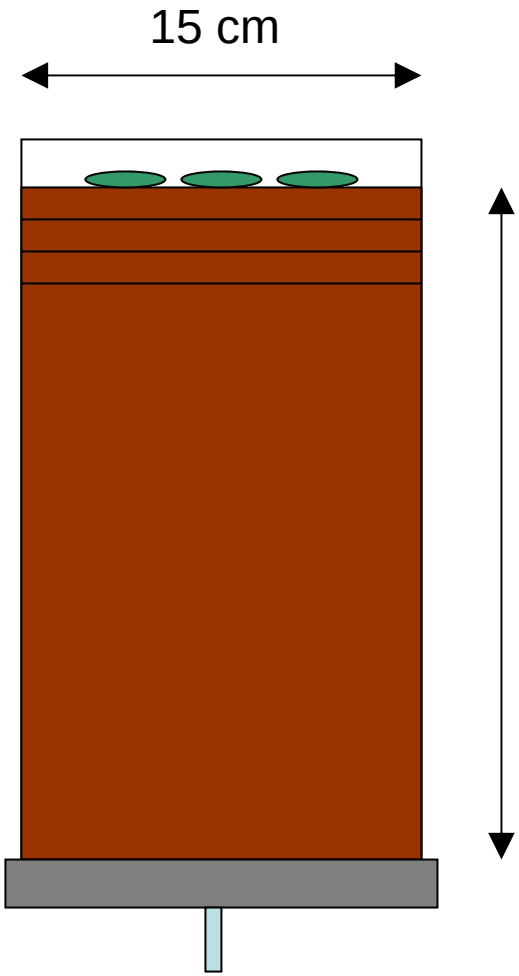
- **Compare estradiol and testosterone transport in intact and disturbed columns using stock solutions of hormones or solutions mixed with litter.**
  - Radcliffe,Vencill, Hassan, Huang

Objective 4 - Approach

- 6 undisturbed soil columns (15 cm ID, 30 cm long) taken from a pasture that has received litter
- 6 packed columns with the same soil
- 6,7- ^{3}H-estradiol, 4-^{14}C-testosterone
- Pure solution or mixed with litter
- Three replications
- Background solution: $CaNO_3$
- 8 pore volumes
- TDR used to measure water content



- Effluent analyzed by liquid scintillation
- Metabolites separated by HPLC and analyzed by GC/MS or LC/MS



- 1- cm increments sampled, oxidized
- oxidation cocktail analyzed by liquid scintillation
- Sorption-kinetics and sorption-isotherms

- **Complete study by July 2009**
- **Submit article by September 2009**

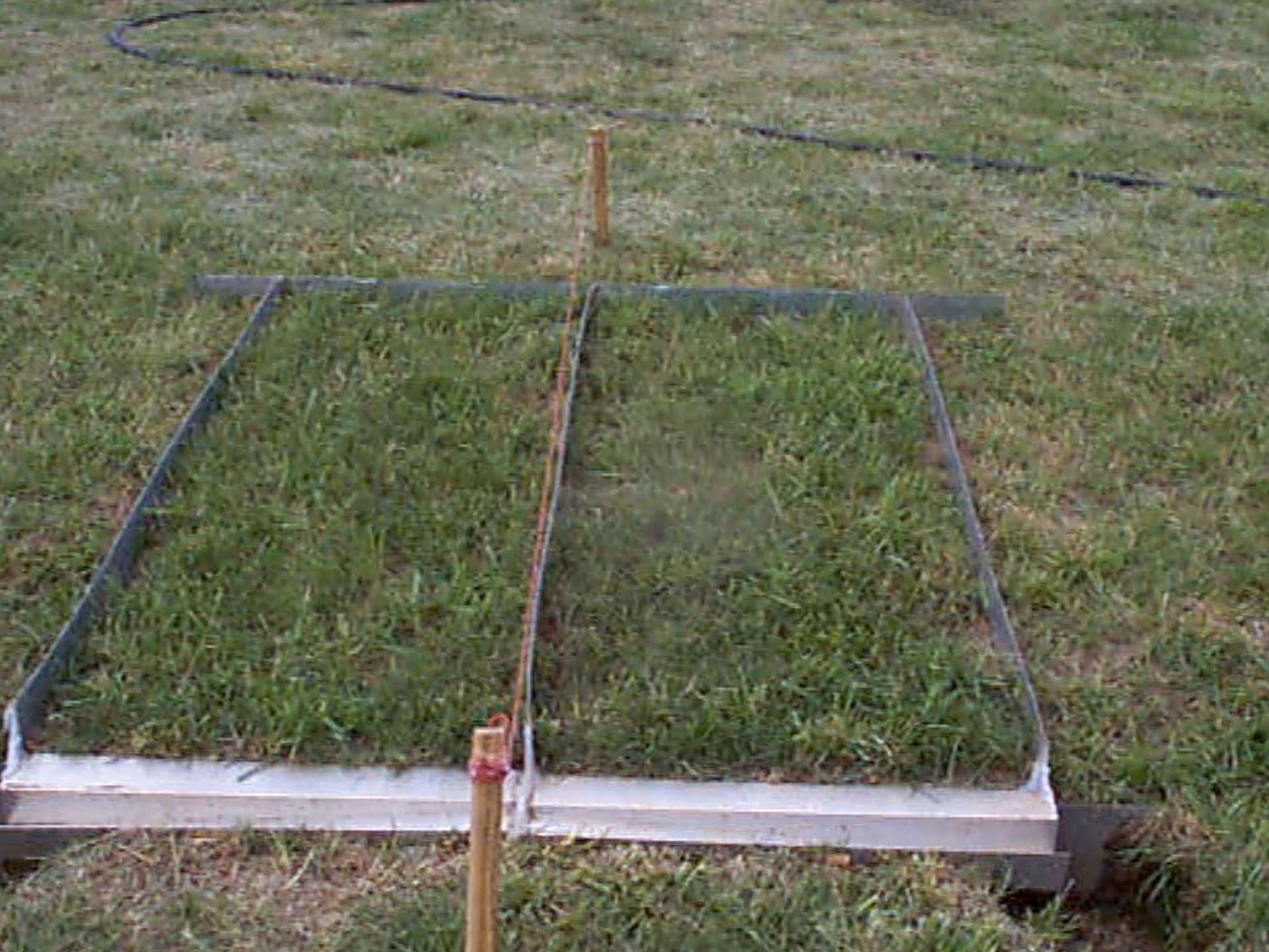
Objective 5

- Evaluate the effect of runoff occurring at different times after litter application on hormone concentrations in runoff.

- Endale, Hassan, Huang

Objective 5 - Approach

- 16 plots (0.75 x 2 m plots), Eatonton station
- Broiler litter applied at 5 Mg/ha
- Rain at 0, 1, 2, or 4 weeks after application
- 50 mm/h for 30 min of runoff
- Four replications
- Study conducted in winter and summer
- Samples analyzed for hormones and metabolites
- Water content and temperature monitored continuously with dataloggers



Objective 5 - Approach

- Finalize plot installation by July 2008
- Summer study in August 2008
- Winter study in January 2009
- Submit journal article by December 2009

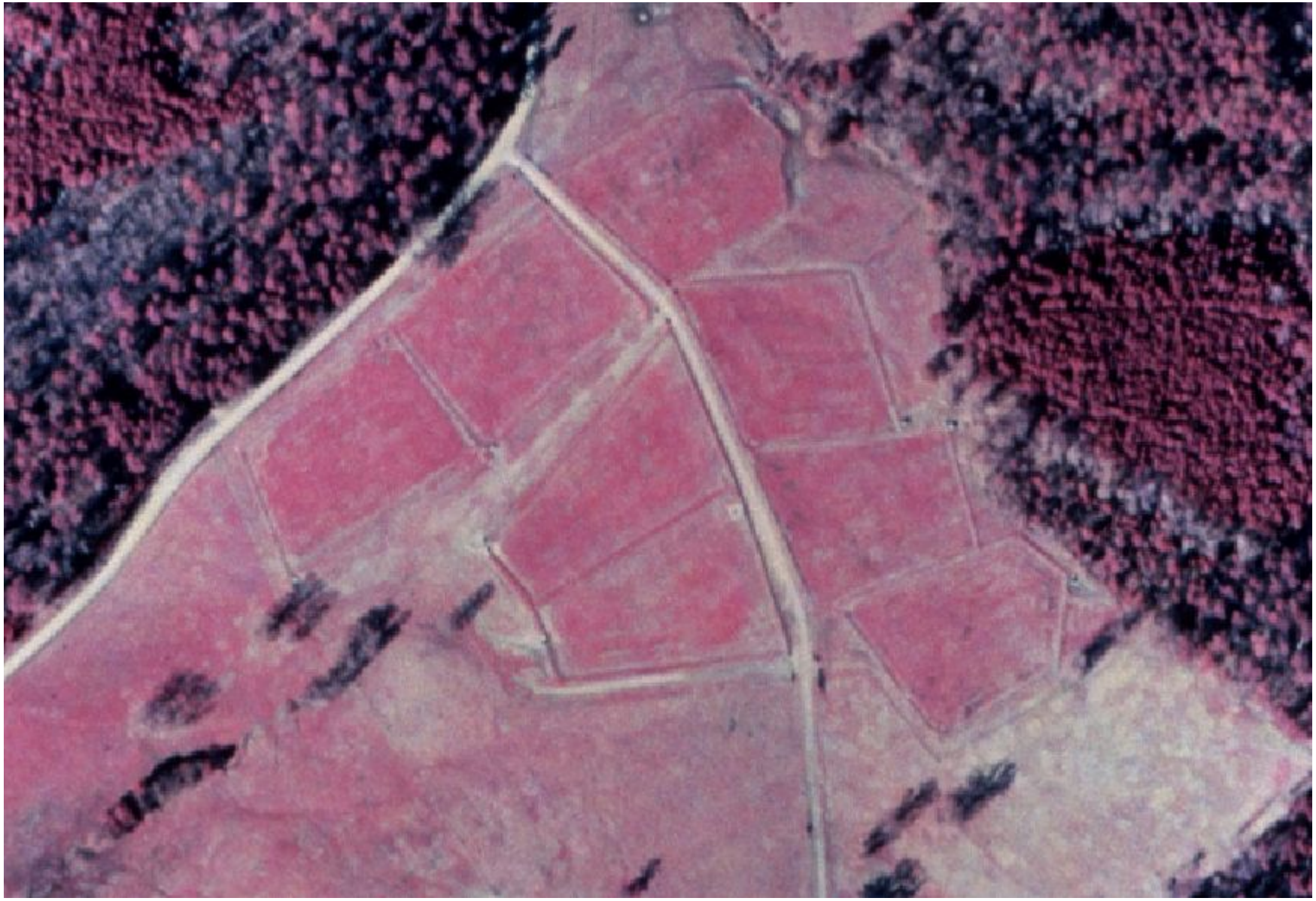
Objective 6

- Evaluate the effect of grassland aeration on concentrations of hormones and metabolites in runoff

- Cabrera, Hassan, Huang

Objective 6 - Approach

- 10 plots (0.8-ha each) in Eatonton
- 6 will receive 2.5 Mg litter/ha spring and fall
- 3 will be aerated, 3 not aerated
- 4 control plots (2 aerated, 2 not aerated)
- Runoff collected and analyzed for hormones and metabolites
- Plots will be grazed
- Soil samples collected weekly for the first 4 weeks after application
- Soil analyzed for hormone concentrations



Objective 6

- Finalize equipment installation by October 2007
- Make first application in October 2007
- Make last application in October 2009
- Submit journal article by June 2010

Thank you!