



**Genomes to Fields  
2014 Workshop**

***Airplane aerial imagery***

***Jode Edwards***

***USDA ARS***

***Chicago, IL***

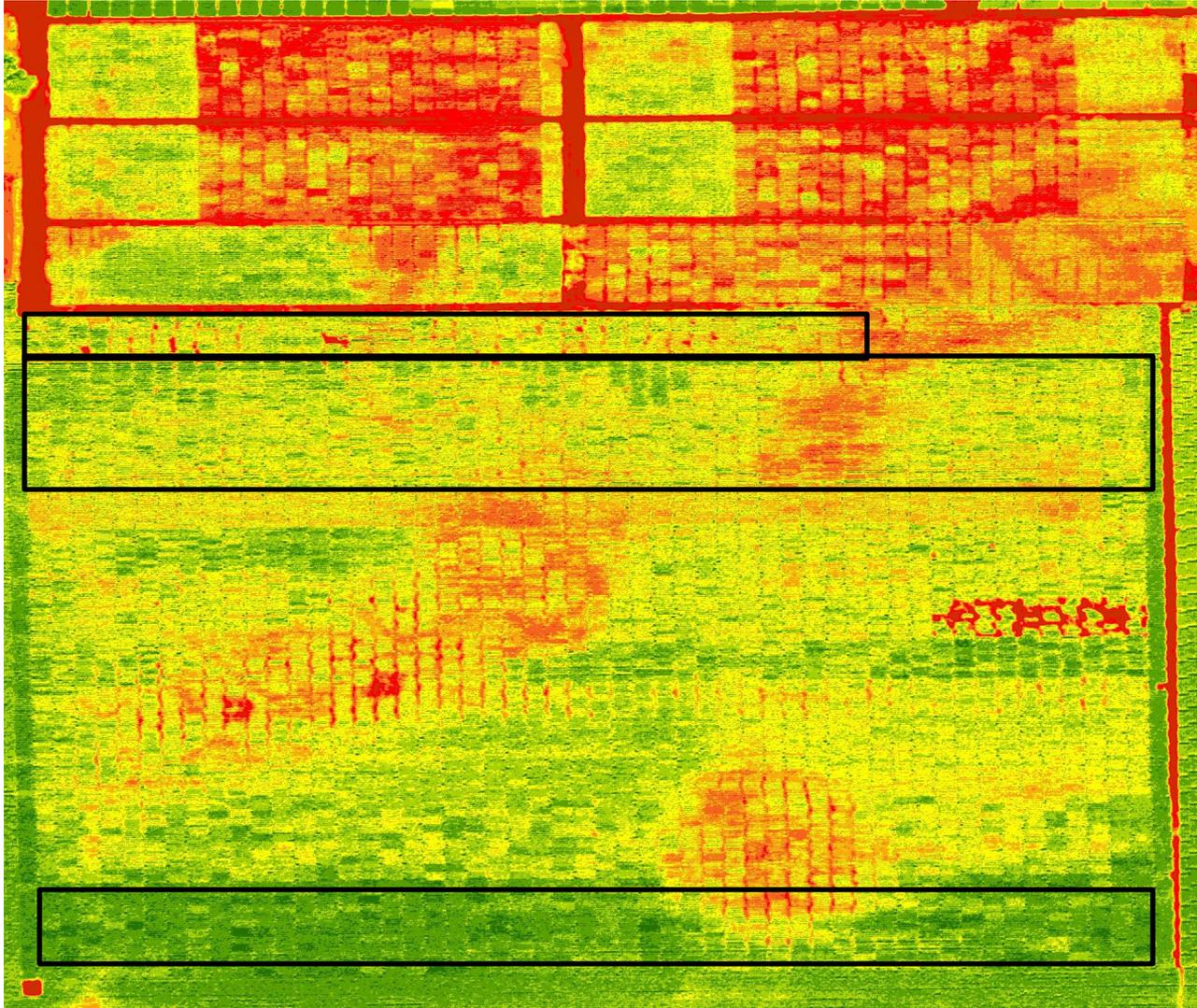
***December 10***

# 2014 Data Collection

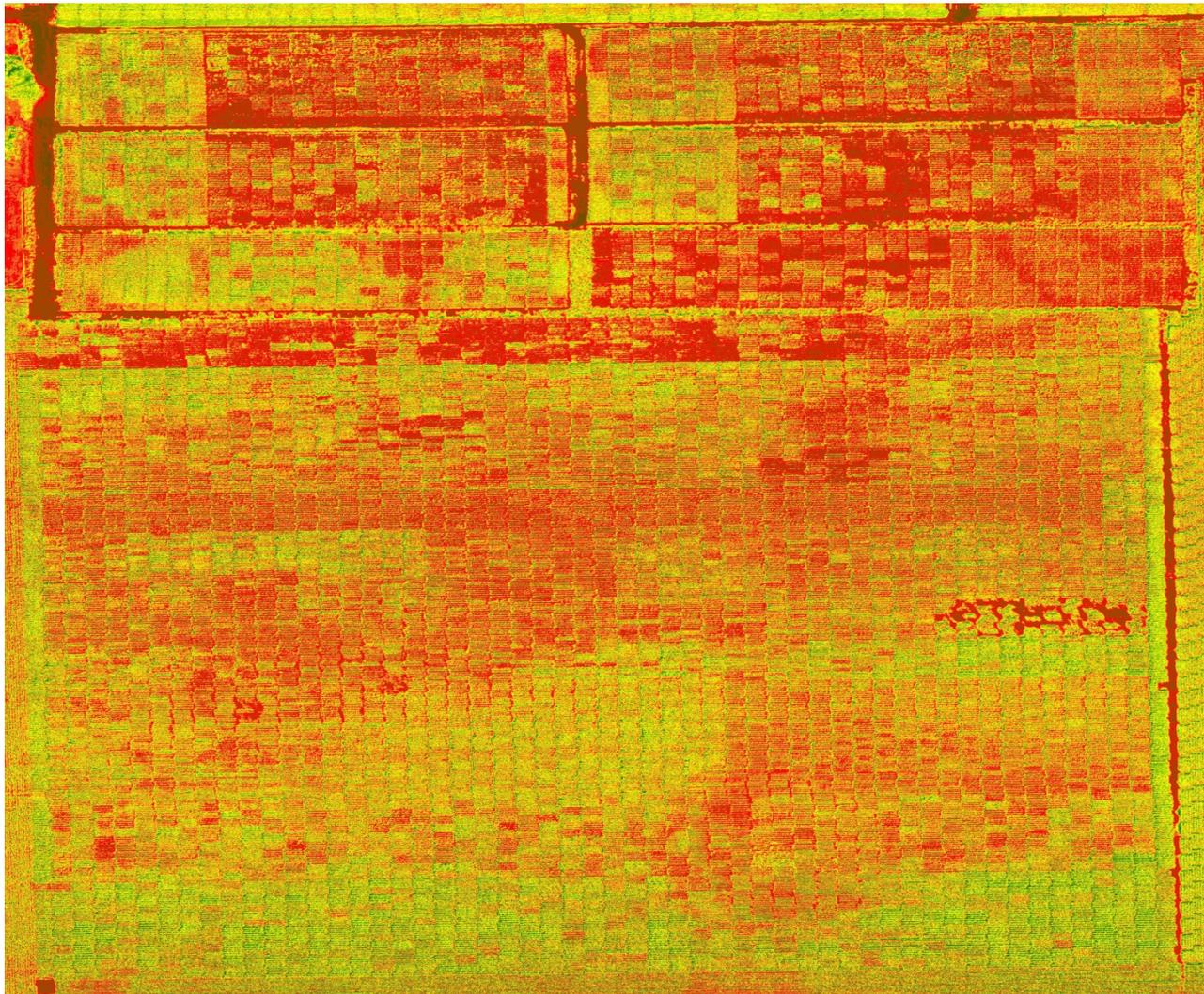
- ✧ Three Cessna flights (Roboflight Incorporated)
  - ✧ Flight 1 on 8/14/2014 at 3,000 feet
    - ✧ Resolution approximately 25 cm/pixel
  - ✧ Flights 2 and 3 at 1,000 feet
    - ✧ Resolution approximately 4-7 cm/pixel
- ✧ Normalized difference vegetative index
  - ✧  $(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$
  - ✧ NIR=760 nm, Red=660 nm



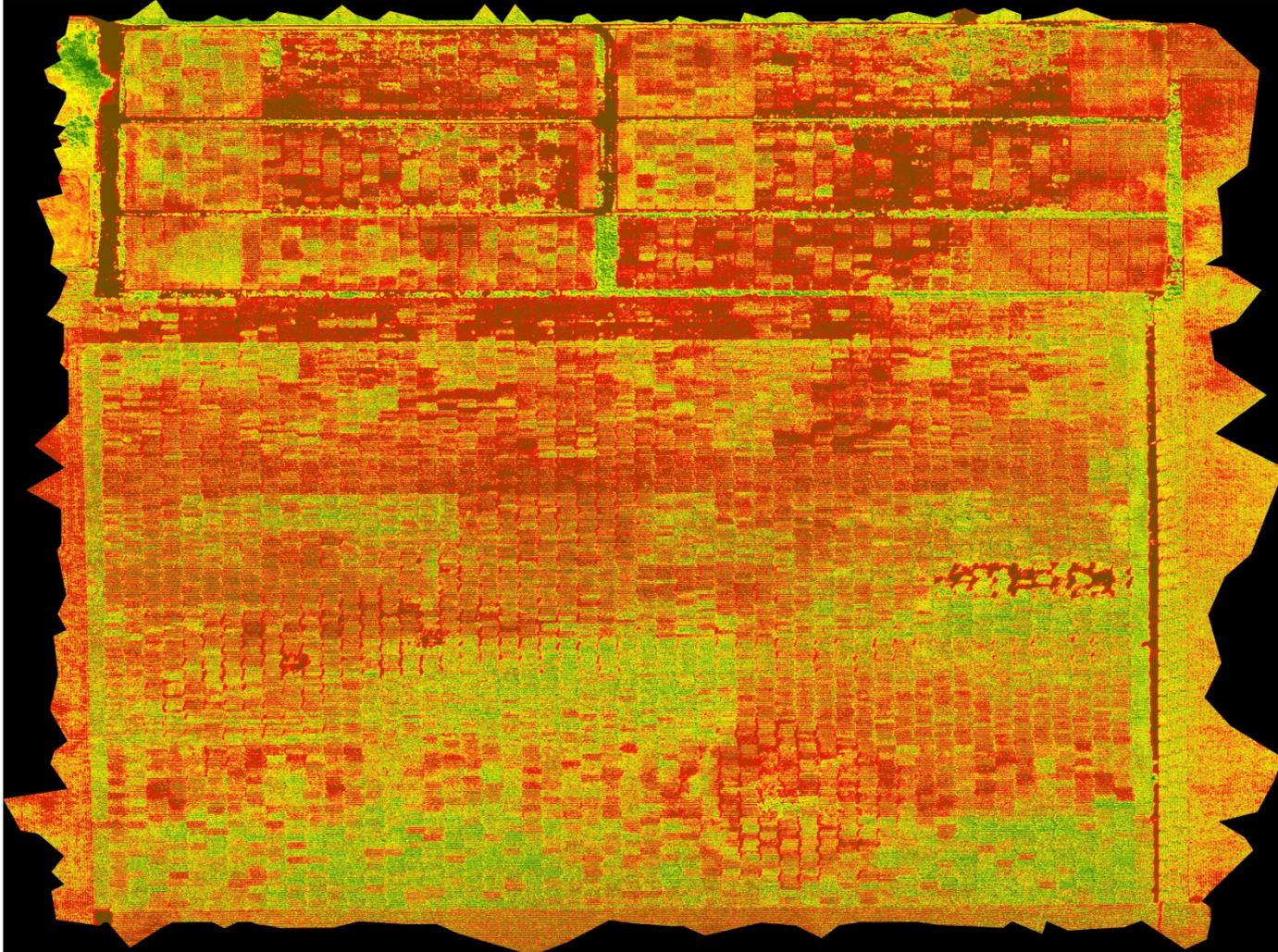
8/14/2014



9/7/2014



9/18/2014

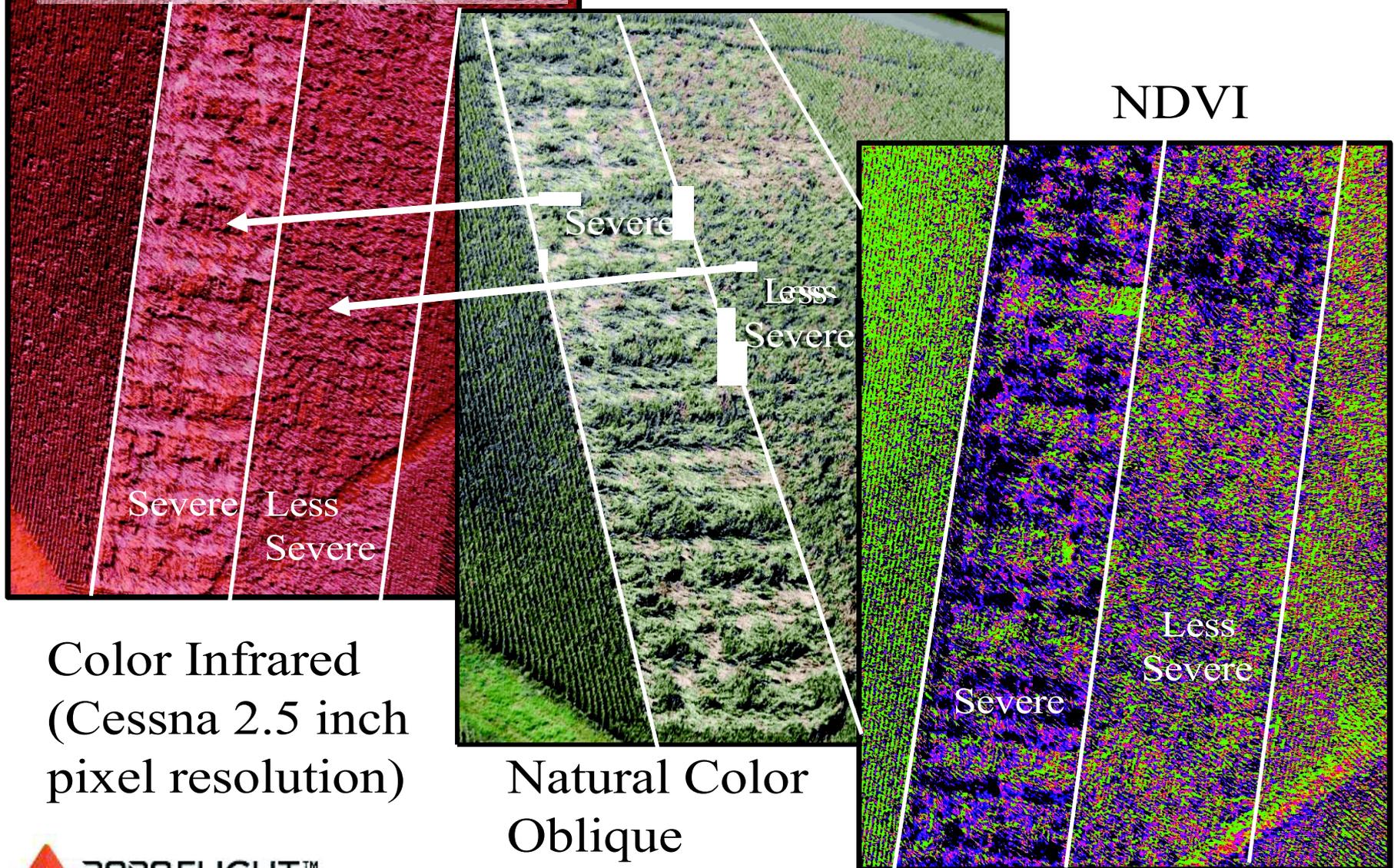


# Lodging from the ground



# Corn Root Lodging in University Genetic Breeding Plots

Corn Genetics susceptible to root lodging



# Analysis plans

- ✧ Average NDVI on a plot basis
  - ✦ Compute average NDVI from row-to-row (30" width) in 2 row plots
- ✦ Correlate NDVI with phenotype
  - ✦ Grain yield for all locations
  - ✦ Flowering dates in Ames where available and wide variation in flowering times



# Future Plans

- ✧ Stand counts and plant spacing
  - ✧ Season long imagery to model phenology
  - ✧ Additional indices
    - ✧ Senescence Index (PSRI)  $(\text{Red}-\text{Green})/\text{NIR}$
    - ✧ Leaf Structure  $(\text{NIR}-\text{Blue})/(\text{Green}-\text{Blue})$
    - ✧ Chlorophyll Index (CI)  $(\text{NIR}/\text{Green})-1$
    - ✧ Biomass Ratio  $\text{NIR}/\text{Red}$
    - ✧ Leaf Area Index (SAVI)  $(\text{NIR}-\text{Red})(1+L)/(\text{NIR}+\text{Red}+L)$
- Blue=460 nm, Green=510 nm, Red=660, NIR=760 nm, L=soil baseline



# Phenotypic prediction

- ✧ Conduct more intense ground phenotyping at a subset of locations (as some did 2014 inbreds)
- ✧ Conduct season long imaging with best available imaging platform (gold standard: collaborative effort with NLAE, Ames, planned in 2015)
- ✧ Conduct season long imaging at as many locations as possible
  - ✧ Cessna in 2015 as in 2014
  - ✧ Add as many locations as feasible with at least Cessna-quality images
- ✧ Questions
  - ✧ What phenotypes can be predicted from best available platform?
  - ✧ What phenotypes can be predicted from the Cessna?
- ✧ Based on those 2 questions, predict phenotypes at additional imaged locations to correlate phenotype and performance

