

Post-harvest Fates of Agricultural Seed in Tennessee Croplands

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1986: NAWMP Created



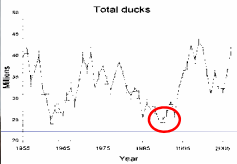




Fig. 1. Waterfowl breeding population estimate, 1955-2007 (USFWS 2007).

**Foraging Habitat
(Non-breeding areas)**

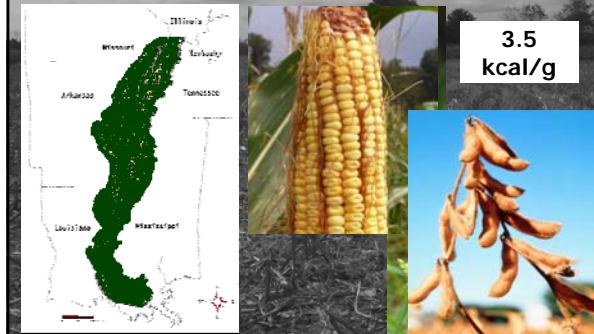
Nutritional Needs

- **Migration, Courtship, Thermoregulation**
 - Energy demanding
- **Seeds**
 - 58-97% of diet
(Anderson 2000, Heitmeyer 2006)
 - Agricultural Seed

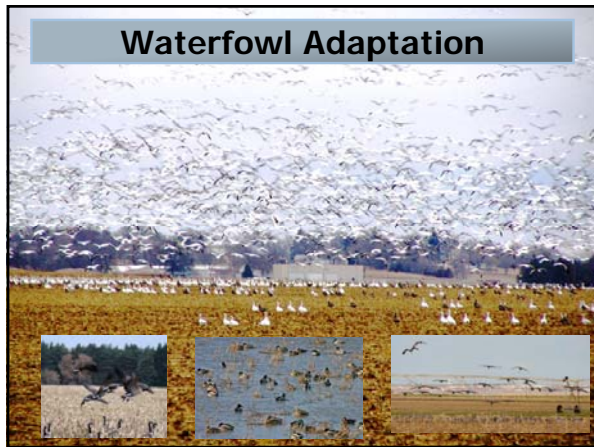


Photo: R. Caveny

Conversion of the Southeast Landscape



Waterfowl Adaptation



Duck-energy Days and Waste Grain Estimates

$$DED = (Q_F - 50 \text{ kg/ha}) * TME / DER$$
 Q_F = quantity of food
 TME = true metabolizable energy
 DER = daily energy requirement

Accurate Estimates Q_F
 - Landscape Studies

Lower MS Valley JV
 - Outdated (corn, milo, soybean)
 - From disparate geographic areas

Mayeaux et al. 1980
 Iverson et al. 1985
 Warner et al. 1985
 Krapu 2004

Objectives:

1. Estimate *mass* of seed in harvested corn, grain sorghum (milo) and soybean fields from harvest through January.
2. Estimate *mass* in unharvested agricultural fields.
3. Estimate *available DEDs* in December for LMVJV.

Study Duration
Sept - Jan 2006 and 2007

Photo: D. Streifel

Study Areas

Corn, Grain Sorghum and Soybeans Fields
 $n = 105$ harvested, $n = 59$ unharvested



- Federally-owned (TNWR)
- State-owned (TWRA)
- Privately-owned

Sampling Sites:

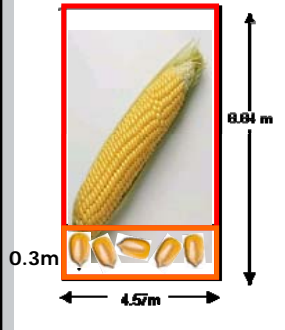
One 0.202-ha plot / field
Random location

All sites:

- 3 subplots randomly selected
- Sampled every 4 wks post-harvest or post-drydown through January

Subplot Sampling:

(Frederick et al. 1984)



Unharvested Fields

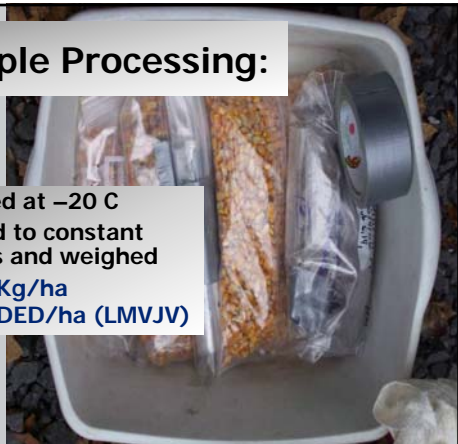
- Seeds clipped from plants
0.3 x 4.57 m
- Seed on the ground

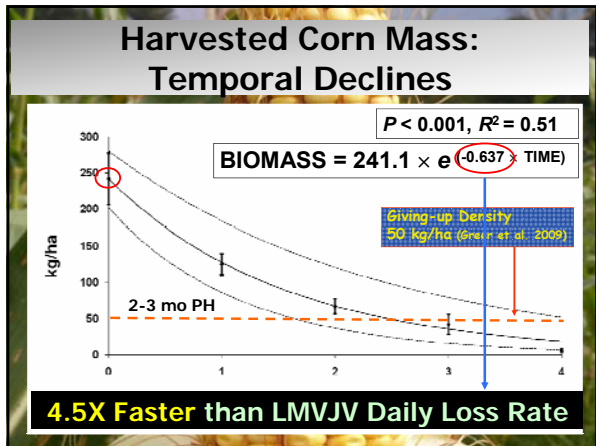


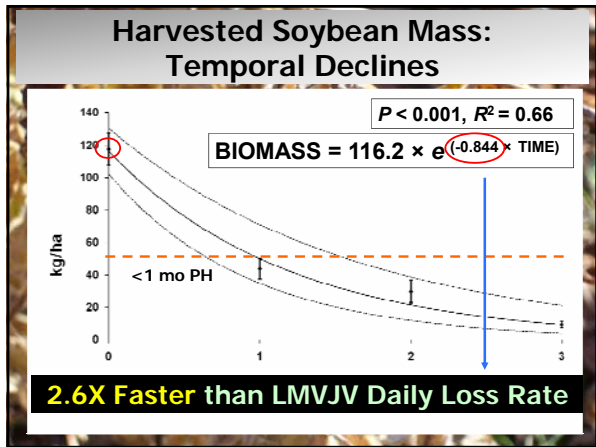
Sample Processing:

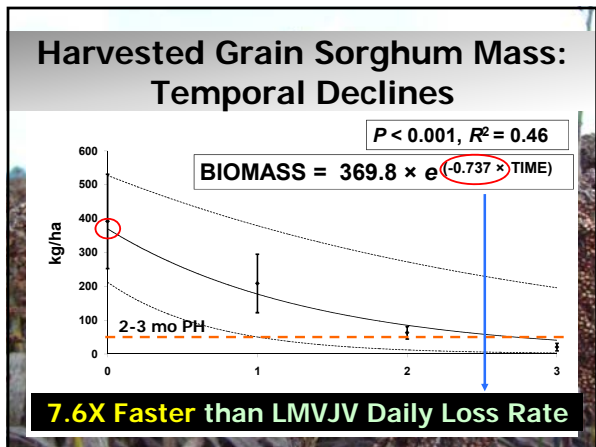
1. Stored at -20 C
2. Dried to constant mass and weighed

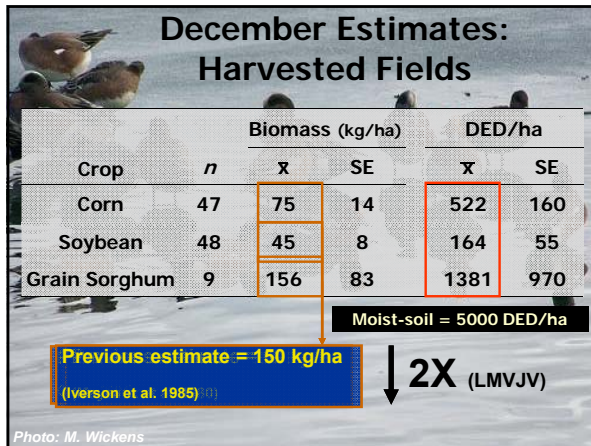
•Kg/ha
•DED/ha (LMVJV)

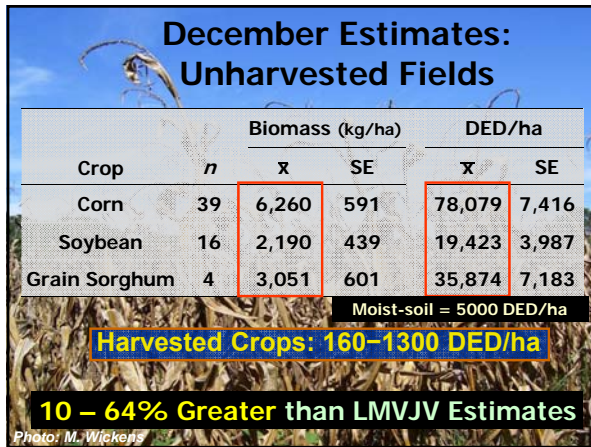













Part II: QUANTIFYING SEED FATE



In harvested fields, there is less available seed and it is disappearing quickly. What is happening to it?

Methods: Seed Fate

(Intact, Germinated, Decomposed, or Depredated)

Scattered 100 seeds


- Under granivore enclosure
- Open plot 5 m away

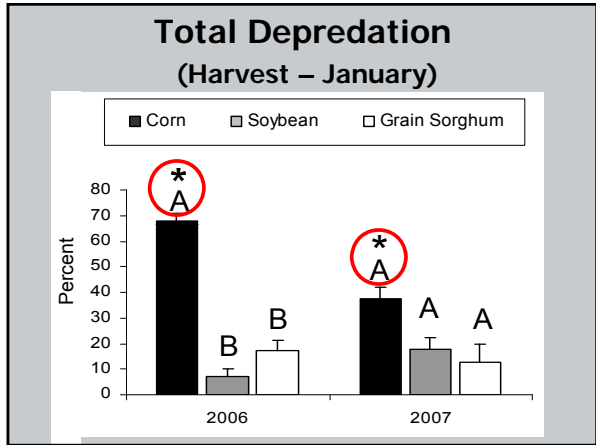
Counted every 4 weeks

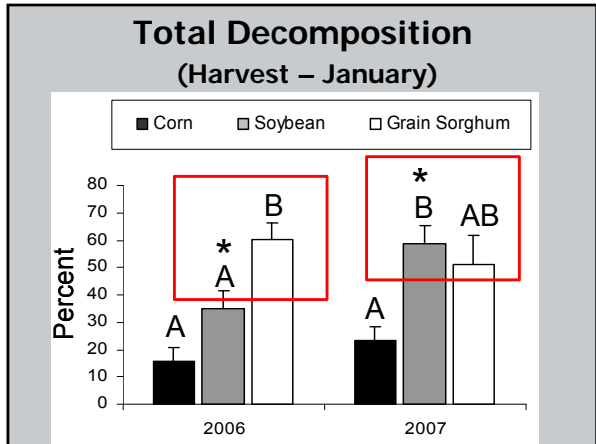
- Harvest through January

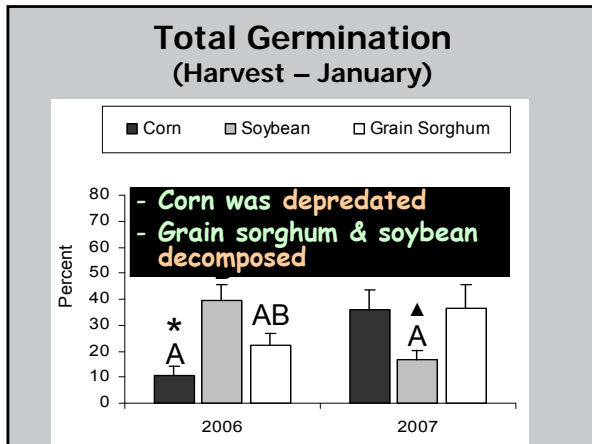
Calculated depreddation

Depredation = $NF_{OPEN} - NF_{EXCLOSED}$
 NF = seed not found
 NF_{OPEN} results from decomposition & depreddation
 NF_{EXCLOSED} results from decomposition









Effect of Flooding

- **Faster decomposition** in 2006 than reported **underwater** (Neely 1956, Shearer et al. 1969)
- **Do seeds persist longer underwater?**
 - Anaerobic conditions

Effect of Flooding:

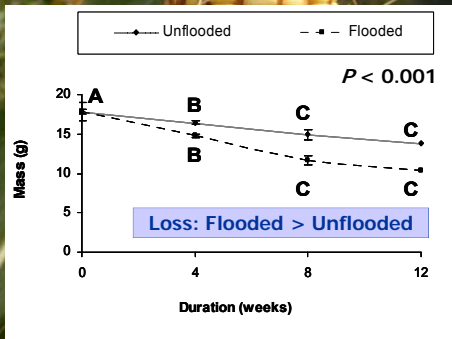
- Wire mesh bags
 - 100 seeds/bag
 - Shearer et al. (1969)

Effect of Flooding

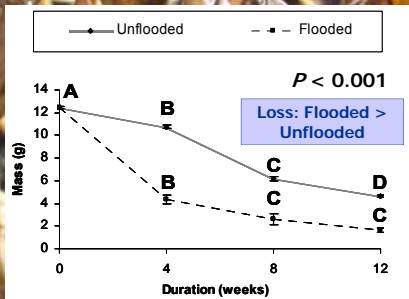
- 2 treatments
 - Flooded, Unflooded
- 40 bags per species
 - 10 – initial dry mass
 - 30 – deployed ($n=10/\text{trt}$)
 - 16 Oct 2007
- 3 durations retrieved
 - 4, 8, and 12 weeks

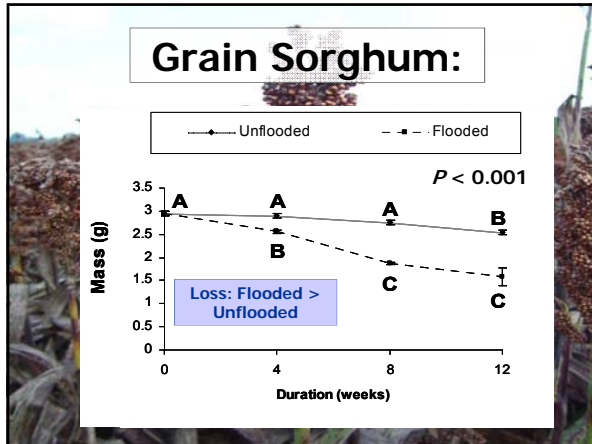


Corn:



Soybean:





Mass declines...

- Flooded:**
 - Corn: 42%, Soybean: 87%, Sorghum: 46%
 - Similar to previous flooding studies
- Unflooded:**
 - Corn: 22%, Soybean: 63%, Sorghum: 14%
 - Slower than decomposition (enclosed plots)
 - Corn: 79%, Soybean 81%, Sorghum: 97%
 - Artifact of bags

40 – 300% Faster when Flooded

LMVJV Estimates: Seed Bags

6 – 10X Faster than LMVJV Daily Loss Rate

Management Recommendations:

Less Grain After Harvest and Disappearing at a Faster Rate

- LMVJV revise DEDs estimates for corn, soybean & grain sorghum seed as has been done for rice fields
- LMVJV update daily loss rates and account for flooding

Food Plots:

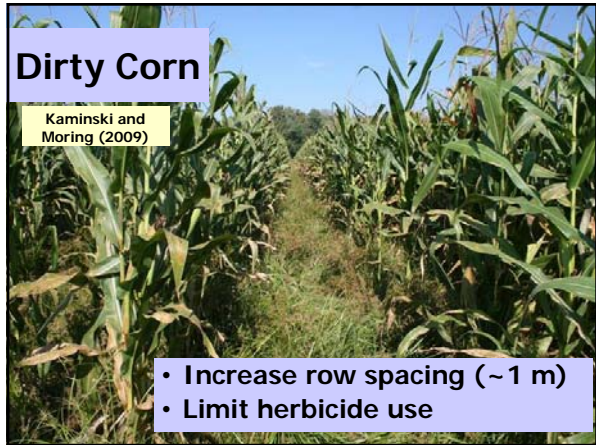
- **Corn:**
 - 70,000 DED/ha
(Harvested: 275 DED/ha)
 - Rates of decline <5% monthly
- **Delay flooding until waterfowl begin to arrive to reduce food loss**
- **Sorghum: 40% Lower DED than Corn**



Dirty Corn

Kaminski and Moring (2009)

- **Increase row spacing (~1 m)**
- **Limit herbicide use**



Publications

Management and Conservation Article

Agricultural Seed Biomass for Migrating and Wintering Waterfowl in the Southeastern United States

MELISSA A. FOSTER, University of Tennessee Wildlife Program, Department of Forestry, Wildlife and Fisheries, 274 Ellington Plant Sciences Building, Knoxville, TN 37996-5842
 MATTHEW J. GRAY, University of Tennessee Wildlife Program, Department of Forestry, Wildlife and Fisheries, 274 Ellington Plant Sciences Building, Knoxville, TN 37996-5842
 RICHARD M. KAMINSKI, Chicago State University, Department of Wildlife, Fisheries and Aquaculture, Box 9400, Chicago, IL, 60629-0940

Comparison of Agricultural Seed Loss in Flooded and Unflooded Fields on the Tennessee National Wildlife Refuge

Melissa A. Foster, Matthew J. Gray, Craig A. Harper, Jonathan G. Walls
 M.A. Foster, M.J. Gray, C.A. Harper
 University of Tennessee, Department of Forestry, Wildlife and Fisheries, 274 Ellington Plant Sciences Building, Knoxville, 37996
 J.G. Walls
 Auburn University, School of Forestry and Wildlife Sciences, 602 Duncan Drive, Auburn, Alabama 36849

Fate Study:

Foster, M.A., M. J. Gray, C. A. Harper, and R. M. Kaminski. Accepted. Post-harvest fates of agricultural seeds in Tennessee. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 65:XXX-XXX.




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Questions?

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Photo: M. Wickens
