Field Corn Stover Moisture Relations Determined by *In-situ* Weight and Grab Sample Techniques

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Introduction

- Moisture influences biomass feedstock management
- Moisture influences energy economy of some biomass conversion processes
- Two strategies for collecting biomass
  - Dry
  - Wet

- Selection of strategy depends on end use, location, in-place harvest systems
- One rationale for Field Dry collection:
  - Utilize solar gain as energy source
- Moisture relations of various crops as function of environment, evaporation potential
- Corn stover as promising feedstock
- Lack of good moisture relations with environmental conditions

Objectives

- Primary: Evaluate corn stover on-field moisture under southeast U.S. conditions as a function of time after harvest and environmental factors
- Secondary: Determine effect of stalk conditioning on moisture relations

Methods

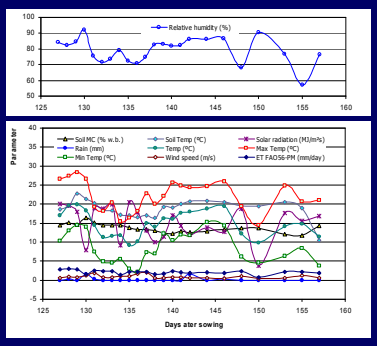
- Overall: Harvest corn and take frequent, detailed measures of on-field stover moisture and relate them to environment and elapsed time
- 2 Corn Harvest Stages (to vary initial m.c.)
  - Early harvest [~25% m.c. (w.b.) grain] [Sept 24]
  - Late harvest [~15% m.c. (w.b.) grain] [Oct 8]
- 2 Corn Harvest Methods (to examine conditioning)
  - Combine
    - [AC Gleaner, corn head, shredder]
  - Sickle Bar

Additional Control:
Tent Shelter, Mowed Stover

- 2 Stover M.C. Methods (to examine bulk vs. pinpoint)
  - *In situ* Field Baskets [2.5 x 2.5 m]
  - Grab Samples
    - Sample Unit: 2 (200-mm) Mid-sections of different stalks
    - Remove leaves
    - 2 Classifications
      - Contact Soil [2 Sample Units per plot]
      - Not Contact Soil [2 Sample Units per plot]
    - Oven Method [103° C, 24 h]

- **2** Sampling Times
  - Morning
  - Afternoon
- Weekday sampling until Oct 24 [stabilized m.c.]
- Plots [10-14 rows, 30"; 50 m long, 3 reps combine]
- Monitor Environmental Conditions
  - Soil m.c. & temp
  - Solar
  - Rain
  - Air temp
  - Air R.H.
  - Wind Dir. and Speed
  - Calculate E.T. Penman-Monteith
- Trends, Pearson Correlations, Mult. Linear Regressions,

Environmental Conditions

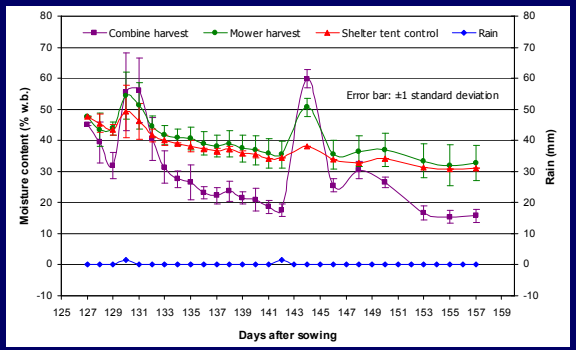


Results

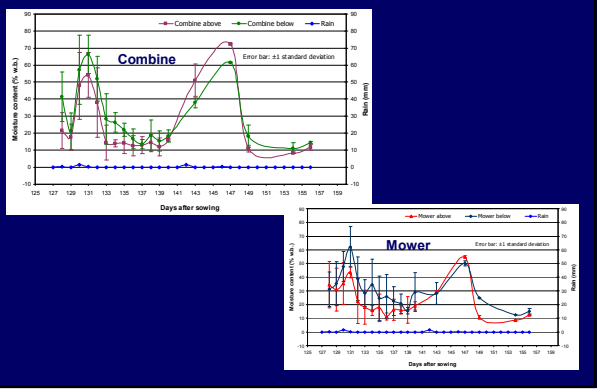
Overall Means

Category	Field Basket		Grab Sample	
Early harvest	34	A	26	A
Late Harvest	15	B	21	A
Morning measure	38	A	29	A
Evening measure	27	B	23	B
Field Block 1	25	B	23	A
Field Block 2	33	A	26	A
Field Block 3	32	A	26	A
Plot Sample Location 1	32	A	26	A
Plot Sample Location 2	27	A	25	A
Stover Above Soil			22	B
Stover Contacting Soil			28	A
Combine Harvest	28	B	24	B
Mower	36	A	27	A
Mower - Shelter Tent	33	A		

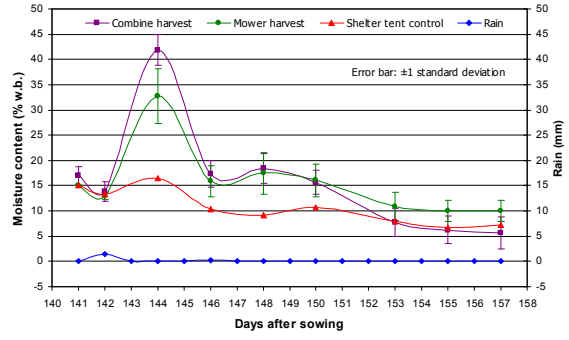
Early Harvest
In Situ Field Basket



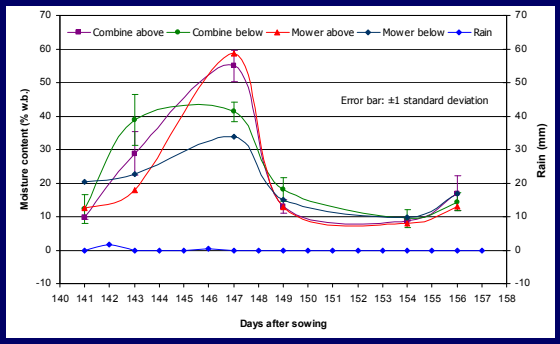
Early Harvest
Grab Sample



Late Harvest
In Situ Field Basket



Late Harvest
Grab Sample



Pearson Correlation Coefficients
In Situ Field Basket - Combine

For P≤ 0.05

Factor	Early Harvest	Late Harvest
DAS	- 0.5	- 0.6
Soil M.C.	0.6	--
Soil Temp.	0.2	0.5
Solar	--	--
Rain	0.3	--
Air Temp.	0.2	0.5
R.H.	0.3	0.4
Wind Dir.	0.3	--
Wind Speed	0.2	--
Max Air Temp.	0.2	--
Min Air Temp.	0.3	0.6
ET	0.2	--

Example Regression Equations

	r^2
Early Harvest, Combine, Field Basket	
MC = 44.02 - 0.58 *DAS* + 3.68 *SM* + 3.24 *SR* + 10.22 *WS* + 2.34 *MIT* - 29.80 *EP*	0.57
Early Harvest, Combine, Grab Sample	
MC = -97.84 + 0.47 *DAS* + 7.67 *SM* - 0.41 *RH* + 3.09 *MIT* - 1.89 *MXT*	0.37
Late Harvest, Combine, Field Basket	
MC = -972.76 + 3.42 *DAS* + 4.44 *RH* + 143.06 *WS* + 3.75 *MIT*	0.86
Late Harvest, Combine, Grab Sample	
MC = -938.58 + 3.97 *DAS* - 1.13 *SR* + 4.09 *RH* + 33.64 *EP*	0.82

Conclusions

- Stover moisture depends environmental conditions, harvest method, and moisture measurement method.
- A combine provided a significant conditioning effect on stover that enhanced moisture removal, and moisture uptake after rain events.
- The full effect of rain events on increasing stover moisture occurred several days after the event.
- Stover moisture was significantly greater in the morning compared to afternoon, and was greater for stover contacting the soil compared with stover not in soil contact. Rain events can reverse these trends.
- Correlation of stover moisture with an evapotranspiration factor was not as strong as correlations with other combinations of environmental factors.
- Regressive predictions of stover moisture by environmental factors provide a useful means of predicting moisture relations, and were generally improved upon with an additional factor based on elapsed time.