

Phantom Yield Loss: Myth or Reality

Mark Licht
Associate professor
Extension cropping systems specialist
lichtma@iastate.edu

IOWA STATE UNIVERSITY
Extension and Outreach

1

Phantom, ghost, mystery, invisible yield loss

Known:

- Ear drop
- Head loss

Anecdotal:

- Dry matter loss
- Respiration



IOWA STATE UNIVERSITY
Extension and Outreach

2

1976	Iowa State University	Knittle and Burris	2 locations, 4 hybrids, 6 harvest dates; no yield loss from 35% to 19% grain moisture
1984	University of Illinois	Nafziger	4 hybrids, 4 harvest dates; no dry weight loss from 27% to 18% grain moisture
1983-1984	Pioneer	Cerwick and Cavalieri	8 hybrids; no yield reduction during drydown
1991-1994	Purdue University	Nielson	3 hybrids; 0.9% dry weight loss per point of grain moisture loss
1995	Pioneer	Reese and Jones	2 hybrids, 2 locations; dry weight did not change from BL to 15% grain moisture
1995-1997	University of Nebraska	Elmore and Roth	6 hybrids, 9 environments; no evidence of kernel dry matter loss
2002-2004	Ohio State University	Thomison et al.	3 locations, 3 harvest dates, 4 pl. pop., 4 hybrids; no evidence of dry matter loss
2016-2017	Iowa State University	Licht et al.	2 locations, 3 hybrids, 2 planting dates, 6 harvest dates; no kernel dry matter change from 30% to 15% grain moisture

3

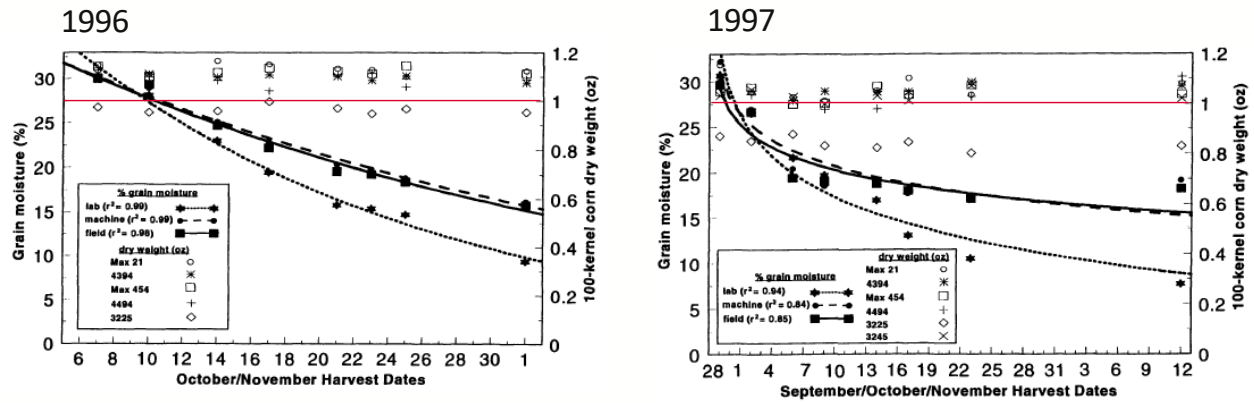
Indiana study of dry matter accumulation

Table 1. Kernel dry weight loss during field drydown of mature grain for three Pioneer brand corn hybrids. Purdue Agronomy Research Center, westcentral Indiana, 1991-94.

Hybrids (averaged over years)	Physiological maturity		Kernel dry weight loss per point decrease in GMC	
	1000 Kernel dry weight (g)	% Moisture at maturity	grams/1000 kernels	% dry weight loss
3527	298.7	27.9	2.7	0.9
3394	326.9	27.8	3.2	1.0
3245	324.2	29.5	4.1	1.3
Years (averaged over hybrids)				
1991	297.0	29.8	3.2	1.1
1992	303.7	32.5	3.5	1.2
1993	305.4	25.8	ns	ns
1994	360.2	25.3	3.4	0.9
Average	316.6	28.4	3.4	0.9
<i>GMC = Grain moisture content (%)</i>				
<i>ns means not significant at P=0.10 or less.</i>				

4

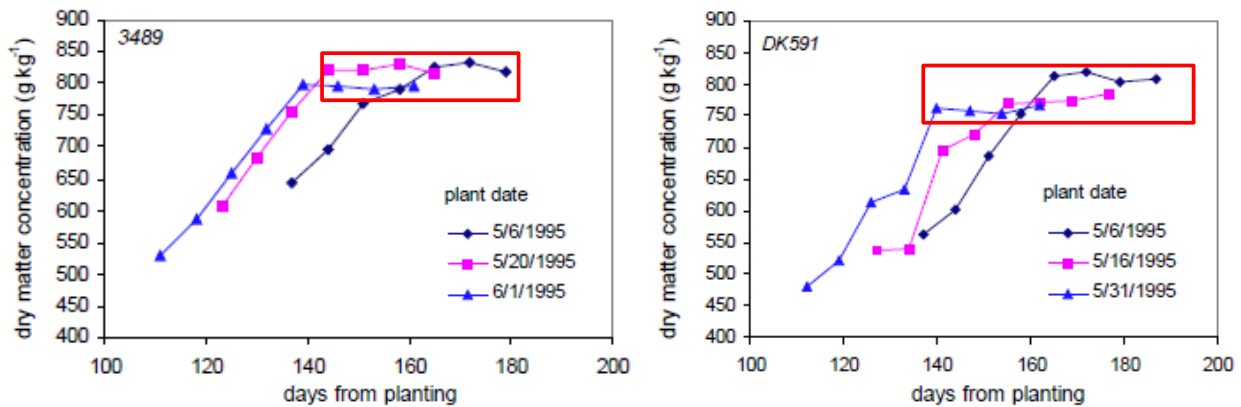
Nebraska study of dry matter accumulation



No trend in kernel dry matter

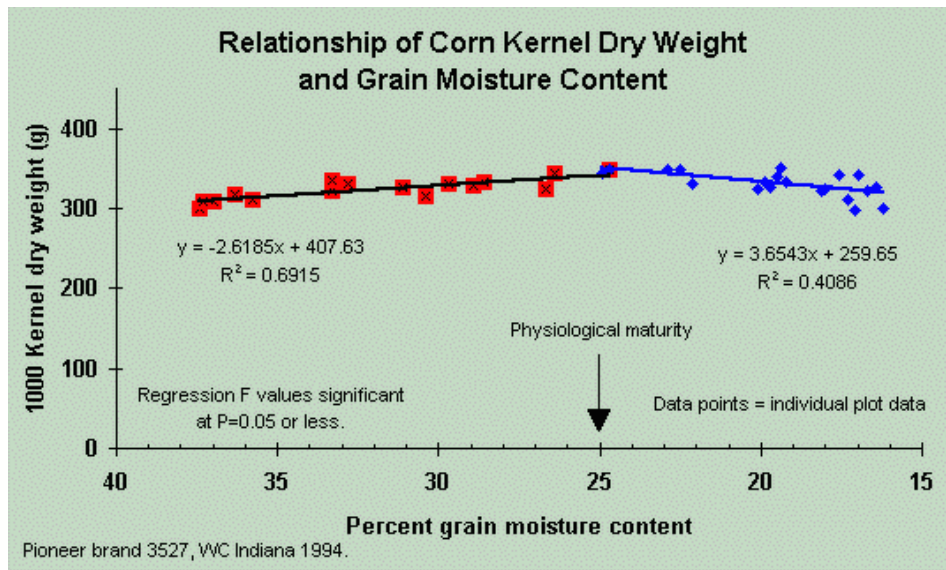
5

Illinois study of dry matter accumulation

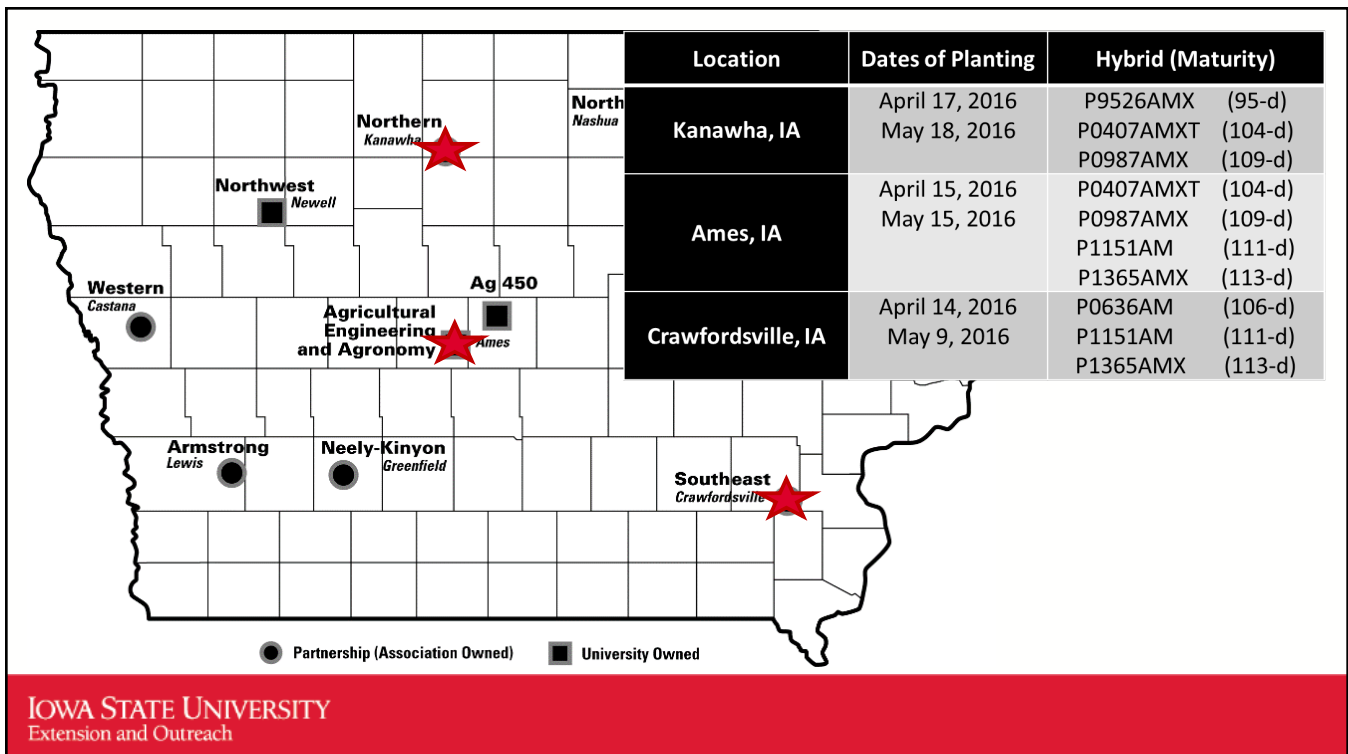


6

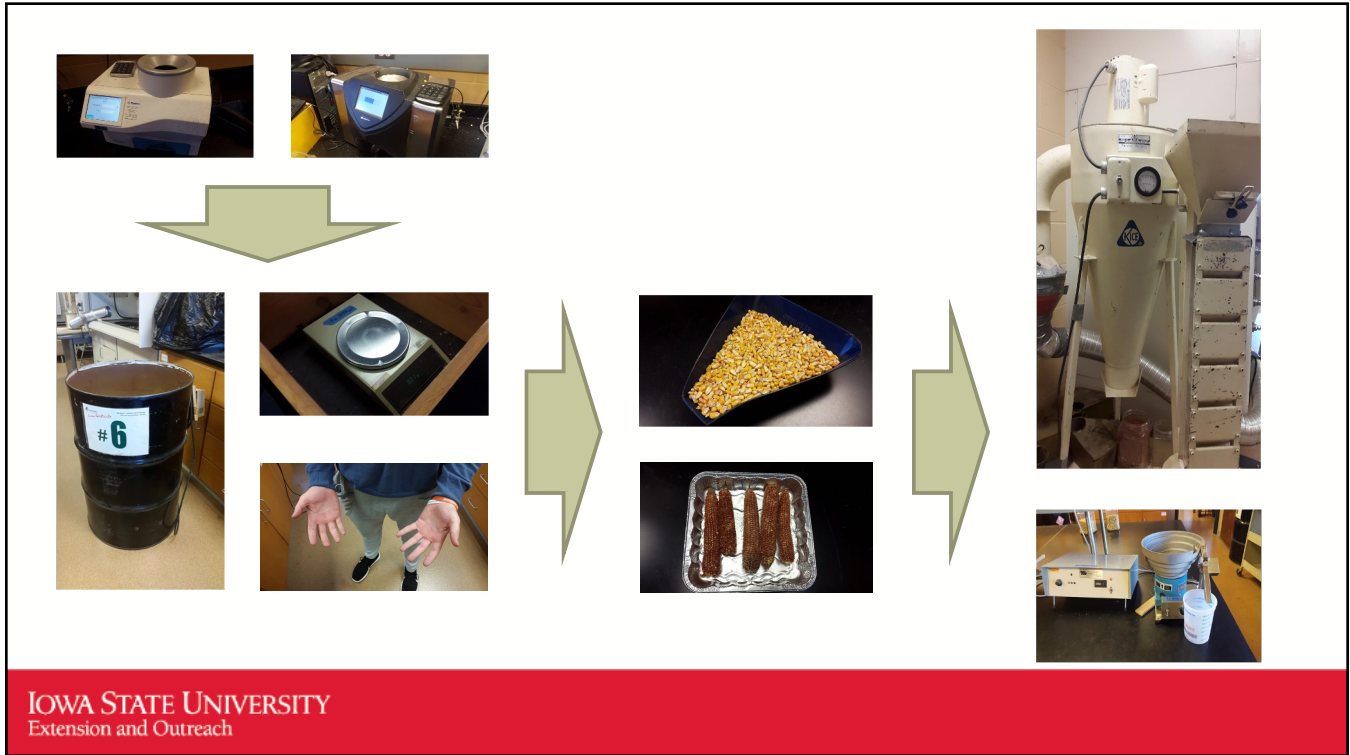
Indiana study of dry matter accumulation



7

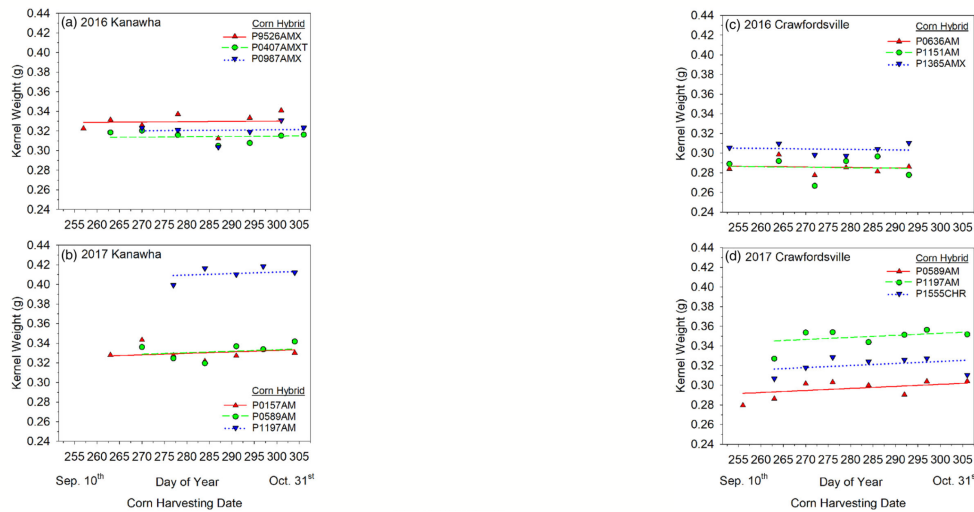


8



9

Iowa study of dry matter accumulation



IOWA STATE UNIVERSITY
Extension and Outreach

10

What about grain respiration?

Knittle and Burris, 1976

- When kernel moisture <30%, respiration was a fraction of the rate measured at dent stage

Saul and Steele, 1966

Storage Temperature	35°F	50°F	65°F	80°F	95°F	110°F
Days required for 1% DM reduction in stored corn (28%)	129	50	25	10	6	4

IOWA STATE UNIVERSITY
Extension and Outreach

11



IOWA STATE
Extension and Outreach

12



IOWA STATE
Extension and Outreach

13

What about field and combine losses?

- Gliem et al., 1990
 - Average 1.5 bu/ac loss
 - Range 0.1-5.0 bu/ac loss
 - 19 of 55 > 2.5 bu/ac
 - 14 of 55 < 0.5 bu/ac
- Ayres et al., 1972
 - Average 3.7 bu/ac
 - Range 0.5-23.0 bu/ac
 - 48 of 84 > 3 bu/ac
 - 7 of 84 < 1.0 bu/ac

	Average (bushels/acre)	Top 10% (bushels/acre)
Machine ear loss	1.5	0.0
Stalk roll shelling	0.9	0.3
Cylinder loss	0.6	0.0
Separating loss	0.7	0.2
Total harvesting loss	3.7	0.5
Preharvest dropped ears	2.1	1.0
Total loss	5.8	1.5

IOWA STATE UNIVERSITY
Extension and Outreach

14

What about field and combine losses?

10 ft² (4ft x 30in) for kernel loss

2 kernels/ft² = 1 bu/ac loss

1/100 of an acre for ear loss (436ft²)

1 (¾lb) ear = 1 bu/ac loss



IOWA STATE UNIVERSITY
Extension and Outreach

15

SF Successful Farming
INDIANA
PrairieFarmer.

Home > Crops > Corn

HOW FAST W FIELD?

By Beck's Hybrids
10/13/2014

Many factors can contribute to corn drydown. Plant characteristics can influence dry down, but weather conditions also influence dry down.

Since weather is such a large factor in corn drydown, it's important to understand the factors that influence drydown in the field.

Corn Illustrated: Here's why drydown

AgFax

Ohio Corn: Grain Drydown – What to Expect?

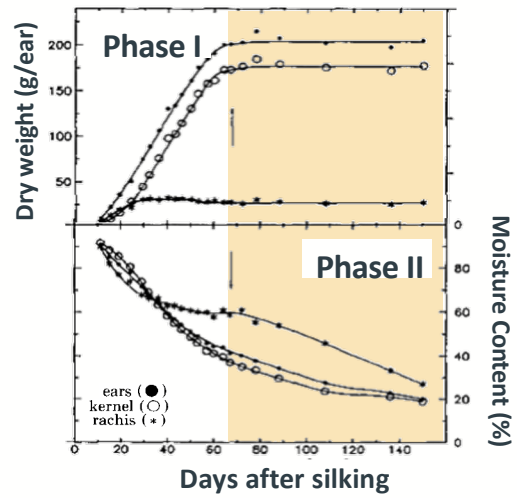
September 24, 2019
By Peter Thomison, Ohio State University Extension Specialist

f t in p e w 0 SHARES

16

Old Rule of Thumb for Dry Down

- September
 - 0.5% - 1% per day
- October
 - 0.25% - 0.5% per day
- November
 - 0.0% - 0.25% per day



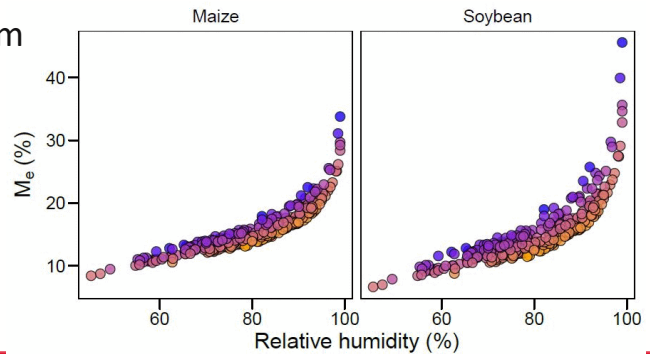
17

Henderson-Parry equation

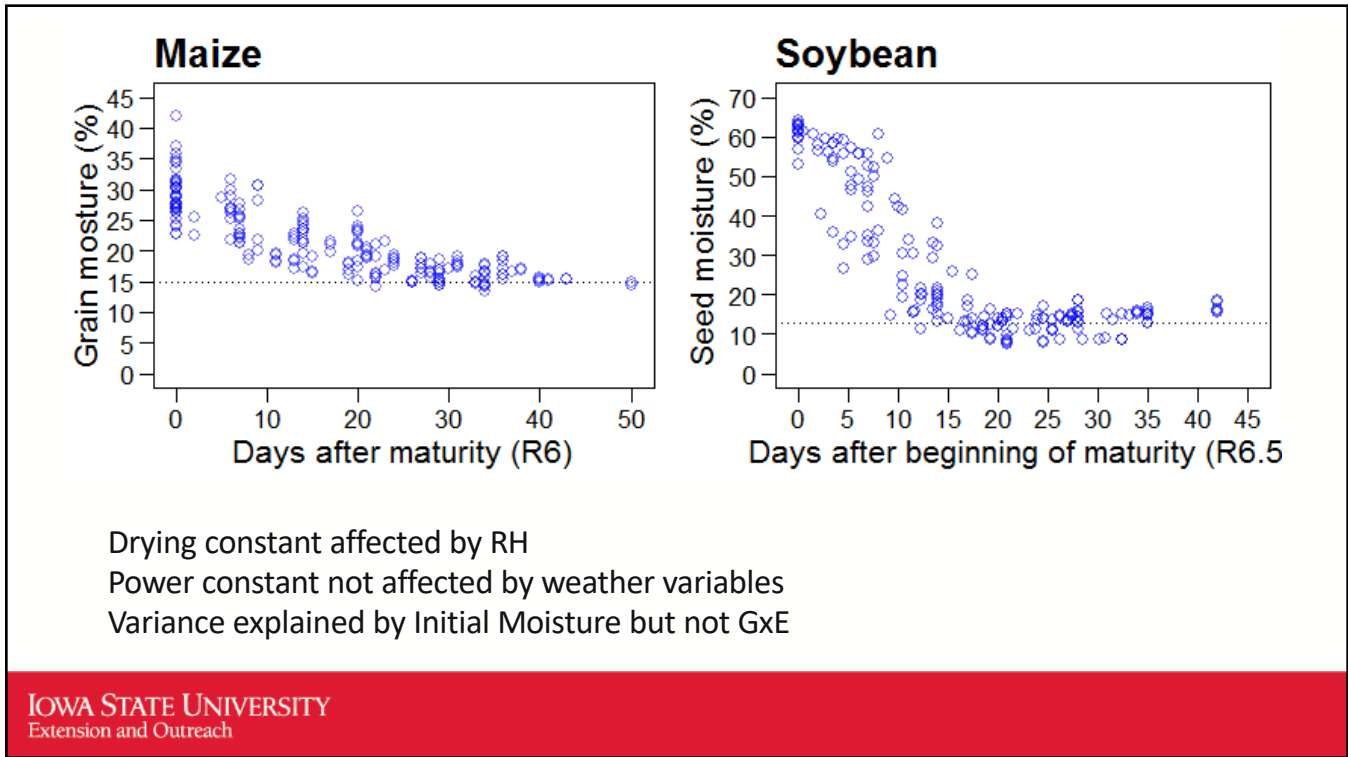
$$\frac{dM}{dx} = -k \cdot (M - M_e) \rightarrow M_e = \left(\frac{\ln\left(1 - \frac{RH}{100}\right)}{-A(T + B)} \right)^{1/C}$$

Annotations for the equation:

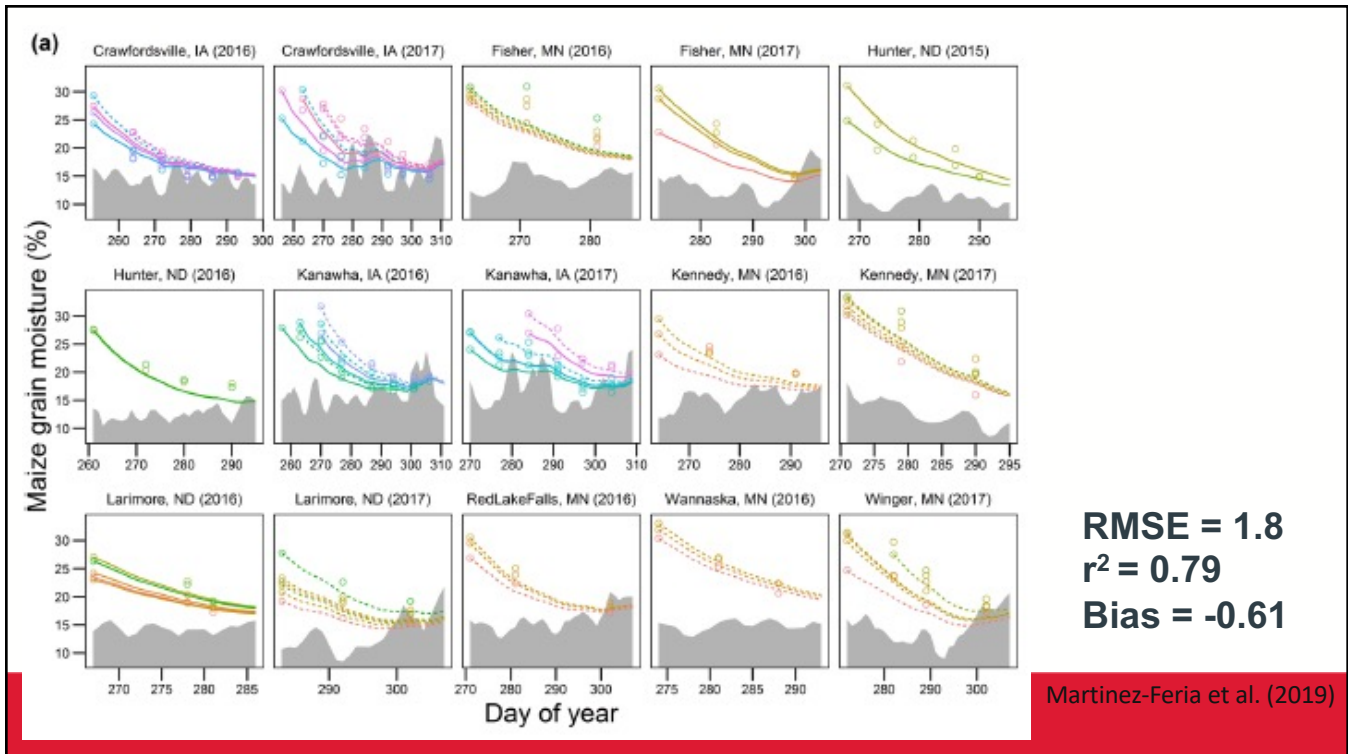
- $\frac{dM}{dx}$: Change in moisture over time
- k : Drying constant
- M : Initial moisture
- M_e : Moisture equilibrium
- $\ln\left(1 - \frac{RH}{100}\right)$: Relative humidity
- $1/C$: constant
- A : constant
- $T + B$: Temperature



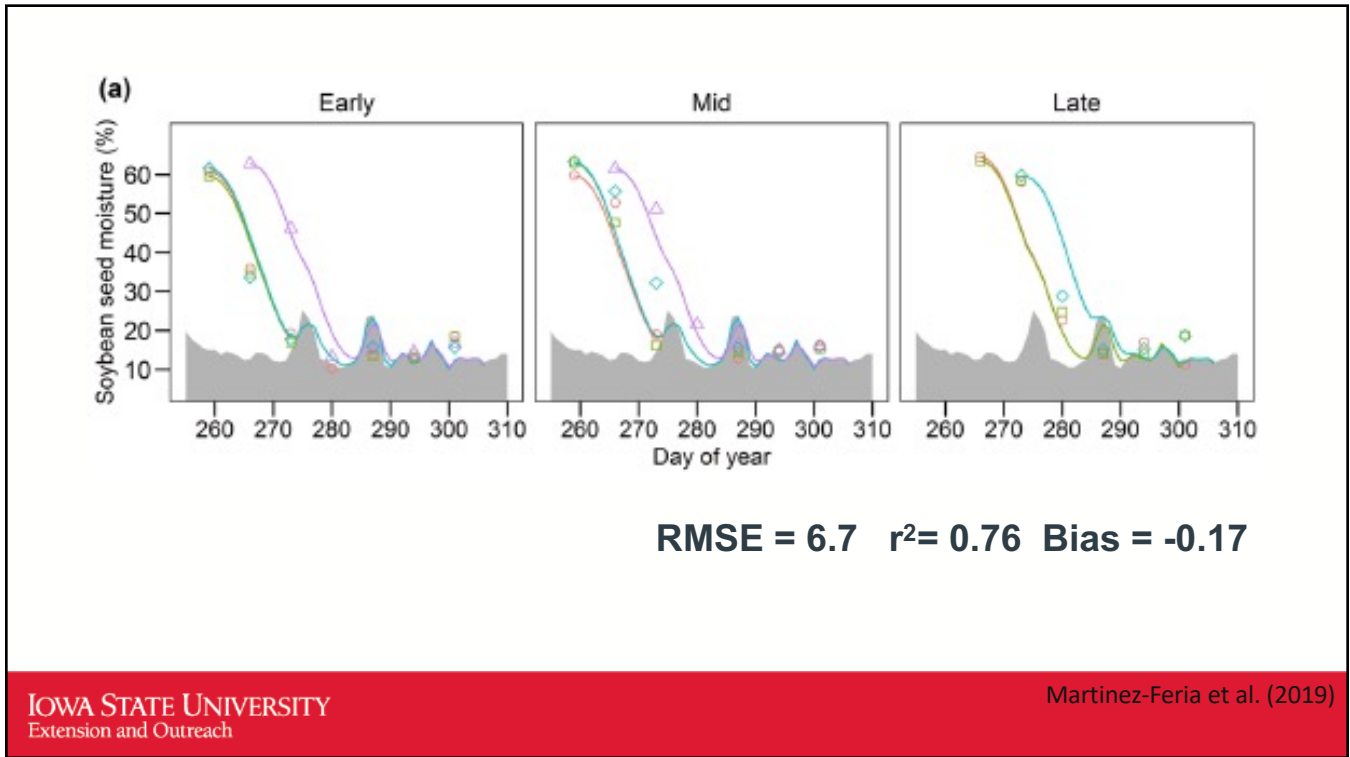
18



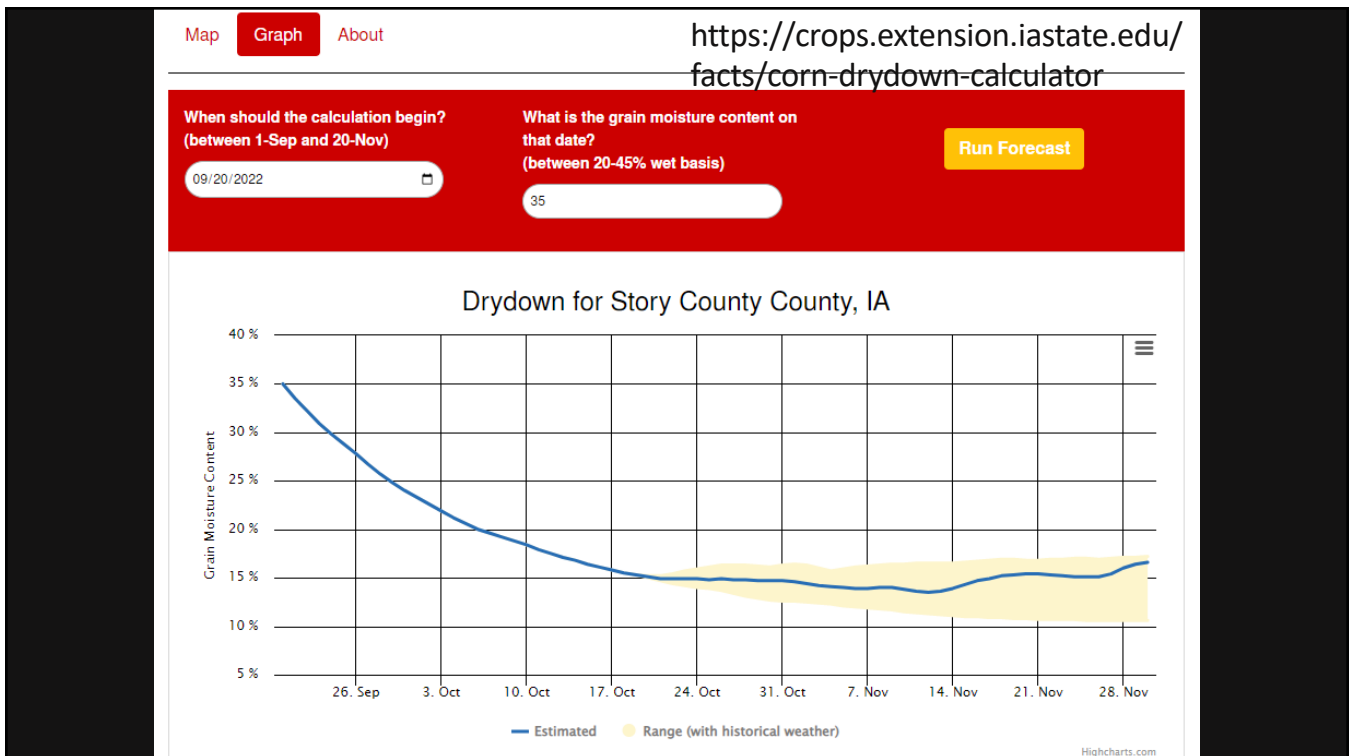
19



20



21



22

What Questions Do You Have?

Mark Licht
Extension Cropping Systems Specialist
lichtma@iastate.edu

Charles Hurburgh
Mark Hanna
Rasel Parvej
Sotirios Archontoulis
Rafael Martinez-Feria

<https://crops.extension.iastate.edu/facts/corn-drydown-calculator>

IOWA STATE UNIVERSITY
Extension and Outreach

This institution is an equal opportunity provider. For the full non-discrimination statement or accommodation inquiries, go to www.extension.iastate.edu/diversitytext.