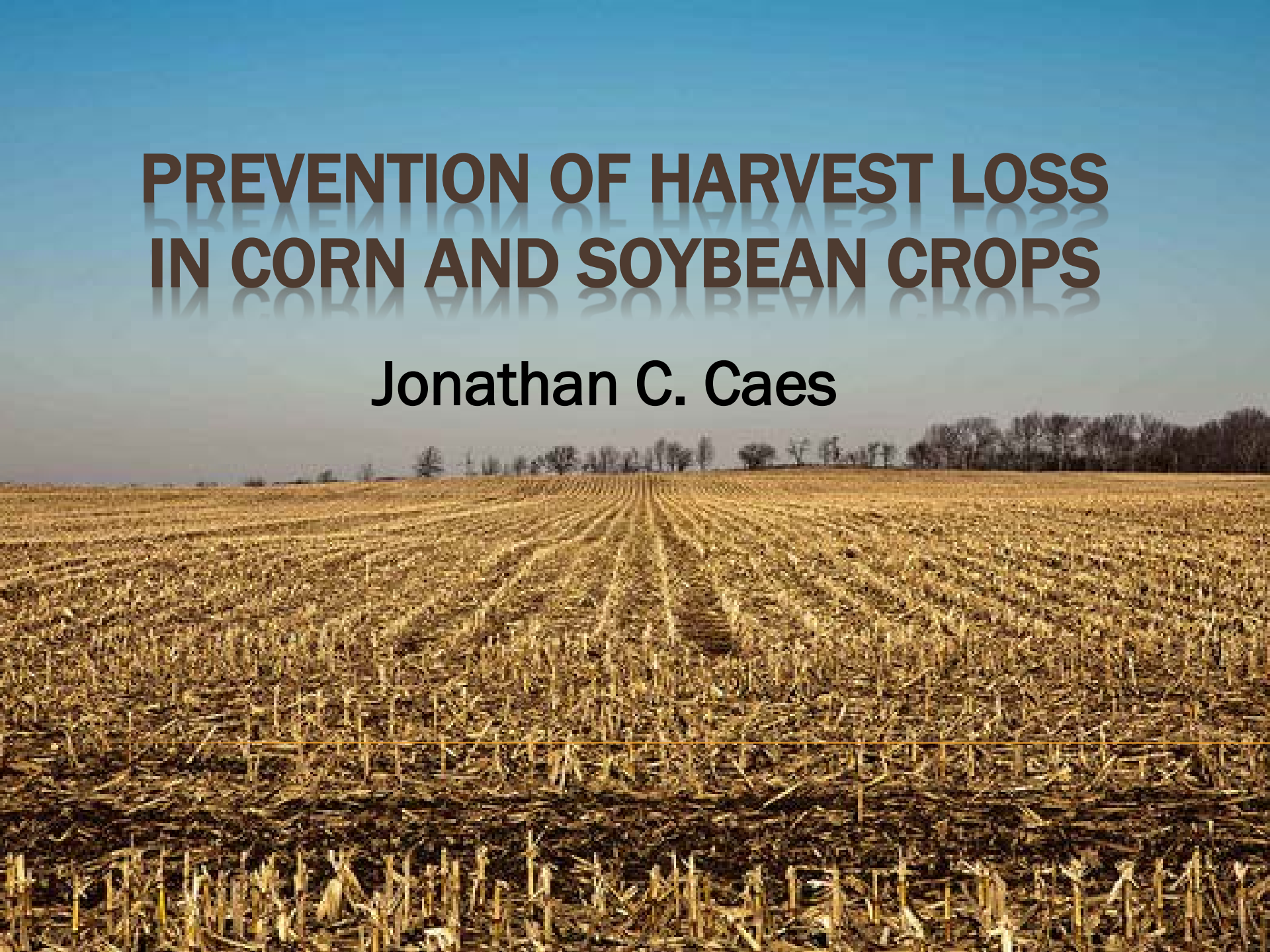
PREVENTION OF HARVEST LOSS IN CORN AND SOYBEAN CROPS

Jonathan C. Caes



BACKGROUND

Agronomy Hall Courtyard

- Eastern Iowa farm
- Schooling
  - 2006 – Durant High School
  - 2008 – Muscatine Community College: Associate in Arts
  - 2010 – Iowa State University: BS in Agronomy
- Work Experience
  - Caes Trucking
  - DuPont Pioneer

OVERVIEW

- What is Harvest Loss?
- Causes of Harvest Loss
- How to Measure Harvest Loss
- Harvest Loss Repercussions
- Prevention of Harvest Loss
- Summary
- Quiz Questions

WHAT IS HARVEST LOSS?

- The loss of saleable seed during the harvesting process
- Examples:
  - Corn kernels
  - Corn ears
  - Soybean seeds
  - Soybean pods
  - Alfalfa leaf shatter
  - Wheat kernels

EXAMPLES OF HARVEST LOSS

Corn seed and ear loss during harvest.
Courtesy of Roberts, 2012.

Soybean pod loss during harvest.
Courtesy of Minnesota Farmer, 2011.

Handling alfalfa in the windrow needs to be done carefully to reduce the loss of high-leaves or yield and quality will suffer.

Wheat kernels lost during harvest.

CAUSES OF HARVEST LOSS

- Crop specific
  - Corn pollination and ear size
  - Dropped pods (soybeans) or kernels (wheat)
  - Alfalfa leaf shatter

Various ear sizes can influence kernel removal from the ears during harvest.

CAUSES OF HARVEST LOSS

- Weather dependent
  - Altered drying
  - Drought
    - Lower pollination
    - Smaller seed sizes
    - Smaller ears

Drought-stricken soybeans (left) shrivel and lose oil content.

Drought-stricken ear of corn.

CAUSES OF HARVEST LOSS

- Weather dependent
  - Wind Damage
- Insect root feeding
- Stalk rot diseases
- Poor genetics for standability

Stalk rots can cause the lower internodes to weaken and not be able to support the upper portion of the plant.

Wind lodged corn near time of pollination.

Lodged corn from corn rootworm larvae root feeding.

Harvesting lodged corn with a corn reel on the corn head.

CAUSES OF HARVEST LOSS

- Mechanical settings
  - Potentially the largest contributing factor
  - Due to:
    - Inaccurate settings
    - Neglected Machinery
    - Poor operation

Harvesting soybean. Courtesy of Wikimedia.

http://commons.wikimedia.org/wiki/File:Harvesting_soybeans.jpg

CAUSES OF HARVEST LOSS

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  - Due to:
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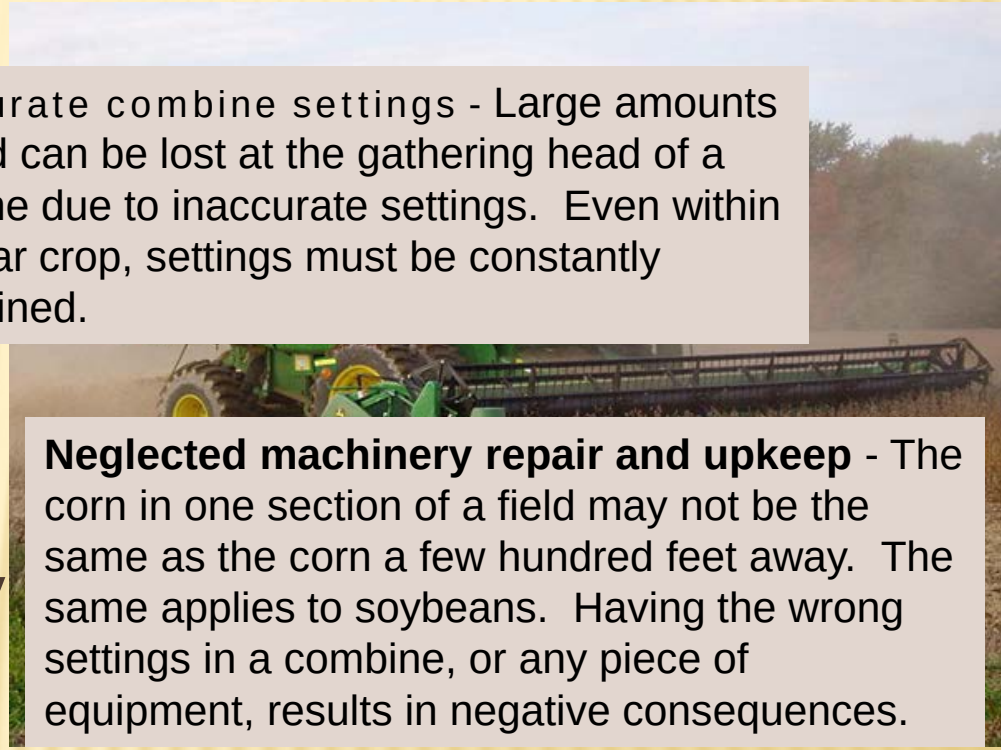
Inaccurate combine settings - Large amounts of seed can be lost at the gathering head of a combine due to inaccurate settings. Even within a similar crop, settings must be constantly maintained.



Neglected machinery repair and upkeep - The corn in one section of a field may not be the same as the corn a few hundred feet away. The same applies to soybeans. Having the wrong settings in a combine, or any piece of equipment, results in negative consequences.

Harvesting soybean. Courtesy of Wikimedia

Poor operation of the combine - Improper care of machinery is another guaranteed way to increase harvest loss. To ensure equipment is functioning at its peak ability, it is necessary to perform routine maintenance. Nonetheless, the correct settings and all the care in the world will mean nothing if the operator does not run the equipment properly.

CAUSES OF HARVEST LOSS

- Mechanical settings
  - Pollination determines kernels per ear
    - Poor pollination = lower kernel production
  - Fewer kernels increase shatter losses
    - No “buddy” kernels to provide support

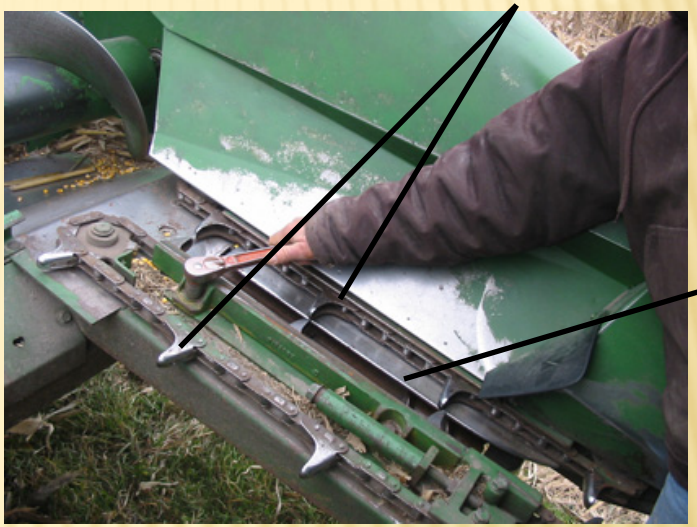
Good vs. poor corn pollination. Courtesy Coulter, 2008.

Soybean pod already open on dried soybean plant prior to harvest. Courtesy of USDA-ARS.

CAUSES OF HARVEST LOSS

- Mechanical settings
  - Corn stalked pulled down *via* stalk rollers
  - Detached by deck plates
  - Increased shatter losses

Gathering Chains



Deck plates

Platform Auger

Reel

Cutter bar

Stalk rollers

CAUSES OF HARVEST LOSS

- Ear size
  - Determined by several factors:
    - Variety selected
    - Stress during growth
    - Kernel development
  - Smaller ears increase loss chances
    - Deck plates “catch” ears
    - Small ears pass through deck plates

Deck plates and gathering chains of a corn harvester head are important in stripping the ear from the corn stalk and moving it into the combine.

CAUSES OF HARVEST LOSS

Summary of Corn Field Losses (Iowa)

Sources of Loss	Average Growers (bushels per acre)	Top 10% of Growers (bushels per acre)
Failure to gather ears	1.5	0
Shelling from stalk rolls	0.9	0.3
Separating Loss	1.3	0.2
Total Combine Loss	3.7	0.5
Ears dropped before harvest	2.1	1.0
Total field loss	5.8	1.5

Source: University of Arkansas: Division of Agriculture 2013

CAUSES OF HARVEST LOSS

- Grain moisture
  - Plants decrease moisture uptake due to senescence
    - Maximum dry matter ≈ 35% moisture
  - Black layer formation ≈ 28% moisture (± 4%)
  - Harvest maturity ≈ 25%
    - Least amount of damage and harvest loss

Black layer formation in a corn kernel.
Courtesy of Robert Nielsen, Purdue University.

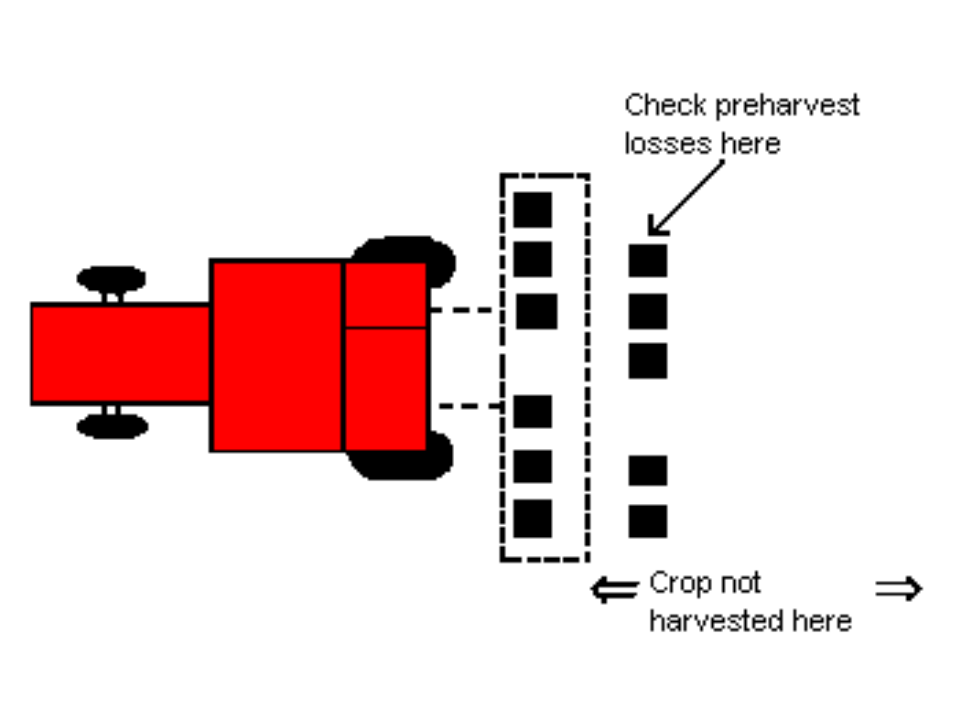
CAUSES OF HARVEST LOSS

- Grain moisture
  - Penalties for wet grain
  - Field drying requires no input
  - Dry grain shatters easily
    - Moist kernels held tighter on the ear
    - Moist pods are more difficult to split open
  - The drier the crop, the higher the harvest loss

Field dried corn ready for harvest.

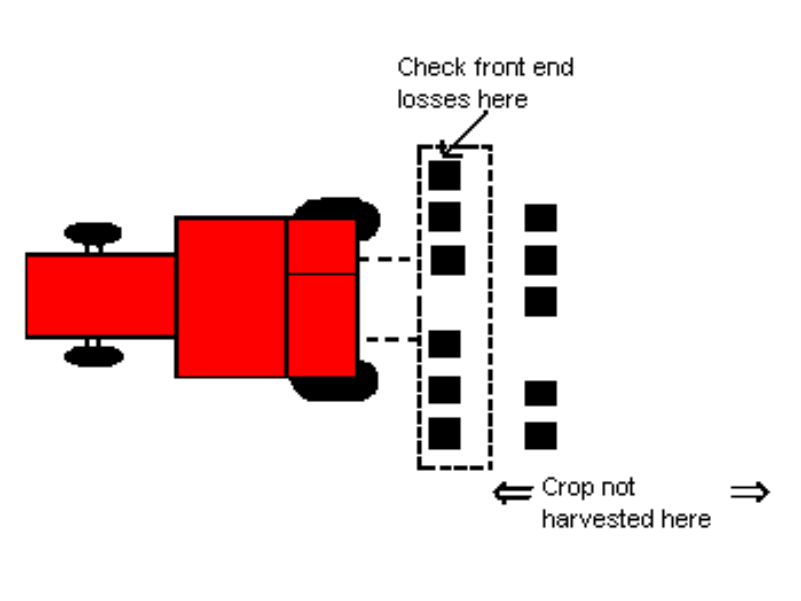
MEASURING HARVEST LOSS

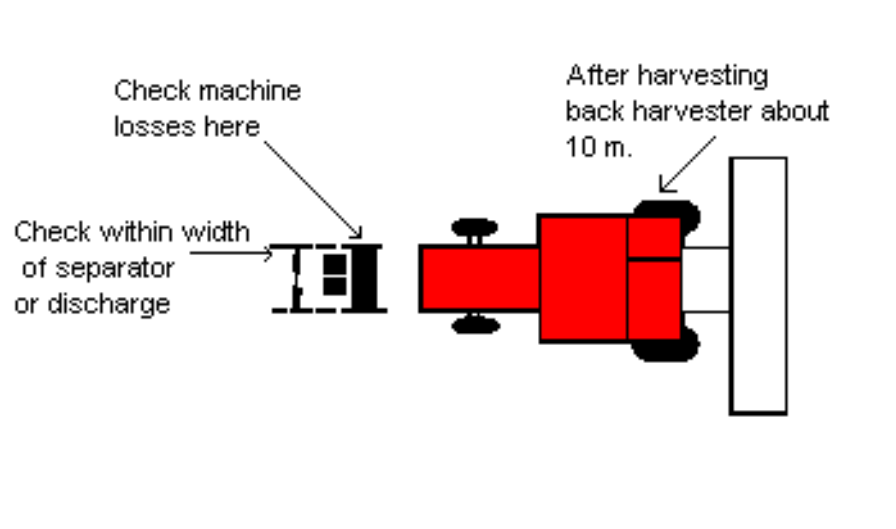
- Yield loss
  - Can involve complex equations
  - Best to do multiple counts
  - Conduct pre-harvest counts



MEASURING HARVEST LOSS

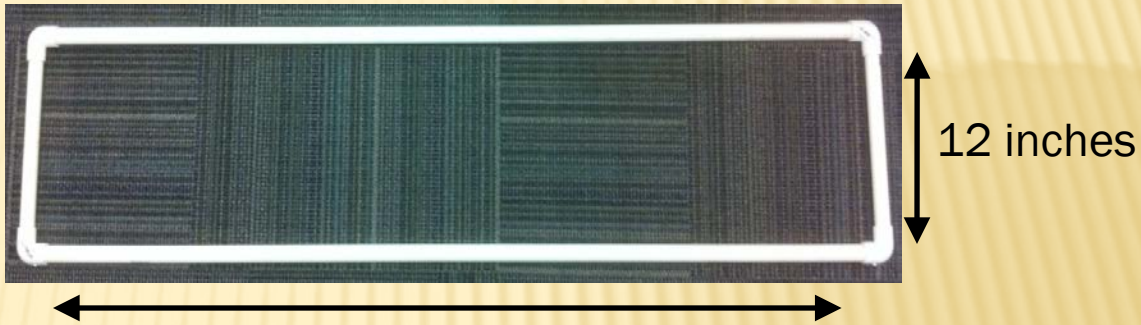
- Yield loss
  - Header loss
    - Harvest a given area
    - Stop combine
  - Separator loss





MEASURING HARVEST LOSS

- Corn yield loss
  - Kernel counts
    - 1 square foot
  - Ear counts
    - 1/1000th of an acre
    - Weight



Courtesy of DuPont Pioneer

Width of Picker Head (Rows)	3	4	5	6	7	8	9	10	12	14	16
Length of Measurement Area (Feet & Inches)	58' 1"	43' 7"	34' 10"	29' 0"	24' 11"	21' 9"	19' 4"	17'5"	14' 6"	12' 5"	10' 11"

Courtesy of DuPont Pioneer

MEASURING HARVEST LOSS

- Soybean yield loss
  - Counting seeds
    - Prior to harvest
    - Behind the head
    - Behind the combine

Soybean seeds lost during harvest

HARVEST LOSS REPERCUSSIONS

- Yield loss
  - One bushel per acre loss =
    - Two kernels of corn per square foot
    - Four soybeans per square foot
  - "A lost ear can contain 300 to 400 kernels." (Gullickson, 2011)

HARVEST LOSS REPERCUSSIONS

- Yield loss economics
  - Assuming $3 per bushel corn and $11 per bushel soybeans:
    - One bushel of corn lost per acre over 80 acres = $240
    - One bushel of soybeans lost per acre over 80 acres = $880
  - Assuming $7 per bushel corn and $13 per bushel soybeans:
    - Three bushels of corn lost per acre over 80 acres = $1680
    - Three bushels of soybeans lost per acre over 80 acres = $3120

HARVEST LOSS REPERCUSSIONS

12 kernels of corn per square foot

6 kernels per square foot and two ears in 1/1000th of an acre weighing ¾ lb

HARVEST LOSS REPERCUSSIONS

2 soybeans per square foot

8 soybeans per square foot

HARVEST LOSS REPERCUSSIONS

- Volunteer crops
  - Any crop growing that wasn't directly planted
    - Typically a result of harvest loss
  - Compete for nutrients, water, sunlight, etc.
  - Lowers energy production for planted crop

Volunteer corn in a soybean field. Source: Davis, 2009

HARVEST LOSS REPERCUSSIONS

- Volunteer crops
  - Pests
    - Crop rotations
    - “Insect Bridge”
      - Corn rootworm beetles/larvae

Volunteer corn growing in a soybean field can attract corn rootworm beetles and be a food source for corn rootworm larvae.

HARVEST LOSS REPERCUSSIONS

- Lower Crop Quality
  - Poor seeds result in lower selling prices
    - Low starch content in corn kernels
    - Low oil content in soybeans
  - Smaller seeds

HARVEST LOSS REPERCUSSIONS

- Lower crop quality
  - Small seeds may be lost through various processes
    - Grain movement/transfer
    - Drying
    - Storage

Grain vac loading grain from a bin to a semi.

PREVENTION OF HARVEST LOSS

- Maximize pollination
  - Select appropriate variety
  - Match populations
  - Reduce stress

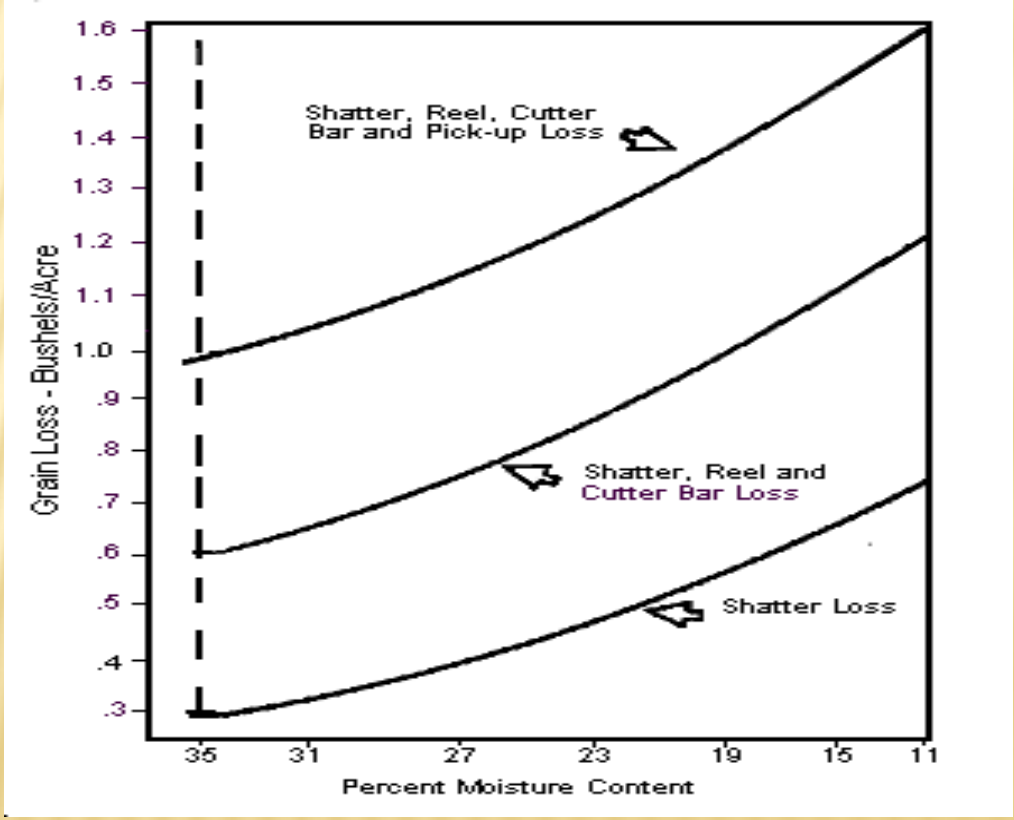
Corn ear, the female portion of the corn plant, ready for pollen.

Corn tassel, source of pollen to fertilize the ear silks.

PREVENTION OF HARVEST LOSS

- Monitor moisture
  - "Shatter losses increase with crop dryness," (Shay et al., 1993)

Grain losses in the field at harvest time. Source: Hofman, 1978



PREVENTION OF HARVEST LOSS

- Correct equipment usage and settings
  - Soybean head height: “Gathering loss is the soybean harvest that does not get inside the combine, and accounts for around 80% of the total harvest loss,” (Pedersen, 2006).

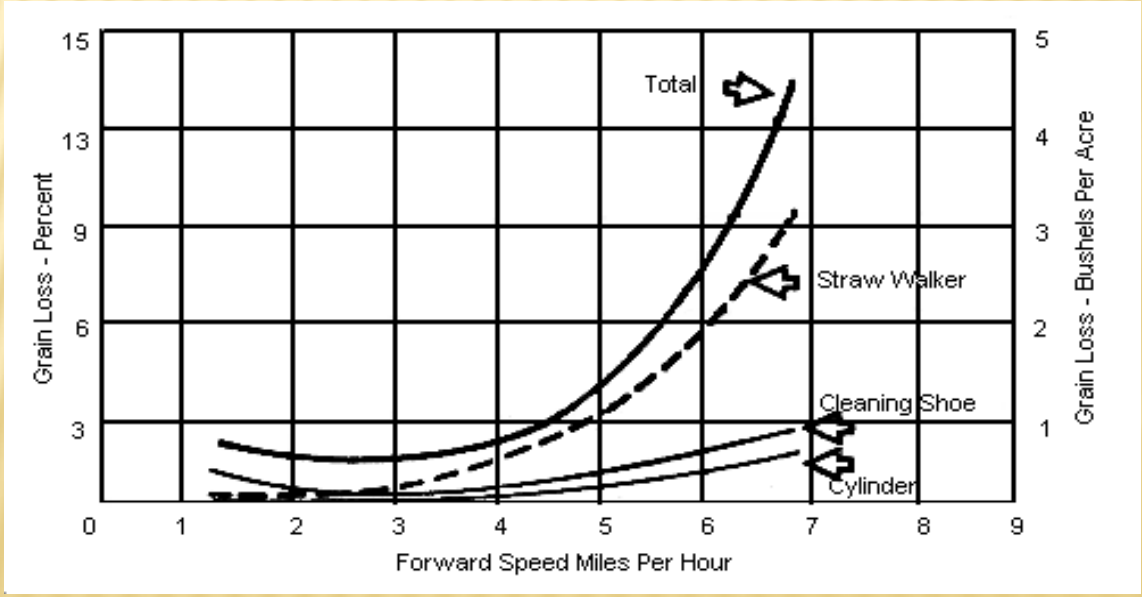
Height of Cut	% Loss
0 inches (hand-harvested)	0%
3.5 inches	5.4%
5.0 inches	9.4%
6.5 inches	12.2%

Source: Iowa State University

PREVENTION OF HARVEST LOSS

- Correct equipment usage and settings
  - Speed
    - "Improvement in operator performance can have a greater effect on reducing harvest losses than will new combine designs," (Hofman, 1978).

Typical combine performance. Source: Hofman, 1978



SUMMARY

- Yield improvements
  - Increased income
    - “Harvest losses of 10% or more are not unusual, when they should be in the 2 to 4% range,” (Sumner and Williams, 2012).
- Clean fields
  - Few volunteer crops
  - Decreased crop competition
- Higher community standing

SUMMARY

- Harvest loss is a serious concern
  - Often overlooked
  - May cost producers thousands
- Prevention education is essential
- Low harvest loss values need to become a main producer goal

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QUIZ QUESTIONS

- What effect can drought conditions have on soybean seeds?
  - Higher moisture
  - Lower oil content*
  - Lower pod height
  - More pods

- Around what grain moisture does "harvest maturity" occur?
  - 35%
  - 25%*
  - 15%
  - 40%