Unit D: Agricultural Equipment Systems

Lesson 7: Operating, Calibrating, and Maintaining Grain Harvesting and Handling Systems
Terms

- Allowable storage time
- Cleaning
- Drying front
- Drying zone
- Equilibrium moisture content
- Feeding
- Handling
- Lodging
- Tailings
- Threshing
Objective #1

What are the operating principles of grain harvesting equipment?
Basic Functions

- Gathering the standing crop is referred to as cutting
  - Involves the platform, cutter bar and reel, corn head, snapping unit (gathering chains, snapping rolls, and stripper plates)

- Delivering the crop material to the threshing unit in a steady, uniform flow is referred to as feeding function
  - Involves header or platform auger (table auger), feeder house (feeder conveyor, paddle conveyor, or feeder chain)
Basic Functions

- **Threshing** involves the removal of grain from the head, seed pod, or cob by either flailing or rubbing action
  - Involves cylinder or rotor and concave
- Separating the loose grain grain from the straw is referred to as separation function
  - Includes the grates, straw walkers, beater, or rotary deflector
Basic Functions

- **Cleaning** function removes the grain from the trash
  - Includes the cleaning shoe (sieves, chaffer, and fan)

- **Moving the grain throughout the machine is the handling function**
  - Includes clean grain (augers, elevators, and grain tank), tailings (augers and elevators), grain holding (grain tank), and unloading (augers).
Two different machines harvesting cotton
HOW GRAIN FLOWS THROUGH A COMBINE
Objective #2

How is grain harvesting equipment calibrated?
Harvesting losses

- **Pre-harvest losses** are those that occur before combing
  - Result of wind shatter, lodging, down crop or weather conditions
  - *Lodging* is the inability of the crop to stand

- **Header losses**
  - Header is operated improperly or crop shatters easily
Harvesting losses

- Threshing losses caused by unthreshed grain carried over straw walkers, cracked grain due to overthreshing, or cracked grain due to excessive tailings
  - *Tailings* material not completed threshed
- Separator losses caused by feeding too much material over them by excessive ground speeds
  - Too much material prevents grain from falling through walkers and onto cleaning shoe
Harvesting losses

- Cleaning shoe losses caused by too much air from fan, too much material on chaffer, or improperly adjusted chaffer and sieve
- Leakage losses can occur anywhere on the combine
  - Inspect to see if all doors are in proper position and closed
  - Check for holes, torn sheet metal, or torn seals
Cotton difficulties

- Moisture removal
- Valuable fiber ejection
- Cleaning lint
Corn losses

- Occur as ear losses and kernel loss
- Largest loss of corn is ears left in the field
Global positioning systems, yield monitors, moisture monitors are calibrated by operator manual
Objective #3

What maintenance procedures should be followed for grain harvesting equipment?
Maintenance

- Costly repairs, premature wear, loss of field time, and accidents, can be reduced if combine is properly maintained and adjusted.
Operator’s manual

- Used as a reference to specific maintenance intervals, location of service points, and instructions for performance of maintenance and service adjustments.
General Maintenance

- Before season starts, make a preliminary inspections and adjustments
- Keep machine clean.
- Make sure that nuts, cap screws, shields, and sheet metal parts are tight
- Inspect machine daily before starting
- Keep maintenance records
- Do not abuse the machine
General maintenance

- Check all fluid levels daily before starting
- Lubricate bearings and chains
- Check tire pressure
- Check belts for tension, wear, tearing, cracking, swelling, and unraveling
- Maintain correct chain tension, 1/4" of sag between shaft centers
Belt maintenance

- Replacing a belt never pry over the rim
- Wipe off all grease as soon as possible
- Clean belts periodically in mild soap and water
- Use of belt dressing is not recommended because causes deterioration
- Check pulleys for misalignment, excessive wear, damage, distortion, and dirt
Chain maintenance

- Remove at end of season for cleaning and lubrication
- Add or remove links for proper tension
- Do not add new or old links to the chain as it will wear on sprockets
- Check alignment of all sprockets
- Do not put new chain on worn sprockets, as its life will be shortened.
COMBINE SERVICING—
BELTS, CHAINS

Check sprocket alignment with a straight edge or string. Misalignment will cause rapid wear of sprockets and chains.

Check pulley alignment. Pulley misalignment will result in distortion of belts which results in excessive wear and damage.

Never pry a belt over a pulley. This breaks the cords in the belt and will result in belt roll-over and early belt failure.

Keep chains adjusted to \( \frac{1}{4} \)" sag per foot between shaft centers. Over tightening produces rapid chain and sprocket wear. Loose chains “whip” and can cause chain and sprocket damage.
Objective #4

What are the principles for operating grain drying and handling equipment?
Principles

- Grain drying and handling equipment involve factors relating to system design and the removal of moisture.
Goals of a drying system

- Timely harvest of top quality grain
- Safe and pleasant working conditions
- Ability to do important drying jobs efficiently
  - Holding wet grain
  - Drying wet grain
  - Cooling dried grain
- Capacity to handle grain at harvesting rate
- Provision for expansion in the future
Grain dries by removing water

- Grain harvested at high moisture to minimize harvesting losses
- Grain is dried artificially to prevent spoilage
  - Fan picks up air, carries it over an energy storage, pushes air through the grain mass to absorb moisture and carry it outside the system
  - **Drying zone** is the layer being dried, only grain in this zone is being dried, grain below this zone is dried and grain above is wet
  - **Drying front** is the leading edge of drying zone
The drying zone starts at the bottom. When it reaches the top, drying is completed. Spoilage will occur if the drying zone doesn’t reach the top within the allowable storage time.
Grain dries by removing water

- **Equilibrium moisture content**
  - Point when continued contact with drying air results in no further moisture removal

- **Allowable storage time (AST)**
  - Length of time grain can be stored at a given moisture and temperature
  - Drying & storage designed around AST
  - Combination of high moisture and temp. leads to fast mold and spoilage
  - Factors affecting stored grain are insects, rodents, & bacteria
Objective #5

How is grain drying and handling equipment calibrated?
Calibrating Grain Drying Equipment

- Important to attain the proper moisture content for grain storage
- Considerations when calibrating grain drying
  - Initial moisture content of grain
  - Temperature of grain
  - Relative humidity of outside air
  - Desired final moisture content of the grain based on the use of the grain
Objective #6

What maintenance procedures should be followed for grain drying and handling equipment?
Proper maintenance and service adjustments are necessary

- Costly repairs, premature wear, loss of harvesting time and accidents can be reduced if equipment is properly maintained and adjusted.
- Operator’s manual should be used as reference for maintenance intervals, location of service points, and instructions for maintenance and service.
Maintenance Practices

- Thoroughly clean equipment prior to use
- Inspect all bearings and friction surfaces for wear
- Make sure all safety equipment is in place
- Keep up to date maintenance records
- Inspect equipment daily
- Check fluid levels daily
Maintenance Practices

- Lubricate bearings and chains
- Check belts for tension, wear, tearing, cracking, swelling, and unraveling
- Maintain correct chain tension, 1/4” of sag per foot between shaft centers
- Check all electrical equipment
- Insure that all fire extinguishers are properly charged and in working order
Review

- What are the operating principles of grain harvesting equipment?
- How is grain harvesting equipment calibrated?
- What maintenance procedures should be followed for grain harvesting equipment?
- What are the principles for operating grain drying and handling equipment?
Review

- How is grain drying and handling equipment calibrated?
- What maintenance procedures should be followed for grain drying and handling equipment?