Unit D: Agricultural Equipment Systems

Lesson 3: Operating, Calibrating, and Maintaining Agricultural Planting Systems
Terms

- Broadcasting
- Checkrow planting
- Field calibration
- Germination
- Hill drop planting

- Population
- Row-crop planting
- Solid planting
- Starter fertilizer
Objective #1

What are the operating principles of planting equipment?
Basic Functions of the planter

- Open a furrow in the soil
  - seed must be in contact with moisture to germinate
    - **germinate**
      - change from a dormant condition to one of activity & growth
      - seed in equal depth regardless of soil conditions
      - furrow opener accomplishes this

- Meter the seed to the soil
  - specific rates are needed
  - accomplished by metering devices
Basic Functions of the planter

- Place seed in soil
  - yields depends on depth & spacing
- Covers the seed
  - seed must have protection in order to survive
  - accomplished by press wheels on planters and chains or drags on drills
- Firm the seedbed
  - provides adequate seed to soil contact
  - press wheels and drag chains accomplish this
Objective #2

What are the types of planting equipment?
Types of planting equipment

- **Row crop planting**
  - require precise row spacing and even spacing of plants within the row
  - planted in rows far enough apart to permit operation of machinery such as cultivators and harvesters
  - generally sorghum and cotton

- **Grain drills and air seeders**
  - used to sow crops such as wheat
Types of Row crop planters

- **Drill planting method**
  - seeds are dropped individually in the row at given distances
  - spacing depends on population
  - population
    - number of seeds or plants desired per hectare

- **Hill drop planting**
  - seeds are located in hills of 2 to 5 seeds per hill

- **Checkrow planting**
  - 3 to 5 seeds dropped in hills same distance in all directions
Types of planting equipment

- Broadcast seeders
  - used to broadcast small grains, grasses & legumes
  - *broadcasting*
    - seeds are scattered on a random, non-row basis on top of the seedbed

- Specialized planters
  - designed for special planting operations
  - examples include: potato planter, vegetable planter, and transplanters
Transplanters
Objective #3

What are the components of row-crop planting equipment?
Frames used on planters

- **Drawn or trailing planter**
  - has its own wheels in contact with the soil
  - units are mounted on the main frame
  - attached to tractor by a tongue
  - raised and lowered by hydraulic cylinders

- **Integral planter frame**
  - attached by a 3 point hitch on tractor

- **Tool-bar planter**
  - has its own frame and drives
  - attached to a tool bar either on tractor or implement
Planter drives

- Deliver the correct spacing of seeds in the row at varying travel speeds under varying soil and topographical conditions
- either ground driven or hydraulic driven
Ground driven drives

- **Carrying-wheel drives**
  - used on most trailing type planters
  - power comes from transport wheels through a series of chains, sprockets, gears and shafts
  - populations changed by changing sprocket sizes

- **Gauge-wheel drives**
  - used on the tool bar planters
  - power comes from the transport wheels
  - populations changed by changing sprocket sizes
Ground driven drives

- Press-wheel drives
  - power is transmitted through a drive chain and sprocket
  - slippage is greater because press wheel running in loose soil and pressure on wheels might not be enough to prevent slippage
  - populations changed by changing sprockets
Hydraulic drives

- Operated by tractor’s hydraulic system
- Hydraulic motor mounted on planter drives metering system through chains & sprockets
- Seeding population controlled using variable rate technology (VRT)
- Radar gun or Global Positioning System (GPS) used to automatically adjust population depending on ground speed
Furrow openers

- Major function is to open a well defined groove in the soil where the seed is placed at proper depth and in contact with soil.
Furrow openers

- **V-trench**
  - 2 sharply angled disks and close hugging gauge wheels are used to make a V-shaped trench

- **Disk openers**
  - 2 sharply angled disks are used to make a V-shaped trench

- **Runner openers**
  - runner opener widens from the front to rear which has formed a furrow
Furrow openers

- Combination runner and double disk openers
  - advantages from both types
- Shovel openers
  - used to prepare a seed slot in sticky soil conditions
Seed metering device

- Function of seed metering device is to deliver seeds from the hopper to the seed placing mechanism at a selected rate.
Seed plates must be changed each time seed size changes.
Seed plate metering system

- Has a seed plate with openings that rotates
- Seed plate turns, seeds fall into openings
- One kernel at a time if proper size is selected
- Spring loaded pawl keeps other seeds out
- When plate passes over the discharge hole a knockout pawl ejects the seed
- Seed plates have to be changed to match seed size
Finger-pickup metering system

The finger pick-up system eliminates the need to change plates to match seed size.
Finger-pickup metering system

- Eliminates changing of plates
- Fingers pickup individual kernels
- Has 12 spring loaded fingers that open & close by a cam as they rotate
- Fingers select one individual kernel
- Delivers it to the discharge tube
- Goes to the seed placement mechanism
Three types of air metering systems

- Pressurized metering drum
- Pressurized metering disk
- Vacuum metering disk
Pressurized metering drum
Pressurized metering drum

- Uses PTO or hydraulic motor fan to pressurize the seed hopper and drum
- Drum has holes around its circumference for each row to be planted
- Pressure inside drum is higher than outside
- Seeds are held due to this pressure
- Discharge manifold a release wheel releases seed into seed delivery tube
- Air pushes seed to row planting unit
Pressurized metering disk
Pressurized metering disk

- Uses a vertical rotating disk to pickup seeds from reservoir at base of the disk
- Seed is held by blower
- Disk holds seeds in pockets around the disk
- Cutoff device causes seed to drop into delivery tube and then into the soil
Vacuum System
Vacuum System

- Seeds are held in openings by atmospheric air pressure
- Seed cutoff wiper removes excess seeds
- Vacuum metering system use hydraulic powered pump to create consistent vacuum to each unit
Volume Metered Systems

- Metered on basis of spacing, weight or volume per hectare
- common types
  - feed cup
  - picker wheel
  - adjustable hole
  - adjustable cutoff plate
Volume metering systems

- **Feed cup**
  - has scallops on inside feed cup, fed into from hopper, carried upward, discharged into seed tubes

- **Picker wheel**
  - used on cotton

- **Adjustable hole**
  - agitator moves seeds over hole to delivery tube

- **Adjustable cutoff plate**
  - seeds flow through a stationary cutoff plate onto a rotating dome type seed plate to the discharge tube
Seed Placement Mechanism

- Function is to accept seed from metering device, drop it into the seed tube, and deliver it to the furrow properly spaced.
Seed Placement Mechanism

- **Gravity drop**
  - simplest and least expensive
  - disadvantage is not placing seed uniformly because planter is moving

- **Seed conveyor belt**
  - used with finger pickup
  - seed is placed on a belt to be delivered to the soil
  - seed placement is very accurate
Seed Placement Mechanism

- Rotary valve
  - used with plate-type metering system
  - valve holds seed until a lobe ejects the seed

- Chain drop
  - picks up seed at metering devices carries it to soil then ejected to soil

- Air seed drop
  - uses air velocity to transport seed to soil
Seeds planted at proper depth

- Depth control devices required
- Gauge wheels are found in different places of planters
- Best place is beside furrow openers
Seed covering devices

- Shovel covers
- Knife covers
- Disk covers
- Chain covers
Seed to Soil contact

- Seed firming wheels
  - close the furrow and firm seedbed
- Press Wheels
  - used when seed to soil contact is not a problem
- Seed Hoppers
  - either individualized or central
  - made from fiberglass or metal
Seed Monitors

- Function is to alert the operator of a planter malfunction
- contains a photo-electric eye at seed tube senses the seed as it falls
- sends information to monitor
- monitor displays information to operator
Other attachments

- Starter fertilizer
  - fertilizer applied at planting time
- fertilizers and pesticides can be applied through the planter either in dry, granular, or liquid
- tillage attachments can be added to reduce other passes over the field
Objective #4

What are the components of solid planting equipment?
Solid planting devices

- **Solid planting**
  - row spacing is too close to permit cultivating between the rows

- grain drills, air seeders, broadcast seeders, and in large open areas airplanes, & helicopters
Types of drills

- **End-wheel drill**
  - has wheels that support and drive drill

- **Press-wheel drill**
  - has press wheel gangs mounted at rear of drill that firms the soil, drives the metering system, and supports the drill

- **Tiling drill**
  - same as end-wheel with a power driven cutter that prepares the seedbed
Solid planting components

- Metering systems is driven by sprockets, chains and gears
- fluted-feed and double-run feed are seed metering devices
- seed tube attached to metering unit & furrow opener
- furrow openers makes the opening in the soil
- depth is controlled by a stop on a hydraulic cylinder and spring pressure
- covering the soil is by the use of drag chains or press wheels
Objective #5

How is the planting equipment calibrated?
Calibrating the planter

- Proper field adjustment and operation of planting equipment can lead to better yields
- Operator’s manual is used as a guide for initial planter settings
- **Field calibration**
  - the process of actually checking and making final adjustments to the planter
Calibrating the planter

- Fill seed hoppers 1/2 full
- tie up covering wheels
- mark row distance equal to 1/1000 hectare
- plant measured distance at normal speed
- count seeds in the row
- multiply number of seeds X 1000
- equals your population rate
Calibrating the planter

- Fill hoppers and plant several meters
- Measure 1 meter along each row
- Count the number of seeds and find average number of seeds per row
- Multiply average number by appropriate factor and 1000
Calibrating hydraulic planters

- Leave planter in transport mode
- Place a collection container under rows
- Turn on drive for a set distance
- Count the seeds collected
Objective #6

What are the maintenance procedures for planting equipment?
Proper Maintenance

- Proper servicing can mean the difference between profitable crop and high losses.
- Planters are precision instruments; they require large amounts of care.
Servicing planter before season

- Clean planter thoroughly
- check for obstructions to keep the mechanisms operating properly
- inspect metering systems for worn or broken parts
- repair or replace any damaged parts
- check all bolts and hoses for tightness
Servicing during season

- Store planter away from moisture when not in use
- Use correct type of lubricant
- Lubricate at appropriate times
- Avoid getting dirt into bearings
- Wipe fittings before lubricating
Servicing planter after season

- Empty and clean all boxes
- Check for worn or broken parts and replace them before next season
- Coat furrow openers, knife and disk covers with protective coverings
- Paint any exposed metal surfaces
- Lubricate all bearings
- Store inside away from weather
- Block the planter up with wheels off of ground
Review

- What are the operating principles of planting equipment?
- What are the types of planting equipment?
- What are the components of row-crop planting equipment?
- What are the components of solid planting equipment?
- What are the maintenance procedures for planting equipment?