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


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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

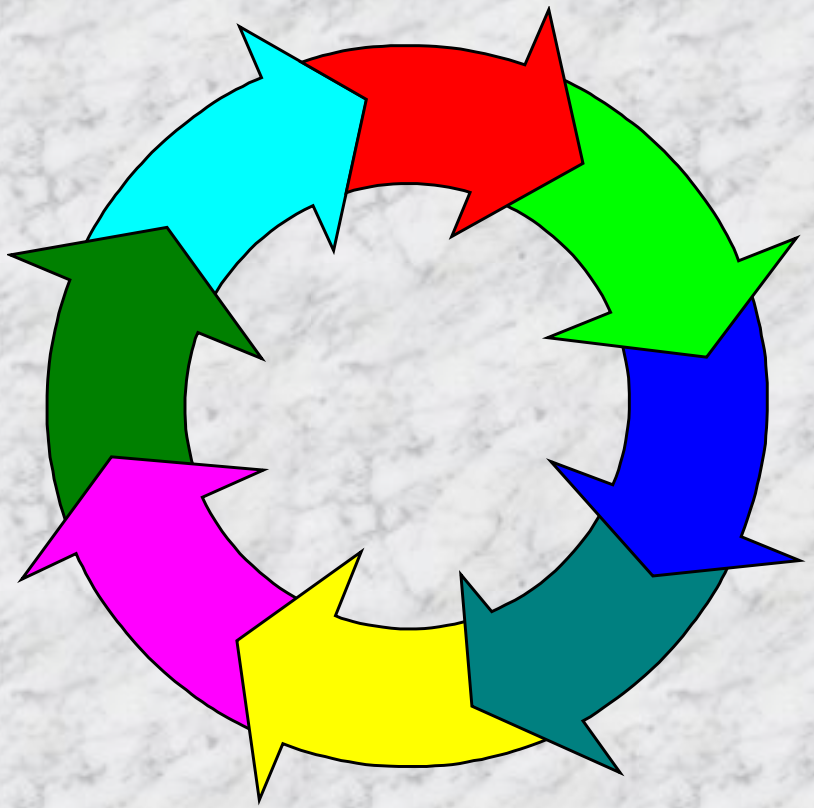
- V-trench
  - 2 sharply angled disks and close hugging gauge wheels are used to make a V-shaped trench
- Disk openers
  - 2 sharply angled disks are used to make a V-shaped trench
- Runner openers
  - runner opener widens from the front to rear which has formed a furrow

Furrow openers

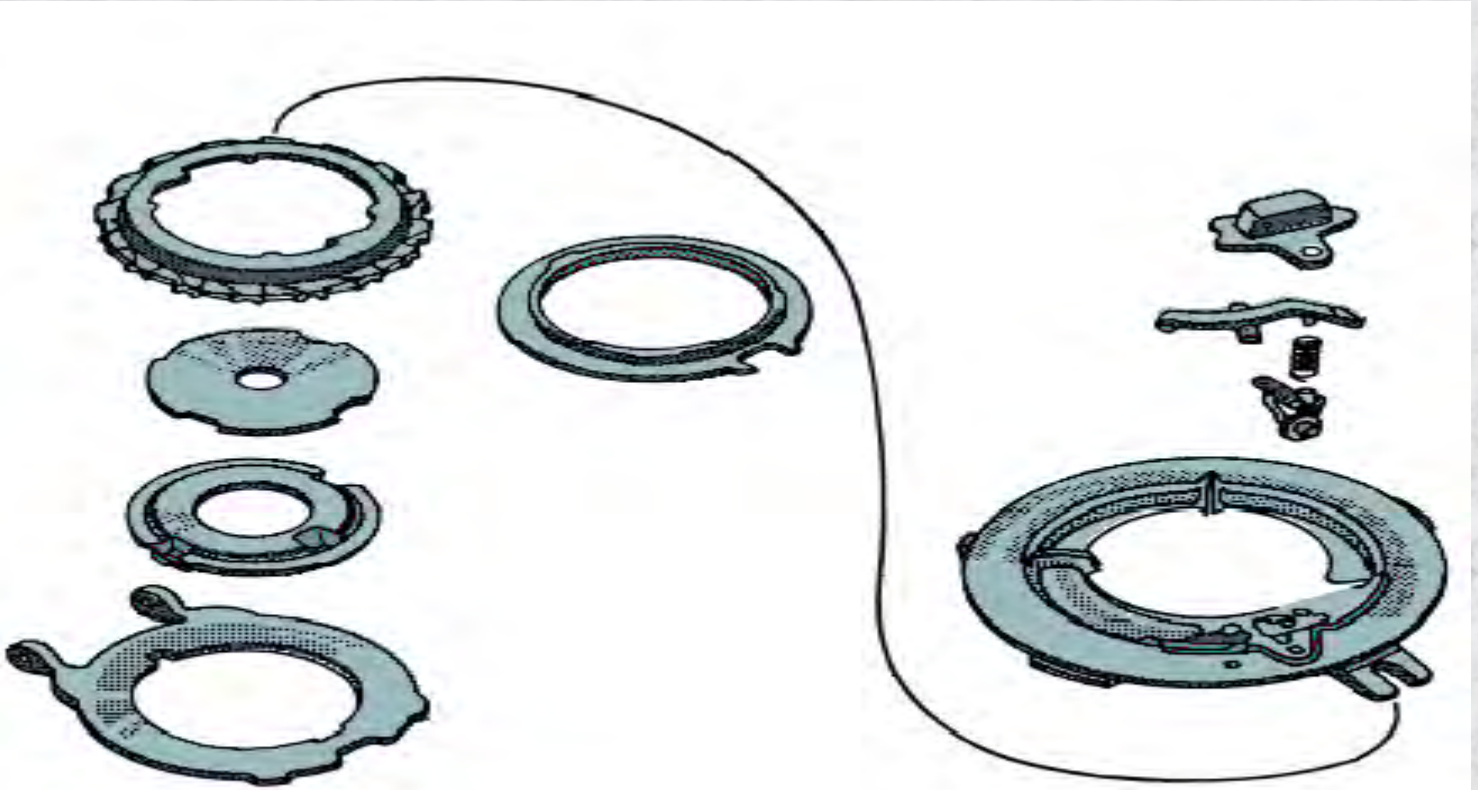
- Combination runner and double disk openers
  - advantages from both types
- Shovel openers
  - used to prepare a seed slot in sticky soil conditions

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 Plate Metering System

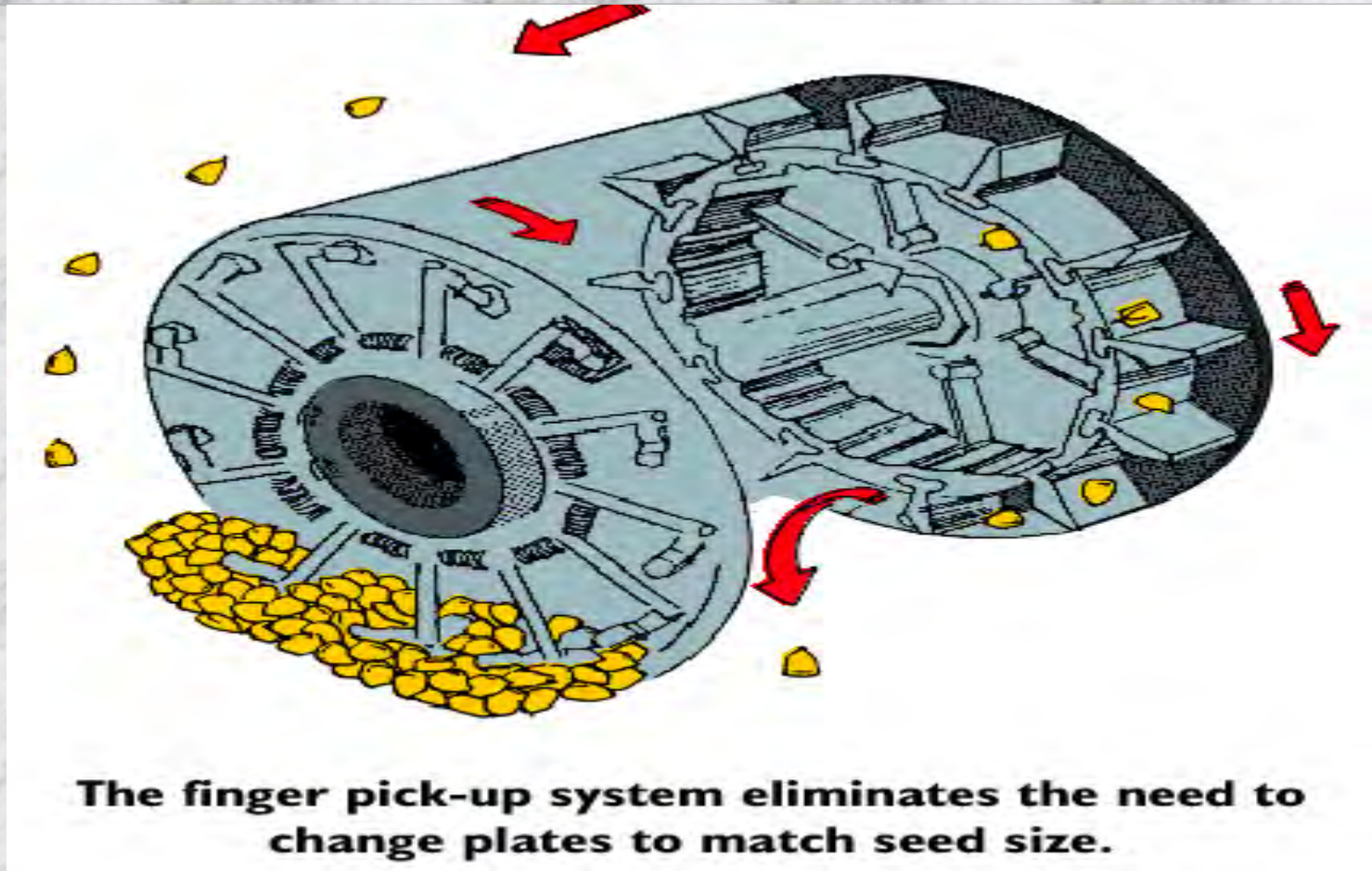


Seed plates must be changed each time seed size changes.

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

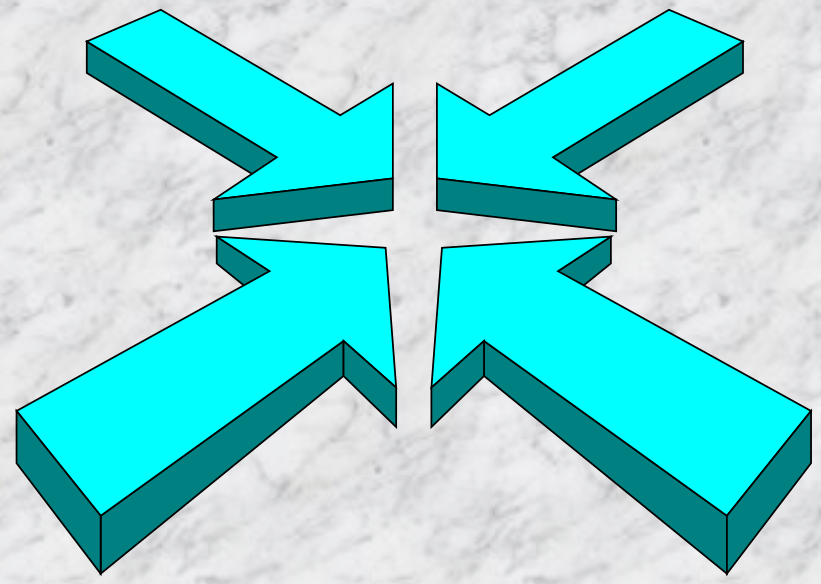


The finger pick-up system eliminates the need to change plates to match seed size.

Finger-pickup metering system

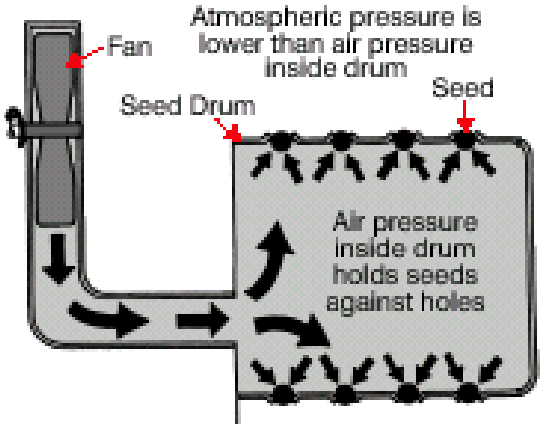
- Eliminates changing of plates
- fingers pickup individual kernels
- has 12 spring loaded fingers that open & close by a cam as they rotate
- fingers select one individual kernel
- delivers it to the discharge tube
- goes to the seed placement mechanism

Three types of air metering systems

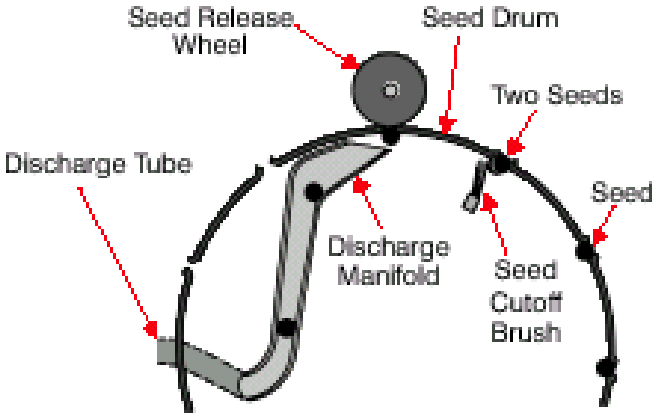


- Pressurized metering drum
- pressurized metering disk
- vacuum metering disk

Pressurized metering drum



Pressurized air holds seeds in place.



Seed cutoff and release mechanisms.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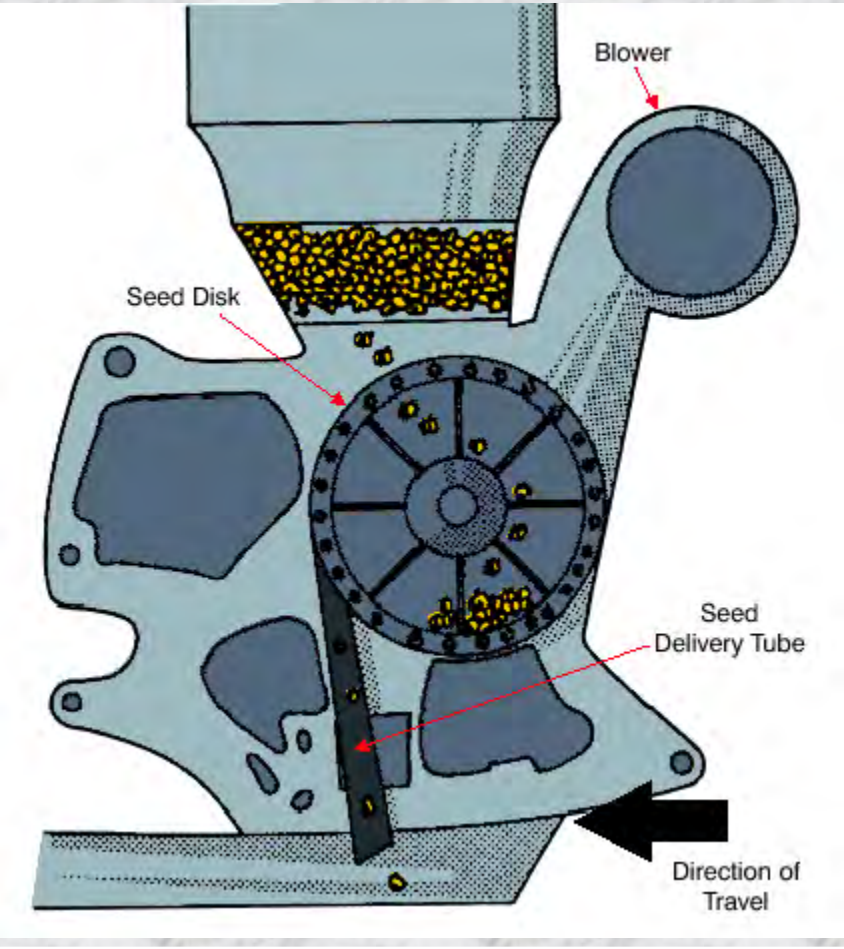
Pressurized metering drum

- 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

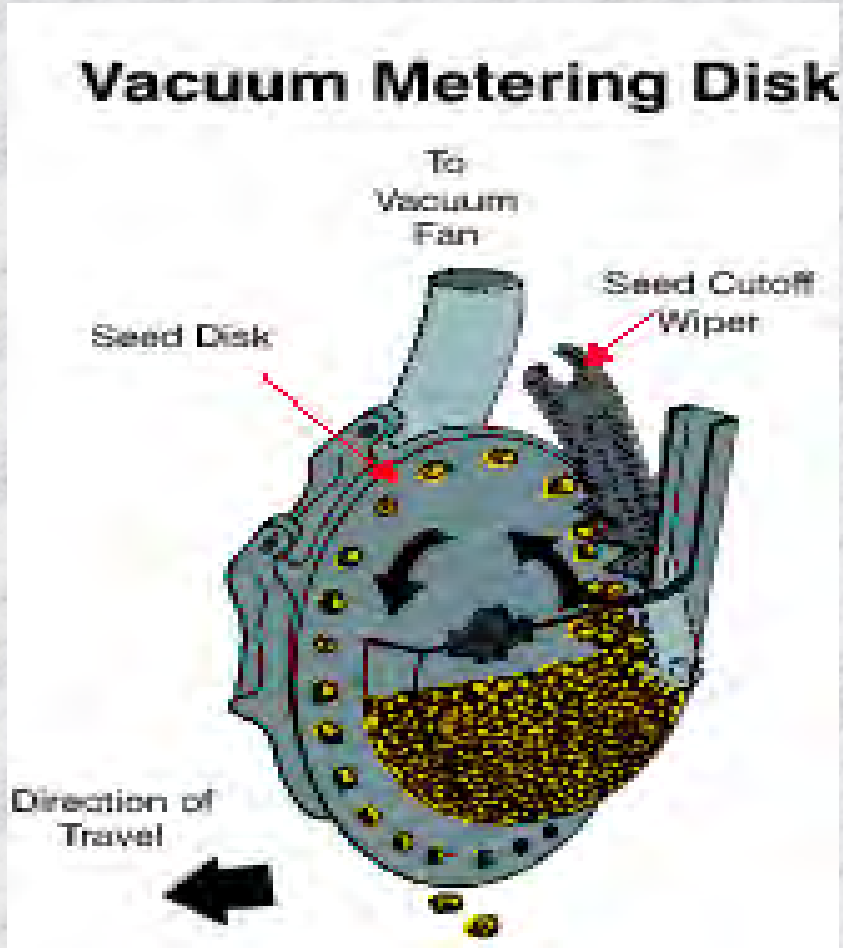
Pressurized metering disk



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

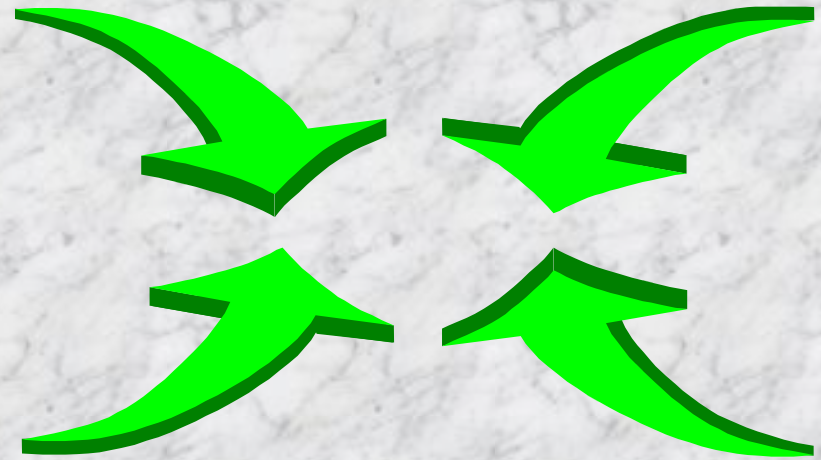
Other attachments

- ***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

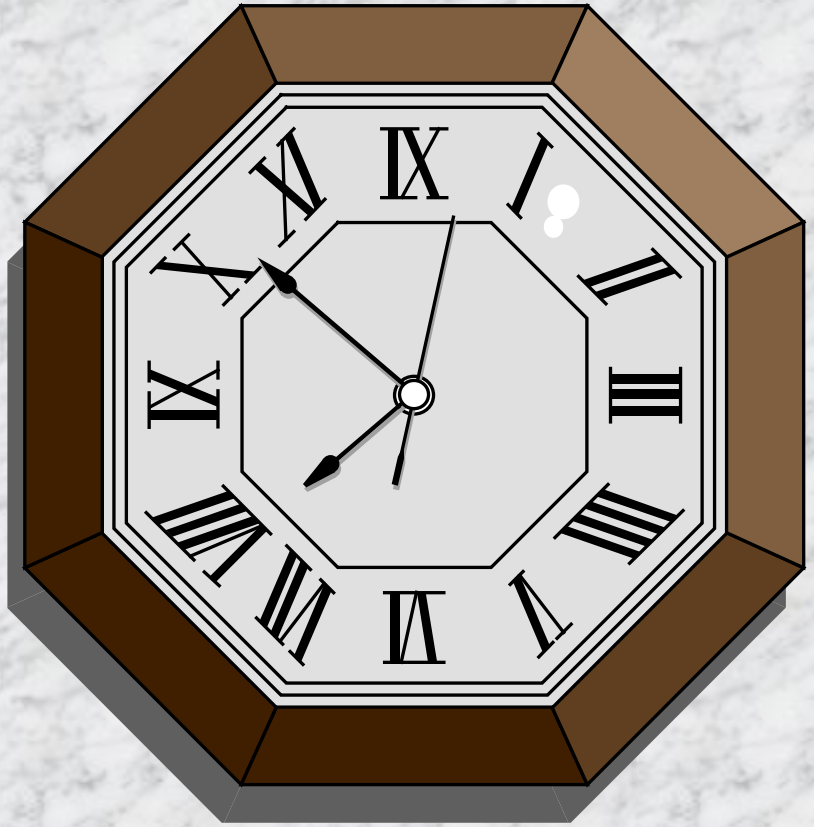
- Leave planter in transport mode
- place a collection container under rows
- turn on drive for a set distance
- count the seeds collected

Objective #6

What are the maintenance procedures for planting equipment?

Proper Maintenance

- Proper servicing can mean 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 of 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?