Farm Machinery and Power

• Equipment in the farm are classified as farm power and farm machinery
• Power provides pull/force required to operate implements… a prime mover only
  – Provide either mobile or stationary operations
• Machinery are tools/implements attached to a power source to manifest the effect of power generated. Without machinery power is useless and without power machinery are not able to perform their intended functions
• Machinery and power are complementary and the combination make up a farm equipment
• Tools….. Without frame and external power source
• Implements …. Several tools mounted on a frame and driven by an external power source
Implement types

• Pulled…trailed
• Mounted
• Semi mounted
• Self-propelled

Operations of farm implements with tractor

• Process of attaching implement to tractor is called Coupling
  • Through … the Hitch system or PTO drive system

• Hitch system
  • Three point linkage at back of tractor … top link and two lower links
    • Corresponding links are established on implement

• Types of hitch system
  • One point or single hitch
  • Two-point hitch and Three-point system

Pto drive (Power take off)

• Tractor provides an auxiliary rotary power through a shaft to implements that require a rotary movement.

• A pair of universal joints attached to a long shaft is used … a pto drive

• Two standard drives for farm implements..
  – 1000rpm and 540 rpm
Power Transmission

• Power from tractors to implements are transmitted to various components called machine elements
• Transmissions elements are used in determining power transmission system of any machine or equipment
• Power transmission methods
  – Belt and pulley drive
  – Shaft and universal joint drive (pto)
  – Sprocket wheel and chain drive
  – Gear drive
  – Hydraulic system

Pulley and belt drives

• Simplest form of transmission, made up of a belt that forms a band around a set of pulley or sheave
• Belt … a flexible material made from natural or artificial rubber, canvas or leather.
  – Flat or vee shaped belt
  – Flat belt…… rectangular, endless by metal fasteners
  – Vee-shaped belt … trapezoidal, reduces slippage, standard sized.
  – Positive drive belt… precision or timing belt … mesh into splines
• Pulley are cylindrical elements in form of wheels on which belt runs. Used on flat belt
  – Crowning prevents slippage
• Sheaves are made of cast iron with grooves embedded along its circumference to accept the shape of a vee - belt
  – Used for vee -belts
• Arrangements
  – Opened or closed (Cross)
• Belt speed ratio
• Belt length
• Driven power
• Belt maintenance
Shaft and universal joint (pto drive)

- A shaft. Hollow or solid bar on which revolving elements are mounted, subjected to all types of loading
- Axle is a solid or hollow bar carrying revolving elements but not subjected to torsion loading
- A spindle is a short rotating shaft
- Shapes are dependent on uses and design but mostly cylindrical

Universal joints

- Used with a shaft to provide efficient power transmission at bends or corners
- Commonly used are Cardan or Hooke joint
- Pto drives are used on mounted or trailed implements such as harvester, sprayer, rotary or vibratory implements where constant angular speed are required

Sprocket Wheel and Chain drive

- Chain drive consist of endless chain whose links are designed to engage the tooth of a heeled sprocket
- Chain
- Sprocket
- Lubrication is essential
- Avoid excessive tension
- No creep
- Distance not restricted
Gear Drives

• Gear is a solid cylindrical element with set of tooth around its circumference
• Gear drive consist of two or more gears that engage each other with the aim of transmitting motion without shock, minimum wear and noise.
• Gear drive is one of the most commonly used trans. system
• Arrangement
  – Simple or Compound
• Types
  – Spur, helical, Bevel, worm
• Characteristics
  – Transmits more efficiently
  – Low power loss
  – Higher cost
  – Speed is inversely proportional to number of tooth on gear
  – Speed Ratio in Toothed Gear
    • Speed ratio for simple arrangement
    • Speed ratio for compound arrangement

Other Elements

• Bearings
  – Radial and thrust
  – Plain or journal and Rolling contact

Lubrication necessary
  effects of lubrication
  reduces friction, acts as coolant, flushes out dirt, prevents corrosion.

• Spring
  – Designed to Provide large elastic deflection under loading
Hydraulic system

• Method of transmitting motion through a fluid medium from a power source to a machine or component
• Allows transmission to a remote or inaccessible sections of a machine
• Makes it easier to convert rotary motion to other forms of motion
• Basic components are pump, actuator, connector, valves, sump, fluid, filters, lines, couplers.

Hydraulic components

• Pump ... creates the flow of the fluid medium
• Converts power from the engine to fluid power
• Motor ... converts fluid power into a rotary motion where required, usually in a far place from power source.
• Actuators: devices that manifest the effect of the pump in the hydraulic system
• They are usually hydraulic cylinders and hydraulic motors
• Valves .... To control actions performed by actuators
• Three groups ... Directional (Spool or Check)
• Pressure Valves (Pressure control, pressure relief, by-pass, priority or pressure sequence valve, reducing valve)
• Volume control valve

• Lines and Couplers
• Lines are flexible tubing or hoses made of steel, copper or synthetic rubber. Have inner and outer cores resistant to oil.
• Inner core reinforced with steel/ layers of wire, or fabric braid to avoid failure
• Strength of hose inversely proportional to diameter
Components Cont’d
- Couplers are used in joining hoses or connect hoses as part of a main system or to a secondary system.
- Hydraulic fluid
- Moving component of the system that transmit power at high pressure
- Also lubricate the system
- Viscosity is ability to resist flow
- Adequate viscosity to prevent leakages and reduced efficiency

- Reservoir or Sump
- Storage for the moving fluid
- Incorporates cooler to remove heat generated by fluid during movement in circuit

Tractor Implement Control Systems
- Nudging
  - Implements control by hand lever at side of operator by pushing forward and back to neutral position for lifting and keeping in position.
- Auto-position
  - Allows selection of predetermined position of implement by positioning the hand lever control. The position is maintained for the implement during operation regardless of leakages or obstructions

- Auto-Draft
  - Allows a selection of pre-determined draft or force required by an implement by a position on the lever control. A sensing device usually attached to the link system maintains the draft regardless of obstruction by varying the depth of penetration if used in tillage practices