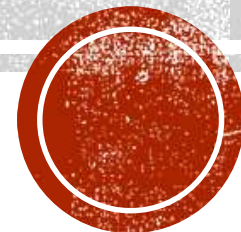




# TRACTORS 101

University of Georgia – Colleges of Family and  
Consumer Science and Agricultural and Environmental  
Science



Instructors – Glen C. Rains, Mason Dean, Kyle Haney

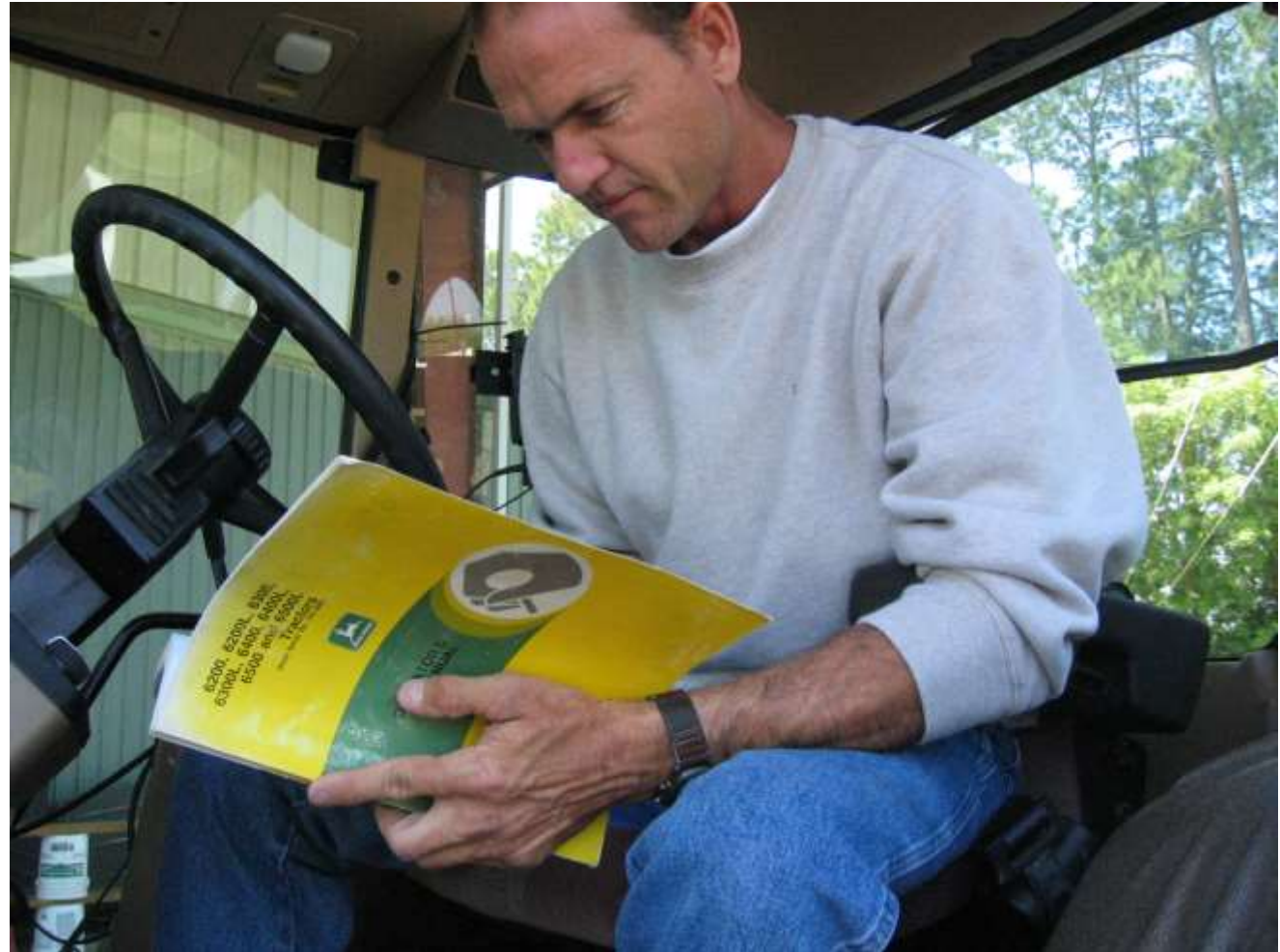
You can download at:

<https://gcrains.weebly.com/safety.html>

# TRACTORS 101



- Read the Operator's Manual



# TRACTOR TYPES

- Wheeled and tracked
- 2WD and 4WD or articulated
- Tricycle front end
- No ROPS and ROPS equipped



# TRACTOR PURPOSE

- Move load (loader, round bale carrier or excavator attachment)
- Remote Power Source (PTO and Hydraulics Couplers)
- Implement Carrier (3-point hitch)
- Transport Unit (pull-type equipment)



# TRACTOR CONTROLS

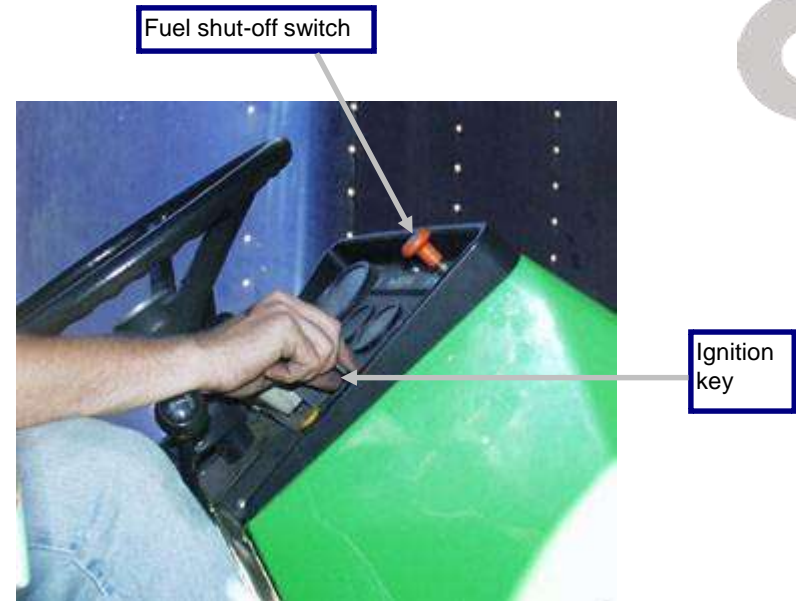


- Color coding for controls:
  - Stop Engine—**RED**
    - Ignition Switch or Pull-to-Stop knob
  - Ground Motion—**ORANGE**
    - Engine RPM's
    - Transmission
    - Brake
    - Differential Lock
    - 4WD
  - Power Engagement—**YELLOW**
    - PTO
    - Augers, cutterheads, feed rolls
  - Positioning and Adjusting—**BLACK**
    - Raise/Lower lower links
    - Remote Hydraulics
    - Light/Flashers/Turn Signals
    - Seat Adjustment



# ENGINE STOP CONTROLS

- The Color **Red**
  - Stop Engine Control
    - Gasoline Engine
      - **Red** letters on key switch
    - Diesel Engine
      - **Red** fuel shut-off switch
      - Older diesel tractors are shut off with a fuel shut-off push/pull knob rather than the ignition key.
      - Newer tractors have electric fuel shut-off solenoid (cut-off with ignition)



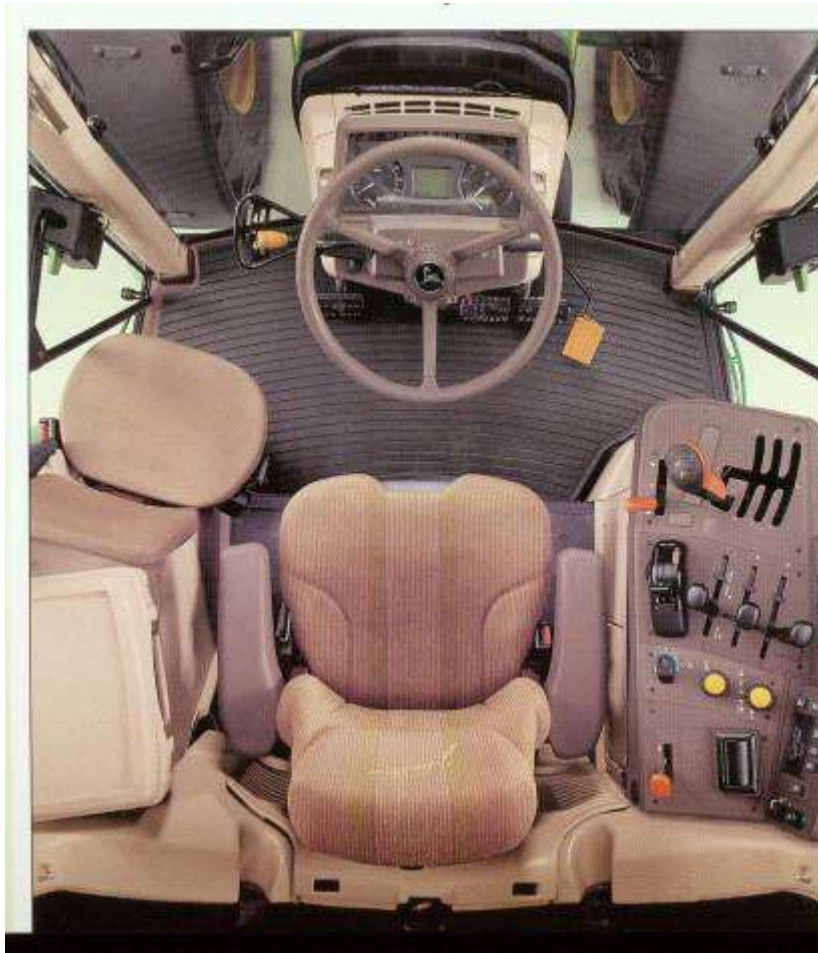
# GROUND MOTION CONTROLS



- The Color **Orange**
  - Engine Speed
  - Transmission Controls
  - Parking Break or Park-Lock
  - Independent Emergency Brakes
  - Differential Lock



# PICTURES OF ORANGE





# SPEED SELECTOR



# POWER ENGAGEMENT CONTROLS



- The Color **Yellow**
  - PTO
  - Cutterheads
  - Feed Rolls
  - Elevators
  - Winches
  - Unloading Augers



# PTO ENGAGEMENT

- **Transmission PTO**
  - PTO is directly linked to transmission
  - Disengages when clutch is pushed in.
  - Older tractors
- **Live(two-stage clutch)**
  - Halfway push in to change gears
  - Push all the way down to disengage PTO
- **Independent**
  - Most common
  - Separate control to engage or disengage
  - Not connected to clutch and independent of transmission



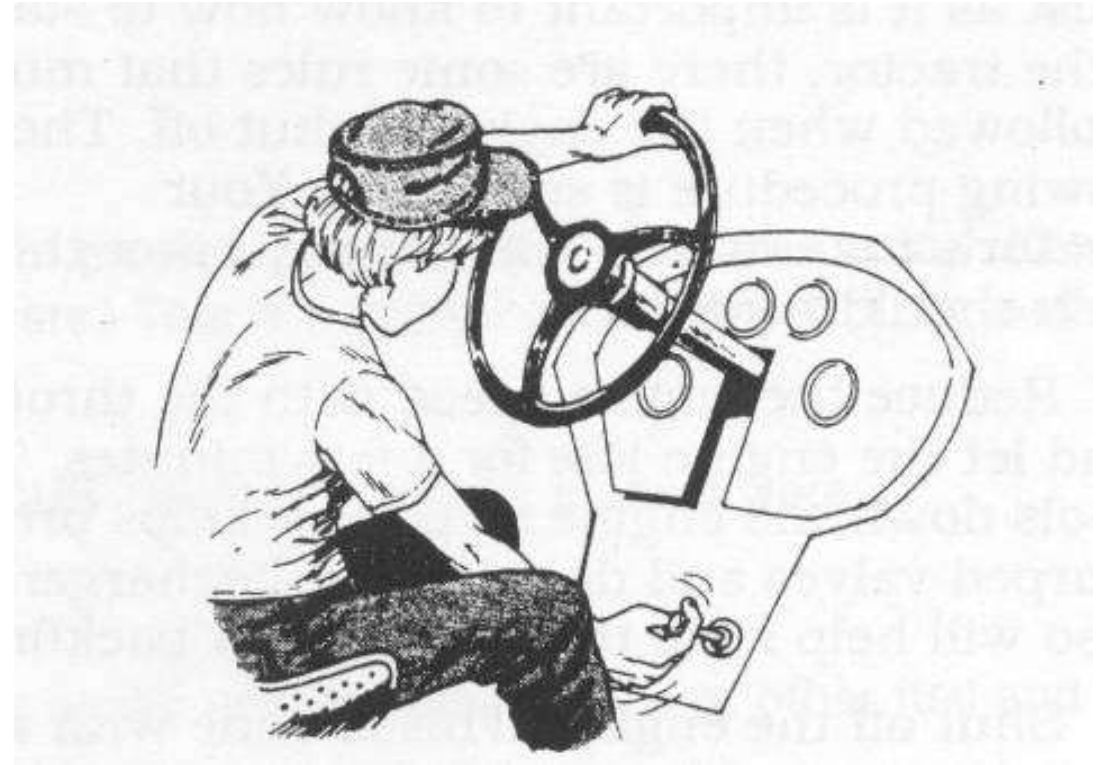
# PICTURES OF YELLOW



# POSITIONING AND ADJUSTING CONTROLS



- **The Color Black**
  - Remote hydraulics
  - Implement hitches
  - Unloading components
  - Engine chokes
  - Steering column position
  - Lights, flashers, signals
  - Cab comforts





# SOME RULES FOR BLACK

- These controls can be knobs, toggle or rocker switches, levers, or pedals.
- Lift controls operated from the tractor seat must be clearly identified and are found on the right side of the cab.
- Front-end loader controls must be located on the right side of the operator.
- Foot controls must be pushed forward to lower equipment.



# PICTURES OF BLACK



# MOVEMENT AND LOCATION OF CONTROLS



## ■ *Brake control*

- Foot brake pedals must be located on the right side.
- Push the brake forward and/or downward to engage.
- If a hand brake is provided, it can be on either side and must be pulled to be set.
- Brake locks may be lifted to be set.



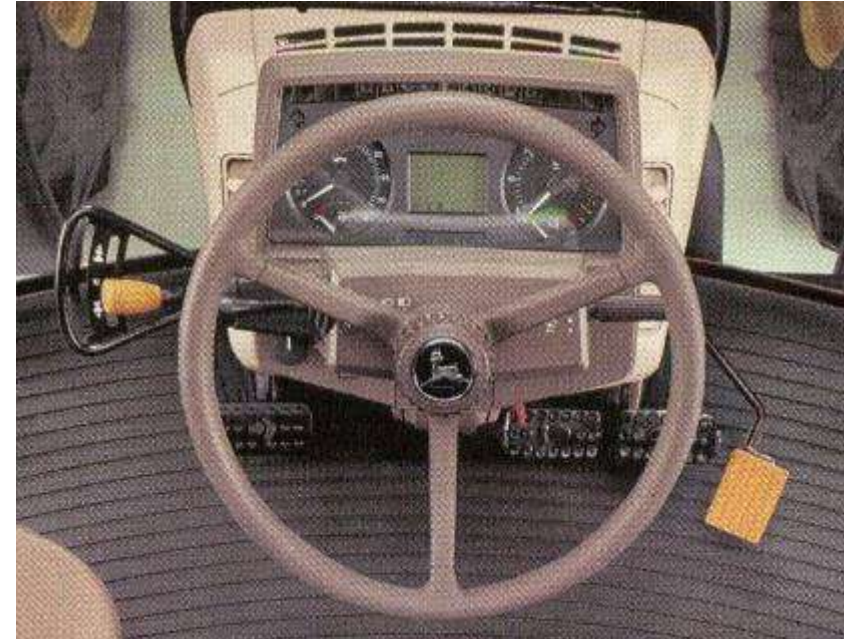


# MOVEMENT AND LOCATION OF CONTROLS



## ■ *Clutch control*

- A foot clutch pedal must be located on the left side.
- The pedal is moved forward or downward for disengagement.
- A hand-operated clutch can be located on either side and must be moved toward the operator to be disengaged.



# MOVEMENT AND LOCATION OF CONTROLS



- *Power Take-Off (PTO) control*
  - A hand-operated PTO control can be located on either side and will be moved upward or forward for engagement and rearward or downward for disengagement.



# MOVEMENT AND LOCATION OF CONTROLS

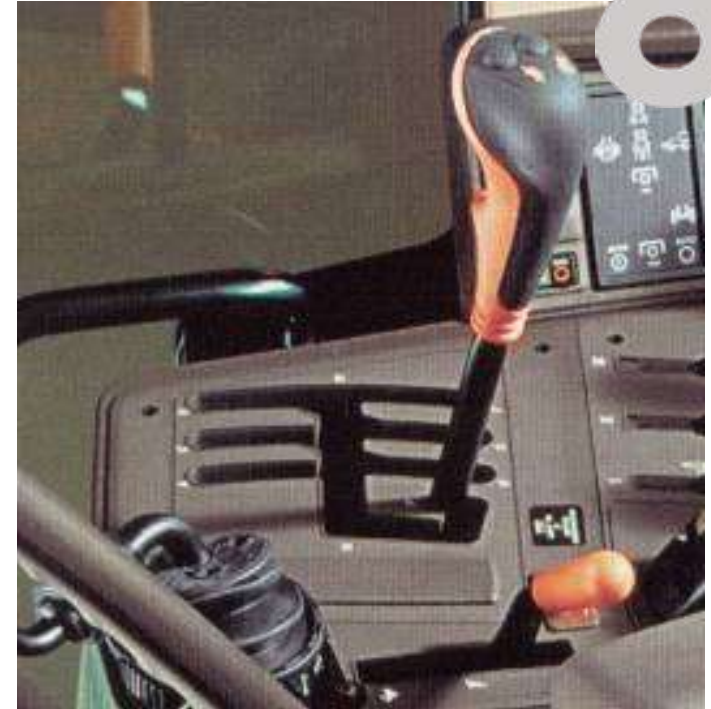
- *Engine speed control*
  - The control is located on the right side.
  - If the hand- operated control is located next to the tractor seat
    - the direction of motion must be forward or upward to increase engine speed and rearward or downward to slow engine speed.
  - If the hand-operated speed control is located near the steering wheel
    - the direction of motion must be rearward and/or downward to increase speed and forward and/or upward to slow engine speed.
  - If a foot-operated control is provided
    - it must be on the right side and moved forward and/or downward to increase speed.



# MOVEMENT AND LOCATION OF CONTROLS

## ■ *Ground speed control*

- A hand-operated forward-reverse (non-variable speed) directional control must be moved forward for forward travel and rearward for reverse.
- A hand-operated variable speed control must be moved forward and/or upward to increase speed and rearward and/or downward to decrease speed.
- A hand-operated combination direction and variable speed control must be moved forward or away from the operator—from the neutral position—for forward travel and increasing speed. To reverse and to increase reverse speed, the control is moved rearward or toward the operator, from a neutral position.



# MOVEMENT AND LOCATION OF CONTROLS



## ■ *Ground speed control*

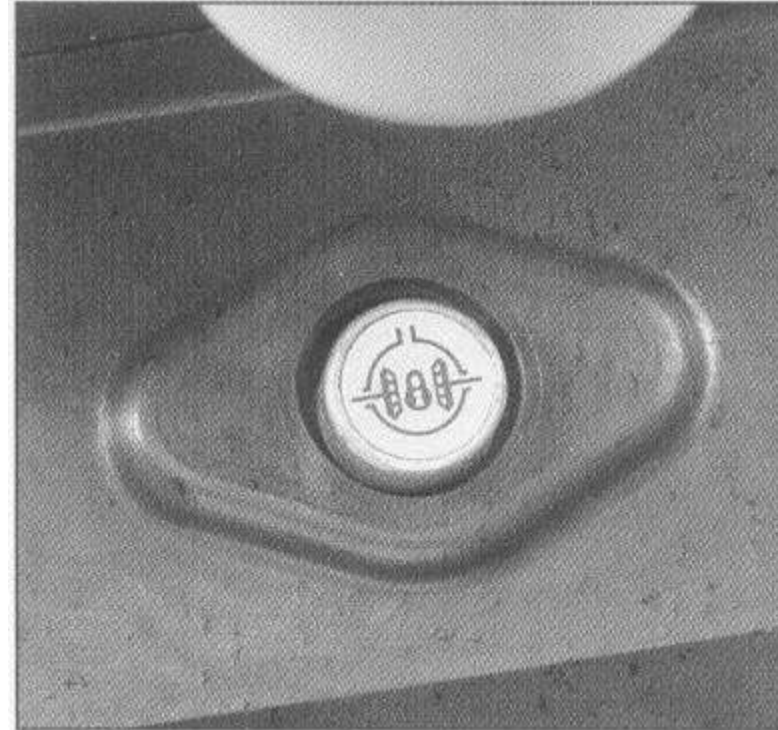
- A foot-operated combination direction and variable speed control(s) must be on the right side.
  - If a single pedal is used, it must produce forward motion with a forward or downward toe motion, and move in reverse with a rearward or downward heel motion.
  - If two pedals are used, the inner pedal must be moved forward or downward for forward motion, and the outer pedal must be moved forward or downward for backing up.
  - Also, the forward or downward pressure on both pedals must increase speed and automatically return to a neutral position when a foot is taken off the pedal.



# MOVEMENT AND LOCATION OF CONTROLS



- *Differential lock control*
  - A differential lock must be moved forward or downward for engagement.



# MOVEMENT AND LOCATION OF CONTROLS



- *Lift controls for implements or attachments*
  - Lift controls must be located on the right side.
  - A hand-operated control must be moved forward, downward, or away from the operator for lowering, and backward, upward or toward the operator for lifting.



# TRANSMISSIONS



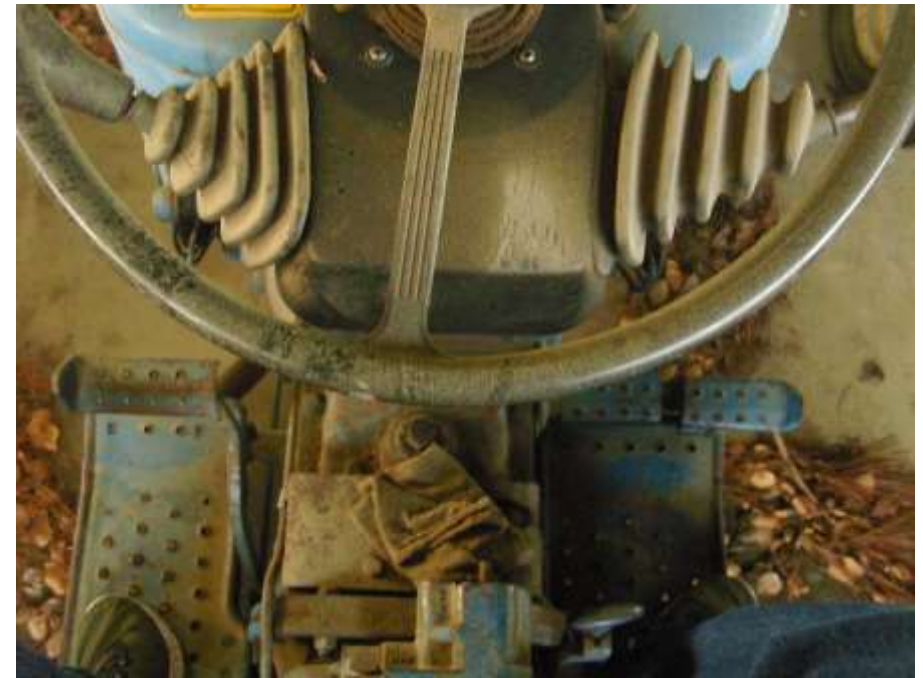
- **Geared (manual)**
  - **Like manual transmission on car, except must be stopped to change gears with clutch and shifter**
- **Hydrostatic – push pedal to go (forward/backward)**
  - **Common on smaller HP engine tractors**
- **Synchromesh – changing gears on the go (like manual transmission on car)**
- **Power Shuttle – change direction with lever without stopping**
- **Power Shift – change gears without stopping in ranges**
  - **Within each speed range you can change gears**
- **Continuously Variable transmission – allows you to select a speed and the engine changes RPMS to maintain that speed under different loads.**





# BRAKES AND CLUTCH

- Two brake pedals on right side.
  - Can be coupled together or separated for individual rear wheel braking
- Clutch is on left side
  - Used to change gears and sometimes to disengage PTO



# FORWARD/REVERSE AND GEARS



Older tractors are not color coded



# TRACTORS 101

- Connecting and Disconnecting
- Connecting to pull-type equipment
  - Drawbar
- 3-point Hitch Equipment
- PTO Connections
- Hydraulics and Hydraulic Connections



# CONNECTING AND DISCONNECTING EQUIPMENT



YES



NO, do not get between tractor and implement



# PULL-TYPE EQUIPMENT



- Equipment Hooks to drawbar on tractor
- Hay balers, Forage choppers, airblast sprayers, peanut combine
- May or may not have additional hook-ups
  - PTO
  - Hydraulic couplings
  - Electrical

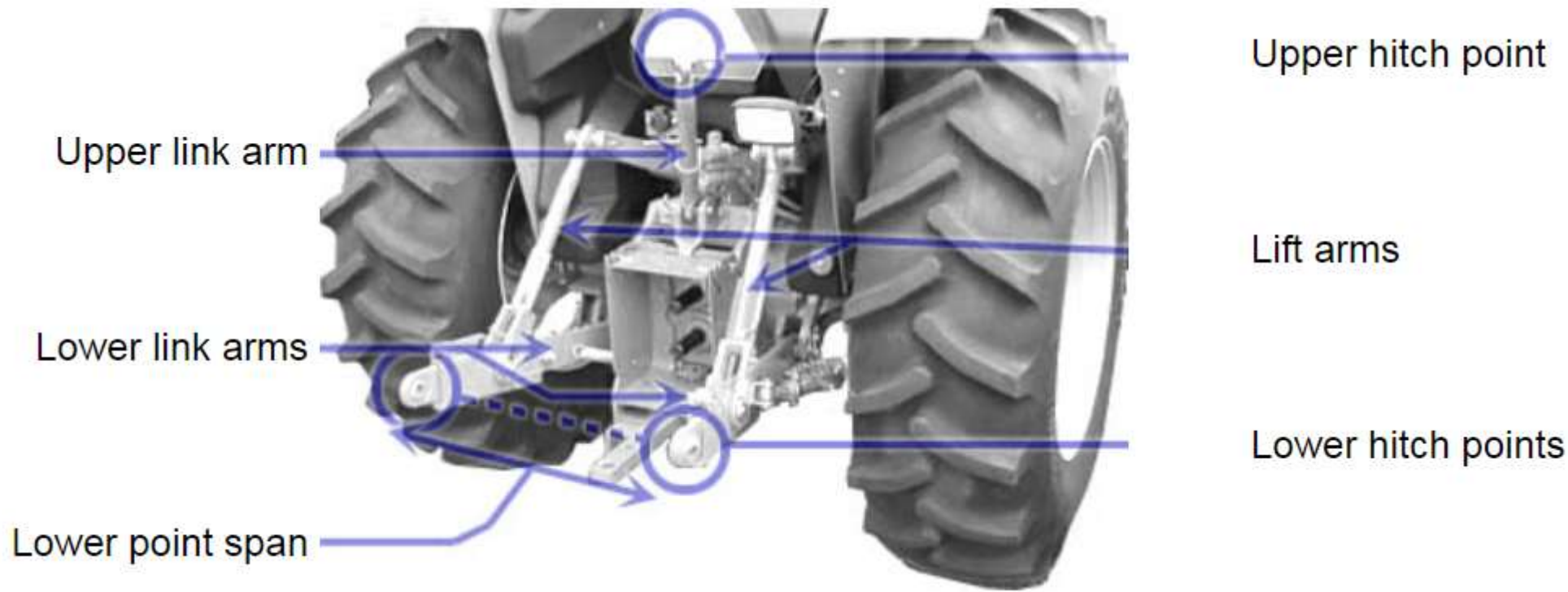


# PULL-TYPE EQUIPMENT



# 3-POINT ATTACHMENTS





### Three-point hitch specifications

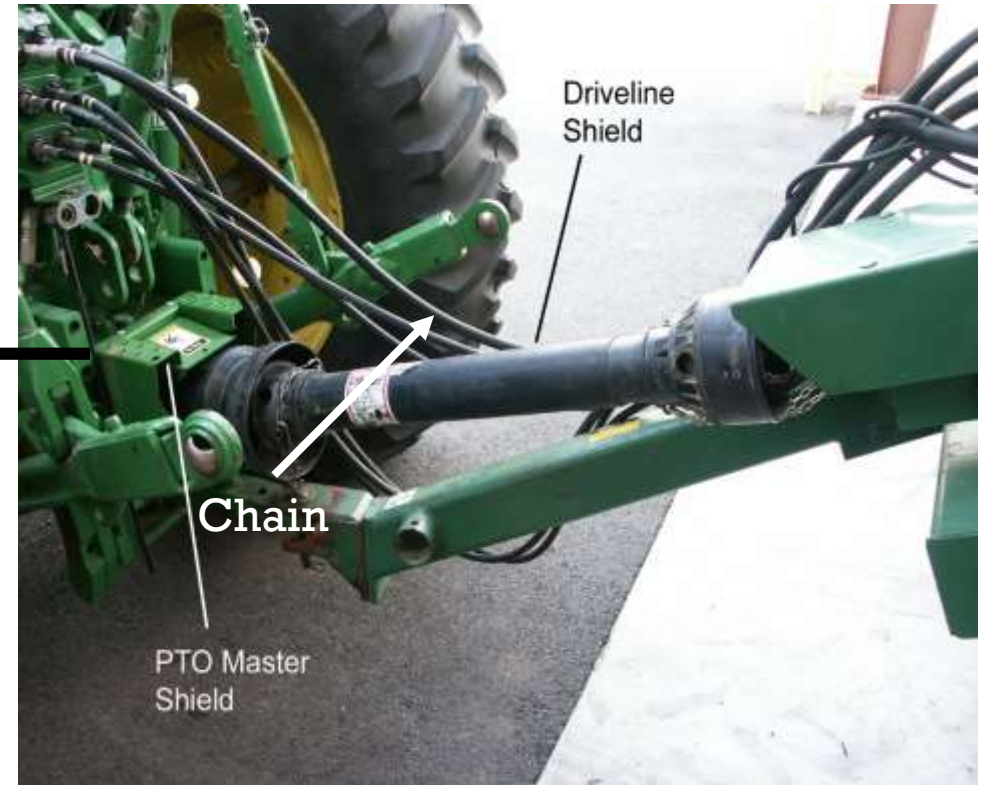
Category	Hitch pin size		Lower hitch spacing	Tractor drawbar power
	upper link	lower links		
0	17 mm ( $\frac{5}{8}$ "	17 mm ( $\frac{5}{8}$ "	500 mm (20")	<15 kW (<20 hp)
1	19 mm ( $\frac{3}{4}$ "	22.4 mm ( $\frac{7}{8}$ "	718 mm (28")	15-35 kW (20-45 hp)
2	25.5 mm (1")	28.7 mm (1 $\frac{1}{8}$ "	870 mm (34")	30-75 kW (40-100 hp)
3	31.75 mm (1 $\frac{1}{4}$ "	37.4 mm (1 $\frac{7}{16}$ "	1010 mm (40")	60-168 kW (80-225 hp)
4	45mm (1 $\frac{3}{4}$ "	51 mm (2")	1220 mm (48")	135-300 kW (180-400 hp)



# PTO BASICS



Pedestal

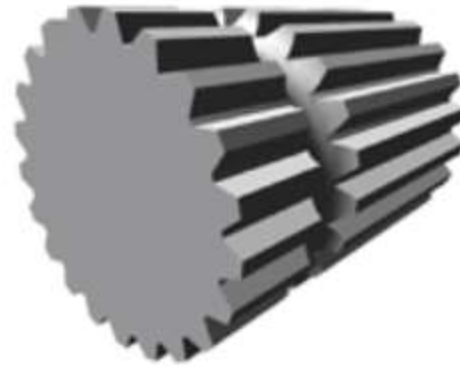
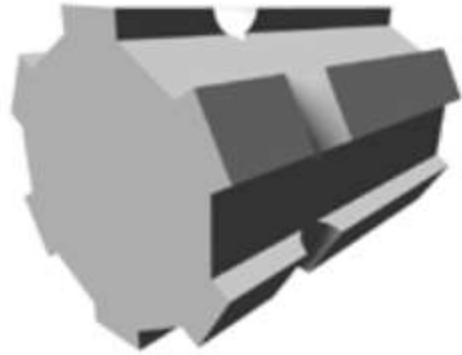


U-Joint





## Tractor PTO Shafts



PTO Type:	Type 1	Type 2
Diameter:	1 3/8" (35mm)	1 3/8" (35mm)
Speed:	540 RPM	1000 RPM
Gear teeth:	6	21
Rotation:	Clockwise, as viewed from end of shaft	



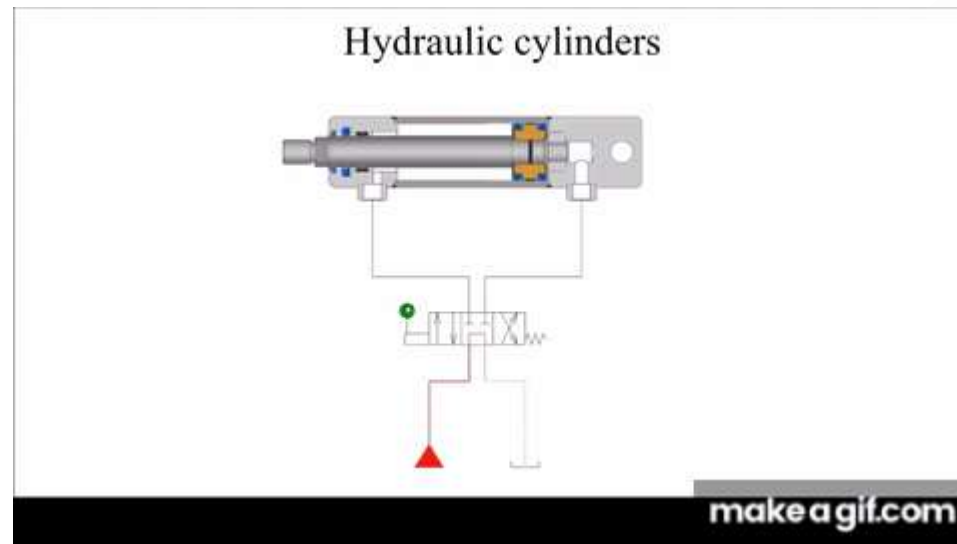
# PTO BASICS



# HYDRAULICS AND HYDRAULIC CONNECTIONS



- Tractors move heavy loads and powerful equipment through the use of hydraulics
- Pressure is 2000-3000 psi
  - This means 2000-3000 lbs of force per square inch of area.
  - A 2-inch hydraulic cylinder can deliver over 9000 lbs of force.
- Temperature over 140 F



# WORKING WITH HYDRAULICS





# TRACTORS 101 - SAFETY

ROPS, or rollover protective structure, is a cab or frame that provides a safe environment for the tractor operator in the event of a rollover.

However, the first ROPS device was not marketed on new tractors until 1965. Many old tractors used today do not have ROPS.

**ROPS**



# MAINTENANCE AND SAFETY CHECK



# ROPS TYPES



2-POST

Fold-Down



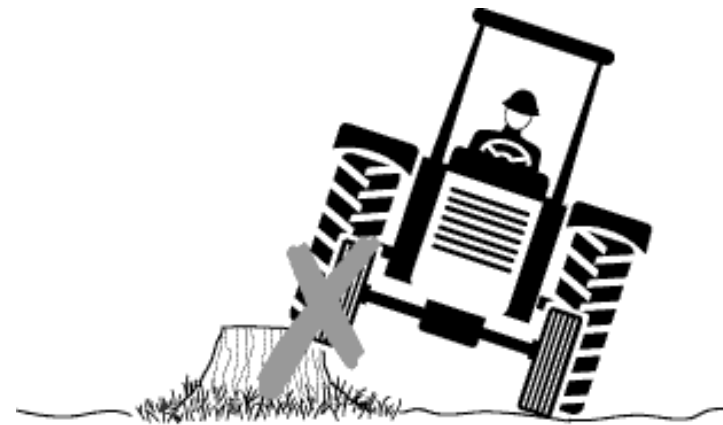
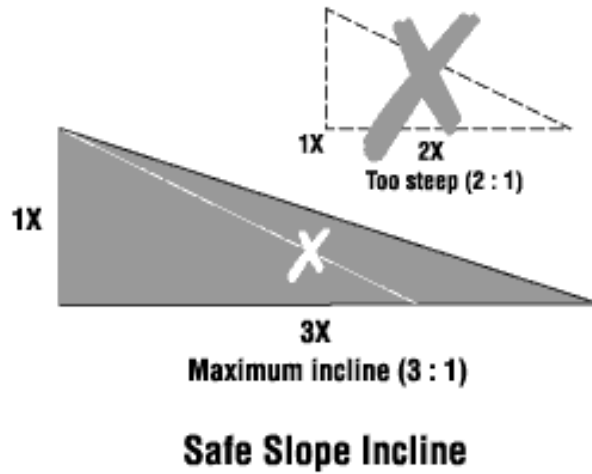
4-POST

2-POST  
CANOPY

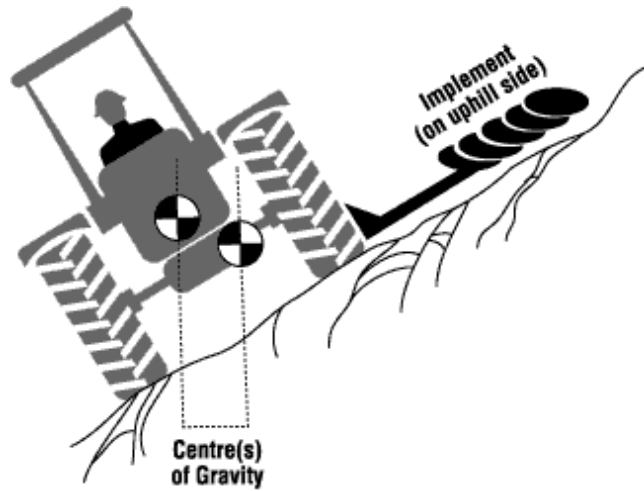




# SIDE ROLLOVER



# PREVENTING ROLLOVER



Operate Implement on Uphill Side

Avoid Field Depressions  
When Possible



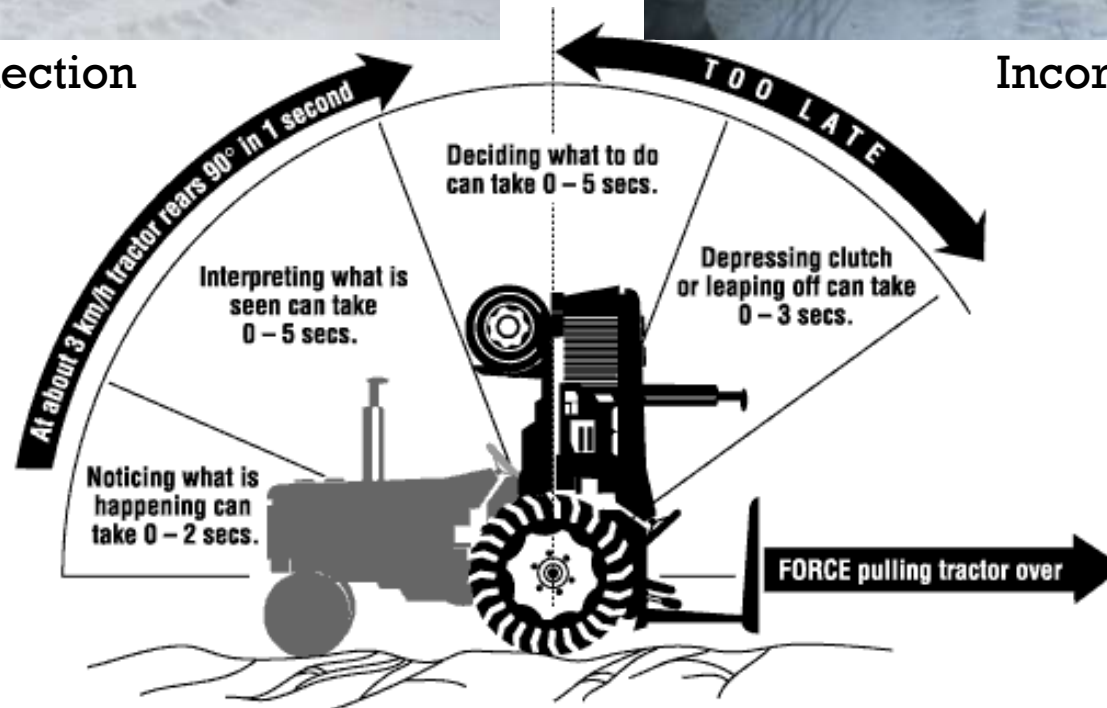
# REAR ROLLOVER



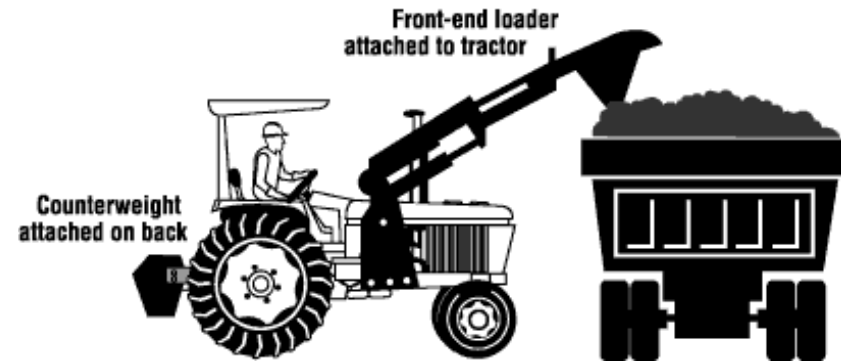
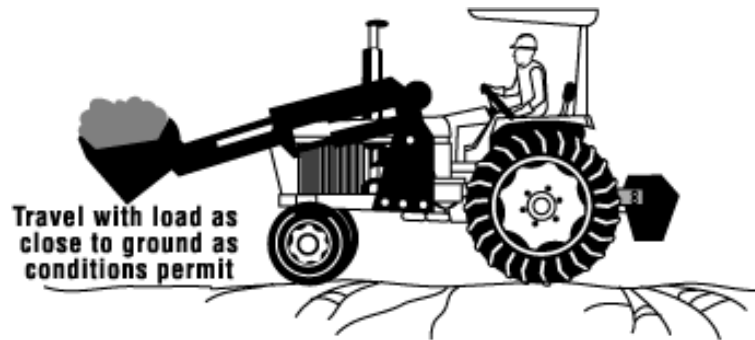
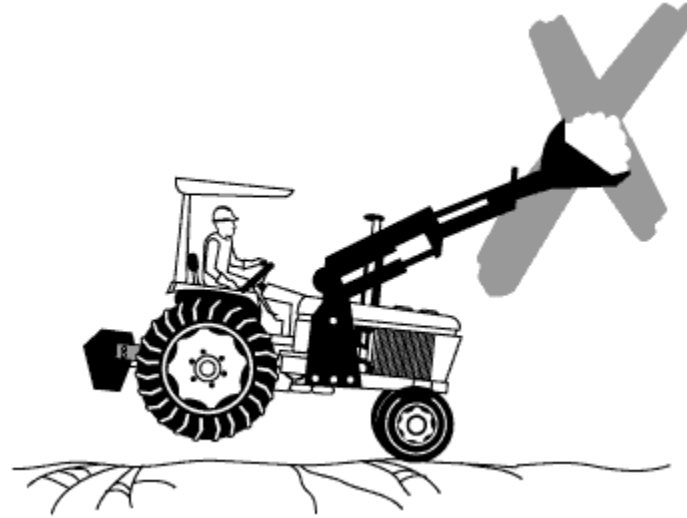
Correct Connection



Incorrect Connection



# OPERATING FRONT-END LOADER



# ENTERING AND EXITING TRACTOR



- Always keep 3 points of contact
- Enter and exit facing tractor
- DO NOT jump down
- Keep steps and floor free of debris

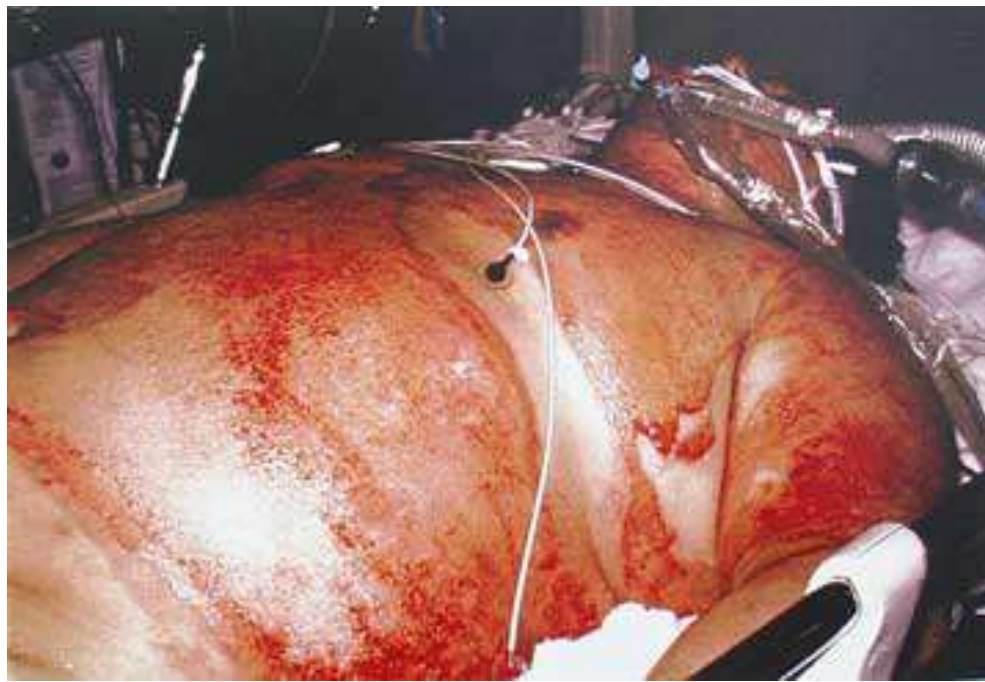


# HYDRAULICS



- Leaks
  - Never use hand to check for leaks
- High Pressure
- Flammable

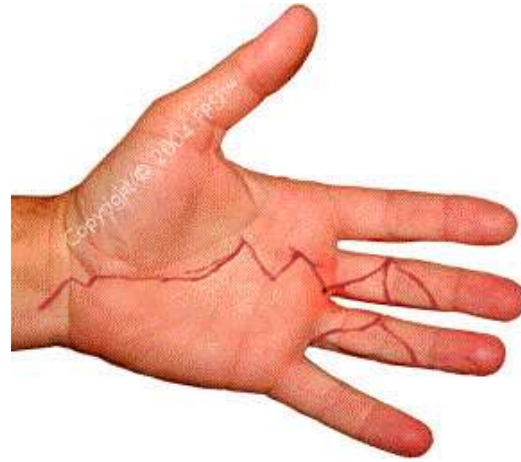
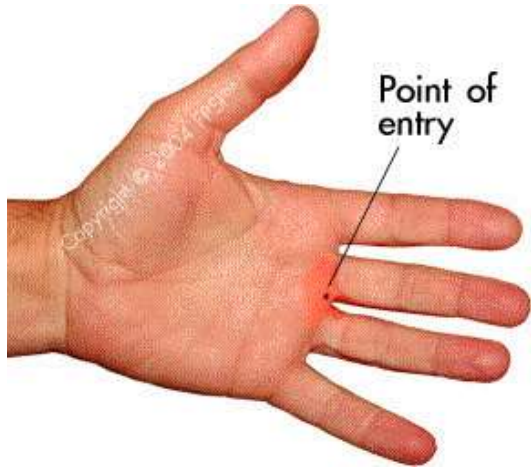




## **Three kinds of hydraulic hazards exist:**

1. burns from the hot, high pressure spray of fluid
2. bruises, cuts or abrasions from failing hydraulic lines
3. hydraulic injection of fluid into the skin.









# HAZARDS OF LOOSE CLOTHING AND HAIR



Long Hair



Loose Clothing

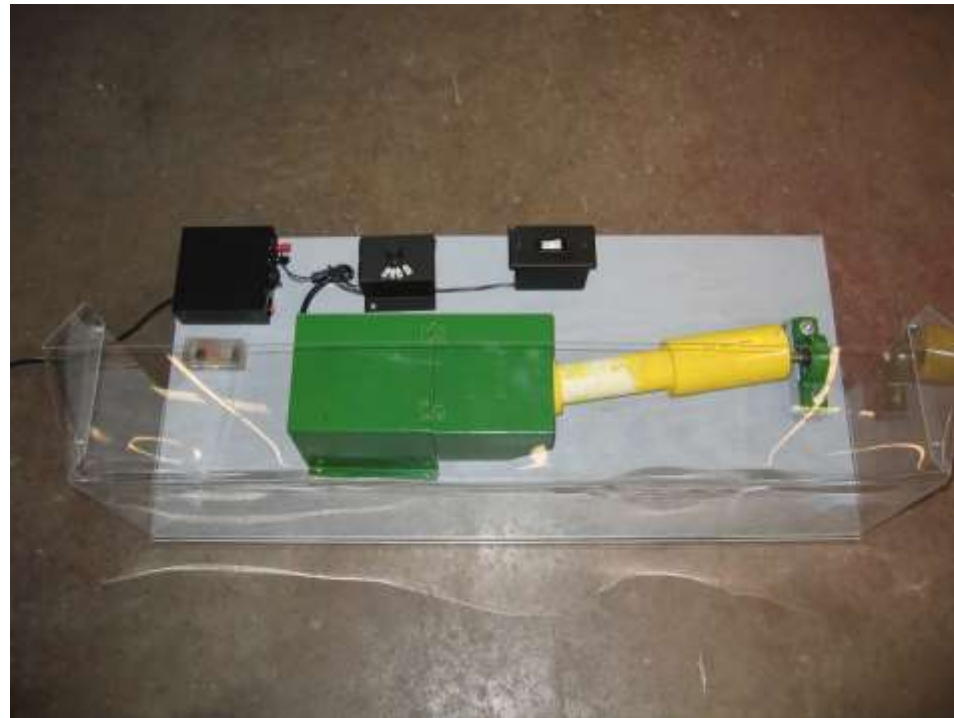


Shoe Strings





# PTO MODEL DEMONSTRATION



# DO NOT GET OFF TRACTOR WITH PTO ENAGED



# NO EXTRA RIDERS



NO!

NO!



# FIELD HAZARDS



ROAD ACROSS DAM



DITCH



IRRIGATION EQUIPMENT



# FIELD OPERATION



Keep Check-in Schedule



You Should have Walkie-Talkie and/or cell phone



# HAZARDS THAT ARE DANGEROUS AND CAN BREAK EQUIPMENT

Disconnect after Use



Avoid Sharp Turns with pull-type machinery



Do not leave PTO Engaged when starting Tractor







# GRAIN AUGER



# BALERS



# ROAD TRANSPORTATION





SPEED  
LIMIT  
35





# TRANSPORTING A LOAD ON TRAILER

- <https://www.youtube.com/watch?v=aWqQtU2n1G4>



## Chain Working Load Limits (lbs)

Chain Diameter	Grade 30	Grade 43	Grade 70	Grade 80	Grade 100	Grade 120
1/4"	1,300	2,600	3,150	3,500	4,300	-
9/32"	-	-	-	-	-	5,200
5/16"	1,900	3,900	4,700	4,500	5,700	6,600
3/8"	2,650	5,400	6,600	7,100	8,800	10,600
7/16"	3,700	7,200	8,750	-	-	-
1/2"	4,500	9,200	11,300	12,000	15,000	17,900
5/8"	6,900	13,000	15,800	18,100	22,600	-





# TRACTOR AND EQUIPMENT NOISE

Permissible Noise Exposures:

<u>Duration Per Day (hours)</u>	<u>Sound Level, dB(A)</u>	
8	90	
6	92	
4	95	Motorcycles
2	100	
1	105	
1/2	110	Chain Saw
1/4	115	Rock Concert

Table 3.2. Exposure time limits to sound levels decrease as the db(A) level increases. Use the chart on page 1 to answer the following questions. What is the sound level at your high school dance or at a rock concert? How long should you be exposed to that intensity of sound pressure level?





# EAR PROTECTION

An NRR of 25 reduces noise levels by 25 dB.  
 An NRR of 33 reduces noise levels by 33 dB.



## Painful:

150 dB = Rock Concerts at Peak

140 dB = Firearms, Air-Raid Siren, Jet Engine

130 dB = Jackhammer

120 dB = Jet Plane Take-off, Amplified Music at 4-6 ft., Car Stereo, Band Practice

## Extremely loud:

110 dB = Machinery, Model Airplanes

100 dB = Snowmobile, Chain saw, Pneumatic Drill

90 dB = Lawnmower, Shop Tools, Truck Traffic, Subway

## Very loud:

80 dB = Alarm Clock, Busy Street

70 dB = Vacuum Cleaner

60 dB = Conversation, Dishwasher

## Moderate:

50 dB = Moderate Rainfall

40 dB = Quiet room

## Faint:

30 dB = Whisper, Quiet Library



# SUN EXPOSURE

- This photo from the *New England Journal of Medicine* shows the extreme photoaging of a 69-year-old truck driver whose left side sat exposed to Ultraviolet-A sun rays for more than 25 years. A team of Northwestern dermatologist and laser surgery experts are treating the patient in an effort to restore as much of his facial features as possible.





Questions?

