Machinery Unit Plan

# Introduction

Basic machinery skills are used in many jobs in production agriculture. This lesson is designed to provide classroom instructional materials and for the agricultural mechanics CDE (state and national). These topics will lay a foundation for more advanced machinery skills such as troubleshooting, machinery management, and operation techniques. The realm of machinery is vast. The unit focuses on tractors and introduction to common equipment.

Note: That small engines curriculum is another avenue to introduce machinery. Small engines units are found in a number of textbooks. Small engines allow students to gain understanding of engine theory, demonstrate mechanical skills, and practice troubleshooting skills.

# Teacher Preparation

For teachers unfamiliar with agriculture machinery, we suggest the resources below be reviewed before teaching in addition to the videos provided with this curriculum. Teachers should practice the provided activities.

## Print Materials

John Deere Publishing:

Machinery Management

Tractors

Hydraulics

Engines

Tillage

Planters

Note: The John Deere books are well suited to a high school audience with many illustrations. John Deere also has companion materials for teachers that are useful. See link below. The current catalog is provided in the resources folder.

Agricultural Technical Systems and Mechanics, 2nd Edition, 2019

Agricultural Mechanics and Technical Systems, 2017

Agricultural Mechanics: Fundamentals and Applications, 7th edition, 2015

## Websites:

<https://www.deere.com/en/parts-and-service/manuals-and-training/>

<https://www.br-automation.com/en-us/products/software/>

## Teacher Notes

* Files are organized by type in folders as described under “Resources”. Files are editable and teachers are encouraged to customize as needed.
* The unit plan is designed in small topics so the instructor can combine to fit into their curriculum.
* Time estimates include classroom instruction and activities. These are estimates and should be used as a guide only. Teaching methods, period scheduling, class size, and the ability to leave an activity setup can impact the instructional time greatly.
* While PowerPoint is useful teachers are to use hands on instruction wherever possible using actual equipment.
* The material format can be used as a model to expand to other equipment that you may want to cover.

## Teaching Methods

* Some activities may have limited equipment (like the number of tractors available). Consider rotating through activities concurrently. Activity rotations can be designed to allow for more students to participate simultaneously.
* Use actual tools rather than PowerPoints when possible.
* Do hands on demos instead of videos when possible.
* Look to develop examples at your school. For example, use a car to do a pre-op check if you do not have access to a tractor.
* Your school maintenance department most likely has a tractor or lawn mower you could use for some of the activities.

## Required Equipment

* Tape measures (25’ steel tape, fiberglass tape)
* Precise measuring tools (ex. calipers)
* Basic mechanics tool set
* Clean/reusable rags
* Cups
* Tractors, implements, other agriculture equipment
* (See activities for more specific requirements)

## Interest Approach

The agriculture industry is diverse and is embedded into the very nature of our being. Machinery, tractors, and implements are designed to improve the efficiency and effectiveness in all aspects of agriculture. There is a need for tractor operators, technicians, engineers, sales and other professions that are focused solely on the equipment used in agriculture. Due to the growing demands for mechanization, careers in this aspect of agriculture are growing and in need of intelligent people to fill the needs of this crucial industry. The skills learned in this content area are used universally in areas such as diesel mechanics, auto mechanics, machinists, and many other career fields.

## Math Skills

* Calculating field efficiency
* Calibrating sprayers and planters

## Student Learning Outcomes

At the completion of the unit the students should be able to:

* Identify equipment, tractors, and common implements
* Practice safe practices when operating equipment
* Calibrate a sprayer/planter
* Classify equipment as to need, capacity, use
* Identify engine, hydraulic, powertrain and electrical systems
* Use a multi-meter
* Identify and describe different types of implements used in agriculture machinery
* Have a basic understanding of tillage and hay equipment
* Complete a proper pre-operation and safety check on a tractor
* Understand and identify equipment used in precision agriculture
* Explains farming with Global Information Systems (GIS)
* Safely and properly hitch a tractor

# Unit Plan

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Topic | Time (hours) | PPT | Assessment | Activity | Video | Resources |
| 1 Introduction | .5 | X |  |  |  | X |
| 2 Tractor Safety | 2 | X | X |  |  | X |
| 3 Agriculture Tractors | 1.5 | X | X |  |  | X |
| 4 Pre-Operation Check | 1.5 | X | X | X |  | X |
| 5 Tractor Hitching | 1.5 | X | X | X |  | X |
| 6.0 Tractor Power Systems | 1 | X | X | X |  | X |
| 6.1 Hydraulics | 1 | X | X | X |  |  |
| 7.0 Tillage ID | .5 | X |  |  |  |  |
| 7.1 Tillage Principles | 1.5 | X | X |  |  | X |
| 8.0 Sprayer ID | 2 | X |  |  |  |  |
| 8.1 Sprayer Calibration | .5 | X | X | X |  | X |
| 9.1 Planter and Seeder ID | .5 | X | X | X |  | X |
| 9.2 Hay Equipment ID | .5 | X | X | X |  | X |
| 9.3 Grain Drill Parts ID | .5 | X | X | X |  | X |
| 10 Precision Agriculture | 1 | X |  |  |  | X |
|  Total | 16.5  | 16 | 9 | 11 |  | 4 |

# Instruction Resources:

## PowerPoints

Machinery 01 Introduction.pptx

Machinery 02 Tractor Safety.pptx

Machinery 03 Agricultural Tractors.pptx

Machinery 04 Machinery Pre-Check Inspections.pptx

Machinery 05 Tractor Hitching.pptx

Machinery 06.0 Tractor Power Systems.pptx

Machinery 06.1 Hydraulics.pptx

Machinery 07.0 Tillage Implement ID.pptx

Machinery 07.1 Tillage Principles.pptx

Machinery 08.0 Sprayer Implement ID.pptx

Machinery 08.1 Sprayer Calibration.pptx

Machinery 09.1 Planters and Seeders ID.pptx

Machinery 09.2 Hay Equipment.pptx

Machinery 09.3 Grain Drill ID.pptx

Machinery 10 Precision Agriculture.pptx

## Guided Notes

Machinery GN Lesson 01 Introduction.docx

Machinery GN Lesson 02 Safety.docx

Machinery GN Lesson 03 Ag Tractors.docx

Machinery GN Lesson 04 Machinery Pre-Check.docx

Machinery GN Lesson 05 Tractor Hitching.docx

Machinery GN Lesson 06.0 Power Systems.docx

Machinery GN Lesson 06.1 Hydraulics.docx

Machinery GN Lesson 07.0 Tillage ID.docx

Machinery GN Lesson 07.1 Tillage Principals.docx

Machinery GN Lesson 08.0 Sprayer ID.docx

Machinery GN Lesson 08.1 Sprayers and Calibration.docx

Machinery GN Lesson 09.1 Planters and Seeders ID .docx

Machinery GN Lesson 09.2 Hay Equipment ID.docx

Machinery GN Lesson 09.3 Grain Drill ID.docx

Machinery GN Lesson 10 Precision Agriculture.docx

## Activities

Machinery 04 Pre-Operational Check Activity.docx

Machinery 05 3 Pt Hitching.docx

Machinery 05 Tractor Hitching.docx

Machinery 06 Mower-Shredder Study.docx

Machinery 06.1 Hydraulic Testing Activity.docx

Machinery 07 Boarder Maker-Blocker Study.docx

Machinery 07 Chisel-Ripper Study.docx

Machinery 07 Discs Study.docx

Machinery 07 Field Cultivator Study.docx

Machinery 07 Land Plane Study.docx

Machinery 07 Lister-Bed Maker Study.docx

Machinery 07 Plow Study.docx

Machinery 07 Ring Roller Study.docx

Machinery 07 Rolling Cultivator Study.docx

Machinery 07 V Chisel Study.docx

Machinery 08 Chemical Sprayer Study.docx

Machinery 08 Orchard Sprayer Study.docx

Machinery 08 Sprayer Calibration Activity.docx

Machinery 09.1 Corn Seed Planter Study.docx

Machinery 09.1 Grain Drill Study.docx

Machinery 09.2 Baler Study.docx

Machinery 09.2 Hay Rake Study.docx

Machinery 09.2 Windrower-Swather Study.docx

Machinery 09.3 Grain Drill Calibration.docx

Machinery Implement Study Directions (all).docx

Machinery Implement Studies (04, 06, 06.1, 07, 07.1, 08, 08.1, 09.1, 09.2, 09.3, 09.4)- There are many equipment studies in the activities folder. Each study is labeled with the unit of study it aligns with as well as the name of the implement or equipment. The purpose of these activities is to allow students to learn about specific pieces of equipment. The documents are “lab sheets” that have questions about certain pieces of equipment. They can be altered to fit the equipment you have available. The directions on how to use these forms are on the document labeled “Machinery Implement Study Directions”.

## Assessments

Machinery 02 Tractor Safety Key.docx

Machinery 02 Tractor Safety Test.docx

Machinery 03 Tractor ID Answer Sheet.docx

Machinery 03 Tractor ID Quiz.pptx

Machinery 04 Pre-Check Inspection Quiz.docx

Machinery 05 Ag Tractors Quiz.docx

Machinery 06.0 Power Systems Quiz.docx

Machinery 06.1 Hydraulics Quiz.docx

Machinery 07 Tillage Implement- Quiz.docx

Machinery 08 Sprayers and Calibration - Quiz.docx

Machinery 09.1 Planters and Seeders ID Answer Sheet.docx

Machinery 09.1 Planters and Seeders ID Quiz.pptx

Machinery 09.2 Hay Equipment ID Answer Sheet.docx

Machinery 09.2 Hay Equipment ID Quiz.pptx

Machinery 09.3 Grain Drill Parts ID Quiz.pptx

Machinery Tractors-Equipment-Implements Quiz.docx

## Videos

(under development)

## Resources

Backpack-and-Hand-Held-Sprayer-Calibration.pdf

Ballasting Tractors.docx

Calibration of sprayers formulas.doc

Calibration Formula Scenario Practice.pdf

Cultural Practices.pptx

Estimating Fixed Costs.pptx

Facts and formulas .doc

Fuel and Lubrication Costs.pptx

Grain Drill Calibration.docx

Improving Efficiency.pptx

JD Publishing Catalog.pdf

Machinery Hitching.docx

Machinery ID.pptx

Machinery Identification Full.docx

Machinery Management Intro.pptx

Measuring Capacity.pptx

Measuring Wheel Slip.docx

Power Ratings and Matching.pptx

Production Agriculture.pptx

Setting the Proper Tractor Tire Pressure.docx

The drawbar is the place to hitch.pdf

Tractor Check.docx

Tractor Safety Outline.docx

Tread Width, Wheels and Tires.pptx

Read through the resources folder as there is additional curriculum and information that adds to this unit.

# Outlines:

Detailed outlines can be found in the PowerPoint slide decks. To print choose File | Print then select Outline. Some slides also contain notes. These can be viewed with the slide or printed as notes pages.

# Standards and Skills:

## Oregon ANFR:

AGPT01.01.05 Compare efficiency of energy sources.

AGPT01.03.01 Investigate solutions to AFNR power, structural, and technical systems.

AGPT01.04.01 Design or modify equipment, structures, or biological systems to improve performance of an AFNR enterprise or business unit.

AGPT02.01.01 Maintain machinery and equipment by performing scheduled service routines.

AGPT02.01.02 Lubricate machinery and equipment.

AGPT02.01.05 Perform machine adjustments (e.g., belts, drive chains).

AGPT02.01.10 Design a preventive maintenance schedule.

AGPT02.01.12 Calibrate metering, monitoring, and sensing equipment.

AGPT02.02.01 Perform service routines to maintain power units and equipment.

AGPT02.03.01 Operate machinery and equipment while observing all safety precautions.

AGPT02.03.02 Describe function of machine controls and instrumentation.

AGPT02.03.06 Perform pre-operation inspection.

AGPT03.01.02 Describe principles of operation.

AGPT03.01.03 Identify engine systems and components.

AGPT03.02.03 Describe principles of operation of various power transmission systems.

AGPT03.03.02 Describe features, benefits, and applications of types of hydraulic systems.

AGPT03.06.01 Service electrical systems by troubleshooting from schematics.

## Oregon Ag Mechanics CDE:

**AGRICULTURAL POWER AND MACHINERY**

1. Tractor Power –

a. Identify external parts of the tractor.

b. Problem solving according to manufacturer’s specifications

2. Agricultural Machinery –

a. Identify the parts of the current year’s identified machine.

b. Adjust and/or calibrate machinery.

## National FFA CDE Skills:

* Identify safe machinery operational practices.
* Identify the recommended service and maintenance operations from the operator’s manual.
* Identify functions of machinery components.
* Identify parts and functions of hydraulic systems.
* Identify safe adjustment [level] on power equipment.
* Identify repair procedures, techniques and materials.
* Match tractors to implement.
* Adjust equipment hitches and drives.
* Adjust and/or calibrate chemical application, seeding, fertilizing, harvesting, processing and materials handling machinery.
* Install, operate, maintain, adjust and evaluate machine systems for field conditions.
* Select and use appropriate safety equipment.
* Identify safe machinery operation practices for field and highway conditions.
* Identify the recommended service and maintenance operations from the operator’s manual.
* Operation and interpretation of circuit diagrams and flowcharts for electrical, hydraulic, fuel, oil, cooling, intake, and exhaust systems.
* Describe principles of power transmission.
* Identify the parts and functions of electrical, hydraulic, lubrication, cooling, governor and fuel systems.
* Conduct a pre-operation inspection of a tractor or implement.
* Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.