Oakland CUSD #5

Ag Mech

April 20-24, 2020

Jeff Coon

Week of April 20-24, 2020

All of these assignments are on google classroom. You must pick one of the 3 listed and complete by next Monday April 20 for credit. If you would like to use google docs to complete the work that would be most efficient, just remember to start a new copy with your own work please. Paper copies can be returned to the school.

Class	Choice 1	Choice 2	Choice 3 (Enrichment)
Ag Science	Common Breeding	Starting an sae	FFA Official dress
Ag Business Mang	MaInvestments	Life Insurance	Business Plan
BSAA	Advanced DNA	Animal Repro Systems	Domestic Animals
Landscape Design	Environment	Landscape tools	Landscape IPM
Intro To Ag	FFA Creed	Parly pro	World food supply
Ag Mech.	Profile Leveling	Power tools	Precision Ag

Choice 1

Mr. Coon Ag Mech Profile Leveling April 20 - 24

Checking Your Knowledge:

1. How are field note pages organized?

2. How are field notes completed?

3. Why should profile notes in the field notebook be completed as the survey is completed?

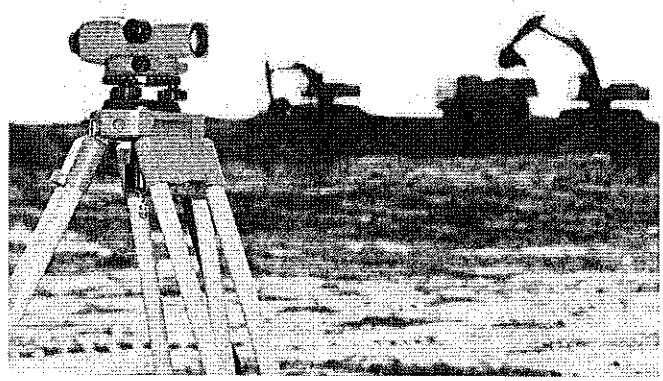
4. Why is accuracy in surveying notes important?

5. How is allowable error calculated?

Coon April 20-24 Choice 1

Profile Leveling

WHEN SURVEYING, measurements are often needed for many points along a line rather than just two points as in calculating slope. For this reason, profile leveling is an important skill. Profile leveling is used when installing field tiles, constructing roads, and many other applications in everyday life. It is important to know how to conduct the survey. In addition, accurate measurements and notes will ensure a quality survey with reliable results. Knowing these skills may lead to a successful career in surveying.



Objective:

Conduct profile leveling surveys, and calculate allowable error in a survey.

Key Terms:

- allowable error
- backsight
- benchmark
- elevation
- field notes
- foresight
- height of instrument
- profile leveling
- station
- turning point

Understanding Profile Leveling

Profile leveling is the process of determining the elevations of a series of points at measured intervals along a line. Whereas slope calculations are determined from measurements between two points, a profile survey takes measurements of a series of points along a slope. A profile survey is extremely useful for locating drains, roads, dams, and other earth structures.

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TERMS IN PROFILE LEVELING

The usual procedure in profile leveling is to determine the elevations along the profile line, choose the grade elevations needed, and compute cuts or fills. The procedure for completing a profile survey is relatively simple, but accurate completion relies on a foundation of knowledge.

Benchmark

The first reading is taken on a point known as a benchmark. A **benchmark** is a permanent point of known or assumed elevation from which a leveling survey is started. A benchmark is used in closing out a survey to calculate for measurement error.

Elevation

Elevation is the height of a point relative to the benchmark location of the survey. Most surveys start with an assumed elevation of 100 feet to prevent negative numbers. To calculate the elevation of a point, subtract the foresight from the height of instrument.

Station

When completing a survey, the target readings are taken at a point known as a station. A **station** is the location of the leveling rod when the reading is being taken. This may be denoted as a benchmark, a turning point, a numerical point, or some other form of identification.

A station may have up to two types of readings taken on it: a backsight and a foresight. A **backsight** is a level reading taken on a point of known or assumed elevation. In contrast to the backsight, a **foresight** is a level reading taken on a point of unknown elevation. Each foresight is subtracted from the first height of the instrument until the instrument is moved.

Height of Instrument

Once the elevation has been determined and the benchmark has been measured with a backsight, the height of instrument can be established. The **height of instrument** is the elevation of the level line of sight with respect to the benchmark, as indicated by the cross hairs in the telescope. Height of instrument is calculated by adding the backsight to the elevation of the station being measured.

Measurements

The survey continues by taking measurements at designated stations. This may be denoted as a benchmark, turning point, numerical point, or some other form of identification.

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Turning Point

When taking station readings along the profile line, it may become difficult to see as the target rod moves farther away. In this instance, a turning point must be established. A **turning point** is a solid location—usually marked by a temporary stake—on which a foresight is taken, to which the instrument is moved, and from which a backsight is taken to determine a new height of instrument.

PROFILE LEVELING SURVEY NOTES

When completing a survey, accurate survey notes (field notes) must be taken. **Field notes** are the measurement records for a survey. They must be legibly recorded into a field book as the work is completed. To reduce the opportunity for error, it is unacceptable to take notes and transfer them into a field book at a later time. Also, the quality of the field notes generally reflects the quality of the work. Therefore, professional notes typically indicate professional quality work in measurement and readings.

Accuracy in surveying is vital, as other surveyors completing later surveys often refer to survey notes from previous work. When making entries in the field book, use a 3-H or 4-H pencil because pen or soft lead pencil markings may become smeared and unreadable over time. Erasures of data should be avoided because this makes the validity of the data questionable. Corrections should be made by drawing a single thin line through the incorrect data and writing the correct entry above it.

COMPONENTS OF FIELD NOTES

To complete accurate field notes, it is imperative to understand the necessary components.

Table of Contents

A few pages should be left blank at the beginning of the book for a table of contents. On these pages, make a brief description and a page reference for each activity completed. Include

FURTHER EXPLORATION...

ONLINE CONNECTION: Surveying Videos

Various surveying videos are available online. With your teacher's permission, search for surveying videos to assist in your understanding of surveying processes and surveying as a career. Watch the following sample video at:

https://www.youtube.com/watch?v=I-QufqAeFyM

Corn April 20-24 Choice 1

Table of Contents

Page	Activity	Location	Date
1	Taping	P. Hermes Farm	Aug. 4, 20-
2	Profile Leveling	T. Smith Farm	Sept. 2, 20-
3	Waterway Profile	I. Jones Watershed	Sept. 9, 20-
4,5	Differential Leveling—Tiling Henry Brown — 600 Acres		Oct. 21, 20-
6	Construction Survey—House Drain T. Hayes Addition Lot 7		Nov. 3, 20-

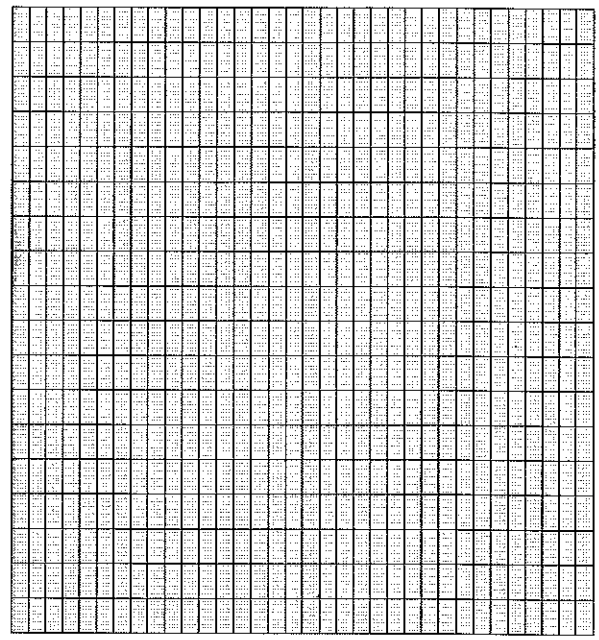

FIGURE 1. This is a field notebook table of contents.

enough information so someone examining the table of contents can identify the work done, the place, and the date it was completed.

Paging

A survey activity may require one or more sets of facing pages. Each set is considered one page when pages are numbered. Begin a new day's work on a new page.

Form of Entries

Printed entries are generally more legible than written entries. Field notes should be arranged according to the standard form that has been developed. This form outlines specific information, which should be found on each of the facing pages.

Right-Hand Page

The right-hand page provides information regarding the site and surroundings. Record the date, time of day, and weather conditions at the top left of this page. Record the names and duties of the survey party at the top right of the right-hand page. The type and number of the surveying instrument may be recorded there. Also, include (on this page) a sketch of the survey. It should be to general proportions. Indicate north on all sketches using conventional signs and symbols. In addition, sign the lower right corner of the right-hand page.

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Left-Hand Page

The left-hand page includes a legal description of the land and the type of survey at the top of the page. Place column headings between the first two horizontal lines at the top of the page. Record and tabulate readings in these columns as well. Make sure you record figures with the decimal point and digits in line vertically. Also, show precision of readings by recording significant zeros (i.e., 4.7 compared to 4.70). The column headings should be station (Sta.), backsight (BS), foresight (FS), height of instrument (HI), and elevation (ELEV). Two equations that help in making calculations include the following:

$$\text{Height of Instrument} = \text{Backsight} + \text{Elevation}$$

$$\text{Elevation} = \text{Height of Instrument} - \text{Foresight}$$

Bob Hofmann Farm
NW¼ SW¼ Sect T3N R6W
Profile Leveling – Tile Drain

April 17, 20--
1–4 p.m.
Cold, Cloudy, Calm

Brian Myers
Kim Romine
Tom Jones
Level #372

Sta.	BS	HI	FS	Elev.
BM-1	3.81			
		103.81		
0+00			9.42	94.39
0+50			5.21	98.60
1+00			4.80	99.01
1+50			4.95	98.86
2+00			4.98	98.83
2+50			4.62	99.19
3+00			4.51	99.30
TP-1	7.47		4.40	99.41
		106.88		
3+50			7.78	99.10
4+00			7.32	99.56
4+50			7.15	99.63
4+80			6.48	100.40
5+00			6.95	99.93
5+50			6.80	100.08
6+00			6.71	100.17
6+35			6.27	100.61
TP-2	7.31		6.81	100.07
		107.38		
BM-1			7.39	99.99
	Error = 0.01'			

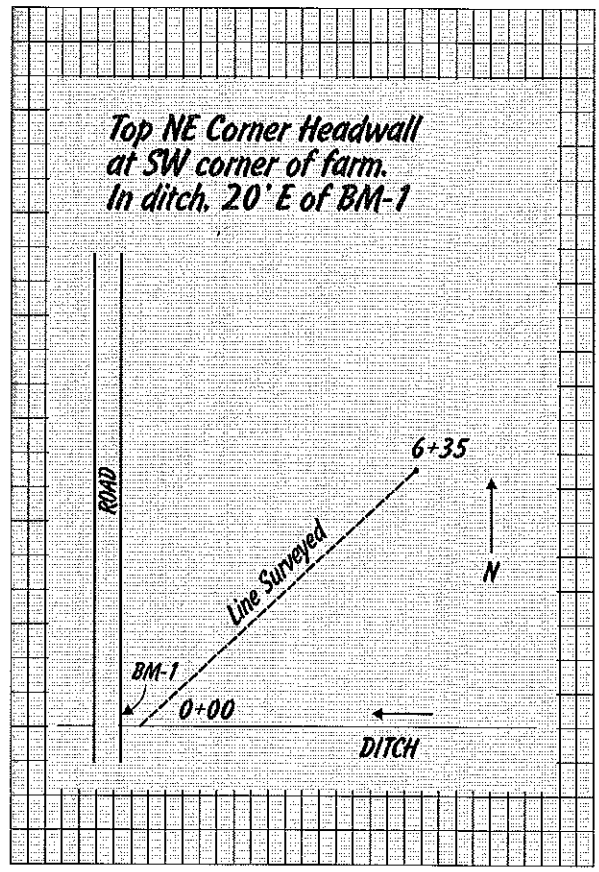

FIGURE 2. These are left- and right-hand pages with field book notes.

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COMPLETION OF FIELD NOTES

Basic steps for completing the field notes (assuming the survey has already been completed) are as follows:

- For the first station, fill in BM-1 in the corresponding column. Place the backsight measurement in the corresponding row and column.
- To calculate the height of the instrument, add the elevation to the backsight.
- Write the measurement values for foresights into the field notes page in the corresponding station row until a turning point is reached.
- At turning points, insert the backsight reading into the correct column and corresponding station rows to calculate for a new height of instrument. Place this new height of instrument into the next row.
- Continue writing down all of the readings for the survey, repeating previous steps as needed.
- Once all readings are taken, calculate elevation for each of the stations by subtracting the foresight from the height of instrument reading. Place this elevation into the corresponding column and row on the field notes page.
- To calculate the slope between each station, take the difference between two station elevations and divide by the distance between those two points. Multiply this figure by 100 for the percent slope between two stations.

PROFILE SURVEY

After learning about the equipment and preliminary components of a survey, you are ready to take that information to complete a survey and the corresponding field notes. To conduct a profile survey from scratch requires you to understand the process on paper and to apply that understanding in the field.

When conducting a survey in the field, you need at least two people, unless a laser level is being used. The crew should begin by "laying out" the survey according to specified measurements and requirements. Use flags to mark stations at which to take readings. Do not remove the markers for the survey until the survey has been completed. Set up and level the tripod level at the specified location.

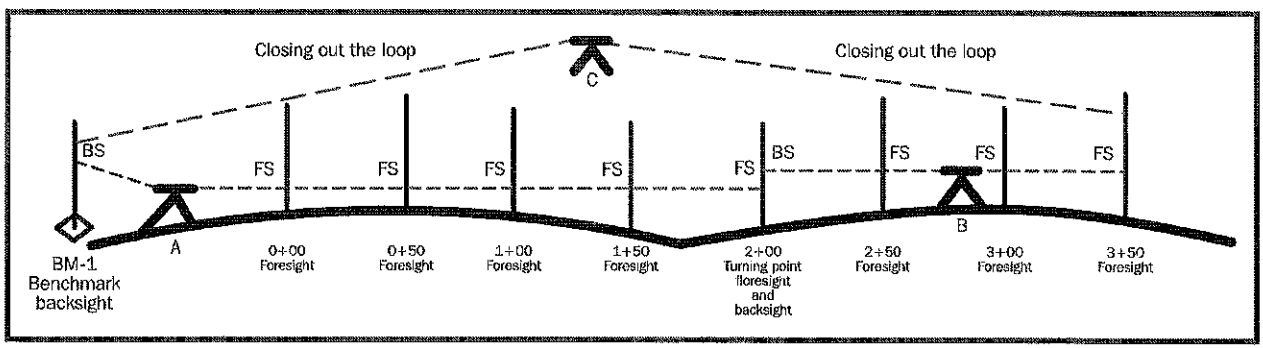

FIGURE 3. Profile survey.

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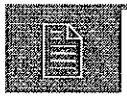
Once the crew has set up, you may begin taking and recording readings. When or if needed, the tripod may be moved to a new location to ensure accurate readings. After the foresights on stations along the profile have been taken, the survey should not be considered finished until a differential circuit is completed and a final reading is taken on the beginning benchmark. This is called "closing the loop."

ALLOWABLE ERROR

In leveling, errors can and will occur. To accept a survey as valid, it must be within the **allowable error**, which is the maximum acceptable distance that a survey may be off in measurement after being closed out on the benchmark. The final error of closure in a leveling circuit is proportional to the square root of the number of rod readings. The formula assumes a distance of 100 feet for each rod reading. Therefore, it is necessary to divide the total length of the traverse (distance surveyed) by 100, determine the square root of that dividend, and multiply by the factor of 0.014. This will provide an allowable error measurement in feet. For experienced surveyors, a less tolerant factor of 0.007 may be used. If the error of the survey is greater than the allowable amount calculated, the survey should be repeated.

Summary:



Profile leveling is the process of determining the elevations of a series of points at measured intervals along a line. A profile survey is extremely useful for locating drains, roads, dams, and other earth structures. The procedure for completing a profile survey is relatively simple.

No aspect of surveying work is more important than keeping accurate records of field notes. Surveying notes must be recorded legibly and accurately in a field book as the work is completed. Important sections are the table of contents, paging, and form of entries. The column headings are station, backsight, foresight, height of instrument, and elevation.

In leveling, errors can and will occur. The final error of closure in a leveling circuit is proportional to the square root of the number of rod readings. If the error of the survey is greater than the allowable amount calculated, the survey should be repeated.

Checking Your Knowledge:

1. How are field note pages organized?
2. How are field notes completed?
3. Why should profile notes in the field notebook be completed as the survey is completed?

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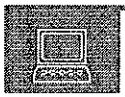
4. Why is accuracy in surveying notes important?
5. How is allowable error calculated?

Expanding Your Knowledge:

Job shadow a surveying technician. Assist in the completion of a profile survey along with the completion of field notes.

Web Links:



Surveying Basics
http://stream.fs.fed.us/news/streamnt/jul96/jul96a5.htm

Profile Leveling
http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-ROORKEE/SURVEYING/modules/module4/html/52.htm

Profile Leveling
https://engineering.purdue.edu/~asm215/topics/proflevl.html

Profile Leveling
http://www.tpub.com/engbas/14-14.htm

Agricultural Career Profiles
http://www.mycaert.com/career-profiles

Choice 2

Mr. Coon Ag Mech Power Tools April 20 -24

Checking Your Knowledge:

1. What is an advantage and disadvantage to using electrical, pneumatic, hydraulic, and fuel-engine power tools?

2. Describe the personal protective equipment needed to use power tools.

3. When is it more appropriate to use a chainsaw instead of a circular saw?

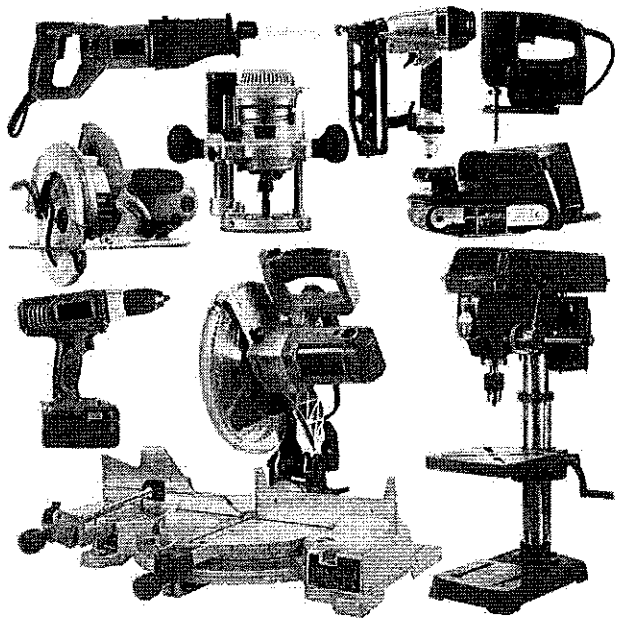
4. What are the advantages and disadvantages to using corded power tools instead of cordless power tools?

5. For what purposes are major power tools used?

Coon April 26-24 Choice 2

Power Tools

POWER TOOLS perform essential functions in agricultural mechanics and have many applications in agricultural construction. They are used in almost every industry and on almost every material. Power tools were first used during the time of the ancient Egyptians. Being able to use them properly will keep you safe and, in many cases, allow you to perform tasks more efficiently than with hand tools.



Objectives:

1. Explain and compare power sources for power tools.
2. Explain general power tool safety.
3. Identify and use basic power tools properly and safely.

Key Terms:

AC
air compressor
band saw
battery-operated power tool
chainsaw
circular saw
compound miter saw
corded drill
corded electric power tool
cordless drill
crown nailer
DC
double-insulated tool
drill press
electricity
fence
finishing sander
fuel-engine power tool
ground-fault circuit interrupter (GFCI)
grounding
guard
hammer drill
hydraulic pump
hydraulic tool
jigsaw
jointer
miter gauge
miter saw
nail gun
operator's manual
personal protective equipment (PPE)
pneumatic tool
pole saw
portable belt sander
portable disc grinder/sander/buffer
portable power tool
power tool
radial arm saw
reciprocating saw
rectifier
rip fence
router
scroll saw
stationary grinding wheel
stationary power planer
stationary power tool
table
table saw

Coen April 20.24 Choice 2

Identifying and Using Power Tools

A **power tool** is any instrument powered by a source other than human force. While people may move the power tool or parts of the power tool in its operation, the major power for operating the primary working part(s) is not from human effort.

POWER SOURCES

Power for power tools comes from four primary sources: electricity, fuel engines, pneumatics, and hydraulics.

Electricity

The most common power supply for power tools is **electricity**—the flow of electrons or charge through a conductor. The energy sources for electricity can be renewable or nonrenewable, but electricity is not renewable or nonrenewable. Electricity travels in closed loops or circuits. It must have a complete path before the electrons can move. If a circuit is open, the electrons cannot flow. When a switch is flipped, the circuit is closed or opened. On portable power tools, when a trigger is pulled on an electric power tool, the tool is turned on or off. Electricity is one of the most widely used forms of energy and comes in two forms: AC and DC—both running motors that perform work.

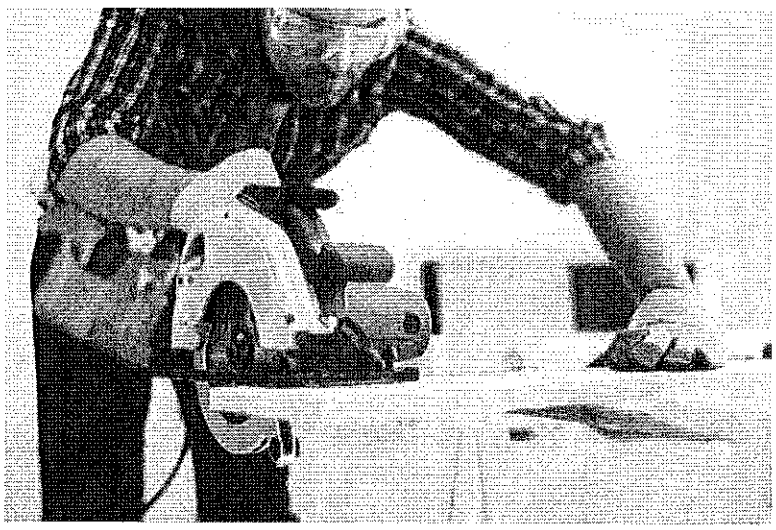


FIGURE 1. AC electricity is the most popular source of power for power tools. However, corded tools, such as this circular saw, must be used near a source of electricity.

Alternating Current

AC is alternating current generally rated at 120 volts and 60 cycles per second or hertz. Its flow alternates direction twice per cycle. A **corded electric power tool** is an instrument that uses AC electricity to operate (e.g., a saw, drill, planer, and sander). A corded electric power tool is lighter and usually provides more power than its battery-operated counterpart. However, it must be near electrical service.

Direct Current

DC is direct current that flows in one direction, from a negative to a positive charge. A **battery-operated power tool** is an instrument that uses DC (electric) to operate. It has

become popular in recent years, especially as newer, lightweight batteries provide more power and hold a charge longer. The tool has a battery that needs to be charged, so the charger is plugged into AC power to recharge the battery using a **rectifier**—a power converter that changes AC power to DC power. Two common battery types are the Ni-Cd and lithium ion batteries.

Battery Types

Ni-Cd batteries are the most common type and have a proven durability under tough working conditions. Lithium ion batteries do not necessarily provide more power or longer run time than Ni-Cd batteries. Higher voltage batteries will have more power and run time. Lithium ion batteries are more expensive, but they are smaller and lighter weight than Ni-Cd versions. Also, they do not self-discharge or suffer from battery memory (a situation in which a battery's full charge will decrease without fully charging and discharging the battery during each charging cycle), as Ni-Cd batteries often do.

Motors

Many electric power tools rely on motors to function. Electric motors depend on magnets to operate. Magnets have a north pole and a south pole. When the poles of magnets are moved close together, similar poles repel and opposite poles attract. Electric motors operate by creating magnetic fields that rotate a shaft, thereby creating power and performing work.

Fuel-Engine Power

A **fuel-engine power tool** is an instrument run by an internal combustion engine and is used in locations where electricity, pneumatics, or hydraulics cannot be used. A fuel-engine power tool typically runs on gasoline, but diesel and propane are sometimes used. Chainsaws, leaf blowers, post hole diggers, and electrical generators are examples. A fuel-engine power tool is more powerful than its electric counterparts, but it is heavier and bulkier. In addition, a fuel-engine tool produces exhaust fumes, which can be dangerous in enclosed spaces.

Pneumatics

A **pneumatic tool** (air tool) is an instrument that uses compressed air as power for operation. It is powered by compressed air and works by rotating a component similar to an electric motor or by operating a piston in a cylinder in a back-and-forth motion.

An air tool is connected to the compressed air with hoses attached by means of quick couplers. The female end has a spring-loaded stopper to control the flow of air. The male end does not have a valve to restrict the air flow. When a male end and a female end are connected, the male end unseats the stopper in the female end to permit a flow of air through the coupler. Compressed air can be dangerous when air hoses are being coupled and uncoupled if pressurized air is allowed to escape. For instance, pressurized air can drive foreign materials into eyes or cause injuries to skin.

Con April 20-24 Choice 2

Maintaining and operating an air compressor is important to ensure adequate air supply for pneumatic tools. It is regularly used in many workplaces and shops. A conventional **air compressor** is an instrument that has a cylinder, piston, crankshaft, and connecting rod—similar to engine components. It is powered by an electric motor or a gas engine. Air is pulled into a cylinder through a reed valve and is pushed into a tank where the pressure is built up. The complete compressor unit contains an air tank that holds a quantity of air within a specific pressure range, and this compressed air drives the air tools. The compressor's motor automatically turns on and off to maintain the air tank pressure. Checking the oil level of the compressor, draining the air out of the hose, and draining the water from the air tank by slowly opening the drain cock are important to extending the life of an air compressor and air tools. Removing the water from the air tank prevents water from entering air tools and prevents water buildup from reducing the tank capacity. An air tool works best close to the air compressor.

When kept clean and lubricated with oil, an air tool is almost indestructible. It has few moving parts, so maintenance is minimal. An air tool runs cool because it is powered by compressed air. It is lightweight, which helps reduce fatigue, and it is easy to store. Drawbacks to using air tools are not having an adequate air supply and excessive noise from the piston or hammering action often associated with tools.

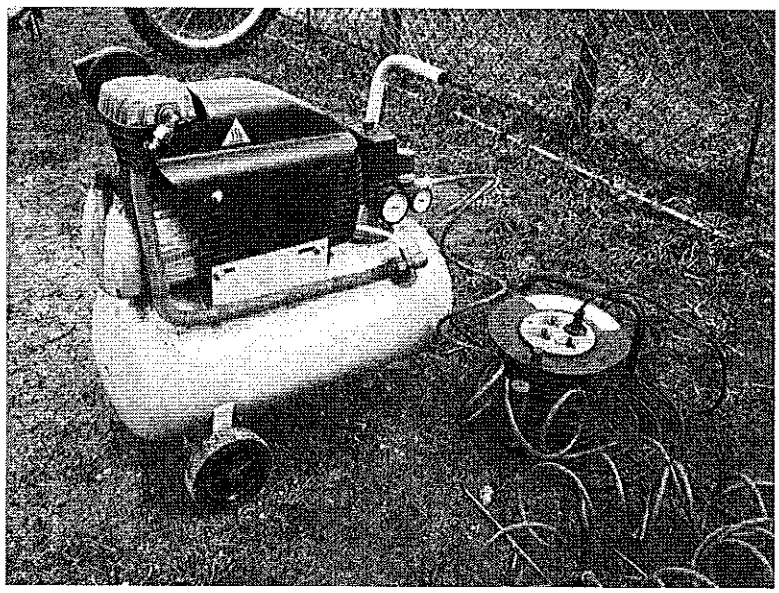


FIGURE 2. Air compressors commonly need electricity or another power source to operate.

Hydraulic Tool

A **hydraulic tool** is an instrument that uses compressed liquids, usually oil, to provide the power for tool operation. Jacks, loaders, lifts, and presses are often hydraulically powered. Some tools (e.g., chainsaws, wrenches, and jack hammers) can be run on hydraulic power. Hydraulic power is popular because of its instant power, ease of control, and flexibility.

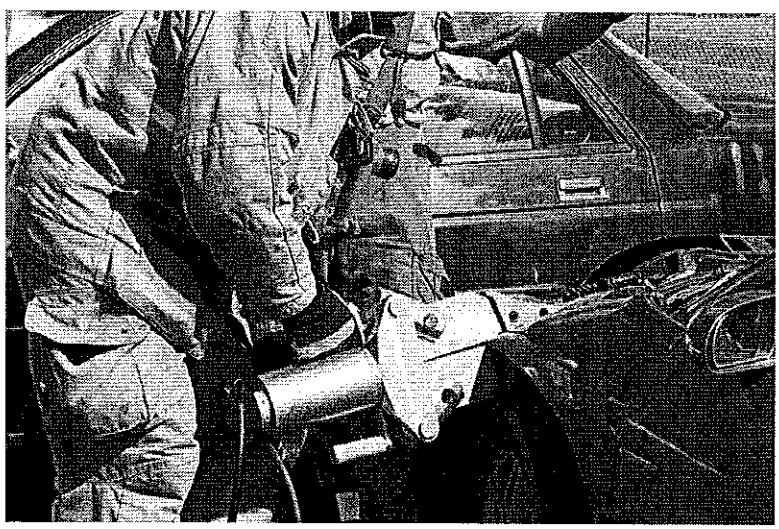


FIGURE 3. Hydraulic tools provide instantaneous, strong power for cutting, lifting, and rotating tools. Firefighters and other emergency personnel rely on hydraulic tools to rescue people.

Conn April 20-24 Choice 2

The identification of hydraulic parts is not difficult. Usually the hydraulic system has two cylinders: the master cylinder and the slave cylinder. The piston receiving the original force is the master cylinder, and the piston driven by the master cylinder is the slave cylinder. Hydraulic power is created by applying force at one point to a non-compressible fluid and transferring that same force to another point. The fluid is typically a type of oil, which is kept under high pressure. Because the oil cannot be compressed, hydraulic power is extremely efficient.

Hydraulic Force

Hydraulic force can be multiplied easily by changing the size of one piston and cylinder relative to the size of the other. Increasing output of hydraulic power can be accomplished by using a slave cylinder with a larger diameter than that of the master cylinder. As a result, the master cylinder will move a greater distance than the slave cylinder. The multiplication of power and the size of the cylinders can be calculated using the formula $F_1 / A_1 = F_2 / A_2$. F_1 is the force applied to the master cylinder; A_1 is the area of the master cylinder; F_2 is the force coming from the slave cylinder; and A_2 is the area of the slave cylinder. For example, if a 10-pound force is applied to a master cylinder with an area of 10 in^3 and has a slave cylinder with an area of 50 in^3, the output force coming from the slave cylinder will be 50 pounds. That is five times more force than what was applied to the master cylinder. However, the master cylinder must move five times as far as the slave cylinder.

A pump is a typical method of creating hydraulic pressure. A **hydraulic pump** is an instrument that creates pressurized fluid plumbed to a valve controlled by the operator. When the oil is directed to a slave cylinder, the cylinder performs work. The oil returns from the slave cylinder to a holding tank ready to repeat the cycle. A slave cylinder can be a reciprocating cylinder, which moves back and forth, or a hydraulic motor, which rotates. The hydraulic system pressure can be high enough to cause injury if someone were to come into contact with it.

UNDER INVESTIGATION...

LAB CONNECTION: Pascal's Law

Pascal's Law states that pressure applied in one area to a confined fluid will be transmitted equally in all directions. Use different sizes of syringes (without needles), plastic tubing, and vegetable oil to create a closed hydraulic system. Observe the effects.

Fill a syringe with vegetable oil, and connect it to the plastic tubing. Push the oil into the tubing until the tubing is filled. Then fill the other syringe and connect it to the other end of the plastic tubing. Press the plunger down, and watch the effect. When using different sizes of syringes, record the effects of pushing fluid from one syringe to the other sizes.

Build a wooden stand to hold each syringe upright with plungers facing up. Place equal-sized weights on top of each syringe, and record your results. Use larger and smaller weights in different combinations, with larger and smaller syringes. Record the results. What conclusions can you draw about hydraulic force and surface area?

Corn Apnl 20-24 Choice 2

Power Source Combination

Often a combination of two power sources is used. Hydraulic pressure is typically developed by using an electric motor or a fuel engine. An electric motor is used to develop air pressure to operate pneumatic tools. In contrast, a gasoline engine is used on portable electric generators to power electric tools.

Power Tool Safety

A major difference between hand tools and power tools is that power tools are more dangerous. Accidents with power tools often are more serious. For instance, improper use can result in losing an eye, finger, hand, or even a life. Yet there are many ways to stay safe when using power tools.

OPERATOR'S MANUAL

Never operate a power tool without reading the operator's manual before use. An **operator's manual** is a written document that states how to safely use and maintain a power tool. A manual usually accompanies a new power tool. Proper assembly, installation, service procedures, parts lists, and operating instructions are given. Look over any new tool before operating it, paying special attention to the placement and condition of any shields or guards.

GROUNDING

All electric-powered tools should be properly grounded. As a result, if a short develops, the operator will not be shocked or electrocuted. **Grounding** is a direct electrical connection to the earth that prevents electrical shock by providing a low-resistance path for electricity. It prevents you from being shocked due to short-circuiting of equipment. Grounded tools may be identified by the three-prong plug.

DOUBLE-INSULATED TOOL

A **double-insulated tool** is an instrument that uses two-wire, non-grounded cords with electric parts insulated or separated from the user by special insulation inside the motor and by the use of a plastic motor housing. The operator of a power tool should check the operator's manual of any power tool with a two-prong plug to be sure it is double-insulated. The tool operator should avoid damp or wet areas when using electrical power tools. If possible, another power supply should be used.

Conn April 20-24 Choice 2

GFCI

A **ground-fault circuit interrupter (GFCI)** is a fast-acting circuit breaker recommended wherever electricity, people, and water are present, even when using grounded or double-insulated tools. It breaks the circuit whenever there is a ground fault. This protects you from electrical shock and potential electrocution. Extension cords are now available with GFCI protection. If any moisture is present, wearing rubber sole shoes will increase your resistance to possible electrical shock.

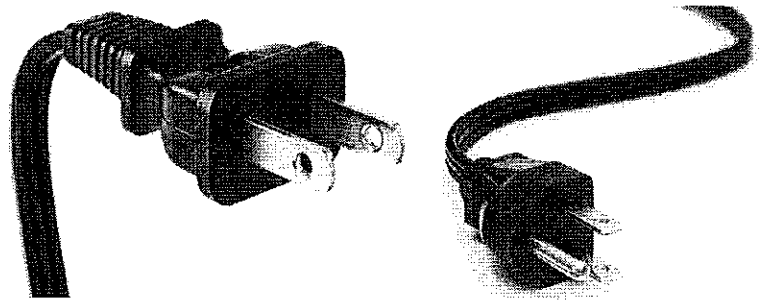


FIGURE 4. A two-prong plug is found on double-insulated tools while a three-pronged plug is found on grounded tools.

PERSONAL SAFETY

You should practice good personal safety, which involves your behavior and use of personal protective equipment. Your behavior should be cautious. For example, thinking through the entire process before starting, working purposefully, and using good judgment are the marks of being mindful of safety. Thinking through a project or job before starting allows time for you to choose proper tools. In addition, working slowly and purposefully can prevent accidents and injuries. Good judgment, common sense, and the ability to foresee consequences can prevent careless mistakes and injuries, too. Also, be aware of people and of what is happening nearby at all times to avoid accidents.

Personal Protective Equipment (PPE)

You should always select the proper personal protective equipment to be safe when working with tools. **Personal protective equipment (PPE)** is any material or device worn to protect a person from, and possibly prevent, injuries. PPE may include gloves, helmets, and steel-toe boots. Safety glasses are the most important PPE item needed when working with tools. They should always be worn when working. Other equipment that may be needed includes work gloves,

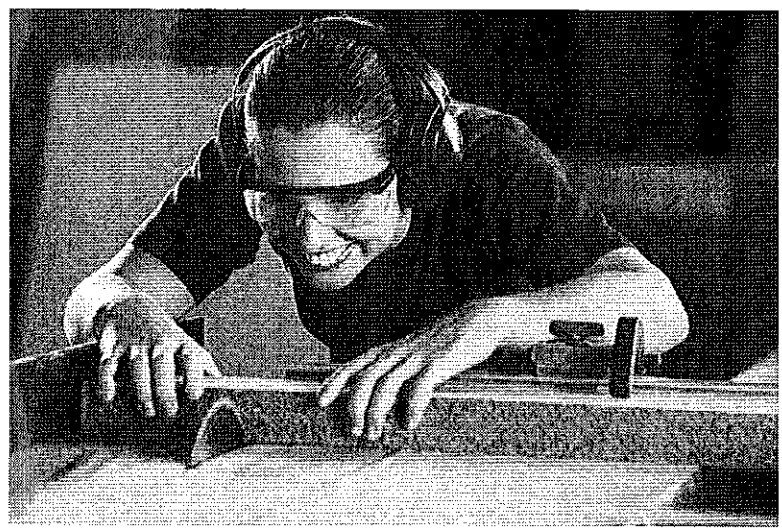


FIGURE 5. Wearing proper PPE when using power tools is important. Eye protection should be worn at all times when working with tools.

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long pants, long sleeves, hats, respirators, sunscreen, and steel-toe work boots. Ear muffs or ear plugs are important when using loud tools.

Tool Condition

Keeping tools in good condition can keep you safe. The condition of the tool should be checked before use. Guards, shields, cords, and hoses should be carefully inspected. Blades and bits should be sharp because sharp tools require less pressure to make the tool function, resulting in a safer situation. Tools should be kept clean and free of dirt, rust, and oils. The tools should be inspected for cracks, chips, and other broken parts. Also, any insulation on tools should be checked. In addition, tools should be kept in a safe place away from water and dirt.

Identify and Use Power Tools

You should be able to identify tools, so you can select the proper tool for the job. In addition, you should be able to use the tools properly.

STATIONARY POWER TOOLS

A **stationary power tool** is a large machine that remains in one place while the work piece can be moved across it. The stationary power tool should be placed in an area that allows sufficient room to work around it. Guards and shields should be kept in place. In addition, blades, knives, and bits should be kept sharp. A **guard** is a safety piece that covers blades and other dangerous areas (or power tools) and is designed to prevent accidents. All manufacturers' recommendations for the installation, use, adjustment, and repair of each machine should be followed. Safety tape or paint should be used to mark the safety zone around each machine where only the operator is allowed to stand. Wearing safety glasses should be mandatory around these machines, and the operator must shut off the machine before leaving the safety zone.

Miter Saw

The **miter saw** (chop saw) is a stationary power tool used to cut material at precise angles. The **compound miter saw** is a variant of a stationary power tool used to cut material at precise angles that can cut two angles at once. The miter saw works by drawing a circular blade down and through the work piece. Some miter saws are mounted on a shop table or may be mounted on a specialized stand. The **table** is the surface on which the work piece rests. The **fence** is a vertical, flat surface that provides a straight cutting edge and adds stability to the work piece.

To operate the saw, hold material securely on the table and up against the fence. The blade can be brought down without depressing the trigger to check that the blade is in the proper

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cutting position. Then the blade should be raised off the work piece, and the trigger must be depressed to start the motor. Bring the saw blade slowly and smoothly through the work piece to cut it. Keep your hands as far as possible from the blade, and hold the work piece firmly against the table and fence to prevent it from moving while cutting.

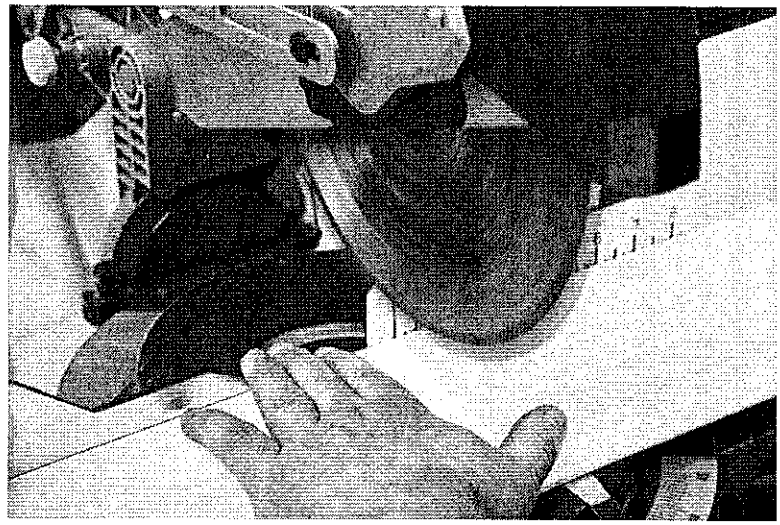

FIGURE 6. When using power tools, such as a miter saw, be sure to keep your hands clear of any moving parts and blades to avoid accidents.

Drill Press

A **drill press** is a stationary power tool with a table for resting a work piece and a drill head mounted above it that allows for holding various bits and bringing them down into the material with a lot of control. It is designed for accurate and heavy drilling jobs. A drill press gives you an easy control mechanism for feeding the drill bit into the work. Securely clamp the work piece being drilled to prevent accidents. If too much pressure is applied, the bit will overheat or break. Use of a sharp bit is critical. After turning on the drill press, pull down the handle in a circular motion to bring the bit into the work piece. After cutting to the desired depth, return the handle to the staring position to bring the bit out of the work piece.

Grinder

A **stationary grinding wheel** is a rotating tool with two spinning discs attached to either end of an electric motor. The disc or wheels can be made of wire (for polishing) or abrasive stone (for grinding). Turn on the machine, hold the work piece on the table, and bring it slowly into the wheel. Guards and shields should never be removed. A grinding wheel can create dangerous sparks and flying objects, so PPE should be worn at all times, including flame-retardant clothing.

Table Saw

A **table saw** is an instrument that has a platform or table with a circular blade where the wood to be sawed is pushed into the blade. The blade depth should be adjusted so it protrudes ¼ inch through the material to be cut. The table or the blade may be tilted to cut angles.

Miter Gauge

A **miter gauge** is the guide used to line up the wood to be pushed into the blade. The miter gauge can be set to make square or angle cuts. Long boards need to be supported when cutting to avoid kickbacks or pinching of the blade with the wood.

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Rip Fence

A **rip fence** is an instrument adjusted to a desired width to guide the wood being pushed through for ripping. A push stick (push block) is a safety device used to protect the hands of the user while providing greater control of the work piece. Whenever the table saw is used, the guard should be in place. In addition, the kickback fingers should be set to touch the wood.

Radial Arm Saw

A **radial arm saw** is a power tool made up of a circular saw on a sliding arm above a table. While the wood is held against the fence, the blade is pulled into the wood to be cut. The blade/motor unit can be pivoted to cut angles or to rip boards. The most popular use of the radial arm saw is for cutoff work, including squaring boards, cutting them to length, and cutting at angles or bevels.

Band Saw

The **band saw** is a stationary power tool that uses a continuous metal band with teeth to cut through material. An electric motor turns the drive wheel using belts and pulleys. The blade has teeth on one edge that can quickly cut material. It is used to make curved and straight cuts. The material to be cut is placed on the platform and pushed into the blade. Do not push the material into the blade too rapidly. A band saw may be equipped with a tilting table, a miter gauge, and a rip fence. This saw type is sized by blade length and width. Thinner blades can cut smaller radii than thicker blades. Models may be handheld or clamped to a shop table.

Scroll Saw

A **scroll saw** is a stationary power tool with a thin blade that moves rapidly up and down and cuts on the down stroke. It can cut intricate curves because of its small blade and can cut interior patterns by removing the blade and inserting through a predrilled hole in the material. A scroll saw is sized by the depth between the blade and back arm of the tool, which is called the throat. It is used mostly for cutting thin material to make craft projects. Cut slowly with a scroll saw, as the blade just cuts on the down stroke.

Planer

A **stationary power planer** is a tool that removes a uniform amount of material from a work piece as it is passed through the machine. The planer is an excellent tool to level and smooth wide pieces made by gluing boards together. The depth of cut is the main adjustment. Attempting to remove too much wood in one pass through the planer is a common problem. Once a board is started, the machine will pull the board into the machine on its own because it is self-feeding. The operator should be sure to carefully examine any board to be planed for nails and screws because they can cause major damage to the cutting knives and major accidents in general. Sharp, properly installed knives are essential for successful planing.

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Jointer

A **jointer** is an instrument that uses sharp knives fastened to a cylinder turning at a high rate of speed to straighten and smooth edges of boards and to cut bevels. The jointer is potentially dangerous. For example, the knives can inflict severe cuts, and lumber may be thrown if not handled properly. Therefore, all knives need to be installed so their cutting edges extend to the same height and leave the board smooth and even as the cutter head rotates. The rear outfeed table should be adjusted so it is level with the cutting edges of the knives. The height of the front in-feed table determines the cut depth. Yet the user must ensure the guard is in place and that it covers the knives, except where the lumber is against the fence. The operator should hold the board against the fence while being careful not to press down on the lumber because this can cause uneven, wavy cuts.

PORTABLE POWER TOOLS

A **portable power tool** is an instrument activated by a power source other than human power and can be moved across the work piece. It can be moved easily from job to job. In addition, a portable power tool saves labor and is relatively inexpensive. It is often designed to do the same work as a large stationary power tool that cannot be moved to the job site. A portable model is lighter than a stationary model and is designed with handles to make it easy to use. A portable power tool runs on electrical (AC or DC), pneumatic, fuel engine, or hydraulic power. Some commonly used in carpentry are sanders, grinders, drills, saws, and routers.

Disc Grinders and Sanders

A **portable disc grinder/sander/buffer** is a rotating disc tool used for work in which the material to be ground, sanded, or buffed is too large or heavy to move to a stationary tool. Secure the work piece before using a grinder on it. Also, hold the tool tightly, wear eye protection, and have solid footing during use.

A **portable belt sander** is an instrument that uses a rotating sanding belt to rapidly smooth wood. The belt sander usually is used for rough sanding, but the belts vary in coarseness. Most are equipped with a dust bag for collecting dust before it enters the air. When putting on a new belt, watch the belt arrow so it is installed in the correct direction. Hold the belt sander with both hands, and turn on the switch just before the sander touches the

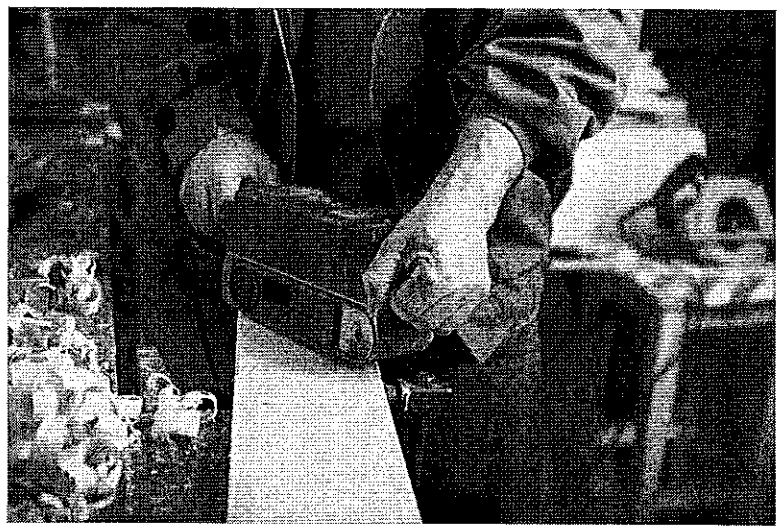

FIGURE 7. Using a slightly sideways, back-and-forth motion with a belt sander ensures that the sanding occurs in a uniform manner.

work piece. Move the sander gently with the grain in a straight, but slightly sideways, back-and-forth motion.

A **finishing sander** is an instrument used for final sanding. It moves in a forward and backward motion or in an orbital or circular motion at a high rate of speed. It should be moved in a back-and-forth motion with the wood grain until the desired smoothness is achieved. Several fineness grades of sandpaper are available.

Portable Drill

A portable drill is usually variable speed, reversible, and sized by the maximum size bit shank that it can hold (e.g., 1/4 inch, 3/8 inch, and 1/2 inch).

Corded Drill

A **corded drill**, running on AC power, is a rotary tool that has a pistol grip, a trigger, and a chuck that can hold bits for drilling and screwing into wood and other materials. The chuck is a bit holder with adjustable jaws. An older drill may have a chuck key to tighten the bit and may have a secondary handle for two-handed use.

Cordless Drill

A **cordless drill** is a rotary tool that uses DC power from rechargeable batteries to turn bits. It generally produces less torque than a corded model, ranges in voltage from 7.2V to 24V, and is considered light duty. Higher voltages produce more torque. Many cordless drills are built with a keyless chuck, which is an adjustable bit holder that can be tightened or loosened by hand, so a chuck key is not needed. The main advantage of a keyless chuck over a keyed chuck is that bits can be changed quickly. However, it may not hold the bit as tightly. When drilling into metal, the location to be drilled should be marked with a center punch. Then the work should be secured with a clamp or in a vise prior to drilling. Exert pressure to get the twist drill to go into the material, but relieve the pressure as the point of the bit begins to go through the material.

Hammer Drill

A **hammer drill** is a drill that turns the bit and provides a rapid striking action on the bit to speed up drilling in masonry materials.

Portable Saws

Some portable saws are the jigsaw, reciprocating saw, circular saw, and chainsaw.

Jigsaw

A **jigsaw** (also known as a sabre saw and a bayonet saw) is an electric reciprocating saw with a narrow blade used for cutting curves and straight lines through a material. Its blade moves back and forth along a roller that guides the blade. An orbital jigsaw, which moves in a slight circular motion, can be used to reduce tearing of the material as the blade moves

upward. Most cuts begin at the edge of the material to be cut. To cut a hole in the middle of a piece of material, first drill a hole so the blade can be inserted. The material to be cut must be firmly held in position. Move the saw slowly and carefully to achieve quality cuts. It is critical to use slower speeds for metal and faster speeds for wood.

Reciprocating Saw

A **reciprocating saw** (tiger saw) is a saw that uses a back-and-forth motion to cut through materials and often is used in remodeling and construction work because of its versatility and durability. A reciprocating saw can quickly and easily cut through materials at difficult angles and in tight spaces. It has many blade options for cutting through various materials and is similar to a jigsaw. The reciprocating saw, however, is larger and heavier than a jigsaw.

Circular Saw

A **circular saw** is a tool that uses a motor to turn a metal blade with teeth or an abrasive disk to cut through materials. It often is used where stationary saws are impractical. A circular saw is the most popular saw used in woodworking. This saw can be used for crosscutting, ripping, and beveling. Because of its high speed and the tendency to kick back, the portable circular saw can be a dangerous tool. As a result, before operating a portable circular saw, read the operator's manual, check the working condition of the guard, see that the saw is grounded, and ensure the blade is sharp. In addition, saw to the line. When cutting a long board, have a helper support the piece being cut off so the blade does not kick back when the board is cut.

Chainsaw

A **chainsaw** is a powered saw used for cutting and pruning trees and cutting large pieces of lumber when precision is not important. A chainsaw cuts with a banded chain that has teeth attached to its links. The chain is similar to that found on a bicycle. Oil is regularly released onto the chain in small amounts to assure that it moves with little friction around the guide bar. In addition, a motor spins a sprocket, which drives the chain. Many models are equipped with a knuckle guard, which will disengage the chain if it is struck to prevent accidents. A chainsaw model mounted on a pole is called a **pole saw** and is used to trim small branches and tree limbs.

Proper tension adjustment is always needed to assure safety and efficient cutting. A loose-fitting chain can jump from the guide bar and cause injury. Careful attention must be given to safety.

FIGURE 8. Chainsaws can be used to create artistic sculptures from wood. Great care and caution should be used anytime you operate a chainsaw because there is no guard to protect you from the blade.

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For instance, the blade must be kept away from body parts (e.g., the arms, legs, and feet). Always stand with good balance and securely grip the handles because of kick back. Without a good grip and balance, you could be cut, knocked down, or otherwise injured. In addition, never cut anything located above your body because falling pieces may cause serious injuries. Also, eye protection and hearing protection are needed with a chainsaw powered by a gasoline engine. Chaps (heavy leg wear), gloves, and steel-toed shoes are recommended. A hardhat is a good idea, too.

Router

A **router** is a high-speed, rotary tool that utilizes bladed bits to cut, bore, trim, and shape different materials. Its flat base is moved across the material by the operator as a bit turns at a high rate of speed to create grooves and ornamental shapes on the face or edge of wood. The groove or cut is determined by the bit type, shape, and size. Clean, sharp bits will provide clean and even cuts if the router is held firmly to the wood. Dull, rusted, or gummed up bits are dangerous and should not be used.

Guides and jigs can be used to help with straight lines as well as circular or contour routing. A fixed base router has an exposed bit when the table depth is set and is not in contact with the work piece. A plunge-base router keeps the router bit retracted into the table until it contacts the work piece. Two main types of bits are used in handheld routers: fluted bits—which cut into and through materials—and profile bits—which have a roller on the tip and are made to cut along an edge. Fluted bits are commonly used with a pattern, straight-edge, or fence because the router's rotary motion can make them hard to control.

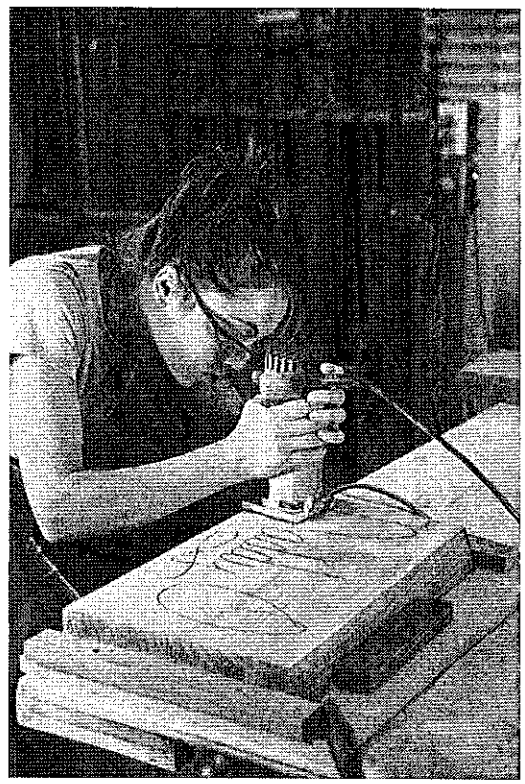

FIGURE 9. A router with a profile bit is a great tool to use when cutting curves and designs into wood.

Nail Gun

A **nail gun** is a powered machine that pushes a nail into a surface. It is usually pneumatic, but it can be powered by electricity, flammable gas, or a small explosive charge. Largest to smallest—in order of nail size—are framing, finish, brad, and pin nailers.

Crown Nailer

A **crown nailer** is a tool that shoots staples instead of nails. It has a safety mechanism that will prevent firing nails or staples unless the gun is in contact with the work to be joined. A crown nailer stores nails in a magazine that allows you to install many nails without having to reload. It speeds up construction work substantially when many nails are needed.

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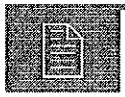
Summary:



A power tool is any tool that has power for its operation from a source other than human force. Power for power tools comes from four primary sources: electricity, fuel engines, pneumatics, and hydraulics.

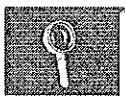
Accidents with power tools are often more serious than hand tool accidents. Read the instruction manual before use; check the tool and any guards; use common sense; and wear proper personal protective equipment.

Stationary power tools are large machines that remain in one place while the work piece can be moved across it. Examples are a drill press, table saw, miter saw, and planer. Portable power tools are tools activated by a power source other than human power and can be moved across the work piece. Examples are drills, saws, routers, and nail guns.

Checking Your Knowledge:

1. What is an advantage and disadvantage to using electrical, pneumatic, hydraulic, and fuel-engine power tools?
2. Describe the personal protective equipment needed to use power tools.
3. When is it more appropriate to use a chainsaw instead of a circular saw?
4. What are the advantages and disadvantages to using corded power tools instead of cordless power tools?
5. For what purposes are major power tools used?

Expanding Your Knowledge:



Contact a few professional contractors and tradespeople. Ask if you can schedule a time to record them demonstrating the power tools they use for their professions. Be ready to ask them about why they use those tools, their versatility, and the various power sources used.

Web Links:

Power Tool Types and Features
http://www.popularmechanics.com/archive/home/reviews/power-tools/0/10

Power Tool Safety Tips
http://www.teched101.com/pdf/powtolsaf.pdf

Bench Top Stationary Power Tools
http://www.woodmagazine.com/woodworking-tools/reviews/more/benchtop-vs-stationary/

Choice 3

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Checking Your Knowledge:

1. What is precision farming?

2. How are GPS and GIS related in agriculture?

3. Describe how precision farming uses variable rate technology.

4. Describe how the use of precision farming benefits farmers and the environment.

5. List the three precision farming career areas discussed. Give a brief description of each career area.

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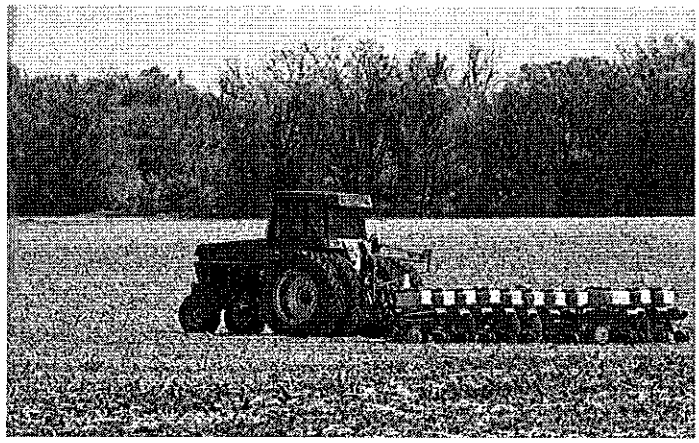
Precision Technologies

WHAT PLACE does precision technology have in agriculture? Should all farmers adopt precision technology, or should it be reserved for farmers with large acreage? A recent survey in Ohio found that about 40 percent of farmers had at least one piece of precision farming equipment. The precision agriculture industry is growing quickly. As a result, skilled specialists are needed to match the number of farmers interested in adopting new technologies.



Objective:

Describe the concepts of precision agriculture and the impact this technology has on farming and the environment.

Key Terms:

- geographic information system (GIS)
- global positioning system (GPS)
- GPS receiver system
- grid
- machinery controllers
- precision agriculture instructor
- precision agriculture specialist
- precision agriculture technician
- precision farming
- remote sensing
- site-specific farming
- triangulation
- variable rate technology (VRT)
- yield sensing

Determining the Role of Precision Technologies

Scientific and technological developments are enhancing cropping practices through environmentally sound site-specific farming. **Site-specific farming** is the practice of using vari-

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ous technologies to sample soils and crops and to create a specific cropping plan within a given field or area.

PRECISION FARMING

Precision farming is a site-specific crop management system that uses global positioning and other technology to meet the needs of the land. Two main areas contribute to the goals of precision farming: GPS and GIS.

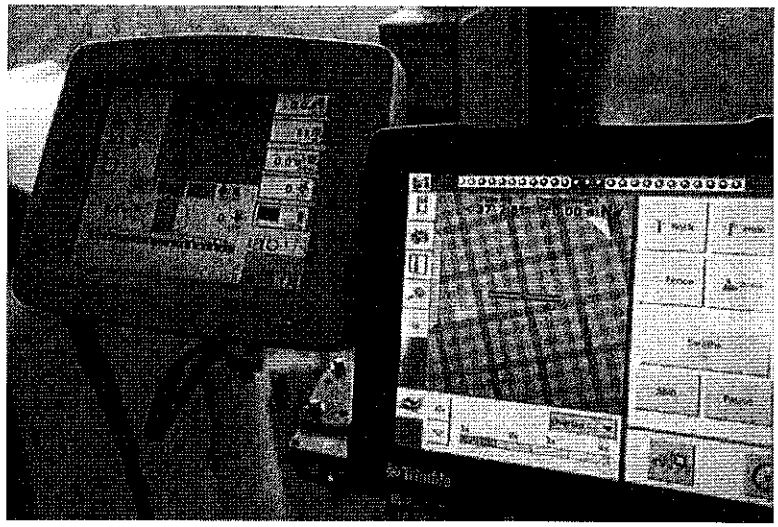

FIGURE 1. Precision farming is a site-specific crop management system that uses global positioning and other technology to meet the needs of the land. (Courtesy, Natural Resources Conservation Service, USDA)

Components of Precision Agriculture

A **global positioning system (GPS)** is a satellite-based system that can determine exact points within a field. GPS is used by farmers and other people who wish to know their exact location and elevation on the earth's surface. Currently, 24 Navstar satellites are orbiting the Earth and are used for GPS. This system operates with **triangulation**, which is a method of determining the exact location and elevation of a GPS receiver by receiving signals from three or more satellites.

A **geographic information system (GIS)** is a system that gathers, stores, manipulates, analyzes, manages, and presents information to create detailed maps as well as spatial data for a given field or area. GIS information is displayed in a grid pattern. A **grid** is the division of a field or area into uniform squares using vertical and horizontal lines.

UNDER INVESTIGATION...

LAB CONNECTION: Using a GPS Device

GPS technology has become common in our society. Cars and trucks now come equipped with GPS and navigation systems. Also, cell phones have available GPS tracking. Now it is easy for someone to locate an exact position and altitude on the surface of the earth. As with any technology though, people need to learn how to use it properly. Familiarize yourself with how a GPS receiver operates.

Obtain materials to conduct an experiment using a GPS device. In addition to a handheld GPS device, you will need a clipboard, map, and writing utensil. Review the map with your instructor, and identify the 8 to 10 locations. Use the GPS device to find the longitude and latitude for each of the locations. Note the land features at each location.

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Variable Rate Technology

Remote sensing is the process of gathering and recording the data about crop fields from satellites. Farm implements can be equipped with a **GPS receiver system**—a system including antenna and software that is able to collect signals from satellites and calculate latitude, longitude, and altitude.

Once the field has been plotted with GPS and a GIS map has been created and uploaded to a computer, other farm equipment can use that information to provide variable rate technology. **Variable rate technology (VRT)** is the ability of a machine to adjust the rate of fertilizer application or other cropping practices for each individual grid on the GIS map.

The fertilizer implement uses **machinery controllers**, which are computerized devices installed on equipment to change the rate during application. The computer, not the driver, controls the application of the fertilizer or spray.

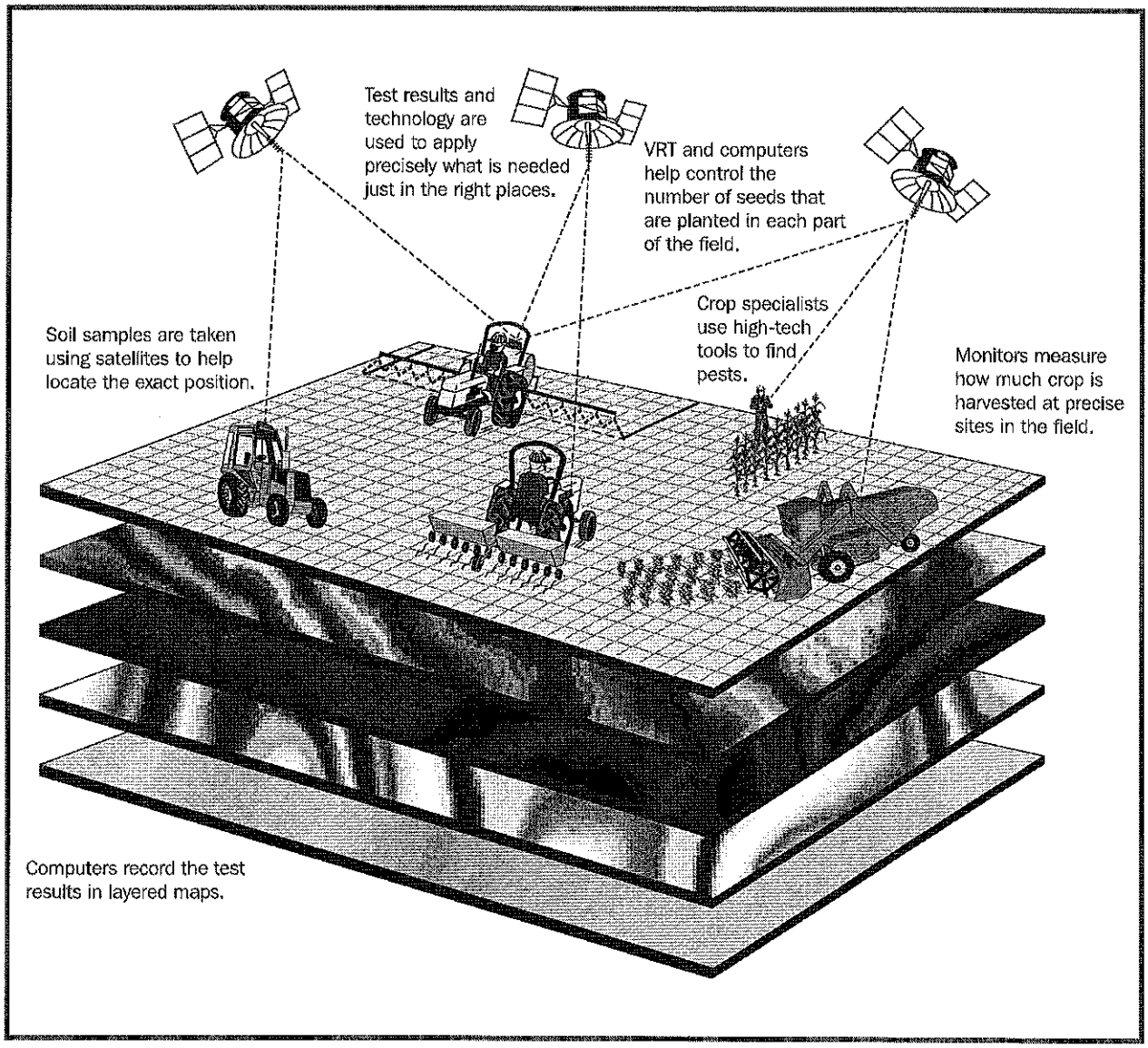

FIGURE 2. Precision farming uses GPS technology to create specific cropping plans.

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BENEFITS OF PRECISION AGRICULTURE

Precision farming increases the production efficiency, promotes sustainable agriculture, and protects the environment.

Farmer Benefits

Precision farming increases production efficiency by dividing large fields into smaller areas based on various factors, such as soil fertility and water-holding capacity. Farmers can use yield sensing for a more accurate picture of the production of a given field. **Yield sensing** is the process of using GPS and yield monitors on harvesting equipment to plot out a map of production within a field. This, combined with soil sample maps and variable application of fertilizer, promotes a more efficient use of the land and increased profits.

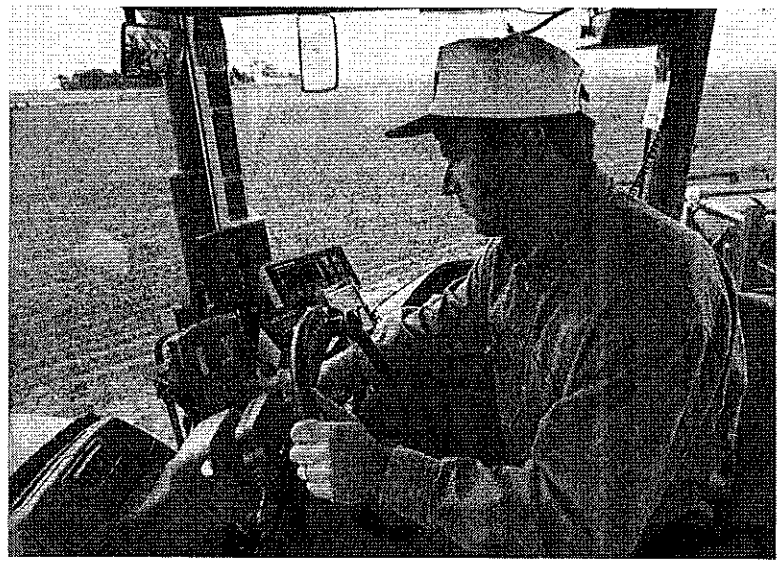

FIGURE 3. This farmer is operating a GPS system in a tractor. (Courtesy, Natural Resources Conservation Service, USDA)

Environmental Benefits

Sustainable agriculture is promoted by improving the precision at which fertilizers, herbicides, insecticides, and other chemicals are applied to a field. Applications are made exactly where needed instead of performing a blanket application to the entire field.

When chemicals are applied exactly where needed, and in the exact amount needed for that location, there is a reduced risk of runoff or over-application, which results in environmental problems. Gone are the days of massive one-size-fits-all applications that waste resources and pose a threat to the environment.

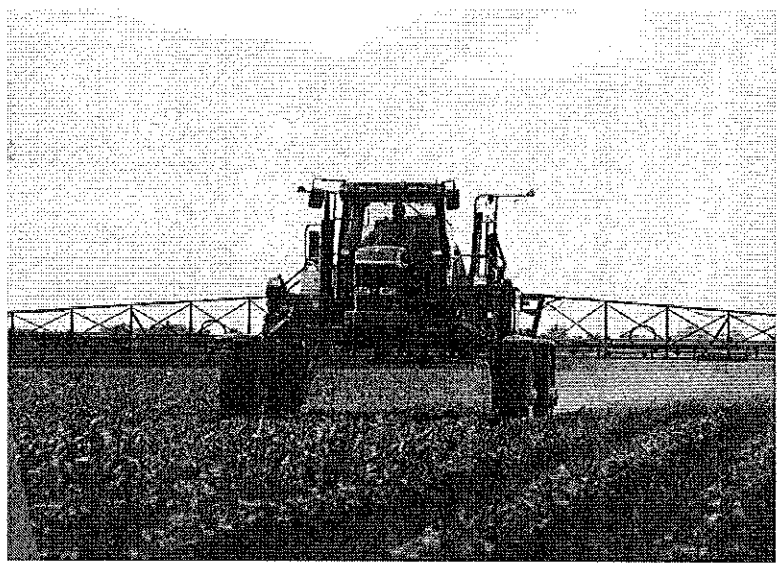

FIGURE 4. Precision farming provides greater control over fertilizers and other chemical inputs. (Courtesy, Natural Resources Conservation Service, USDA)

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CAREERS IN PRECISION AGRICULTURE

Like most technology areas, precision farming is seeing a large increase in the number of available agriculture careers. Experience in computers, GPS, mobile technologies, and communications is vital to success in the site-specific farming arena.

Specialist

One career area with a large demand for workers is precision agriculture specialist. A **precision agriculture specialist** is a person who sells, installs, trains (farmers), troubleshoots, and repairs any and all systems associated with precision farming technology. An ability to work with others, diagnose and resolve problems, and keep up on new technology is a must for anyone in this career area.

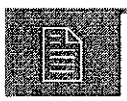
Technician

Another career area seeing large growth and demand is precision agriculture technician. A **precision agriculture technician** is a person who is responsible for taking the data from GPS, soil samples, yield maps, fertilizer application, and other farm data to create a cropping plan to help farmers minimize cost and maximize yield. A precision agriculture technician must have excellent computer skills and the ability to work with large amounts of data and information. He or she must be able to communicate well with fellow employees (e.g., chemical and fertilizer applicators and the farmer, whose livelihood depends on the accuracy and dependability of the technician's recommendations).

Instructor

A **precision agriculture instructor** is a person who is trained to teach technology to company salespeople, farm groups, and possibly students at community colleges or universities. The instructor works closely with developers of GPS/GIS systems for agriculture to stay current on all agricultural technologies. The instructor is the critical link between manufacturers of precision equipment and those who are selling and using the equipment.

Summary:



Site-specific farming is the practice of using various technologies to sample soils and crops and create a specific cropping plan within a given field or area. Precision farming is a site-specific crop management system that uses global positioning and other technology to meet the needs of the land. A global positioning system (GPS) is a satellite-based system that can determine exact points within a field or farm.

Precision farming increases production efficiency by dividing large fields into smaller areas based on various factors, such as soil fertility and water-holding capacity. Like most technology areas, precision farming is seeing a large increase in the

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number of careers in agriculture available to young people today. Experience in computers, GPS, mobile technologies, and communications is vital to success in the site-specific farming arena.

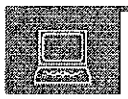
Checking Your Knowledge:

1. What is precision farming?
2. How are GPS and GIS related in agriculture?
3. Describe how precision farming uses variable rate technology.
4. Describe how the use of precision farming benefits farmers and the environment.
5. List the three precision farming career areas discussed. Give a brief description of each career area.

Expanding Your Knowledge:

Interview an extension agent, college instructor, or agribusiness person about the use of precision technology in agriculture. Ask the person to address the procedures, use, and benefits of the technology. Write a report on your findings to share with your class.

Web Links:



Precision Agriculture
http://www.precisionag.com/

Precision Technology in Farming
http://farmindustrynews.com/precision-farming

Crop Management
http://www.hrlimited.com/land-surveyor-services/precision-farming/

Agricultural Career Profiles
http://www.mycaert.com/career-profiles/