

Glossary Of Precision Crop Management Terms

**Compiled For Use In Classroom Teaching by Dr. Bruce Erikson,
Purdue University**

August 2017

Sources

Glossary of forage terms, Purdue Extension

(<https://www.agry.purdue.edu/ext/forages/Forage%20Glossary-2010.pdf>)

A glossary of terms for precision farming, Purdue University,

<https://www.agriculture.purdue.edu/ssmc/frames/newglossery.htm>

Agriculture terms and definitions, Maryland Cooperative Extension,

http://extension.umd.edu/sites/extension.umd.edu/files/_docs/Agriculture%20Terms2.pdf

Precision agriculture series, timely information agriculture, natural resource and forestry. Alabama Cooperative Extension system.

<https://sites.aces.edu/group/crops/precisionag/Publications/Timely%20Information/Introduction%20to%20Precision%20Ag%208-2010.pdf>

Important precision agriculture terminology, The Ohio State University,

<https://fabe.osu.edu/programs/precision-ag/other/precision-agriculture-terminology>

FAO Corporate Document Repository, Glossary of biotechnology and Genetic Engineering,

<http://www.fao.org/docrep/003/X3910E/X3910E04.htm#TopOfPage>

FAO. 1983. Resolution 8/83 of the Twenty-second Session of the FAO Conference. Rome, 5-23 November 1983.

FAO. 1999. *The Global Strategy for the Management of Farm Animal Genetic Resources - Executive Brief*. (see Glossary, pp. 39-42; the glossary was still evolving, but the draft definitions are those developed by the Panel of Experts assisting FAO to detail the Global Strategy.)

USDA-DoA, Agricultural Biotechnology Glossary.

<https://www.usda.gov/topics/biotechnology/biotechnology-glossary>

Soil Science Society of America, Glossary of Soil Science Terms,

<https://www.soils.org/publications/soils-glossary>

Crop Science Society of America glossary of crop science terms,

<https://www.agronomy.org/publications/crops-glossary#>

International Standard ISO 7256, Sowing equipment – Test Methods – Part 1: Single seed drills (precision drills) Ref. No. ISO 7256/1-1984 (F.)

John Deere http://manuals.deere.com/omview/OMA104916_19/?tM=HO

Precision Planting <https://cloud.precisionplanting.com/pubs/?view=0Bx7V2J-P2yNZLW9HX19oTmfdUE>
<https://cloud.precisionplanting.com/pubs/?view=0Bx7V2J-P2yNZeWIINTZMQ2Y3SHM>

Alphabetical Glossary Of Precision Crop Management Terms

A

AB line – The imaginary reference line set for each field that a tractor/sprayer guidance system uses to follow. There are different reference lines that can be set in a field to fit a particular geography or

abiotic stress The effect of non-living factors which can harm living organisms. These non-living factors include drought, extreme temperatures, pollutants, etc.

Accuracy (of GPS receivers) – The measure of closeness of an object’s actual (true) position to the position obtained with a GPS receiver. Accuracy levels are used to rate the quality of GPS receivers.

Acid Soil: A soil with an acid reaction, a pH less than 7.0.

Acre: A parcel of land, containing 4,840 square yards or 43,560 square feet

Active Down Force (sometimes displayed as “down force margin”) - A system which automatically adjusts the force in the air spring circuit based on soil condition information gathered from the row unit gauge wheel sensors.

Active sensing systems - sensing systems that generate a signal, bounce it off an object, and measure the reflected signal.

Actuator - a device used in variable-rate application that responds to controller signals to regulate the amount of material applied to a field.

Aerial photography - Photos taken from airplanes to assist growers to determine variations within an area of interest such as a field.

Adaptive Sampling - dynamic sampling plan that changes over time based on actual field conditions and analysis results; often affects the number and location of samples.

Aerial Imaging - photos taken, or images collected, from aircraft to assist growers and consultants in determining variations within an area of interest such as a farm field

Aerobic (i) Having molecular oxygen as a part of the environment. (ii) Growing only in the presence of molecular oxygen, such as aerobic organisms. (iii) Occurring only in the presence of molecular oxygen (said of chemical or biochemical processes such as aerobic decomposition).

Air (-filled) porosity The fraction of the bulk volume of soil that is filled with air at any given time or under a given condition, such as a specified soil-water content or soil-water matric potential.

Agriculture: The utilization of biological processes on farms to produce food and other products useful and necessary to man. Both a “way of life” and a “means of life” for the people involved in this industry.

Agricultural Biotechnology: A range of tools, including traditional breeding techniques, that alter living organisms, or parts of organisms, to make or modify products; improve plants or animals; or develop microorganisms for specific agricultural uses. Modern biotechnology today includes the tools of genetic engineering.

Agriculture Extension Service: Cooperative (Federal, State, and County) agency doing research and education for rural and urban producer and consumer groups, located in each county with specialist personnel for each particular area.

Ag consultant - Person trained in agricultural and management sciences to provide information to land owners/managers for a fee related to the farming operation.

Ag consultant certification - There are 3 types of certification for ag consultants that are recognized in the US:

1. Certified Crop Advisor (CCA). Administered by the American Society of Agronomy. Requirements include a high school education, 4 years of experience, continuing education credits and testing.
2. Certified Professional Agronomist (CPAg). Administered by the American Society of Agronomy. Requirements include a college education, 4 years of experience, continuing education credits and testing.
3. Certified Professional Crop Consultant (CPC). Administered by the National Alliance of Independent Crop Consultants. Requirements include a college ag degree, 4 years of experience, continuing education credits and testing.

Agriculture anomaly - an agronomic (vegetation or soil) deviation or inconsistency in excess of "normal" variation from what one would expect to observe

Agronomy: The science of crop production and soil management.

Algorithm - an ordered set of rules or instructions written as a computer program designed to assist in finding a solution to a problem. For example, an algorithm can be created to permit a microprocessor to relate sensor input to actuator output onboard a crop chemical applicator.

Albedo The ratio of the amount of solar radiation reflected by a body to the amount incident upon it, often expressed as a percentage, as, the albedo of the earth is 34%

Analysis Buffer - An area defined by a specified length extended around a point, line, or area.

Anaerobic (i) The absence of molecular oxygen. (ii) Growing in the absence of molecular oxygen (such as anaerobic bacteria). (iii) Occurring in the absence of molecular oxygen (as a biochemical process)

Ancillary Data - Secondary data or additional information used to verify, classify, or model attribute associations.

Animal Unit: A unit of measurement of livestock, the equivalent of one mature cow weighing 1,000 lbs. The measure is used in making comparisons of feed consumption. Five mature ewes also are considered an animal unit.

Anion exchange capacity The sum of exchangeable anions that a soil can adsorb. Usually expressed as centimoles, or millimoles, of charge per kilogram of soil (or of other adsorbing material such as clay).

Annual: A plant that completes its life cycle from seed to plant, flower, and new seed in 1 year or less.

Anti-Spoofing – Process of encrypting the L2 signal to prevent unauthorized transmissions of false GPS signals.

Apiary: Colonies of bees in hives and other beekeeping equipment for the production of honey.

Application Rate - Amount of seed distributed, expressed as a number, mass or volume of seed per unit of length or surface

Applied Down Force - The amount of weight applied as the planter passes through the field.

archive - The storage of historical records and data. When you have collected a year or two of data from your precision farming applications, you have started your own archive.

Array- A line of sensors that collect a whole line, or swath, of data at once.

As-Applied Map – Is a map containing site-specific information about the location and rate of application for fertilizer or chemical input. Usually created with a GPS equipped applicator and data logger.

ASCII- (American Standard Code for Information Interchange) the predominant code used by present-day computers for identifying characters like numbers and letters.

Aspect- Horizontal direction in which a slope faces. For example, a southwest-facing slope has an aspect of 225 degrees.

Attribute- A numeric and/or text description of a spatial entity.

Auger: Spiral device on a shaft used to move grain through a tube.

Automatic Section Control – turns application equipment OFF in areas that have been previously covered, or ON and OFF at headland turns, point rows, terraces, and/or no-spray zones such as grass waterways. Sections of a boom or planter or individual nozzles/rows may be controlled.

Autocorrelation- The correlation of a variable with itself over successive time intervals. Also called serial correlation.

Auto Swath - GPS machine control systems that include boom control and planter control by row sections or individual row.

Auto-Steer – a GPS guidance system that steers agricultural equipment with centimeter accuracy. This level of accuracy requires real time kinematic (RTK) correction of GPS signals. Auto-steer is an add-on component for equipment. It includes both the GPS system to receive and process the signals, software and hardware to allow the input of control maps and the mechanical equipment to actually steer the tractor. Some new tractors are available “auto-steer ready.”

Automatic Section Control - Turns application equipment OFF in areas that have been previously covered, or ON and OFF at headland turns, point rows, terraces, and/or no-spray zones such as grass waterways. Sections of a boom or planter or individual nozzles/rows may be controlled.

Autonomous Operation - Vehicle guidance without the need for human intervention. A tractor may be driven by a series of on-boards sensors and GPS for precision driving without damage to crops.

B

Backslope The hillslope position that forms the steepest, and generally linear, middle portion of the slope. In profile, backslopes are bounded by a convex shoulder above and a concave footslope below.

Band- A discrete interval of the electromagnetic spectrum between two wavelengths. See also waveband.

Banding A method of fertilizer or other agrichemical application above, below, or alongside the planted seed row. Refers to either placement of fertilizers close to the seed at planting or subsurface applications of solids or fluids in strips before or after planting. Also referred to as band application.

Bare fallow Complete inversion and incorporation of residues for maximum decomposition, done to prevent the growth of all vegetation; usually associated with summer fallow.

Base Map – a simple map that shows the boundaries of a field or section and information about any unique feature (sinkholes, or streams).

Base Station - The RTK-GPS receiver and radio that are placed in a stationary position, functioning as the corrections source for roving tractor units in an area. These stations can be either portable or permanently installed systems and their coverage can range from 5 to 10 miles depending on topographic conditions, antenna height, and radio-transmit power. Also called a reference station, is a receiver located at a surveyed benchmark. The base station

calculates the error for each satellite and through differential correction, improves the accuracy of GPS positions collected at unknown locations by a roving GPS receiver.

Batch-Type Yield Monitor. A yield monitor that weighs the amount of harvested grain as it sits in the combine grain tank or as it is being unloaded. Yield must be calculated using an estimate of the area harvested.

Baud Rate- A measure of the speed at which individual digital elements are transmitted over a communication line, typically between a computer and some other _electronic device

Biomass The weight of living organisms (plants and animals) in an ecosystem, at a given point in time, expressed as fresh or dry weight.

Bit - An abbreviated term for binary digit, the smallest unit of computer data.

Bloating: Abnormal swelling of the abdomen of livestock, caused by excessive gas formation which can result in death.

block kriging - A piecewise form of kriging based on grid cells.

Boom/section Controller – An electronic device that is capable of turning on/off sections of a chemical application boom manually or automatically in combination with GPS positioning and area mapping.

Dormant seeding - The practice of planting seed during the late fall or early winter after temperatures become too low for seed germination to occur until the following spring.

Broadcasting: Random scattering of seeds over the surface of the ground. If the seed is to be covered, this is done as a separate operation, usually with a spike-tooth harrow.

Broiler: A chicken of either sex about 7 weeks of age.

Bt crops: Crops that are genetically engineered to carry a gene from the soil bacterium *Bacillus thuringiensis* (Bt). The bacterium produces proteins that are toxic to some pests but non-toxic to humans and other mammals. Crops containing the Bt gene are able to produce this toxin, thereby providing protection for the plant. Bt corn and Bt cotton are examples of commercially available Bt crops.

Buffer power The ability of solid phase soil materials to resist changes in ion concentration in the solution phase. Can be expressed as $\partial C_s / \partial C_l$ where C_s represents the concentration of ions on the solid phase in equilibrium with C_l , the concentration of ions in the solution phase. Includes pH buffering as well as the buffering of other ionic and molecular components.

Burying Device - Device generally comprising of a coulter, a device to regulate the ground penetration depth of the coulter and a unite that covers the seed

Bushel: A unit of dry measure (1 cubic foot) for grain, fruit, etc., equivalent to 8 gallons of liquid. Weight varies with the density/bulk of the commodity. Example: Oats weigh 32 lbs. Per bu.; barley, 46 lbs. Per bu.; and corn, 56 lbs.,. Per bu.

Bulk density, soil (ρ_b or D_b) The mass of dry soil per unit bulk volume.

Byte - A unit of computer storage of binary data usually comprising eight bits, and equivalent to a character. You will commonly hear computer memory and storage referred to using terms such as Kilobyte (approximately one thousand bytes), Megabyte (approximately one million bytes) and Gigabyte (approximately one billion bytes).

C

CAN-Bus (in tractors and implements) – CAN-Bus is a high-speed, wired data network connection between electronic devices. The hardware/wiring of CAN-Bus networks are generally the same, while the protocols for communication can be different and vary depending on the industry where they are used. These networks are used to link multiple sensors to an electronic controller, which can be linked to relays or other devices on a single set of wires. This reduces the amount of wires needed for a system and allows for a cleaner way to connect additional devices as system demands change.

Capacitance Type Sensor- A moisture sensor that measures the dielectric properties of grain as it passes between metal plates.

Carbon cycle The sequence of transformations whereby carbon dioxide is converted to organic forms by photosynthesis or chemosynthesis, recycled through the biosphere (with partial incorporation into sediments), and ultimately returned to its original state through respiration or combustion

Carrying capacity - The maximum stocking rate possible that will achieve a target level of animal performance and that will maintain or improve

Cartography - The art and science of the organization and communication of geographically related information such as a yield image into maps or charts. The term will refer to their construction, from data acquisition to presentation and use.

Cash Crop: Any crop that is sold off the farm to yield ready cash.

Cation Exchange Capacity (CEC)- Represents the total quantity of negative charge that is available in the soil to attract positively-charged ions in the soil solution.

Carrier- The radio frequency signal on which information is encoded and then transmitted.

Carrier -Phase Tracking- Accurate and sophisticated method of determining position requiring two special receivers that measure small differences in the radio signals.

Carrier Tracking Loop- Module in a GPS receiver that extracts the satellite message by aligning the receiver's internally-generated signal with the phase of the received GPS signal. Once the internal signal is locked to the GPS carrier, its phase can be measured to provide a carrier-phase observation.

Centroid - The position at the center of a one- or two-dimensional (2D) entity such as a polygon.

Certified Seed - Seed grown from pure stock which meets the standards of certifying agency (usually a state government agency). Certification is based on germination, freedom from weeds and disease, and trueness to variety.

Channel- Circuitry necessary for a GPS receiver to receive the signal from a single GPS satellite.

Choropleth Map- A thematic map such as a yield image where quantitative spatial data is depicted through the use of shading or color variations of yield ranges.

Circular Error Probable (CEP)- A measure of accuracy in positioning and navigation. CEP is the radius of the circle inside of which the true coordinates of a position have a 50-percent probability of being located.

CF card (Compact Flash card) – a small, portable card used for storing data in electronic devices. In precision ag equipment it is used in monitors and/or controllers to store and transfer data.

Client (commonly referred to as Grower) This term is used by a custom applicator or crop consultant to describe the customers that they are working for. This term is used by producers/growers, when a producer/grower is doing custom work for a neighbor; i.e. they set the neighbor up as a "client"

Clod A compact, coherent mass of soil varying in size, usually produced by plowing, digging, etc., especially when these operations are performed on soils that are either too wet or too dry and usually formed by compression, or breaking off from a larger unit, as opposed to a building-up action as in aggregation.

Cluster Sampling- A technique in which observation units in a population are aggregated into larger sampling units known as primary units.

Coarse Acquisition (CIA) Code- A unique code for each GPS satellite. The standard code used by civilian receivers.

Collect-and-Weigh - A method for determining crop yield, typically on a whole-field basis. Each truck or wagon load of grain is weighed as it leaves the field and the moisture content is determined by sampling the load.

Complete Fertilizer: A fertilizer containing the three macro nutrients (Nitrogen, Phosphorous, and Potassium) in sufficient amounts to sustain plant growth.

Computer aided design (CAD) - Software with the capability of performing standard engineering drawings.

Computer aided mapping (CAM) - Software with the capability of generating standard mapping functions. In contrast to GIS, it can not analyze or process a database.

Compost: Organic residues, or a mixture of organic residues and soil which have been piled, moistened, and allowed to undergo biological decomposition. Mineral fertilizers are sometimes added.

Cone penetrometer An instrument in the form of a cylindrical rod with a cone-shaped tip designed for penetrating soil and for measuring the end-bearing component of penetration resistance. The resistance to penetration developed by the cone equals the vertical force applied to the cone divided by its horizontally projected area. See also cone index, penetration resistance and friction cone penetrometer.

Confinement: Livestock kept in “dry-lot” for maximum year-round production. Facilities may be partial or complete solid floored and enclosed/covered.

Control Segment - The portion of GPS consisting of a network of monitoring stations used to update satellite navigation signals.

Contour Map – yield map that combines dots of the same intensity/yield level by interpolating (or kiging).

Contour Line – a line used to represent the same value of an attribute (elevation or yield).
Contouring – interpolation method used to distinguish between different levels of an attribute (elevation, fertility, yield).

Controller- An electronic device used to change product application rates on-the-go.

Control Segment – the network of tracking stations that monitor and control GPS satellites.

Cooperative: An organization formed for the purpose of production and marketing of goods or products owned collectively by members who share in the benefits. Most common examples in agriculture are canneries and creameries.

CORS (network) – Continuously Operating Reference Station. A network managed by the U.S. office of National Ocean Service (NOAA) to provide GNSS data consisting of carrier phase measurements throughout the United States.

Coordinate System - Used in GPS/GNSS navigational systems to reference locations on Earth. There are many coordinate systems but frequently used ones include: latitude and longitude, Universal Transverse Mercator (UTM), and State Plane coordinate systems.

Cover crop Close-growing crop, that provides soil protection, seeding protection, and soil improvement between periods of normal crop production, or between trees in orchards and vines in vineyards. When plowed under and incorporated into the soil, cover crops may be referred to as green manure crops.

Crop Rotation: More or less regular recurrent succession of different crops on the same land for the purpose of maintaining good yields.

Coulter - Device for opening a furrow in the ground in which the seeds leaving the meter mechanism are placed

Crop - A grain, fruit, vegetable, or fiber that can be harvested.

Crop Planted Date - The actual date the crop is planted in the soil; the actual date the seed is placed and incorporated into the soil

Crop residue Portion of plants remaining after seed harvest; refers mainly to grain crop residue, such as corn stover, or of small-grain straw and stubble.

Crop Sensors - Optical crop sensors used to measure and/or quantify crop health or evaluate crop conditions by shining light of specific wavelengths at crop leaves, and measuring the type and intensity of the light wavelengths reflected back to the sensors

Crop Variety - The distinctive name of the crop type or the named, specific characters used to identify the crop

Crop Year (commonly referred to as Growing Season) - The period within which a crop is normally grown, regardless of whether or not it is actually grown, and designated by the calendar year in which the crop is normally, harvested.

Crop Practice - The customary and systematic husbandry actions undertaken in establishing and caring for the crop

Crop Sensors - Optical crop sensors used to measure and/or quantify crop health or evaluate crop conditions by shining light of specific wavelengths at crop leaves, and measuring the type and intensity of the light wavelengths reflected back to the sensors.

Cultivar (1) A variety, strain, or race that has originated and persisted under cultivation or was specifically developed for the purpose of cultivation. (2) For cultivated plants, the equivalent of botanical variety, in accordance with the International Code of Nomenclature of Cultivated Plants-1980. *Usage:* Cultivar names are not italicized, and are indicated by single quotes at first use, or the word cultivar (but not both). The abbreviation cv. is properly used only with a binomial name: *Genus species* cv. cultivarname. Omit the abbreviation if single quotes are used: *Genus species* 'cultivarname'

CWT: Hundredweight or 100 pounds.

D

Data Layer (in GIS) – A layer of information on a GIS map. A map can have many layers to present different types of information. For example, the first layer of a map may be a satellite image of an area. The next layer may have only lines that represent roads or highways. The next layer may contain topographic information and so forth.

Database – a collection of different pieces of georeferenced information (yield, soil type, fertility) that can be manipulated (layered) in a GIS model.

Datum – a geodetic datum defines the reference systems that describe the size and shape of the earth. Datum have evolved from those describing a spherical earth to ellipsoidal models derived from years of satellite measurements. Frequently used datum include: World Geodetic

System 1984 (WGS 84), North American Datum of 1983 (NAD 83), and North American Datum of 1927 (NAD 27). Referencing geodetic coordinates to the wrong datum can result in large position errors.

Dead Reckoning - A method for calculating position in a field based on vehicle speed, travel time, equipment width, and number of passes through a field. Errors in position can be caused by small speed changes, wheel slippage, nonparallel or overlapping passes, and starting and stopping at the ends of the field.

DEM -(Digital Elevation Model) - a digital representation of the elevation of locations on the land surface. A DEM is often used in reference to a set of elevation values representing the elevations at points in a rectangular- grid on the Earth's surface. Some definitions expand DEM to include any digital representation of the land surface, including digital contours.

Denitrification Reduction of nitrogen oxides (usually nitrate and nitrite) to molecular nitrogen or nitrogen oxides with a lower oxidation state of nitrogen by bacterial activity (denitrification) or by chemical reactions involving nitrite (chemodenitrification). Nitrogen oxides are used by bacteria as terminal electron acceptors in place of oxygen in anaerobic or microaerophilic respiratory metabolism.

Department of Defense (DOD)- The organization responsible for the creation and operation of the Global Positioning System.

Depth -General term relating to depth of soil, water, or similar. A dimension taken through an object or body of material, usually downward from an upper surface, horizontally inward from an outer surface, or from top to bottom of something regarded as one of several layers.

Developmental stage Discrete portion of the life cycle of a plant, such as vegetative growth, reproduction, or senescence. Several published systems are in use for various crops to subdivide the broad stages. *Usage:* Preferred to growth stage (except when growth stage is part of the name of a published system). *See also* bloom, early; bloom, full; bloom, late; boot stage; grain maturity.

Dielectric- A material that does not conduct electricity. Examples include plastic and dry grain.

Differential Correction – correction of a GPS signal that is used to improve its accuracy (to less than 100 m/~330 ft) by using a stationary GPS receiver whose location is known. A second receiver computes the error in signal by comparing the true distance from the satellites to the GPS measured distance.

Differential Global Positioning System (DGPS) – a method of using GPS which attains the position accuracy needed for precision farming through differential correction.

Digitize- To digitally record the relative position of a point, line, or area located on a map.

Dinitrogen fixation Conversion of molecular nitrogen (N_2) to ammonia and subsequently to organic nitrogen utilizable in biological processes.

Directed Sampling- Targeted, guided, or 'smart' sampling technique that relies on existing ancillary, secondary, or associated spatial information to assist in determining sample placement, selection, and number of samples to collect.

DLG- (Digital Line Graph) A U.S. Geological Survey digital map format used to distribute topographical maps in vector form. The digital files contain lists of the coordinate points that describe linear map features.

DOP (Dilution Of Precision) - One of many quality measurements to evaluate solutions derived by a positioning receiver. This is a numeric value that relates relative geometries between positioning satellites as well as the geometries between the satellites and the receiver; the lower the value, the higher the probability of accuracy. DOP can be further classified to other variables: GDOP (three-dimensional position plus clock offset), HDOP (horizontal position), PDOP (three-dimensional position), TDOP (clock offset), VDOP (vertical position). A DOP value of 4 or less is typically desired for best accuracy.

Double Crop: Two different crops grown on the same area in one growing season.

Down Force - Weight being measured by the gauge wheels for those row units equipped with a sensor.

Down Force Margin - The amount of extra down force applied to row units, over and above what is required for opener disks to penetrate the soil and achieve full planting depth. The extra down force comes from the weight of the row unit and meter, weight of seed in the seed hoppers, the pneumatic down force system, or external down force springs.

DNA (deoxyribonucleic acid): The chemical substance from which genes are made. DNA is a long, double-stranded helical molecule made up of nucleotides which are themselves composed of sugars, phosphates, and derivatives of the four bases adenine (A), guanine (G), cytosine (C), and thymine (T). The sequence order of the four bases in the DNA strands determines the genetic information contained.

Drainage: The removal of excess surface water or excess water from within the soil by means of surface or sub-surface drains.

Drilling: The process of opening the soil to receive the seed, planting the seed and covering it in a single operation.

Dry Cow: A cow that is not producing milk, the period before the next calving and lactation.

Dry Land Farming: The practice of crop production without irrigation.

Dry matter disappearance (1) Grazing: Forage present at the beginning of a grazing period plus growth during the period minus forage present at the end of the period. (2) Digestibility: Loss in dry weight of forage exposed to in vitro digestion

E

EC, soil electrical conductivity is a measurement that correlates with **soil properties** that affect crop productivity, including **soil** texture, cation exchange capacity (CEC), drainage conditions, organic matter level, salinity, and subsoil characteristics. EC is the ability of a soil to carry an electrical current.

Electromagnetic Energy- Energy that is reflected or emitted from objects in the form of electrical and magnetic waves which can travel through space.

Electromagnetic Spectrum- All wavelengths of electromagnetic energy including x-rays, ultraviolet rays, visible light, infrared light, microwaves, and radio waves.

Electro-Optical Sensors- Light-sensitive, electronic detectors that create an electrical signal proportional to the amount of electromagnetic energy that hits them.

Email - messages distributed by electronic means from one computer user to one or more recipients via a network

End of Pass Delay- A delay that allows any grain that passes by the flow sensor after the combine header has been raised to be included in yield calculations.

Enhanced Thematic Mapper (ETM)- A sensor that senses multispectral bands at a spatial resolution of 30m, a short wave thermal band at a resolution of 120m, multispectral thermal bands at a resolution of 60m, and a panchromatic band at a resolution of 15m. The ETM is used on LANDSAT-7.

Erosion: The wearing away of the land surface, usually by running water or wind.

Extrapolation - A method or technique to extend data or inferences from a known location to another location for which the values are not known.

Evapotranspiration, water loss from the combined impact of soil evaporation and crop transpiration

I

Iteration - repetition of a mathematical or computational procedure applied to the result of a previous application, typically as a means of obtaining successively closer approximations to the solution of a problem.

F

Farm - Identification Attributes: Owner, Operator, Landlord, Renter, Common Name, Farm Serial Number, Tract Number, Common Land Unit identifier, Legal description.

Feature - A geographic component of the earth's surface that has both spatial and attribute data associated with it. Examples include a field, well, or waterway.

Fertilizer Any organic or inorganic material of natural or synthetic origin (other than liming materials) that is added to a soil to supply one or more plant nutrients essential to the growth of plants.

Fertilization: The union of pollen with an egg to form an embryo.

Field Capacity: The moisture content of soil in the field as measured two or three days after a thorough wetting of a well-drained soil by rain or irrigation water.

Field- Set of alphanumeric characters comprising a unit of information within a data record. Examples of fields within a data record such as a line from a crop yield file include latitude, longitude, flow rate, and moisture content.

Field - All acreage of tillable land within a natural or artificial boundary (e.g., roads, waterways, fences, etc.). Different planting patterns or planting different crops do not create separate fields. The environment in which the commodity is produced.

Field burning - Burning plant residue after harvest to (i) aid in insect, disease, and weed control; (ii) reduce cultivation problems; and (iii) stimulate subsequent regrowth and tillering of perennial crops.

Field trial: A test of a new technique or variety, including biotech-derived varieties, done outside the laboratory but with specific requirements on location, plot size, methodology,

Firmware – refers to the program that internally controls an electronic device. Precision ag systems and GPS receivers contain firmware and manufacturers often offer updates to the firmware when new features and system advancements are available.

Flash Card - Category of PC card that will retain data without the need for a battery or other power source.

Flow Rate- Amount of seed distributed, expressed as a number, mass or volume of seed per unit of time

Flow Sensor- A sensor that measures the amount of material flowing through a conduit per unit of time.

Footslope The hillslope position that forms the inner, gently inclined surface at the base of a slope. In profile, footslopes are commonly concave and are situated between the backslope and a toeslope

Forage: Vegetable matter, fresh or preserved, which is gathered and fed to animals as roughage (e.g., alfalfa hay, corn silage, or other hay crops).

Frame Grabber- Hardware device that can directly read digital pixel data output from a camera and transfer information to computer memory as an image.

Frequency Modulation (FM)- A method of transmitting information on radio waves by encoding the information as a change in frequency or number of cycles per second

Frequency of Coverage- A measure of how often a sensing system, such as a satellite, can be available to collect data from a particular site on the ground. **Fix** - A single position calculated by a GPS receiver with latitude, longitude, altitude, time, and date.

G

Gene: The fundamental physical and functional unit of heredity. A gene is typically a specific segment of a chromosome and encodes a specific functional product (such as a protein or RNA molecule).

Gene expression: The result of the activity of a gene or genes which influence the biochemistry and physiology of an organism and may change its outward appearance.

Gene flow: The movement of genes from one individual or population to another genetically compatible individual or population.

Gene mapping: Determining the relative physical locations of genes on a chromosome. Useful for plant and animal breeding.

Gene (DNA) sequencing: Determining the exact sequence of nucleotide bases in a strand of DNA to better understand the behavior of a gene.

Genetic engineering: Manipulation of an organism's genes by introducing, eliminating or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant DNA techniques.

Genetically engineered organism (GEO): An organism produced through genetic engineering.

Genetic modification: The production of heritable improvements in plants or animals for specific uses, via either genetic engineering or other more traditional methods. Some countries other than the United States use this term to refer specifically to genetic engineering.

Genetically modified organism (GMO): An organism produced through genetic modification.

Genetics: The study of the patterns of inheritance of specific traits.

Genome: All the genetic material in all the chromosomes of a particular organism.

Genomics: The mapping and sequencing of genetic material in the DNA of a particular organism as well as the use of that information to better understand what genes do, how they are controlled, how they work together, and what their physical locations are on the chromosome.

Genomic library: A collection of biomolecules made from DNA fragments of a genome that represent the genetic information of an organism that can be propagated and then systematically screened for particular properties. The DNA may be derived from the genomic DNA of an organism or from DNA copies made from messenger RNA molecules. A computer-based collection of genetic information from these biomolecules can be a "virtual genomic library."

Genotype: The genetic identity of an individual. Genotype often is evident by outward characteristics, but may also be reflected in more subtle biochemical ways not visually evident

Geographic Data – data that contains information about the spatial location (position) and the attribute being monitored (yield, seed population, etc.). Also referred to as spatial data.

Geocode- A code that describes the location of a spatial element.

Geographic Data- Data that contains not only the attribute being monitored but also the spatial location of the attribute. Also known as spatial data.

Geographic Information System (GIS) – a computer-based system used to input, store, retrieve, and analyze geographic data sets. The GIS is usually composed of map-like spatial representations called layers which contain information on a number of attributes such as elevation, land ownership and use, crop yield and soil nutrient levels.

Geographic coordinate system - A reference system using latitude and longitude to define the locations of points on the surface of a sphere or spheroid.

Geometric Correction- Correction to align measured ground control points in a remotely-sensed image with the ground control points on an established map of the area.

Geometric Dilution of Precision (GDOP)- Term quantifying the effect of satellite geometry (relative positions of several satellites) on the magnitude of error in a position measurement.

Georeferenced Data- Spatial data that pertains to a location on the earth's surface.

Georeferencing- The process of associating non-spatial data such as crop yield values with geographic coordinate data to produce spatial data.

Geo-Stationary Satellite- Space vehicle in an orbit that keeps it over the same location on the earth at all times.

Georectification is the process of using points with known locations to reduce distortions resulting from: 1) sensor height and velocity variability, 2) non-linearity in the data set, and 3) Earth curvature.

Georeferencing – the process of adding geographic data to yield data or other field attributes either in real-time (on-the-go) or by post-processing or the process of associating data points with specific locations on the earth's surface.

Geo-Stationary Satellite – an orbital path of a satellite that is synchronized with the earth's orbit or space vehicles in an orbit which keeps them over the same location on the earth at all times.

Germination (1) Resumption of active growth by the seed embryo, culminating in the development of a young plant. (2) In seed laboratory practice: emergence and development from the seed embryo of those essential structures, which, for the kind of seed in question, are indicative of the ability to produce a normal plant under favorable conditions.

GIS (Geographic Information System) - A computer based system that is capable of collecting, managing and analyzing geographic spatial data. This capability includes storing and utilizing maps, displaying the results of data queries and conducting spatial analysis. GIS is usually composed of map-like spatial representations called layers which contain information on a number of attributes such as elevation, land ownership and use, crop yield and soil nutrient levels.

Global Positioning System (GPS) – A system using satellite signals (radio-waves) to locate and track the position of a receiver/antenna on the Earth. GPS is a technology that originated in the U.S. It is currently maintained by the U.S. government and available to users worldwide free of charge. There are 30 satellites in the GPS constellation.

GLONASS (GLObal naya NAVigatsionnaya Sputnikovaya Sistema) – Russian version of the American GPS satellite system. It is a radio-based satellite navigation system operated for the Russian government by the Russian Space Forces with a constellation of 24 operational satellites in 2010.

GPS (Global Positioning System) - A network of satellites controlled by the Defense Department that is designed to help ground based units determine their current location in latitude and longitude coordinates. Note that the term "GPS" is frequently used incorrectly to identify Precision Farming. GPS is only one technology that is used in Precision Farming to assist you to return to an exact location to measure fertility, pests and yield.

GPS Antenna – The device that receives satellite signals from space. On most hand-held GPS devices, the antenna is integrated into the receiver device. For machine GPS systems, the antenna is typically an external device that can be mounted on top of the vehicle, away from the receiver.

GNSS (Global Navigation Satellite System) – Is the standard generic term for satellite navigation systems that provide geo-spatial positioning with global coverage using time signals transmitted from satellites. The United States GPS and the Russian GLONASS are the only two fully operational GNSS. Top of the line GNSS receivers can communicate with both GPS and GLONASS satellites effectively doubling the available reference satellites at any given time.

Grain moisture content - Moisture content (MC) is the weight of **water** contained grain. The moisture content is generally reported on the wet basis **meaning** the total weight of the **grain** including the **water**.

Gravitational Water: Water that either runs off or percolates through a soil. Not available for use by plants.

Green Manure: Any crop or plant grown and plowed under to improve the soil, by addition of organic matter and the subsequent release of plant nutrients, especially nitrogen.

Grid Mapping – Predetermined locations in a field where soil or plant samples may be obtained for analysis. The test information can be used for assessing fertility needs and determining approximate locations for varying fertilizer and lime applications.

Grid Soil Sampling – dividing of a field into grids (typically 2.5 acres each) for soil sampling. Grids are established using the field boundary and an AgGIS software program. Once established a handheld device equipped with GPS and GIS software is used to navigate to the grid and a soil sample is collected from each grid. Soil sample results are then linked to the appropriate grid in an AgGIS for variable rate fertilizer and lime applications.

Ground reference data - The field collection of data that is used in the interpretation of information gathered from other sources such as a yield image or a remotely sensed image. Also known as ground truth but the preferred terminology is ground reference.

Gguided crop scouting – Assessment and recording of crop anomaly and conditions on a site-specific basis using a backpack GPS receiver and hand-held computer. The system allows the user to record growth stage/maturity, plant vigor, presence of disease, weed and insect infestation.

Ground Control Points – stationary objects/areas on the earth's surface that provide georeferenced points in a remote sensing image/aerial photograph.

Ground Contact - Refers to the percentage (%) of time when a row unit is in contact with the ground during planting. 100% represents optimum ground contact for row units and 0% represents no ground contact for row units.

Grid Center Method - Soil sampling method in which samples are taken from the center of a grid cell. Also known as grid point sampling or point sampling.

Grid Sampling -Soil sampling method in which a field is divided into square sections (grids) of several acres or less. Samples are then taken from each section and analyzed.

Ground Control Point -An easily-identifiable feature with a known location that is used to give a geographic reference to a point on a yield map or remotely-sensed image.

Ground Referencing - Verification of the accuracy of data by actual field investigation of areas that have been remotely sensed. It is important that ground referencing be done at the same time as remote sensing because of the rapid changes in field conditions that may occur. Also known as ground truthing.

Ground Waves - The manner in which low-frequency radio signals, like the US Coast Guard differential correction signals, travel. These waves are not blocked by hills or bluffs like FM radio signals since they follow the curvature of the earth.

Guidance - The determination of the desired path of travel (the "trajectory") from the vehicle's current location to a designated target, as well as desired changes in velocity, rotation and acceleration for following that path. There are two basic categories of guidance products: lightbar/visual guidance and auto-guidance. For lightbar/visual guidance, the operator responds to visual cues to steer the equipment based on positional information provided by a GPS. For auto-guidance, the driver makes the initial steering decisions and turns the equipment toward the following pass prior to engaging the auto-guidance mechanism. Auto-guidance can use differential correction such as WAAS, subscription services, and RTK. RTK is the most accurate level of auto-guidance available, typically +/- 1 inch. Benefits include improved field efficiency, reduced overlap of pesticide applications, time management and reduced driver fatigue. See also WAAS, Subscription Correction Signal and RTK.

H

Hard disk - A large capacity, mechanical, magnetic, computer storage device that stores your programs and data.

Hardiness Capability of an organism to withstand environmental stress. *Synonym:* stress tolerance..

Hardware - The various physical components of an information processing system such as a computer, view screen, plotters, and printers.

Herbicide-tolerant crops: Crops that have been developed to survive application(s) of particular herbicides by the incorporation of certain gene(s) either through genetic engineering or traditional breeding methods. The genes allow the herbicides to be applied to the crop to provide effective weed control without damaging the crop itself.

Hex Shaft - Displays the rotational speed of the hex shaft relative to its expected speed given actual planter speed and target population. This reading may indicate wheel slippage in ground drive systems and radar calibration errors in hydraulic drive systems. It is not a parameter to manage by itself, but a tool to diagnose population problems of drivetrain issues.
Histograms- Graphs of the frequency of occurrence of different ranges of measurements or counts within a set of data.

Horizontal Positioning Accuracy - The statistical difference, at a 95% probability, between horizontal position measurements and a surveyed benchmark for any point within the service volume over any 24-hour interval.

Hyperspectral Sensors- Sensors capable of measuring hundreds of individual wavelengths simultaneously.

Hybrid: The offspring of any cross between two organisms of different genotypes.

Humus: The well decomposed, relatively stable portion of the organic matter in a soil.

I

Infrared, near The preferred term for the shorter wavelengths in the infrared region extending from about 750 nm to 2000 nm.

Internet - An international network comprised of many possible dispersed local and regional computer networks in which one can share information and resources. Developed originally for military and then academic use, it is now accessible through commercial on-line services to the general public

Image Classification - Processing techniques that apply quantitative methods to the values in a digital yield or remotely-sensed scene to group pixels with similar digital number values into feature classes or categories.

Impact Plate - A plate placed in the path of grain flow. The force with which the grain strikes the plate is measured and used to estimate grain flow rate.

Instantaneous Field of View (IFOV) - A measure of the spatial resolution of a scanning-type sensor. The IFOV is the area on the ground "seen" by a sensor at any instant.

Interpolation – mathematical procedure for estimating unknown values from neighboring known data.

Insecticide resistance: The development or selection of heritable traits (genes) in an insect population that allow individuals expressing the trait to survive in the presence of levels of an insecticide (biological or chemical control agent) that would otherwise debilitate or kill this species of insect. The presence of such resistant insects makes the insecticide less useful for managing pest populations.

Insect-resistance management: A strategy for delaying the development of pesticide resistance by maintaining a portion of the pest population in a refuge that is free from contact with the insecticide. For Bt crops this allows the insects feeding on the Bt toxin to mate with insects not exposed to the toxin produced in the plants.

Insect-resistant crops: Plants with the ability to withstand, deter or repel insects and thereby prevent them from feeding on the plant. The traits (genes) determining resistance may be selected by plant breeders through cross-pollination with other varieties of this crop or through the introduction of novel genes such as Bt genes through genetic engineering.

Instantaneous Yield Monitor - A yield monitor that continuously measures and records crop yields on-the-go.

Interpolation - A procedure for predicting the unknown values between neighboring known data values.

Inverse Distance Weighting- An interpolation method similar to local averaging except that the samples closer to the desired location have more influence on the estimation than distant samples.

Ionosphere - A blanket of electrically charged particles 80 to 400 km above the earth.

Irrigation The intentional application of water to the soil, usually for the purpose of crop production.

ISOBUS – ISOBUS standard 11783 is a communication protocol for the agricultural industry that is used to specify a serial data network for control and communications on forestry or agricultural tractors and implements. ISOBUS-compliant tractors and implements come with round 9-pin connectors.

K

Kriging - An interpolation technique for obtaining statistically unbiased estimates of field characteristics, such as surface elevations, nutrient levels, or crop yields, from a set of neighboring points.

L

Lag - The horizontal distance between two geographic data points. Used to create a semi-variogram.

Land Classification: (land capability class) The classification of units of land for the purpose of grouping soil of similar characteristics, in some cases showing their relative suitability for some specific use.

landscape A collective term for all the natural features (such as fields, hills, forests, water, etc.) that distinguish one part of the earth's surface from another part. Usually used in reference to that land or territory which the eye can comprehend in a single view, including all its natural characteristics

LANDSAT (LAND SATellite) – a series of U.S. satellites used to study the earth's surface using remote sensing techniques.

Latitude – A global standard coordinate used to identify a position on earth given in degrees, minutes and seconds, indicates the north/south position above/below the equator, positive is in the northern hemisphere and negative is in the southern hemisphere.

Latitude/Longitude (LAT/LONG)- A coordinate system that is used to identify positions on earth. Latitude is the north to south position. Longitude is the east to west position. Locations are described in units of degrees, minutes and seconds.

L-Band - The segment of the radio spectrum ranging in frequency from 1,000 to 2,000 MHz.

Leaching: The process of removal of soluble materials by the passage of water through soil.

Legumes: A type of plant which has nodules formed by bacteria on its roots. The bacteria that compose these nodules take nitrogen from the air and pass it on into the plant for the plant to use. Some legumes are alfalfa, soybeans, sweet clover and peanuts.

Lidar - (light detection and ranging) is an optical remote-sensing technique that uses laser light to densely sample the surface of the earth, producing highly accurate x,y,z measurements. Can be used to produce elevation maps.

Lightbar (in machine guidance) – A device connected to a GPS receiver typically consisting of a row of led lights to provide the tractor operator with a visual guide, day or night. The lightbar does not automatically steer the tractor or machine, rather it aids the operator in driving on the imaginary reference line.

Light intensity The output of light per unit area or per unit solid angle at a source. *Usage:* Not to be used to describe the amount of irradiation at any plane away from the source. To describe a flux of radiant energy at a plane away from a source, light flux (density) or radiant flux (density) (in amount per unit area per unit time) are appropriate. The appropriate terms for the receipt of radiation on a surface are *irradiance* (in energy or quantum units) and *illuminance* (in photometric units). Light may be defined variously as radiation in the visible portion of the spectrum with wavelengths 400 to 700 nm up to 380 to 780 nm.

Limiting factor An environmental variable (or, less often, a plant trait) found at a level that restricts the performance of the organism.

Livestock: Any domestic animal produced or kept primarily for farm, ranch, or market purposes, including beef and dairy cattle, hogs, sheep, goats, and horses.\

Load Cell -A device that converts the effect of a force or weight into an electrical signal.

Local Average - An interpolation method in which the unknown value is estimated by a simple average of a selected number of points near the desired location.

Local Coordinate System- A coordinate system in which the coordinates are referenced to a known location in the immediate area. Two local coordinate systems will not "line up" on the same map.

Longitude – A global standard coordinate used to identify a position on earth given in degrees, minutes and seconds, indicates the east/west position around the globe from a reference point which overlays Greenwich, England. Negative values are east of Greenwich and positive values are west.

M

Macronutrient A plant nutrient found at relatively high concentrations ($>500 \text{ mg kg}^{-1}$) in plants. Usually refers to N, P, and K, but may include Ca, Mg, and S.

Management Zone - Management zones are created by subdividing a field into 10-20 acre areas with similar characteristics. Yield maps, soil texture maps, elevation data, EC data, sensor data and farmer knowledge can be used to create management zones in GIS software. There are several methods available for creating management zones.

Management Unit - An area or subunit of a farm field that has a functionally homogeneous combination of yield-limiting factors for which a single rate of a specific crop production input is appropriate. There can be a different set of management units for each type of input or treatment that a field receives.

Manure: Generally, the refuse from stables and barnyards including both animal excreta and straw or other litter.

Map-Based Variable-Rate Application System - A system that adjusts product application rate based on information contained in an electronic field map.

Map unit, soil (i) A conceptual group of one to many delineations identified by the same name in a soil survey that represent similar landscape areas comprised of either: (1) the same kind of component soil, plus inclusions, or (2) two or more kinds of component soils, plus inclusions, or (3) component soils and miscellaneous area, plus inclusions, or (4) two or more kinds of component soils that may or may not occur together in various delineations but all have similar, special use and management, plus inclusions, or (5) a miscellaneous area and included soils. (ii) A loose synonym for a delineation. See also delineation, component soil, inclusion, soil consociation, soil complex, soil association, undifferentiated group, miscellaneous areas.

Map Projection- A portrayal of geographic features from the curved surface of the Earth onto a flat plane.

Mass Flow Sensor - Is a sensor that measures grain flow in a yield monitor system.

Menu - A list of options displayed by a computer data processing program, from which the user can select an action to be initiated. These choices are usually displayed in the form of alphanumeric text but may be as icons.

Metering Mechanism - Mechanism which takes seed from a bath leaving the hopper individually or in groups and deposits them in a line (or row)

merge - To take two or more maps or data sets and combine them together into a single coherent map or database without redundant information.

Metadata - A term used to describe information about data. Metadata usually includes information on data quality, content, currency, lineage, ownership, and feature classification.

Micronutrients - Trace elements or minor nutrients - materials needed by plants in very small quantities.

Minimum Shift Keying (MSK) - A digital coding method used for transmitting differential correction data from the U.S. Coast Guard for use with DGPS.

Minimum tillage (1) Minimal soil manipulation in combination with chemicals for adequate seedbed preparation and vegetation control. (2) Minimal soil manipulation in combination with

chemicals and residue incorporation for minimum moisture loss, reducing energy input and labor requirement

Miss (commonly referred to as Skips) - For a single seed drill, the absence of a seed where there should be one theoretically. In practice by analogy with statistical evaluation of results, all spaces larger than 1.5 times the theoretical seed spacing are considered to be misses

Modem (modulator-demodulator) – A modem is a device that enables computers to access the internet to exchange data over telephone lines, cable lines or wirelessly. Cellular modems are typically used to access Real-time RTK Network or CORS data via the internet. When using a cellular modem, a data plan is required for internet access

Molecular biology: The study of the structure and function of proteins and nucleic acids in biological systems.

Mutation: Any heritable change in DNA structure or sequence. The identification and incorporation of useful mutations has been essential for traditional crop breeding

Mosaic - Process of assembling GIS database files for adjacent areas into a single, seamless file.

Moisture Sensor - Is a sensor that measures grain moisture in a yield monitor system

Multispectral Linear Array (MLA) - A sensor that uses a radiometer to collect data from 16 bands within the visible and NIR wavelengths at a spatial resolution of 10 m.

Multispectral Scanner - An electromagnetic sensor which collects data in several wavelength bands simultaneously.

Multiples (commonly referred to as Mults.) - For a single seed drill, the presence of two or more seeds metered where only one should be present. In practice, by analogy with statistical evaluation of results, all spacings less than 0.5 times the theoretical spacing are considered to be multiples

Mycotoxin A toxin or toxic substance produced by a fungus.

N

NAD83 (North American Datum 1983) – one of many different mathematical projection models used for precision agriculture data and mapping. NAD83 is a best-fit model for North America, Canada, Mexico, and Central America, while the previous model (NAD27) was designed for a central portion of North America only. Neither datum is wrong; however, errors may be introduced into positioning if one operates outside of the datum's range or if coordinates from one datum are compared to coordinates from another datum.

NAVSTAR (NAVigation by Satellite Timing and Ranging) - The U.S. based global navigation satellite system that was funded by taxpayers and controlled by the DOD.

NDGPS - Nationwide Differential Global Positioning System

NDVI Image - The Normalized Difference Vegetation Index (NDVI) is a simple graphical indicator that can be used to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not.

Nearest Neighbor - An interpolation method in which the unknown value is set equal to its nearest neighbor.

Near-isogenic lines Two distinct composites of F_3 lines from a single cross, one consisting of lines homozygous recessive and the other consisting of lines homozygous dominant for specific genes. That is, the paired composite lines have the same genetic background, differing only in being homozygous dominant vs. recessive for the specific genes.

Nematode: Soil worms of microscopic size. These organisms may attack the root or other structures of plants and cause extensive damage.

Nitrogen (N) - An inert gas that makes up about four-fifths of the air. Nitrogen for commercial purposes can be "fixed" synthetically from the atmosphere by several processes. A nutrient critical to plant growth.

Nitrogen Cycle: The sequence of transformations undergone by nitrogen in its movement from the free atmosphere into and through soils, into the plants, and eventually back. These biochemical reactions are largely involved in the growth and metabolism of plants and microorganisms.

Nitrification Biological oxidation of ammonium to nitrite and nitrate, or a biologically induced increase in the oxidation state of nitrogen

Nitrate toxicity A variety of conditions in animals, resulting from ingestion of feed high in nitrate; the toxicity actually results when nitrate (NO_3) is reduced to nitrite (NO_2) in the rumen

No-till A method of planting crops that involves no seedbed preparation other than opening small areas in the soil for placing seed at the intended depth. There is generally no cultivation during crop production; instead, chemicals are used for vegetation control. *Synonym:* zero till.

Nutrient: A chemical element or compound that is essential for normal body metabolism, growth and production. Includes: carbohydrates fats, proteins, vitamins, minerals and water.

Nutrient stress A condition occurring when the quantity of nutrient available reduces growth. It can be from either a deficient or toxic concentration.

NMEA - National Marine Electronics Association - NMEA O 183 is a widely-used data transmission protocol for GPS receivers.

Normalized Difference Vegetation Index (NDVI) - A common vegetation index that incorporates near-infrared and visible reflectance to produce a map of vegetative conditions.

NDVI Image - The Normalized Difference Vegetation Index (NDVI) is a simple graphical indicator that can be used to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not.

O

OmniSTAR - A subscription based differential GPS source. Omnistar is a satellite-based DGPS source that requires a special GPS antenna.

Operation Delay - The time required for grain to move from the combine header to the grain flow sensor.

Organic agriculture: A concept and practice of agricultural production that focuses on production without the use of synthetic inputs and does not allow the use of transgenic organisms. USDA's National Organic Program has established a set of national standards for certified organic production which are available online.

Organic Fertilizer: Any fertilizer material containing plant nutrients in combination with carbon.

Outcrossing: Mating between different populations or individuals of the same species that are not closely related. The term "outcrossing" can be used to describe unintended pollination by an outside source of the same crop during hybrid seed production.

Orthophotograph- An aerial photograph that corrects distortion caused by tilt, curvature and ground relief.

P

Panchromatic - Images created from radiation with wavelengths between 0.45 and 0.90 μm , usually produced in grayscale (black and white).

Parallel Swathing- Driving (or flying) a vehicle in straight, parallel paths without leaving gaps or overlapping consecutive paths (swaths).

Paddock - A relatively small subdivision of a pasture generally fenced (permanently or temporarily) and used to control livestock grazing.

Parent material - The unconsolidated, and more or less chemically weathered, mineral or organic matter from which the upper layers of a soil profile are developed by naturally occurring environmental processes.

Particle density The density of the soil particles, the dry mass of the particles being divided by the solid (not bulk) volume of the particles, in contrast with bulk density. Units are Mg m^{-3} .

Particle size The effective diameter of a particle measured by sedimentation, sieving, or micrometric methods.

Particle size analysis Determination of the various amounts of the different soil separates in a soil sample, usually by sedimentation, sieving, micrometry, or combinations of these methods.

Particle size distribution The fractions of the various soil separates in a soil sample, often expressed as mass percentages.

Particulate organic matter (POM) The microbially active fraction of soil organic matter consisting of fine particles of partially decomposed plant tissues.

Parts per million (ppm) The concentration of solutions expressed in weight or mass units of solute (dissolved substance) per million weight or mass units of solution. (ii) A concentration in solids expressed in weight or mass units of a substance contained per million weight or mass units of solid, such as soil.

Passive Sensing Systems - Sensing systems that measure naturally-emitted and reflected signals.

Pest-resistant crops: Plants with the ability to withstand, deter or repel pests and thereby prevent them from damaging the plants. Plant pests may include insects, nematodes, fungi, viruses, bacteria, weeds, and other.

Pesticide resistance: The development or selection of heritable traits (genes) in a pest population that allow individuals expressing the trait to survive in the presence of levels of a pesticide (biological or chemical control agent) that would otherwise debilitate or kill this pest. The presence of such resistant pests makes the pesticide less useful for managing pest populations.

Phenotype: The visible and/or measurable characteristics of an organism (how it appears outwardly).

Photosynthesis - the process by which plants, some bacteria, and some protists use the energy from sunlight to produce sugar, which cellular respiration converts into ATP

Plant breeding: The use of cross-pollination, selection, and certain other techniques involving crossing plants to produce varieties with particular desired characteristics (traits) that can be passed on to future plant generations.

PC card -A small credit-card-size data storage device used by most yield monitors. One type of PC card is referred to as a flash card.

PCMCIA - Personal Computer Memory Card International Association

pH - A term used to indicate the degree of acidity or alkalinity. A material that has a pH of 7.0 is neutral. Values above 7.0 denote alkalinity and below 7.0 denote acidity. Chemically, pH is the negative logarithm of the hydrogen ion concentration.

Phosphorus (P) - A highly-reactive element that combines readily with other elements and is one of the three primary plant foods.

Photosensor - A sensor that is used to detect light.

Pixel - An abbreviation of "picture element" - the smallest area or element of an image map. A pixel is represented in a remotely-sensed image as a rectangular cell in an array of data values and contains a data value that represents a measurement of some real-world feature.

Plan (commonly referred to as Crop Plan) - A plan is a specified document, or sets of documents, that is crop specific and is typically drafted at a high level by a consultant or trusted advisor. A plan may include crop season, seed and other products, and estimated rates for the products needed for planting. A grower may create and/or use 0...n plans. A plan is the first step in the data sequence and includes plan, number, timestamp, crop variety, operation and cultural practice, farm or land unit.

Plant available water - The amount of water between the permanent wilting point and field capacity.

Planter - An agricultural farm implement towed behind a tractor, used for sowing crops through a field. It is connected to the tractor with a draw-bar, or three-point hitch. Planters lay the seed down in a precise manner along rows. Seeds are distributed through devices called row units. The row units are spaced evenly along the planter. Planters vary greatly in size, from 2 to 48 rows. The spacing between the row units also vary greatly.

Planting (commonly referred to as Seeding) - The act of placing seed in the ground for the purpose for raising a crop for harvest

Plant Population (commonly referred to as Population, Target Pop.) A general term that indicates the target or actual number of seeds of a crop planted per acre

Plant Spacing - The row spacing in inches between the planted row of plants

Planter Speed (commonly referred to as Ground Speed) - Displays the speed of the planter

Pollen: The male germ cells.

Pollination: The transfer of pollen from the anther to the stigma.\

Pomology: the science or study of growing fruit.

Polygon - An area enclosed by a line describing spatial elements, such as a similar crop yields range, land use, or soil type.

Positioning Accuracy- The statistical difference, at a 95% probability, between position measurements and a surveyed benchmark for any point within the service volume over any 24-hour interval.

Positioning System - A general system for identifying and recording, often electronically, the location of an object or person.

Post-Processing - Differential correction of GPS position data after it has been collected in the field and stored on a computer diskette or PC card.

Potash (potassium oxide) (K₂O) - The potassium content of fertilizers is expressed as potash.

Potassium (K) - A highly-reactive element that combines readily with oxygen and many anions.

Potentiometer - A device that produces a changing electrical resistance as the relative positions of its components are changed.

Precision Farming - managing crop production inputs (seed, fertilizer, lime, pesticides, etc.) on a site-specific basis to increase profits, reduce waste and maintain environmental quality.

Prescription – refers to the map created in an AgGIS which assigns product application rates for variable rate applications. Prescription information is exported to a precision ag controller for application. Prescription maps are commonly used for variable rate seeding, fertilizer, lime and irrigation.

Prescribed Application - The dispensing of a material or chemical into the field on a prescribed or predetermined basis. A prescription map is generated by an expert (grower and/or agronomist) based on information about the field in use before an application. The prescription determines how much of something will be applied.

Precise (P) Code - A PRN code transmitted by GPS satellites. Each satellite is assigned a unique segment of the code which is so complicated it would take 266 days to transmit the entire code. Reserved mainly for military GPS receivers.

Precise Positioning System (PPS) - The full accuracy, single-receiver GPS service provided to the US military. It includes access to the P-code.

Pressure Sensor - A sensor that produces an electrical signal proportional to a fluid pressure.

Productive Soil: A soil in which the chemical, physical, and biological conditions are favorable for the economic production of the crops suited to a particular area.

Protein - any of a class of nitrogenous organic compounds that consist of large molecules composed of one or more long chains of amino acids and are an essential part of all living organisms.

PseudoRandom Noise (PRN) - Binary sequences of code that have noise-like properties. PRN codes allow all GPS satellites to use a single frequency for the transmission of data at low power levels.

Pseudorange - An estimation of the true distance (range) from a GPS receiver to a satellite. The estimate contains some error due to atmospheric propagation delays and the offset between the receiver's clock and the satellite clock.

Prescribed Application – The dispensing of a material or chemical into the field on a prescribed or predetermined basis. A prescription map is generated by an expert (grower and/or agronomist) based on information about the field in use before an application. The prescription determines how much of something will be applied.

Prescription File – A computer generated GIS file that assigns a value to a given geographical area. Example: Nitrogen application rate.

R

Racehorse hybrids yield more in optimal soil and climate environments. Stable hybrids have comparable yields from year-to-year with minimal influence from climate. Racehorse hybrids have higher yield potentials in high yield environments but involve greater risk as they appear to have less tolerance to low yield environments

Radar (RADio Detection And Ranging) - A method of determining the position or velocity of an object by bouncing high frequency signals off the object and measuring the reflected signal.

Radio Data Broadcast System (RDBS) - Same as RDS.

Radiometric Correction - Correction to reduce remotely-sensed image distortion from variations in radiation levels at the time of sensing.

Radiometric System - A yield monitoring system that determines mass flow rate by measuring the reduction in the intensity of a radioactive stream of particles as the grain obstructs the flow of the radioactive particles.

Raster Format - Format for storing GIS spatial data in which the data are stored in cells which are addressed by the row and column of the cell.

Rate Controller – An electronic device that varies the amount of chemical/plant nutrient applied to a given area.

Receiver (in GPS hardware) – A computer-radio device that receives satellite information by way of radio waves to determine the position of its antenna relative to the earth's surface. The antenna can be integrated into the receiver or connected externally with a cable.

Reflectance The ratio of the radiant energy reflected by a body to that incident upon it.

Remote Sensing - the act of monitoring an object without direct contact between the sensor and object.

Real-Time Correction - correction of a GPS signal by simultaneously transmitting the differential correction information to a mobile receiver.

Real-Time Kinematic (RTK) - Procedure whereby carrier-phase corrections are transmitted in real time from a reference receiver to the user's receiver.

Rectified - A remotely-sensed image that has been geometrically corrected to eliminate the effects of sensor orientation and distortion present at the time of measurement.

Registration - A process to geometrically align maps or images to allow one to have corresponding cells or features. This allows one to relate information from one image to another, or a map to an image. An example is registering a yield image to a soil map to determine if soils are influencing the yield response.

Release rate, fertilizer The rate of nutrient release following fertilizer application. Water-soluble fertilizers are termed quick-release or fast-release, while insoluble or coated soluble fertilizers are referred to as slow-release or controlled-release. *See also* residual response.

Relief Displacement - Differences in elevation that cause objects to appear to be positioned differently when viewed from an angle instead of from overhead.

Real-Time Correction - Correction of a GPS signal by immediately sending the differential correction information to the mobile receiver on-the-go.

Repeat Cycle - The time it takes for a satellite to view the entire Earth.\

Resolution - A way of detecting variation. In remote sensing, one has spatial resolution (the variation caused by distance separating adjacent pixels), spectral resolution (the variation from the range of spectral responses covered by a wavelength band), and temporal resolution (the variation caused by time over the same location).

Rhizobium: Bacteria living in nodules on the roots of leguminous plants that are capable of removing nitrogen from the air and soil "fixing" it into forms that plants utilize for growth.

Rhizome: A subterranean stem, usually rooting at the nodes and rising at the apex; a rootstock.

Ribonucleic Acid (RNA): A chemical substance made up of nucleotides compound of sugars, phosphates, and derivatives of the four bases adenine (A), guanine (G), cytosine (C), and uracil (U). RNAs function in cells as messengers of information from DNA that are translated into protein or as molecules that have certain structural or catalytic functions in the synthesis of proteins. RNA is also the carrier of genetic information for certain viruses. RNAs may be single or double stranded.

Ride Quality (commonly referred to as Ride Dynamic or Good Ride) - Indicates the level of vertical movement (e.g. bouncing) by a row unit. Displayed commonly as a percentage (%) of time when ride quality is sufficient to not impact seed spacing. One hundred percent good ride (e.g. no vertical movement thereby a smooth operation) represents optimum row unit ride quality and zero percent represents the poorest ride quality.

RMS (Root Mean Square) - Also known as "one sigma." - a statistical measure of the scatter of normally-distributed data points about their mean.

Rover – refers to a mobile GPS/GNSS device

RTCM - Radio Technical Commission for Maritime Services Subcommittee 104 of the RTCM developed standard message formats for GPS signals.

RTK - the most accurate form of GPS/GNSS correction and the only GPS/GNSS correction that provides +/-1 inch (centimeter-level) accuracy and year-to-year repeatability. RTK utilizes two dual-frequency receivers which are necessary for highly accurate operations, such as precision guidance for row crop production. RTK correction can be provided in two ways: personal base stations or Continuously Operating Reference Stations (CORS). Personal base stations utilize radios to communicate the correction signal from the base station to the rover radio on the

tractor, and typically have a 6 mile line-of-sight radius. CORS utilizes an internet-capable device such as a cellular phone or cellular modem to transmit correction signals from a server to the tractor. Initial research has indicated that CORS can provide accurate correction signals up to a 20 mile radius. Cellular coverage and a cellular data plan are required to utilize CORS. See also *Base station* and/or *CORS*

S

Satellite – A communications vehicle orbiting the Earth. Satellites typically provide a variety of information from weather data to television programming. Satellites send time-stamped signals to GPS receivers to determine the position on the Earth

Satellite constellation - A system of 24 satellites that is owned by the US Department of Defense (DOD) that can determine location to within inches. There are usually at least 4 of these satellites that are in view 24 hours a day. The DOD can intentionally introduce error into the signal during national emergencies. This error called “Selective Availability” would allow an accuracy of approximately 50 yards without differential correction

Satellite Ranging - A method for determining position by measuring distances from several different satellites.

Saturate: To fill all of the openings among soil particles with liquid.

saturated soil paste A particular mixture of soil and water. At saturation, the soil paste glistens as it reflects light, flows slightly when the container is tipped, and the paste slides freely and cleanly from a spatula

SBAS - Satellite-Based Augmentation System

Scale - The ratio between the distance on a map, chart, or photograph and the corresponding distance on the ground. A typical topographic map has a scale of 1:24,000 meaning that 1-inch on the map equals 24,000 inches (2,000 feet or 609.6 meters) on the ground.
scale - The ratio or fraction between the distance on a map, chart, or photograph and the corresponding distance on the ground. A topographic map has a scale of 1:24,000 meaning that 1-inch on the map equals 24,000 inches (2,000 feet) on the ground.

Scanners - Sensors used to collect remotely-sensed data in parallel paths. Computer equipment used for converting information from paper into a digital format that can be read by a computer.

Secondary Nutrients - The secondary plant foods include calcium, magnesium and sulfur. Less-critical elements required in smaller amounts for plant growth than nitrogen, potassium and phosphorous.

Secondary tillage Tillage that works the soil to a shallower depth than primary tillage, providing additional pulverization; levels and firms the soil, closes air pockets, kills weeds

Section - In U.S. land surveying under the Public Land Survey System (PLSS), a **section** is an area nominally one square mile (2.6 square kilometers), containing 640 acres (260 hectares), with 36 **sections** making up one survey township on a rectangular grid.

seed (1) A mature (ripened) ovule consisting of an embryonic plant and a store of food (stored in the endosperm, in some species), all surrounded by a protective seed coat. (2) To sow or plant seed (e.g., broadcasting or drilling of small-seeded grasses and legumes or other crops).

Seed product - The generic name of the crop to be planted: corn, soybeans, etc.; to include: manufacturer (seed company), company name, crop (seed), variety, application units, identifiers to include batch/lot number

Seed Hybrid - The identification given to seed by a seed company; a seed that has been developed by selective genetics and cross-breeding

Seed variety - A different type within a hybrid that is give a unique identification by a seed company

Seed vigor Those seed properties that determine the potential for rapid uniform emergence and development of normal seedlings under both favorable and stress conditions.

Seedling A young plant grown from seed.

Seed Rate Unit- The measure used to determine seeding rate

Seeding Rate- The quantity of seed units being applied to an acre.

Selective Availability (SA) - The procedure of intentionally introducing error into GPS signals thereby creating a pseudorange error. SA was used by the Department of Defense as a national security measure to keep non-military receivers from obtaining high-accuracy position information. SA was officially discontinued by presidential order on May 1, 2000.

SemiVariance - A measure of how much neighboring data points differ in value. Equal to one-half the square of the difference between two values.

Semi-Variogram - Line fit to the data in a plot of semi-variance versus lag.

Senescence (1) The developmental stage during which deterioration occurs leading to the end of functional life of an organism or organ. Sometimes defined from specific criteria such as a decline in chlorophyll or dry weight. (2) More generally, a slowing in the rate of growth of a plant or plant organ, usually due to old age.

Sensor-Based Variable Rate Application System - A system that adjusts product application rate on-the-go based on information received from real-time sensors.

Sensor Technologies - Sensor technology refers to on-the-go optical sensors used to measure crop status. These sensors utilize an active LED light source to measure NDVI (Normalized Difference Vegetative Index) to predict crop yield potential. NDVI values reflect the health or "greenness" of a crop and can also provide a relative biomass measurement. Data collected

from these sensors are being used to direct variable rate nitrogen applications in grain crops and plant growth regulator and defoliant in cotton.

Serial Port - A connector on a computer which can be used to communicate to other serial devices such as a modem. Serial refers to the protocol used for the communications. The most common serial protocol is RS-232.

Shadowing - A reduction in the level of light hitting an object.

Sheet Erosion: The gradual, uniform removal by water of the earth's surface, without the formation of hills or gullies.

shoulder The hillslope position that forms the uppermost inclined surface near the top of a slope. If present, it comprises the transition zone from backslope to summit. This position is dominantly convex in profile and erosional in origin.

side slope The slope bounding a drainageway and lying between the drainageway and the adjacent interfluvium. It is generally linear along the slope width and overland flow is parallel down the slope. See also nose slope.

Silage: Prepared by chopping green forage (grass, legumes, field corn, etc.) into an airtight chamber, where it is compressed to exclude air and undergoes acid fermentation that retards spoilage.

Single Seed Drills (commonly referred to as Precision Drills) - Drills whose metering mechanism distributes seeds singly by means of a burying device at predetermined intervals to form a sowing line

Singulation - The percentage (%) of seeds properly singulated by a seed meter.

Site Specific Crop Management (SSCM) - The use of yield maps, grid sampling and other precision tools to manage the variability of soil and crop parameters and aid decisions on production inputs (also referred to as Precision Farming)

Site-Specific Yield Map - A representation of field crop yields collected on-the-go by a harvester equipped with an instantaneous yield monitor. Each location/site in a field is assigned a specific crop yield value.

Slow-release fertilizer with a rate of dissolution less than is obtained for completely water-soluble fertilizers; may involve compounds that dissolve slowly, materials that must be decomposed by microbial activity, or soluble compounds coated with substances highly impermeable to water. *Synonyms:* controlled-availability, controlled-release, delayed-release, metered-release, and slow-acting fertilizer. *Compare* quick-release fertilizer. *See also* response rate.

Soil The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and

macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics.

Soil Horizon: A layer of soil material approximately parallel to the land surface which differs from adjacent genetically related layers in color, structure, texture, or consistence. It also differs in biological and chemical characteristics.

Soil Map – A map designed to show the distribution of soil types or other soil-mapping units in relation to the prominent physical and cultural features of the earth's surface.

Soil-Moisture Tensiometer: An instrument which measures the tension with which water is held by soil. The instrument can be used for estimating when to irrigate land and for detecting drainage problems.

Soil moisture content - Moisture content (MC) is the weight of **water** contained soil. The moisture content is generally reported on the dry weight basis.

Soil probe A soil-sampling tool, usually having a hollow cylinder with a cutting edge at the lower end.

Soil shredder A machine that crushes or pulverizes large soil aggregates and clods to facilitate uniform soil mixing and topdressing application.

Soil Reaction: The degree of acidity or alkalinity of a soil usually expressed in terms of pH value.

Soil pH - A numerical measure of the acidity or hydrogen ion activity of soil. See pH.

Soil Series: A grouping of soils which have developed from a particular kind of parent material and which are similar in all characteristics except texture of the surface layer. The soil series is one of the principal units of soil classification.

Soil Structure: Refers to bonding together of soil particles and the resulting configuration of solid and voids.

Soil Survey: The systematic examination, description, classification, and mapping of soils in an area.

Soil test - A chemical, physical, or biological procedure that estimates the suitability of a soil to support plant growth.

Soil Texture – Refers to the coarseness or fineness of a soil. It is determined by the relative proportion of various sized particles (sand, silt, and clay) in a soil.

Soil Type – A finer subdivision of a soil series. It includes all soils of a series which are similar in all characteristics, including texture of the surface layer

Sowing Unit - Unit generally comprising the metering mechanism and the burying device

Space Segment - The portion of GPS consisting of NAVSTAR satellites orbiting the earth at 20,200 km.

Spatial Data – Data that contains information about the spatial location (position) and the attribute being monitored such as yield, soil properties, plant variables, seed population, etc. Synonymous with geographic data.

Spectroscopy Observation by means of an optical device (spectroscope) of the wavelength and intensity of electromagnetic radiation (light) absorbed or emitted by various materials. Theoretical interpretation of well-defined wavelengths of elements (often present in only minute quantities) in obtained spectra leads to knowledge of atomic and molecular structure. *See also* nuclear magnetic resonance spectroscopy.

Spatial Resolution - The size of the smallest object that can be distinguished by a remote sensing. A measure of the ability of a machine or device to vary application rate or treatment - defined by the smallest area in a field that can receive a treatment or input that is purposely different from that received by an adjacent area. The term also applies to measuring systems such as crop yield monitors.

Spatial Variability - Differences in field conditions, such as plant, soil, or environmental characteristics from one location in a field to another.

Spectral Resolution - The ability of a sensing system to differentiate between electromagnetic radiation at different wavelengths.

Spectral Response – reflectance patterns of radiation reflected or emitted from an object. The ability of a sensing system to respond to radiation measurements within a spectral band.

Speed Sensors - Sensors that measure the rotational speed of a shaft or the reflection of radio or sound waves off the ground to determine machine speed.

Spherical Error Probable (SEP) - A measure of accuracy in navigation. SEP is the radius of the sphere inside of which the true three-dimensional coordinates of a position have a 50-percent probability of being located.

SSURGO (Soil SURvey GeOgraphic) Database - It is a digital version of the NRCS soil books. Each soil type is represented as a polygon and tied with associated soil type properties.

Standard Deviation - A measure of the distribution of measurements around their average.

Standard Positioning System (SPS) - The positioning service using a single receiver which is available to any user on a continuous, world-wide basis. This system uses only the CIA code transmitted via the satellites.

Start of Pass Delay - A delay that allows the initial flow of grain before full flow is achieved to be ignored in yield calculations when starting a pass.

State Plane Coordinates (SPC) - A coordinate system similar to UTM using units of feet and using the NAD27 datum. Each state may have a different coordinate system which attempts to minimize distortion over the state.

Static Features - Objects that do not change in reflectance.

Strain Gage - A device that has a changing electrical resistance as it is deformed. Used in load cells to convert force to electrical signals.

Strip Cropping: Growing crops in long narrow strips across a slope approximately on a line of contour, alternating dense-growing intertilled crops. This is sometimes done with crops grown under government acreage allotments in order to increase yields per acre, since the intertilled area is not included in the allotment. It is also done in some dryland areas to conserve moisture and reduce the hazards of wind erosion.

Subsoiling: Breaking of compact subsoils without inverting them. This is done with a special narrow cultivator shovel or chisel, which is pulled through the soil at a depth from 12 to 24 inches and at spacings from 2 to 5 feet.

Summer Fallow: Land plowed up (usually in spring) and left unseeded through the summer. This is done to let the land air out and rest until fall, when it is worked up and planted to a crop of grain. May also be done to break down organic matter or kill weeds.

Summit - The highest point of any landform remnant, hill, or mountain.

Sun-Synchronous Orbits - An orbit in which each pass of a satellite over a given point occurs at the same local time.

Sustainability - Managing soil and crop cultural practices so as not to degrade or impair environmental quality on or off site, and without eventually reducing yield potential as a result of the chosen practice through exhaustion of either on-site resources or non-renewable inputs.

T

Target Down Force Margin - A level of downforce that must be entered based on the operator's judgment of planting conditions. Level should be set high enough to create a defined seed furrow but not so high that the side wall of the furrow is compacted

Tensiometer A device for measuring the soil-water matric potential in situ; a porous, permeable ceramic cup connected through a water-filled tube to a manometer, vacuum gauge, pressure transducer, or other pressure measuring device.

Temporal Resolution - The time period over which data was collected. A measure of how often a remote-sensing system can be available to collect data from a particular site on the ground. Also known as "frequency of coverage."

Temporal Variability - Fluctuations in field conditions, such as plant, soil, or environmental characteristics, from one point in time to another.

Terrain Compensation - An add-on feature for auto-guidance systems which correct position error that may occur when equipment travels over rolling terrain. Roll, pitch and yaw are commonly referred to when discussing terrain compensation. Roll refers to the change in elevation between the left and right sides of the vehicle; pitch refers to the change in elevation between the front and rear of the vehicle; and yaw refers to any sliding or turning motion of the vehicle to the left or right.

Tillage The mechanical manipulation of the soil profile for any purpose; but in agriculture it is usually restricted to modifying soil conditions and/or managing crop residues and/or weeds and/or incorporating chemicals for crop production.

Till-plant Seedbed preparation and planting completed in the same operation, or one immediately following the other, leaving a protective cover of crop residue on and mixed in the surface layer. In some areas, referred to as minimum tillage.

Transgenic organism: An organism resulting from the insertion of genetic material from another organism using recombinant DNA techniques.

Thematic Map - Result from remote sensing data classification that produces categorization of all pixels in a digital image into classes or themes.

Thematic Mapper (TM) - A remote sensor designed to create maps of different surface feature categories or "themes." The TM sensor has a spatial resolution of 30 m and is capable of collecting data on seven different bands including a thermal band. The TM sensor was flown on LANDSATs 4 and 5.

Theoretical Seed Spacing - The spacing set on the control mechanism and stated by the manufacturer

Thermal Band - Infrared wavelengths of electromagnetic energy.

Toeslope - The hillslope position that forms a gently inclined surface at the base of a slope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a slope continuum that grades to a valley or closed depression

Tolerance range Range of environmental conditions in which an organism can survive; set mainly genetically, but modified by previous environmental history of the individual

Top Dressing: Lime, fertilizer, or manure applied after the seedbed is ready, or after the plants are up.

Topsoil: The layer of soil used for cultivation, which usually contains more organic matter than underlying materials.

Transformation (1) Genetic transformation is the transfer and incorporation of DNA, especially recombinant DNA, into a cell. The cells, plants, or progeny resulting from this process are said to be transformed upon demonstration of the expression in the recipient organism of unique marker genes carried by the transferred DNA. (2) Biochemical transformation (or biotransformation) is the process of using cultured cells to convert substrates into other desirable organic compounds by virtue of an endogenous enzyme system that catalyzes the reactions.

Transportation: The loss of water vapor from the leaves and stems of living plants to the atmosphere.

Troposphere - Lower atmosphere.

Turnaround Time - The elapsed time between a satellite taking an image and receipt of that image by the customer.

U

UAV (Unmanned Aerial Vehicle) - An unmanned aerial vehicle (UAV), commonly known as a drone and also referred by several other names, is an aircraft without a human pilot aboard. The flight of UAVs may be controlled either autonomously by onboard computers or by the remote control of a pilot on the ground or in another vehicle. In agriculture, UAVs are typically used to survey crops. The available two types of UAVs – fixed-wing and rotary-wing – are both equipped with cameras and are guided by GPS. They can travel along a fixed flight path or be controlled remotely.

USB - (Universal Serial Bus) - a networking standard based on serial bus architecture that is used for connecting input and output devices to computers.

User Segment - The portion of GPS consisting of receivers used by civilians and the military for determining the position of a person or object.

UTM (Universal Transverse Mercator) – This is one of many different mathematical models upon which satellite-derived positions can be translated into a coordinate system that corresponds to positions derived through standard maps. For the sake of simplicity, each datum has mathematical parameters that define it, including the predicted center of the Earth and the mathematical shape of the Earth. Because the Earth is not perfectly spherical, the mathematical parameters may provide a model that is accurate on one portion of the planet, while being horribly inaccurate on another. UTM, however, is a global model that has been divided into numerous parts that represent certain sections of the globe. UTM coordinates are conventionally presented in meters, unlike NAD-83 coordinates (conventionally presented in survey feet)

V

Vacuum Level - Pressure, expressed in inches of water, for a planter equipped with vacuum sensors.

Variable-Rate Application (VRA) - Adjustment of the amount of cropping inputs such as seed, fertilizer, and pesticides to match conditions in a field.

Variable Rate Technology - GPS and precise placement technology that uses an "application guidance" map to direct the application of a product to a specific, identifiable location within a field. Instrumentation such as a variable-rate controller for varying the rates of application of fertilizer, pesticides and seed as one travels across a field. VRT consists of the machines and systems for applying a desired rate of crop production materials at a specific time (and, by implication, a specific location); a system of sensors, controllers and agricultural machinery used to perform variable-rate applications of crop production inputs.

Variety: A group of individuals within a species that differs from the rest of the species.

Vector Format - A format for storing and displaying GIS spatial data in which the data is stored as points, lines, or areas that create the terrain or map objects. By using a nearly continuous coordinate system vector data can be more accurately georeferenced than raster data.

Vegetative cover A soil cover of plants irrespective of species.

Vegetation Indexes - A tool for identifying the levels in health of plant biomass. A vegetation index can be used to assess or predict plant characteristics such as leaf area, total plant material, and plant stress. A vegetation index reduces several wavelengths of sensor data into a single number.

Vegetative Change Map - A map used to identify locations in the field that have undergone changes in vegetative spectral response between two consecutive remote-sensing flights.

Vertical Positioning Accuracy - The statistical difference, at a 95% probability, between vertical position measurements and a surveyed benchmark for any point within the service volume over any 24-hour interval.

Volunteer plants Plants that occur (in a population) not as a result of current seeding (of the crop under consideration) but resulting from seeds or propagative vegetative parts growing uncontrolled from previous seeding or from plants escaped from cultivation that have been scattered by natural means.

W

WAAS - (Wide Area Augmentation System) - differential correction source based on signal transmitted by the Federal Aviation Administration to support a GPS-based navigation and landing system that provides precision guidance to aircraft.

Water Rights (Riparian Rights): The rights of a person owning land containing or bordering on a water course or other body of water in or to its banks, bed, or waters.

Water Table: The upper limit of the part of the soil or underlying rock material that is wholly saturated with water. In some places an upper or perched water table may be separated from a lower one by a dry zone.

Waveband - A remote-sensing term used to describe a contiguous range of wavelengths of electromagnetic energy.

Webpage - A document on the World Wide Web, consisting of an HTML file and any related files for scripts and graphics, and often hyperlinked to other documents on the Web. The content of webpages is normally accessed by using a browser.

Wet weight - Weight before drying.

WGS-84 (World Geodetic System 1984) – one of many different mathematical datum models used for precision agriculture data and mapping. WGS-84 is a commonly used datum and is comprised of a standard coordinate frame, spheroidal reference surface, and nominal sea level, for Earth used by GPS since January 1987.

Wilting point Water content of a soil when indicator plants growing in that soil wilt and fail to recover when placed in a humid chamber.

Windbreak: A strip of trees or shrubs serving to reduce the force of wind; any protective shelter from the wind.

Winterkill Any injury to turfgrass plants that occurs during the winter period.

Wireless Communication – Data transfer and voice communications using radio frequencies or infrared light.

Workhorse hybrids have a yield advantage when soil and climate environments are sub-optimal and the crop is under stress. Workhorse hybrids have the least amount of yield variation, but do not take advantage of average or high yield environments and are outperformed by racehorse and stable hybrids

X

Xylem The portion of the conducting tissue that is specialized for the conduction of water and minerals.

Y

Yield Monitoring – Yield monitoring allows growers to determine higher and lower yielding areas of the field. When coupled with a GPS, yield monitors can be used to produce yield maps. Yield monitor components include sensors (used to measure yield), DGPS (provides position information) and a display (processes information from sensors, displays information in the cab and writes yield data to a data card). Yield monitors are readily available for combines and cotton pickers. Equipment manufacturers offer the option to order yield monitors as a factory add-on and third-party products are also available.

Yield Calibration - Procedures used to calibrate a yield monitor for specific harvest conditions such as grain type, grain flow, and grain moisture. **Yield Mapping** - Is a yield monitor coupled with a GPS. Each yield reading is tagged with a latitude and longitude coordinates, which is then used to produce a yield map.

Yield curve A graphical representation of nutrient application rate or availability versus crop yield or nutrient uptake.

Yield goal The yield that a producer expects to achieve, based on overall management imposed and past production records

Yield Limiting Factor - The plant, soil, or environmental characteristic or condition that keeps a crop from reaching its full yield potential within any specific area in a farm field.

Yield Map - A representation of crop yields collected on-the-go by a harvester equipped with an instantaneous yield monitor. Each location/site (pixel) in a field is assigned a specific crop yield value.

VRA (Variable Rate Application) - Adjustment of the amount of crop input such as seed, fertilizer, lime or pesticides to match conditions (yield potential) in a field.

Yield Monitor - A yield-measuring device installed on harvest machines. Yield monitors measure grain flow, grain moisture, and other parameters for real-time information relating to field productivity.

Z

Zone Management – The information-based division of large areas into smaller areas for site specific management applications.