

## WITH UP-TO-DATE SOYBEAN PRODUCTION INFORMATION

### GENERAL AGRICULTURAL SCIENCE TERMINOLOGY

Articles posted on this website contain terms and phrases that are specific to agriculture or agricultural enterprises and activities. The below definitions (listed alphabetically) should aid in understanding the content of these articles and articles that are linked in them.

**Abiotic.** Environmental factors such as drought, wind, hail, or excess moisture that impact the growth of living organisms. Usually used as “abiotic stresses”.

≤formulation in a spray mix to modify—i.e., enhance—the activity or application characteristics of the applied pesticide.

**Adsorb, adsorption.** In soil terms, the adhesion of ions (i.e.,  $K^+$ ,  $Ca^{++}$ ) or molecules to the surface of soil particles. This process differs from absorption where a material—the absorbate—is dissolved in the soil solution.

**Alluvial Soil.** Soil that is deposited by water flowing over flood plains, river valleys, and creek bottoms; may be coarse- to fine-textured, depending on proximity to water deposition source. Usually the product of erosion from an uphill or upstream source; thus the term “Lower Mississippi River Valley alluvium”.

**Aquifer.** Porous, underground deposit of permeable rock or sediment such as sand or gravel that contains water that can be used to supply wells. Pores in the deposits are interconnected so that water flows through them over a large area. Aquifers may be shallow (the Delta aquifer) or deep.

**Available soil water holding capacity.** The amount of soil water that is available for plant use, or the amount of water volume between field capacity and permanent wilting point. Available water ranges from an average 0.7 in/ft of soil in coarse sand to an average 2.25

in/ft of soil in very fine sandy loam and silt loam.

**Banded.** Fertilizer placed below and to the side of seed at planting, or herbicides applied to a defined width that includes the planted row.

**Biennial rotation.** Practice of growing two different crops in alternating years. Examples—corn and soybeans, rice and soybeans.

**Biological control.** Pest management that protects, augments, or releases organisms that are natural enemies of a pest. Biological control agents are important in Integrated Pest Management systems.

**Biomass–energy definition.** Plant matter expressed on a dry weight basis (after removal of all water) that can be converted to an energy or fuel source by either direct or indirect methods. In today’s agriculture, the most popular indirect method is conversion to ethanol.

**Biotic.** Biological factors such as insects, disease pathogens, nematodes, and weeds that affect other living organisms.

**Breakeven price.** Per-unit revenue (or income) required to provide an economically sustainable enterprise; calculated by dividing a cost (e.g., dollars/acre) by a production quantity (e.g., bushels/acre).

**Broadcast.** Fertilizer spread on the soil surface, or herbicides applied across the entire width of a cropped or planted area.

**C<sub>3</sub> plant.** Uses a photosynthetic pathway that produces a 3-carbon molecule called 3-phosphoglyceric acid. About 85% of the earth’s plants use this C<sub>3</sub> pathway to fix C via the Calvin

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Cycle. During this one-step process, the enzyme RuBisCo (ribulose biphosphate carboxylase/oxygenase) causes an oxidation reaction in which some of the energy used in photosynthesis is lost through **photorespiration**, and this results in about a 25% reduction in the amount of C that is fixed by the plant; this lost C is released back to the atmosphere as CO<sub>2</sub>. Soybeans, cotton, wheat, and rice are common C<sub>3</sub> plants.

**C<sub>4</sub> plant.** The light-dependent reactions and the Calvin Cycle are physically separated. The light-dependent reactions occur in the mesophyll cells (spongy tissue in the middle of the leaf), and the Calvin Cycle occurs in bundle-sheath cells (cells around the leaf veins). A C<sub>4</sub> plant produces the intermediate 4-carbon molecules malic or aspartic acid during the carbon fixing process. This intermediate step in the pathway before the Calvin Cycle reduces the amount of C that is lost to the atmosphere in the overall process. The CO<sub>2</sub> that is taken in by a C<sub>4</sub> plant is moved to the bundle sheath cells (also contain chloroplasts) by the malic or aspartic acid molecules (now called malate and aspartate molecules). The oxygen content in the bundle sheath cells is very low, so the RuBisCo enzymes are less likely to catalyze oxidation reactions and waste C molecules. The malate and aspartate molecules release the CO<sub>2</sub> in the chloroplasts of the bundle sheath cells and the Calvin Cycle begins. C<sub>4</sub> plants include corn, sugar cane, and sorghum.

**C factor.** Cover management factor used in the Revised Universal Soil Loss Equation that reflects the effect of cropping and management practices on erosion rates.

**Cation exchange capacity (CEC).** Refers to the quantity of negative charges that exist on the surfaces of clay particles and organic matter in soil. These negative charges attract positively charged ions or cations such as potassium (K<sup>+</sup>), calcium (Ca<sup>++</sup>), magnesium (Mg<sup>++</sup>), and ammonium (NH<sub>4</sub><sup>+</sup>), which are

major plant nutrients. Hydrogen (H<sup>+</sup>), sodium (Na<sup>+</sup>), and aluminum (Al<sup>+++</sup>) are the other predominant cations occupying the CEC in soils. High percentages of clay particles will impart a higher CEC, while a high percentage of sand particles will impart a low CEC. Small increases in organic matter will greatly increase soil CEC. The CEC of a soil is important because it implies the size of the reservoir of nutrients that is available to replenish the nutrients removed by plant uptake. Also, the CEC of a soil can be an indicator of how much leaching of nitrogen and potassium fertilizers will occur; i.e., higher CEC soils will experience less leaching of cationic elements.

**Cellulosic ethanol.** Biofuel that is produced from lignocellulose, the structural material that comprises the mass of most plants. Corn stover, switchgrass, and wheat straw are common agricultural sources of lignocellulose that are being/can be used in cellulosic ethanol production.

**Commodity Crop.** Crops such as corn, soybean, wheat, cotton, sorghum, and non-wheat cereal grains that are grown in large volume for the purpose of sale to the commodities market vs. being sold for direct consumption or processing. Many of the commodity crops re-enter the food production industry as oils, sweeteners, starches, and animal feed. They also re-enter the market as components used in industrial manufacturing processes and as substrates for biofuel production.

**Conservation tillage.** Limited mechanical operations with implements that result in the soil surface being covered with >30% plant residue (older standard) or a **STIR** of ≤80, and do not use a moldboard plow. Conservation tillage practices generally include mulch-till, strip-till, and no-till.

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**Conventional tillage system.** Combination of mechanical operations with implements that result in a seedbed that is essentially free of weeds and plant residue cover. This is the antithesis of conservation tillage. Tillage management practices in this system result in a [STIR](#) of >80.

**Cover crop.** Crop (e.g. cereal rye) grown to provide soil cover during seasons when an annual grain crop is absent.

**Crop Residue.** Plant material remaining after harvest of a crop such as corn, soybean, or wheat.

**Crop rotation.** Practice of growing two or more annual crops in the same field in a planned pattern or sequence in successive crop years. A conservation rotation should include at least one high-residue crop (e.g. corn), at least one low-nitrogen crop (e.g. soybean), and attain a threshold level of average annual residue. Thus, a corn-soybean rotation is not a conservation rotation.

**Cultural control.** Pest management that uses tillage, sanitation, harvesting, and other techniques to alter the pest's environment. Includes practices that enhance plant productivity to overcome the effects of pest injury.

**Deep tillage.** Mechanical operations with implements that affect soil properties below 6 inches. This can be compatible with conservation tillage if the soil surface is relatively undisturbed by the operation.

**Disease.** Plant injury from biotic stress resulting from infection by fungi, oomycetes, nematodes, bacteria, or viruses.

**Doublecrop.** Harvesting two cash crops alternately from the same field during a 12-month period.

**Drift Reduction Agent (DRA).** An adjuvant added to pesticide sprays to prevent or retard the offsite deposition (drift) of those sprays during their application.

**Dryland production system.** Growing a crop without supplemental water or irrigation.

**Enterprise budget.** Type of farm financial report that owners or managers may use to help make decisions. After defining the specific production techniques to be used by the enterprise (e.g., a crop produced with no-till practices), the budget typically will have a section describing the projected dollar values (usually on a per-acre or per-bushel basis) for gross receipts, operating costs, ownership costs, and returns above costs. These are generated by computer programs such as the Mississippi State Budget Generator.

**Erosion.** Undesirable displacement of soil from a site by wind and/or water.

**Essential Elements for Plant Growth and Development.** *Supplied by air and water*—carbon, hydrogen, and oxygen; *Primary macronutrients*—nitrogen, phosphorus, and potassium; *Secondary macronutrients*—sulfur, calcium, and magnesium; *Micronutrients*—boron, chlorine, copper, iron, manganese, molybdenum, and zinc.

**Evaporation (E).** The process of water leaving a surface—i.e., soil, water, and plant leaves—and being absorbed into the drier surrounding air. In a crop environment, water lost through soil evaporation is of no benefit since it does not contribute to crop growth, development, and yield. Thus, cropping practices that reduce E from the soil should benefit a developing crop.

**Evapotranspiration (ET).** A dynamic variable that defines the transfer of water in the form of water vapor from the surface of soil and plants

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(leaves) to the surrounding atmosphere. It is a combination of water that is evaporated (E) from the soil surface and water that moves from the soil through plant leaves to the atmosphere (T—transpiration).

**Fallow.** Land normally used for the production of a crop (cultivated land) that is left idle with no crops growing on it for a season. Fallow land may be untilled or tilled during the idle period. The fallow practice is often used to destroy weeds and conserve and/or accumulate soil moisture in the absence of a crop.

**Farm gate value.** Value of an agricultural crop when it leaves the farm, usually synonymous with the selling price of the product.

**Fetch.** The distance in the direction of the prevailing wind that air or water can travel continuously without obstruction. **Should be considered when installing a rain gauge to accurately measure rainfall received on a site; i.e., ensure no obstructions that will affect rainwater collected in a gauge.**

**Field capacity (FC).** The volume of water remaining in soil after gravitational water flow has ceased. This point of soil water content is generally accepted as about 0.3 bar tension.

**Genotype.** Genetic makeup of an organism (as distinguished from its phenotype or physical characteristics), or the total of genes that are transmitted from parent to offspring.

**Germplasm.** Collection of diverse genetic resources (e.g. soybean seed) that are available to be used in the development of improved breeding lines and varieties.

**Herbicide.** Chemical substance or cultured biological organism used to kill or suppress the growth of plants.

**Herbicide-Tolerant.** Ability of a plant to survive and reproduce after herbicide treatment. Often used interchangeably with **Herbicide-Resistant**.

**Host-plant resistance.** Genetically controlled innate or bred phenotypic or physiological property of a plant that enables it to withstand injury from insect feeding and pathogenic infection.

**Identity preserved (IP).** Refers to identification and maintenance through marketing channels (usually through contract-growing for a higher or premium price) of seed with specific traits or characteristics that are sought or preferred by users.

**Integrated pest management (IPM).** The ecologically based decision support system for managing weeds, plant pathogens, and insect pests while minimizing use of agrichemicals. Combines complementary and compatible biological, chemical, and cultural control tactics to make pest management economical, environmentally sound, and socially acceptable.

**Leaching (Leachate).** As related to soil, the downward movement of dissolved material through soil by percolation, which is the gravitational movement of water through the soil pores. Often results in the complete removal of the dissolved material (the material being leached).

**Macronutrient.** An essential nutrient element that is needed by plants in relatively large quantities. Elements are N (Nitrogen), P (Phosphorus), K (Potassium), S (Sulfur), Ca (Calcium), and Mg (Magnesium).

**Micronutrient.** An essential nutrient element that is needed by plants in small quantities. Elements are Cl (Chlorine), Fe (Iron), B

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(Boron), Mn (Manganese), Zn (Zinc), Cu (Copper), Mo (Molybdenum), and Ni (Nickel).

**Monocropping.** The year-after-year production of the same crop in the same field; i.e., continuous cropping where the alternative is crop rotation.

**Monoculture.** Growing one crop species in a field at a time; the alternative is polyculture or intercropping such as multiple plant species in a cover crop mix or a pasture.

**Mulch Till.** A conservation tillage practice where soil is tilled but soil disturbance is low—e.g. [STIR](#) <80.

**Net returns.** The estimated dollar value of the projected gross receipts minus the projected costs that have been allocated to a particular farm enterprise. Net returns (or returns above costs) represent a residual return to all factors of production for which a cost has not already been included. For example, an enterprise budget may include a cost for all inputs except land. In this case, the net return (if positive) would represent the amount available to pay for a land charge. Another example might be a case in which all inputs except management have been included in the cost estimate. In such a case, the net return would be the amount available to pay for the management functions related to the enterprise. Net returns may be negative, indicating that the revenue generated by the enterprise is not capable of covering all allocated costs. The statement “Net return to land, management, and general farm overhead” indicates that all costs except those associated with the three listed items have been accounted for in the calculated net return. Net profits or total net returns include income minus all overhead items, which include machinery and equipment capital servicing, the opportunity cost of land measured as its rental rate, taxes and

insurance, unallocated labor, and other general farm overhead.

**Nitrogen fixation.** Process by which atmospheric nitrogen is combined with other elements to form inorganic compounds which can then be converted by nitrification into nutrients that can readily be absorbed by plants and used for making more complex organic compounds. Specifically, conversion of atmospheric nitrogen into nitrogen compounds by *Rhizobium* bacteria in the root nodules of legumes.

**Nitrification inhibitors.** Chemical compounds added to nitrogen fertilizer for the purpose of reducing the rate of conversion of ammonium form of fertilizer to nitrate form.

**Nodules.** Small bodies or organelles (on the soybean root surface) that contain *Rhizobium* bacteria.

**Non-selective herbicide.** Chemical compound that is generally toxic to all plants treated; used to kill a wide range of plant species that usually includes crop species in the treated area. Some selective herbicides may become nonselective if used at very high rates.

**No-till.** A conservation tillage practice where soil is not tilled for any reason except that done by a planter when planting a crop.

**Operating profit.** The gross value of or income from production minus variable production costs, which include the sum for custom operations [paid by operation or task vs. by the hour], electricity, fuel, fertilizer, seed, interest on operating capital, irrigation, pesticides, repair and maintenance of equipment, and allocated labor [machinery operation, scouting for pests, and other manual work required for the enterprise].

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**Oxidation of organic matter.** Breakdown of organic matter by microbial activity. Process is temperature driven; therefore, more pronounced in the Midsouth which has relatively mild winters.

**Pan Evaporation (PE).** A measure of the amount of water that evaporates from a water surface. It usually is obtained from a Class A evaporation pan that holds water for the determination of the amount of evaporation at a given location.

**Plant Pathogens.** Organisms such as fungi, bacteria, viruses, and nematodes that cause plant diseases. These organisms infect plants with resulting negative effects exhibited by root, stem, and leaf symptoms (e.g. blights, cankers, rots, rusts, wilts, galls, leaf spots, molds) that indicate a pathogenic stress to the plant. These pathogenic stresses are generally referred to as diseases.

**Percolation.** As related to soil, the gravitational (downward) movement of water with dissolved minerals through the soil pores.

**Perennial.** Plant species that have a life cycle lasting more than two years. Perennial plants survive winter and environmental stresses as underground tissues such as roots, rhizomes, bulbs, or tubers.

**Permanent wilting point (PWP).** The volume of water remaining in soil when plants can no longer extract water, and the point at which a plant will not recover from wilt until water is added to soil. This point of soil water content is generally accepted as about 15 bars tension.

**Phenotype.** Physical appearance of an organism (as distinguished from its genotype) that results from the interaction of its genotype with the environment, which includes such factors as light, soil moisture, and temperature.

**Plant introduction (PI).** Germplasm brought to the United States from other parts of the world to provide new genes for potential improvement of crop productivity.

**Plant pathogen.** Fungi, oomycetes, nematodes, bacteria, or viruses that infect plants and cause injury and/or disease.

**Plant residue cover.** Plant material remaining on the soil surface after crop harvest. Often used in relation to definition of tillage systems.

**Potential Evapotranspiration (PET).** The amount of water that can be moved from a surface to the surrounding air through the processes of evaporation and transpiration assuming the availability of unlimited water. It is usually obtained from pan evaporation or atmometer data. Solar radiation, wind, and air temperature are the factors that most influence PET.

**Reduced tillage system.** Limited mechanical operations with implements that result in the soil surface being covered with 15 to 30% plant residue.

**Relative Humidity (RH).** RH is the ratio of water in the air to the amount of water that air will hold at a given temperature. In essence, it is the amount of water in an air-water mixture and is usually expressed as a percentage. High RH reduces ET, and conversely low RH increases ET because low RH increases the VPD of the air surrounding leaves.

**Residual herbicide.** A herbicide that persists in the soil and injures or kills germinating weed seedlings for a relatively short period of time after application.

**Rhizobium.** Group of nitrogen-fixing bacteria that are found in the nodules affixed to roots of legume species.

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**Ridge tillage.** Soil is mounded up (a ridge or bed is built) in the fall of the year and the crop is then planted on top of this shallow ridge or bed.

**Row spacing.** Lateral spacing between plants that are planted in a row or drill.

**Selective herbicide/pesticide.** A chemical compound that kills only certain species of plants or plant pathogens. Broad or narrow spectrum, depending on the compound.

**Soil bulk density.** The ratio of dry soil mass to a known soil volume, including pore spaces. Usually given in g/cm<sup>3</sup> using undisturbed, oven-dried soil obtained from a core sample with a known volume.

**Soil persistence.** Refers to the length of time that a herbicide applied to or in soil remains effective.

**Soil porosity.** Refers to the amount of pore or open space between soil particles. Pores are created by the contact between soil particles. Fine-textured soils have more total pore space than coarse-textured soils; however, the pores are much smaller than those in soils with a high sand content. Thus, clay soils (more fine particles) hold more water than coarse-textured sandy soils, but because of the large surface area associated with the smaller clay particles, much of this water is adsorbed and difficult for plants to extract.

**Soil texture.** Classification of a soil based on its percentage of sand (largest particles), silt, and clay (smallest particles). Soil properties such as speed of internal drainage, water holding capacity, available water holding capacity, aeration, susceptibility to erosion, and cation exchange capacity (CEC) are influenced by texture. Soils that have a predominance of clay particles are called fine-

textured soils, while those dominated by larger particles are called coarse-textured soils.

**Soil Water holding capacity.** The amount of water that is held in a soil after gravitational water loss has ceased.

**Stale seedbed planting system.** A seedbed that has received no seedbed preparation tillage just prior to planting. It may or may not have been tilled since harvest of the preceding crop. Any tillage conducted in the fall, winter, or early spring will have occurred sufficiently ahead of planting time to allow the seedbed to settle or become stale. A crop is planted in this unprepared seedbed, and weeds present before or at planting are killed with herbicides. This system does not preclude tillage because it is a minimum or reduced tillage concept rather than a no-till concept.

**STIR.** A numerical index that represents the severity of tillage disturbance of soil. The value incorporates the type of tillage equipment, speed of operation, tillage depth, and degree of soil disturbance (width of soil surface disturbed) caused by tillage operations. Higher values are associated with higher tillage intensity.

**Strip Till.** A tillage system whereby soil disturbance is confined to narrow strips where seeds are planted. The [STIR](#) is typically well below 80.

**Symbiotic nitrogen fixation.** The conversion of N<sub>2</sub> from the atmosphere to inorganic nitrogen by microorganisms that live in nodules on the roots of soybean plants. "Symbiotic" indicates that both the *Rhizobium* bacteria in the nodules and the host plant (e.g., soybean) receive mutual benefit from the relationship.

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**Tillage system.** A combination of mechanical operations with implements that alter the soil environment to effect crop production.

**Tolerant.** The inherent ability of a plant to survive and reproduce after application of herbicides or during infestation by plant pathogens. May either be inherent (natural) or acquired through genetic manipulation. Often used synonymously with **Resistant**, which implies that a plant is either immune to or unaffected by particular biotic or abiotic stresses.

**Upland soil.** Soil on elevated land that: (1) is located outside of a flood plain, (2) is not subject to flooding, (3) may be subject to erosion, and (4) may have been subjected to long-term erosion and subsequent loss of a portion of topsoil.

**Value-added trait.** A quality trait or characteristic that increases the value of a crop product relative to its typical or commodity version, and that requires a uniform and uncontaminated end product; in soybean, commonly referred to as specialty varieties with specific physical or chemical characteristics that are required for specific markets.

**Vapor Pressure Deficit (VPD).** An indication of the dryness of the air. VPD is the difference between the amount of water in the air and how much water the air can hold when it is saturated at a given temperature. As the VPD increases, root extraction of water from the soil must increase to meet the increased demand of air for water from the plant. A reduction in relative humidity (drier air) increases the VPD, which results in a corresponding increase in ET. Higher ET will always need to occur to meet the demand of the air for moisture when VPD increases. The VPD is a function of both relative humidity and air temperature.

**Variable rate application.** Applying nutrients at differing rates on specific areas of an individual field based on the specific and differing requirements of those areas.

**Varietal resistance.** Resistance of a particular variety to injury caused by herbicides, pathogens, or insects. Resistance to the same pest may be expressed at different levels among different varieties of the same species. Often synonymous with **Host-Plant Resistance**.

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**Weed control.** The process of reducing weed growth and/or infestation to an acceptable level. Often synonymous with weed management.

*Composed by Larry G. Heatherly, Updated June 2020,  
[larryheatherly@bellsouth.net](mailto:larryheatherly@bellsouth.net)*