Compiled by S. K. Omi and T. D. Landis

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A

Absorption: Movement of a pesticide from the surface into a body of water or of nutrients into a plant (compare with **adsorption).**

Acid soil: Soil having a pH value less than 7.0.

Active ingredient (a. i.): Portion of a pesticide formulation that produces the desired toxic, stimulatory, or repelling effect, expressed as a percentage.

Adjusted sodium adsorption ratio (ASAR): Irrigation-water quality index that is the ratio of deleterious ions (i.e., Na^+, CO_3^{--}, and HCO_3^-) to beneficial ions (i.e., Ca^{++} and Mg^{++}). The ASAR value is used to assess the effect of salts on soil permeability (compare with **residual sodium carbonate, RSC**).

Adsorption: Attraction or bonding of ions or compounds, usually temporarily, to the surface of a solid (compare with **absorption**).

Advection frost: Frost occurring when cold air flows from a higher location to a lower one, displacing lighter, less dense air and often pooling to form a frost pocket (compare with **radiation frost, wind frost**).

Aeration (soil): Process by which (1) oxygen diffuses through the soil to the root and (2) carbon dioxide and other gases released from the root diffuse to the soil surface.

Aerobic: Occurring or growing in the presence of oxygen.

Alkaline soil: Soil having a pH value greater than 7.0.

Allelopathy: Production of chemical compounds by one plant which are released into the soil environment and are harmful to other nearby plants.

Amendment: Any substance added to a soil to alter its physical or chemical properties and thereby make that soil more useful for plant production.

Anaerobic: Occurring or growing in the absence of oxygen.

Anion: Ion having a negative charge, e.g., Cl^-, NO_3^- (compare with **cation**).

Annual: Plant that completes its entire life cycle from seed germination to seed production and death within a single season (compare with **perennial, biennial**).

Artificial regeneration: Reforestation of a stand by direct seeding or planting (compare with **natural regeneration**).

Available nutrient: Any essential element or compound in the soil that can be readily absorbed and assimilated by plants.

Available water: Portion of soil water that can readily be absorbed by plant roots. Generally considered to be that water held in the soil within a water-potential range of approximately $-1/3$ to -15 bars.

B

Band application: Spreading of a chemical or fertilizer to a restricted area (such as in, on, or along a crop row), rather than over an entire field or area (compare with **broadcast application**).

Bar: Unit of pressure equaling 1,000,000 dynes/cm^2; typically used to measure plant and soil water potential.

Base saturation percentage: Proportion of the cation exchange capacity (CEC) occupied by cations other than hydrogen or aluminum; expressed as a percentage of the total CEC.

Bed: Elongated strip of soil in which seedlings or transplants are grown.

Bed foot (meter): Area of seedbed 1 lineal foot (or 1 lineal meter) long times the width of the bed.

Biennial: Plant that requires 2 years to complete its entire life cycle, from seed germination to seed production and death. Food is stored in the first season and then used in the

second season when flowers and seed are produced (compare with **annual, perennial**).

Biometrics: Use of statistical techniques to evaluate biological problems.

Box pruning: Root-culturing technique that consists of the lateral pruning of roots in a four-sided box shape around a seedling in a seedbed (compare with **lateral pruning**).

Broadcast application: Spreading of a chemical or fertilizer over an entire area or field rather than only on rows, beds, or individual plants (compare with **band application**).

Broadcast seeding: Method of sowing in which seeds are distributed across the seedbed by hand (compare with **drill seeding).**

Broadleaf species: Those plants classified as Dicotyledoneae: characterized by having round and flattened leaves (compare with **narrow leaf species**).

Brushing: Frost-protection technique in which shields are placed near plants to deflect radiation to the plant and soil during the day and reduce heat loss to the sky at night; used primarily for agricultural crops.

Buffer capacity: Ability to resist change in pH. A soil with a high buffer capacity will have stable soil pH.

Bulk density (soil): Mass (weight) of dry soil divided by soil volume, commonly expressed as pounds per cubic foot or grams per cubic centimeter.

C

Caliper: Stem diameter of a seedling, usually measured just above the root collar.

Candle: Terminal shoot of conifers, especially pines, that has elongated but not yet produced needles. Color of bud scales or a waxy secretion gives the terminal shoot the appearance of a white candle.

Capillary water: Water held in the small pores of a soil, usually with attraction forces exceeding the pull of a 60-cm column of water. Most capillary water is available to plants.

Carbon:nitrogen (C:N) ratio: Ratio of carbon content to nitrogen content. The C:N ratio in plant residues is often a convenient predictor of decomposition rates but is not the only determinant.

Catch crops: Crops which are grown and then incorporated into the soil, primarily to capture and retain nutrients on the site but also to increase soil organic matter (compare with **cover crops, green manure crops**).

Cation: Ion having a positive charge, e.g., Ca^{++}, Mg^{++} (compare with **anion**).

Cation exchange capacity (CEC): Sum total of exchangeable cations that a soil can adsorb, expressed in milliequivalents per 100 grams of soil, clay, or organic colloid. Because of the high CEC of organic matter, the buffer capacity of a soil is increased after organic amendments are added, and the soil is better able to hold cationic nutrients.

Chelation: Formation of strong bonds between metals and organic compounds. Those chelates used in fertilizers are soluble and increase and maintain the availability of micronutrients (such as iron, zinc, manganese, and copper) for plant uptake.

Chilling requirement: A certain period (usually expressed in hours) of cold temperatures (0 to 10°C) that seeds or seedlings must experience before growth occurs in periods of warmer temperatures. This adaptive mechanism helps to protect buds from flushing during temporary warm-temperature spells in winter or early spring and being subsequently killed when cold temperatures return.

Chilling sum: Cumulative number of hours that a seedling is exposed to a certain range of temperatures, of either soil or air, known to effectively release dormancy for the species of interest (e.g., for Douglas-fir in the Northwest, the temperature range is 0 to 5°C). Chilling sums are used to assess seedling dormancy status and to determine proper lifting dates.

Chiseling: Breaking or loosening soil, without inverting it, with a cultivator or chisel plow, generally below the normal plow depth (compare with **subsoiling, ripping**).

Chlorosis: Yellowing of normally green plant tissue, due to a lack of chlorophyll. Chlorosis can be a symptom of disease, nutrient deficiency, or inadequate light.

Clay: Soil particle less than 0.002 mm in diameter; soil textural class characterized by a predominance of clay particles.

Claypan: Dense, compact layer in the subsoil which has a much higher clay content than the overlying material, resulting from the downward movement of clay or the synthesis of clay in place during soil formation. Claypans, separated from the soil material above by a sharply defined boundary, are typically hard when dry and plastic and sticky when wet. They usually impede water and air movement and growth of plant roots (compare with **hardpan**).

Coefficient of variation (CV): Relative measure of variation in which the standard deviation is expressed as a percentage or fraction of the treatment mean.

Compaction (soil): Increase in bulk density, hence lower porosity, of a soil, due to the rearrangement of soil aggregates from applied loads, pressure, or vibration. The reduction of pore spaces between particles impedes gas and water exchange and also root penetration.

Complete fertilizer: Fertilizer containing all three of the major fertilizer elements—nitrogen (N), phosphorus (P), and potassium (K): the concentration is expressed as the percentage of N but as the percentage of the *oxide* of phosphorus (P_2O_5) and potassium (K_2O).

Compost: Organic residues or a mixture of organic residues and other materials (e.g., sawdust combined with nitrogen fertilizer or sewage sludge) that have been piled and allowed to undergo biological decomposition.

Concretion (soil): Local concentration of a chemical deposit, such as calcium carbonate or iron oxide, in the form of an aggregate or nodule of varying size, shape, hardness, and color.

Confidence Interval: Specified range within which the quantity of interest (e.g., treatment mean) will be contained for a specific level of confidence (e.g., 95%).

Contact herbicide: Herbicide that kills plant tissue by direct contact rather than by translocation or root uptake (compare with **systemic herbicide).**

Control treatment: Zero-level application of a treatment. A control treatment (e.g., no wrenching) is used to judge whether particular treatment levels (e.g., multiple wrenchings) are effective (compare with **standard treatment**).

Cotyledon: First leaf or leaves of the embryo in seed plants. In conifers, the cotyledon stage occurs after the seedling has emerged and until the primary (true) leaves develop.

Cover crops: Crops grown principally to control various forms of erosion but also incorporated into the soil to increase organic matter (compare with **catch crops, green manure crops**).

Cull: Seedling which is not acceptable because it does not meet certain size and quality standards and which is thought to have low survival and growth potential.

Cull factor: Number of seedlings that do not meet shippable standards (e.g., diseased, poor form or size, damaged), expressed as a percentage.

Cultural control: Indirect control measure (as opposed to direct killing) used to prevent pest damage—e.g., use of a previous crop that is antagonistic to the pest.

D

Damping-off: Disease characterized by either seed decay in the soil or seedling wilting and death after germination, usually caused by soil-borne fungi.

Deciduous plants: Plants which shed their leaves at a certain season, usually autumn.

Deductive reasoning: Drawing conclusions or making inferences which logically follow from a well-defined base of biological, chemical, or physical principles (compare with **inductive reasoning**).

Designed experiment: Detailed investigation in which the experimenter or researcher requires precise and unbiased (1) conclusions and (2) measures of uncertainty associated with those conclusions. Treatments are usually replicated and applied to plots at random (compare with **operational trial**).

Determinant growth: A 2-year process of shoot growth in which primordia are laid down in buds in the first year but elongate in the second year. Species exhibiting determinant growth may only have one growth flush per year (compare with **indeterminant growth**).

Dicot (Dicotyledoneae): Larger of the two classes of flowering plants (Angiospermae), distinguished from the smaller class (Monocotyledoneae) by the presence of two seed leaves (cotyledons) in the embryo and by other structural features, e.g., net-veined leaves; includes oak, elm, alder. Certain herbicides (e.g., 2,4-D) are effective against dicots but do not harm monocots.

Disking: Breaking up surface layers of soil with a disk implement, to destroy weeds, prepare the soil for planting, or incorporate a pesticide or fertilizer.

Dormancy: Condition in which a tissue predisposed to elongate does not do so even if environmental conditions are suitable for growth. Dormancy, composed of different phases, is a plant adaptation to survival under stress (e.g., frost, drought).

Drench: Saturation of a soil with pesticide, usually to control root diseases.

Drill seeding: Nursery sowing method in which seeds are planted in rows with a seed-drilling implement (compare with **broadcast seeding**).

Dysgenic: Causing harmful changes in the genetic makeup of a population.

E

Ectendomycorrhiza(e): Group of mycorrhizae which have both intercellular and intracellular fungal penetrations of root cortical cells. The branching and Hartig net formation are similar to those in ectomycorrhizae; infection within cortical cells is similar to that in endomycorrhizae.

Ectomycorrhiza(e): Group of mycorrhizae in which the fungal hyphae penetrate between the host root cells, often forming a mantle or sheath over the feeder roots. Ectomycorrhizae are common on members of the Pinaceae, Fagaceae, Betulaceae, and Salicaceae.

Electrical conductivity: Reciprocal of electrical resistance, expressed in "mhos" (reverse of "ohms"). A method for expressing salt concentration in soil or water.

Embryo: Young plant developing after the union of male and female gametes. In seed plants, the embryo is contained in the seed.

Emulsifiable concentrate (EC): Liquid pesticide formulation consisting of an active ingredient, a solvent, and an emulsifier that mixes with water to form an emulsion.

Emulsifier: Material which helps to suspend one liquid in another, such as oil in water.

Emulsion: Mixture of two or more immiscible liquids, such as oil and water, in which one is suspended or dispersed in the other in the form of very minute droplets and remains so through the use of an emulsifier.

Endomycorrhiza(e): Group of mycorrhizae in which the hyphal infections of host roots are intracellular. This group is not as common in conifer species as it is in many angiosperms and herbaceous species, although cedars and redwoods have endomycorrhizae.

Evapotranspiration: Sum of the water transpired by vegetation plus that evaporated from the soil.

Experiment: Planned inquiry designed to obtain new facts or to confirm or deny information from previous results, to aid in making recommendations or decisions.

Experimental plot: Smallest physical unit (e.g., specific length of nursery bed) to which a treatment is applied independent of other treatments.

F

Factorial experiment: Experiment in which each level of a given factor is tested across each level of one of more other factors.

Fallow: Allow cultivated land to lie idle during the entire or greater portion of the growing season.

Fertilizer: Any organic or inorganic substance, either of natural or synthetic origin, which is added to the soil to provide elements essential for plant growth.

Field capacity: Soil water content resulting after the free water has been allowed to drain from a saturated soil for 1 to 2 days; expressed as a percentage on a dry-weight basis.

Field efficiency: Amount of area growing trees divided by the amount of area cultivated in a given field: expressed as a percentage. Field efficiency primarily depends on the distance between irrigation lines and the width of tractor paths.

Frost cracking: Type of cold injury caused by freezing and thawing in which exterior and interior portions of the bark expand and contract at different rates, causing the bark to crack.

Frost hardiness: Ability of plant tissue to survive and resist the stress from freezing temperatures without sustaining irreversible physical damage.

Frost heaving: Lifting of the soil surface due to growth of ice crystals in the underlying soil; when this recurs over a period of time, seedlings can be physically lifted out of the ground.

Frost pocket: Area whose topographic features cause cold air to accumulate, increasing frost hazard to seedlings.

Frost smothering: Condition occurring when a saturated soil freezes, allowing little or no oxygen to reach plant roots. If the condition persists over 48 hours, seedling damage or death can result.

Fumigant: Chemical applied as liquid or powder which volatilizes to gases and kills insects, nematodes, fungi, bacteria, seeds, roots, rhizomes, or entire plants. Fumigants are usually applied beneath a tarp, sheet, or other enclosure.

Fumigation: Use of chemicals in gaseous form to destroy pests, usually applied under a cover or shelter.

Fungicide: Chemical used to kill or inhibit fungi.

Fungistasis: Inhibition of fungal growth, without destroying the fungus, by preventing the germination of conidia and other spore types.

G

Genotype: Genetic constitution of an organism, i.e., the set of genes belonging to an individual. Genotype interacts with environment to produce the phenotype (compare with **phenotype**).

Germination: The beginning of growth of a mature, generally dormant seed.

Germination percent (seed): Percentage of seeds that germinate under standard treatment and after a given time period. This value, considered a principal index of seed quality, is used to calculate seedbed sowing density.

Germinative capacity: Number of seeds in a given sample that actually germinate regardless of time required, expressed as a percentage.

Germinative energy: Number of seeds that have germinated at the time of peak germination, expressed as a percentage.

Gley: Layer of mineral soil developed under conditions of poor drainage, characterized by reduction of iron and other elements, and gray colors and mottles.

Grading: Process of identifying and subsequently separating various classes of acceptable (shippable) and inferior (cull) stock to improve stock quality. This operation occurs after lifting and before packing and storing.

Gravitational potential: Component of soil water potential caused by the force of gravity.

Green manure crops: Crops grown primarily as organic amendments for the soil. Green manure crops are incorporated into the soil while green but before seedset, to benefit succeeding crops (compare with **catch crops, cover crops**).

H

Hardening off: Natural process of adaptation by plants to cold or drought. Hardening off may be induced in the nursery by reducing water or by root culturing, thus preparing the seedling for outplanting or transplanting.

Hardpan: Hardened soil layer caused by cementation of soil particles with materials such as silica, sesquioxides, or calcium carbonate. The hardness does not change appreciably with changes in moisture content (compare with **claypan**).

Hartig net: Hyphal network of ectomycorrhizae which penetrates between root cortical cells of the host. This extensive contact between fungus and plant root facilitates the exchange of nutrients and other substances.

Herbicide: Chemical used to kill or inhibit unwanted plants or weeds.

Hormone: Growth-regulating substance synthesized in one location, usually in small amounts, and then transported to another location within the organism where if affects growth and differentiation.

Humic acid: Mixture of dark-colored organic materials of indefinite composition extracted from soil with dilute alkali and precipitated by acidification.

Humification: Breakdown of organic residues to humus.

Humus: Fraction of soil organic matter remaining after most plant and animal residues have decomposed; usually dark colored. The chemical composition of humus is very different from that of the original parent compound. Humic substances (1) help the soil retain water, (2) increase the cation exchange capacity, and (3) stabilize soil pH.

Hydraulic conductivity (K): Flow-rate constant, expressed in centimeters/second, which indicates the ability of soils to transmit flowing water. Values of K commonly range from 1×10^{-1} cm/sec in sands to 1×10^{-9} cm/sec in tight clays.

Hydroponics: Commercial production of plants in sand or gravel cultures. The sand or gravel is relatively inert, providing mechanical support for growth, and nutrients are supplied by liquid solutions.

Hypothesis testing: Statistical technique which uses experimentation to support or reject a (null) hypothesis, formulated before the experiment, with a certain level of confidence.

IJK

Incorporation: Mixing of a fertilizer or chemical into nursery soil before sowing.

Indeterminant growth: Shoot growth resulting from the successive periods of initiation and elongation of apical meristem cells during the growing season without extended periods of rest (compare with **determinant growth**).

Inductive reasoning: Making inferences or drawing conclusions, based on a limited number of observations, about a wider sphere of interest (compare with **deductive reasoning**).

Infiltration rate: Rate at which water can be absorbed into a soil surface. Infiltration rate can be altered by nursery practices influencing the porosity and structure of surface soils. A soil with a poor infiltration rate is subject to surface runoff and erosion.

Inoculation: Process of introducing microorganisms for some beneficial effect, such as the addition of *Rhizobium* bacteria to legume seed or of mycorrhizal fungi to nursery seedbeds.

Inoculum: Portions of a pathogen (e.g., fungal spores) capable of causing infection or initiating mycorrhizae upon contact with the host.

Interception system (drainage): Type of closed drainage system located below the water-table level, intended to remove water before it enters the soil. The system may vary from a simple line of pipes positioned at the source of seepage to a complex grid pattern and is usually used in small land areas (compare with **relief system**).

Ions: Atoms or groups of atoms which are electrically charged, i.e., cations or anions.

L

Lammas shoots: Additional flushes of growth on the terminal shoot which result from bursting of current-year buds, thought to be stimulated by excess fertilization or irrigation. A seedling with lammas shoots may be more susceptible to frost damage or less resistant to the stresses of lifting, storage, and planting.

Lateral pruning: Root-culturing technique in which blades or colters are passed between drill rows to sever long lateral roots. The purpose of lateral pruning is to facilitate lifting, stimulate root growth and fibrosity, and retard height growth (compare wifih **box pruning**).

Leaching: Downward movement of materials in the soil solution. Soluble nutrients such as nitrate are often leached out of the seedling root zone.

Lifting window: Time period of the year believed to be the best for harvesting seedlings from the seedbed, i.e., when seedlings are most resistant to handling stresses and when subsequent survival and growth potential upon outplanting are high. The lifting window will vary from year to year depending on seed source, nursery location, and cultural regimes used before lifting.

Lignification: Deposition of lignin (complex aromatic compounds) in the cell walls of sclerenchyma, xylem vessels, and tracheids, making them rigid.

Lime (calcium) requirement: Amount of agricultural limestone required per acre to raise the soil pH to an optimal value for seedling growth; usually calculated for a soil depth of 15 cm or per 910,000 kg of soil.

Liming: Addition of calcium, sometimes including magnesium (dolomite), in the form of calcium carbonate, ground limestone, or hydrated lime to furnish elements for plant growth and to neutralize soil acidity.

Loam: Textural class for a soil having moderate amounts of all three soil separates-sand, silt, and clay.

Luxury consumption: Absorption of excess amounts of nutrients beyond those necessary for optimal growth.

M

Macronutrient: Chemical element necessary for plant growth in large amounts (usually greater than 1 part/500 in the plant); often supplied artificially in fertilizers (compare with **micronutrient**).

Maintenance dressing: Fertilizer application which functions to keep soil macronutrient and micronutrient levels adequate during the. crop rotation.

Material attributes: Individual measurements of one aspect of seedling quality which can indicate physiological condition, e.g., leaf osmotic potential, root starch concentration, and shoot:root ratio. Performance attributes reflect the sum total of material attributes.

Matric potential: Largest component of total soil-water potential; caused by capillary action and attraction of water by soil particles. Matric potential can be measured with tensiometers and is usually expressed in negative pressure units such as – bars.

Measurement plot: That part of the experimental plot in which the observational units are measured.

Megagametophyte: Haploid generation portion of a seed plant representing the female contribution to the developing embryo.

Metabolism: Chemical processes comprising the synthesis and degradation of constituents within an organism.

Micronutrient: Chemical element necessary for plant growth in very small amounts (less than several parts per million in the plant). Micronutrient fertilizers are not normally needed except under soil conditions such as excessively high or low pH (compare with **macronutrient**).

Milliequivalent (meq): One milligram (mg) of hydrogen or the amount of any other ion that will combine with it. Milliequivalents are units used in cation exchange capacity and fertility calculations. For example, 1 meq of a calcium ion (Ca^{++}) is computed as its atomic weight in grams (40) divided by the valence (2), or 20 mg.

Mineralization: Conversion of organic elements to the inorganic state as a result of microbial decomposition.

Mineral soil: Soil consisting largely of mineral matter, with organic matter usually less than 20%.

Mineral spirits: Derivatives of naphthenic petroleum, containing 10 to 20% aromatic hydrocarbons, used as a solvent for some pesticides; sometimes used in tree nurseries as a contact herbicide.

Monocot (Monocotyledoneae): Smaller of the two classes of flowering plants (Angiospermae), distinguished from the larger class (Dicotyledoneae) by the presence of a single leaf (cotyledon) in the embryo and by other structural features, e.g., parallel-veined leaves; includes grasses, lilies, orchids. Certain herbicides are effective against monocots but do not harm dicots.

Mulch: Layer of plant residues or other material (e.g., plastic film, paper fiber) spread upon the soil surface to protect soil, seeds, or plant roots from the effects of freezing, evaporation, crusting, etc.

Mycorrhiza(e): The biological association, usually symbiotic, between plant roots and pFarticular fungi.

N

Narrow leaf species: Those plants classified as Monocotyledoneae; characterized by having narrow, parallelveined leaves (compare with **broadleaf species**).

Natural regeneration: Reforestation of a stand by natural seeding (compare with **artificial regeneration**).

Nitrification: Biological process in which (1) ammonium is oxidized to nitrites, and (2) nitrites are further oxidized to nitrates.

Nonselective pesticide: Material that is toxic to a wide range of pests or to more than one plant or animal.

Null hypothesis: Specific hypothesis about a population that is being investigated by analyzing data from a sample of that population. For both statistical and biological reasons, elements under investigation are hypothesized to have *no* effect on the response variable—thus, the use of "null."

O

Observational unit: Item to be measured within an experimental plot (e.g., tree seedling).

Operational trial: Preliminary inquiry in which each treatment is applied to only one plot (i.e., treatments are unreplicated) (compare with **designed experiment**).

Organic matter: The complex interaction of (1) plant, animal, and microbial residues in various stages of decay, (2) humus, and (3) live organisms. Organic matter increases the buffer capacity, cation exchange capacity, and water retention of the soil and provides a substrate for microbial activity.

Organic soil: Soil usually containing 20% or more organic, matter.

Ornamentals: Plants, including trees, shrubs, and flowers, which function to beautify homes, gardens, and lawns; refers to stock used for landscaping rather than wildland plantings.

Osmotic potential: Pressure that would have to be applied to a solution to prevent water from moving from the less concentrated solution to the more concentrated one when two solutions are separated by a semipermeable membrane. Soil osmotic potential refers to solute concentration in the soil solution; plant osmotic potential refers to solute concentration of the cell sap.

Outplanting: Planting of seedlings on a forest site.

Oxidation: Chemical process of combining with oxygen; removal of hydrogen or electrons.

P

Parasite: Organism that lives on other living organisms.

Pathogen: Specific agent (usually fungus, bacterium, virus, or nematode) that can cause infectious disease.

Peat: Largely undecomposed or slightly decomposed organic matter accumulated under conditions of excessive moisture and low oxygen availability; soil amendment used to increase soil organic matter and lower soil pH.

Perched water table: Surface of a local zone of water saturation held above the main body of ground water by an impermeable layer, usually clay or rock, and separated from the main body of ground water by an unsaturated zone.

Percolation rate: Downward movement of water through the soil, particularly the downward water flow in saturated or nearly saturated soil. Percolation rate is used to calculate the internal drainage requirements of a soil.

Perennial: Plant that continues growing from year to year. Tops may die back in winter but roots or rhizomes persist (compare with **annual, biennial**).

Performance attributes: Attributes of seedling quality measured by assessing the performance of seedlings subjected to environmentally controlled test conditions, e.g., root-growth potential and frost hardiness. Performance attributes reflect the sum total of material attributes.

Permanent wilting percentage: Water content of a soil when indicator plants growing in that soil wilt and fail to recover when placed in a humid chamber; varies with plant species but is generally considered to occur at approximately – 15 bars water potential.

Permeability (soil): Soil attribute that enables water or air to move through it; determined by soil porosity.

pH: Numerical measure (negative logarithm of the hydrogen ion activity) of the acidity or alkalinity in a soil or solution. A pH reading of 7 is neutral for soils measured in water paste.

Phenotype: Morphological appearance of an organism. The phenotype results from the interaction of genotype and environment (compare with **genotype**).

Photoperiodism: Plant response to relative length of day and night. Temperature and photoperiod are the principal environmental factors affecting plant dormancy.

Photosynthesis: Production by plants containing chlorophyll of organic compounds from water and carbon dioxide, using energy absorbed by the chlorophyll from light.

Phytotoxic: Causing injury or death to plants.

Plant moisture stress (PMS): Measure of plant water status; equal to the absolute value of plant water potential. PMS is an integrated index of the current moisture status of a plant, and is influenced by soil moisture status and evaporative demand of the atmosphere.

Plant water potential: Current water status of a plant; consists of two components, turgor potential and osmotic potential, and is measured in negative pressure units (– bars).

Plasmolysis: Shrinkage of cell protoplasm away from the cellulose wall due to osmotic withdrawal of water.

Plug plus one (p+1): Transplanted seedling that was started in a container and then transplanted to the field, usually for 1 year (compare with **stock type**).

Point estimate: Number that estimates a certain quantity in the population of interest (e.g., treatment mean, standard deviation).

Pore space: Total space not occupied by soil particles in a bulk volume of soil.

Porosity (soil): Volume of total soil bulk not occupied by solid particles, expressed as a percentage. Percent porosity equals the volume of pores divided by total soil volume.

Postemergence: Time pefiod *after* crop plants or weeds emerge through the soil surface.

Preemergence: Time period *before* crop plants or weeds emerge through the soil surface.

Preplanting treatment: Application of, e.g., herbicide or fertilizer before a crop is planted.

Profile (soil): Vertical section of soil extending through all of its horizons and into the parent material.

Prolepsis shoots: Shoot growth resulting from the expansion of lateral buds at the base of the terminal bud or on lateral shoots. Prolepsis shoots may be more susceptible to winter injury because of inadequate time to harden off.

Propagule: Any part of a plant that is capable of growing into a new organism.

QR

Quiescence (seedling): Period of physiological inactivity preceding true dormancy when plants still can grow if environmental conditions are suitable.

Radiation frost: Frost occurring when large amounts of heat in soil and plants are dissipated into the atmosphere, allowing temperatures near the ground to reach the freezing point. This condition occurs on cloudless nights with little or no wind (compare with **advection frost, wind frost**).

Radicle: Root of the embryo in seed plants.

Randomization: Assignment of treatments to a set of plots such that all plots are equally likely to receive any treatment.

Relief system (drainage): Type of closed drainage system located below the water-table level, designed to drain already saturated soils. The system may consist of a simple pipeline or a complex interconnecting network (compare with **interception system**).

Replication: Repetition of a treatment in an experiment.

Residual sodium carbonate (RSC): Irrigation-water quality index that measures the difference between the sum of calcium and magnesium ions and the sum of carbonate and bicarbonate ions. RSC values are used to determine the effect of salts on soil permeability (compare with **adjusted sodium adsorption ratio, ASAR**).

Respiration: Metabolic process of taking oxygen from the environment to produce energy and release carbon dioxide (in organisms); oxidative breakdown of fuel molecules and subsequent release of energy (in cells).

Response variables: Characteristics which an experiment and its treatments are designed to test (e.g., height, caliper).

Ripping: Cultural practice used to ameliorate compacted subsoils by pulling shanks through the soil at a depth of 40 to 80 cm. Usually, the shanks are then pulled at right angles to the first pass to produce a grid pattern (compare with **subsoiling, chiseling).**

Rolling: Cultural practice used before sowing to ensure good contact between seeds and soil particles. A cylindrical roller is passed over the land to firm the soil without causing a great deal of compaction.

Root culturing: General term for those nursery cultural practices designed to modify seedling root growth (e.g., undercutting, wrenching).

Root-growth capacity (root-growth potential): Physiological capability of a plant for producing new roots under optimal environmental conditions for root growth. High root-growth capacity is thought to be one of the best indicators of seedling field survival.

S

Salt: Water-soluble chemical compound that either is found naturally in the soil or is applied as fertilizer. In soil solutions, salts are generally dissociated into cations (e.g., calcium, sodium, potassium) and anions (e.g., sulfates, nitrates, bicarbonates). High salt levels are detrimental to plant growth. Conifer seedlings are especially sensitive to salts.

Sand: Soil particle between 0.05 and 2.00 mm in diameter; soil textural class characterized by a predominance of sand particles.

Saprophyte: Organism that lives on dead or decaying organic matter.

Scarification (land): Type of site preparation in which the duff and litter layers of the forest floor are removed or the mineral soil is mechanically mixed with the organic surface layer.

Scarification (seed): Process of scratching the seedcoat with abrasive material to improve germination of seeds with hard seedcoats which are relatively impervious to water.

Seedbed: Elongated strip of prepared soil in which seeds are sown and seedlings raised.

Seedbed density: Number of seedlings growing in a seedbed, expressed relative to area (e.g., number per square meter or foot) or lineal measure (e.g., number per lineal meter or foot).

Seedling: Young tree propagated from seed.

Seedling quality: Potential of a seedling to survive and grow successfully after outplanting.

Seedling water potential: See **plant water potential.**

Seedlot: Quantity of seeds from a particular location and elevation (seed zone) which are reasonably similar or uniform in quality. The identity and integrity of each seedlot (one of the basic divisions in seedling recordkeeping) are maintained during seed storage and during the nursery production period.

Seed protectant: Pesticide applied to seed before planting to protect seeds and new seedlings from diseases and insects.

Seed purity percent: Proportion of the total seedlot that is seed and not debris, expressed as a percentage of the seedlot weight.

Seed zone: Area of similar environmental conditions. Plants originating from the same seed zone are believed to be similarly adapted to the environment.

Serotinous: Cones which remain closed after maturing and which do not release seeds until several years after reaching maturity or exposure to high temperatures (e.g., some ecotypes of lodgepole pine).

Shale: Flat, layered rock consisting of consolidated clay and silt.

Shippable percent: Percentage of seedlings remaining at the end of the nursery growing period which meet certain size and form specifications (compare with **tree percent, yield percent**).

Silt: Soil particle between 0.05 and 0.002 mm in diameter; soil textural class characterized by a predominance of silt particles.

Sludge: General term for solid wastes, usually collected by sedimentation from water. Sludge is derived from many sources including agricultural wastes, brewery and cannery wastes, and sewage.

Soil horizon: Layer of soil approximately parallel to the land surface and differing from adjacent genetically related layers

in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, amount of organic matter, and degree of acidity or alkalinity.

Soil-moisture retention curve (soil-water characteristic curve): Curve depicting the relationship between soil matric potential and soil water content; varies with soil textural class and is usually calculated by soil-testing laboratories. This curve aids nursery managers in regulating soil matric potential and therefore irrigation scheduling.

Soil test: Chemical or physical analysis of a soil to determine texture, acidity, total salt concentration, or concentration of nutrient elements.

Soil water potential: Amount of work that a plant must exert to absorb water from the soil, usually expressed in units of negative pressure (– bars). It is composed primarily of matric potential but can also have as components osmotic potential, pressure potential, and gravitational potential.

Sowing: Process of placing seeds in the seedbed at a specific depth and density.

Specific gravity: Ratio of weight of a volume of matter to weight of an equal volume of water at a specific temperature.

Standard treatment: Treatment which simulates the operational procedures of a current practice (compare with **control treatment).**

Statistical Inference: Process of making generalizations, based on sample data, about a population or wider sphere of interest.

Statistics: Use of mathematical techniques to draw conclusions from a limited number of observations.

Stock type: Seedling classification, usually by age and location in the nursery-e.g., 1+0, 2+0, etc. The first of the two digits represents the number of growing seasons spent in the seedbed, the second digit the number of growing seasons spent in a transplant bed. " 1+0 for 1+1 " or "2+0 for 2+1 " means seedlings grown for transplanting, often under specific cultural conditions (e.g., high seedbed density) (compare with **plug plus one, p+1**).

Stratification (seed): Treatment applied before germination to overcome seed dormancy. Cold stratification consists of placing seeds in an environment of cold temperature, sufficient moisture, and oxygen for a specified time period.

Subsoiling: Tillage of subsurface soil without inverting it, to break up dense soil layers that restrict water movement and root penetration (compare with **ripping, chiseling**).

Summer annuals: Plants which germinate in the spring, do most of their growing in the summer, produce flowers or seeds, and then die in the fall of the same year (compare with **winter annuals).**

Surfactant: Chemical agents (e.g., spreaders, detergents, wetting agents) added to pesticides to make mixing easier and to assist application of a solution and adherence to the treated surface.

Symbiosis: Association of two dissimilar organisms, usually referring to cases in which the relationship is beneficial to one or both organisms.

Systemic: Entering and then acting within an entire organism; used especially to describe the action of pesticides or diseases within a plant.

Systemic herbicide: Herbicide which is absorbed by and then distributed within a plant, as opposed to one which functions only on contact with the plant's surface (compare with **contact herbicide).**

T

Table pruning: Pruning of seedling roots at the time of grading and packing.

Tensiometer: Instrument for measuring the matric potential of soil water, often used for monitoring irrigation.

Tilth: Physical condition of soil as related to its ease of tillage, fitness as a seedbed, and impedance to seedling emergence and root growth.

Tissue analysis: Chemical analysis of plant tissue to determine the concentrations of essential elements in the plant.

Top dressing: Application of chemical or fertilizer after a crop has been established.

Top pruning: Clipping of seedling terminal leaders with a sharp blade to alter shoot:root ratio, facilitate handling, achieve uniformity in crop size, and control height growth.

Trace element: See **micronutrient**.

Transpiration: Process of water movement through a plant to the atmosphere as a result of evaporation of water from leaves.

Transplant: Cultural practice of moving seedlings from one bed to another to promote additional growth. Also, a seedling after it has been lifted and then replanted one or more times in the nursery.

Transplant shock: Reduced growth rate of a young tree after it has been transplanted or outplanted.

Tree percent: Number of seedlings, irrespective of size or form, in a nursery bed at lifting compared to the number of viable seed sown, expressed as a percentage (compare with **yield percent, shippable percent**).

Turgor potential: One of the main components of plant water potential; reflects a positive force exerted inward by the cell wall.

Type 1 error: Rejection of the null hypothesis when it is true.

Type 2 error: Acceptance of the null hypothesis when it is false.

UV

Undercutting: Root pruning in the nursery bed using a sharp blade drawn parallel to the soil surface at a regulated depth to stimulate root growth and fibrosity (compare with **wrenching**).

Vesicular-arbuscular (VA) mycorrhiza(e): Group of mycorrhizae in which the fungal hyphae form two characteristic structures—vesicles and arbuscules—which are both intercellular and intracellular. Vesicles are saclike storage and reproductive structures, whereas finely branched arbuscules facilitate nutrient exchange. Though not visible to the naked eye, VA mycorrhizae can be seen by staining infected cells and then inspecting by microscope.

Viability: Ability of a seed to germinate and grow under a given set of conditions; usually estimated by germination percent or other tests.

WXYZ

Water content (soil): Index of soil moisture status, calculated as the amount of water lost from the soil upon drying to constant weight at 105°C; usually expressed as the weight of water per unit weight of dry soil.

Waterlogged: Saturated with water. Waterlogged soil, which may result from a high water table caused by overirrigation, seepage, or inadequate drainage, is detrimental to plant growth.

Water potential: See **plant water potential, soil water potential.**

Water table: Upper surface of the ground-water level, below which the soil is saturated with water.

Wettable powder (WP): Powder formulation of a pesticide which contains a wetting agent so that it will readily form a suspension in water.

Wetting agent: Compound added to a pesticide solution causing the spray droplets to spread and more thoroughly wet the leaf surface.

Wind frost: Frost occurring when winds in excess of 4 mph from cold regions displace warmer air. Wind frosts can occur day or night and are not necessarily dependent on topography (compare with **radiation frost, advection frost).**

Winter annuals: Plants which germinate in the fall or early winter, exist in a rosette form over the winter, do most of their growing the following spring, and then die after flower-ing and producing seeds (compare with **summer annuals**).

Winter burn: Type of cold injury to foliage. Foliage is warmed above freezing by the winter sun during the day (even though air temperature is below freezing), then refreezes after sunset (compare with **winter scald**).

Winter desiccation: Type of foliage injury which occurs on warm days when the ground is frozen: actually a type of physiological drought caused by excessive transpiration when frozen soils prohibit water absorption.

Winter scald: Type of cold injury to tree bark. Bark is warmed above freezing by the winter sun during the day (even though air temperature is below freezing), then refreezes after sunset (compare with **winter burn**).

Wrenching: Passing of an *angled* horizontal blade beneath the soil surface of the nursery bed at a specified depth to cut newly penetrating roots and to loosen and aerate soil. Wrenching is used to stimulate root growth and fibrosity and to regulate seedling growth (compare with **undercutting**).

Yield percent: Number of trees which meet a specific size criterion, regardless of form; expressed as a percentage. These seedlings may have multiple tops or damage from insects, disease, or other agents—characteristics that may make them unacceptable for shipping (compare with **shippable percent, tree percent**).