**A300 (Part 2) Draft 4 Version 1 *Soil Management a. Modification, b. Fertilization, and c. Moisture***

for Tree Care Operations –
Tree, Shrub, and Other Woody Plant Management –
Standard Practices *(Soil Management a. Modification, b. Fertilization, and c. Moisture)*

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## Contents

**Foreword** (This foreword will not be considered part of the revised and approved A300 Part 2 American National Standard)

ANSI A300 Standards are divided into multiple parts, each focusing on a specific aspect of woody plant management (e.g. Pruning, Soil Management, Supplemental Support Systems, etc).

These standards are used to develop written specifications for work assignments. They are not intended to be used as specifications in and of themselves. Management objectives may differ considerably and therefore must be specifically defined by the user. Specifications are then written to meet the established objectives and must include measurable criteria.

ANSI A300 standards apply to professionals who provide for, or supervise the management of, trees, shrubs, and other woody landscape plants. Intended users include businesses, government agencies, property owners, property managers, and utilities. The standard does not apply to agriculture, horticultural production, or silviculture, except where explicitly noted otherwise.

This standard has been developed by the Tree Care Industry Association (TCIA), an ANSI-accredited Standards Developing Organization (SDO). TCIA is secretariat of the ANSI A300 standards, and develops standards using procedures accredited by the American National Standards Institute (ANSI).

Consensus for standards writing was developed by the Accredited Standards Committee on Tree, Shrub, and Other Woody Plant Management Operations – Standard Practices, A300 (ASC A300).

Prior to 1991, various industry associations and practitioners developed their own standards and recommendations for tree care practices. Recognizing the need for a standardized, scientific approach, green industry associations, government agencies and tree care companies agreed to develop consensus for an official American National Standard.

The result – ANSI A300 standards – unify and take authoritative precedence over all previously existing tree care industry standards. ANSI requires that approved standards be developed according to accepted principles, and that they be reviewed and, if necessary, revised every five years.

TCIA was accredited as a standards developing organization with ASC A300 as the consensus body on June 28, 1991. ASC A300 meets regularly to write new, and review and revise existing, ANSI A300 standards. The committee includes industry representatives with broad knowledge and technical expertise from residential and commercial tree care, utility, municipal and federal sectors, landscape and nursery industries, and other interested organizations.

This draft is a public review document. The public review period starts on February 5, 2010 and ends on March 22, 2010. This document is not approved as a draft for trial use. Official public comments or information requests regarding this document must be forwarded to: Rouse@tcia.org, A300 Secretary, c/o Tree Care Industry Association, Inc., 136 Harvey Road – Suite 101, Londonderry, NH, 03053. Responses will be provided. Comments may be forwarded to ASC A300 members, however, comments that are forwarded only to ASC A300 members may not be recorded as official comments and a response may not be provided.

The ASC A300 has the following members as of January 22, 2010:

Tim Johnson, Chair
(Artistic Arborist, Inc.)

Bob Rouse, Secretary
(Tree Care Industry Association, Inc.)

| **Organizations Represented** | **Name of Representative** |
|---|---|
| Alliance for Community Trees | Michael Galvin |
| | Alice Ewan Walker (Alt.) |
| American Nursery and Landscape Association | Warren Quinn |
| | Craig J. Regelbrugge (Alt.) |
| American Society of Consulting Arborists | Jerry Pulley |
| | Stephen Miller (Alt.) |
| American Society of Landscape Architects | Ron Leighton |
| Asplundh Tree Expert Company | Geoff Kempter |
| | Peter Fengler (Alt.) |
| Bartlett Tree Expert Company | Peter Becker |
| | Dr. Thomas Smiley (Alt.) |
| Davey Tree Expert Company | Joseph Tommasi |
| | R.J. Laverne (Alt.) |
| International Society of Arboriculture | Bruce Hagen |
| | Sharon Lilly (Alt.) |
| National Park Service | Robert DeFeo |
| Professional Grounds Management Society | Thomas Shaner |
| Professional Land Care Network | Preston Leyshon |
| | Bill Brinn (Alt.) |
| Society of Municipal Arborists | Gordon Mann |
| | Nolan Rundquist (Alt.) |
| Tree Care Industry Association | Dane Buell |
| | James McGuire (Alt.) |
| USDA Forest Service | Keith Cline |
| | Ed Macie (Alt.) |
| Utility Arborist Association | Matthew Simons |
| | William Rees (Alt.) |

Additional organizations and individuals:
American Forests (Observer)
Peter Gerstenberger (Observer)
Sabeena Hickman (Observer)
Andy Hillman (Observer)
Myron Laible (Observer)
Beth Palys (Observer)
Richard Rathjens (Observer)
Mary Reynolds (Observer)
Richard Roux (NFPA-780 Liaison)
Don Zimar (Observer)

ASC A300 mission statement:

Mission: To develop consensus performance standards based on current research and sound practice for writing specifications to manage trees, shrubs, and other woody plants.

***Cause 1 excerpted from ANSI A300 (Part 1)*** **Pruning.**

## 1 Scope, purpose, and application

### 1.1 Scope

ANSI A300 standards present performance standards for the care and ~~maintenance~~ management of trees, shrubs, and other woody plants.

### 1.2 Purpose

ANSI A300 standards are intended ~~as guides~~ for use by federal, state, municipal, and private ~~authorities~~ entities including arborists, property owners, property managers, and utilities ~~in the drafting of their maintenance~~ for developing written specifications.

### 1.3 Application

ANSI A300 standards shall apply to any person or entity engaged in the ~~business, trade, or performance of repairing, maintaining, or preserving~~ management of trees, shrubs, or other woody plants.

**(Moved to 10.3.1)** ~~**1.4 Implementation**~~

~~Specifications for tree maintenance should be written and administered by an arborist.~~

## 10 Part 2 – ***Soil Management a. Modification, b. Fertilization, and c. Moisture*** standards

### 10.1 Purpose

The purpose of this clause is to provide standards for developing specifications for soil management, a. modification, b. fertilization, and c. moisture content.

**(Moved from 10.2) 10.1.1** ~~Fertilization~~ Soil management practices for agricultural, horticultural production, or silvicultural purposes are exempt from this standard unless this standard, or a portion thereof, is expressly referenced in standards for these other related areas.

### 10.2 Reason ~~for fertilization~~

**10.2.1** The reason for soil management shall be to manage the physical, chemical, and/or biological properties of the soil to create and/or maintain favorable nutritional and soil conditions in the root zones of tree, shrubs, and other ornamental plants to meet an objective.

**(Former 10.2.1) 10.2.2** The reason for fertilization is to supply nutrients determined

to be deficient to achieve a clearly defined plant management objective. That objective should be accomplished in the manner most beneficial to the plant and the environment.

**(Former 1.4) 10.3 Implementation**

**10.3.1** Specifications for ~~fertilization~~ soil management should be written and administered by an arborist.

**10.3.2** Specifications for soil management should include location, objectives, site and soil evaluations, number of soil samples, materials, application method(s), soil loosening method(s), and treatment area.

**10.3.3** Specifications for fertilization should include location of plants, objectives, materials, rate, application method(s), treatment area, and timing.

**10.3.4** Soil management and fertilization specifications shall be adhered to.

**(Former 10.3) 10.4 Safety**

**10.4.1** ~~Tree maintenance~~ Soil management shall be performed ~~only~~ by an arborist~~s or arborist trainees who, through related training or on-the-job experience, or both, are~~ familiar with the practices and hazards of ~~arboriculture~~ soil management and the equipment used in such operations.

**10.4.2** This performance standard shall not take precedence over ~~arboricultural~~ applicable industry safe work practices.

**10.4.3** ~~Operations~~ Performance shall comply with applicable Federal and State Occupational Safety and Health Administration (OSHA) standards, ANSI Z133, Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Federal Environmental Protection Agency (EPA) regulations as well as state and local regulations.

**10.4.4** The sites shall be inspected for hazards prior to implementing any soil management operations within the root zones of trees and woody plants.

**10.4.5** The location of utilities and other obstructions both below and above ground shall be taken into consideration prior to soil management operations. Utilities and other obstructions include, but are not limited to, gas, electric, communications, sewer, drainage, and signage.

## 11 Normative references

The following standards contain provisions that, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements

based on this American National Standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI Z60.1, Nursery stock

ANSI Z117.1, Safety Requirements for Confined Spaces

ANSI Z133, ~~.1, *for Arboricultural Operations – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush*~~ Arboriculture – Safety requirements

29 CFR 1910, General industry[1]

1926.650, Trenching and Excavation[1]

29 CFR 1910.268, Telecommunications[1]

29 CFR 1910.146, Permit-required Confined Spaces (PRCS)[1]

29 CFR 1910.269, Electric power generation, transmission, and distribution[1]

29 CFR 1910.331 - 335, Electrical safety-related work practices[1]

[1)] Available from U.S. Department of Labor, 200 Constitution Ave., NW, Washington, DC 20210.

**12 Definitions** (Definitions will not be considered part of the ANSI A300 Part 2 standard)

**12.1 arborist:** An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for, or supervise the management of, trees and other woody ornamentals.

**12.2 arborist trainee:** An individual undergoing on-the-job training to obtain the experience and the competence required to provide for, or supervise the management of, trees and woody ornamentals. Such trainees shall be under the direct supervision of an arborist.

**12.3 available water:** Water remaining in the soil after gravitational water held within soil macropores has drained and before the permanent wilting point is reached**.**

**12.4 buffering capacity:** The ability of the soil to maintain or resist change in pH.

**12.5 bulk density:** Mass of dried soil per unit volume; often used as a measure of soil compaction.

**12.6 compacted soil:** A high density soil lacking structure and porosity characterized by restricted water infiltration and percolation (drainage), and limited root penetration.

**12.7 drip line:** A boundary on the soil surface delineated by the branch spread of a single plant or group of plants.

**12.8 fertilization:** The application of fertilizer to the soil or plant.

**12.9 fertilizer:** A substance containing one or more nutrients to be added to a plant or surrounding soil to supplement the supply of essential elements.

**12.10 fertilizer analysis:** The composition of a fertilizer expressed as a percentage by weight of total nitrogen (N), available phosphoric acid ($P_2O_5$), soluble potash ($K_2O$), and other nutrients.

**12.11 fertilizer ratio:** The ratio of total nitrogen (N), available phosphoric acid ($P_2O_5$), and soluble potash ($K_2O$); e.g., the ratio of a 30-10-10 fertilizer is 3:1:1.

**12.12 field capacity:** The maximum water content of a soil after drainage due to the force of gravity.

**12.13 fill soil:** Soil placed over the existing soil surface to raise the finished grade to some specified level.

**12.14 geotextile fabric:** A woven blanket manufactured from synthetic fibers.

**12.15 gravitational water:** Water that drains from larger soil pores (macropores) due to the force of gravity.

**12.16 hand-digging:** Careful soil excavation using 'hand-tools' to expose roots for inspection or to determine where mechanical excavation can be done without causing significant root damage or loss.

**12.17 hydraulic soil excavation:** The removal of soil using pressurized water to minimize root damage.

**12.18 impenetrable layer:** Full or partial obstructions such as hardpans, plow pans, rock, abrupt textural changes, or retaining walls that restrict drainage.

**12.19 implant:** A capsule or other device permanently inserted into the xylem.

**12.20 infiltration:** The entry of water into a soil.

**12.21 nutrient:** Element or compound required for growth, reproduction or development of a plant.

**12.21.1 macronutrient:** Nutrient required in relatively large amounts by plants, such as nitrogen (N), phosphorus (P), potassium (K), and sulfur (S).

**12.21.2 secondary nutrient:** Nutrient required in moderate amounts by plants, such as calcium (Ca) and magnesium (Mg).

**12.21.3 micronutrient:** Nutrient required in relatively small amounts by plants, such as iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), and boron (B).

**12.22 minimally injurious soil excavation:** Method to remove soil around woody roots that minimizes bark injury, such as manual, hydraulic, pneumatic, or tunneling.

**12.23 mulch:** A material applied to the soil surface to protect the soil, deter erosion, moderate soil temperature, conserve moisture, inhibit weeds and improve soil structure.

**12.24 organic fertilizer:** A carbon-based fertilizer that releases essential plant nutrients upon breakdown.

**12.25 organic layer:** The layer of decomposed and decomposing and organic material above the mineral topsoil.

**12.26 percolation:** The movement of free water through the soil profile.

**12.27 permanent wilting point:** The point at which a plant roots can no longer absorb water from the soil.

**12.28 permeability:** The ease with which water penetrates and passes through the soil profile.

**12.29 pneumatic soil excavation:** The removal of soil using pressurized air to minimize root damage.

**12.30 quick-release fertilizer:** A fertilizer that is immediately available to the plant.

**12.31 salt index:** A measure of the salt concentration that fertilizer produces in the soil solution. The higher the salt index, the more likely that plant damage will occur.

**12.32 saturated soil:** A soil condition where all of the pores (micro and macropores) are filled with water.

**12.33 shall:** As used in this standard, denotes a mandatory requirement.

**12.34 should:** As used in this standard, denotes an advisory recommendation.

**12.35 slow-release fertilizer:** A fertilizer containing plant nutrients in a form that delays availability for plant uptake and use after application, or that extends availability

to the plant.

**12.36 soil aeration:** The process by which air in the soil is replaced by air in the atmosphere and carbon dioxide is able to diffuse into the atmosphere, or the process of improving soil porosity.

**12.37 soil modification:** Physically or chemically altering soils to improve conditions

**12.38 soil pH:** The relative acidity or alkalinity of soil; the negative log of the hydrogen ion concentration.

**12.39 soil salinity:** The measure of the concentration of mineral ions dissolved in soil solution (water).

**12.40 soil structure:** Soil classification characteristic of how soil particles clump or bind together (aggregate), creating voids between the aggregates.

**12.41 soil texture:** Soil classification characteristic of the relative size (fineness or coarseness) of soil mineral particles, specifically the proportions of sand, silt, and clay.

**12.42 soil volume:** The volume of soil available to trees and other woody plants for root development.

**12.43 specifications:** A detailed, measurable plan or proposal for performing a work activity or providing a product, usually a written document.

**12.44 standard, ANSI A300:** The performance parameters established by industry consensus as a rule for the measure of extent, quality, quantity, value or weight used to write specifications.

**12.45 subsurface application:** The application of dry or liquid fertilizer below the soil surface.

**12.46 surface application:** The application of dry or liquid fertilizer to the soil surface, mulch or ground cover.

**12.47 topography:** As used in this standard, pertains to the surface of the land – the physical relief or terrain, such as hills, ridges, slopes, swales, drainage, slope and aspect – that influence water movement and drainage, soil depth, soil moisture content, exposure to sunlight, wind, and other factors.

**12.48 trunk injection:** The process of injecting a liquid into the plant.

**12.49 water-insoluble nitrogen (WIN):** Nitrogen not readily soluble in cold water.

**12.50 wood-chip mulch:** A material placed on the soil surface composed of coarsely

ground wood, bark and leaves usually generated by sending tree parts through a wood chipping machine.

## 13 Soil management practices

### 13.1 Objectives

**(Former 13.2) 13.1.1** ~~Fertilization~~ Soil management objectives shall be established ~~prior to beginning any fertilization operation~~ before the specified work is to begin.

**13.1.2** Soil management objectives shall include, but are not limited to, one or more of the following:
Protecting existing root systems;
Preventing or mitigating soil conditions unfavorable for root growth;
Ensuring plant establishment and long term survival;
Enhancing root function and development;
Promoting plant health, increasing growth and improving appearance;
Managing soil moisture;
Managing diseases;
Inhibiting competitive vegetation;
Reducing soil erosion and compaction; and,
Enhancing soil biological diversity.

### 13.2 General

**13.2.1** Soil management practices should include, but are not limited to, one or more of the following:
Assessing soil conditions;
Mulching;
Tilling (cultivation);
Adding amendments to alter soil conditions;
Fertilization;
Irrigation;
Improving drainage;
Removing fill soil or pavement within the root zones of trees; and,
Providing adequate soil volume for new planting.

**(Former 13.1) 13.2.2** ~~Fertilization~~ Soil management material safety precautions shall be followed for all products.

**13.2.3** Materials shall be used in accordance with federal, state, and local regulations.

**(Former 13.3) 13.2.4** To achieve the defined objective, site factors shall be considered, including proximity to waterways, past soil management practices, slope,

and irrigation.

**13.2.5** Applications of materials to adjust the soil pH shall be considered.

**(Former 13.8) 13.2.6** Plant conditions such as disease, insect infestations, and herbicide damage shall be considered.

**(Former 13.9) 13.2.7** Soil modification to improve nutrient uptake shall be considered prior to fertilization.

**13.2.8** Practices that reduce natural leaf litter accumulation within the root zones of plants should be avoided.

## 14 Soil modification practices

**14.1** Soil modification objectives shall include, but are not limited to, one or more of the following:
Protect existing roots;
Enhance root development; and,
Maintain tree health.

**14.2** Soil modification practices shall include one of more of the following:
Evaluating site soil conditions;
Managing soil organic matter content; and,
Prevention and mitigation of soil compaction.

### 14.3 Evaluating site soil condition practices

**14.3.1** Site and soil evaluation objectives shall be established.

**14.3.2** Site and soil evaluation items should include, but are not limited to, the following:
Site topography – surface and subsurface drainage;
Soil drainage (infiltration and percolation);
Soil texture;
Soil profile;
Soil structure (bulk density);
Soil depth;
Presence of impermeable layers and height of water table; and,
Organic matter levels.

**14.3.3** Soil and site physical characteristics should be assessed prior to designing, planting and or developing management plans for landscapes.

**14.3.4** Soil testing should be done prior to designing, planting and or developing management plans for landscapes.

**14.3.5** The number of samples to be collected should be specified and should be representative of the site, see Annex B.

## 14.4 Managing soil organic matter content practices

**14.4.1** Soil organic matter content management objectives shall be established.

**14.4.2** Objectives shall include, but are not limited to, one or more of the following:
Maintain soil organic matter at an adequate level for the plant species at the site.

**14.4.3** If soil organic matter content is low, organic materials should be incorporated into the soil or applied to the surface as mulch.

**14.4.4** When organic matter is incorporated into the soil, compost should be used.

## 14.5 Prevention and mitigation of compaction practices

**14.5.1** Objectives for prevention and mitigation of soil compaction shall be established. Objectives should include, but are not limited to, one or more of the following:
Maintain or improve soil aeration;
Maintain or increase water penetration (infiltration rate) and percolation;
Maintain or enhance water-holding capacity and drainage;
Maintain or improve ease of root penetration; and,
Maintain or reduce surface runoff and soil erosion.

**14.5.2** Methods to mitigate compacted soils shall be specified. Methods include, but are not limited to:
Mulching;
Incorporation of soil amendments;
Mechanical loosening (cultivation); and,
Loosening using high pressure air.

**14.5.3** Measures should be taken to prevent or minimize soil compaction while working within the root zones of trees and woody plants or where landscapes are planned.

**14.5.4** Activities on wet soils should be avoided or preventative actions shall be taken to avoid compaction.

**14.5.5** Soils with surface compaction in areas where landscapes are planned should be amended with organic matter following mechanical loosening to the depth of soil compaction.

**14.5.6** Mulching should be considered an effective long term means to treat compacted soil within the root zones of trees and woody plants.

## 14.5.7 Surface application of organic mulch

**14.5.7.1** The objectives of mulching shall be established. Objectives should include but are not limited to one or more of the following:
Inhibit weed growth;
Conserving soil moisture;
Moderating soil temperature extremes;
Preventing and alleviating soil compaction;
Preventing soil erosion and surface crusting;
Improving the soil structure and fertility;
Encouraging beneficial soil microorganisms;
Inhibiting certain root pathogens; and,
Increasing root growth and plant vigor.

**14.5.7.2** Types of mulch and methods of application shall be specified to meet the objective.

**14.5.7.3** When selecting the type of mulch, consideration should be given to tree species, soil conditions, irrigation practices, and pathogenic fungi.

**14.5.7.4** Fresh or partially composted coarse (greater than ¾ inch average wood particle size) wood-chip mulch from trees should be preferred when the objective is to improve soil structure and enhance soil biological activity.

**14.5.7.5** Fresh wood-chip mulch that is known to cause an allelopathic response in the plants being mulched, to be contaminated by a transmittable disease, or to contain seeds of undesirable plant species should be avoided.

**14.5.7.6** The ignitability of mulches shall be considered.

**14.5.7.7** Impervious plastic sheeting shall not be placed under the mulch.

**14.5.7.8** Pervious fabric or sheeting should not be used under the mulch when the objective is to improve soil structure and increase organic matter content.

**14.5.7.9** Mulch shall not be placed against tree trunks.

**14.5.7.10** Mulch should be applied over as much of the root zone as practical.

**14.5.7.11** Mulch should be applied and maintained at a depth of 2-4 inches (5-10 cm).

## 14.5.8 Incorporation of soil amendments

**14.5.8.1** Soil amendments specified should be appropriate for the chemical and physical characteristics of the site soil and to meet the objective.

**14.5.8.2** When re-compaction is a concern, structural amendments, based on soil texture, shall be specified to meet objectives.

**14.5.8.3** Non-composted woody materials shall be avoided when incorporating into the soil.

**14.5.8.4** Composts, when used as soil amendments, should be tested by a qualified lab for chemical properties, such as pH and salt index.

**14.5.8.5** Soil amendments should be incorporated into the soil after mechanical loosening of the soils has been completed.

**14.5.8.6** Soil amendments should be incorporated throughout the layer of compacted soil.

**14.5.8.7** Sand should not be considered as a soil amendment for clayey soils unless it will exceed 50 percent of the soil volume following amendment.

**14.5.8.8** Gypsum should not be considered an effective amendment for mitigation of soil compaction for soils with high calcium content or excessive sodium (sodium adsorption ratio > 6).

**14.5.9 Mechanical soil loosening**

**14.5.9.1** Compacted soil should be mechanically loosened before adding topsoil.

**14.5.9.2** The depth of the compacted layer to be loosened shall be specified.

**14.5.9.3** Pneumatic soil excavation should be considered the preferred method to loosen compacted soil within the root zones of plants.

**14.5.9.4** Compacted soils should be moist before being loosened using pneumatic excavation tools.

**14.5.9.5** Moisture content of compacted soil should be less than field capacity before being mechanically tilled.

**14.5.9.6** Under existing plants, compacted soils should be loosened using the least injurious method to meet the objective.

**14.5.9.7** Under existing plants, when mechanical loosening of the soil is impractical, organic mulch should be applied to mitigate compaction in time.

**14.5.9.8** Under existing plants, compacted soil should be remediated within the affected root zone area using methods that minimize injury to roots. Remediation includes one or more of the following:
Loosening;
Amending; and,
Replacing.

**(Former 13) 15 Fertilization practices**

**(Former 13.5) 15.1** Soil and/or foliar nutrient analysis should be used to determine the need ~~for~~ , type, and rate of fertilizer.

**(Former 13.4) 15.2** The types and rate of fertilizer – as well as timing, method, and ~~location of application~~ treatment area – shall be specified to achieve a clearly defined plant management objective.

**(Former 13.6) 15.3** Soil pH shall be considered when selecting the fertilizer.

**(Former 13.7) 15.4** New transplants and plants sensitive to fertilizer salt should only be fertilized with a slow-release fertilizer.

**15.5 Soil reaction (pH) adjustment**

**15.5.1** The objectives for adjusting soil pH shall be established.

**15.5.2** Soil pH should be determined prior to adjusting.

**15.5.3** Soil pH in landscapes with recognized pH problems should be monitored and treated periodically to meet the objective.

**15.5.4** When pH adjustments are specified for new plantings, they should be performed prior to plant installation.

**15.5.5** Elemental sulfur or sulfur-containing compounds should be the preferred material to lower pH.

**15.5.6** Lime (calcium carbonate) or dolomite (calcium magnesium carbonate) should be the preferred material to raise pH.

**15.5.7** Application rates shall be determined based on the objective and soil pH.

**15.5.8** The material selected to adjust pH should be incorporated or injected into the upper 2 to 4 inches of the soil or to a depth that meets the objective.

**15.5.9** Adjusting pH in calcareous soil, those containing free calcium carbonate, should be considered impractical.

## 15.6 Fertilizer applications

### 15.6.1 When to fertilize

**15.6.1.1** Applications should be timed to meet management objectives.

### (Former 14.2) 15.6.2 ~~Types~~ Formulations and rates of fertilizer

**(Former 14.2.2) 15.6.2.1** Fertilizer ~~ratio~~ formulation should be adjusted based on objectives, condition and age of the plant, local knowledge, nutrient analysis, site conditions, and/or species.

**(Former 14.2.1) 15.6.2.2** In the absence of soil and/or foliar nutrient analysis, fertilizers with higher ratios of $P_2O_5$ and $K_2O$ should be avoided with the exception of palms.

**(Former 14.2.3.2) 15.6.2.3** The amount of water insoluble nitrogen (WIN) shall be considered.

**(Former 14.2.3) 15.6.2.4** Slow-release fertilizers with a minimum 50 percent WIN should be preferred ~~due to site considerations and plant sensitivity~~.

**15.6.2.5** Fertilizers with a salt index of less than 50 should be preferred.

**15.6.2.6** Slow-release fertilizers should be applied at rates between 2 and 4 pounds of actual nitrogen per 1000 $ft^2$ (1 to 2 kg N/100 $m^2$) and should not exceed 6 pounds of actual nitrogen per 1000 $ft^2$ (2.9 kg N/100 $m^2$) within 12 months.

**15.6.2.7** Quick-release fertilizers should be applied at rates between 1 and 2 pounds of actual nitrogen per 1000 $ft^2$ (0.5 to 1 kg N/100 $m^2$) per application and shall not exceed 4 pounds actual nitrogen per 1000 $ft^2$ (2 kg N/100 $m^2$) every 12 months.

### 15.6.3 Treatment area

**(Former 14.3.1) 15.6.3.1** The ~~fertilization~~ treatment area shall be defined prior to application. Consideration shall be given to root accessibility, root location, fertilization objectives, plant species, and site considerations.

**(Former 14.3.2) 15.6.3.2** For most trees and shrubs, the ~~fertilization~~ treatment area should be from near the trunk to near or just beyond the drip line. Inaccessible surfaces shall not be included in the rate calculation.

**(Former 14.3.3) 15.6.3.3** For fastigiate trees and unusual situations, the method for

determining the ~~fertilization~~ treatment radius should be calculated by multiplying the plant's stem diameter at 4½ feet (1.4 m) above ground, measured in inches (cm), by 1 to 1½ (0.12 to 0.18) to determine the radius, expressed in feet (m), from the trunk of the plant.

For example, a 15-inch (38.1 cm) DSH (DBH) tree would have a fertilization area radius of 15 to 23 feet (4.6 to 6.9 m).

**15.6.4 Surface application**

**15.6.4.1** Where turf or ground covers exist, subsurface fertilization should be the preferred method of fertilization.

**15.6.4.2** Precipitation and irrigation methods should be considered.

**(Former 14.4.1) 15.6.4.3** Fertilizer shall be uniformly distributed within the defined ~~fertilization~~ treatment area.

**15.6.4.4** Surface applied fertilizers shall be watered in.

**15.6.4.4.1** The watering-in period should be specified based on the objective and the material used.

**14.6.4.5** Surface application shall not be made where surface runoff is likely to occur.

**15.6.5 Sub-surface dry fertilization**

**15.6.5.1** Damage to the buttress roots should be avoided.

**(Former 14.5.2) 15.6.5.2** Holes shall be evenly spaced within the defined ~~fertilization~~ treatment area.

**15.6.5.3** Hole depth, diameter, and spacing shall be specified. Holes should be 2 to 4 inches (5 to 10 cm) in diameter, spaced 12 to 36 inches (30 to 91 cm) apart, and 4 to 8 (10 to 20 cm) inches deep.

**15.6.5.4** The fertilizer shall be evenly distributed among the holes.

**(Former 14.5.5) 15.6.5.5** Fertilizer should be ~~not be closer~~ deeper than 2 inches (5 cm) ~~to the soil surface~~.

**15.6.6 Sub-surface liquid fertilizer injection**

**15.6.6.1** Damage to the buttress roots should be avoided.

**(Former 14.6.2) 15.6.6.2** Injection sites shall be evenly spaced within the defined ~~fertilization~~ treatment area.

**15.6.6.3** Injection site spacing and depth shall be specified. Injection sites should be 12 to 36 inches (30 to 91 cm) apart, and 4 to 8 inches (10 to 20 cm) deep, not to exceed 12 inches (30 cm) deep.

**15.6.6.4** Fertilizer shall be evenly distributed among the injection sites.

**15.6.7 Alternative fertilization techniques**

**15.6.7.1** All products shall be used in accordance with manufacturers' recommendations.

**15.6.7.2** Foliar applications, trunk injections, or implants shall only be used when soil application of fertilizer is impractical or ineffective in achieving fertilization objectives. Fertilizer specified shall be formulated for the application method.

**15.6.7.3** Water pH, salinity, and hardness should be considered.

**15.6.7.4** When applying foliar fertilizer, the fertilizer solution should be sprayed to thoroughly cover the foliage at the proper stage of growth to achieve fertilization objectives.

**15.6.7.5 Injections and implants**

**15.6.7.5.1** Timing of injection/implant application should be at the proper growth stage to achieve fertilization objectives.

**15.6.7.5.2** Products should be applied in the root flare or as low as practical in the trunk.

**15.6.7.5.3** Holes shall be made as small and shallow as practical.

**15.6.7.5.4** Application intervals should be timed to optimize results with minimal negative impact.

**15.6.7.5.5** Small diameter trees and drought-stressed trees should not be treated with injections or implants.

**15.6.7.5.6** If a drill is used to create injection/implant sites, then sharp bits shall be used.

**16 Moisture practices**

**16.1** The objectives of managing soil moisture shall be established. Objectives should include, but are not limited to, one or more of the following:
Preventing environmental stress on plants;
Managing disease problems;
Promoting plant growth;
Mitigating plant damage from human activity;
Improving plant aesthetics;
Increasing fire-resistance;
Preventing excess water from collecting within the root zones of plants;
Improving soil aeration;
Managing subsurface water flow; and,
Managing surface water flow.

## 16.2 General

**16.2.1** Measures to manage soil moisture and mitigate drainage problems should include, but are not limited to, one or more of the following:
Reduction of soil compaction;
Mitigation of impermeable layers (deep cultivation);
Excavation, swales, ditches; and,
Installation of drains, sumps.

**16.2.2** Soil drainage improvement should be considered most practical when done as a treatment prior to plant installation.

**16.2.3** Where drainage is restricted, and it is not practical to mitigate the conditions, species tolerant of wet soils should be selected.

**16.2.4** When improving drainage is not practical, planting on soil mounds or large berms should be considered to improve soil aeration in plant root zones.

**16.2.5** Drains should be installed through or behind retaining walls to prevent water from impounding behind the walls.

**16.2.6** Drain systems shall have sufficient slope to achieve the objective.

**16.2.7** Planting containers shall have adequate drainage or facility to remove excess water.

## 16.3 Mitigation of impenetrable layers

**16.3.1** Impenetrable layers that restrict drainage, limit aeration, or impound water should be mitigated.

**16.3.2** Impenetrable layers near the surface should be disrupted by sub-soiling or soil ripping prior to planting.

**16.3.3** Auguring holes through impermeable layers around existing plants, and areas that can not be disrupted by conventional means, should be considered to improve drainage.

**16.3.4** Drain systems should be considered in areas where impeded drainage will adversely affect soil aeration in existing or planned landscapes.

## 16.4 Mitigation/adjustment of surface drainage

**16.4.1** Surface drains (swales, ditches, culverts, berms, etc.) should be considered to prevent water from collecting around trees or in landscaped areas if drainage is slow or impeded.

## 16.5 Mitigation/adjustment of subsurface drainage

**16.5.1** Subsurface drainage should be installed in sites where drainage is slow, the water table is close to the surface, or water is impounded by retaining walls, foundations, etc.

**16.5.2** Subsurface drains should be installed to an adequate depth to meet the objective.

**16.5.3** The subsurface drain method (French drains, perforated pipes, etc.) and design shall be specified.

**16.5.4** French drains should be excavated to the depth needed to ensure favorable root zone conditions and be filled with coarse, uniform-sized gravel.

**16.5.6** Filter-fabric should be installed around perforated pipe to prevent infiltration of soil material.

**Annex A – Specification writing flow chart** (This annex will not be considered part of the ANSI A300 Part 2 standard.)

**Annex B – Site soil sampling guidelines** (This annex will not be considered part of the ANSI A300 Part 2 standard.)

**B-1** The number of samples taken may depend on the size of the site, the variability of soils at the site, history and the level of accuracy needed.

**B-2** When soil conditions appear variable, planting sites may be divided into sampling units.

**B-3** Samples taken at the 0- to 6-inch layer are typically done to assess chemical properties of the soil.

**B-4** Samples taken at deeper measurements are typically done to identify changes in profile (textural changes), obstructions to drainage, and propensity for root development.