Centre for Urban Greenery & Ecology
CUGE Standards

SPECIFICATIONS FOR
SOIL MIXTURE FOR GENERAL LANDSCAPING USE

CS A03:2013

Specifications on Properties of Planting Media

(Formerly CS A01:2009 and CS A02:2009)

Published by:
Centre for Urban Greenery and Ecology
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CS A: Specifications on properties of planting media
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Soil Mixture for General Landscaping Use

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The CS A03: 2013 is expected to be revised from time to time as more technical information becomes available.

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Soil Mixture for General Landscaping Use

SECTION 1 - SCOPE

1.1 INTRODUCTION

This Technical Specification sets out the minimum soil mixture requirements for general landscaping use.

NOTES:

The requirements of this Technical Specification do not cover soils for specialised use (such as civil engineering) or locations (such as green roof, sky rise greenery etc.) or for plants with special requirements.

1.2 OBJECTIVE

This Technical Specification provides a framework of definitions, general requirements and test methods. This standard is intended as a guiding reference for use by end-users, suppliers of soil, compost and soil mixes for landscaping and garden use, and those involved in providing and specifying landscaping and garden soil-based growing media.

The objective of this Technical Specification is to provide a set of minimum requirements that ensures that soil mix used in landscapes in Singapore can support plant growth, and which act as a common reference point for quality assurance of the media.

1.3 DEFINITIONS

For the purpose of this Technical Specification, the definitions below apply.

Soil quality – Soil quality is the capacity of a soil to function, within ecosystem and land-use boundaries, to sustain biological productivity, maintain environmental quality, and promote plant, animal and human health. Maintaining soil quality is important to optimise plant growth.

Top soil – A natural soil which is the original upper surface layer from natural vegetation land surface with high organic matter content.

Soil texture – Soil texture is the relative proportions of various soil particles such as sand, silt and clay in a soil mass. According to the International System by International Society of Soil Science, the soil particles are differentiated as -

Sand – soil particles with 2 - 0.2 mm particle diameter.
Silt – soil particles with 0.02 - 0.002 mm particle diameter.
Clay – soil particles with smaller than 0.002 mm particle diameter.

Soil texture directly affects soil water holding capacity, water infiltration rate and workability, and indirectly affects soil fertility through cation exchange capacity (CEC).

Soil structure – Soil structure is defined as the arrangement of primary soil particles into a certain secondary structural units or peds. The secondary units are characterised based on their size, shape and grade. Soil structure is the physical aspect of soil that influences water infiltration and retention, aeration, exchange of gases, resistance to root growth and conditions for microbial activity.

Soil taxonomy – Soil taxonomy is the soil classification system for systematic distinguishing, orderly naming of type, groups within a subject field.

Soil morphology – Soil morphology is the physical constitution of a soil profile and arrangement of the horizons in the profile (Figure 1).

Soil horizon – Soil horizon is the layer of soil approximately parallel to the land surface which can be distinguished from adjacent layers by its physical, chemical and biological properties (Figure 1).

Soil organic matter – Soil organic matter refers to the organic fraction of the soil exclusive of undecayed plant and animal residues. Soil organic matter generally contains around 58% of soil organic carbon. Therefore it is estimated that soil organic carbon multiplied by 1.724 = soil organic matter. Organic matter supports the biological, chemical and physical processes in soils to promote plant growth.

Humus – Humus is the dark coloured fraction of soil organic matter remaining after decomposition.

Soil bulk density – Bulk density is defined as the weight per unit volume of a dry soil and expressed as g/cm^3 or Mg/m^3. It is an important indicator for the level of compaction in the soil and for suitability of the soil to provide anchorage.

Hydraulic conductivity – The 'hydraulic conductivity' refers to the ability of a saturated soil to transmit water, and is expressed as length per unit time. It is important in determining the internal drainage of soils and to predict soil's behaviour under irrigation.

Soil organism – Soil organisms are classified into two broad groups, such as soil flora and soil fauna. These are again subdivided, depending upon their size, into soil macroflora (e.g. roots of higher plants) and soil microflora (e.g. bacteria, fungi, actinomycetes and algae), and soil macrofauna (e.g. earthworm, moles etc.) and soil microfauna (e.g. protozoa, nematodes). Soil organisms carry out nutrient transformation such as decomposition of organic matter and nitrogen fixation that support plant growth.

Soil respiration – Soil respiration is the production of carbon dioxide (CO_2) as a result of biological activity in the soil by microorganisms, live roots, and macroorganisms such as earthworms, nematodes, and insects. It describes the level of microbial activity, organic matter content and its decomposition.

Bioassay – Bioassay is the biological standardisation for monitoring environmental pollutants. Plant species act as natural bioindicators of environmental pollutants.

Soil pH – The pH is defined as the negative logarithm of the hydrogen ion activity in the solution. The pH determination is helpful in characterising soil for nutrient availability and physical condition. The soil pH scale varies from 0 - 14 with a neutral pH value of 7. With a decrease of pH from 7, soil acidity increases, similarly as pH increases from 7, the alkalinity of soil increases.

Electrical conductivity (EC) – EC is the ability of the soil to conduct electrical current. It is commonly used to measure the soluble salt content in the soil solution and expressed as milliSiemens per centimetre (mS/cm) or deciSiemens per metre (dS/m).

Cation Exchange Capacity (CEC) – CEC is defined as the sum of exchangeable cations that can be held onto soil. It provides a measure for evaluating the fertility status of a soil. It is usually expressed in centimoles of charge per kilogram of soil (cmol/kg). Generally CEC increases with increased clay content of soils and also addition of compost helps to increase CEC.

Carbon-Nitrogen (C:N) ratio – The C:N ratio is defined as the ratio of the organic carbon to the total nitrogen in soil, organic material, plants, or microbial cells. It can be used to indicate the maturity level of the organic matter present in soil. The optimal C:N ratio of soil usually varies from 18 - 24:1.

Pasteurisation – A process whereby organic materials are heat-treated for a sufficient duration to destroy plant and animal pathogens and plant propagules.

Compost – Compost refers to the organic residues, or a mixture of organic residues and soil, that have undergone thermophilic decomposition to achieve pasteurisation and a specified level of maturity.

Composting is the controlled biological process which converts organic constituents into humus-like material suitable for use as a soil amendment.

Compost maturity – Compost is considered mature when Carbon to Nitrogen ratio has stabilised within a desirable range (see Table 5) and there is no significant temperature variation within the compost.

Foreign matter – Foreign matter in composts refers to the presence of impurities such as weed seeds, stones, plastic, metal, glass or any other inert materials.

Plant propagule – Plant or parts of a plant that could generate a new plant, e.g. a seed, part of a rhizome, corm, bulb, etc.

Mulch – Mulch refers to any natural or artificial material, such as woodchips, compost, straw, leaves, plastic film, loose soil, etc., that is spread on the surface of the soil to protect the soil, or plant roots from the effects of raindrops, erosion, soil crusting, evaporation, etc.

1.4 SOIL PROFILE

A soil profile is the vertical cross section of a soil. It shows the layers of soil from the surface that may be dark-coloured due to presence of organic matter and grading down through to minerals of incompletely weathered bedrock.

Figure 1 below shows the profile of a natural soil; the profile distribution may differ in urban soil.

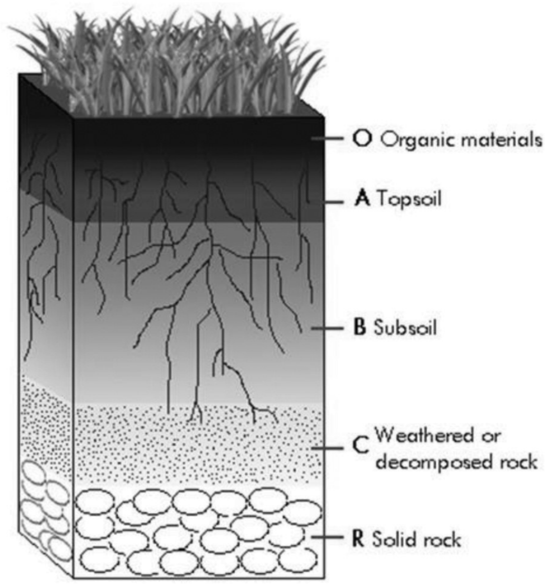

Fig 1 A natural soil profile

O horizon – The layer is dominated by organic material. The decomposed organic matter, or humus, enriches the soil with nutrients, aids soil structure, and enhances soil moisture retention.

A horizon – Dark coloured mineral horizon, characterised by an accumulation of humified organic matter intimately mixed with the mineral fraction.

B horizon – The layer is characterised with accumulated concentrations of silicate clay, iron, aluminium, humus, carbonates and gypsum.

C horizon – The layer is least affected by pedogenic processes. The C horizon represents the soil parent material, either created *in situ* or transported into its present location.

R horizon – The layer with hard bedrock.

1.5 SOIL TEXTURE CLASSIFICATION

A soil texture triangle is used to classify the texture class of a soil. The sides of the soil texture triangle are scaled for the percentages of sand, silt, and clay. The relative proportions of the various soil separates in a soil as described by the classes of soil texture shown in Figure 2.

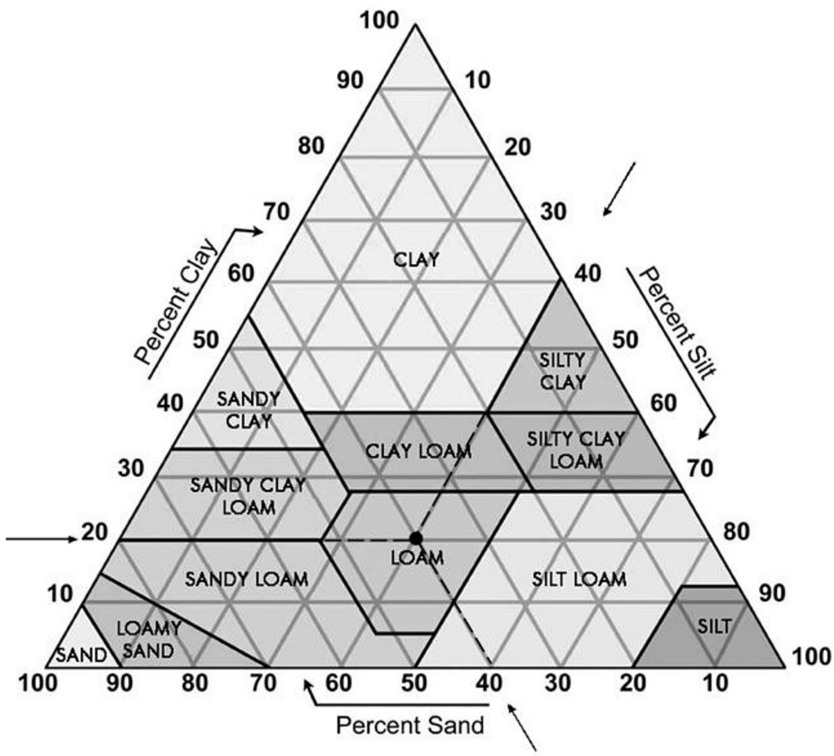

Fig 2 Soil texture triangle

The textural class can be determined from the soil textural triangle if the sand, silt, and clay percentages of a soil are known. For example, a soil with 40% sand, 40% silt and 20% clay would be classified as a loam (Figure 2).

1.6 VARIOUS CLASSES OF SOIL TEXTURE

There are different subclasses of soil texture as shown in soil texture triangle (Figure 2).

clay – Soil material that contains 40% or more clay, less than 45% sand, and less than 40% silt.

clay loam – Soil material that contains 27 - 40% clay and 20 - 45% sand.

loam – Soil material where sand, silt and clay particles are present in about equal proportions, contains 7 - 27% clay, 28 - 50% silt, and less than 52% sand.

loamy sand – Soil material that contains 70 - 90% sand, 0 - 30% silt, and 0 - 15% clay.

sand – Soil material that contains 85% or more sand; percentage of silt plus clay does not exceed 15.

sandy clay – Soil material that contains 35 - 55% clay, and 45 - 65% sand.

sandy clay loam – Soil material that contains 20 - 35% clay, less than 28% silt, and 45% or more sand.

sandy loam – Soil material that contains up to 20% clay and 52 - 82% sand.

silt – Soil material that contains 80% or more silt and less than 12% clay.

silty clay – Soil material that contains 40% or more clay and 40% or more silt.

silty clay loam – Soil material that contains 27 - 40% clay and less than 20% sand.

silt loam – Soil material that contains 50% or more silt and 12 - 27% clay, or 50 - 80% silt and less than 12% clay.

Soil characteristics vary with different textural classes which affect the soil quality and fertility status. Based on texture, soils differ in their susceptibility to erosion (erodibility); for example, a soil with a high percentage of silt-sized particles is more susceptible to erosion than a soil with clay or sand-sized particles. Other soil properties such as bulk density, porosity and CEC vary with soil textural classes, which have greater impact on soil fertility (Table 1).

Table 1 Characteristics for different classes of soil texture

TEXTURE	BULK DENSITY	% POROSITY	CEC (cmol/kg)
Sand	1.60	40	1 - 5
Loam	1.20	55	5 - 30
Clay	1.05	60	>30

SECTION 2 - GENERAL REQUIREMENTS

2.1 SOIL MIX COMPOSITION

Suitable general-purpose soil mixture, referred to as Approved Soil Mix (ASM) for general landscaping use can be mixed in the proportions shown in Table 2 below:

Table 2 Soil mix composition and their uses

SOIL MIX COMPOSITION	USE
3 parts of top soil, 2 parts of compost and 1 part of sand by dry weight*	General landscape applications

(For specialised uses (such as green roof, sky rise greenery, vertical greenery, etc.), please modify accordingly to suit the site conditions)

*Mixture of ASM components should be based on their dry weight. Volumetric mixing is consistent with gravimetric mixing only when the materials have similar bulk densities. However, in practice, while mixing the top soil for ASM, soil weight should be based on the moisture content of the soil.

Soil and compost specifications required for ASM should comply with the following criteria. Checking the individual components in the soil mix (soil and compost) separately before mixing is a good way to ensure conformity to specifications in the final mix. Sub soils and soil discarded from construction sites must not be used. The proportion of individual components and the mixing efficiency will ultimately determine the quality of the soil mix. There should not be any extraneous matter in the soil mix.

2.1.1 TOP SOIL SPECIFICATIONS - PHYSICAL AND CHEMICAL REQUIREMENTS

Table 3 Physical and chemical requirements

PARAMETERS	REQUIRED RANGE/ VALUE
Textural Class	Loam (sandy loam/silt loam/clay loam)
Texture Composition	Sand - Max 75% Min 20% Silt - Max 60% Min 5% Clay - Max 30% Min 5%
pH	5.5 - 7.2
Electrical Conductivity	Less than 2.0 mS/cm
Bulk Density	1.0 - 1.4 g/cm^3
Moisture Content	Not more than 30%
Organic Matter	2 - 5% by dry weight
C:N Ratio	18 - 24:1
Cation Exchange Capacity	Greater than 8 cmol/kg soil by dry weight
Infiltration Rate	Unsaturated hydraulic conductivity 50 - 100 cm/h

Table 4 Soil testing parameters

PARAMETER	FREQUENCY	COMMENTS
Physical		
Soil Texture	Baseline*	Soil texture is not likely to change significantly year in year out except where particulates are deposited or soil improvement is undertaken
Water Holding Capacity	Baseline	Should be retested following any soil physical improvements
Infiltration Rate	Baseline	Should be retested following any soil physical improvements and establishing irrigation regime
Soil Compaction	As required	Clegg Hammer or Penetrometer to establish remediation requirements
Biological		
Soil Respiration	As required	CO_2 - C per gram soil per day
Bioassay	Baseline and new media	Germination and/ or growth of selected indicator plant
Chemical		
Soil pH	As required	Account for seasonal variation
Electrical Conductivity	Baseline	Not likely to change in the short term unless contaminated particularly through recycled water or over application of fertilisers
Cation Exchange Capacity	As required	CEC of the individual soil component is a soil property that does not change. CEC of soil mixes could be modified by addition of organic matter
Organic Matter	Annual	Maintain levels in the 2 - 5% range
Carbon: Nitrogen Ratio	As required	A less than ideal C:N ratio could deplete soil N
Macronutrient Elements	As required	N, P, K, Ca, Mg and S
Micronutrient Elements	As required	B, Cu, Fe, Cl, Mn, Mo and Zn

*Baseline parameters are only measured in the first soil tests unless significant changes are made to the physical structure of the soil.

2.1.2 COMPOST SPECIFICATIONS - PHYSICAL AND CHEMICAL REQUIREMENTS

Table 5 Physical and chemical requirements

PARAMETERS	REQUIRED RANGE/ VALUE
pH[1]	5.5 - 8.0
Electrical Conductivity[2]	Max 4 mS/cm
C:N Ratio[3]	Less than 25:1 but not below 12:1
Organic Matter[4]	Minimum 25% by dry weight
Moisture Content[5]	Less than 35% (wet weight basis)
Bulk Density	0.4 - 0.6 g/cm^3
Particle Size	85% air dried sample should pass through 10 mm sieve
Foreign Matter/ Physical Contaminants	Free from any foreign matter
Pathogens	Free from *Salmonella enteriditis* and Salmonella *typhimurium* if chicken manure is used
Pest Insects/ Invertebrates	No live eggs, pupae and larvae of invertebrates
Odour	Free from strong odour

**Note: Compost should be prepared without adding sewage sludge to avoid possible heavy metal contamination.

[1]pH is a measure of active acidity in the compost. The pH scale is 0 (acidic) to 14 (alkaline) with 7 being neutral pH. Finished composts generally have pH values in the range of 5.0 to 8.0. Ideal pH of compost is dependent on its use. A lower pH is preferred for certain ornamental plants while a neutral pH is suitable for most applications.

[2]Soluble salts are determined by measuring electrical conductivity (EC) in a 1:5 (compost:water) slurry. EC is related to the total soluble salts dissolved in the slurry and is measured as mS/cm or dS/m. Composts typically have ECs around 1 - 6 mS/cm. Ideal EC levels would depend on the end use of the compost. Final compost blends with soil, soil mixes or potting mixes should be tested for soluble salts.

[3]This is the ratio of total carbon (C) to total nitrogen (N) in the sample. C:N ratio can be used as an indicator of compost stability and N availability. The C:N ratio typically decreases during composting if the starting C:N ratio is > 25, but may increase if the starting C:N ratio is low (< 15). Composts with high C:N ratios (> 30) will likely immobilise N if applied to soil.

[4]There is no ideal organic matter level for finished compost. Organic matter content will decrease during composting. Organic matter content (dry weight basis) of 50 - 60% is desirable for most compost uses.

[5]The ideal moisture content for composts depends on the water holding capacity of the materials being composted. In general, high organic matter materials have higher water holding capacities and a higher ideal moisture content. Finished compost should have moisture around 35%.

2.1.2.1 FEEDSTOCKS FOR COMPOSTING

Table 6 Common feedstocks and their characteristics

FEEDSTOCK	MOISTURE CONTENT (%)	C:N RATIO
Sawdust	20 - 60	200 - 700
Horticultural wood chips	-	100 - 500
Leaves	-	30 - 80
Green waste	-	40 - 60
Grass clippings	-	15 - 25
Vegetable wastes	-	10 - 20
Poultry manure	20 - 40	5 - 15

*compost made from feedstock with high C:N ratio may be commercially available, but not advisable for use in soil mix.

2.1.2.2 PRODUCT TESTING METHODS

Table 7 Soil and compost testing methods

PARAMETERS	TEST METHODS	REFERENCES FOR TESTING METHODS
pH	pH in water (1:2.5 dilution)	Methods of Soil Analysis - Part 3. Soil Science Society of America
Electrical Conductivity	EC in water (1:5 dilution)	Methods of Soil Analysis - Part 3. Soil Science Society of America
Organic Matter	Loss on ignition method (350°C)	Methods of Soil Analysis - Part 3. Soil Science Society of America
Cation Exchange Capacity	Ammonium acetate method	Methods of Soil Analysis - Part 3. Soil Science Society of America
C:N Ratio (mature compost)	Nitrogen - Kjeldahl method Organic Carbon - Loss on ignition method (@ 350°C) or Nitrogen & Carbon determination by Elemental Analysers	Methods of Soil Analysis - Part 3. Soil Science Society of America
Moisture Content	Gravimetric method @ 105°C	Methods of Soil Analysis - Part 1. Soil Science Society of America
Particle Size	Sieving	Methods of Soil Analysis - Part 4. Soil Science Society of America
Pest Insects	Using Berlese funnel	Methods of Soil Analysis - Part 2. Soil Science Society of America
Invertebrates	Visual Examination	-

2.1.3 APPROVED SOIL MIX SPECIFICATION

Table 8 ASM specifications

PARAMETERS	REQUIRED RANGE/ VALUE
pH	5.5 - 7.5
Electrical Conductivity	Less than 2.0 mS/cm
Bulk Density	0.8 - 1.2 g/cm^3
Moisture Content	Less than 30%
Organic Matter	Minimum 10% by dry weight
C:N Ratio	15 - 30:1
Cation Exchange Capacity	Greater than 10 cmol/kg soil by dry weight
Pathogen	Faecal coliforms < 1000 MPN per g total solids

2.2 SOIL SAMPLING

Soil sampling is undertaken to determine suitability of a growing media to fulfill its functional requirements. The term growing media may be used instead of soil mix, as many urban circumstances (such as for skyrise greenery or for export purposes) require soil-less media to fulfill their functional requirements. Samples are required for each distinct landscape management unit.

2.2.1 Number of Samples Within a Landscape Management Unit

A landscape management unit is an area of land where there are similar soil, plant types, water application and use characteristics. Each of these landscape units should be sufficiently distinct in area and/or value where it is viable to apply different soil, plant, water or people management regimes.

Sufficient numbers of samples are required to provide appropriate analysis of the soil mix's functional capabilities. The number and location of samples analysed is dependent upon the variability within each landscape management area. The greater the variability within a landscape management area such as urban systems, the more samples are required to obtain an effective and representative "snapshot" of soil mix conditions. A site analysis will assist to determine the variability of each distinct landscape management unit.

2.2.2 Representative Sampling

It is important to follow a systematic sampling protocol for efficient soil quality assessment for urban soils. Collected sample should be representative of that area; otherwise the results and recommendations can be misleading.

In order for the soil sample to be representative of the landscape management unit, care must be taken that the sample is not contaminated during the collection.

A sampling procedure includes the following:

a. Identify distinct landscape units.

b. Record each sample position in a format that allows an anonymous person to locate where the sample came from, for example, compass directions, fixed landmarks or a geographic reference, using Global Positioning System (GPS), if possible.

c. Note the sampling area land use, vegetation, landform, soil profile and any other significant influences on the existing nutrient balance.

d. When sampling, avoid unusual areas such as eroded sections, dead furrows, and fence lines. If the field to be sampled covers a large area with varied topography, subdivide it into relatively uniform sampling units.

e. Avoid atypical sampling such as very wet conditions or across soil types.

f. Ensure all sampling equipment is clean of contaminants likely to affect the soil test results.

g. Within each sampling unit take soil samples from several different locations and mix these subsamples into one composite sample. The number of subsamples needed to obtain a representative composite sample depends on the uniformity and size of the sampling unit. Take a composite sample of up to 20 to 30 individual cores per hectare or proportionate smaller sample numbers or sub-samples in an appropriate form such as a transect or grid pattern.

h. Identify the actual and readily achievable root exploitation soil depth and sample to the appropriate depth. This may constitute two separate samples to allow determination of impediments to more efficient exploitation of the soil profile. Most soil sampling procedures recommend that samples are taken from the top 150 mm of the soil profile. However, very few soils and plants follow the ideal. In reality, in the urban context, root distribution generally follows available air and water primarily and secondarily, nutrient availability. This can only be determined through sampling to the rooting depth required to provide plant resilience to urban environmental and wear stresses.

2.3 SOIL MIXING

The performance of the soil mix will depend on how well it provides support for plant roots, maintain sufficient level of moisture and nutrients and provides optimum amount of oxygen for roots respiration. For general landscape purposes, it is suggested that the largest aggregate size should not exceed 10 mm, expressed as 85% passing through a 10 mm sieve, with a specified maximum of 5% aggregate size passing a 0.2 mm sieve. In order to achieve the soil mix performance required, the components must be blended uniformly to meet specified aggregate grades. For consistency in mixing, it is advisable to use dry weight of the materials.

The aggregate grading specification will vary according to the functional requirements of the soil mix. For example, the soil mix required to provide structural support may require aggregates up to 150 mm for support and infill with graded sand, while a rooftop garden growing media may require a lightweight material to provide sufficient macropore drainage with adequate moisture and nutrient retention capacity for the climatic extremes of rooftop exposure.

In practice, large volumes of soil mix (greater than 2 m^3) should be produced by a specialist growing media supplier with appropriate grading, blending and dry storage facilities. These facilities should be able to store soil mix components in a relatively dry condition (i.e. 15 - 20% moisture) to ensure mixability. Large scale grading equipment such as large volume rotating tumblers or sieves (trommels) will be necessary to achieve uniformity. A common practice of mixing wet components with an excavator is not acceptable. Also, to protect the integrity of the blend, the soil mix components must be stored in relatively dry state (i.e. between 15 - 20% moisture).

Smaller volumes of growing media (less than 2 m^3) may be blended by hand, or a rotating auger with a feed hopper, or a rotating tumbler (such as a cement mixer).

2.4 SPECIALIST SOIL LABORATORY TESTING

Field testing can provide clear indications of growing media quality. However, where greater accuracy is required, samples will need to be analysed by a specialist soil testing laboratory. In addition, many growing media parameters can only be determined in the laboratory. This includes elemental analysis such as organic carbon, potassium, phosphorous, CEC and C:N ratio.

SECTION 3 - MARKING AND DOCUMENTATION

An information sheet shall accompany the product at point-of-sale/ delivery to inform the client the detail contents of the product.

The information sheet includes:

- Name, or registered trademark and Street address of manufacturer, packer or distributor.
- Volume of contents (m^3).
- The classification to which the product belongs, complying with Clause 4 (Soil texture classification).
- Health warning label shall be printed on the information sheet/ invoice.

WORKPLACE SAFETY & HEALTH ALERT NOTIFICATION

THIS MIXTURE CONTAINS MICRO-ORGANISMS

PLEASE AVOID BREATHING DUST

WEAR MIST-WEAR PARTICULATE MASK

WEAR GLOVES IF DUSTY

KEEP PRODUCT MOIST WHEN HANDLING

GLOSSARY OF CONVERSION FACTORS FOR SI AND NON-SI UNITS

PARAMETER	NON-SI UNIT	MULTIPLY BY	SI UNIT
Area	acre	0.405	hectare (ha)
Length	foot (ft) inch (in)	0.304 2.54	metre (m) centimetre (cm)
Mass	pounds (lbs) ton (t)	0.454 1000	kilogram (kg) kilogram (kg)
Volume	acre-inch cubic foot (ft^3) cubic foot (ft^3)	102.8 0.028 28.3	cubic metre (m^3) cubic metre (m^3) litre (L)
Concentration	percent (%) parts per million (ppm)	10.0 1.0	gram/kilogram (g/kg) milligram/kilogram (mg/kg)
Cation exchange capacity	milliequivalents per 100 grams (meq/100g)	1.0	centimole per kilogram (cmol/kg)
Bulk density	gram/cubic cm (g/cm^3)	1.0	Megagram/cubic metre (Mg/m^3)
Rate	pounds/acre (lbs/acre) ton/acre (t/acre)	1.12 2.24	kilogram/hectare (kg/ha) ton/hectare (t/ha)
Electrical Conductivity (EC)	milimhos/cm (mmhos/cm)	1.0	deciSiemens/metre (dS/m) or miliSiemens/centimetre (mS/cm)
	micromhos/cm (μmhos/cm)	1.0	miliSiemens/centimetre (mS/cm)

* SI units refers to The International System of Units