AS 3743—2003

AS 3743

Australian Standard™

Potting mixes

Standards Australia

This Australian Standard was prepared by Committee CS-037, Garden Soils and Potting Mixes. It was approved on behalf of the Council of Standards Australia on 4 August 2003 and published on 5 September 2003.

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Australian Institute of Horticulture
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This Standard was issued in draft form for comment as DR 01335.

Australian Standard™

Potting mixes

Originated as AS 3743—1989.
Previous edition AS 3743—1996.
Fourth edition 2003.

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Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 5480 5

PREFACE

This Standard was prepared by the Standards Australia Committee CS-037, Garden Soils and Potting Mixes to supersede AS 3743—1996, *Potting mixes*. The Standard was originally requested by the Australian Institute of Horticulture and the Division of Soils, CSIRO.

This edition incorporates AS 3743—1996 Amendment 1—1998. Other changes comprise refinements which take into account results of further experience in the determination of air filled porosity (Appendices B and H) nutrients (Appendices D and G) and the toxicity test (Appendix F). Marking has changed to include bold line bordering around the health warnings for prominence on the bag.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

CONTENTS

Page

FOREWORD 4

SECTION 1 SCOPE AND GENERAL
1.1 SCOPE 5
1.2 OBJECTIVE 5
1.3 APPLICATION 5
1.4 REFERENCED DOCUMENTS 5
1.5 DEFINITIONS 6
1.6 NOTATION 6
1.7 CLASSIFICATION 6

SECTION 2 GENERAL REQUIREMENTS
2.1 COMPOSITION 8
2.2 PHYSICAL AND CHEMICAL REQUIREMENTS 8
2.3 STORAGE BEFORE TESTING 8
2.4 PACKAGING 8
2.5 MARKING 8

APPENDICES
A METHOD FOR THE MEASUREMENT OF VOLUME 14
B METHOD FOR THE MEASUREMENT OF AIR-FILLED POROSITY AND TOTAL WATER HOLDING CAPACITY 15
C METHOD FOR THE DETERMINATION OF WETTABILITY 19
D METHODS FOR THE DETERMINATION OF pH, ELECTRICAL CONDUCTIVITY, AMMONIUM, MANGANESE NITRATE, CHLORIDE AND OTHER NUTRIENTS 21
E METHOD FOR THE DETERMINATION OF NITROGEN DRAWDOWN INDEX 24
F METHOD FOR THE DETERMINATION OF TOXICITY TO PLANTS 28
G METHOD FOR THE DETERMINATION OF NUTRIENT LEVELS 30
H ALTERNATIVE METHOD FOR AIR-FILLED POROSITY AND TOTAL WATER HOLDING CAPACITY 34
I MEANS OF DEMONSTRATING COMPLIANCE WITH THIS STANDARD 38

FOREWORD

Long-term storage of potting mix, especially in warm, moist environments, can lead to depletion of the available nitrogen content of the mix. The concentration of nitrogen that is available to plants at potting will be decreased from what it was at manufacture. Marking requirements and the note in Clause 2.5.1(c) relate to this problem. A 'best-before' date was discussed by the Committee, but was not considered to be the total answer, as retailers would not necessarily see any advantage in rotating mixes in the store, nor consumers any problem in using a mix after the date. Consumers do not generally understand this situation and would need to be educated to understand the fact that fertilizer may need to be added even to a premium mix that has been stored for some time.

In view of this, and in order to increase the likelihood that plants will still have sufficient nutrients to produce plant growth for at least the short term after sale of the potting mix, it is suggested that potting mix ingredients should have an NDI (see Appendix E) of at least 0.6 at the time of their incorporation into a standard potting mix.

STANDARDS AUSTRALIA

Australian Standard
Potting mixes

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies physical, chemical, biological and labelling requirements for potting mixes packaged for retail sale. Potting mixes of both regular and premium quality are covered. Requirements are also included for mixes labelled as suitable for African violets, bulbs, hanging baskets, seedlings, orchids, acid-loving plants and plants that are sensitive to phosphorus.

Test methods for the analysis of potting mixes are set out in Appendices A to H.

NOTE: Appendix I gives guidance on the determination of compliance with this Standard.

1.2 OBJECTIVE

The objective of this Standard is to provide manufacturers, educational institutions, consumers and growers with a set of requirements which will ensure that potting mixes can germinate seeds, grow seedlings, strike cuttings and maintain plant growth.

1.3 APPLICATION

All potting mixes shall comply with Section 2 of this Standard and specifically with the applicable requirements in Table 2.1. Requirements shown in the table apply at the time of testing.

1.4 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1199	Sampling procedures and tables for inspection by attributes
1199.0	Part 0: Introduction to the ISO 2859 attribute sampling system
1199.1	Part 1: Sampling schemes indexed by acceptance quality limit (AGL) for lot-by-lot inspection

AS/NZS

1336	Recommended practices for occupational eye protection
1715	Selection, use and maintenance of respiratory protective devices
1716	Respiratory protective devices
2161	Occupational protective gloves
2161.2	Part 2: General requirements
ISO 9001	Quality management systems—Requirements
ISO 9004	Quality management systems—Guidelines for performance improvements
HB 18	Guidelines for third-party certification and accreditation
HB 18.28	Guide 28—General rules for a model third-party certification system for products

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1.5 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.5.1 Air-filled porosity

The percentage of air, by volume, in a potting mix after it has been watered and drained under standard conditions.

1.5.2 Batch

A limited quantity of product which is made in one cycle of manufacture and is uniform with respect to starting materials, composition and method of manufacture.

1.5.3 Potting mix

A growing medium suitable for the establishment and development of a wide range of plants in containers.

1.5.4 Premium potting mix

A potting mix complying with the requirements in Table 2.1 of this Standard. Most particularly, its soluble nitrogen content and low ability to deprive plants of soluble nitrogen enable it to sustain good plant growth for at least a month without added fertilizers if the use of the mix is commenced within 2 months of manufacture. Its nutrient levels, water holding capacity and wettability are superior to those of a regular grade mix.

1.5.5 Primary package

Any form of packaging material, i.e. any packet, envelope, box, bag or the like, which is in intimate contact with the product.

1.5.6 Regular potting mix

A potting mix with properties as defined in Table 2.1 of this Standard and requiring the use of a balanced fertilizer from the time of potting.

1.5.7 Shall

Indicates that a statement is mandatory.

1.5.8 Should

Indicates a recommendation.

1.6 NOTATION

The following unit is used in this Standard:

dS/m decisiemens per metre (1 dS/m = 1 mS/cm)

1.7 CLASSIFICATION

1.7.1 General

Potting mixes shall be classified as either—

(a) regular; or

(b) premium.

1.7.2 Specialist mixes

Potting mixes intended for specialist applications shall be classified as follows:

(a) Seedling (regular grade only).

(b) Orchid (regular grade only).

(c) Low phosphorus (regular or premium grades).

(d) Acid (regular or premium grades).

(e) African violet (regular or premium grades).

(f) Bulb (regular or premium grades).

(g) Hanging basket (premium grade only).

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SECTION 2 GENERAL REQUIREMENTS

2.1 COMPOSITION

Potting mix shall not contain materials such as glass, or any sharp objects that could injure the hands of a user. It may, however, be composed of any other materials, provided that the requirements of Table 2.1, as appropriate, are met. The mix should also be free of plant pathogens, other pests, harmful chemical substances and any parts of plants generally considered to be weeds.

2.2 PHYSICAL AND CHEMICAL REQUIREMENTS

Potting mixes shall comply with the applicable physical and chemical requirements for the type and grade of mix, as given in Table 2.1 at the specified time of testing.

2.3 STORAGE BEFORE TESTING

When the test method requires that testing be undertaken at a certain time after the manufacture of the potting mix, then storage conditions shall be at a temperature of 15-25°C and in the shade.

2.4 PACKAGING

2.4.1 Volume

Potting mix shall be packaged in multiples of a litre, but otherwise there is no specific requirement on the volume or size of pack contents. When measured in accordance with Appendix A, the actual volume of the packaged mix shall not be less than the volume stated on the bag.

NOTE: As well as the requirements in this Clause, attention is drawn to any relevant federal and state legislation related to size, packing volume, weight or labelling.

2.4.2 Protection

Potting mix should be packaged so that, under normal conditions of handling, storage and transport, the contents are protected from contamination by extraneous matter and the contents are not released unintentionally.

NOTE: Packaging should contain small perforations to allow for pressure equalization and ease of handling.

2.5 MARKING

NOTE: As well as the requirements in this Clause, attention is drawn to any relevant federal and state laws which may require additional marking or documentation.

2.5.1 Required marking

The primary package of each potting mix shall be permanently and legibly marked with the following:

(a) Name, or registered trade mark, and full address of the manufacturer, packer or distributor.

(b) Volume of contents, in litres (to the nearest litre) printed in letters a minimum of 4.8 mm high. Packages shall not be marked with codes such as 'No. 1 pack', or similar, as a substitute for stating the actual number of litres of contents in the package.

The volume determined by the procedure in Appendix A shall be the only volume marked on the bag.

NOTE: This information should be located in a prominent position on the package.

(c) Instructions on the correct application of fertilizer after potting, including the type of fertilizer and application details, for example:

(i) *For a regular mix*: 'A balanced fertilizer should be used from the time of potting.'

(ii) *For a premium mix*: 'The soluble nitrogen content of this mix is higher and its ability to consume soluble nitrogen is lower than that of regular mixes. A balanced fertilizer was added at the time of manufacture, but additional fertilizer may be required, depending on plant needs.'

NOTE: The intention of this wording is to ensure that sufficient fertilizer exists for the plant at the time of sale. A manufacturer may choose to use a date stamp or 'use-by date' as an alternative.

(d) If the mix is intended for other than general use, the type of plants for which it is designed.

(e) A statement complying with items (i) or (ii) below, as appropriate:

(i) *For potting mixes complying with the requirements for regular potting mixes* 'This mix complies with the requirements of AS 3743 for a regular grade potting mix.'

(ii) *For potting mix complying with the requirements for premium potting mixes* 'This mix complies with the requirements of AS 3743 for a premium grade potting mix.'

The word 'premium' shall not be marked anywhere on the package unless the contents comply with the relevant requirements given in Table 2.1.

(f) A health warning label* and hazardous information label for customers on the handling of potting mix.

NOTE: As well as the requirements in this Clause, attention is drawn to any relevant federal and state laws which may require either additional or different marking or documentation.

The following requirements apply:

(i) *Appearance* The warning specified in Clause 2.5.1(f)(ii) shall be printed in a contrasting colour to other non-warning printing, have a border in bold and shall appear in accordance with Items (A) or (B) as appropriate:

(A) On 15 L or larger packages, in 16 point Arial bold or another similar distinctive font.

(B) On packages of less than 15 L, in a 12 point Arial bold or another similar distinctive font.

(ii) *Health warning label* The following warning* shall be printed in a prominent position on the front of the package as follows:

NOTE: Each point should be separated by a space, dot or other indication that a new point is being made.

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* At the time of publication of this Standard, the health warning specified in Clause 2.5.1(f)(ii) was the latest agreed to jointly by the now renamed Nursery and Garden Industry Association of Australia and enHealth. It is the responsibility of the manufacturer to ascertain this is still the latest required warning. For further information refer to the relevant Material Safety Data Sheet.

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HEALTH WARNING

THIS PRODUCT CONTAINS MICRO-ORGANISMS

**AVOID BREATHING DUST OR MISTS—
WEAR PARTICULATE MASK IF DUSTY**

WEAR GLOVES AND KEEP PRODUCT MOIST WHEN HANDLING

WASH HANDS IMMEDIATELY AFTER USE

READ DETAILED WARNING LABEL ON THIS BAG

(iii) *Hazardous information label* A warning shall be printed on the reverse side (or back of the package) to the warning in Clause 2.5.1(f)(ii).

The actual words on the label are optional, but the example on the following page gives guidance on the type and extent of information to include on the label. The title 'HAZARDOUS' should be printed in a font size not less than twice the size of the general text.

2.5.2 Optional marking

The primary package may also carry statements about the major ingredients included in the mix, watering instructions, advice about the need for wetting agents, a caution about settling of the mix during transport, and other information related to the growing of plants in the mix.

Where claims are made regarding additives to or performance of the product, such claims must be capable of being verified. Verification will be audited as part of the certification process.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

HAZARDOUS

COMPOSTS, POTTING MIXES

AND OTHER ORGANIC GARDENING MATERIALS

This product is made from organic materials, including composted pinebark, and contains living micro-organisms, including bacteria, fungi and protozoa. May also contain mineral and fertiliser additives.

RISK	Inhalation of dust and/or liquid mists may irritate, inflame or sensitise the nose, throat and lungs resulting in illnesses ranging from hayfever or asthma, to pneumonia (e.g. Legionnaire's disease) or pneumonia-like illnesses. Direct contact with this material or its dust and/or liquid mists (bioaerosols) may cause skin irritation (dermatitis), and skin or eye infection or irritation. People particularly at risk are those suffering from asthma or allergies, and those whose immune defence systems are compromised.
SAFETY	Avoid contact with eyes and skin. Avoid breathing dust and/or liquid mists (bioaerosols). Wear suitable protective clothing and standard duty gloves (AS/NZS 2161.2). If exposed to dust and/or liquid mists, also wear dust resistant eye protection (AS/NZS 1336) and particulate respirator (AS/NZS 1715 and AS/NZS 1716). Wash thoroughly immediately after handling. Wash work clothes regularly. Clean up by wet sweeping or vacuuming. Store this product in a cool location.
FIRST AID	Irrigate eyes with plenty of water for 10 minutes. Wash skin with soap and water. Seek medical attention for any persistent skin, eye or respiratory symptoms.
DISPOSAL	Follow above safety precautions and collect in containers for disposal as trade waste in accordance with local authority guidelines.
MANUFACTURER	xxxx

For further information, refer to the Material Safety Data Sheet for this product which is available from xxxx.

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TABLE 2.1

PHYSICAL AND CHEMICAL REQUIREMENTS FOR POTTING MIXES

Characteristic	Unit of measurement (Note 1)	Requirement		Test method
		Regular	Premium	
Air-filled porosity (Note 2)	%			Appendix B or Appendix H
Seedling mix		8 to 15	Not applicable	
Orchid mix (Note 3)		≥ 20	Not applicable	
Other mixes (Note 4)		≥ 13	≥ 13	
Total water holding capacity	%			Appendix B
Orchid mix		No requirement	Not applicable	
Seedling mix		≥ 50	Not applicable	
Other mixes		≥ 40	≥ 50	
Wettability	min	≤ 5	≤ 2	Appendix C
pH	pH units			Appendix D
Acid mix		4.8 to 5.8	4.8 to 5.8	
Other mixes		5.3 to 6.5	5.3 to 6.5	
Electrical conductivity	dS/m			Appendix D
Seedling mix		≤ 1.5	Not applicable	
Other mixes		≤ 2.2	≤ 2.2	
Chloride (Cl)	mg/L			Appendix D
Seedling mix		≤ 60	Not applicable	
Other mixes		≤ 200	≤ 200	
Nitrogen (N) (as ammonium ions)	mg/L			Appendix D
Seedling mix		≤ 50	Not applicable	
Other mixes		≤ 100	≤ 100	
Nitrogen (N) (as ammonium plus nitrate ions)	mg/L			Appendix D
Seedling mix		≥ 25	Not applicable	
Other mixes		No requirement	≥ 50	
Nitrogen drawdown index	—			Appendix E
Seedling and orchid mix		≥ 0.5	Not applicable	
Other mixes		≥ 0.2	≥ 0.7	
Toxicity	mm %	≥ 70	≥ 70	Appendix F
Phosphorus (P)	mg/L			Appendix G
Low phosphorus mix		≤ 3	≤ 3	
Low phosphorus soil mixes (Note 5)		≤ 0.5	≤ 0.5	
Other soil mixes		≥ 0.5	0.7 to 4	
Other mixes		No requirement	8 to 40	
Potassium (K) (Note 6)	mg/L			Appendix G
DTPA extract		No requirement	≥ 50	
Ammonium acetate extract		No requirement	≥ 30	
Sulfur (S)	mg/L	No requirement	≥ 40	Appendix G
Calcium (Ca)	mg/L			Appendix G
Seedling mix		≥ 80	Not applicable	
Other mixes		≥ 50	≥ 80	
Magnesium (Mg)	mg/L	≥ 15	≥ 15	Appendix G
Calcium/magnesium ratio	—	1.5 to 10	1.5 to 10	Appendix G
Potassium/magnesium ratio	—	No requirement	1 to 7	Appendix G

(*continued*)

TABLE 2.1 (*continued*)

Characteristic	Unit of measurement (Note 1)	Requirement		Test method
		Regular	Premium	
Sodium (Na)	mg/L			Appendix G
Seedling mix		≤ 60	Not applicable	
Other mixes		130	≤ 130	
Iron (Fe) (Note 7)	mg/L			Appendix G
Acid mix; low phosphorus mix		≥ 35	≥ 35	
Other mixes		≥ 25	≥ 25	
Copper (Cu)	mg/L	0.4 to 15.0	0.4 to 15.0	Appendix G
Zinc (Zn)	mg/L	0.3 to 10.0	0.3 to 10.0	Appendix G
Manganese (Mn) (Note 8)	mg/L	1 to 15	1 to 15	Appendix G
Boron (B)	mg/L	0.02 to 0.65	0.02 to 0.65	Appendix G

NOTES:

1 Measurements in milligrams per litre refer to milligrams per litre of the extract prepared in accordance with Appendix G or Appendix D.

2 This Standard applies primarily to potting mixes sold in retail packs. However, as its methods are also widely used to assess mixes sold in bulk to production nurseries, users of information about air-filled porosity should note the following: Oxygen supply to the roots of plants growing in potting mixes is best assessed through measurements of oxygen diffusion rate. This is a function of the size, shape and connectedness of the air-filled pores in the mix and the distance the oxygen must diffuse from the atmosphere. Air-filled porosity is a useful, but relatively poor measure of this ability. Figures for air-filled porosity should be interpreted against such other parameters as the porosity to oxygen of the walls of the containers, the size of the container (e.g. an air-filled porosity of 2% may be acceptable for plug mixes because of the very short distance over which oxygen has to diffuse to reach roots), plant type and container height (see *Australian Horticulture* April: 28-30 (1993)).

3 Requirements for orchid mix apply to mixes for semi-terrestrial orchids such as the cymbidiums and to mixes for terrestrial orchids. They do not apply to mixes for epiphytic orchids. Potting mixes for epiphytic orchids should have an air-filled porosity of not less than 50% and a statement should be included on the pack to inform the user that liquid fertilizer should be used regularly from the time of potting. Mixes for semi-terrestrial orchids should be at the lower end of the specified ranges for major nutrient contents. Terrestrial orchids can be grown in mixes complying with the general requirements for regular potting mixes.

4 General requirements for regular potting mixes accommodate regular grades of African violet mix and bulb growing mix. General requirements for premium potting mixes accommodate premium grades of hanging basket mix, African violet mix and bulb growing mix.

5 Soil mixes are mixes which include natural soil in their composition. Washed sand is not considered to be a soil.

6 An ammonium acetate extracting solution is used to ensure adequate potassium is available for plants where the level by DTPA extract is low and where the potting mix is known to contain zeolites for which the DTPA extracting solution is inappropriate.

7 These concentrations apply when the sources of iron in the mix are iron-sulphate or GU-49. If the main source is natural soil or an iron chelate, much lower concentrations in the DTPA extract can be adequate for plant growth. The onus is on the manufacturer to provide evidence of equivalent plant growth. (See *Journal of Plant Nutrition*, 15(2): 179-189 (1992), and *Australian Horticulture* July: 26-28 (1991).

8 The test method in Appendix G is carried out before the manganese test. Mixes with a concentration of manganese in the DTPA extract of above 15 (see Appendix G) will be acceptable provided that there is < 2 mg/L manganese in the water extract (see Appendix D).

9 When reporting on the results of test for chemical and physical characteristics specified in this Standard, laboratories should state on the test report:'Test results apply to the sample(s) submitted for analysis and do not necessarily imply that the product meets all the requirements of this Standard.'

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APPENDIX A

METHOD FOR THE MEASUREMENT OF VOLUME

(Normative)

A1 SCOPE

This Appendix sets out the method for measurement of a volume of potting mix contained in a bag.

A2 PRINCIPLE

The mix is poured into a rigid, calibrated container and the contents levelled.

A3 APPARATUS

Rigid, straight-sided pails made from translucent plastic, calibrated in litres from the bottom and having the following nominal capacities:

(a) For packages of 11 L or more ..... 10 L to 20 L

NOTE: The contents of the package may require more than one pail (see Paragraph A4(c)).

(b) For packages of 6 L to 10 L ..... 10 L

(c) For packages of 2 L to 5 L ..... 5 L

NOTE: If necessary, grind off protrusions of plastic on the base of the pail so that it sits flat.

A4 PROCEDURE

The procedure shall be as follows:

(a) Calibrate the pail by pouring into it, water to the nominal volume of the smallest package to be measured. Include a small amount of detergent in the water to allow wetting of the container. Allow the water in the pail to come to rest, then mark the container of the water surface. Continue adding further water to the nominal volumes of other packages whose volumes are to be measured.

(b) Select one package at random from a batch of packages. Sit the package upright on the floor. Completely cut off the upper end of the package to expose the contents.

(c) Empty the package into the chosen pail and allow its contents to flow out. Use more than one pail if necessary.

(d) Level off the surface of the mix and read the volume.

NOTE: A possible method is to gently rest on the surface of the soil, a flat object with a diameter about 2 cm smaller than that of the pail and with a previously calibrated indicator projecting upwards out of the pail. This indicator is marked so that a reading taken from it at the position level with the top of the pail corresponds to the volume of soil in the pail. The volume of soil in the pail is derived from the reading taken from this inner indicator.

(e) Add the volume for each pail used, if more than one pail was required for a single package of potting mix.

A5 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) The volume for the package.

(c) Reference to this test method, i.e. Appendix A of AS 3743.

APPENDIX B

METHOD FOR THE MEASUREMENT OF AIR-FILLED POROSITY AND TOTAL WATER HOLDING CAPACITY

(Normative)

B1 SCOPE

This Appendix sets out a method for the measurement of air-filled porosity in potting mix and a method for determining the total water holding capacity under conditions resembling a home or nursery growing environment.

NOTES:

1 Table 2.1 specifies the compliance requirements.

2 Paragraph B6 specifies interpretation of results and replication of tests.

3 Appendix H sets out an alternative method which has been shown in one laboratory to be less prone to operator error than the method of this Appendix. However, another laboratory found that both methods gave very similar results. Users should make their own assessments of these alternative methods and choose the one that gives the most consistent results for them. They should advise Standards Australia of their results and their preferred method.

B2 PRINCIPLE

A known volume of mix is immersed in water for a specified time and then removed and drained. The volume of water drained from the mix is measured and expressed as a percentage of the total volume of mix to give air-filled porosity. The mix is then dried and the total water holding capacity calculated as the difference between the wet and dry mass.

B3 APPARATUS

The following apparatus is required:

(a) Apparatus made from 90 mm diameter UPVC stormwater pipe and matching cap as follows:

(i) Cut two 12 cm lengths of stormwater pipe and deburr the ends. Ensure that the cuts are at right angles to the length of the pipe.

(ii) Drill four 9 mm holes in the cap in such positions that it is easy to cover them with four fingers while holding the base with two hands (see Paragraph B4(i)) and glue the cap to the base of one length of pipe, ensuring that the pipe is pushed in to the full extent of the cap. Apply extra glue to the upper edge of the cap on the outside to allow easy shedding of water during use. If the cap is of the type with a raised rim around the whole of the outside, cut small portions of this away to allow water easy entry to the holes when the base is sitting in a bucket of water. This is the base of the apparatus.

(iii) Heat one end of the second length of pipe and splay it out so that about a 1 cm length can be pushed over the top end of the base. Work the heated pipe around until it fits snugly but not tightly over the end of the base.

(b) Nylon or other gauze and a rubber band are to be used to prevent loss of mix from the base during saturation.

(c) Plastic bucket, approximately 10 L capacity.

(d) Means of measuring volume of water drained from mix, graduated in millilitres.

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(e) Oven, preferably with forced draught, capable of heating to a temperature between 100°C and 105°C.

(f) Balance, accurate to 0.5 g.

(g) Flat dishes or baking trays.

(h) Plastic rods, approximately 1 cm square section, about 7 cm long.

B4 PROCEDURE

The mix should be moistened at least 24 h before testing. The mix should flow freely and be of such moisture content that water cannot be squeezed from it. Any mix which has been squeezed should be discarded. The moisture content of the mix should be adjusted 24 h before testing to be within the 45 to 55% w/w range.

NOTE: If the mix is received in a moist condition this preliminary step, may be omitted and the test may be commenced without delay.

The procedure shall be as follows:

(a) Measure or calculate the volume of the base of the apparatus to the nearest 5 mL. This represents the total volume (V_t) of mix used.

(b) Place the top section of the apparatus firmly onto the base.

(c) Pour the moistened mix into the apparatus up to the top of the top section. Drop the apparatus five times from a height of 5 cm. This is to be a free fall, not a gentle lowering or a vigorous thumping.

(d) Fill the container (B3(c)) with enough water to reach above the top of the apparatus base. Lower the apparatus of mix into the water. Hold it vertically until it has taken up enough water to stand by itself, then let it sit on the bottom of the container. If the base of the apparatus is flat, allow it to sit on two pieces of plastic rod (B3(h)). Adjust the height of water upwards in the container until it is level with the top of the mix. Do not at any time allow mix components to separate from one another by having some float to the top because the height of water in the container is too high.

(e) Remove the apparatus vertically from the water when 30 min has elapsed and allow to drain for 2 to 5 min.

(f) Repeat the wetting and draining cycle twice more, allowing 10 min for each wetting period. At the end of the third cycle, remove the upper part of the apparatus. Slice the excess mix from that contained in the base without exerting pressure down on the mix remaining in the base and cover the top of the base with gauze secured by a rubber band (B3(b)). A 5 mm long slit in the gauze may be needed to allow air to escape.

(g) Adjust the water level in the container so that it will just flood over the top of the base. Slowly lower the base of mix into the water and allow it to become fully saturated with water.

(h) Reach down with two hands into the water and cover the four holes in the bottom of the base with four fingers, two from each hand. Raise the base of saturated mix vertically from the water. Allow water to drip from hands and sides of the base. Also allow any water ponded above the surface of the mix in the base to flow away by slightly releasing the pressure on one of the fingers covering the holes.

NOTE: The mix should be fully saturated just to its top.

(i) Move the base above the tray (B3(g)) and remove the four fingers from the holes while lowering the base onto plastic rods (B3(h)) placed in the tray. Allow to drain for 30 min.

(j) Remove the base full of mix from the draining tray without tilting it, and transfer all of its contents to a flat dish (B3(g)), weigh the dish of wet mix (m_1) to the nearest gram.

(k) Measure the volume of drainage water (V) to the nearest millilitre.

(l) Dry the mix in an oven (B3(e)) at between 100°C and 105°C to constant mass. Record the mass of the dish plus dry mix (m_2) to the nearest gram.

NOTE: Constant mass is achieved when, after the initial drying period, successive drying over 1 h periods gives rise to a weight loss of not more than 1% of the initial weight loss.

B5 CALCULATIONS

B5.1 Air-filled porosity

Calculate the air-filled porosity of the sample, expressed as a percentage, from the following equation:

$$\text{Air-filled porosity} = \frac{V \times 100}{V_t} \qquad \text{. . . B5.1}$$

where

V = volume of water drained from the mix, in millilitres

V_t = total volume of mix, in millilitres

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is ±20% for regular grade seedling mix and minus 20% for other results.

B5.2 Water holding capacity

Calculate the total water holding capacity (WHC) of the sample, expressed as a percentage, from the following equation:

$$WHC = (m_1 - m_2) \times \frac{100}{V_t} \qquad \text{. . . B5.2}$$

where

m_1 = mass of tray and drained mix, in grams

m_2 = mass of tray and dry mix, in grams

V_t = total volume of mix, in millilitres

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is minus 20%.

B6 INTERPRETATION OF RESULTS

Replicate determinations according to Paragraph B6 shall be applied to all following test methods in Appendices C, D, E and G when indicated. The following shall apply:

(a) A mix is deemed to pass the test when a result is better than or equal to the appropriate requirement indicated in Table 2.1.

(b) When an initial result fails to meet the criteria of Table 2.1 but is within the accepted error range of the test, a replication procedure shall follow within one week using two further tests on the original sample.

(c) The mean ($\bar{x}$) of the three tests shall lie within the values indicated in Table 2.1 plus or minus the accepted error range of the test.

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(d) When compared to the absolute value(s) indicated in Table 2.1, $\bar{x}$ shall not be greater than a maximum value or less than a minimum value and no two results shall be above the maximum or below the minimum.

NOTE: Accepted error ranges are given in each test method (when relevant).

B7 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) Air-filled porosity, to the nearest 0.5%.

(c) Total water holding capacity, to the nearest 0.5%.

(d) Reference to this test method, i.e. Appendix B of AS 3743.

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APPENDIX C

METHOD FOR THE DETERMINATION OF WETTABILITY

(Normative)

C1 SCOPE

This Appendix sets out a method for determining the the wettability of a potting mix.

NOTE: Table 2.1 specifies the compliance requirements.

C2 PRINCIPLE

Water is applied to dried mix and the time taken for all the water to soak into the mix is determined.

C3 REAGENT

C3.1 *Deionized or distilled water.*

C4 APPARATUS

The following apparatus is required:

(a) An oven capable of heating a sample of potting mix to 40 ±2°C and validated for time to constant mass.

NOTE: Constant mass is achieved when, after the initial drying period, successive drying over 1 h periods gives rise to a weight loss of not more than 1% of the initial weight loss.

(b) Stopwatch.

(c) Three vessels of any material of minimum depth 25 mm and no less than 80 mm across.

NOTE: Small plastic dishes or aluminium pie dishes have been found to be suitable.

(d) Measuring cylinder or dip pipette capable of delivering a volume of 10 mL.

C5 PROCEDURE

The procedure shall be as follows:

(a) Pack the mix firmly into vessels (C4(c)) to a minimum depth of 20 mm and dry in the same vessel to constant mass at 40 ±2°C.

(b) Make a small depression (approximately 50 mm diameter and 5 mm deep) in the centre of the mix.

NOTE: This depression should be made in a reproducible manner by an object with a smooth, hemispherical end. The rounded end of a standard light globe has been found suitable.

(c) Add 10 mL deionized or distilled water (C3.1) to the centre of this depression using a measuring cylinder or dip pipette (C4(d)).

(d) Check regularly to determine whether the water has soaked into the mix. The water is regarded as being soaked-in when it is not possible to detect any water movement in the wet patch on tilting.

(e) Record the time taken, in minutes, for the water to soak into the mix samples. If more than 5 min elapses and the water has not soaked in, note this and the final time the mix was checked.

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NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for the wettability method is +20% of the absolute value stated in Table 2.1.

C6 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) The time, in minutes, taken for the water to soak into the mix. If the water did not soak into the mix within 5 min, report this and the time period for which the mix was monitored.

(c) Reference to this test method, i.e. Appendix C of AS 3743.

APPENDIX D

METHODS FOR THE DETERMINATION OF pH, ELECTRICAL CONDUCTIVITY, AMMONIUM, MANGANESE NITRATE, CHLORIDE AND OTHER NUTRIENTS

(Normative)

D1 SCOPE

This Appendix sets out methods for determining the pH, electrical conductivity and ammonium, manganese nitrate, chloride and other nutrients of potting mix by water extraction.

NOTES:

1 Table 2.1 specifies the compliance requirements.

2 This procedure may be carried out for manganese if the concentration using DTPA extraction in Appendix G is >15 mg/L. In this case the concentration using this test method should be <2 mg/L to meet the requirements of this Standard.

D2 PRINCIPLE

A sample of potting mix is shaken with water and the required properties determined on the extract.

D3 REAGENT

D3.1 *Deionized or distilled water.*

D4 APPARATUS

The following apparatus is required:

(a) Plastic extraction vessel, filtration equipment and mechanical shaker, as specified in Items (b), (e) and (f) of Paragraph G4 of Appendix G.

(b) Fast and slow filter papers.

NOTE: 'Whatman' No. 41 for fast and Advantech 131 for slow papers have been found to be suitable.

(c) Plastic vessel marked at the height corresponding to the chosen sample size.

(d) Centrifuge having a maximum speed of not less than 3000 r/min.

(e) pH meter, accurate to 0.1 pH unit.

(f) Conductivity meter, accurate to 0.05 dS/m.

(g) Means of determining the nitrate ion concentration in the extract to an accuracy of 5 mg/L N.

NOTE: Suggested apparatus includes an auto-analyser, ion chromatograph, other colorimetric methods or nitrate strips. Nitrate strip readers may be used provided they are correctly calibrated on each occasion of use. Nitrate ion electrodes have been found to give inaccurate results where soluble organic matter exists.

(h) Means of determining the ammonium ion concentration in the extract to an accuracy of 5 mg/L N.

NOTE: Suggested apparatus includes distillation plus titration apparatus, distillation plus a spectrophotometer and an auto-analyser. Ammonium analyser strips may be used to indicate the ammonium ion concentration but are not acceptable for determining their concentration.

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(i) Means of determining the chloride concentration in the extract to the nearest 5 mg/L.

NOTE: Suggested apparatus includes an auto-analyser or electrometric apparatus such as that described by Rayment and Higginson*.

(j) Means of determining the manganese concentration in the extract to the nearest 0.1 mg/L if this procedure is followed. (See Paragraph D1, Note 2).

NOTE: Suggested apparatus includes inductively coupled plasma spectrometer, atomic absorption spectrometer and flame photometer (or another method that can be demonstrated to give equivalent results).

D5 PROCEDURE

D5.1 General

The potting mix shall be moistened with deionized or distilled water (D3.1) to the usual moisture content needed for potting, and stir gently. On measurement, the moisture content (water mass/wet mass) shall be >40% and preferably 50–55%. Dry mix should be moistened at least eight days before testing.

Between 7 and 28 d shall have elapsed between when the potting mix is manufactured and the commencement of testing for pH and electrical conductivity.

NOTES:

1 The mix should flow freely and be of such moisture content that water cannot be squeezed from it. Ensure any material squeezed is not used for the test because the squeezing could have ruptured control release fertilizer prills.

2 The mix moistened as above can be used for the test methods in Appendices E and G as well.

D5.2 Extraction

The extraction procedure shall be as follows:

(a) Perform the extraction specified in Steps (b) to (f) of Paragraph G5.2 of Appendix G, substituting distilled or deionized water (D3.1) for the extracting solution.

(b) Determine the pH of the suspension to the nearest 0.1 pH unit.

(c) Filter the suspension through a fast filter paper (D4(b)) and determine its electrical conductivity to the nearest 0.05 dS/m.

(d) Centrifuge the filtrate or pour it through a slow filter paper (D4(b)) if this is sufficient to give a clear solution. The filtrate or centrifugate is the test solution for determination of ammonium, nitrate and chloride and manganese if this procedure is followed. (See Paragraph D1, Note 2).

D5.3 Measurement of ammonium ions

The concentration of ammonium ions shall be determined in the test solution by a standard laboratory procedure such as titration or distillation plus spectrophotometric measurement., A suitable method is detailed in *Standard Methods for the Examination of Water and Wastewater*†.

Calculate the nitrogen present in the test solution as ammonium ions from the following equation:

$$N_{am} = 0.78 \times A \qquad \text{. . . D5.1}$$

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* RAYMENT, G.E. and HIGGINSON, F.R., *Australian Laboratory Handbook of Soil and Water Chemical Methods* (1st edition), Melbourne Inkata Press, 1992.

† *Standard Methods for the Examination of Water and Wastewater* (16th edition) 1985, Prepared and published jointly by AMERICAN PUBLIC HEALTH ASSOCIATION, AMERICAN WASTEWATER ASSOCIATION and WATER POLLUTION CONTROL FEDERATION.

where

N_{am} = Nitrogen concentration present in the test solution as ammonium ions, in milligrams of nitrogen per litre

A = Ammonium ion concentration in the extract, in milligrams per litre

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is +20%.

D5.4 Measurement of nitrate ions

Determine the concentration of nitrate ions in the test solution using UV-visible spectrophotometer. Dilute the test solution if necessary to give a solution with a nitrate ion level in the working range of the instrument. Adjust the measured nitrate ion concentration to compensate for any dilution made to the test solution.

Calculate the nitrogen concentration present in the test solution as nitrate ions from the following equation:

$$N_n = 0.226 \times NO_3 \qquad \text{. . . D5.2}$$

where

N_n = nitrogen concentration present in the test solution as nitrate ions, in milligrams of nitrogen per litre

NO_3 = nitrate ion concentration in the extract, in milligrams per litre

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is minus 20%.

D5.5 Measurement of chloride ions

Determine the concentration of chloride in the test solution by an appropriate method (see Paragraph D4(h)).

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is +20%.

D5.6 Measurement of manganese

If this procedure is followed, (see Paragraph D1, Note 2) determine the concentration of manganese ions in the test solution by an appropriate method (see Paragraph D4(j)).

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is ±20%.

D6 TEST REPORT

The following information shall be reported:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) pH to the nearest 0.1 unit.

(c) Electrical conductivity to the nearest 0.05 dS/m.

(d) The concentration of chloride, nitrogen present as ammonium ions and nitrogen present as nitrate ions to the nearest 5 mg/L in milligrams per litre of test solution.

(e) The concentration of manganese present to the nearest 0.1 mg/L of test solution (if the procedure was carried out according to this test method).

(f) Reference to this test method, i.e. Appendix D of AS 3743.

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APPENDIX E

METHOD FOR THE DETERMINATION OF NITROGEN DRAWDOWN INDEX

(Normative)

E1 SCOPE

This Appendix sets out a method for determining the nitrogen drawdown index (*NDI*) from the rate at which a potting mix uses (draws down) soluble nitrogen.

NOTE: Table 2.1 specifies the compliance requirements.

E2 PRINCIPLE

The stored potting mix is leached then charged with a solution of potassium nitrate and the proportion of the applied nitrogen remaining after 96 h of incubation is determined.

E3 REAGENTS

E3.1 *Deionized or distilled water.*

E3.2 *Nitrate solution—75 mg/L N as nitrate*

Dissolve 0.54 g potassium nitrate and 0.043 g monopotassium phosphate in one litre of deionized or distilled water. This solution contains 75 mg/L nitrogen as nitrate ions and 11 mg/L phosphorus as phosphate ions.

E4 APPARATUS

The following apparatus is required:

(a) The following shall be made from 50 mm uPVC water pipe:

  (i) Sample-measuring vessels 100 mm long, with cap glued onto one end. The volume of this vessel is 200 mL.

  (ii) Filling sleeves 150 mm long, with coupling glued onto end.

  (iii) Six incubation tubes, 150 mm long, onto one end of which is glued a coupling, which holds a sieve plate (see Item (b)(i)) in place. The lower end of the coupling shall have slots cut into it to facilitate drainage.

  (iv) Six leaching/charging solution holders, 100 mm long, onto one end of which is glued a coupling, which holds a regulator plate (see Item (b)(ii)) in place.

(b) The following shall be made from PVC sheet approximately 1 mm thick:

  (i) Six sieve plates for incubation tubes. To have 9 holes, each of approximately 4.5 mm diameter.

  (ii) Six regulator plates for leaching/charging solution holders. To have four holes, each of 1 mm diameter.

(c) Measuring cylinder of at least the same capacity as the volume of the tubes used.

(d) Plastic or glass containers of at least four times the capacity of the tubes used.

(e) Rigid plastic stirring rod approximately 25 cm long.

(f) Filter funnels, fast or slow filter papers and test tubes.

(g) Centrifuge having a maximum speed not less than 3000 r/min.

(h) Means of determining nitrate ion concentrations in aqueous solutions to the nearest 5 mg/L.

NOTE: Suggested instruments are an auto-analyser, ion chromatograph, other colorimetric methods or nitrate strips. Nitrate strip readers may be used provided they are correctly calibrated on each occasion of use.

(i) Balance for weighing incubation tubes.

E5 PROCEDURE

E5.1 General

The method shall be applied between 21 and 28 days after the day of manufacture of the potting mix.

E5.2 Leaching

Dry mix should be moistened at least eight days before testing.

The leaching procedure shall be as follows:

(a) Moisten the potting mix with deionized or distilled water (E3.1) to the usual moisture content needed for potting. On measurement, the moisture content (water mass/wet mass) shall be greater than 40% and preferably 50–55%.

NOTE: The mix should flow freely and be of such moisture content that water cannot be squeezed from it.

(b) Fit a filling sleeve (E4(a)(ii)) onto a sample-measuring vessel (E4(a)(i)).

(c) Loosely fill the whole assembly with moistened mix, repeat for the other sample-measuring vessels.

(d) Dump each assembly five times from 5 cm (drop only, not forced).

(e) Carefully remove the sleeve by turning and pulling. Allow excess mix to fall away.

(f) Using a gentle action, cut off and even the mix to the top of the sample-measuring vessel.

(g) The sample-measuring vessel now contains 200 mL of mix.

(h) Pour the mix into the incubation tubes (E4(a)(iii)), using a funnel cut off so as to provide a wide opening that is a little smaller than the internal diameter of the NDI tube. Do not tap or dump the mix. (Dumping greatly reduces infiltration rate and so reduces the efficiency of charging. Leaching and charging actions are enough to settle the mix.)

(i) Fit a leaching/charging solution holder (E4(a)(iv)) onto each incubation tube.

(j) Pour 200 mL deionized or distilled water into each solution holder and leave for half an hour to run into and drain from the mix.

E5.3 Charging the mix with nitrate solution

The charging procedure shall be as follows:

(a) Pour 200 mL of the nitrate solution (E3.2) into each solution holder (E4(a)(iv)).

(b) Wait for 30 min and then add a second 200 mL of nitrate solution into each solution holder. Allow the containers to drain for 15 min. Remove the solution holders.

(c) Tilt each incubation tube (E4(a)(iii)) to an angle of about 30° so as to allow any excess charging solution trapped in the lower part of the mix to drain away.

(d) Within 30 min of the addition of the second nitrate charging solution, for each of three incubation tubes pour the contents of each tube into a separate container

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(E4(d)). Add 150 mL deionized or distilled water to the mix in each container, using part of the water to rinse any remaining mix from the tube. Stir.

(e) Allow the slurries to sit for about 5 min, then stir and collect about 10 mL of the solution separately from each by filtration (E4(f)).

(f) Clear solutions can be used without further treatment, but cloudy solutions shall be centrifuged (E4(g)).

(g) Solutions from both the day 0 slurries and the day 4 slurries shall be analysed on the same day. To achieve this, the solutions shall be frozen within an hour of collection. They shall be thawed and their temperature allowed to rise to ambient for no longer than about an hour before testing.

Determine the concentration of nitrogen present as nitrate ions in each solution, in milligrams of nitrogen per litre within an hour of the completion of defrosting.

NOTE: It may be necessary to dilute the solution to bring the nitrate ion concentration into the working range of the instrument being used. Take this dilution into account when calculating the nitrate ion concentration of the test solution.

Calculate the mean of the three determinations for the mix ($N_{(\text{day } 0)}$).

(h) For the other set of three tubes, after all drainage has stopped, stand each tube on a separate saucer and record the weight of each of these assemblies to the nearest gram. Place this set in a constant temperature room or enclosure set at 22 ±1°C and leave it there for 96 ±2 h.

(i) After this period, remove the tubes on their saucers from the incubation area. Slowly add deionized or distilled water to the surface of the mix until the assembly weighs the same as it did in Step (h).

(j) Tip the mix into the container and proceed as in Steps (d) to (f).

(k) Determine the concentration of nitrogen present in each solution, in milligrams of nitrogen per litre by the same method used in Step (g). Calculate the mean of the three determinations for the mix ($N_{(\text{day } 4)}$).

E6 CALCULATION

The nitrogen drawdown index shall be calculated as follows:

$$NDI = \frac{N_{(\text{day } 4)}}{N_{(\text{day } 0)}} \qquad \text{. . . E6.1}$$

where

NDI = nitrogen drawdown index (dimensionless)

$N_{(\text{day } 4)}$ = concentration of nitrogen or nitrate found in the solution collected after incubation (Paragraph E5.3(k)), in milligrams per litre

$N_{(\text{day } 0)}$ = concentration of nitrogen or nitrate found in the solution collected soon after addition of the nitrate solution (Paragraph E5.3(g)), in milligrams per litre.

Expression of $N_{(\text{day } 4)}$ and $N_{(\text{day } 0)}$ shall be in the same units.

NOTE: Refer to Paragraph B6 for interpretation of results. The accepted error range for this test is minus 50% for regular mixes and minus 20% for premium mixes.

For a regular grade mix, if the initial test value lies between 0.1 and 0.2, then conduct two further tests as described in Paragraph B6. For a premium mix, if the initial test value lies between 0.56 and 0.70, conduct two further tests as described in Paragraph B6.

E7 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) The *NDI* calculated in Paragraph E6 to two decimal places.

(c) Reference to this test method, i.e. Appendix E of AS 3743.

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APPENDIX F

METHOD FOR THE DETERMINATION OF TOXICITY TO PLANTS

(Normative)

F1 SCOPE

This Appendix sets out a method for determining whether a potting mix is sufficiently toxic to inhibit the growth of roots.

NOTE: Table 2.1 specifies the compliance requirements.

F2 PRINCIPLE

Seeds are germinated on a sample of the mix and the early growth of roots is assessed against a minimum length requirement.

F3 APPARATUS AND MATERIALS

The following are required:

(a) Radish cultivar *Long Scarlet* seeds, with a germination percentage of at least 80%. The germination percentage of each batch shall be verified before it is used.

NOTE: It is preferable to purchase fresh seeds every year.

(b) Deionized or distilled water.

(c) Nursery pots or other containers at least 150 mm tall e.g. Victorian forestry pots.

(d) Seed germinating cabinet or an enclosure capable of being maintained at a temperature of 25 ±2°C and providing a 12 h day/night cycle. If an enclosure is used, a fluorescent light for illuminating the enclosure from a height of about 250 mm shall be used to provide the 12 h day/night cycle.

(e) Means of measuring in millimetres.

F4 PROCEDURE

The procedure shall be as follows:

(a) If the test sample is dry, it shall be moistened at least eight days before testing. Moisten the sample until water can just be squeezed from it. On measurement, the moisture content (water mass/wet sample mass) shall be greater than 40% and preferably 50-55%. Fill two containers (F3(c)) with the test sample to within 1 cm of the upper rim to form replicates.

(b) Leach the replicates by pouring deionized or distilled water (F3(b)) through the mixes equivalent to the volume of mix taken.

(c) Sprinkle 10 radish seeds (F3(a)) onto the surface of each of the replicates. Lightly press the seeds into the surface to ensure rapid uptake of water. Cover loosely with plastic sheeting and place the containers close to one another in the germination cabinet (F3(d)) for 96 ±4 hours, maintaining the samples at an appropriate moisture level.

(d) Remove the containers from the germination cabinet, and the seedlings from the containers. Measure the average length of the roots in millimetres for each replicate separately. An average root length of 70 mm, or greater in both replicates indicates that the product is not toxic to plants.

NOTES:

1 Laboratories should ensure that adequate incubation conditions are maintained through appropriate calibration of equipment.

2 Good contact of the seed with the test is vital to encourage both germination and seedling growth. This is generally achieved by pushing the seed into the surface to a depth of about 2 mm.

3 The root length is averaged over the number of seedlings obtained, not over the number of seeds (i.e. 10) used. If less than 7 seeds germinate in both or either replicate, or where the difference in average root length between replicates is greater than 20 mm, the test should be repeated, after investigating seed viability, seed/sample contact and incubation conditions.

F5 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the product.

(b) Whether the product passes or fails the tests (Paragraph F4(d)).

(c) Reference to this test method, i.e. Appendix F of AS 3743.

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APPENDIX G

METHOD FOR THE DETERMINATION OF NUTRIENT LEVELS

(Normative)

G1 SCOPE

This Appendix sets out a method for determining nutrient levels in potting mixes by diethylenetriamine-N,N,N′N″,N″-pentaacetic acid (1,7-diamino-4-azapentane-N,N,N′N″,N″-pentaacetic acid) (DTPA) extraction or ammonium acetate extraction.

NOTE: Table 2.1 specifies the compliance requirements.

G2 PRINCIPLE

Nutrients are extracted from a potting mix sample using an extracting solution and the nutrient content of the extract is measured.

G3 REAGENTS

G3.1 *Extracting solution—2.0 mmol/L DTPA*

Dissolve 0.79 ±0.01 g of analytical grade DTPA in 200 mL of distilled or deionized water by warming to about 50°C and then dilute to about 900 mL. Cool and then make up to 1.00 L.

NOTE: Do not use a salt of DTPA.

G3.2 *Extracting solution—0.5 mol/L ammonium acetate*

Dissolve 38.54 g of analytical grade ammonium acetate in approximately 500 mL of warm distilled or deionized water. Cool and make up to 800 mL with water. Add acetic acid (approximately 25 mL) until the pH is 4.65. Make up to 1.00 L with water.

NOTE: This extracting solution is required for potting mixes containing zeolites.

G3.3 *Deionized or distilled water*

G4 APPARATUS

The following apparatus is required:

(a) Inductively coupled plasma spectrometer, atomic absorption spectrometer, or a combination of UV-visible spectrophotometer and flame photometer (or another method that can be demonstrated to give equivalent results).

(b) Plastic extraction vessel with close-fitting lid. The volume of the vessel should be sufficient to hold the mix sample (see Paragraph G5.2(d)) plus 1.5 times its volume of extractant, with sufficient airspace for easy shaking.

(c) Plastic vessel marked at the height corresponding to the chosen sample size (see Paragraph G5.2(d)).

(d) Centrifuge having a maximum speed of not less than 3000 r/min.

(e) Filtration equipment including low ash filter papers.

NOTE: 'Whatman' No. 41 and 54 papers have been found to be suitable.

(f) Mechanical end-over-end shaker.

(g) Means of applying a pressure of 10 kPa (0.102 kg/cm^2) greater than atmospheric pressure to the sample in the vessel (G4(c)).

G5 PROCEDURE

G5.1 General

Moisten the potting mix with deionized or distilled water (G3.3) to the usual moisture content needed for potting. On measurement, the moisture content (water mass/wet mass) shall be >40% and preferably 50–55%. Dry mix should be moistened at least eight days before testing.

At least seven days shall have elapsed between the addition of nutrients to the base materials of the potting mix and testing by this method. Earlier testing will give concentrations of several trace elements that are higher than the equilibrium concentrations that will be experienced by plants growing in the mix.

NOTE: The mix should flow freely and be of such moisture content that water cannot be squeezed from it. Ensure any material squeezed is not used for the test because the squeezing could have ruptured control release fertilizer prills.

The DTPA extracting solution (G3.1) shall be used for the determination of most nutrients and trace elements except pH, electrical conductivity, ammonium, nitrate and chloride ions.

For potting mixes containing zeolites, and giving <50 mg/L potassium in a DTPA extract, the ammonium acetate extracting solution (G3.2) shall be used.

G5.2 Extraction with DTPA

The extraction procedure when using DTPA shall be as follows:

(a) Before commencing the extraction, pour through a filter paper (G4(e)) a volume of the DTPA extracting solution (G3.1) roughly equal to the volume of filtrate to be collected in actual determinations. Measure the concentrations of all nutrients listed in Paragraph G5.4. Use another brand or type of filter paper if there is any significant contribution of any element from the filter paper.

(b) Take a test sample of approximately 200 mL volume which is representative of the mix.

NOTE: Do not dry the mix before analysis. Use it straight from the package or sample container.

(c) Moisten the test sample with distilled or deionized water (G3.3) until it is just possible to manually squeeze water from it. Stir gently.

NOTE: The pressure should be that of a firm handshake and the water should just seep through the fingers as the pressure is applied.

After applying the water, remix so that any salts leached from the top of the mix are again fully incorporated. If water flows from the hand during squeezing, discard the test sample and return to Step (b).

NOTE: These procedures should be as gentle as possible so as not to rupture any granules of slow-release fertilizer present.

(d) From the moistened test sample, remove a volume sufficient to give between 50 mL and 100 mL of firmly packed material.

Place the material loosely into a plastic vessel (G4(c)) marked at the height corresponding to the chosen sample size (G4(c)). Gently apply a pressure to the mix of 10 kPa (0.102 kg/cm^2) above atmospheric pressure.

NOTE: Results will be most consistent if the amount of mix added to the container is close to the required volume. If, after the application of the pressure, the volume is found to be considerably more than required, it is best to start again with a smaller amount of mix.

(e) Put the compressed mix into the extracting vessel (G4(b)) and add a volume of DTPA extracting solution (G3.1) that is 1.5 times the volume of the mix.

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(f) Seal the vessel and shake by hand to disperse the mix through the extractant. Shake on an end-over-end mechanical shaker rotating at less than 10 r/min, for 90 min.

If a mechanical shaker is not available, shake the vessel at least four times evenly spaced during the 90 min.

(g) Filter the solution through a low ash filter (G4(e)) then centrifuge the filtrate at about 3000 r/min for 5 min.

NOTES:

1 Centrifugation is essential if Fe is to be determined in the extract.

2 It is important not to prolong the contact between the extractant and mix beyond 90 min. Mixes which contain fine material may take longer than an hour to filter if they are not centrifuged first.

(h) The clear centrifugate is the test solution.

G5.3 Extraction with ammonium acetate

The extraction procedure when using ammonium acetate extracting solution (G3.2) shall be as follows:

(a) Before commencing the extraction, pour through a filter paper (G4(e)) a volume of the extracting solution (G3.2) roughly equal to the volume of filtrate to be collected in actual determination and measure the potassium present as described in Paragraph G5.4 to ensure that the extract will not be contaminated by the filter paper.

(b) Take a test sample of approximately 200 mL volume which is representative of the mix.

NOTE: Do not dry the mix before analysis. Use it straight from the package or sample container.

(c) Moisten the test sample with distilled or deionized water (G3.1) until it is just possible to manually squeeze water from it.

NOTE: The pressure should be that of a firm handshake and the water should just seep through the fingers as the pressure is applied.

After applying the water, remix so that any salts leached from the top of the mix are again fully incorporated. If water flows from the hand during squeezing, discard the test sample and return to Step (b).

NOTE: These procedures should be as gentle as possible so as to rupture as few as possible of any granules of slow-release fertilizer present.

(d) Remove from the moistened test sample a volume sufficient to give between 50 mL and 100 mL of firmly packed material.

Place the material loosely into a plastic vessel (G4(c)) marked at the height corresponding to the chosen sample size (G4(c)). Gently apply a pressure to the mix of 10 kPa (0.102 kg/cm^2) above atmospheric pressure.

NOTE: Results will be most consistent if the amount of mix added to the container is close to the required volume. If, after the application of the pressure, the volume is found to be considerably more than required, it is best to start again with a smaller amount of mix.

(e) Put the compressed mix into the extracting vessel (G4(b)) and add a volume of extracting solution (G3.2) that is 5 times the volume of the mix.

(f) Seal the vessel and shake by hand to disperse the mix through the extractant. Allow to shake on an end-over-end mechanical shaker rotating at less than 10 revolutions per minute, for 120 min.

If a mechanical shaker is not available, the vessel is shaken at least four times evenly spaced during the 120 min.

(g) Filter the solution through a low ash filter (G4(e)) then centrifuge the filtrate at about 3000 r/min for 5 min.

NOTE: It is important not to prolong the contact between the extractant and mix beyond 120 min. Mixes which contain fine material may take longer than an hour to filter if they are not centrifuged first.

(h) The clear filtrate or centrifugate is the test solution.

G5.4 Measurement of elements

The concentration of calcium, magnesium, phosphorus, potassium, sulfur, iron, manganese, zinc, copper, boron and sodium in the test solution shall be determined using any of the instruments as listed in G4(a). Checks should be made to ensure that glassware is neither contributing boron to extracts nor removing it from very dilute solutions.

NOTES:

1 If the concentration of manganese is greater than 15 mg/L, the procedure by water extraction in Appendix D should be applied. If the concentration is less than 2 mg/L by water extraction, the mix has met the requirements of this Standard.

2 Refer to Paragraph B6 for interpretation of results. The accepted error ranges for these tests are—

(a) for calcium, magnesium, potassium, sulfur, iron and phosphorus (for regular grade soil mix)—minus 20%;

(b) for manganese, copper, zinc, boron and phosphorus (for premium mix)—plus or minus 20%; and

(c) for sodium and phosphorus values (for low phosphorus mixes)—plus 20%.

G6 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) The concentrations of calcium, magnesium, phosphorus, potassium, sulfur, iron and sodium (to the nearest 1 mg/L); manganese, zinc and copper (to the nearest 0.1 mg/L) and boron (to the nearest 0.02 mg/L) in milligrams per litre of extract.

(c) A list of the determinations for which the DTPA extract (Paragraph G5.2) was not used, showing which extracting solution was used for each of the listed determinations.

(d) Reference to this test method, i.e. Appendix G of AS 3743.

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APPENDIX H

ALTERNATIVE METHOD FOR AIR-FILLED POROSITY AND TOTAL WATER HOLDING CAPACITY

(Informative)

NOTE: This modified standard method is offered as an alternative to the test method set out in Appendix B. See Note 3 to Paragraph B1.

H1 SCOPE

This Appendix sets out a method for the measurement of air filled porosity and for determining the total water holding capacity under conditions resembling a home or nursery growing environment.

The method uses the same apparatus as described in Appendix B. However, this method has been shown to be less prone to variation when used by different operators. This method is included here as an alternative to the method described in Appendix B.

H2 APPARATUS

The following apparatus is required:

(a) Apparatus made from 90 mm diameter uPVC stormwater pipe and matching cap as follows:

(i) Cut two 12 cm lengths of stormwater pipe and deburr the ends. Ensure that the cuts are at right angles to the length of the pipe.

(ii) Drill four 9 mm holes in the cap in such positions that it is easy to cover them with four fingers while holding the base with two hands (see Paragraph B4(i)) and glue the cap to the base of one length of pipe, ensuring that the pipe is pushed in to the full extent of the cap. Apply extra glue to the upper edge of the cap on the outside to allow easy shedding of water during use. If the cap is of the type with a raised rim around the whole of the outside, cut small portions of this away to allow water easy entry to the holes when the base is sitting in a bucket of water. This is the base of the apparatus.

(iii) Heat one end of the second length of pipe and splay it out so that about 1 cm of its length can be pushed over the top end of the base. Work the heated pipe around until it fits snugly but not tightly over the end of the base.

(b) A jug or beaker of approximately 1 L capacity, 10 cm in diameter and 14 cm in height (larger than the bottom half of the apparatus (H2(a)).

(c) Plastic rods, approximately 1 cm square section, about 7 cm long.

(d) Balance, accurate to 0.5 g.

(e) Tape or plastic wrap to seal drainage holes.

(f) Means of measuring volume of water drained from mix, graduated in millilitres.

(g) Flat dishes or baking trays.

(h) Oven, preferably forced draught, capable of heating to a temperature between 100°C and 105°C.

(i) Piece of loose weave cloth (such as fly screen or shade cloth, with aperture of 1.5–2.5 mm) to fit inside the base of the apparatus (H2(a)).

(j) Large tub/sink.

H3 CALIBRATION

Calibrate as follows:

(a) If the base of the apparatus (H2(a) is flat, allow it to sit on two pieces of plastic rod (H2(c)) in the bottom of the jug (H2(b)) to prevent the apparatus from sitting hard against the bottom, which would otherwise prevent water free access to the apparatus drain holes during assessments.

(b) Place the jug on the balance (H2(d)) and tare it.

(c) Seal the drainage holes of the bottom half of the apparatus against water leakage with tape or plastic wrap (H2(e)).

(d) Place this container inside the jug

(e) Carefully pour tap water down the side between the walls of the bottom half of the apparatus and the jug until it is filled to the top of the apparatus. Carefully hold the bottom half of the apparatus down against the bottom or weight it down.

(f) Note the weight (and thus the volume) of the water added. This is the volume (V_o) outside the bottom half of the apparatus inside the jug.

The apparatus is now calibrated with the holding container. Remove the tapes from the holes to use the bottom half of the apparatus.

(g) Record the volume of the bottom half of the apparatus. This represents the total volume (V_m) of mix used.

(h) Record the mass (M_s) of the bottom half of the apparatus.

H4 PROCEDURE

The procedure is as follows:

(a) Place the top section of the apparatus (H2(a)) firmly onto the base and put a piece of loose weave cloth (H2(i)) into the base of the apparatus to prevent material from being washed out when draining.

(b) Moisten the media sample.

NOTE: The mix should flow freely and be of such moisture content that water cannot be squeezed from it. Any mix which has been squeezed should be discarded. The moisture content of the mix should be adjusted 24 h before testing to be within the 45 to 55% w/w range.

(c) Tip the moistened mix into the apparatus to at least half way up the height of the top section. Drop the apparatus five times from a height of 5 cm. This is to be a free fall, not a gentle lowering or a vigorous thumping.

(d) Fill a tub (or the Laboratory sink) (H2(j)) with enough water to reach above the top of the base of the apparatus. Slowly lower the apparatus of mix into the water. Hold it vertically until it has taken up enough water to stand by itself. Adjust the height of the water upwards in the container until it is level with the top of the mix, or at least well above the top of the base of the apparatus. Do not at any time allow mix components to separate from one another by some floating to the top because the height of water in the container is too high.

(e) Leave to soak for one to two hours.

(f) After the mix is fully wet, slowly remove the apparatus vertically from the water and allow to drain for a few minutes.

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(g) Repeat the wetting and draining cycle twice more allowing about 10 minutes for each wetting period. The purpose is to simulate the settling caused by watering cycles in the nursery.

(h) At the end of the third cycle, remove the apparatus and drain for 10 minutes then, remove the upper part of the apparatus. Carefully slice the excess mix off the top of the base without exerting pressure down on the mix remaining in the base.

(i) Repeat the wetting and draining cycle once more, if necessary, being careful not to allow any surface material to float off or separate.

(j) Allow to finally drain until drainage stops (for not less than 10 minutes and usually up to 60 minutes, depending on the fineness of the mix). At this point it is important to avoid tilting the apparatus. Drain it in a situation where there is no contact between the drain holes in the bottom of the container and the drained water, otherwise capillary action will draw water from the perched water table.

(k) Carefully slide the apparatus and mix into the tared jug (H2(b)) with the plastic rods (H2(c)) at the bottom of the jug (as for H3(a)) on the balance (H2(d)). Note the weight (this is the drained weight M_1) then re-zero the balance.

(l) Carefully pour tap water down the side between the walls of the apparatus and the jug to about half to three quarters the height of the apparatus. Tilt the jug to ensure there are no air bubbles trapped under the base. Allow the water to seep into the mix. Note that if the water addition is done too quickly, then air pockets may be left in the mix, producing inaccurate results.

(m) Continue the water addition until the water is level with the top of the bottom half of the apparatus.

(n) Note the weight (and thus the volume) of the water added (V_t). This is the total of the volume outside the apparatus inside the jug plus the volume of the air space inside the mix in the apparatus.

(o) Now remove the apparatus plus potting mix from the jug and allow to drain.

(p) Tip the potting mix onto a baking tray (H2(g)) or other suitable flat container and dry at 100°C in the oven (H2(h)) to constant weight (usually 1–2 days). Record the dry mass of the material (M_2) to the nearest gram for the total water holding capacity assessment.

H5 CALCULATIONS

The following calculations are required:

(a) Calculate the air-filled porosity (AFP) of the sample using the following equation:

$$\text{Air filled porosity (\%)} = \frac{V_t - V_o}{V_m} \times 100 \qquad \text{. . . H5.1}$$

where

V_o = volume of water between the standard base and the jug, in millilitres

V_t = total volume of water added, in millilitres.

V_m = total volume (of mix) in the standard base, in millilitres.

(b) Calculate the total water holding capacity (WHC) of the sample using the following equation:

$$\text{Water holding capacity (\%)} = \frac{M_1 - M_s - M_2}{V_m} \times 100 \qquad \text{. . . H5.2}$$

where

M_1 = mass of bottom half of the apparatus and drained mix, in grams

M_s = mass of bottom half of the apparatus, in grams

M_2 = mass of dry mix, in grams

V_m = total volume of mix, in millilitres.

H6 TEST REPORT

The test report shall contain the following:

(a) Sample identification, including sufficient details to show the time period between the manufacture and testing of the mix.

(b) Air-filled porosity, to the nearest 0.5%.

(c) Total water holding capacity, to the nearest 0.5%.

(d) Reference to this test method, i.e. Appendix H of AS 3743.

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APPENDIX I

MEANS OF DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Informative)

I1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Evaluation by means of statistical sampling.

(b) The use of a product certification scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

I2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample needs to be drawn randomly from a population of product of known history. The history needs to enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199.1, guidance to which is given in AS 1199.0.

I3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

I4 SUPPLIER'S QUALITY MANAGEMENT SYSTEM

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality management system or systems, this may provide the necessary confidence that the specified requirements will be met. The

quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Information on establishing a quality management system is set out in AS/NZS ISO 9001 and AS/NZS ISO 9004.

I5 OTHER MEANS OF ASSESSMENT

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform to the full requirements of the Standard.

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NOTES

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ISBN 0 7337 5480 5

Printed in Australia

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