In 1961 R. A. H. Legro in Holland (2) published an account of his breeding work with delphiniums which he had started in 1953. He produced a tetraploid hybrid between *D. cardinale* and *D. nudicaule* and then crossed this hybrid to various forms of *D. elatum*. Whether his work has been any more successful than ours in producing hardy, fertile, red-, or pink-flowering delphiniums than ours we do not know.

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A REVIEW OF THE BOOK: GROWING MEDIA FOR ORNAMENTAL PLANTS AND TURF

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The motto of the International Plant Propagators' Society, "To Seek and to Share", should not be forgotten. I came 12,000 miles to this meeting to seek and to share and I thought that I might be able to bring something to share with you. The more I thought about sharing at the time, I realized I could not bring an emu egg, like I did to the IPPS Western Region meeting a few years ago. Therefore, I decided to share a new Australian book. The book, *Growing Media for Ornamental Plants and Turf*[1], was published in 1984, and I was fortunate enough to cooperate with the two authors. This book was co-authored by Kevin A. Handreck, Division of Soils, Commonwealth Scientific and Industrial Research Organization, Adelaide, South Australia, and Neil D. Black, Ryde School of Horticulture, New South Wales Department of Technical and Further Education.

[1] Published by New South Wales University Press, P O Box 1, Kensington, N S W 2033, Australia

The thing I like about the book is that it deals with basics, as you can see from the table of contents (Table 1).

Table 1. Table of contents of, "Growing Media for Ornamental Plants and Turf," by K A Handreck and N D Black

Introduction	Fertilizer Practice in Nurseries
Plants Need for Good Growth	Turf Plants
The Basics	Managing Turf Soils
Texture and Particle Size	Fertilizng Turf
Some Simple Chemistry	Salinity A Growing Problem
Organic Matter The Vital Component	Watering When and How Much
Problems with Organic Materials	Irrigation Overview
Clay and Humus Soil Colloids	Drainage
Structure and Pore Space	Life in Growing Media
Growing Media and Water	Soil-borne Diseases in Nurseries
Supplying Air to Roots	Nutrient Solution as a Medium Hydroponics
pH	Temperature
Composting	Soils and Landscapes
Choosing Materials for Potting Mixes	Containers
Foundations for Good Turf	From Nursery to Landscape
Plant Nutrients	Collecting Samples for Analysis
Fertilizers	Simple Tests

One of the examples from the book that I can show is that of nutrient deficiency symptoms which seem to show up as a problem in all nurseries at one time or another. This book, to my knowledge, contains the first up-to-date chart showing the availability of plant nutrients for organic potting mixes (Figure 1). In practice, for non-soil mixes, the availability of nutrients is far different from that of soil mixes (Figure 2). If you look at these two charts you will understand why the authors are stressing the importance of keeping the pH between 5 and 6 for a general mix instead of 5.5 to 6.5 which we commonly use. The link between pH and nutrient availability is different in highly organic media from that in mineral soils. If you look at an element, such as phosphorus, you can see that at pH 6.5 availability is reduced in organic soils. A comparison of the two charts underlines the important change in attitude towards pH in growing media.

A great deal of emphasis is placed on the question of moisture in pots. Excellent chapters on growing media and water, and supplying air to the roots, are covered in the book. No matter what the shape of the pot, the degree of saturation in pots of similar height is the same. We can illustrate that point in a number of ways. However, if we understand how containers work, then we are halfway to eliminating the problem. Container design is an area that I have spent a lot of time on during the last 20 years. I have been pushing the importance of tall containers to minimize the amount of saturation in pots. Tall pots give the roots a much higher proportion of air space than short squat pots. Figure 3 shows a pot with lots of drainage and which is tall and thin at the same time. Probably the most important thing we, as nurserymen, do is watering.

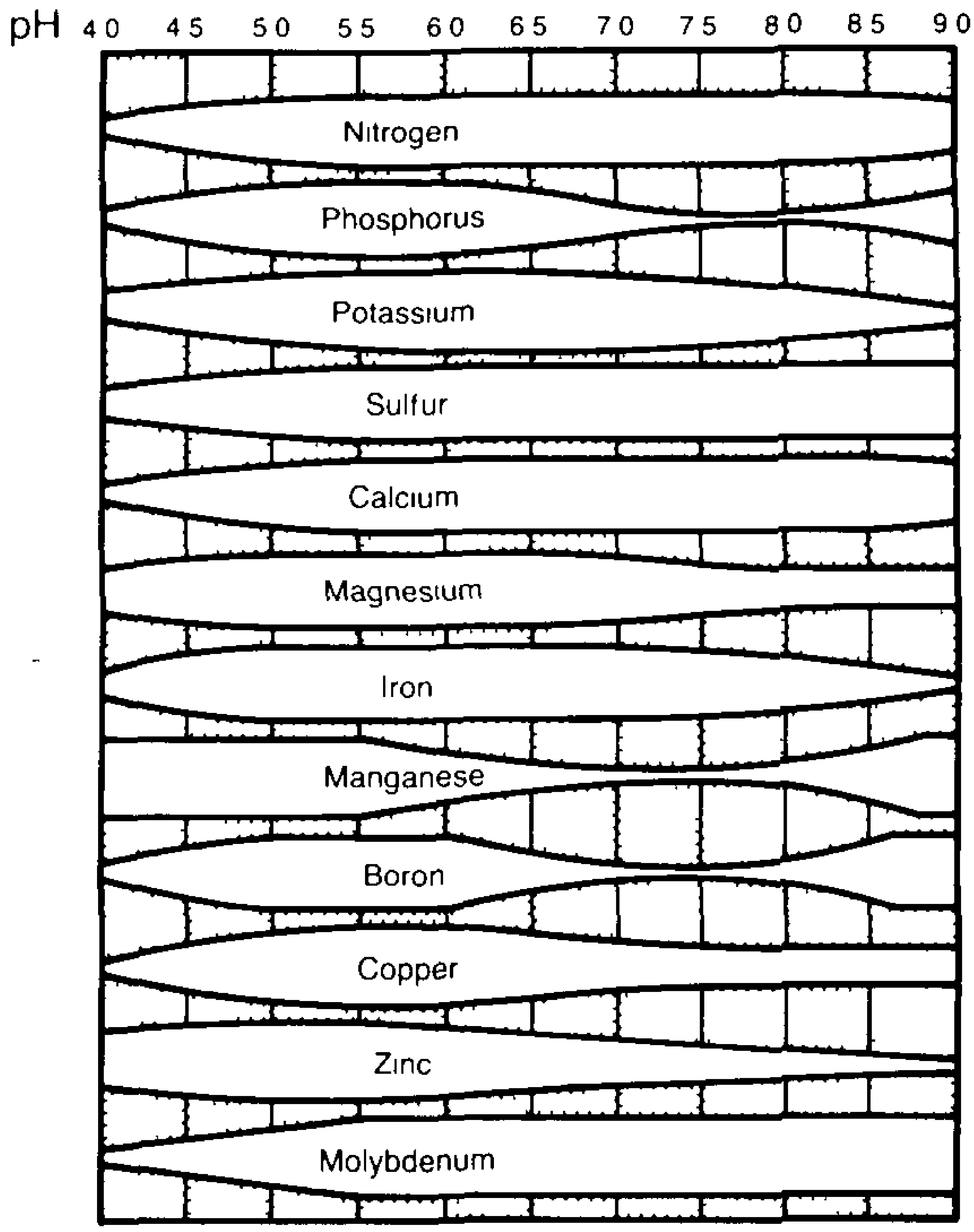

Figure 1. The availability to plants of nutrient elements in organic soils and in organic potting mixes varies with pH in the manner shown here The wider the bar, the greater the availability (Used by permission from, *Growing Media for Ornamental Plants and Turf*, by Handreck and Black)

I find a great deal of confusion about what is meant by the air-filled porosity of a container mix. Growers are not conducting aeration tests at the time they put the mix into the pots, and they do not know their aeration after the roots have grown into the mix. In addition, I think that it is important to know air-filled porosity as the crop grows. An excellent simple technique, as given in this book, for determining the air-filled porosity of a container mix is as follows:

1) Select a milk carton of a suitable height Cut the fold-over top off, or open it out if the entire height is needed Mark the required height of mix on the inside
2) Cut four holes in its base in positions such that you can close them with four fingers while holding the carton vertical with two hands The holes should be about 1 cm in diameter, or as big as your fingers will allow

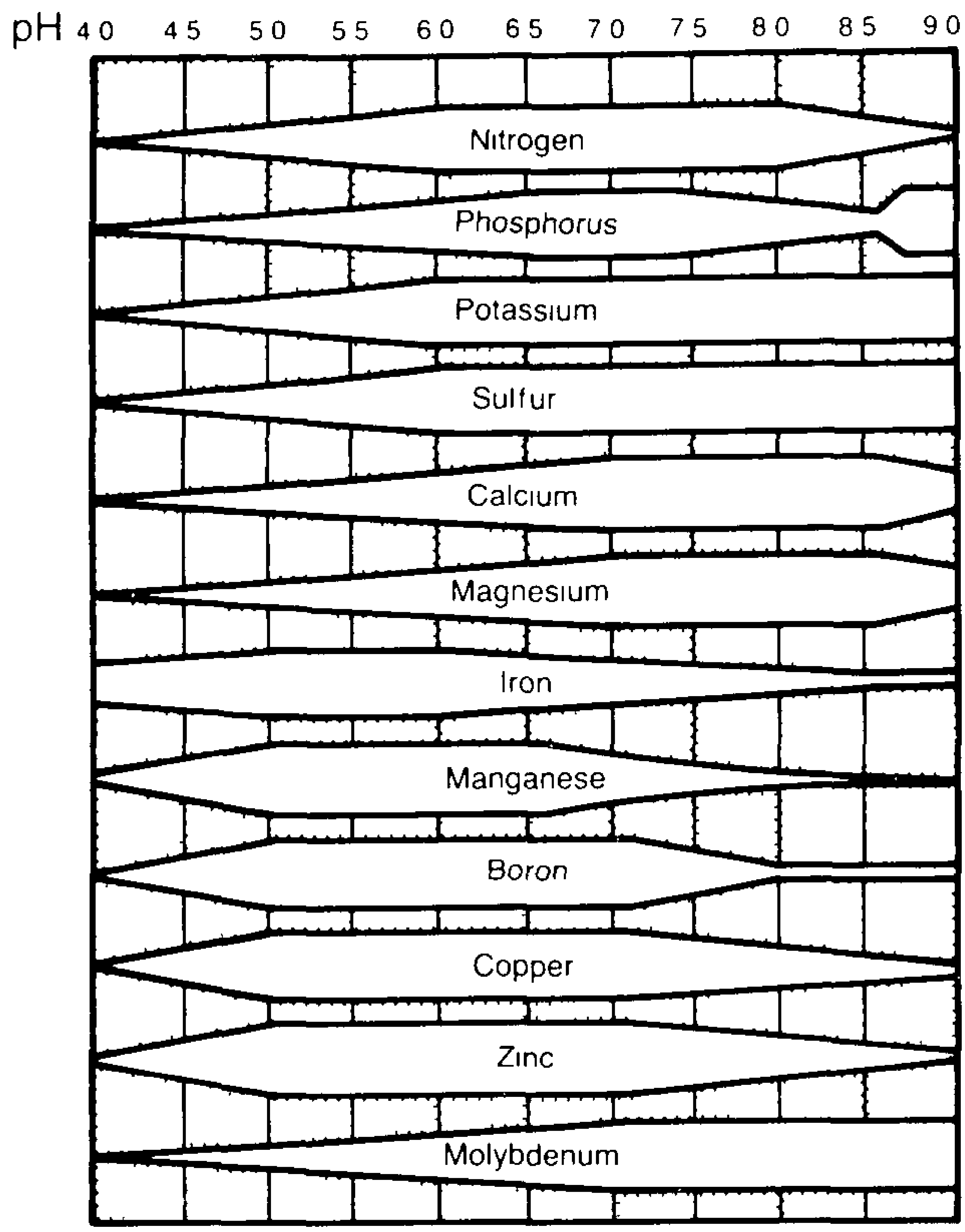

Figure 2. The availability to plants of nutrient elements varies with pH in this manner in mineral soils (Used by permission from, *Growing Media for Ornamental Plants and Turf*, by Handreck and Black).

3) Fill moistened mix into the carton in your usual way, or as near to it as is possible Ideally, the mix should have been moist for a week or more so that all particles have had time to become wet right through
4) Stand the carton on a bench where it can be watered from overhead a few times each day for several days The aim is to gently compact the mix as would happen in normal practice If necessary, top up the mix to the mark.
5) Gently lower the carton of mix into water in a large (9 l) bucket The height of water should be just a few millimetres below the top of the mix Have the water low at the start and pour more into the bucket as needed. Make sure that the mix does not float up Then carefully remove the carton from the water by slowly raising it vertically. Allow to drain, then lower into water again Repeat twice This further settles mix

6) Allow to stand overnight or longer in the water.

7) Reach down through the water and work your fingers underneath the carton until they seal the holes. Just before final sealing, make sure that the mix is saturated *just* to its surface.

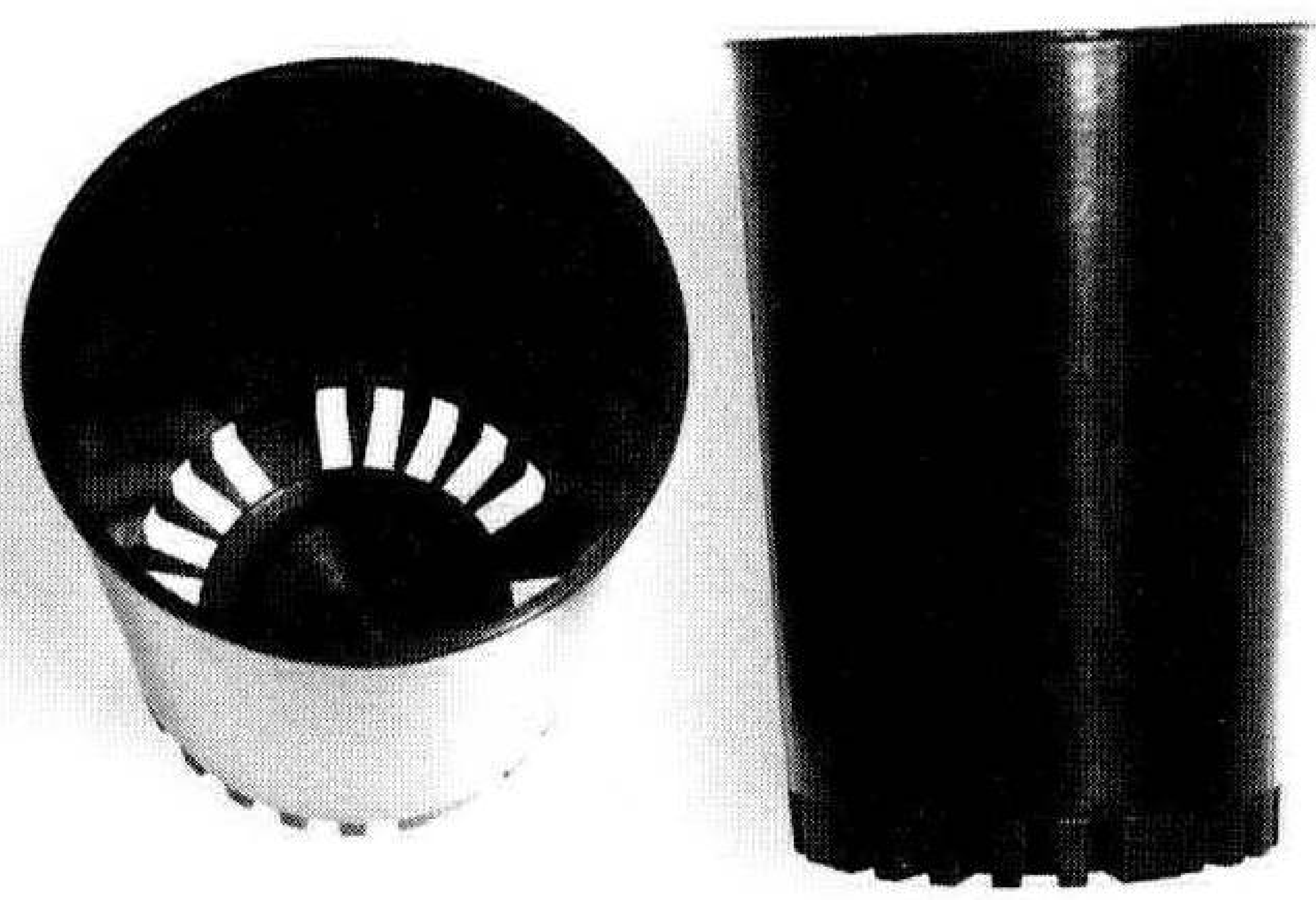

Figure 3. A tall and thin pot with good drainage.

8) Raise the carton from the water. Allow water to drain from the outside.

9) Place the carton on blocks in another bucket. Remove your fingers. Make sure that the holes can drain freely. Allow water to drain from the carton. The base of the carton must be horizontal (any tilting or squeezing will allow more water to drain out, so giving a high reading of air-filled porosity).

10) Cover the bucket with a sheet of plastic to prevent loss of water by evaporation. Drainage could be finished in 10 minutes or it could take several hours. The water draining from the mix is replaced by air. The volume of air that enters is the same as the volume of water that has drained into the bucket.

11) After drainage has stopped, remove the carton from the bucket, without tilting. Measure the volume of water in the bucket, or weigh it (1 ml water weighs 1 g).

12) Calculate or measure the volume of carton occupied by the mix.

13) Calculate the air-filled porosity of the mix with the formula:

$$\text{Air-filled porosity} = \frac{\text{volume of water drained (ml)}}{\text{volume of mix (ml)}} \times 100 \text{ (volume \%)}$$

Example: 120 ml of water drained from 600 ml of mix

$$\text{Air-filled porosity} = \frac{120}{600} \times 100 = 20 \text{ volume \%}$$

That is, 20% of the volume of the mix was air immediately after it had stopped draining.

One thing that came as a bit of a shock to me a few years ago, and which is discussed in the book, is the difference in suppressiveness to pathogens, such as *Rhizoctonia*, of different growing media. Peat moss has no ability to suppress *Rhizoctonia*, whereas composted bark aged for 11 weeks, has a high degree of suppressiveness. The suppressiveness is partly destroyed when the compost is reheated to 60°C for 5 days. If you want minimal disease in containers have, as part of the medium, well-matured compost.

These are just a few highlights about the book. I would like to present a copy to the President of the Eastern Region, Len Stoltz, and wish you the best of luck with your 1984 program. I would also like to invite you to come down to Australia and share with us.

BENCH GRAFTING OF TREES UNDER POLYTHENE

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Bench grafting of trees under polythene offers the propagator a number of advantages. These include:

1) Fills the labour trough during the winter period.

2) Reduces the time span from the rootstock phase to obtaining a saleable tree (one year faster than budding),

3) Allows the grafting operation to be done under cover without the need for working outside.

METHODS AND MATERIALS

A whip-and-tongue graft, using dormant wood, from January to the end of April is used. The graft is held together with a 200 × 25 × 2 mm biodegradable, natural-rubber tie, except on some fast-swelling, slow to callus types, such as *Acer platanoides* 'Drummondii' or 'Crimson King'. In the latter case, a clear polyethylene tape is used.

Rootstocks are generally bareroot and of the appropriate thickness to match the scion material. After grafting, the finished graft is potted into a 2 litre container and placed on a capillary sand bed in an unheated polyethylene structure. Grafts are initially well watered then only watered sparingly thereafter. Callusing of the union commences in 2 to 3 weeks but is dependent upon the weather and the difficulty of the subject.

The longer and stronger the sunlight before permanent callusing of the graft union, the quicker the tie degrades. It may become necessary to retie a small percentage of grafts. Obviously, this may be a much more important consideration under the higher intensity sunlight areas of the USA.