ASSESSING A NEW SOIL MEDIUM[1]

K. G. LASSCOCK

Lasscock's Nurseries
Lockleys, South Australia

When assessing a new soil medium there are three broad areas to be considered: the chemical environment of the medium, the physical environment of the medium, and managerial aspects. Each of these areas can be analyzed logically.

Chemical Environment. There are four factors to be analyzed:

1. What are the ideal nutrient levels;
2. How does the applied fertilizer's output vary with time;
3. What are the detrimental by-products within the fertilizers;
4. What beneficial chemicals are present.

Firstly, the question of ideal nutrient levels. Below is a roughly ideal general soil analysis (ppm): nitrogen (total) 170; phosphorus 85; potassium 185; magnesium 320; iron 500; calcium 1750; copper 2; boron 2.5; manganese 50; molybdenum 2; zinc 25.

One may well have an analysis like this but those nutrients may not be available to the plant. Since nutrient availability is linked to soil pH, aeration, water supply, soil texture and symbiotic micro-organisms, these factors must be considered too.

A pH of 5.8 to 6.2 results in a happy trade off between the availability of the various nutrients. Most plant nutrients are actively taken up by plants. That is, the plant expends energy in the extraction of nutrients from the soil. Sugars are burnt in the presence of oxygen to supply this energy. Thus, low oxygen in the soil leads to a low metabolic rate and poor nutrient uptake irrespective of the applied fertilizers.

The nutrients that plants manage to take up are carried in solution around the plant. The plant also uses some water in its metabolism. So, poor water supply results in poor nutrient uptake. Microscopic particles in the soil carry electrostatic charges that will bind up plant nutrients. So a soil should be low in colloid and dust.

Certain plants have evolved in environments low in particular nutrients. The result is the development of symbiotic-like associations between plants and certain bacteria and fungi. These organisms "digest" certain nutrients for the plant in ex-

[1] This paper was presented at the 1977 IPPS Australian Region meeting.

change for sugars and proteins. The result is a situation, for example with Proteaceae, where it is very difficult to chemically compensate for the absence of these organisms.

One last comment on the ideal nutrient levels. Provided total dissolved salts are low, a plant will not be harmed by the presence of super-optimal levels of most nutrients. The plant generally will not take up more than it needs although boron and manganese are exceptions. These can be taken up to toxic levels.

The next factor to be considered is the variation of nutrient levels with time. There are two parts to this question. Firstly, how do the plant's requirements change with time. Nutrient supply must match plant growth rates. Thus an accelerating supply followed by a lower maintenance level is needed in container-grown plants. Secondly, how do the nutrients supplied by the soil vary with time. One should consider how the fertilizer itself changes and how the soil changes. Organic fertilizers and those like VF38 give a big release of nutrients early then taper off quickly, so liquid feeding is needed. Liquid feed schedules give a boost at each watering followed by starvation. Combinations using Osmocote are ideal.

The soil itself will change chemically; for example, as pine bark decomposes iron is released. As sawdust decomposes nitrogen is tied up in the bodies of the decomposing organisms. The soil also changes physically resulting in reduced oxygen and water levels and so reduces the available nutrient levels.

The final factors in this section on the chemical environment are detrimental and beneficial chemicals. The fluorine associated with phosphate production harms proteaceous plants via a phosphate-iron-microorganism association. Preservative-treated timbers can kill. On the beneficial side, the phenols produced during *Pinus radiata* bark decomposition controls *Pythium* and *Phytophthora*. By the way, some barks release phenols, etc. that can kill plants.

Physical Environment. There are four factors to consider:

1. The physical support of the plant;
2. Detrimental organisms;
3. Beneficial organisms;
4. The physical resistance to root growth.

The growing medium should act to prevent the plant from blowing over.

Detrimental organisms can be inherent in some media, for example *Pythium* on peanut hulls. Heat or chemical treatment can eliminate these organisms. Beneficial organisms will be killed by methy bromide and the like, so re-introduction may be needed. Heat treatment (150°F for 30 minutes) removes detrimental but not beneficial organisms. Pine bark in a heap reaches 170°F, thus no steam treatment is needed. Bacteria are essential for the release of nitrogen from VF38 and for the uptake by some plants of some nutrients.

The soil can physically obstruct root growth. Reductions of up to 50% can occur in heavy clay soils.

Managerial Aspects. There are five factors to consider in this area:

1. Cost;
2. Availability;
3. Ease of use;
4. Ease of treatment;
5. Customer acceptance.

Cost is often analyzed in a strange way. Each ingredient is emotionally ranked as too dear or too cheap based on the bill you get when one ton is delivered. Cost per pot for the total mix is a more reasonable system. This cost will usually be a quarter of the cost of the pot and about equal to the cost of the label.

So you have found the ideal medium but the ship from Transylvania sinks with this miracle medium aboard and you go broke. Availability and reliability of supply is then as important as the nitrogen level, etc.

The soil is too dusty or too heavy to move, or the ground glass in the mix is rapidly reducing your work force, to say nothing of your soil mixer. Management must consider the "ease of usage". Bark "pasteurises" itself, so treatment is easy. Loam does not, and needs steam treatment with the associated cost. Such cost should be calculated per pot.

Now after this huge analysis you come up with the super medium but the customers do not relate to a purple soil, nor a smelly or rough soil, so you go broke, again. Individuals ultimately buy your plants, so they *must* be happy with your choice of a potting medium.

SUMMARY

Below is a list of twenty questions to be answered when deciding on a new medium:-

1. pH now and over time.
2. Analysis of untreated media now and over time.
3. Fertilizers required.

4. Release pattern of the selected fertilizer.
5. Total dissolved salts, boron and manganese.
6. Half saturation percentage now and over time.
7. Oxygen levels at saturation now and over time.
8. Any detrimental chemicals and their levels.
9. Effect of detrimental chemicals.
10. Weight per cubic yard.
11. Physical resistance to root growth.
12. Colloid level and ion exchange capacity.
13. Intrusive flora and fauna.
14. Necessary hygiene treatments.
15. Other treatments (nitrogen stabalization of sawdust).
16. Ease of usage.
17. Dust levels.
18. Customer acceptance.
19. Availability.
20. Cost per pot.

EFFECT OF SUPERPHOSPHATE AND HIGH LEVELS OF LIME ON THE GROWTH OF WESTERN AUSTRALIAN BANKSIAS[1]

R. K. ELLYARD and D. K. McINTYRE

National Botanic Gardens and City Parks Research Unit, A.C.T.

Western Australian species of the genus *Banksia* have, in general, proved very difficult to grow in Eastern Australian states. In many cases the fungus *Phytophthora cinnamomi* has been blamed.

Webb (5) has, following extensive observation as to the soil environment of successfully grown Western Australian species and on the basis of field trials, concluded that the addition of high levels of lime to soils permitted the successful growing of many Western Australian *Banksia* species in Canberra.

At the National Botanic Gardens there has been considerable difficulty in propagating Western Australian *Banksia* species. In most cases death occurred soon after pricking out into the standard UC mix used at the Gardens. This mix contains a high level of phosphate (1200g superphosphate, 1200g blood and bone/m^3). Since most Australian species, and Western Australian species in particular, have evolved in an environment

[1] This paper was presented at the 1977 IPPS Australian Region meeting.