mined diatomite from Barraba, NSW, contains 30 to 40% clay (kaolinite and halloyrite) which provides cation exchange capacity not exhibited by the calcined product.

Most of the Australian native plants grew at least as well in the mixes containing diatomite as in the unsupplemented commercial mixes. The exception was *Grevillea* 'Ivanhoe' which reacted extremely unfavourably in mixes containing 50% of the raw ore fines grade of diatomite. The large, calcined particles remained discrete throughout the trial and improved the drainage and aeration characteristics of mixes. The raw ore fines product with the high clay fraction reduced water infiltration rate, drainage, and aeration.

The variations in growth shown by *Grevillea obtusifolia* demonstrated the need for further work and additional commercial trials are being undertaken to see if preferential patterns can be determined.

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APPLICATION OF PHOSPHORUS TO PROTEACEOUS PLANTS

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The basis of this discussion came about indirectly from a statement made by Professor Carl Whitcombe at Oklahoma State University several years ago in which he said "pH doesn't matter." I was reluctant to accept this statement, so over time I set out to find out what he was really saying.

I have concluded that there is some truth in his statement with the following qualifications. There is no problem if the necessary elements can be applied in the correct form to sustain plant growth without becoming fixed, and thus unavailable to the plant. However, for more practical purposes, such as growing commercial quantities of blue-flowering hydrangeas at a pH of 7.5 to 8.0 it is probably much easier and cheaper to achieve good plants at a pH of 5.5 to 6.5.

Here we had the situation of a university professor questioning one of the traditions of nursery practice.

This suggested to me that everything was open to question and this led to my assault on the claim that plants from the family Proteaceae should not be supplied with phosphorus. This is the current advice tendered by many researchers and extension officers worldwide.

When one thinks about this it is in error. The facts are these (and, in my opinion, facts are the current statement of knowledge that changes over the years so, by definition, they are temporary)—

- plants from the family Proteaceae respond well to phosphorus with much improved growth rates.
- the quantity and rate of release of phosphorus is important.
- the form of phosphorus applied is important.
- the use of the wrong form and the wrong quantity of phosphorus can be most damaging.

A similar effect can be obtained with alcohol on humans. A little can be quite nice, too much causes a hangover, and eventually too much over a long period causes death.

Many researchers have used superphosphate as their source of phosphorus on plants in the family Proteaceae. In containers this causes major problems; however in the field I have observed many cases of banksias responding well to superphosphate applied to wheat fields. These plants however seldom get a high application of fertiliser as they are usually on the fence line and often on the other side of a firebreak, from the area being fertilised for wheat.

Here we have a beneficial effect of superphosphate, when correctly applied, i.e. in low concentration and volume. (It can be toxic when incorrectly applied.)

Another example is the application of phosphorus by liquid feed methods, using low concentrations of 100–150 ppm N, 70 ppm P, 100 ppm K every two weeks. This achieved good growth results with a wide range of plants in the family Proteaceae when grown in containers. The source of phosphorus was mono ammonium phosphate.

We believed that a slow-release form of phosphorus was needed to reliably grow a wide range of these plants. Many forms and concentrations were tried; the most reliable proved to be a Mitsubishi product called IB 10-10-10. We have been using this exclusively for the past five years even though it has 10% phosphorus. It is used on all our Proteaceae plants including *Banksia, Grevillea, Leucodendron, Leucospermum, Protea*, etc.

This product really is slow-release under a wide range of soil types, temperatures, and watering conditions. Many field tests have been carried out in Kuwait where the temperature can be 48°C for several months of the year, and where much irrigation is done with water having a salinity of up to 8000 ppm.

It out-performed other products because the three elements, nitrogen, phosphorus, and potassium are all in slow-release form and stable in their own right. Some are coated with silica or IBDU to slow their rate of release down to the desired level before being combined into a single pellet. The size of these pellets determines the length of the release time.

Technically 10-10-10 is a hardened IB compound, known as IBSI, with 80% of its 10% nitrogen derived from IBDU. IBDU is the only slow-release nitrogen that is slowly and evenly dissolved to a soluble form of nitrogen that can be utilised by plants. Other slow release forms of nitrogen depend on certain temperatures and bacterial activity, adequate coating thickness and technique, and/or diffusion of soluble nitrogen through a porous membrane.

The pellets are very hard and large, from 5 to 10mm in diameter, and composed of IBDU, superphosphate, fused magnesium calcium phosphate, and potassium sulphate. In this case the fused magnesium calcium phosphate and the superphosphate react to form a compound hardening the pellets and suppressing the rate of release of the elements, and making the effectiveness of the pellet to be from 6 to 8 months.

Another product, known as "Woodace", is a briquetted fertiliser containing IBDU, Linstar (a form of slow-release phosphorus), and fused potassium silicate. It has a very long release period of up to 2 to 3 years.

As IBDU, Linstar, and fused potassium silicate are all available as individual fertilisers it is possible to have any combination of slow-release N-P-K you wish. However the time of release of the elements is limited to 3 to 4 months because of the size of the granules. Only by combining all the elements in the one granule can they be made to last up to 3 years.

These fertiliser combinations offer several advantages. They are long-lasting, safe, simple to use, and labour saving. Probably the most important feature of IBDUSI is that there is no wastage due to leaching from overwatering. This is because the product is only slightly soluble in water, and the size of the pellet determines the release pattern. Microbial action breaks down the outer surface of the pellets to start the fertiliser effect.

Sensitive plants, such as azaleas and proteaceous plants, actually use the fertiliser as it is supplied. We have had many instances where 4 or 5 pellets have been placed on the top of a pot and the roots actually penetrate the pellets and hold them. The pots can be turned upside down and they will not fall off. Generally with all other slow-release fertilisers tried, roots tend to stay at least a centimeter away from the source of the nutrient, as the salt concentration is too high for them to approach any closer, let alone penetrate and establish a "cocoon" around the source of the fertiliser.

As well as placing the granules on the soil they can be added to the soil mix with excellent results.

So there we have it—another statement brought into question and found to be incorrectly expressed. What should have been said was: "plants in the family Proteaceae are sensitive to phosphorus when it is applied in the wrong form and the wrong concentration."

When phosphorus is applied in the correct form however, the results are very impressive with much increased growth, good leaf colour, firm stems, better yields of flowers, and more cutting material for propagation per plant.

As always, you will need to adjust these findings to your own production systems and do the necessary trials to verify these claims before achieving the results outlined above.

THE INFLUENCE OF RADIO COMMUNICATION TOWERS ON THE PROPAGATION OF FUCHSIAS

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Tamborine Mountain Plants specializes in fuchsias and these are grown from cuttings. Our main market is for potted plants in flower in the winter months. To feed this market, about 85,000 cuttings are struck in summer, during the months of December and January, each year. The cuttings are struck in 50mm tubes with a propagation mix consisting of peat and perlite, and the tubes are placed, 109 tubes per wire tray, on wire benches in an "open" area, and the cuttings are misted at regular intervals during the day. The "open" area consists of walls of solar-weave and the "roof", made of wire mesh supported by water-pipe, is covered with solar-weave over the newly-struck cuttings and with 50% shade-cloth over older cuttings. The nursery is supplied with bore-water.

In late February, 1986, a rapid deterioration of the fuchsia cuttings occurred, affecting first the stem tips and leaves, then the stem, and much later, the roots. Nearly 80% of all cuttings were affected. The immediate task was to identify the cause of this dieback but, even if it had been readily apparent, already the nursery's main market had been lost because no rapid striking of cuttings could make up for the two months required to reach the same stage of maturity. But the cause was not readily apparent, everything had been done in exactly the same way in 1986 as in previous years; the same propagation mix, the same bore water, the same fertiliser program and so on. Within a fortnight, we were able to rule out a microbial cause, so we knew we had to find a non-microbial