USE OF DIATOMITE AS A SUPPLEMENT TO GROWING MEDIA FOR ORNAMENTAL PLANTS

TONY BIGGS[1]

N.S.W. Department of Agriculture
McKell Building, Sydney, New South Wales

The desire to produce uniformly standard potting media is a major reason for the evolution of soilless mixes. Components such as peat, sand, composted sawdust, pine bark, vermiculite, and others are used worldwide but others are only used locally because of specific availability. The possibility of using diatomite arose because of sizeable deposits of this material at Barraba in northeastern New South Wales.

Properties of a diatomite. Diatomite is a sedimentary rock which consists of siliceous skeletal remains of tiny freshwater or marine organisms called diatoms. The microscopic organisms measured only a few microns in length and when they died the skeletons sank to the bottom of the sea or freshwater lake where very thick deposits gradually accumulated. Geological movements of the earth's crust have relocated the deposits into accessible situations from which the diatomite can be mined. The New South Wales deposit was laid down in a freshwater lake and is rich in a diatom known as *Melosira granulata* which had skeletons with an average length of 15 microns. The deposits are up to 100 million years old. Diatom skeletons alone are very clean but often the deposits of diatomite also contain clay particles which influence the properties of the mined product. A typical analysis of the diatomite as mined, processed, and used in growing media is shown in Table 1.

Table 1. Composition of horticultural grade diatomite.

Chemical composition	Range (%)
SiO_2	65–85
Al_2O_3	14–18
Fe_2O_3	3.0–4.0
TiO_2	0.65–0.85
P_2O_5	0.04–0.08
MnO	0.04–0.06
CaO	1.6–2.2
K_2O	0.9–1.2
pH	8.0 (average)
Physical properties:	
Apparent density	0.04–0.05 g. per ml.
Water absorption	50–130% by weight

The diatomite used in these trials was very absorbent, chemically inert, light weight, and contained sufficient clay to provide very useful cation exchange capacity (CEC). Since the

[1] Principal Horticulturist (Vegetables)

diatomite formed in fresh water there was no risk of salt contamination in the material.

The 5.0m. thick deposit of diatomite at Barraba is covered by an average of 3.0m. of overburden and 0.5m. of topsoil. The trials described below compared the performance of the material as mined (raw ore fines) with calcined material produced by passing the raw ore fines through a coal-fired rotary kiln. During the calcining process, water is driven off, any organic matter is burnt off, and the silicon dioxide is changed from an amorphous to a crystalline form.

In the literature there have been brief references to the use of diatomite in growing media but variation in pH among batches, cost, and contamination with sodium chloride are cited as possible problems.

Trials with seedling mixes. Peat, vermiculite, and two grades of diatomite were used to prepare mixes in which tomato and onion seedlings and marigolds (as a flowering pot plant), were grown. The composition and properties of the mixes are shown in Table 2.

Table 2. Composition and properties of seedling/pot plant mixes.

	Composition (% by volume)				Properties	
Mix	peat	vermiculite	diatomite (r.o.f.)	diatomite (calc.)	pH	E.c. (μScm^{-1})
A	50	50	0	0	4.7	23.8
B	0	50	50	0	8.1	26.2
C	50	0	50	0	5.5	35.0
D	25	50	25	0	6.6	24.0
E	25	25	50	0	5.3	37.5
H	0	50	0	50	9.3	42.0
I	50	0	0	50	7.9	32.5
J	25	50	0	25	7.2	19.7
K	25	25	0	50	6.7	22.5
L	50	25	0	25	5.7	28.0

Tomatoes (cv. Rouge de Marmande) and onions (cv. Hunter River Brown) were used in the seedling trial. With each of the eleven mixes, 3 seedling punnets were sown with tomatoes and three with onions; 25 tomato seeds or 40 onion seeds were sown in each punnet. The seeds were covered uniformly with a thin layer of the appropriate mix and all punnets were watered with a fine spray. The punnets were kept in a fibreglass greenhouse throughout the trial.

The number of emerged seedlings was counted regularly and the results are shown in Figures 1 and 2.

Trials with mixes for a flowering pot plant. A dwarf marigold (cv. Janie) was used because of its rapid growth. Seed was sown into a 50:50, peat:vermiculite mix, with the seedlings transferred to the trial mixes in 140mm diameter pots 14 days later.

The eleven mixes shown in Table 2 were used but with Nutricote and Micromax added to provide slow-release nutrients,

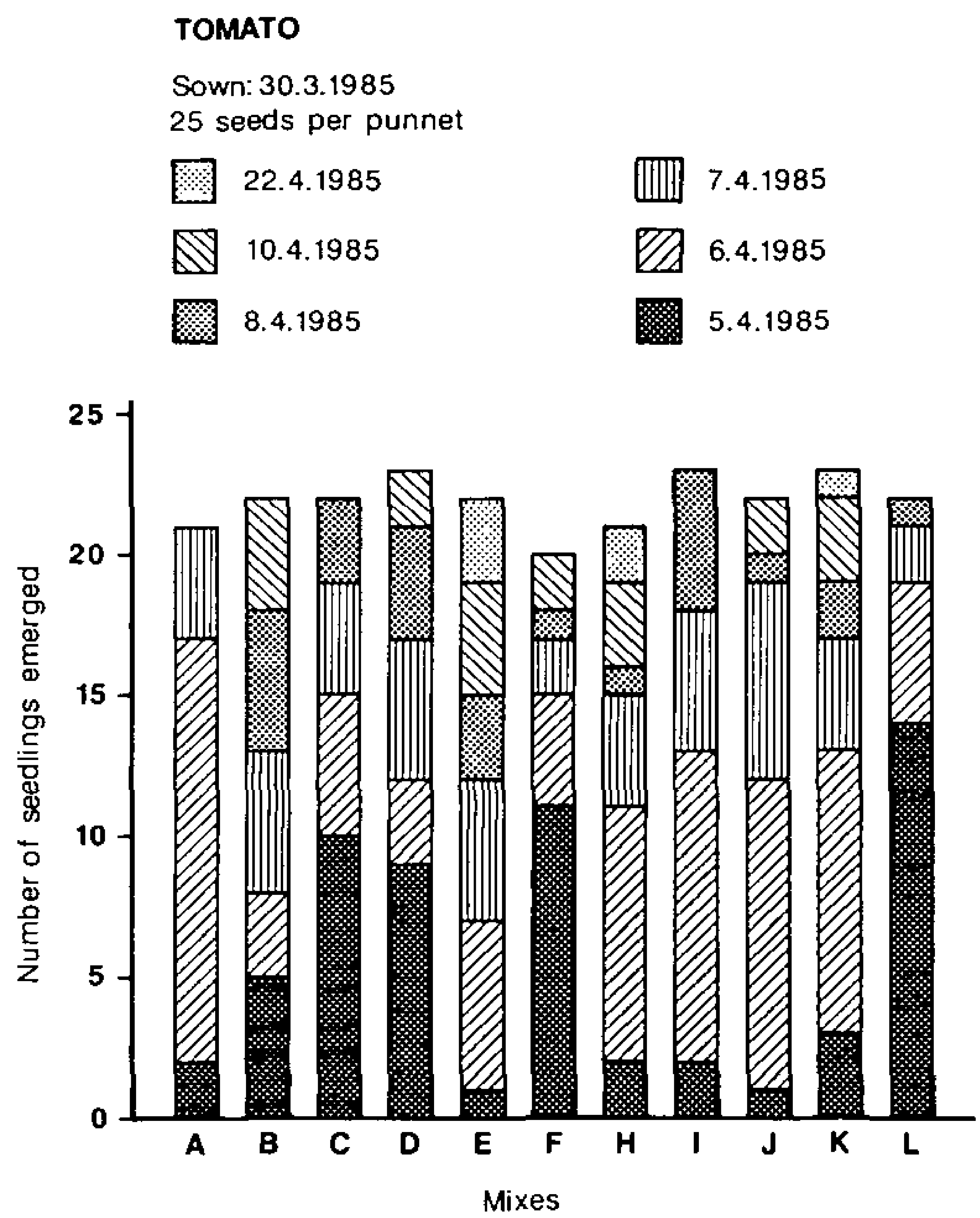

Figure 1. Emergence of tomato seedlings cv. Rouge de Marmande after sowing in a range of mixes.

Table 3. Composition of commercial mixes.

Mix 1		*Mix 2*	
Ingredient	*Quantity*	*Ingredient*	*Quantity*
Composted hardwood sawdust	30%	Composted hardwood sawdust	25%
Composted bark fines	30%	Composted softwood sawdust	15%
Coarse sand (double washed)	20%	Composted bark fines	25%
Composted horticultural bark	10%	Coarse sand	20%
Black soil	10%	Killarney® peat	15%
	per m^3 of mix		per m^3 of mix
4–5 month Nutricote	2kg	3–4 month Osmocote	1kg
8–9 month Nutricote	2kg	8–9 month Osmocote	2.5kg
Coated iron	500g	Micromax	500g
Micromax	500g		
IBDU	300g		
dolomite lime	1kg		

and with calcium carbonate added to raise the pH. One seedling was potted into each 140mm pot and 30 pots of each mix were used. The

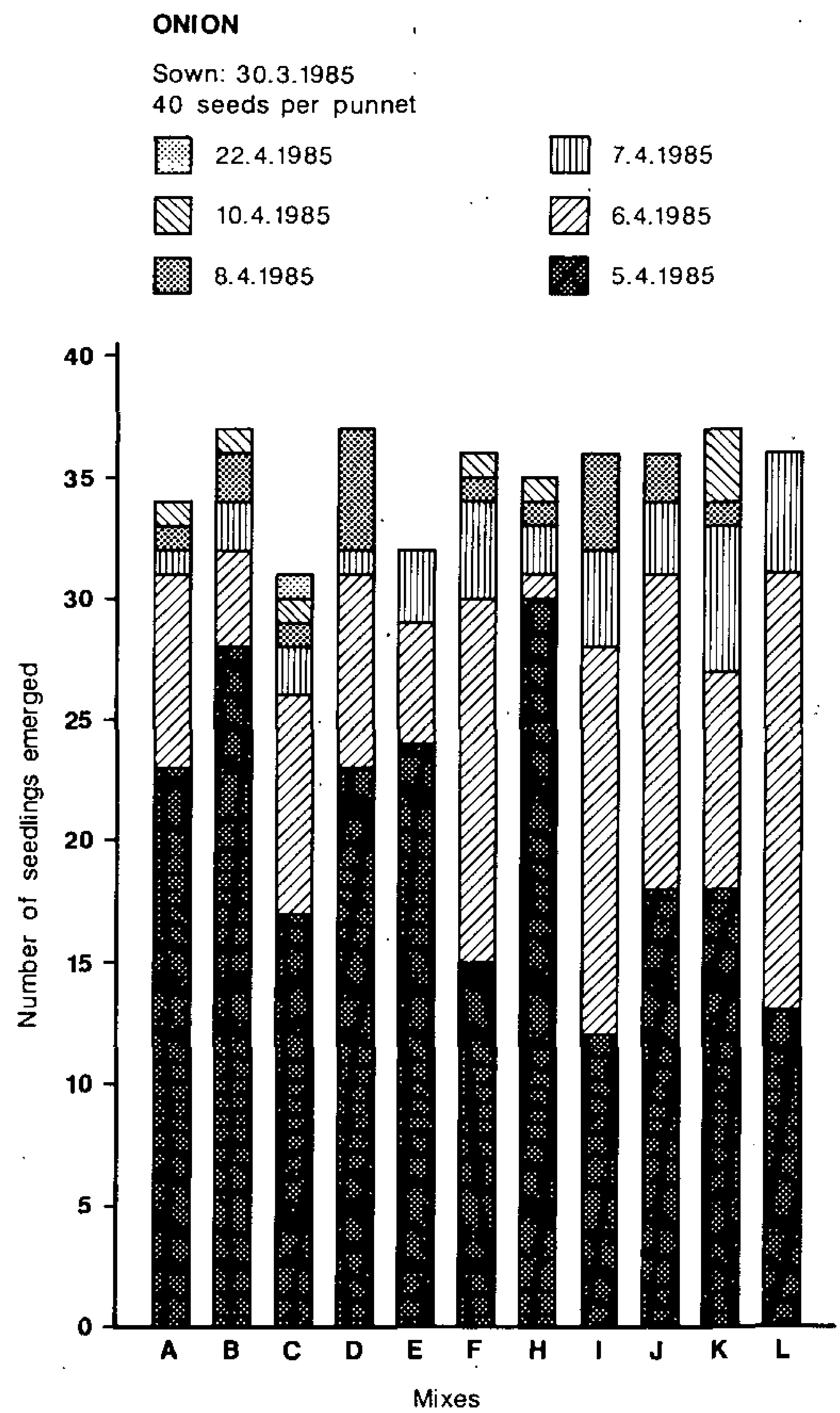

Figure 2. Emergence of onion seedlings cv. Hunter River Brown after sowing in a range of mixes.

plants were grown in an unheated greenhouse throughout the trial. Three weeks after potting the 30 plants in each mix were divided into two groups of 15. One group in each mix was liquid-fed regularly with the proprietary material, Thrive, during the remainder of the trial while the other group was given water only.

The trial was terminated 10½ weeks from potting, at which time the aerial parts of each plant were oven-dried and the dry weights recorded. The results are shown in Figure 3.

Trials with mixes for Australian native plants. Four Australian native plants were used in this trial—*Callistemon* 'Kings Park Special', *Melaleuca armillaris, Grevillea* 'Ivanhoe' and *Grevillea obtusifolia*. Two commercial potting mixes were used, supplemented with different rates of diatomite. The physical ingredients and nutrient status of the commercial mixes is shown in Table 3.

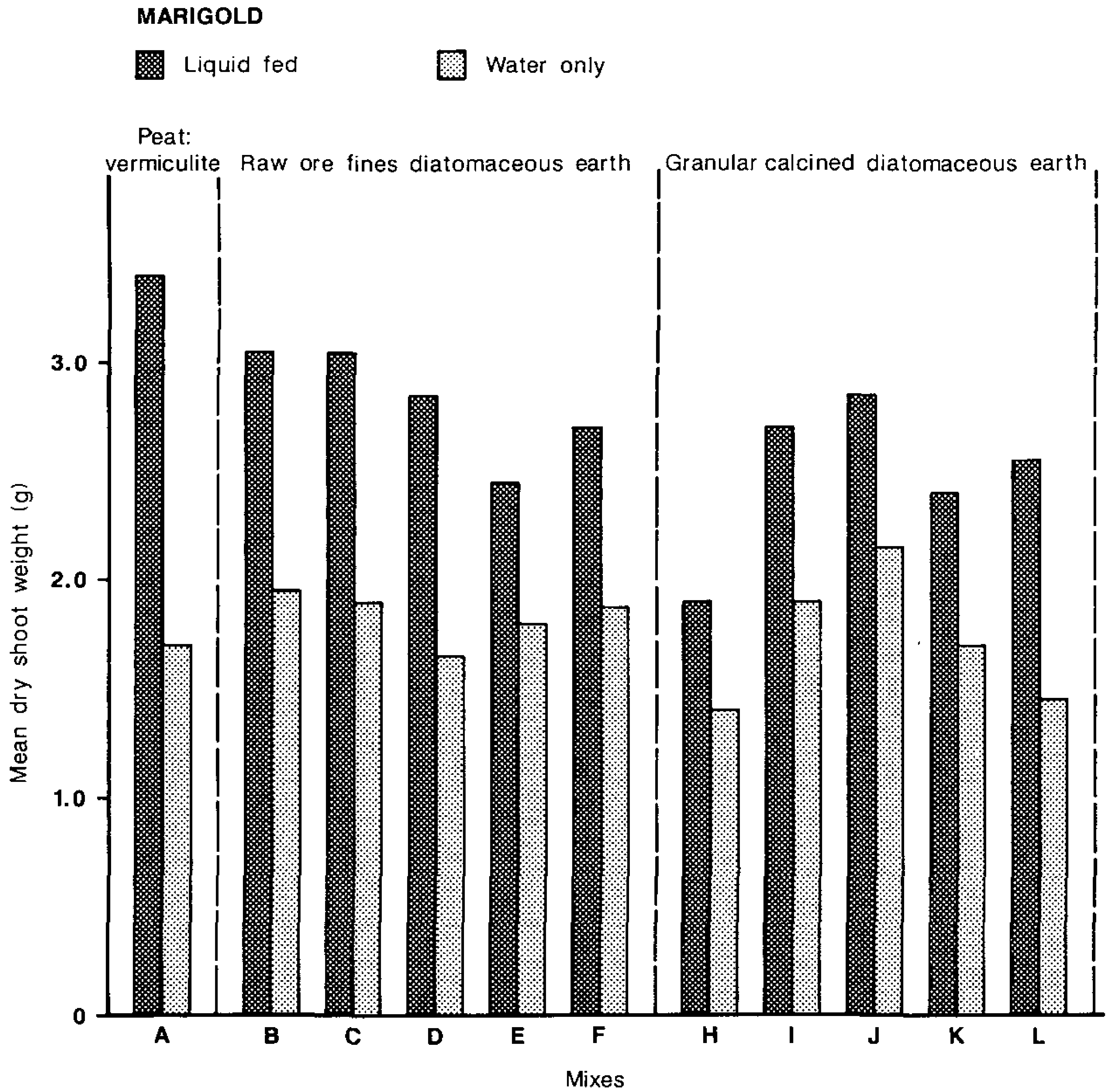

Figure 3. Mean dry weights of marigolds grown in a range of mixes with diatomaceous earth.

Raw ore fines and calcined diatomite were mixed with the commercial mixes in the proportions shown in Table 4 which also shows the pH and electrical conductivity of each mix.

Rooted cuttings of each test species were selected by the author at a large local propagation nursery. The rooted cuttings were potted up into tubes and grown on prior to potting into 150mm diameter, 1.5 litre growing pots. Plants were rigorously sized-graded prior to final potting in order to provide as uniform material as possible; 12 plants of each of the four Australian natives were potted into each potting mix. The trial was terminated 6 months after the final potting when overall plant heights and dry weights of aerial portions were determined. The results are shown in Table 5 and 6.

CONCLUSIONS

No differences were observed in the emergence and growth of tomato and onion seedlings in a range of mixes containing different

Table 4. Composition and properties of Australian native mixes.

Mix	Composition (% by volume)				Properties	
	Commercial Mix 1	Commercial Mix2	Diatomite (r.o.f.)	Diatomite (calc.)	pH	E.c. (μScm^{-1})
A	100	0	0	0	5.1	1590
B	75	0	25	0	6.8	1200
C	75	0	0	25	6.7	1541
D	50	0	50	0	8.7	755
E	50	0	0	50	7.5	1475
F	0	100	0	0	6.3	1117
G	0	75	25	0	7.4	600
H	0	75	0	25	7.0	997
J	0	50	50	0	8.8	713
K	0	50	0	50	7.6	937

Table 5. Plant height (cm) 6 months after potting.

Species	Mix 1					Mix 2				
	Neat	25% diatomite		50% diatomite		Neat	25% diatomite		50% diatomite	
		(calc)	(rof)	(calc)	(rof)		(calc)	(rof)	(calc)	(rof)
Callistemon 'Kings Park Special'	39.5	62.0	57.0	67.0	49.0	71.0	67.0	60.0	72.0	64.0
Melaleuca armillaris	69.5	95.0	88.0	97.0	84.0	105.5	105.5	97.0	111.0	92.0
Grevillea 'Ivanhoe'	77.0	87.0	79.0	87.0	43.0	87.5	79.0	64.0	86.0	45.0
Grevillea obtusifolia	—	—	—	—	—	—	—	—	—	—

Table 6. Shoot dry weights (g) 6 months after potting.

Species	Mix 1					Mix 2				
	Neat	25% diatomite		50% diatomite		Neat	25% diatomite		50% diatomite	
		(calc)	(rof)	(calc)	(rof)		(calc)	(rof)	(calc)	(rof)
Callistemon 'Kings Park Special'	17.4	33.2	30.1	36.9	28.9	31.2	32.3	24.4	40.2	33.1
Melaleuca armillaris	30.9	51.1	38.0	57.1	42.5	46.3	54.0	42.9	50.4	39.7
Grevillea 'Ivanhoe'	38.4	48.7	42.8	58.6	10.5	41.7	46.8	48.0	49.2	16.3
Grevillea obtusifolia	19.8	25.7	24.0	28.0	25.8	24.0	26.0	21.5	17.5	died

grades of diatomite.

Growth of marigolds was commercially acceptable in all mixes but the best results were obtained in mixes containing the raw ore fines grade. This is thought to be due to the fact that the unprocessed 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.

Acknowledgements Thanks are due to Australian Diatomite Mining Pty. Ltd. who provided the initiative for these studies, also to Hawkaid (the Research and Development unit of Hawkesbury Agricultural College) who provided valuable administrative assistance.

APPLICATION OF PHOSPHORUS TO PROTEACEOUS PLANTS

ADRIAN BOWDEN

Plantex Australia Pty. Ltd.
62 Thomas St.
South Lake, Western Australia

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.