ORCHIDS IN NEW ZEALAND

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ORCHID PRODUCTION AND POTENTIAL

David J. Brundell Ministry of Agriculture and fisheries Horticultural Research Station, Pukekohe

Last year I visited the United States of America, England, France, the Netherlands, the Federal Republic of Germany and Singapore, primarily to investigate aspects of the culture of orchids. I also had the opportunity to witness the production of other cut flowers and ornamental crops under protected cultivation. While much time was spent at research stations, I was also able to visit numerous commercial operations (usually with research or advisory officers).

I will limit this discussion mostly to standard cymbidiums, our most significant export cut flower crop. I will however allude to other genera such as Paphiopedilum and Phalaenopsis as there is interest in these types and they will serve to illustrate a point.

I will also limit this discussion largely to environmental and nutritional factors affecting crop production and then only after they have been taken out of tissue culture.

PRODUCTION OF DATA

With production costs ever increasing, the greater the number of blooms we can produce and market from our holdings, the greater will be our profits. Especially for cymbidium orchids, I qualify that statement by assuming we have planted the correct cultivars in terms of market acceptance.

While not always applicable, the most satisfactory way to express production is on an area basis, rather than on a plant basis (i.e. blooms per square metre rather than blooms or spikes per plant). This makes discussions on factors affecting production, especially environmental factors, more meaningful as it takes into account plant spacing as well as (including) that area set aside for paths.

Detailed quantitive data on production is very limited. In California 100 blooms per square metre was quoted as being a good overall level of production for cymbidiums and one Santa Barbara grower was reported to be achieving 150 blooms per square metre.

In the Netherlands, where over 100 ha of cymbidiums are grown, 85 blooms per square metre is considered good.

In New Zealand, however, similar data are very difficult to establish due to the relative small size of holdings and the large number of different cultivars and seedlings grown.

GENETIC FACTORS

Cultivar selection is of utmost importance for both market acceptance and maximum flower production. While literally thousands of cymbidium hybrids have been made, breeding has been largely biased towards producing a vast diversity of floral forms (often only subtly different), and very little information has been documented on the commercially important aspects of flower productivity. Plant supply catalogues only scantily refer to this aspect of flower production and growers must depend on the (possibly biased) opinions of breeders or other growers.

Accordingly, cymbidium cultivar selection for cut flower purposes requires rationalisation. The typical situation on commercial units in New Zealand, where very many different clones (with relatively few plants of each) are growing closely together is not conducive to efficient cropping. Cultivar evaluations and recommendations are best organised by grower groups ON AN INDUSTRY BASIS and should be made in light of market requirements (bloom colour, size and form, numbers of flowers per spike, time of flowering, maximum bloom life).

This sort of approach has taken place in the Netherlands even though there is intense competition between growers. It is interesting to note that a lot of their growers are only aware of their cultivars in terms of a code number. While on this subject I remember one grower in the Netherlands, who had over two hectares of cymbidiums, telling me he was hoping to reduce his total number of cultivars to nine. While you as growers are aware of all the subtleties of colour and form, I wonder whether the ultimate buyers are so concerned. It is worth noting that the bulk of the tropical cut flower orchid trade, worth many millions of dollars, is based largely on a handful or so of different cultivars. This is also the situation with the other major cut flower crops.

ENVIRONMENTAL FACTORS

Temperature

When orchids in general and cymbidiums in particular become commercially exploited, it was thought that they all grew best in warm shaded green-houses. This was in spite of the fact that most cymbidium species originate from the Asiatic highlands where the temperatures can be rather cool, falling to 4—5°C during the day and to 0°C during the night during certain months of the year (Vacin, 1952).

It was experiments by Rotor (1952) that started to quantify the temperature requirements of cymbidiums by showing they required a cooling period for flowering. Kept constantly above 18° he showed that they did not flower, but did so if they were held at 13°. Went (1957) also showed that cymbidium plants kept at 23—26° during the day and above 14° during the night did not form inflorescences. Lowering the day and night temperatures to 20° and 10°—14° respectively for 1—3 months produced inflorescences.

Some people consider a large variation between day and night temperatures over the summer necessary for maximum flower production. Research, again in the Netherlands, has shown this is not the case and in fact day AND night cooling over the summer was conducive to both maximum flowering and new shoot production.

In grower terms this means keeping the crop as cool as possible over the summer. In other words, plenty of ventilation. Unfortunately, even in some of our open-sided houses, this physiological requirement is not being fully met.

As well as keeping the crop as cool as possible over the summer, the Dutch recommend minimum temperatures over the rest of the year that are notably higher than for most of our cymbidium holdings. This warrants closer consideration. Can we afford to have a third of the crop not marketed due to frost damage? This was the situation on a number of New Zealand units last year. Further, the incidence of other bloom disorders such as petal spotting and blackening of the pollen caps would be minimal if the cropping environment was better controlled, especially over this winter period.

For the future it seems worth considering ways and means of keeping our cropping structures warmer (other than in the summer months), by having better insulated structures and possibly some form of additional heating. With higher solar radiation than many overseas producing areas, this additional heating may not mean a lot in terms of extra energy. Further, with a warmer cropping environment over the winter, especially in conjunction with summer cooling, flowering would likely be advanced (to a more favourable pricing period).

development. Raising minimum temperatures is the most effective way of improving growth of young plants and would produce economic dividends by significantly reducing the time to first flowering.

Light Intensity

Cymbidium orchids have a high light requirement for flower initiation

Further research is however required to better define this requirement level, especially as the heating component is not always easy to disassociate from the light component. This is particularly the

AMOUNT OF LIGHT NEEDED BY SOME ORCHID GENERA

	(lux*)
Cymbidium	80,000 — 10,000
Oncidium	40,000 — 18,000
Odontoglossum	20,000 — 7,500
Phalaenopsis	15,000 — 6,000
Paphiopedilum	10,000 — 2,000

Source: Kronenburg, 1976

*Full summer sun is approximately equivalent to 100,000 lux (or approximately 10,000 foot candles)

Temperature (heating and cooling) regimes are used, especially in the United States, to manipulate the crop harvest date to coincide with holiday periods when prices are considerably higher (e.g. Christmas, Easter, Mothers Day).

Young cymbidium plants have a different temperature requirement than flowering sized plants. For optimum growth and development the Dutch recommend 15°—20° minimum temperatures for such material. Thus the common practice in most of New Zealand of having young stock in the same (cold) environment as adult material is not conducive to optimum

case when crops are grown in enclosed structures where reduced air movement can interfere with the natural cooling mechanisms of the plant. This point highlights the requirement for good ventilation, particularly for cymbidiums over the summer. As we find better controls of the greenhouse environment, particularly temperature (and especially leaf temperature), we expect improved growth and productivity from higher light levels. As with all plants there will be an upper limit response to light intensity so adult cymbidiums should be given as much light over the non-blooming period up to the point of inhibiting leaf growth.

These points also apply for young cymbidium plants although the absolute intensities for optimum growth may be lower than for adult plants.

While high light levels (combined with lower temperatures) are required over the late spring and summer to promote flower initiation, such levels over the flowering period can adversely affect bloom quality and shading may be required. Instead of permanent shading over the crop for the whole of the bloom period, as is the case here, it was common on the newer cymbidium houses in the Netherlands to instal shading screens that automatically cover the crop only when the light intensities were critically high. Such an automated system overcomes the negative effects of unnecessary shading.

This screen also has an important additional function of insulating the cropping structure at night thus keeping the house naturally warmer or reducing the energy to heat the structure. Thermal screens are in almost universal use in central Europe for all greenhouse crops regardless of whether they are required for shading purposes.

Humidity

In this country we are not so concerned about low relative humidities which can be readily rectified by introducing water into the greenhouse atmosphere.

High relative humidities may increase disease problems, especially over the bloom period. Petal spotting and the blackening of the pollen caps, both serious problems in our cymbidium crops, will be significantly improved by preventing very high humidities.

Unfortunately most cymbidium growers in New Zealand have no means of controlling humidities apart from adequate ventilation. In most greenhouses overseas, high humidities are controlled by forcing air around the house, either through perforated ducts or by the use of turbulators. Heating is a very effective means of controlling high humidities as only a few degrees rise in temperature can lower humidities to below critical levels.

NUTRITIONAL FACTORS

Growing Container

The type of container in which to grow cymbidiums does not appear to be critical. From the flask, cymbidiums seem to grow equally well in flats or individual pots. As in New Zealand, a vast array of container types are used overseas for subsequent potting on. Cost is obviously an important consideration in this regard. It was interesting to observe that the black planter bags, commonly used in New Zealand, are not used at all overseas.

While some growers had containers at ground level, most felt that having them 20—80 cm up on open benches is preferred for better air circulation, effective heating and less contamination by soil borne diseases.

Both in the United States and the Netherlands, bed culture had been tried but rejected, largely because of management and disease problems.

Growing Substrate

In New Zealand all manner of materials are included in the cymbidium growing substrate. Often these mixtures are unnecessarily complex.

The substrate's function is to provide physical support and to allow a supply of water, oxygen and nutrients to the plant. Local research is required to develop a satisfactory substrate for cymbidiums that meets these needs and can be reproduced consistently at a satisfactory cost. This is necessary if associated problems of the nutrition and watering are to be overcome.

In the United States, cymbidium substrates are largely bark based. In the Netherlands and Germany however, peat based substrates are virtually exclusively used. Sometimes other products such as pumice polystyrene beads, polyurethane chips are included to improve aeration.

With certain peats becoming scarcer and increasingly more expensive in the Netherlands, attention is being turned to exclusively synthetic substrates such as 'Rockwool,' an expanded rock with excellent aeration and water holding capacities and a uniform composition (hence predictable nutritional responses).

Nutrition

Nutritionally, the cymbidium plant is similar to other plants in that it requires various major and minor elements for growth. Also like other crops, proper balanced fertilisation is essential for maximum growth and sustainable flower production. It is the major elements, and usually nitrogen, which have most effect on growth and development (Davidson, 1975).

The nutritional requirements, like the environmental requirements, of cymbidium crops in New Zealand need rationalising, for these practices are almost as varied as there are growers. By standardising their substrates, the Dutch and the Germans have made real headways in rationalising the nutritional requirements of this crop (Penningsfeld, 1976; Schenk, 1976).

For example, virtually all adult cymbidiums in the Netherlands are grown in an exclusive (50% hard lumpy; 50% soft fibrous) peat substrate containing the following base fertilisers (per m^3): 7.0kg Dolomite lime, 0.5kg 'pg' mixture (14N:7P:15K + TEs).

The 'pg' mixture is a soluble compound fertiliser (produced by Windmill Holland B.V.) supplying, in a low salt concentration form, nutrients except for calcium and magnesium (which are in the dolomite lime).

On the basis of regular (two monthly) substrate analyses, dolomite side-dressings are applied (up to 4—5 times annually) to maintain the substrate pH in the 5.5—6.0 region. Again depending on the nutrient levels in the substrate various completely soluble compound fertilisers are applied, at the rate of 0.5—1.0 g/l of water, from twice weekly to once every fortnight. Trace elements are usually included in these compound fertilisers but these can also be applied separately (particularly iron chelate) once or twice a year.

Research in the United States and the Netherlands has shown that nitrogen and potassium levels of the substrate have a significant effect on shoot growth and subsequent flowering of cymbidiums (Lunt and Kofranek, 1961; Schenk, 1976).

High nitrogen programmes on bark favour vegative growth at the expense of flower production (Lunt and Kofranek, 1961). Heavy nitrogen fertilising for 2—3 months after flowering followed by light nitrogen programmes achieve good vegetative growth without adversely affecting flowering the following year. This conclusion is echoes in the nutritional programme at Bianchi Orchids in New York.

Similarly in the Netherlands, higher N:K ratio fertilisers are applied in the early summer with increased K ratio fertilisers applied over the winter.

In the Netherlands young cymbidium plants are grown in an exclusively soft fibrous peat substrate to which dolomite lime and fertilisers are included. Side dressings of completely soluble compound fertilisers are applied

BIANCHI ORCHIDS LIQUID FEEDING (ppm)

	Spring	Summer	Autumn	Winter
N	120	150	120	75
P	35	35	35	35
K	90	130	90	85

Source: Davidson, 1980

LIQUID FERTILISERS (New Zealand dates)

TYPES	4.5 N : 1.5 K	4.5 N : 2.0 K
Early	August—February	March—July
Mid	September—March	April—August
Late	October—April	May—September
Promotes	Vegetative growth	Flower development

Source: Boertje, 1980

regularly to promote vegetative growth.

Watering

As the plant extracts water at a faster rate than the nutrients, salinity problems can arise as the substrate dries out. Apart from wilting, it is additionally important to avoid water shortages in the root zone.

Provided the substrate is sufficiently well aerated, keeping it close to field capacity for most of the time allows the maximum responses to added fertilisers.

Capillary watering, while it has not been evaluated with cymbidiums, is most successful in the watering of nursery and other crops growing in soil-less substrates. This method of watering, especially for smaller plants, may be one way of ensuring water is always readily available and makes efficient use of added fertilisers without the risk of salinity problems. As this watering method can be readily automated, this may be a way of substantially reducing the time spent on this very labour intensive operation.

CONCLUSIONS

Cymbidium orchids are generally well suited to New Zealand's environment and acceptable yields are presently being realised. However, in an increasingly competitive situation crop management practices will be under closer scrutiny to ensure optimum yields of top quality blooms continue to be attained.

Because of New Zealand's unique temperate climate with generally high light levels, and because different plant substrate and fertilisers are available to us, the direct translation of European and United States research results to cymbidium growing in this country is impossible. Recommendations from these countries must be confirmed for New Zealand. Presently, environmental and nutritional trials are under way, and more planned, on young cymbidiums. As our tissue culture derived plants mature we will also look at the effects of these and other factors on flower initiation, flower production and flower quality.

From such research, hopefully information will come to help ensure cymbidium orchid production in New Zealand remains a viable proposition.

PUKEKURA CORNER

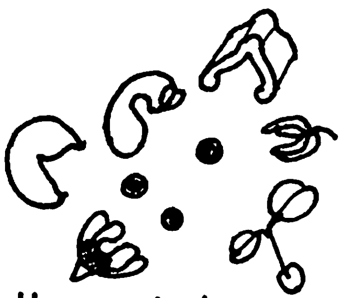
By George Fuller, N.D.H. [N.Z.],
Curator Pukekura Park, New Plymouth.

I beg your pardon.

THE BOTANICAL ILLUSTRATOR

Boo!

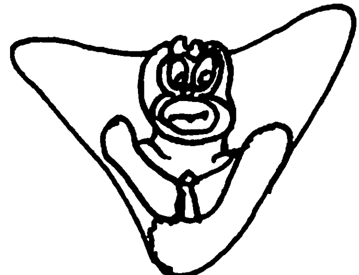
Every calling, however noble, has it hazards stemming from misinterpretation. As examples, ponder on the role of the politician, masseur and scout master. The Botanical Illustrator, particularly in the field of orchids, is no exception.



Hungry little enzymes.

I once roused the indignation of a very serious German orchid enthusiast by returning to him a copy of the original description of a paphiopedilum species with the line drawing of the fascinating staminoide section vandalised into an equally fascinating caricature of himself. He gave a very colourful verbal description of what he thought of my efforts and it wasn't without an element of humour, in all fairness.

The exchange was brought back sharply to mind when just before Christmas I was delighted to find in the local booksellers 'A FIELD GUIDE TO NEW ZEALAND NATIVE ORCHIDS' by Dorothy Cooper. It was a great relief to find at last such a concise, handy, yet quite authoritative and comprehensive work on this subject and when I got as far as the line drawings my imagination ran riot. I do not wish to detract from the technical quality of the drawings for they are excellent and help to place the book in a very special category but I am now firmly convinced that an essential feature in the training of a botanical illustrator must be a year spent with the renowned author and illustrator of childrens books, Dr Seuss!

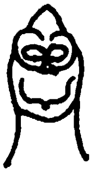


Ouch — these damned new-fangled chairs.

Accurately describing and identifying orchids is very serious work, to which my frivolous outlook is not entirely well suited, for, from practically every page of drawings I see leaping figures of fantasy comparable to the best of Dr Seuss. Some I have copied but there is a fertile field for imagination, some perhaps unsuited for publication in a journal of this nature, so I can guarantee a level of interest for even those not directly concerned with identifying native orchids, but with at least a sense of humour.

---aaaagh!

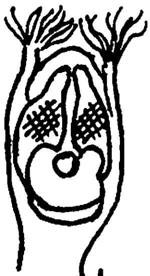
Laaadies and gentlemen...



Inflation will be held down to 25%.

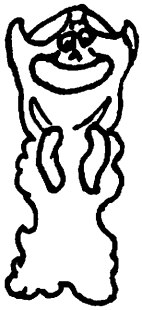
In drafting this unscientific piece of nonsense I have probably risked losing many friends and may even have had a profound restricting influence on the future of botanical illustration, for instance, what will Dorothy think when she next puts pen to paper? Writing under this worthy heading I might even lose my job, but there again, that is one of the hazards of MY calling!

Please, teacher.

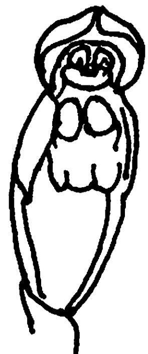


Hic!

Look, no hands!



Dr. who?



Grandma, what big eyes you have.

To those anxious to extend their knowledge of our native flora and endeavouring to achieve some order in the naming of plants found in the wild, this is a long awaited book which will be of tremendous assistance and the flights of fantasy are a bonus.

Illustrations adapted by George Fuller with humble apologies to Dorothy Cooper.

GLASSHOUSE SHADING

by George Fuller

The following formulation provides shading which can be applied to glass to reduce sunlight penetration.

Provided that conditions allow for thorough drying before the first rain, the covering is reasonably resistant to normal summer weather conditions yet can still be removed with relative ease.

Requirements:

Whiting: Obtainable from paint suppliers. This may contain impurities and needs to be screened if the shading is to be applied with a sprayer.

Raw Linseed Oil: Acts as a bonding and sticking agent.

Minteral Turpentine.

Two 10 litre buckets

Metric Measures

Screen: Whitebait — mesh type.

Quantities

To Make 10 litres: 5 litre (Dry measure equivalent) Whiting.

600ml Raw Linseed Oil.

60ml Mineral Turps.

Procedures

Take approximately 7 litres of water and sieve over the surface of 5 litre dry measure of whiting. Sieving is very important to avoid Jumpiness and remove extraneous matter. Mix thoroughly by repeatedly pouring from one bucket to the other.

Mix separately 600ml raw linseed oil with 60ml of turps before adding them to the above. Repeat pouring from bucket to bucket to ensure thorough mixing.

Make up to 10 litres with water.

Adjustment of density to suit different methods of application can be made by varying the water-to-whiting ratio.

Application

Apply only when drying will be rapid. If greater density is required, it is better to apply several thin coats rather than risk "runs."

In effect, the above constitutes a very fluid form of putty with good adhesion.

CYMBIDIUM COMPANIONS

by Ros Bickerstaff

ORNITHOPHORA, Joao Barbosa-Rodrigues

This genus has but one species, O.radicans, which comes from Brazil. The derivation of the genus name means "a bird's eye (or eyelash)" but it is not clear what this refers to. The only species is a small, dainty plant with a cluster of 5—6mm white, yellow-lipped flowers displayed on an arching raceme. Best grown in pots in sheltered positions where it can have plenty of light. Any fibrous, open mix seems to suit; don't over-water.

PAPHIOPEDILUM, Pfitzer

Many of the older growers, and books, still give them the old name of Cypripedium. The true Cypripediums come from temperate parts of North America and a few from the Himalayas, whereas Paphiopedilums come from the

Himalayas through South East Asia to some of the islands of this area. Both names are variations of the name "Venus' slipper" (podion — slipper, pedilon — sandal).

The Paphiopedilums grow easily if given the correct conditions. They need a shady position, kept lightly moist (not wet) because they have fibrous roots and no pseudobulbs, and rot readily if water lodges in the leaf axils. The mottled leaf species usually require a little more warmth than the green-leaved species, although both can be grown together in sheltered positions. If making divisions of these plants do not break them up into too small a division, or they will miss a season or two in flowering. Most of my plants flower each year. I pot in a moisture retentive mix of moss and fibre with a little fine bark and pumice, and sometimes a little peat moss. At present, in my unheated glasshouse, I have in flower P.insigne, P.leeanum, P.leeanum 'giganteum', P.villosum, P.emery, P.venustum, P.maudiae, P.maudiae 'coloratum', P.St Albans, and P.harrisanum. Also doing well in the same conditions are P.barbatum, P.callosum, P.hirsutissimum, P.spicerianum, P. exul, P.sukhakulii, and P.clair de Lune. These will flower, for me, in spring to early summer, although for most growers they flower in early winter. Most of those species originating in Malaysia, the "Bird's Nest" Islands, Thailand, Java, Borneo, and the Philippines need warmer conditions.

PHAIUS, (PHAJUS), Loureiro

These terrestrial plants are found over a wide area from Africa, Madagascar, India, China, South East Asia and Australia. To grow successfully this genus likes a sunny, sheltered corner with an abundance of moisture when in full growth, but kept fairly dry during the period of rest. This genus is well named — phaios in Greek means brown, and the predominant colour of the species' flowers is brown; this colour is usually on the outer surface, while the inner surface is quite brightly coloured. The compost should be quite rich to get the best growth out of the developing bulb so that it is ready to initiate flowers. I use peat, moss, bark, coarse native sawdust, and animal manure with a dusting of blood about every two months.

As the foliage is very thin, it should be kept as dry as possible; water on the leaves causes ugly brown spots to spoil the appearance, and continued dampness turns them black with botritis. Outside, the sun, shining on any of its leaves when damp severely sunburns them. I use trickle irrigation to solve this problem. At present I am growing P.tankervillae (syn. P.tankervilliae), P.maculosa, P.mishmiensis, and P.wallichii.

PLEIONE, D.Don

This is a delightful genus to grow. To see a container packed with flowering bulbs is one of the pleasures I look forward to each year. In Greek, pleion means "more," but whether pleione is derived from this word I am not sure; I only know that I always want more and more, but this is easily satisfied as each bulb makes two or three new bulbs, and has quite a number of small off-set bulbs at the top of the old bulb each year. These small bulbs can be grown to flowering size in one to two years, whereas the larger bulbs from the base give flowers next season.

Pleiones come from the Himalayan mountains, Burma, Thailand, China and Formosa. They grow in cool, sheltered conditions with moisture constantly available. I pot annually, as soon as new growth is evident at the base of the old bulb, in bowls of sphagnum moss which sit in trays of water. I do not rest my plants, as some growers advise, but keep them wet at all times. P.formosana (syn. P.pricei) grows easiest attaining bulbs of 4cm. I also have the autumn flowering species P.praecox and P.maculata but these do not do so well for me.

Sarcochilus, Robert Brown.

These plants grow from India, through South-East Asia, to Australia. It gains its name from two Greek words meaning a fleshy lip, — sarx, sarka and cheilos. Although some of the Australian species are obtainable, I grow the one most commonly seen in this country — S. hartmannii. According to the books, this genus should be grown warm, but I have found that it enjoys a bright, sheltered spot where it can dry out thoroughly between waterings. It has a tendency to "sulk" for more than a year after being divided, and on regrowth it makes numerous leads and keikis, becoming quite a big plant in a few years. It is a prolific flowerer throwing many spikes of beautiful flowers which do not last more than a few days. I use a coarse mix of equal parts of bark and pumice. When spikes appear, beware — snails, slugs and caterpillars enjoy eating them for supper.

Sobralia, Hipolito Ruiz Lopez and Jose Antonio Pavon

This genus is found from Mexico through Central America to Peru, mainly in the Andean mountains. Although mainly terrestrial, some species are epiphytic or lithophytic. It derives its name from Martin Sobral, the botanist. Probably, the most common species in cultivation in New Zealand, the Mexican-Costa Rican species, S.macrantha. It has a reedlike stem about a metre in height. with plicate leaves and large pink Cattleya-like flowers which open successively for four to five weeks. Give a well-fertilised, open Cymbidium compost and water well when in growth; needs plenty of sunlight to flower well. N.B. — these plants take a long time to recover after repotting — often up to a few years.

THUNIA, Reichenbach filius.

This is a terrestrial genus named after the Bohemian Count von Thun Hohenstein of Tetschin. It is found in the mountainous country of North India and Burma. It is not a large genus, having only about eight species, but some of these have been hybridized, producing delightful flowers. These flowers are borne in a cluster at the top of tall canes. They are large and pendulous, usually white with coloured veining in their throats. After flowering is finished, the leaves fall and plants must be rested cool, with practically no watering, through the late autumn and winter until new growths are well-formed. Pot in a well-drained compost of peat, bark, pumice and dried animal manure. Give plenty of light and moisture when in full growth. I am growing T.alba, T.Marshalliana and T.x gattonensis.

Fertilisers and Orchids

P.C. Tomlinson, Wellington Orchid Society

As someone who has just caught the affliction of orchid growing, I have obviously been interested in learning about their culture. One very important element in that culture is the correct feeding of the plants. One reads numerous recommendations and suggestions and it can be difficult to identify the programme best suited to the plants growing under your system of culture. An appreciation of what fertilisers are and the basic principles of their application can assist in the selection of the most efficient and economical programme. It is hoped these notes will be of interest and assistance to those giving consideration to this aspect of their orchid management.

What an orchid comprises

Did you know that the average orchid plant comprises mostly water? This makes up around 90% of the weight of an average plant. Different parts of a plant will contain more or less than this, which will be fairly obvious if one looks at a plant. The leaves, for example, contain around 93% to 95% water, the stem 85% and flower spike 80%. Obviously some plants are more lush than others, but it is often surprising that the tissues contain such quantities.

If all this liquid is removed one is left with a small quantity of material — the dry matter. This can be analysed to ascertain what mineral elements or salts the plant has utilised in its growth. Such analysis can be useful to ascertain the nutrition of a plant, and can assist in the formulation of fertilisers.

A typical analysis of a plant will reveal the following. If one has a specimen weighing, say, one kilogram, 900 grams or 90% of its weight will be water. The 10% dry matter (100 grams in a 1 kg. plant) will contain the following. The figures show not only the elements as a percentage of the dry matter weight, but also, in the example of a 1 kg. plant, represent the weight of each element present in grams.

Element	Percent	
OXYGEN	44.5	
CARBON	43.5	
HYDROGEN	6.0	94%
NITROGEN	1.5	
PHOSPHATE	.2	
POTASH	1.0	
SULPHUR	.15	
CALCIUM	.2	
MAGNESIUM	.15	3.2%
		97.2%
MANGANESE	.04	
BORON	trace	
COPPER	trace	
IRON	.08	
ZINC	trace	
MOLYBDENUM	trace	
CHLORINE	.15	
Aluminium	.1	
Silicon	1.2	2.8%
	TOTAL:	100%

Of the total analysis 94% of the dry matter is made up of only three elements — carbon, hydrogen and oxygen. The balance of the materials in the dry matter contains a number of elements, some of which are essential for plant growth to take place, and some which are not required at all. Of the elements in the above list, the last two — aluminium and silicon — serve no purpose in the plant, and have, with some other unlisted elements, been picked up accidentally by the plant.

If these are absent, there will be no effect on plant growth and development.

The thirteen other elements essential for growth fall into two main groupings. Seven elements are present in the plant and required from the environment in minute quantities and are known collectively as the "trace elements." These are often measured in parts per million, or maybe only seen as traces, and are manganese, boron, copper, iron, zinc, molybdenum and chlorine. These elements are generally naturally available in the environment except in exceptional circumstances, or as impurities of applied fertilisers, and therefore growers do not have to make special efforts to meet the plant's requirements for them.

Six elements shown in the above list have not so far been discussed and, with carbon, hydrogen and oxygen, comprise the group of "major nutrients." The six are nitrogen, phosphorus, potash, sulphur, calcium and magnesium, which together make up 3% to 3.5% of the dry matter. The names of these elements will be recognised as being the ones most fertilisers aim to supply, as they are most likely to be in short supply in the environment. Other elements can affect plant growth, but do not have the influence and importance of the above in allowing the plant to grow fully.

Why fertilise plants?

All living things need to obtain materials and energy from their environment to enable them to grow and function. Complex chemistry is involved, but it has been shown that the processes require certain basic chemical elements to be present to to enable the plant to complete its vegetative and reproductive life cycles. Should any of the elements known to be essential not be available aspects of the plant's growth will be inhibited, and it may even die.

Carbon, hydrogen and oxygen are supplied by the atmosphere and water, and normally are readily available in the quantities required by the plant. The other elements are contained in the soil or in solution in the water. Fertilisers are involved with the supply of those elements present in the environment in insufficient quantities for the plant's requirements, or ensuring the materials are present in a form that enables them to be easily utilised by the plant in the completion of its normal growth cycle.

If any of the sixteen essential elements are in short supply, plant growth will be reduced. Plant growth is regulated by the factor present in the minimum amount in relation to the plant's requirements of each element. Growth rate rises and falls depending on whether the supply of that growth-limiting element is increased or decreased. If, for example, two nutrients are responsible for limiting plant growth, adding only one of them will have little effect, but supplying both will lead to the plant being able to increase its growth substantially and achieve its full potential as allowed by its genetic make-up and environmental situation.

In addition to an adequate supply of the elements required, for growth to take place the following factors must also be present:

— Suitable temperature levels
— Adequate moisture
— Adequate light levels
— Adequate air supplies

Even if mineral levels are satisfactory, growth can still be reduced or affected if all the above environmental factors are not also available in satisfactory amounts. Thus the importance of maintaining all cultural elements at optimum levels cannot be over emphasised if maximum results are to be achieved.

While adequate mineral levels are important, the presence of some in too great a concentration can be dangerous, and can poison the plant. Over-fertilisation can lead also to weak growth that can be susceptible to disease.

A further factor related to the availability of nutrients and plant growth concerns the pH of the growing media and water; i.e. the degree to which it is either acid or alkaline. Generally orchids appear to appreciate a slightly acid medium in which to grow, a pH of between 5.2 to 6.5 being quoted in literature. Occasionally an unsatisfactory pH level may be encountered, and this must be adjusted. One of the most commonly experienced situations where pH correction is necessary is where pine bark is utilised in potting mixes. This material in its natural state has a high level of acidity, and treatment is necessary to make it suitable for orchid growing.

Fertilisers

The natural habitat, the orchid plant receives the necessary nutrients by way of the air and rainfall. The plants often grow in accumulated humus, and the natural breakdown of this also supplies much of the plant's needs. Bird droppings washed down from higher up also provide additional material.

To be continued

Just Think!

by F.L. Rowland

Growing orchids is fascinating, whether we grow them as a hobby, for pleasure, for fun, or even as a business. But a little thought will add that something which makes this venture even more absorbing. And there is an awful lot you can think about.

We have heard they are like children. True, they do have genes, and a mericlone or back bulb propagation has exactly the same combination of genes as the plant it came from. A seedling, however, has a mixture of genes from both the pod parent and the pollen parent, and this mixture includes inherited characteristics from grandparents, and right back to Adam and Eve. And this causes variations, not just to the colour of the eyes, but hair, skin, shape, size, etc. Just think what you can get from a seedling!

We are told that Cymbidiums are "gross feeders." But think about this. A tomato plant is fed heavily and often, and in a few months produces masses of bright fruit and then dies. Our Cymbidium, however, (and other orchids, too) takes a few years to mature, and unless you actually kill it, grows on for year after year — for ever as far as we know. Consequently, what is "heavy feeding" for tomato requirements is not the same as "heavy feeding" for our orchids. Or is it?

We know from experience that excess fertiliser ends up as "salts" in or on the pot, especially clay pots, unless thoroughly leached out with copious watering. Now, as they are like children, will they absorb excess feeding — becoming greedy — or does nature control the uptake according to requirements? Or, is it regulated by the amount and quality of the roots available to the plant? The writer has heard it said that mean feeding makes the plant put out more and longer roots in order to grab the food, and, conversely, that over feeding results in short stunted roots. True or false? Or is it something else again?

Think a bit more. Plants are living things as much as we are. Some members of the living community are vocal and can move about, but plants can only show their happiness or distress. So, when you walk past, just think of this and keep an eye open for the little signs that experience can indicate whether or not your plant is happy.

Again, feed your plants with TLC and lots of food, give them light and water in abundance, breathe over them, wash them down, and generally give them everything you can. And what happens? They don't bloom. One theory is that too much care makes the plant fat and lazy, whereas a certain amount of stern discipline (applied to yourself as well as to the plants) makes for a happy and productive life. And Nature has a way of producing extra seed (flowers first, naturally) to ensure the survival of the species if conditions are getting a little tough. This thought might just keep you awake for an additional ten minutes, but don't, whatever you do, lie awake and worry about it. Here also, Nature will take a hand, and when you awake refreshed after your sleep, you will think you have found the solution to more and better blooms.

A little thought does an awful lot.

CYMBIDIUM CULTURAL NOTES

MARCH — APRIL

by Gordon Maney, Palmerston North

March is a time when flower spikes will be showing in profusion and stakes, if used, should be put in place.

Slug bait must be applied once a week; remember the snails and slugs will find the spikes before you do.

Red spider is likely to be around because of the dry conditions and while regular watering of paths and benches is a help, plants MUST be sprayed. Kelthane, if you can get it, or Orthene. With both these sprays you must wear a mask, gloves and waterproof clothing. It is important to follow up your spraying 7 to 10 days later to kill the insects which will have hatched out of the eggs by then.

Check your plants for scale if you haven't already done so and use All Seasons Oil and Black Leaf 40 or wettable powder Malathion if necessary. Insects such as these do a great deal of damage to your plants.

Feeding now is vital to give colour and size to your flowers and of course strengthens the growths that are producing the spikes. From March, I dry feed with 4 parts Superphosphate, 4 parts Blood and 1 part Potash. This I put round the top of the plant, approximately 1 tablespoon to 10" bucket and this is watered into the plant in the normal course of watering. Repeat again for April. I do not dry feed again until September. Until the end of March I still feed each week with Phostrogen on the flowering plants as a liquid feed. In April, I switch to Nitrosol each week then once a month in May and June. The small plants I never stop liquid feeding using a variation of Nitrosol, Lush, Nitrophoska, Attlas Fish Emulsion etc.

An absolute must is thoroughly water today, feed tomorrow. NEVER FEED A DRY PLANT. I believe if you have overhead irrigation you must leave it on for two hours to wash out any build up of salts. If you are hand watering with a hose, make sure the water is running out of the pot. I have a rule — I never water after noon in summer or 10 am in winter. This will always give your plants a chance to dry out by night fall.

Remember that your houses should be washed down and cleaned, all weeds and rubbish removed as of course these harbour insects and bugs of all descriptions. It's a waste of time and energy to grow orchids if your flowers are eaten by bugs; and yet many thousands of blooms are thrown away each year because of this. Clean conditions give clean flowers.

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