GROWING BY CLIMATE

Ivan BARTON (IB)
Theirry TOMCZAK (TT)
David HANLON (DH)
Based at

YALTA ORCHIDS

83 Joalah Crescent
FERNY HILLS 4055
07 3851 0115
yaltaorc@.westnet.com.au

www/yalta.com.au

GROWING BY CLIMATE (GBC)
Updated 9/03/2006

WE LET OUR ORCHIDS TELL US HOW THEY WANT TO GROW!

INTRODUCTION

(From now on, for brevity in this document, IB, TT & DH – the GBC experimental group, will be replaced by, We, Our etc as 'the GBC group' has expanded somewhat.)

This is not a new way of growing orchids. Rather, We have developed a computer analysis system which can provide, quite quickly, simple, easy to understand results. We are now able to predict successfully the climate needed to grow hybrid orchids. There is no longer the need for novices to kill orchids, "to find out how they grow". We can tell them in which climates their orchids will grow best and what potting techniques are needed. The expert grower with extensive knowledge of many species' and hybrids' growing requirements, can augment his knowledge as a computer's data-storing facility is far better than that of any talented brain. An experienced and talented amateur orchid grower who, by trial and error, by reading etc, realises he is successful, can find, as We did, that you can be more successful if you grow in conditions closer to the centre of the hybrid's 'natural climate'

The computer age has arrived for orchids. Much data is now available on the web and We have harnessed some of this. Many successful growers, usually long term growers, carry thousands of pieces of data in their head and are capable of recalling and analysing them so they become successful growers. Since 1998 IB and TT have been carrying out trials of a computer-controlled system of growing orchids. **Initially IB, then both, made some 'talented' guesses. The orchids had their say and We have made changes to our theory. By the time DH[1] entered (about 2002) We were able to look at a problem and call on Our burgeoning GBC Theory to come up with a solution. While some of these solutions have yet to be verified, the success rate and the theory have snowballed.**

A book THE WORLD OF ORCHIDS by JACK ROSS published in 2001 was 'found' by Us in early 2005 and a Part D is included which evaluates both sets of scientific information. In the meantime we will use corroborating information **under the initials JR** .[2] Between the book and this document there is a massive scientific tie up which could lead to exact orchid growing but the question will become "What novice grower could absorb all the detail". What GBC has attempted to do is keep the results simple and hide the horrific computing behind them.

Dogma

Dogma in orchid growing, as with many human undertakings, has been rife. It is the way orchid growing has advanced over the years. Knowledge based on facts and not dogma, such as reliable information on growing conditions of the species has been accruing for years. There is now so much information that only a computer can handle it. We use about 3000 species in our program, the numbers building all the time. Hard scientific data, such as the specific details of pathogens, and knowledge of fertilizers, see **JR,** have multiplied so, again, a computer can be useful. (We do not use these.)

Never forget the 'old grower' who, by trial and error, keen observation and listening to others, found a way of growing orchids which was passed on as dogma, something which worked for that

---

[1] DH did most of our advanced checking.

[2] **THE WORLD OF ORCHIDS** A PRACTICAL GUIDE TO CULTIVATING ORCHIDS IN SOILLESS CULTURE, JACK ROSS AM Casper Publications 2001

grower, though the reason may not have been known e.g. the use of various bark mixes. GBC now says that, though the old grower may have been successful, he could have been, in many cases, 'more successful' by using Our information.

Consider this, '**O**ur **D**ogma': (OD1). **Orchids have been growing and adapting for thousands of years. Why do they die in our orchid houses? We feel that the long term adaptation of orchids, which controls their survival, is such that they cope best when growing in or near their 'natural' climate, a behaviour which is encoded in their alleles.**

Here is a critical examination just three of many pieces of dogma from orchid circles of the past.

Dogma A. 'Do not water orchids in Brisbane'. IB though this was a bit crazy when he first heard it in the early 80's. We now know it is one of the best pieces of advice to give anyone in Brisbane as about 60% of the orchids we have prefer a 'Brisbane-like' rainfall. The other 40% will not like it to varying degrees.

Dogma B. It was said of soft canes, 'to water til Anzac Day then hang them on a clothesline in full sun to dry out till they flower'. This worked pretty well as 90% of the softcane hybrids are more than 50% *Den nobile* i.e. effectively the same orchid. However, in the late eighties Sandy Anderson of Banana Coast told IB " Never let the stems wrinkle if you want good flowering" and since IB has vigorously pushed this, (OD 2). However, We now know, from GBC, that about 7% of the soft cane hybrids in our collections are different from the *nobile* stereotype. Hence, these are grown 'darker' whereas the *'nobile'* types are grown in full morning sun and/or light shade. Only the computer can delineate the exceptions quickly. Also, further research revealed that the climate Sandy suggested is not quite the correct one but one of the outer limits of *Den nobile*.

Dogma C. 'Grow all *Sophronitis* crosses cool.' This is basically incorrect. It is true that orchids with large amounts of some *Sophronitis* often need cool conditions, but in our collections only 13% of the *Sophronitis* group have a worthwhile amount of *Sophronitis* in them, as only traces can give the colour effects the breeders were after.

IB has a mathematical/scientific background and knows the vagaries caused by the random process of evolution. To stick with one life form, ORCHIDS, when he sees or hears a class statement such as "Cattyleas grow … this way…." he is adamant that they do not. The GBC group has about 1500 different hybrids/species and about 16,000 plants which have been experimented on (and experimentation continues) and has now defined dichotomies for which we can say for each hybrid **'THEY GROW THIS WAY'** with a 99+% reliability.

The random production of life forms renders it impossible to talk about/predict every individual form under group properties but when examining a large number of cases, normal curves and the statistics of life forms kick in. This means that nobody in their right mind would try to grow in their orchid houses the two Queensland orchids *Rhizanthella gardneri* or the 'Narcissus' orchid which grows symbiotically with large trees. But once a species is hybridised, it tends to lose its peculiarities and become a more 'normal' orchid. Very few hybrids, then, have caused Us any trouble, never the less a few species, less than 1%, do not fit into our dichotomies. One example of this behaviour is IB has been growing *Den. Linguiforme* from a plant bought in about 1982 from Kmart. Since the early nineties, following an Orchids Australia article, it was grown successfully on flat bags of sphagnum moss made out of shadecloth.[3] After GBC theory was developed, about 2003, it was classified a "RR" orchid (see later) and so it was 'grown' near the original plants (20+) in flat trays of 1cm deep sphagnum moss. This is a successful GBC way of growing RR orchids. Within six months all five trays were dead. But *Den. linguiforme x racemosum* grows happily in similar shallow potting conditions. IB has observed *Den. Linguiforme* dying on fallen she-oaks and so have others. Does this species only grow in a climbing position?

To put Our GBC theory into perspective, a rough summary of the impact of it is:-

A. **We now claim about 50-60% of the once common cultural problems are caused by growing orchids in the wrong climate**
B. **About 20-30% more of the cultural problems can be eliminated by observing the root habit and thence potting in special ways.**
C. **The remaining few percent of cultural problems have fertilisation, growing media etc in them and the basics of this are pretty well established in traditional orchid thought. Recognised media combinations would be lucky to cause a few percent of the problems, but many media have been misused in terms of the needs of A and B above. That is, it is not the media at fault but the way it is used.**

[3] IB accidentally copied the GBC growth requirements by observation – the theory came 20years later.

A. OUR CLIMATE THEORY

WHY DO WE CONSIDER **GBC** SUCCESSFUL?

?? THE UNEXPLAINED[4] DEATH RATE AT YALTA HAS GONE FROM ABOUT 30% per annum IN SOME CLIMATES, TO A RATE OF LESS THAN .1% IN ALL.

?? GREATER THAN USUAL FLOWERINGS

?? FIRST FLOWERINGS OF ORCHIDS WHICH HAD NOT FLOWERED IN 10+ YEARS

?? FIRST FLOWERINGS (AND HUGE GROWTH) OF ORCHIDS UNDER 3 YEARS FROM FLASK

?? INCREASED NUMBERS OF FLOWERINGS MORE THAN ONCE A YEAR.

?? HAVE THROWN OUT THE FONGARID – NO MORE ROOT ROT

?? NO LONGER HAVE A FUNGAL (?) DEATH KN0W LOCALLY AS BROWN ROT[5]

?? LITTLE BOTRYTIS NOW SEEN. (Once very common)[6]

It needs to be mentioned that TT has a background in computer technology and IB in Physical Sciences and Statistics. IB has been amazed at the way in which the BAKER & BAKER books[7], written by a meteorologist and a biologist, redirected IB's knowledge of physics to produce practical solutions to orchid growing. As a statistician, IB notes that no biological procedure for growing orchids can ever be exact, so the following will contain many estimated odds as percentages.

IB's researching started with growing orchids in matching sets in Sphagnum Moss vs Bark and it will become obvious that this has been central to the development of the final experiment. About 15% are still grown in bark. Because of success in adapting the medium Sphagnum Moss (SM) to the needs of **GBC** (SM more pliable than bark), We take its use for granted. **It is acknowledged that there may be better ways of using SM, and also that other media with similar properties may do just as well**. A series of statements must be made about the media, as it is so interrelated with the final result. Thus We feel that our **GBC** will apply quite well to all media but it is necessary to explain some interrelations. This will take place in Part **B.**

The Brisbane Climate

Growing in Brisbane is the basis for this work. The Brisbane area is a sub-tropical climate and 'standard trickery' has to be used here to create other microclimates. If you live outside SE Queensland, the principles, which follow, need to be adapted to other climates. The only artificial trickery we have used at YALTA is a convectional "glasshouse" to keep Phallies warm at night.

The climate we use as a basis is the Weather Bureau's average climate of Brisbane over the last hundred years or so (e.g. TABLE C). However from 13/11/2005, for an indefinite time, **because of global warming caused by the world's population explosion, and the resulting using up of the various national gross capitals, Brisbane is into about its sixth year of drought and so we have reclassified Brisbane as a "Tropical Desert Climate Q"** This is a warning to SE QLD growers only: **To get the water needs right, you must add water to make up Brisbane's old averages then for various cases add extra to make the wetter climates as is implied from now on.**

The development of 'The Climates'

About Aug 1997, as a result of purchasing Baker & Baker's books (1991, 1996), IB checked out his large orchid house and discovered it to be a disaster. Areas were set up to give better/correct conditions for *Dendrobiums*. Even these minor changes created miraculous improvements in growth and so a complete system was set in motion. The instruments in use were:

a. A 15 year old Practika camera bought for close up photography of orchids. (**It had a manual light meter.)**

b. A thermometer

---

[4] Deaths still occur when water sprinklers clog and at edges of sprinkling systems. If the cause is mechanical it is not counted in the death rate and this will normally occur only in orchids under solar weave which receive no natural water.

[5] These two fungal complaints are caused by the water borne fungi Pythium and Phytophora and the soil fungus Fusarium.

[6] An air borne fungus. Back in 2002, many of IB's orchids had about 4-6 clean new growths but the old pre-GBC leaves were full of 'botrytis' spots.

[7] Baker M L & Baker C O, 1991, *Orchid Species Culture: Pescatorea, Phaius Phalaenopsis, Pholidota,Phragmipedium, Pleione,* Portland, Oregon: Timber Press.
Baker M L & Baker C O, 1996, *Orchid Species Culture: Dendrobium,* Portland, Oregon: Timber Press.

c. A series of cylindrical orchid flasks.

This is all that was needed to apply the information in Baker and Baker. We rarely use these now as our system is now calibrated in other ways.

LIGHT

Here are a few of the results of measuring with a light meter. Prior to that, IB had used his eye despite knowing that the eye is not a 'linear' instrument but gives warped messages to the brain, depending on what the brain is used to seeing or wants to see. Consider these examples of Our thought process:-

- ?? The light under an orange tree, where *Cymbidiums* had been struggling was the same as inside a dark house, whereas, under a gum tree, it was OK for many orchids. The eye said both 'shades' were about the same light value.
- ?? Under clearish plastic, the critical angle of reflection[8] caused huge loss by reflection in morning and afternoon sun but let huge amounts through around midday. Light dispersing solar weave is now used
- ?? The grid of ordinary shade cloth will not let angled light through so orchids only get near a maximum measured amount for the middle four hours of the day and
- ?? Sidewalls are useless for letting effective light through (mainly weak reflected)– they do keep insects out and let the breezes in.
- ?? Be careful of shade cloth supports on the roof – arc mesh fencing actually blocks 14% of light

Hence we calibrate orchids in terms of the shade cloth needed to achieve the desired light values. '30% shade cloth' and dirty or used solar weave have the same shade values and are the basis of the climate calibration. Note that two layers of 30% equal 50% and two 50% make 75%.

For GBC we use five levels – 0% (direct sun), 30%, 50%, 75% and 75+%

In general, 9am till 1pm is the preferred sun time, as this avoids afternoon cloud in Brisbane.

TEMPERATURE

Most of Our orchids were on A-frames for other reasons, but a thermometer showed that when sun was on the shade cloth roof, convection currents caused a temperature difference of 3-5? from top to bottom of a two metre A-frame. While this difference has helped to create 'tropical heat' it did not get cool enough for cool temperate orchids. **Sub-classifications**, **HH** stands for hot or high and **LL** for low or cooler are used. **However 'LL' for Us represents a relative failure.** In Brisbane, fans etc may be needed to grow such orchids.

There is another subtype needed in Brisbane, specifically for Phalaenopsis which do not cope with recurrent cold nights. We use the symbol **CC** for this requirement. (global warming has neutered this problem of late)

A peculiar subtype has recently emerged. Many important breeding orchids, e.g. *Sophronitis* grow in the tropics but at higher elevations up mountains. The tropics create a small range of average temperatures but the heights coolness. These orchids require no long term heat nor long term cold. We use the symbol **WW**. The local, Brisbane warm temperature is what is left, we use **TT.**

RAINFALL

The basis of rainfall in Brisbane is, obviously, Brisbane's average (see Table C) and everyone knows that there can be huge swings, droughts to drenching. But orchids have been handling this for many thousands of years. Why fear for them now? One of the things We had to learn was to watch and admire an orchid coping with a drought situation. They can do it, if they are adapted for that. If watered because the climate is dry in, say, a Brisbane climate when the plant is supposed to be drying out, this seems to cause fungal root rots and death of plants. Of course orchids grow in rainfalls other than Brisbane's so two things are needed, watering systems and drying systems. Solar weave has been used to dry or protect from rain. IB used about a dozen electronically controlled spray lines but TT and DH use forms of hand controlled sprinkling and hosing. The sprays on spray lines used by TT and IB were calibrated by using the cylindrical flask so that the 'amount of rain' received per minute was known. Hence, the time for sprinkling needed to make up the required rainfall was worked out. It is to be noted that the three experimenters now use variations on the original calculations. Some will be mentioned later. Excess rain and/or not letting the roots dry out can cause root rot. Our research and also information in the literature, has lead Us to use the sub-classification symbol '**RR**' to delineate a score of breeding species which must have their roots dried fairly quickly after wettings. See section B.

[8] This is the bending of light as it goes through different media – c.f. spearing fish. At a certain angle (42°) light reflects off water and does not pass through in one direction.

Our latest concept is the subtype symbol '**OO'**. We invented it to explain a factor in growing Vandas. It stands for Openness, the need for large bark. A fortnight later, a researcher from North Queensland arrived and gave us an explanation which was twofold – the need for humidity and light for photosynthesis. We are quite happy that this concept is needed, but as yet, in 2005, it is unproven, in Our eyes. So far, results have been encouraging.

THE CLIMATES

As species orchids were fitting into groups and thus climate types were delineated, they were allocated a letter of the alphabet. There was no pattern in this allocation of letters so please refer to Appendix I for climate details.

The next stage was to computerize the results. As an illustration, for any one hybrid We can find its climatic needs from first principles in about 10-20 minutes. This is what IB did in the initial successful experiments! TT created a program to deal with the 3000 species names, which were commonly needed. To do this, about a thousand dollars of species data were bought in, originally from Baker and Baker (who said our work could not be done – we have the email!). We classified about 26 major climates, some with up to three sub climates. TT developed another program to analyse these and our ideas were confirmed when the climates were able to be assigned the old geographic names Monsoonal, Tropical, Subtropical, Semi-desert, etc. Each of these was broken into 4-5 shade variants and the result was 26 climates covering all in Our collections. We cheated a little by buying *C. mendelii* to be the sole orchid resident in the rare "I" climate, and it is growing well.

All this species data was put into programs and the recommended climates for HYBRIDS were outputted. As an example of Our experimental techniques, in one instance We estimated an initial starting value at 30%. But the orchids themselves disagreed, they said 33%, when We analysed the orchid's responses. About 50 borderline orchids caused us to change the couple of percent. We were amazed, almost could not believe, that the orchids got together for such a small change. Soon we were forced to agree with what the orchids ***were telling us*** and some of the many stories are mentioned later in Appendix 2. It took IB about eight weeks to reorganize his 10,000 orchid house. Nine months later TT put his 150 - 300 0rchids into a tiny, scientifically designed house and almost perfection resulted for him! *The orchids said WOW!*

O.D 3. **Our climates are based on three main axes: light, water, and temperature. Each species can grow within a large sphere of climate with its best conditions near the centre. What We try to do is classify a hybrid as near as possible to the centre of its sphere.** We acknowledge that Our inputted data may have some errors in it and Our pushing of orchids into climates may produce marginal cases. Our final designation of a particular hybrid's climate, in a few cases, may be not black and white. A major problem is with a very small percentage of primary hybrids which have widely divergent species/climates in them. We were aware of these problems going in and that is why We have been amazed with the excellent results obtained with Our 'guesses'. Many growers of the past may not be getting the best out of their orchid as the orchid has been grown toward the limits of this sphere.

It has been noted, of late, that an orchid growing just outside its sphere takes 2-6 years to get to the stage where the approach of death is noticeable.

The individual climates.

Looking at the **SUB TROPICAL** group, which is the Brisbane rainfall in Table A, 32% (3,200) of Our 10000 orchids grow that way. In an early three month drought, IB found it difficult not to water. He hung out and the orchids said thank you.[9]

In the SUBTROPICAL watering group 2300 (23% of total) are under 50% shade, in Climate **A.** About 3% (300) grow in the same water conditions but darker – 75% shade (in **B)** and in **G**, with 30% shade, there are 450. 40 grow in direct sunlight, **C,** and 60 grow in near dark (**O)**. From now on I will drop minor groups like the last few. This finishes the comments on our *au naturel* orchids. Before leaving this area IB notes that he and, probably, the bulk of novice orchid growers, grew all orchids as, approximately, **P**s. The **A**s used to have a death rate of about 10% per annum and the cause seemed to be "a fungus called 'brown rot'". 'Brown rot' has effectively disappeared with correct watering and the current death rate has approached zero.

[9] . (This is not strictly true as every Saturday no watering takes place as IB fertilizes ALL his orchids with a fertigator – this process is considered equivalent to a light misting. Also, in all drought and desert situations, where, in nature, mists etc often occur, IB uses a basic misting of 6 minutes a week and this represents under 10mm a month.

The next biggest group is the **Very Wet MONSOONAL** where there are 25%. It is to be noted that YALTA grows very few hard cane *dendrobiums* because of their size so, possibly, in general collections this percentage could swell. The characteristic of this group is they are sodden (if in sphagnum moss) for seven months and the moss is so hard and dry for the drought five months that, when knuckled, it reverberates. (OD 4) The 'monsoon' at YALTA comes two months early (Sept 13th) so that in the colder months in Brisbane they are dry. The orchids have not noticed they have been tricked, as yet. To create the dry seasons for this and the other dry climates, those orchids are put under SOLARWEAVE and all watering is done artificially. Dirty or used solar weave is about 30% shade. The darker growing orchids are catered for by adding panels of shade cloth over the solar weave.

Now comes an important piece of our dogma. (OD 5) IB was using spraying so that 250+mm of 'rain' fell a month in some climates. It became obvious that most of this finished on the ground. Fortunately, the sprinkling system at Yalta contained three time settings in each program. Initially to control water runoff, then to save water, then to create 'natural' effects, the watering with the YALTA sprinkler set-up started with 20min a day each day, but finished with three lots of three minutes spaced at 2-3 hour intervals in the mornings. No watering is done anywhere on Saturdays as all orchids are fertilized then. The conservation of water became an obvious plus. Another reason for using this is to control evaporation. We wondered what the effect of the $35+^0$ C Christmas temperatures would be – would the orchids burn in the pockets under the solar weave? IB had been in New Guinea for years and when his head was stuck up under the solar weave on such a day it reminded him of that climate, cooled to about 30^0C by the evaporation it was muggy and didn't the orchids love it. Hence a climate sub type, **'HH'** was formed. H stands for High or Hot whichever you like and has become an integral part of our system. Dogma d. This system replaces the old dogmas which worked for hard cane growers in Brisbane – "grow them up high in the orchid house and pour the water in during growing". **Hence We feel that the tropical downpour and runoff can be replaced from both the wetting and evaporation point of view by the spread of a lot less water over intervals.**

Interestingly, but not unexpectedly, most of these orchids, 12%, are centred around only 30% shade, the **D** climate. 9% grow in these water conditions but under 50% shade, the **U** climate..

When IB was growing orchids by trial and error, he tended to grow them in a **P** climate, i.e. when they looked dry he watered them. This worked for the bulk of them but the death rate for some groups, the records showed, got toward 25% per annum. In what became the **D** orchids the root rot, phytophera, was rife. It is now gone. In the first year of the experiment another cause of death arose – death by growth. Some of the greatest growth rates ever seen at YALTA suddenly occurred in this group. Because orchids were grown in order of purchase, miniatures could be next to maxis. The huge growth rates of the maxis shaded the miniatures and killed them. About 2-3% of the orchids died in this way in the first year. In the second year this was eradicated by putting compact and mini orchids above not beside larger orchids on the A frames.

The 'littlies' were grown in trays and in the order of 20% were lost in GBC as had happened in the past. Why? We were now thinking in climates and finally the obvious was seen. All orchids had been potted in chronological order of purchase, so the new compots got potted out in March. This meant they had a few weeks before the 'Monsoon drought' came. So a new system of re-potting had to come in for the drought climates**. Re-potting had to be done by climates and drought orchids had to be repotted in spring.** It has worked beautifully – we are now thinking in terms of climates and the results keep coming. *The orchids love it* and We are crashing through some old dogmas in orchid growing. In the early years, the annual death rate in "D" went from 25% to about .1% [10].

In this Monsoonal group, when in doubt, pot shallow. See Advices 7 & 8 later.

The **Wet Monsoonal** group gets about half the summer 'rain' of the above. It has only 6% of the orchids (3% **L** and 2% **J**) but contains a high diversity of types: - *Cattleya, Encyclia, Dendrobiums, Oncidiums, Vandas* and cool-growing intergenerics. It is noted that because TT is interested in perfumed orchids, his distribution contains an abnormally high proportion of this group.

N. B. In October 2005 We start a two year trial of a change We are already fairly certain will work because G B C thinking implies that we have erred again. The groups J,L,K,W were considered difficult to keep alive because there were so few in each group that the edges were near the centre and this caused watering problems (footnote 10). But it has recently dawned on Us that the problem is most likely the underlined section above. They do not get a lot of water anyhow , so why cut it down by over half. We are trailing the giving to them the same water as the very wet monsoonal, D,U etc.

[10] Because all watering is artificial IB has trouble with the unevenness of the automatic sprays – at edges and corners and up high and occasional blocked sprays in these artificially watered areas.

The **Tropical, very wet and dryish,** contains about 32%. **T** contains about 23%. This is because YALTA tends to specialise somewhat in soft canes. The reason is that, using the old techniques of listening and shifting around IB became successful at growing softcanes. When the climates came through he was spot on – or was he. About 1993, before GBC, IB explained his success by the statement that 90% of his soft canes had over 50% *Den. Nobile* so because of their homogeneity "he knew how to grow them". Our climate research spat out the error in this statement. Of the 98 different soft canes, five contained high proportions of three peculiar species so these orchids are grown and flowered in P and K climates. Another climate lesson was learnt and finally an explanation of why a few soft canes had died. (See Dogma b.). There is another Dogma e, 'that to get the best displays, softcanes should be placed, at budding time, in the sun as that is how they initiate flowering in nature. The stems fall over and the sun beats on them.' We got our best displays on the few in the darker areas, so from 2004 on they will not be sunned to see how they go.

The **P** climate contains about 5% of Yalta's orchids. That is how IB used to grow all orchids and this group has never been a problem.

The **Tropical Wet all year** has about 5%, with about 80% of these in **F** and 10% in **Y**. These contain mainly Vandas, but there are three Cattleya species and a few hybrids of them and other odds and ends.

Here advice 7, below, is most pertinent.

The only orchids grown artificially at YALTA are *Phalaenopsis,* which are grown in a convectional 'glasshouse' to heat them in winter. These were IB's favourites and, as with soft canes, they were grown quite well for many years. When GBC theory came along, another lesson had to be learned. Only about a third were **Z** climate. The rest were **R** climate but both had to be warmed in winter so a sub-type climate (**CC**) is included i.e. warm at night. To date, this has not been validated as is discussed in the appendix 2. *Doritis* derivatives often finish up in **O.**

The **Tropical Semi Desert** is a very interesting group containing just under 1%. We know the **I** climate works well – three orchids, only, growing very well. **Q** is looking good now, after a setback with clogged sprinklers. (Appendix. 2). They are now watered at night and the flowering and growth is terrific. This matches the fact that condensation at night is the main source of watering in the semi desert.

B. Growing Media Correlating with Climate

We would be the first to agree that the reasoning and computer side may be complex, but the using of GBC is simple. What is amazing is its effectiveness. With a new way of thinking about orchids We now seem to have a process which has, so far, solved all problems We have thought about. But, as indicated above, the role of sphagnum moss has been extremely important, though not necessary.

Sphagnum Moss v Bark

We do not believe sphagnum has any magical properties!

?? Bark can have negative properties such as decomposition and the production of an acidic *pH* if it is ill-treated. The same sphagnum has been in a pot more than six years without any noticeable problems of decomposition. However a problem with sphagnum moss beyond the 6-year stage is that when chopped moss is used, it tends to wash out slowly and a high concentration of mainly polystyrene/rubber is left and this is not suitable for orchids. However, older sphagnum is discarded in our potting as mentioned below

?? When potting up in bark, different grades have to be used, whereas the sphagnum may be left around the roots and more added to pack into the larger pot. Implication:

i. Sphagnum is about 50% dearer than bark, but over, say, six years or three pot-ups it is much cheaper.

ii. We believe that the damage done to the roots and the velamen in particular while potting up in bark is a negative for plant growth. (see Chapter 6 **JR**) Moss is gentler on the plant, as there is next to no damage as the orchid roots are treasured.

?? One of the accepted needs for growing orchids well, is to aerate the medium, (p104 **JR**), as this allows roots to dry out, but water has to be absorbed through the velamen. We feel that the balance is the point of interest. We feel that bark could be a safer medium if it is not known how the orchid grows best. Bark sheds excess water easily but keeps little in its layers so minimises over watering. Remember here the 'old growers' mentioned earlier, who learnt by various means how to grow each orchid in their collection. However, the more that is known about the true growing conditions of

orchids, the more-pliable moss really comes into its own. Growing side by side in the correct climate, we have found sphagnum usually more than doubles the growth rate of bark. We are aware of other similar media which can do this [11] but sphagnum has other advantages as given below.

?? Sphagnum moss must NOT be used in the same way as bark was used. While not claiming the best techniques for moss, there follows some of the techniques we have used and hence they are part and parcel of our final experiment.

?? (OD 6.) To improve the aeration moss is mixed with about one third by volume of an inert material. For years, polystyrene was successfully used but, since about 2000, two grades of rubber crumbs have been used. From the point of view of growing there is no apparent difference between these media. However, the rubber is about 40% dearer. We recommend its use for only one orchid reason which is the rubber has been tested and found to be **impervious to water (see previous footnote)** and common chemicals and to have no decomposition or *pH* factor. Its MAJOR advantage for Us is the lack of mess. Apparently polystyrene is banned in the US for ecological reasons and We agree with such a ban. Rubber does not decompose but will 'sink' out of sight.[12]

?? Practical potting techniques:- Our technique is to pot very tightly. This gives a minor advantage over bark as newly potted orchids do not spill. Other major advantages follow – see below

?? Tricks of potting in moss abound. Most are caused by the moss's **stability/stickiness**. Two only are mentioned as examples. *Gastrochilus dasypogon* can be potted on a mound so the peculiar sprays are well displayed. *Brassia verrusosa* can be shelf-potted from little at the back to full pot height at the new lead as this plant climbs out of pots.

?? Type of moss: - We prefer milled moss but supplies have dried up, so we are trying to find ways of milling. The debate continues, milled or long strand, which is best? We are now definitely favouring milled as it is 'stickier' in most circumstances but in a few cases long strand is used. (Used mainly for Large RR orchids which are well attached but need the evaporation.)

?? (OD 7) We use 2-3mm stones to stop drips washing out milled moss and, at repotting, the dirty surface, stones and seeds are crumbled out and discarded. Some of the group use stones for aesthetic purposes - to remove the black surface stains. However, We have no growing problems with this stain, so in the orchids where stones are not used (eg climate D) the stain is ignored. The little mites (fungus gnat) which create this black material, do not seem to have any effect if the plant is healthy as happens with GBC. If you grow in the old slap-dash way, it is suspected that the mites used to cause plant deaths by means of fungus infections.

?? One problem with sphagnum is not only do the orchids grow well but the weeds are particularly healthy

Orchid Roots

Previous versions of this document attempted to classify root systems and this was seen to be working but as further problems were investigated the whole system simplified itself . Once again classification was trying to tell the orchid what it should do, instead **We let the orchid tell us** and almost everything has now fallen into place. Most of what follows is observational and may be argued against by orchid biologists but the Physics is correct (IB's speciality) and something has enabled us to get rid of 'diseases' by using GBC Theory (and no chemicals). This orchid root aspect of GBC is now dealt with.

Firstly a few principles of Physics before Biology.

DRYING. How do orchid roots (potted orchids) dry? We suggest that excess water runs through sphagnum nearly as well as bark. Hence We have cut back on the quantity of water supplied to

[11] JR p46 Figure 3.3 indicates that the best medium may be Rockwool, comparative figure 94% porosity followed by pumice , vermiculite and sphagnum moss about 80%, perlite 70%, bark a poor 50% and rubber crumbs a pleasing 48% with the last among the lowest, 4%, for water retentivity (bark 10% and perlite and sphagnum moss 25%). Sixteen media are compared on these two properties. Rock wool has an extremely high water retentivity, 80%, which would be bad for shallow potting theory later.

[12] The rubber is available from CHIP TYRE, Austin St, NEW CHUM, Q4303. Phone 0738162711. Rubber sizes vary from .6mm to 19mm. In the fines the variation is from .6mm to 6mm. We use 3-6mm with long strand sphagnum moss and 1-4mm with chopped sphagnum moss. We use large grades of rubber to fill pots of the wrong shape – as we once used lumps of polystyrene. The finer grades are available from CHIP TYRE in 25kg bags at $13.75 (including GST), plus freight extra. Coarser grades go down to$11 a bag. In bigger bags the product is cheaper and a more expensive smaller bag can be negotiated.

very wet climate orchids to about a third of that in the climate table and We replace quantity by regularity. Bark dries out in a few days and sphagnum moss take quite a bit longer. "Bark holds in its crevasses for a very long time an amount of water" (This is an old dogma in orchids as p46 **JR** gives bark's water retention, 10%, as worse than sphagnum moss, 25%) but sphagnum moss does not dry out as quickly because of superior porosity, 80% to 10%. Hence a possible problem with sphagnum will probably be with long-term wetness. (The superior water retention with rockwool, vermiculite and coconut husks probably makes them disaster possibilities with what follows on RR orchids in this section). About 40% of orchids need periods of drought so a very definite danger in these climates with sphagnum is that when it does dry out then the occasional wetting may not work as dry sphagnum takes 20min to wet properly. Hence a soaking may be needed every three weeks or so. Here is an advantage of mister sprinkling as 3 x 2min once a week, equivalent to about .4 inch or 10mm a month seems sufficient. What is often mentioned in the literature is how semi-desert orchids get their water from dew and mists. The water is funnelled down the leaves, over the bulbs and directly to the roots. We think of the coping-with-drying processes of orchids in nature. Some send roots into crevices looking for moisture (i.e. permanently soggy roots), but most roots grow and collect only mosses and detritus which may slow drying a little but, in general, the roots dry out[13]. However, We suggest that the need for breezes is an orchid dogma of old. Firstly, an observational point, IB spent six years in the wet area of New Guinea and the only winds were during storms as the normal jungle conditions were still. If you take breezes away the physics of drying is that, after draining, in normal pots huge numbers of water molecules leave the immense surface areas, but if there is a large lip on the pot, a saturated vapour forms and much of the water returns. Hence we move towards NO LIPS on pots after potting. A breeze would certainly help this removal of water if lips are left! More important in nature is heat/light energy from the sun. Fortunately, or because of the biological history of orchids over thousands of years many orchids come from hot/very bright light climates. (D,T and F climates) and these have developed similar global tendencies. We suggest that the climate needs of the orchid species which were created over thousands of years, are in the genes and create behaviour tendencies and needs for each hybrid.

AIR We accept the biological need for air circulation among the roots.[14] Hence, we take precautions to avoid the formation for long periods of soggy areas in the sphagnum moss. In bark potting this process used to be coped with by using bigger grades of bark as the plant and pot got bigger. Was this based on biological guesswork? VPD (vapour pressure deficit) is the difference in water vapour pressure between the inside and outside of a medium , the cause of drying, but it is suggested few orchid growers, past or present know the role of this and certainly We do not use it and Our quick-fix guess is "1/3 rubber" has worked for us.

WATER USEAGE We postulate that in healthy GBC pots the main source of drying is the root hairs on the root tips and the velamen around the roots which collect the water and minerals used in plant growth, NOT evaporation

EXCESS WATER We use for examples *C. aclandiae* and *C.* Gene May 'Emberside' . These require similar yet different conditions. The concept of MOUNTS was used to flower *C. aclandiae* in the early nineties by IB and then, years later, for 18 months it was grown more successfully in very shallow bark. Unfortunately both of IB's last two plants were lost. They fell out of the not to sticky shallow bark into ground cover! So a quick computer search found that *C.* Gene May 'Emberside' is half *C. aclandiae*. Gene May was struggling, growing into lots of small plants in bark but it was one of the 10% of all orchids which, at the time, did even worse in sphagnum. It had never flowered. The next thought was 'why not use shallow sphagnum?' The results were startling. Gene May suddenly trebled its size and flowered. The flowers were so spectacular that IB now has only two small back-cuts left unsold out of about ten surviving plants. Maybe forty other hybrids are now potted **very shallow.** The GBC thought is now (OD 8) "If you grow on a mount, as in nature, you will bonsai the plant because the nutrients have little space to collect. If you grow in deep sphagnum (or bark) the roots will rot and the plants will eventually die. In SHALLOW SPHAGNUM (under 1cm) there is a nutrient collector and the roots can dry quickly by evaporation. The roots do not go black. Instead they produce heavy mats of roots and the roots themselves do a lot of the drying. This type of orchid is called a **RR** orchid, which stands for root rot.

EXCEPTIONS caused by random development and mutations: As expected in biology, We have delineated a few exceptions which caused deaths in hybrids and some have caused changes to our

[13] The attaching side may still be moist

[14] This is well covered in porosity and air porosity p32 JR

GBC theory. We pick three of a total of about six of our 3000 species because of their curious biological diversity: *C. granulosa*. Just looking at its GBC/biological properties We would classify it as a Vanda (F). *Den. Linguiforme* grows with dried out roots on rocks and she-oaks in a harsh Australian climate (see above for an unexplained peculiarity) but it acts as an RR orchid. So too, *C. loddigesii* is a 'wet monsoonal orchid' (PR orchid) growing in a dry Brisbane climate(B). Our summarizing point is that species orchids **do not follow pre-ordained rules but in GBC we have little problem allocating hybrids and most species into dichotomies and pieces of advice can be given which seems to solve nearly all of the orchid growing problems of the past.**

Now to the dichotomies and the simplified processes we have used to achieve Our results.

ADVICE 1 We tend to use mixtures of chopped sphagnum with about one third rubber chips (gauge about 1-3mm). That covers the air and drying needs above. However, because of its 'stickiness' it has many mechanical advantages eg holding Gene May in a cut down pot as mentioned above.

ADV 2 Ignore the knockers who say dried out sphagnum is some sort of plant killer. That is completely wrong! In semi-desert and monsoonal climates, when the droughts are on (in the orchid house) they do get tiny amounts of water. The sphagnum – knockers have forgotten the principles of arid growth. In the literature it is well recorded that the mists/dews come in at night and the plant leaves are collectors (e.g. mule-ear Oncidiums) which channel the droplets to roots, then root hairs. We have found, for example, that the Q climate orchids growing in surface-dry sphagnum mix usually have some of the best, biggest and healthiest root masses and bright green healthy leaves and massive flowerings. The orchids have developed this massive root growth to provide the orchid's water needs. Water them and they are killed by 'drowning'.

A 3. At least once a year every orchid is pulled out of its pot and the roots inspected. If there is a problem one of the steps below is carried out. If there it no problem the orchid is returned to its pot and the orchid is 'undisturbed'. The orchid's roots now tell us what to do[15].

A 4. POTTING TECHNIQUE

a. If an orchid is being potted up, do not over-pot but select the next size to allow a maximum of two year's growth. If there is a lot of root rot or damage the sphagnum can be hosed off, but this is seen rarely now, when some classification error or mechanical error (clogged sprinkler) occurs. See Appendix 2. The old growth of the orchid is placed hard against one side if the pot. And the sphagnum mix is jammed down, very hard, with a vertical action, to fill the pot. The aim is firstly to ensure that the roots are not damaged and then to provide stability.

b. In the case of nearly all orchids the old rhizomes, and their dead roots are cut off and sphagnum is scraped out to allow the flatter pot shape to be filled. In this way the old sphagnum is slowly replaced **but fresh healthy roots are not disturbed[16]**.

A 5. In general, if an orchid is found which has roots growing out of the bottom drain holes of the pot, which has masses of roots in the root bole and, usually, growing in a wetter climate, then you have an easy to grow orchid and it can be potted in old fashioned deep pots. Only about 10-20% of our orchids are like this. Examples of this growth are *Sob. Macrantha, Blc.* Sunstate's Easter Parade x *Lc.* Little Susie, softcanes and *Onc. Sphacelatum.* These are four completely different climates and, interestingly, the plants range in root size from huge diameter to small, which blows apart one of Our original dogmas.

A6. The bulk of Our orchids, about 60-70%, grow best in the shallow profile Port Pots. the 7cm, 10cm, 12.5cm and 28cm.[17] If other deeper pots have to be used (e.g. 15cm), to avoid the creation of sodden areas, the excess depth can be filled with coarse rubber (or polystyrene) as once was done with bark or else use only the bottom half of the pot or, far more preferably, the pot can be cut down. This last is now preferred but Our advice is to replace the slightly shortened pot rim on the pot as this stops warping of the lighter wall material.[18] **A wet climate is a starting point or guide to probable need for shallower potting**. For satisfactory growth it is expected that you find the roots using the full depth of the pots, granted that this growth will be mainly towards the edges.

---

[15] Not strictly true- if you have 20 of the same orchid and only five need repotting and those five all have healthy root systems, then leave the fifteen till next year!

[16] Hence the old (recognised for bark) 'dogma' of 'repotting causes retarding of growth' does not apply

[17] Port POTS are obtainable at the Orchid Pot Co. 02 6581 1735.

[18] Wooden stakes were given up and replaced by aluminium wire as steel wire readily rusts in sphagnum. In cut down pots (and all others) aluminium stakes are squeezed onto the pot sides with pliers and this can hold pot and rim together.

Blc. Sunstate's Easter Parade x *Lc*. Little Susie

Photo A

Photo B

Photo C

A7. In the very wet climates (**F,Y,H,Z**) if vandas, which are special cases, are excluded less than 1% of our collection grow in these climates and logic as well as GBC tells Us that the roots have to dry quickly. The sphagnum is kept below 2cm (1cm for smalls) and magnificent results have been got of late. To accomplish this the pots have to be cut down and the plants potted very tightly. One late innovation is not to use ordinary pots but the open vanda pots of Port Pots (footnote 17). This solution, in 2005, is already producing great results but another year of the trial is Our arbitrary benchmark before we claim success.

Blc. Rustic Spots Photo D

Photo E

A8. If We move into the other wet climates, (D,U,E,R and T,P,V), small plants are being potted in 4cm tall pots rather than 7cms. When they go up to 7cm diameter pots a good look is taken at root penetration. Some roots hardly penetrate at all as the roots run along the surface like *C*. Gene May 'Emberside' and SOME in the oncidium group. These are potted shallow but for *Blc*. Sunstate's Easter Parade x *Lc*. Little Susie the roots head down and the orchid is potted extra deep[19]. As the plants get bigger and bigger the plant is pulled out of its pot at potting time and if the roots are, say, only two thirds of the way down, the bottom one third of the sphagnum mix is scraped away. This shallow potting is labelled **PR** as each new hybrid would determine its own future by where the roots wish to go.

In all of the wetter areas We are experimenting (in 2005) with 'rest days' for water. In the jungles there are dry days so this is being copied. So far this is looking very promising

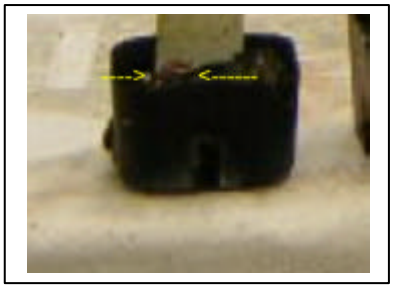
A9. When potting in sphagnum moss the rhizome is kept on top of the moss so fungus does not attack the eyes.

[19] Suspect this is because it contains a lot of *C. bowringiana* with the water searching roots

A10 A very 'iffy' observation is that hairy roots as in the oncidium group should tend toward shallower potting (75%?) but on the other hand sphacelatum types like deep potting!

Photo F

Photo G



Photographic Evidence

Blc. Sunstate's Easter Parade x *Lc*. Little Susie is given as an example of an orchid with many big roots which fill the pot and overflow over the top and through the bottom – easy to grow! Definitely yes but it is actually a very peculiar orchid which shows many of the principles We have developed. This orchid grows in a D climate! A major component of this orchid is the species *C. Bowringiana* which explains the root growth shown in Photo F. When you think about it in terms of climate *C. Bowringiana* grows in Q, a semi desert climate, and the huge root mass is probably a huge vacuum cleaner for water and minerals. Other species make the orchid into a D or a very wet Monsoonal climate so why do We pot deep and not have root rot problems? **We let the orchid tell us the way it wanted to grow but** in hindsight it is obvious by GBC theory.

An orchid from a 15cm pot was cut in two, photo A. The inside surfaces of the pot were solid roots but very wet from the monsoonal watering (3/10/2005) but the core was only damp with meant old yellowish roots and lots of moss and polystyrene. The large suction of osmotic pressure had dried the roots out and there was no sign of black and rotting roots as one would normally get with deep potting in any medium for a D-orchid.

Photo B show plants in pots with one to two years growth since repotting, but most of this growth is over 5 months old as the plants are two weeks out of a five month Monsoonal drought. The rate of growth of a D-orchid in 'the wet' is phenomenonal. Photo C are the same plants with the pots removed but the massive root growth is shown better in the close-up in Photo F.

Blc. Rustic Spots is hugely different. We classified it as an F orchid because it has a large amount of *C. aclandiae* in it. This orchid needs about 300mm, 14in, of rain a month all year and the roots will rot it they remain wet (RR). In the past it would best be grown on a mount or in open bark as in vandas. We grow it with the wet vandas but by shallow potting. Photo D is a sample in their pots and photo E is that sample removed from their pots to show the amount of sphagnum used. IB is very proud of this orchid. He bought and potted a compot of 28 very small plants in February 2004 and repotted a year later. The photos were taken 3/10/2005. The major advantage of shallow potting is that fertilizers etc have sphagnum collectors for osmotic vacuuming whereas on mounts the plants tend to bonsai as the collection of trace elements are limited. 28 plants came in the compot and three were so small it was thought that they 'would die' so they were stuck together in the 6cm tray on the left. FOR THE FIRST TIME ALL PLANTS ARE STILL ALIVE. They are sodden in the morning but dry by early afternoon. The tiniest of the plants is now (3/10/2005) quite healthy and three times bigger than it was, now at 8mm tall and span of 23mm. It is on the left and a blown up photo of the purple plant is photo G. The next smallest plant in the photo was also from the compot and it was the above size and is now 40mm tall and 75mm span (second left), The third plant is an average small, about 10 of them, and the biggest seedlings are so big they had to go into a vanda pot. In March 2005 one put out a sheath but did not flower. It took IB ten years to flower *C. aclandiae* on a mount

Sphagnum Moss v Other Media

On p47 **JR** compares 16 common media on porosity and water retention. A lot of the points are covered in the text above and We have tried only five of the medium investigated. So here is a brief summary of all pertinent ones in the 16, sourced from **JR'S** experiments which are more often than not on the ionic side with fertilizers, pH and such. Rockwool is tops (95% porosity, 80% water retention) but the latter would harm our shallow potting theory. Sphagnum moss, coconut husk fibre, pumice and vermiculite, 80%, are equivalent but the last two are light and not 'sticky' enough for us.

Coconut fibre has a salt (NaCl) problem and it binds needed calcium from fertilizers, p32 JR. Perlite 70% follows but will 'blow out of pots', p35JR, hence would be useless for shallow potting. Bark, 50%, has many problems all minor perhaps if traditional care is taken. Tyre crumbs measures up exactly as We require it, p42, for its inertness.

SUMMARY OF NEED FOR SHALLOW POTTING

a. VERY SHALLOW (**RR**) We have yet to find a FYHZ orchid which does not require shallow potting but this and in the rest of the groups less than 5% need it. It is an urgent need in that the orchid dies in a few years if old potting techniques are used.
b. SHALLOW (**PR)** About two thirds of the orchids in monsoon climates appreciate shallow potting or about 25% of a general collection. You have years to sort out which orchid.
c. Normal potting occurs with the bulk of the orchids.

GENERALISED OBSERVATIONS FROM GROWING BY CLIMATE (In Brisbane)

1. **If the above root system is used to pot, what is found is only quick growers have a few roots outside the pot[20] but another phenomenon is being noticed. The orchids seem to be walking on buttress roots and these root spread out in the moss to form large boles of healthy white roots.**
2. About half our orchids grow best in 30% shade or less.
3. Less than 5% of our orchids grow best in 75% shade or more.
4. To obtain healthy plants, shade variations seem slightly more important than correct water conditions. See Appendix 2
5. Before GBC the Yalta orchid house had many different coloured leaves in it. After GBC, apart from red, the leaves are all about the same colour despite the huge range of shades used.

PART C

So far no orchid groups have fought us successfully except the sub group **LL (A**ppendix 2) We have made lots of mistakes and in a few cases We have yet to show, for particular orchids, that they can be grown when that mistake is corrected. We, in 2005, do not have a lot of information on a lot of cooler growing orchids, but that can be obtained fairly easily[21]. You can work on your species in your own way! Anyone who has the time and money can try to duplicate the process. Good luck to you.

We do not have the data on a few orchids e.g. *Ascda.* Shikanari and *Lc.* Soonputan are two. These names have not been registered and We are told the problem will get worse as S.E. Asia starts to concentrate on supplying the huge Northern Hemisphere markets with pot plants

HOW TO US E GBC

IF YOU WISH TO TAKE ADVANTAGE OF OUR SYSTEM TO GET THE TYPE OF RESULTS WE HAVE HAD, WE HAVE SIMPLIFIED THE SYSTEM SO IT IS EASY TO USE. IT IS NOT NECESSARY TO UNDERSTAND WHY IT WORKS.

Suppose you are an experienced small grower who wants to buy ten orchids. The simplest way is to go to YALTA Orchids and buy the ten. The orchids will have their correct name on the labels and three lines on how to grow them – the climate description. The main table A is available. Any other questions will be answered. A similar service is available by mail or email. The basic problem for such a grower is how to use such information. We deal with this shortly in Z.

Suppose you are a learner, just starting up, wanting to buy ten orchids. YALTA, using the climates, can give out information in many ways. (We find it easiest to deal with novices rather than "experts" as novices do not have preconceived dogma and so easily follow our systems). Such a learner may have a shade house or equivalent or a 'forest setting' and that is a problem, as these might not suit the orchids he desires. With local sales we can

A. Ask what growing conditions the novice has and suggest orchids, which will grow there.
B. If the novice has a few orchids already, which is often the case, We ask for *grex* names.

The usual answer is "I have lost them" in which case general advice similar to that in current beginners

[20] The old dogma of flowering well only when the roots are outside the pot is rubbish as you will rarely see roots, let alone flowers, 'outside the pot' in GBC.
[21] We are not in the business of dealing with species, but hybrids.

books has to be given. However tricks can be given to aid conversion to sphagnum moss which moves in the direction of, hopefully, a better climate.

C. If the novice has the *grex* names tricks can be suggested to convert the present accommodation into a more suitable group of environments. This is what IB did to his 10000 orchid house. It is not pretty but it works.

D. If the novice has nothing and wishes to go all the way to a significant collection then go to Z

E. In the past it was usual to ask if a novice who wanted ten orchids, "What kind?" and show photos. Now, we are able to add the addendum to their selection, 'You can grow that orchid in your area ".....": You really have nowhere to grow that orchid at present, and so on.

In practice, the cases we get are combinations of the above, so we finally get to Z.

Z. TT, as mentioned before, has a purpose built, tiny orchid house. Each orchid has a large letter painted on the pot (for the Climate). This is not recommended. Just use large letters on labels. TT has about five sections of shade and solar weave and a few networks of sprays, hand controlled, on one half A-frame. All told about eight climates of interest to TT, the common A,D,U,L,B, G, are there and he plays with other challenges such as Q and V. If he particularly wants something, he uses ingenuity to create, and that has become his game – the challenge of CREATING MINI CLIMATES to grow his desire.

IB really has about 10 fairly discrete, ancient orchid 'houses' joined together. DH has a smaller version of IB's – about five old converted houses/areas.

The basis of all these orchid house structures is fixed by a number of Physics/ Science facts, which were triggered by the work of Baker and Baker. We can arrange a new design built to accommodate the Botanical and Physics principles we have used. This can be arranged, with instructions on how to create the climates, by YALTA.

If you want to build to Our plans, they are available at a cost depending on how much detail you need for what you want to do. Fairly complicated ones are a maximum of $50. Conversion advice is free.

If you want to have a go at the full GBC system, here is a suggestion:

Suppose you have 100 orchids. Type them into eXcel with a reference number say IB0313 Slc. Mine Gold 'Waianae', where IB are your initials, 03 is the year and 13 is the 13 th orchid in your list. Note the variant name should be included but after recognition by the computer it is then omitted. We will run them through the computer and return their climates. You could then put say the D'S and U's under solar weave and play with the water. We offer no guarantees except it has worked so well for everyone so far. Species lists will not be handled to avoid copyright. The basic charge is 40 cents an orchid (minimum $5) but if you mess up the spelling the computer spits it out and we work manually at 60 cents. It is easier to charge 50 cents an orchid unless you have computer copied all correct names. [22] Some unregistered names may not be found. Information can be Emailed or discs snailmailed by arrangement.

PART D

Because of the close relationship between GBC and JR texts it is best to spell out the differences in this evaluation section. We thank JR for publishing all his data

The major difference is, in GBC, our science was never meant to be accurate and the result was considered proven if the orchids told us by their good behaviour that they liked what we were doing. To do this we used dichotomies or rough groupings. For example we use 0%, 30%, 50% 75% shadecloth as our levels of shade. What happens if an orchid needs 40%? We make 'inspired' guesses and it seems to work. This We call eclectic science.

Jack Ross uses a high proportion of exact scientific measurement. As an example consider pH 6. This means that the partial concentration of the hydrogen ion is 1 in 1000000 (6 naughts). This can be measured quite accurately by scientific instruments. It can be translated to simple-looking scientific graphs and the layman can say 'That orchid likes a slightly acidic environment'.

However, for the particular orchid one is looking at, its dominant species may have spent millions of years adapting to an increasingly alkaline environment. This is the 'ant country' [23]of random development of any living material. So JR can not be orchid specific with any ease. GBC is

[22] Most local firms/suppliers have about a 5% rate of naming errors and hand written labels would be much larger.

[23] Figments of Reality Ian Stewart Jack Cohen Camb ridge University Press 1997 p71

aimed at being orchid specific – pop in the name and the computer spits out some accurate guidelines – but not perfect. JR's measurements are highly accurate but in the long run apply exactly only to the few hundred orchids he measured. But orchids, a billion years ago came from the one mutant so there is a commonality of genes which enable some common properties to apply. IB as a scientist got so much out of the JR book – study both systems if you want scientific knowledge not the dogma of old on orchids. But most people are looking for simple advice on their orchid growing. Our computers gloss over the detail to do that for each orchid. We could be criticised for using the accuracy of science only as guidelines.

Another aspect is the dogma of economics. Not enough rain is now falling to support our increasing population. Oddly, not on purpose, GBC is a water conserving process. Also, big orchid nurseries are looking for simple generalities to save money and individualising orchids would require major upheavals. The JR book is designed to aid hydroponics which is the way of the growers of massive numbers of orchids mainly in the northern hemisphere, but that leads to Our main clash:-

We try to grow orchids a natural way by letting the roots dry out. This is the observational system which uses the 'potting shallow' techniques. The grower needs to observe his orchids roots for success. I cannot imagine the growers of orchids within hectares of hot-house sheds checking roots of each orchid to obtain improvements in their (hydroponic?) systems.

APPENDIX 1

TABLE A

RAINFALL and SHADE

Code	Shade	Rainfall Rate given per month
SUB-TROPICAL - Brisbane		
C	0%	**Sep 15 - Jun 15: 125 mm (5in):**
G	30%	**Jun 15 – Sep 15: 50mm (2in)**
A.	50%	
B	75%	
O	75+%	
Very Wet MONSOONAL-Excess wet - Dry - Darwin		
X	0%	**Sep 15 - Apr 15 250+ mm (10 in):**
D	30%	**Apr 15 – Sep 15 20mm (.8 in)**
U	50%	
E	75%	
R	75+%	
Wet MONSOONAL-Wet and Dry - Charters Towers		
J	30%	**Wet Sep 15 - Apr 15 150 mm(6 in)**
L	50%	**Apr 15 – Sep 15 20mm (.8 in)**
K	75%	
W	75+%	
TROPICAL Wet all Year - Babinda		
N	0%	**200+mm (8+in)**
F	30%	
Y	50%	
H	75%	
Z	75+%	
TROPICAL Very Wet and dryish - Mackay		
S	0%(Morning – then some shade)	
T	30% **Sep 15 - Apr 15 250 mm (10 in)**	
P	50% **Apr 15 – Sep 15 60mm (2.5 in)**	
V	75%	
TROPICAL SEMI-DESERT but humid nights - Brazilia		
I	**30% Sep 15 - Apr 15 75 mm (2.5 in)**	
Q	50% **Apr 15 – Sep 15 12mm (.5 in)**	
M	75%	

>75% shade < 1800fc: 75% 1800-2500fc 50% 2500- 3500fc 30% 3500-4500fc 0% 4500++

TABLE B

TEMPERATURE

Our temperatures are based on Brisbane where the annual monthly averages for the maximum are

July	A	S	O	N	D	J	F	M	A	M	J
20.6	21.7	23.8	25.7	27.4	28.7	29.2	28.9	28.1	26.4	23.5	21.2

The daily ranges can be 20^{o}C. In Jan there could be 6days with a maximum over 35^{o}C and in July there could be 6 days with a minimum under 5^{o}C. Only this is programmed in but orchids which we have found to cause us trouble, have special concepts programmed in the computer as given below

TABLE C

RAINFALL

Brisbane rainfall averages are below in inches (multiply by 25 for mm)

J	A	S	O	N	D	J	F	M	A	M	J
2.5	1.6	1.3	3.7	3.8	5.0	6.4	6.9	5.6	3.6	3.8	2.8

AND OTHER CONCEPTS - THEIR CODES

HH **H**ot climates with at least three months **average** over 30^0
LL **L**ower temperatures with at least three months **average** under 20^0
WW Evenly **W**arm a band about 22^0 to 26^0 as up a mountain in tropics
TT Warm **T**emperate range, Brisbane, as given – (excluding above)
CC No **C**old at night - **average minimums above** 10^0
RR **R**oot rot to be avoided by using mounts or preferably VERY shallow potting
PR **R**oot rot to be avoided by shallow potting
OO **O**penness – presently advise coarse bark (Vandaceous) – still experimenting.
NA Climates **N**ot **A**vailable. Main reasons: orchid is a species; orchid has a non registered name.

APPENDIX 2

MISTAKES AND ERRORS

Our experimentation since 1998 has produced maybe a hundred pieces of evidence supporting the validity of what We were doing. Some evidence caused the variation of theory whilst we sorted out reasoning. There is no desire to give you a hundred but they are part of pleasant memories, so a few only will show the type of reinforcement We got. Here are some of the happenings:

1. In the initial reorganisation in April 2000 by IB, though a computer was used to allocate areas, there were plants all over the ground. They had been grouped in types, e.g. Cattleya Alliance, but they were in chronological order so the three cats AR8712 (about 15 plants), AR8713 *C.* Margaret Degenhardt 'Saturn' (about 25 plants) and AR8714 C. Penny Kuroda 'Spots' (about 30) were jammed together on the ground and then rehung in the correct climate. In Sept, a repot occurred and a plant was found in AR8713, in a 10cm pot, which had about five dead stalks on it but one rhizome had two tiny shoots. AR8713 had spent six months in an A climate and except for this plant, they were going well. IB looked carefully at the label and found that it was AR8714, which is the very wet T climate. The plant was put in its correct climate and in a couple of years it had recovered.
2. The above is a careless error, but, among the first of the errors of 'concentration' was a mistake in C. *intermedia* which needed only 30% shade not 50%. IB thought this would be trivial, but a computer search pulled out about 20 affected orchids and quite amazingly, when the affected orchids were looked for, nearly all of these were showing stress in the 2001 repot. Relocation restored normal growth.
3. The desert climate Q (about 100 orchids) was being misted for nine minutes a week on a late Wednesday morning. This was equivalent to about 20mm a month. They were in a not often looked at corner. It that first summer IB regularly looked at the sprays, everywhere, to see if they were clogged. However he went each week to golf about half an hour before misting in the Q climate. After a few months he noticed these orchids in a bad way. A check of the spray line showed two of the three sprays had blocked. Over half died. All that proved was that semi-desert orchids NEED SOME WATER i.e. this type of orchid walks a water tight-rope. In the last few years, with the sprays functional, rarely is an orchid lost in that climate.
4. On Sept 15 2000, the first artificial monsoon came to YALTA. It took maybe 12 hours (now less than 2) to work out, allocate discrete times to the 200 or so watering times in a 6 day, three phase cycle for the 26 climates, then plug them into the water computers. The process required a lot of concentration. IB then got into his repotting. Above his head were four plants of *Den chrysanthum* There were only about thirty plants in this climate which was dryish monsoon and, to save on water lines, similar climates were hooked to it, two with a total of about 20 and the L climate with about 250 orchids. Over about 10 weeks IB noticed a deterioration in *Den chrysanthum* till finally the program was checked. The wet cycle had not even been calculated, let alone administered – it was still on drought. A good look at the plants showed signs of stress only, so the drought had been extended from five to eight months (but we cheated two months) so that was probably why they were coping. The calculations were done and IB went off on Xmas holidays. When he came back after nearly another month

about a third of the plants were dead. Was this our first climate problem? A check showed IB had calculated but not administered the program because of an interruption. The watering was programmed in and the remaining orchids saved. It was interesting to note that the orchids seemed to have about three months flexibility and then they dropped like flies. There has been no marked dying since. IB was left with one small *Den chrysanthum*.

5. IB had a large gum tree which, for years, had provided summer shade for softcanes and shade for the new B climate. It died in Easter 2001 and was removed. It is hard to imagine that the passing of a giant can be forgotten, but it was. By Jan 2002 it became obvious the B's had a high death rate and the soft canes were keikeiing to extreme. As soon as the correct shade was restored both groups went back to good behaviour.
6. It was said above we lost our black root rot (phytophera) completely, but that is not strictly true. IB would come across say four sick/dead orchids in ten for a certain hybrid, check the roots and they were black. A check of our data would show a stupid or careless mistake and the orchid would be put into its correct climate and then the orchid grew perfectly. One more notable example of this was that, for some reason, a particular new hybrid had its composition written on a record card as C. Wa 44%. The following year many were sick/dead with black roots. Why? 'wa' was assumed to be *warneri* but a recheck showed it should have been *walkeriana*.
7. And so when DH came in to fill the missing links the process became: "What's wrong with this orchid?" If it did not look right e.g. deaths, colour, root rot, spots, we would check the data and often a mistake was found. If the reason was we did not have the data then 'Ring Dave' and, so far, DH has found the reason, and the orchid was put elsewhere. WE have only found a few who have not shown remarkable improvements e.g .*Stan embreii* .
8. But something quite exciting happened in half a dozen cases. DH was rung and given instructions not to look at previous data. DH did not know why, but he has come back with corrections to the original data from Baker & Baker and the indications are Dave is right. Now both Baker & Baker and We accept the possibility of error in our data, but what makes us so pleased is that we can now recognise an error which is *being told to us by the orchids.* But, with *Stan embreii* and about three others both DH and Baker have not solved the problem.
9. My phalaenopsis data has not been properly validated. For some time before data on phallies was being validated, a neighbour was growing a tree. Phallies in Brisbane need warming in winter, and for many years they were growing fairly successfully at YALTA using a convectional glasshouse. Our experiment indicated two types of phallies, wet and dry. The tree shaded the convection house in winter only and 75% of the 'drys' were killed. (about 20% of the 'wets' died but this difference did make sense to us). After two years of negotiating, the tree can now be partially lopped and from the 2003 winter, in not perfect conditions, few are now dying.

APPENDIX 3
HISTORY OF THE PEOPLE CONCERNED

Historically, IB started trials on Sphagnum Moss about 1990. The next major step came when IB purchased the very expensive data part of the Royal Horticultural Society Disks for $400+. A couple of years later IB converted to the far cheaper Wildcatt system. In 1996, Baker and Baker published their database and, eighteen months later, IB found their books and immediately started using the GBC system in a slow, tedious way. About that time TT walked into IB's YALTA ORCHIDS asking for orchids 'to plant in the garden' of his new house. He listened to IB's theories and came to his orchid club. Within about six months he, the amateur, had some 100 orchids stacked in corners around his house, some dying, but many going well – a better than average novice grower. One day TT said "I can do what you want to do far more quickly". IB had found a talented computer programmer. In less than a year, by constructing computer programs and using a mainframe and the Internet, TT truncated the experimental system so it was 'automatic' not laborious. IB and TT have both put hundreds of computer hours into this, so we are exceptionally pleased our time has not been wasted. In April 2000, IB converted his old orchid house to cope with the experimental system and, about a year later, TT built a very small orchid house according to the scientific principles which had been developed to cater for climate based systems. In late 2001, DH joined our group and TT taught him some of the search principles he had been developing. DH has spent hundreds of hours and his main roles have been, firstly, to close the gaps in our species knowledge – we had about 80% of the species we needed, but by March 2003 the unknowns were less than .1%.

Secondly, DH has done huge amounts of cross checking (we all have). He has found errors in the original data and has picked up large numbers of mistakes made by TT and IB. We now publish as, THOUGH WE KNOW THERE WILL BE SOME ERRORS LEFT, WE ARE CONFIDENT THEIR EFFECT WILL BE MINIMAL.

Greg Abraham has joined our group about late 2003 and he has specialised knowledge of the vandaceous group. He also has filled in a number of holes in our biological knowledge.

APPENDIX 4

METHODS BY WHICH WE HAVE VERIFIED OUR RESULTS

This statement was made prior to GBC that "results to date suggest that, in Brisbane, about 70% of the orchids in a general collection and above 90% of the cattleya group, grow much better in moss than in bark". In the original days when dealing with media, if 30 orchids came in a compot, 15 were put in bark and the smaller of the pairs in sphagnum and they were randomly grouped together in the same climate. Results were given number codes 0 for total death and 9 for perfection. This enabled statistical comparisons with other variables. In this way we located half a dozen cattleya species which did not like sphagnum. Later these were to become our first RR orchids and finally, they grew well in very shallow sphagnum.

In the early eighties IB worked on one of the best available filing program called Perfect Filer. IB put all his orchid data on it. It was originally a game but when IB started experimenting in earnest, he was able to harness the information in his data bank. From a compot of about 35 plants bought in 1987, IB can tell you how many were sold and when, and when they died. The data from Perfect Filer has been placed in a superior modern program, Filemaker. THIS DATA AND STATISTICAL USE OF THE DATA INDICATES HOW WE HAVE 'PROVED' OUR THESES.

.

When GBC started IB then TT made some 'talented' guesses. The orchids had their say and we made changes to our theory. By the time DH entered We were able to look at a problem, call on our burgeoning GBC Theory to come up with a solution. While some of these have yet to be verified, the success rate snowballed. Somewhere along the line, the process was reversed. As the theory unfolded, solutions became "obvious" and the need for a trial was omitted.

A couple of examples of this follow.

It was suggested that *Den kingianum* could be made to flower by cooling them by watering them in the evening/night. Six programs had to be put on one water computer and three climates had to be used. The suggestion was a failure but the Q and I climates went on the program. These orchids 'went ape' and we said, with smirks, 'Obvious, that is how they get their water in nature!'.

One of our discarded concepts was to put a number code on root types with the eventual aim to classify species mainly for RR. It soon became obvious that this was too cumbersome and it was realised that all you had to do was let the orchids tell you their needs as in section B above. But the starting point was required and that became the climate groups as given.