

For a long time perlite has been known as a beneficial soil conditioner. Starting some 15 years ago at the West of Scotland Research Station, a hydroponic technique was developed using pure perlite for growing tomatoes. The technique really takes advantage of perlite's excellent capillary action by using a reservoir to hold nutrient solution for the perlite to absorb. In tomato culture studies where the perlite technique was compared to rockwool culture, researchers found the perlite to be superior and much simpler to manage. In 1988, we decided to conduct our own experiment on rockwool and perlite with our orchid collection.

For the experiment, 36 matched *Odontoglossum* seedlings were grown in rockwool and perlite. At the end of a year there was no significant difference in their growth as measured by weight and leaf length. The plants in perlite did seem to take off to a slightly slower start, but caught up by the end of the year. The root systems

in perlite were much larger than those in rockwool and in the ensuing years, the perlite plants did so well and they were so easy to manage that we moved our entire collection from rockwool to perlite in the spring of 1992. Since doing so, we have received three Awards of Merit (AM) and six Highly Commended Certificates (HCC) from the American Orchid Society. Following is our guide for growing orchids in perlite.

### The Medium

Perlite is a volcanic rock that occurs worldwide, though the two largest deposits are found in Greece and the Southwestern United States. The raw material is shipped around the world to factories, where it is processed for local consumption. A little like the process for making popcorn, the rock is heated to 1,000°C and the small amount of water contained in it turns into steam which expands the rock into a lightweight material. The perlite is then graded for size, although currently there are no internationally

recognized size standards. The readily available grade is horticultural grade, so this is what we use for orchid culture.

The two most important features of perlite are:

1. Potting ease.
2. It is free draining, so it's virtually impossible to overwater.

It also maintains excellent aeration. Immediately above a water reservoir, the perlite holds 30 percent of its volume as water, and at eight inches (12 cm) above the reservoir, it still holds 19 percent. Aeration and good capillary action are an excellent combination of features for a medium to have. Additionally, perlite is neutral in pH, which allows for complete control of fertilization. And because it drains so well, it's easy to leach out any salt accumulation.

Two undesirable aspects of perlite are the dust and the occasional occurrence of compaction.

However, both of these negative aspects can be easily dealt with by taking the following measures.



*These orchids (from left to right, beginning on facing page), *Odontoglossum* Sea Flower 'Island Rust' (bred by W. Thomas), *Masdevallia* Clea Bland 'Island Tiger' and *Cochlioda* neozliana are all thriving, thanks to the Thomas' perlite method.*





*One- and two-quart plastic food containers make ideal planters. Note the 3/8" drainage hole in the side of the container on the right; there are actually two drilled into the sides of each pot.*

Prepare the perlite outdoors by pouring a third of a sack into a plastic garbage bin filled halfway with nutrient solution. Hose down the surface briefly and then push the perlite down into the water a few times. Within 10 to 15 minutes the fine material will sink to the bottom, so there is no need to worry about compaction. Left floating should be a light, airy medium ready for use. The fine material that has accumulated in the bottom of the bin may be scattered in the garden.

### Containers

An ordinary pot may be turned into a reservoir pot by covering the holes in the bottom with fiberglass window screening. Then a small pot is placed in the bottom, which will fill up when the plant is watered. We mainly use one-quart and two-quart plastic food containers. The containers are easily converted into reservoir pots by drilling two holes in their sides about 1.25" from the bottom with a 3/8" bit. Window box containers are also excellent. We use ones that are 7" (18 cm) deep and across the top,

6" (15 cm) wide at the bottom and 22" (55 cm) long. Three holes are drilled in each end about 1.25" (3 cm) from the bottom.

### Seedlings

Eight- or 10-inch diameter (20-25 cm) hanging pots are particularly suitable for bringing seedlings out of flask. Fill the pots with perlite to about one inch (2.5 cm) from the rim and plant the seedlings. Carefully cover the surface of the medium with small pea gravel so the perlite cannot be seen. Put the metal hanger in the rim holes and wrap plastic wrap around the hanger leaving an opening at the top (see photos on page 21). This allows for some aeration, yet maintains a micro environment with suitable humidity. Usually, we keep the seedlings five to eight degrees (3-5°C) warmer than adult plants. The containers are watered from the bottom once a week by dipping the pot about three inches (7.5 cm) into a fertilizer solution that is half the strength of that used on adult orchids. In about four weeks the plastic is removed and the fertilizer strength is increased to

### COMPARISON OF COMMONLY USED ORCHID MEDIA

	Bark	Peat	Rockwool	Perlite
pH of medium	slightly acid	acid	slightly alkaline	neutral
fertilizer control	good	good	good	very good
leaching	easy	fair	fair	very easy
aeration	good	fair	fair	very good
disposal	easy	easy	problems	easy
health hazard	care	care	care	care
sterility	no	no	yes	yes
environment	-	overuse	disposal	-
management	fairly easy	fairly easy	fairly easy	very easy
simplicity	fair	fair	fair	very easy
weeding	fairly easy	fairly easy	fairly easy	very easy
availability	good	very good	fair	very good
cost	varies	varies	high	competative
ease of potting	good	good	good	very good
repotting time	1-2 years	1-2 years	1-2 years	2+ years
nutrient	minimal	minimal	nil	nil
overwatering	yes	yes	yes	no
rewetting	fair	fair	very poor	easy
cation exchange	yes	yes	no	no
buffering	slight	acid	no	no



*Mature plants move from the window boxes into these 4.5" pots with saucers where they'll stay for up to two years.*



**A)** Seedlings just out of flask are protected with plastic wrap that creates a microclimate for them. **B)** At four weeks, the plastic is removed. **C)** Here the seedlings are almost ready for planting into the window boxes.

the appropriate level for an adult plant of the genus.

### Transplanting

Young seedlings can be planted into perlite at any time, but larger plants should only be moved into perlite from other media when they are showing new growth. This allows a new and different root system — adapted to the perlite — to develop. The old medium should be thoroughly removed from the roots and all dead roots removed. Hold the plant in position in the pot and firm the wet perlite around its base. It is vital that plants are positioned slightly deeper in perlite than they are in other media because after they have been in a pot for a year or so, the large root system may raise the plant slightly out of the pot. The exposed root system is then vulnerable to drying and insect attack. Once set in place, cover the surface of the perlite with pea gravel, which has three functions:

1. to prevent the newly potted plant from moving when watered,
2. to prevent the perlite from being washed out when watered, and
3. to decrease surface evaporation, which causes salt buildup.

When the seedlings are well established we plant them in the window box units, creating about three rows of eight plants. They remain there until they are mature enough for the 4.5"

pots. This community-type growing gives a more uniform growing environment than is possible with individual pots. For repotting from perlite to perlite, partially fill the new pot with perlite then gently tip the plant out of

its old container and if no root trimming is required, place it in the new pot without removing the remaining perlite. Add more perlite, a layer of pea gravel and that's all there is to it.

There is no need to worry about

**IT'S NOT EASY STAYING GREEN**

**Over-watering. Under-watering. Root rot, mold and mildew. There is no end to the abuse we heap on our houseplants.**



**Until now.** Luwasa's unique patented planters feature an easy-to-read indicator that tells you when to water. The nutrient capsule automatically feeds your plant and only needs replacement every six months. The clay planting medium means you only water every two to three weeks. And it ends the mess of spilled potting soil and stained carpets and furniture.



**The Plant Protection System.**  
Call: **800-522-2898**

distributed exclusively by Pilatus, Inc., 2 West Ridge Road, New Fairfield, CT 06812 Fax: 203-746-4197

leaving plants in perlite for two or three years as there is no change in the medium (we have never seen compaction) and rot is never a problem. This is particularly valuable when pollinating a plant that has already been in a pot for two years and transplanting could be detrimental. Of course, ideally repotting should be done every two years. We use fresh perlite for transplants and use the old perlite for improving the soil in our garden.

### Perlite beds

To further simplify the management of our plants, we constructed beds that offer a large reservoir volume to reduce the frequency of watering. The beds are eight inches (20 cm) deep with plywood bottoms and cedar sides. A sheet of plywood is conveniently cut into three pieces each measuring 32 by 48 inches (80 x 122 cm) for three beds. Once constructed, each bed is lined with double six-millimeter polyethylene. Drainage is provided by a plastic 3/4" (2 cm) through-hull fitting situated on one of the sides 1.5" (4 cm) from the bottom. A bucket is placed beneath the drain to collect used nutrient, which can be recycled or applied in your back-yard garden. After checking for leaks, a square piece of fiberglass screening is placed over the hole and the bed is filled with perlite. The bed must be level and sturdy; when full, it will be very heavy.

When planting in the bed, the orchids are again set slightly deeper than they would be in other media and covered with a thin layer of pea gravel. We have had such beds in operation for up to four years and as of yet, the plants have shown no evidence of infection nor has there been any compaction of the perlite. We have grown both seedlings and adult plants in the beds and both do equally well. Unfortunately, because of their girth, these beds cannot be trans-

### RAW WATER ASSESMENT FOR ORCHID CULTURE

under 50 $\mu$ S	excellent
50-100 $\mu$ S	good
100-200 $\mu$ S	fair
over 200 $\mu$ S	poor

ported to shows, so we have been using the window box units more frequently.

We water beds and pots once a week or less in winter and somewhat more frequently in summer. We hand water, although automated watering is quite feasible. We are reluctant to use recirculating systems since viruses are spread so quickly and easily in them, and orchids are susceptible to several viruses. It is important that the reservoirs don't dry out, although unlike rockwool, perlite is easily rewetted. Initially we flushed out the beds and the pots with plain water every two months; now we simply water heavily with solution each watering and make sure that there is a significant overflow. From time to time we check the EC of the overflow as well.

### Water

Since orchids only require one-quarter to one-sixth of the recom-

mended nutrient concentration for more rapidly growing plants, it is vital to know the makeup of your water supply. The water should have a low salt content. Although rainwater is the best for orchids, this may be difficult to obtain, so you may have to use a mixture of rainwater and the local water supply, or perhaps install a reverse osmosis unit. We collect rainwater in large barrels that are placed beside each other with 3/4" polyethelene tubing acting as a siphon between them. Our larger storage tank is an above-ground swimming pool.

The discussion of feeding may be broken down into two parts: the total quantity of salts, and the qualitative analysis of the salts.

### Quantitative Salts

A reasonably accurate and very practical means of assessing the salt content of water is to measure its electrical conductivity (EC). Most salts will allow for conductivity. Pure water is low in dissolved solids, so it conducts an insignificant amount of electricity.

Conductivity is measured in units that are either called MHOS (ohms in reverse) or Siemens. For orchids, the level of conductivity you're measuring is in millionths, or "micro," expressed by the symbol  $\mu$ . Thus, one would

express a reading of 100 as 100 $\mu$ MHOS or 100 $\mu$ S. A conductivity meter is used to measure the EC; it operates by passing a small electrical current between two electrodes. Unfortunately, meters may be calibrated in two different ways. Some meters read in Siemens, while others read in total dissolved solids (TDS). TDS meters are supposed to be calibrated so they will give readings in parts per million (ppm), but this is misleading since salts have varying conductivity — urea doesn't even conduct electricity. Most horticultural papers report in Siemens, but some



*These homemade perlite beds save room and maintenance time, but the plants become very difficult to transport if necessary.*



We have two Dos-matic proportioners in series. One supplies the plants with two parts calcium nitrate and the other supplies three parts 7-11-27.

yet have definitive information. All plants need hydrogen, oxygen and carbon, as well as 12

or 14 other nutrients. They obtain the first three from the atmosphere, but the others are largely absorbed by the roots.

The problem with supplying all of the nutrients is that if the calcium in calcium nitrate, and the sulfate in magnesium sulfate meet in a concentrated solution, calcium sulfate will rapidly precipitate out. So it's important that these salts only come in contact when they are diluted to deter this reaction. Commonly available fertilizers such as 20-20-20 and 30-10-10, contain neither magnesium sulfate nor calcium, which means that by themselves, they would be unsuitable for hydroponic growing unless your water supply contains those two elements. Thus, salts may be divided into two groups: the group containing the calcium (usually calcium nitrate)

*Continued on page 77*

city water works may give their water analysis values in TDS. Such values are easily translated: 1,000  $\mu\text{S}$  is equal to 666 TDS. For growing orchids, I find the TDS Tester 3 (see sources) to be an ideal small hand held meter. It reads from 0 to 1,999  $\mu\text{S}$ .

Since orchids require such a low level of nutrition, it is important that the water supply has a low level of salts. In the table on page 22, an assessment of the water rating for orchids is given. Certainly orchids are grown in water that is far from ideal, but they do so much better in water with a low salt content, be it natural or produced artificially.

### Qualitative Analysis

Not only should you know the total salt content of the water supply, but also the proportions of the various salts that make up the total amount. All of this information is readily available from your local water authority and the results are given in ppm, which equals milligrams per liter (mg/L). In many areas, the water is very hard, meaning that it has a high content of salts, most often calcium and magnesium in the form of a carbonate. If you must use this water on orchids, the further addition of calcium and magnesium in the fertilizer will not be necessary and could be toxic.

### Fertilizer

We are slowly ascertaining the fertilizer needs of orchids, though there are many for which we do not

#### TENTATIVE VALUES OF EC LEVELS FOR CERTAIN ORCHID GENERA

400 $\mu\text{S}$	<i>Cattleya</i> <i>Paphiopedilum</i>
600 $\mu\text{S}$	<i>Odontoglossum</i> <i>Oncidium</i> <i>Miltonia</i> <i>Masdevallia</i> <i>Lycaste</i> <i>Coelogyne</i>
800 $\mu\text{S}$	<i>Phalaenopsis</i> <i>Cymbidium</i>

# HYDRO CULTURE

Plus de 10 ans d'expérience à votre service



Guy Dionne, prop.

Gilles et Robert pour vous servir

- Jardins hydroponiques d'avant-garde
- Conseils professionnels sur l'éclairage et le jardinage intérieur
- Jardins en opération au magasin

### PRODUITS VEDETTES

- LAINE DE ROCHE GRODAN
- SUN CIRCLE
- PRO TRACK II
- CONTRÔLES GREEN AIR
- CRAYONS ÉLECTRONIQUES HANNA
- GUANO
- HORMONES / SUPERTHRIVE
- ARGILE EXPANSEE
- CO<sub>2</sub>
- VENTILATEURS
- AMPOULES EYE / SUPERSUN / AGRO / VERILUX
- POMPES BECKETT / LITTLE GIANT
- MINUTERIES

NOUVEAU MAGASIN À QUÉBEC

HYDRO CULTURE  
Guy Dionne

HYDROCULTURE GUY DIONNE

1990, boul. Charest O, local 150, Sainte-Foy G1N 4K8

8473, 19<sup>e</sup> avenue, Montréal, Qué. H1Z 4J2

TÉL.: 514 722 9496 TÉLÉC.: 514 722 7826

TÉL.: 1 888 722 GROW

## ÉCLAIRAGE

LAMPE DHI (DÉCHARGE À INTENSITÉ) POUR LE JARDINAGE INTÉRIEUR

LES SYSTÈMES D'ÉCLAIRAGE 150W à 1000W, HPS et MH 199\$ A 529\$ + TX



Le seul système dont le boîtier du transformateur est relié au réflecteur par une fiche électrique



Le réflecteur le plus efficace sur le marché

Transformateur complètement détachable

HYDRO CULTURE  
Guy Dionne

NOUVEAU MAGASIN À QUÉBEC

HYDROCULTURE GUY DIONNE

1990, boul. Charest O, local 150, Sainte-Foy G1N 4K8

8473, 19<sup>e</sup> avenue, Montréal, Qué. H1Z 4J2

TÉL.: 514 722 9496 TÉLÉC.: 514 722 7826

TÉL.: 1 888 722 GROW

**ORCHIDS**, *continued from page 23*  
and the remaining salts, including the micro nutrients and magnesium sulfate. These salts may be combined in two ways:

1. by diluting them in a suitably large volume of water to give the required EC reading, or
2. by diluting concentrated solutions of the two groups of salts with inline fertilizer injectors in the irrigation mechanism.

We use two Dosmatic units in series, which give accurate dilutions at varying pressures. Ours are diluted at the rate of 1/100. Two Hozon units can be used in parallel, but the EC at the nozzle will vary according to the water pressure, so it is vital that you monitor the EC of the final outflow. For example, raising the end of the nozzle four or five feet (1.5 m) may result in a 30 to 40 percent decrease in the concentration of the fertilizer.

Presently we use two parts calcium nitrate by weight and three parts 7-11-27, though 5-11-26 would suffice. For our orchids, the fertilizers are diluted inline as described above and applied at an EC of about 550 $\mu$ S every time we water. During the ensuing week, the EC usually rises to a little over 600 $\mu$ S in the pots, but less in the beds. Our water supply has an EC of 10 to 20 $\mu$ S and a pH of 6.4. Using the above fertilizers at an EC of 550 $\mu$ S, the pH at the nozzle is 5.7 to 5.8. In the reser-

voir the pH falls over a few months, but the plants seem to thrive even with a pH as low as 4.0. We currently have this observation under review.

A small amount of fertilizer can be made for immediate use. Thoroughly dissolve a half teaspoon (2.5 ml) of 7-11-27 and one-third teaspoon (2 ml) of calcium nitrate in two gallons (10 L) of water. If you have no access to an EC meter you should leach out the growing pots and reservoirs with plain water every four to six weeks.

There are many fertilizers now available that contain all the necessary nutrients in one salt mixture. Liquid Dyna-Gro is currently being used by many orchid fanciers. We used this product in a small trial of seedlings over a period of nearly a year. Growth compared favorably with our regularly fertilized plants. For a small quantity use three-quarter teaspoons (3-4 ml) of 7-9-5 in two gallons (10 L) of water. The container should be kept warm and shaken from time to time to prevent the salts from crystallizing.

### **pH**

Perlite is neutral so it's your fertilizer solution that will determine the pH. The pH may be measured by a meter like the EC meter, though it will require more frequent calibration.

### **The Bottom Line**

Perlite has many advantages as a

medium for growing orchids. The most important features are total fertilizer control, ease of potting, simplicity of management, excellent aeration and great drainage. Additionally, roots can be easily washed clean for analysis or agricultural inspection. No other media encompasses so many outstanding qualities as far as we're concerned. We are currently conducting a randomized trial of 108 *Odonoglots* to test their growth at EC levels of 400 $\mu$ S, 600 $\mu$ S and 800 $\mu$ S. Since we started writing on orchid culture in perlite, a number of other orchid fanciers have approached us with reports of success with this method, covering most of the major genera. ❖

### **Sources**

Cole Parmer Company  
(TDS Tester 3)  
7425 North Oak Park  
Niles, IL 60714  
(800) 323-4340

*Wally Thomas is a retired laboratory physician who has grown orchids for 30 years. He is general chairman of the 16th World Orchid Conference to be held in Vancouver, B.C., April 22 - May 2 1999. For details, write: Charles Island Gardens, Box 91471, West Vancouver, B.C. Canada V7V 3P2, or e-mail: jwthomas@unixg.ubc.ca. Barb Thomas, his daughter, has a Ph.D. in Forestry Genetics and has been growing orchids for 10 years.*