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SUN GRO HORTICULTURE

## *NEXT ISSUE…*

- **WSF or CRF? Is there a better way?**

**The Sun Gro'er** *is a newsletter distributed two times yearly by Sun Gro's Technical Network Team for the purpose of communicating horticultural and Sun Gro product information.*

***Editors:*** *Rick Vetanovetz and Dan Jacques*

# *Update on E -Values of Sun Gro Growing Media*

***By Todd Cavins***

In the last issue of the Sun-Gro'er we introduced the concept of the E-value. The E-value was devised to help answer a horticulturists question "How quickly will a mix dry out?" The E-value measurement summarizes the **duration of time** it takes for a mix to dry down in a controlled environment. Rather than just giving "snapshot" information on air and water porosity immediately after saturation as traditional physical property measures do, the goal of the E-value is to provide information on how a mix performs over time by using a single number (the higher the number the wetter the mix over time) that considers many physical property measurements.

We have generated E-values for some of our most popular mixes (Table 1). Looking over the list you may be surprised how some of the mixes rank. Conventional thought is that bark makes mixes dry more quickly; however, you can see that many of the bark mixes take longer to dry down than some peat mixes (some bark mixes have a larger E-value than some peat mixes). There are a couple of reasons for this. Probably the most influential is that, particularly in the Central and Eastern Unites States, Sun Gro composts its pine bark giving rise to smaller and more uniform particle size which in turn enhances water and nutrient holding capacity. Also, bark is heavy and this added weight can "collapse" the large pore spaces that generally hold air and create smaller pores that hold water (Compare Metro Mix 820 to 840).

If you were thinking bark mixes commonly demonstrate better drainage (not dry down time!) than a similar peat-lite mix, you may be correct. Drainage is more evident in the container capacity measurement (water holding capacity immediately after saturation and drainage). While E-values do integrate container capacity, that is not the only factor — And when water content is measured over a given time that container capacity measurement impact is reduced.

One other influential growing medium ingredient that tends to create a "wetter mix" is vermiculite. Vermiculite is similar to peat moss in that it has water and nutrient holding qualities. But because medium grade *vermiculite* has more uniform particle shapes and sizes than a medium grade *peat*, it often results in a mix with a higher E-value. Take for example the data for Sunshine VP and MVP in Table 1. The Sunshine MVP has an increased amount of vermiculite making it a wetter mix demonstrating a higher E-value compared to Sunshine VP. The same observation can be made with Sunshine Mix #6 and Sunshine Redi-earth. In these examples the variation in the shape and size of the peat moss enhances aeration and drainage.

Use the E-value to help you get started when it comes time to choose a mix. But keep in mind that there are other factors to consider as well such as container size,

(Continued on page 3)

*TABLE 1. E-Values of commonly sold Sun Gro products. Products are sorted from a low E-Value to a high E-Value. Percent of ingredients for each product are reported as ranges (exact formulations are proprietary).*

| Product | E- Value | Canadian Sphagnum Peat Moss (%) | Composted Pine Bark (%) ** = fine | Perlite (%) ** = fine | Vermiculite (%) | Bark Ash (%) | Coir | Starter Nutrient Charge | Gyspsum | Slow Release Nitrogren | Dolomitic Limestone | Wetting Agent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sunshine #4 Natural and Organic** | **45** | 60-70 | | 30-40 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Sunshine #4/LA4** | **45** | 60-70 | | 30-40 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Sunshine #1 Natural and Organic** | **48** | 70-80 | | 20-30 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Sunshine #2 Natural and Organic** | **48** | 70-80 | | 20-30 | | | | | ◆ | | ◆ | ◆ |
| **Sunshine #1/LC 1** | **48** | 70-80 | | 20-30 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Sunshine #2/LB 2** | **48** | 70-80 | | 20-30 | | | | | ◆ | | ◆ | ◆ |
| **Sunshine #8/LC8** | **53** | 70-80 | | 20-30 | 5-15 | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 820** | **58** | 55-65 | 15-25 | 15-25 | | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Sunshine #15/LC15** | **59** | 90-90 | | 10-20 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Sunshine #6/LPMX** | **63** | 100 | | | | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 840** | **90** | 35-45 | 35-45 | 10-20 | | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 902** | **94** | 15-25 | 50-60** | 5-15 | 10-20 | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Sunshine VP** | **95** | 45-55 | | 5-15 | 35-45 | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 380** | **96** | 35-45 | 15-25 | 10-20 | 20-30 | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 830** | **100** | 50-60 | 20-30 | 10-20 | 5-15 | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Sunshine #7/LGPL** | **100** | 70-80 | | 20-30 | | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 900** | **101** | 15-25 | 50-60 | 5-15 | 10-20 | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Sunshine Redi Earth** | **110** | 55-65 | | | 35-45 | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 852** | **116** | 25-35 | 50-60 | 5-15 | 5-15 | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 510** | **119** | 30-40 | 35-45 | | 15-20 | 5-15 | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 865** | **127** | 20-30 | 60-70 | 5-15 | | | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Sunshine MVP** | **130** | 25-35 | | 10-20 | 50-60 | | | ◆ | ◆ | | ◆ | ◆ |
| **Metro-Mix 360** | **130** | 40-50 | 10-20** | | 30-40 | 10-20 | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 300** | **134** | 10-20 | 30-40 | 5-15 | 30-40 | 5-15 | | ◆ | ◆ | ◆ | ◆ | ◆ |
| **Metro-Mix 366** | **135** | 35-45 | 15-25 | | 30-40 | 5-15 | | ◆ | ◆ | ◆ | ◆ | ◆ |

environment (greenhouse versus outdoor production), irrigation methods and plant species. We will continue to generate more E-values to help make it easier for our customers to choose Sun Gro mixes for the intended application.

***Authors Note:*** For more details read: **HortScience 46 (4):627 -631, 2011.**

**Editors note and correction:** In the last issue of the Sun Gro'er we had listed a sampling of E-values to introduce the concept. The data presented were not correct because the data was not developed in strict adherence to the published procedure. This has been corrected and the data presented this month in Table 1 are the correct data. It is with regret if this has caused any inconvenience. ***RV & DJJ***

***DID YOU KNOW*……..**

That plant water uptake is driven by the process called transpiration. That is when water is lost to the atmosphere from openings on the bottom of plant leaves called stomates. Water evaporates out of the stomates based primarily on the difference in moisture content of the air, or relative humidity, and water in the plant's stomates. Moisture, temperature and even air movement play a role in this difference. The plant doesn't just "go with the flow", it also can control the rate of transpiration to a degree by regulating the size opening of the stomates. When plants are becoming more "water stressed", the plant has the ability to close the stomates to help limit transpiration. Water in the plant near the stomates is connected to the roots via the plants vascular system, primarily the xylem in the plants stem. Water is literally hanging under tension, stretching from the roots up to the leaves. Thus water uptake from the soil or growing medium into the roots is largely driven by the transpiration of water from the plants leaves.

## *Water Release Curves of Common Growing Media Ingredients*

### *by Shiv Reddy*

Water release curves are used by soil scientists to understand how soils or growing media "hold" and "give up" water. Growing media can hold and "release" water differently depending on the type and percentage of ingredients used in the mix. This information, taken together with E-values, can enhance our customers knowledge to make better judgments on what type of growing media will suit their particular operation.

Each growing media component has its own curve and you can peek at the curves of often used growing media components in this issue of The Sun Gro'er! (See pages 4-7)

**… Growing media components have their own water release curves and you can peek at those curves in this issue…**

**What do water release curves show?** These curves show the ability of growing medium or growing medium ingredient, like peat or rockwool, to release water to the plant.

**How are these curves developed?** The growing media material, say peat, is saturated with water and a certain pressure is applied to "squeeze" out water from the material. The amount of water squeezed out is measured. This process is repeated with increasing pressures. The data is then plotted in graphical format, usually resulting in a curve.

**Why squeeze or apply pressure to growing media?** Plants extract water from the growing media by suction. Negative pressure is the technical term for suction (or tension) in a general sense. Scientists use the same units of measure whether it be positive pressure or negative pressure (suction or tension).

A plant's extraction of water by suction from the growing media is similar to how you squeeze out water from a soaked sponge. As with a sponge, as the media dries, plant roots have to generate more and more pressure to remove water. But pressure generation and growing compete for the same resources inside the plant. So, if a plant has to keep spending more energy to extract water, it won't be growing very well. That's why you readily see small size plants when they are water stressed.

**How is the pressure measured?** The unit typically used when measuring pressure is kiloPascal (kPa). In these graphs, the higher the kPa number, the drier the growing media.

To help you relate to these pressure units, 1 psi is equal to 6.895 kPa (roughly 7 kPa). So the next time you get new tires on your car, ask the mechanic to inflate the tires to the proper pressure in kPa. Is that an Italian tire? You talkin' to me?

**What is a good pressure to maintain in growing media?** There is no set pressure point because as the media starts drying the plant's metabolism keeps changing. But for practical purposes, the amount of water that comes out of growing media between

(Continued on page 4)

0 - 5 kPa pressure is considered easily available to the plants. The amount of water that comes out between 5 – 10 kPa is still available but the plant is spending more energy to extract this water. If the plant has to exert beyond 10 kPa pressure to extract water, it may start wilting.

**How do you interpret these curves?** Look at the water release curve for peat found on this page. Soon after you water peat thoroughly and right after that peat is allowed to drain freely, peat demonstrates about 90% water. If you multiply this % by the size of the container the peat is in, let's say a true gallon container, you get 0.9 gallons or 115 ounces of water in that container. By 5 kPa, the water is roughly at 40%, so the amount of water is about 0.4 gallons or 51 ounces. So, 115 minus 51 nets 64 ounces of water that is easily available to a plant grown in peat in a gallon container. If you forget to re-water the container and let it dry until water in that peat is at a pressure of 10 kPa, about 5% more water in volume or 6 more ounces of water is still available. This illustrates that peat holds a lot of water and gives it up to the plants easily without making plants exert lot of energy.

**How does this help you schedule watering?** As you see, different growing media materials demonstrate varied abilities to provide available water to plant roots and thus demonstrate different water release curves. This means that different growing medium ingredients will dictate different watering schedules. Suppose you have a hydrangea growing in a gallon pot that requires 12 ounces of water per day. From the calculations, you can see if you're using peat, you can most likely sit in your office for 5 days (theoretically) before you re-water, but if that hydrangea is in sand, you would have to go out and water it twice a day!

There are electronic sensors that are capable of measuring the pressure that a growing medium holds onto water. With these sensors, you can automate irrigation cycles. For example, you can program irrigation to start when the growing media demonstrates a pressure of 7 kPa and stop when it reaches 1 kPa. You can adjust the pressure to exert any amount of "water stress" you desire to obtain the plant growth you want.

**A note about these curves.** The curves shown in this article have been collected over years but we wanted to put these in one place as a reference for anyone choosing a material for growing media. These are ***generalized*** curves to illustrate water release capacities of different growing media materials. If you want precise curve of a specific mix or ingredient, it has to be specifically measured of course. This is because the curve depends on how much peat, perlite, etc. are in your mix, how coarse or fine the ingredients, how these particles are arranged in the pot, what is the effect of the container size and things like that.

For more on this subject, check out

http://www.sungro.com/files/articles/Watering%20growing%20media%201.pdf

http://www.greenhousegrower.com/article/24774/how-to-water-more-efficiently

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***FIGURE 1. Water Release Curve of Sphagnum peat moss. Units are in kiloPascal (kPa) units of pressure. This data shows that roughly 50% of the water held in a container is freely available for plant up-take (water release from 0 to 5 kPa). The remainder of the water is more strongly held by the peat and not that easily available to the plant roots (water above >5 kPa). This is why peat mixes provide a lot of water for rapid plant growth.***

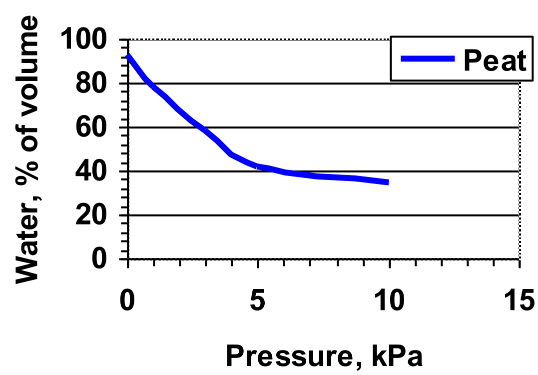



***FIGURE 2. The apparatus in the image on the right is what is called a "pressure plate apparatus" and is used to subject a soil, growing medium ingredient or growing medium blend to increasing pressure. The amount of water that is "extracted" is measured and plotted in graphical format and referred to as a water release curve. (photo courtesy Dr. Mike Evans, University of Arkansas)***

*FIGURE 3. Water release curves for Pine bark, ground Redwood, perlite, vermiculite, coir and sand.*

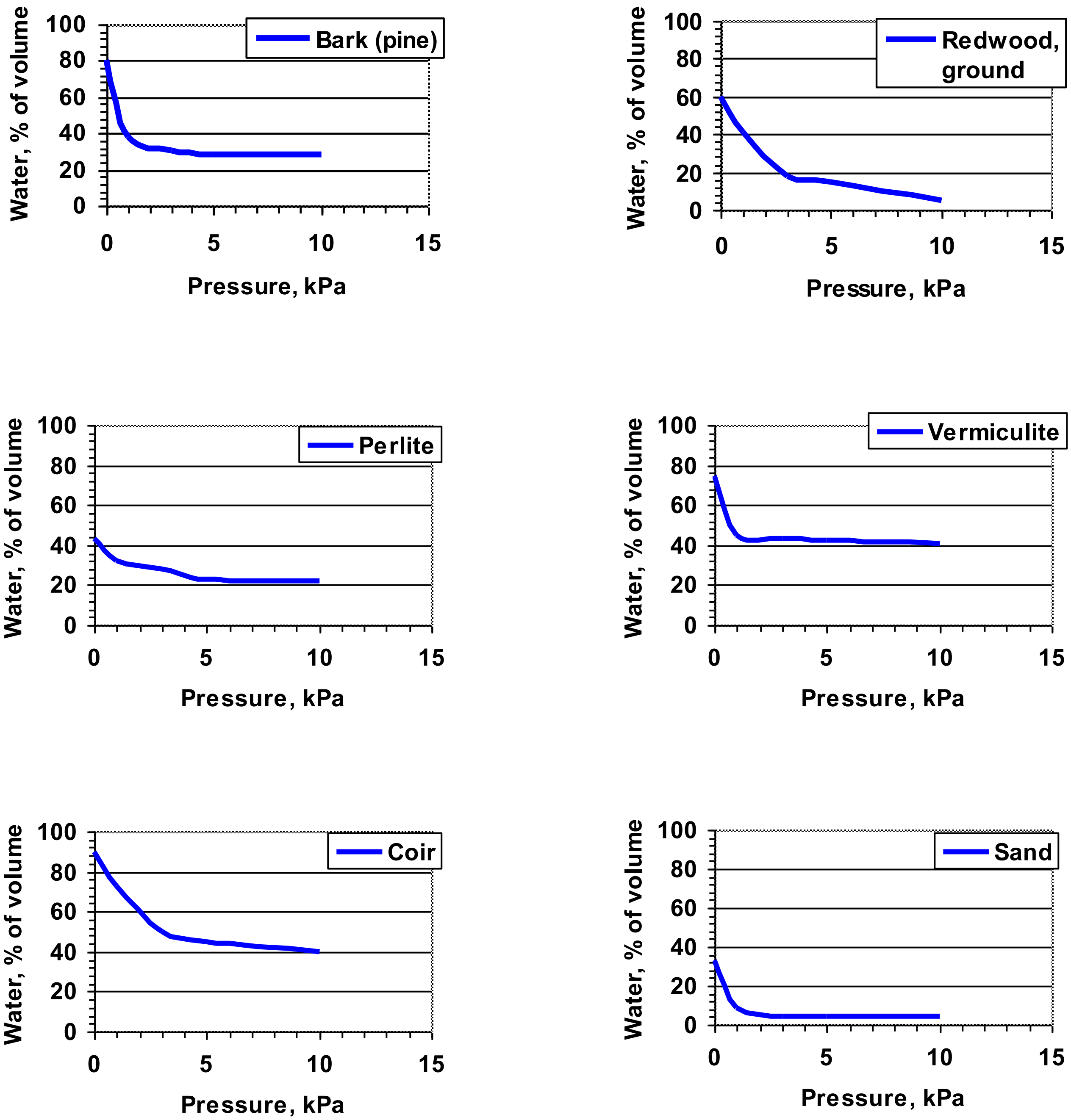


*FIGURE 4. Water release curves for rockwool, clay pellets, pumice, rice hulls, sawdust and clay. Notice how clay soil tends to not "give up" water to plants and retain most of its water.*

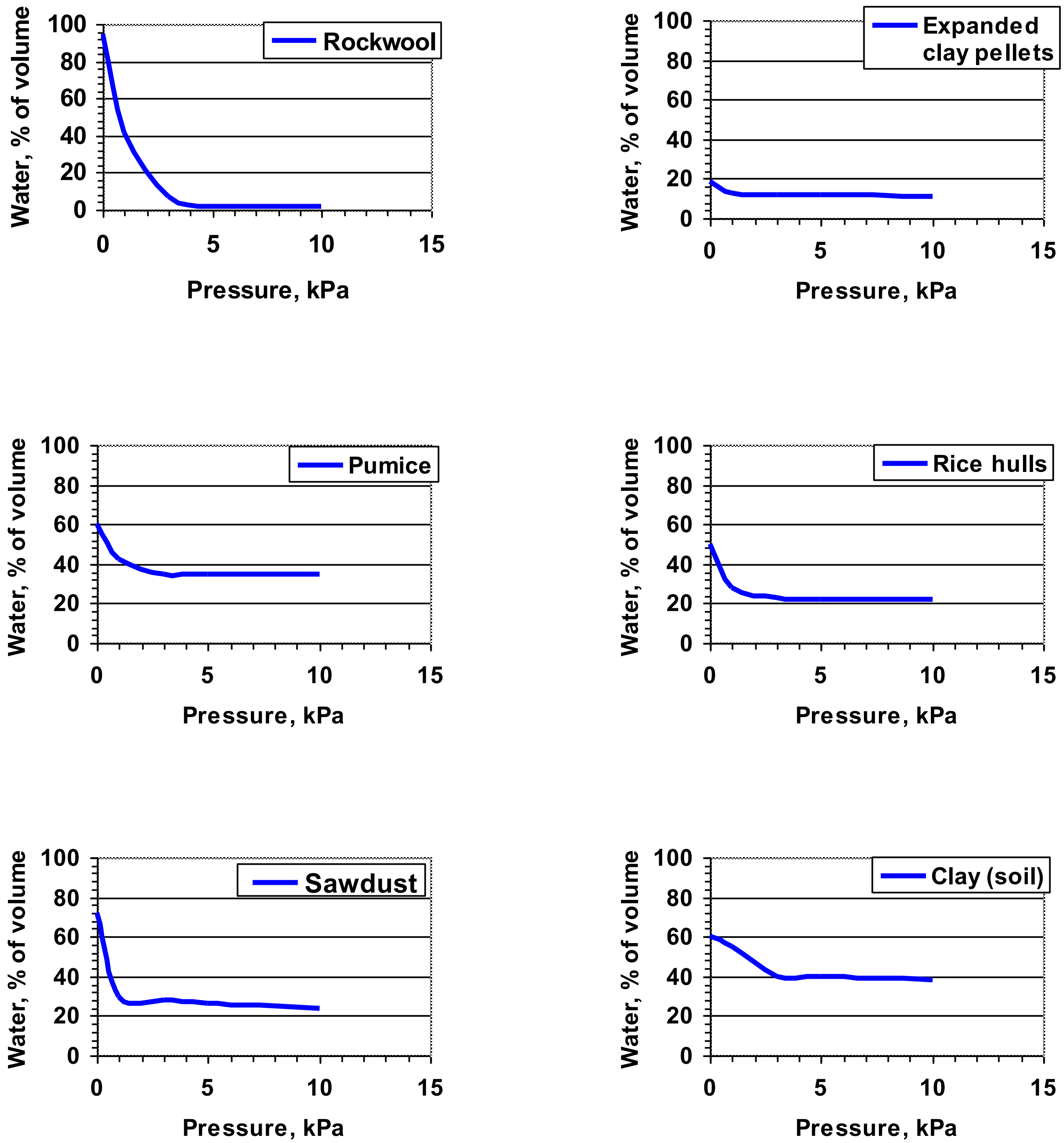
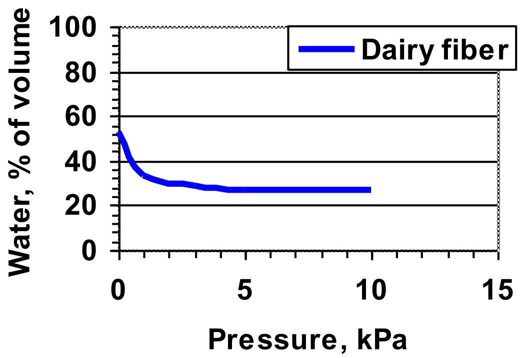
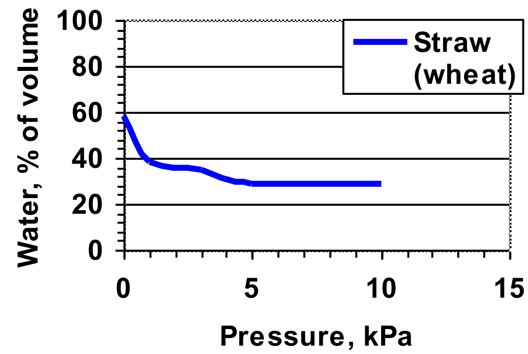
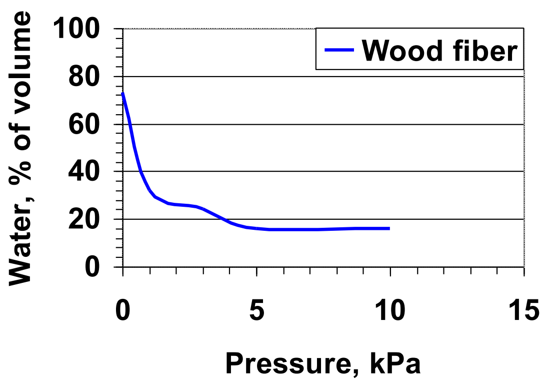


*FIGURE 5. Water release curves of digested dairy fiber, wheat straw and wood fiber.*




## Sunshine #4 Mix with Mycorrhizae from Sun Gro...

Sun Gro has developed a new product for sale to the professional and hydroponics markets - **Sunshine #4 Mix with Mycorrhizae**. This mix is sold in 3.0 cubic foot compressed bales. The package is slightly smaller than the typical 3.8 cubic foot package which seems to be more amenable to customers in the hydroponics market.

The ingredients of the blend are the same ingredients as the standard, and very popular, Sunshine #4 Mix but also with the addition of mycorrhizae. The mycorrhizae incorporated into this product is a specific blend of seven different types of endomycorrhizae suited to the herbaceous crop types that would be grown in this mix. This mycorrhizal blend is formulated to help assure mycorrhizal "association" with a wide range of herbaceous plant types.

As with most Sun Gro mixes, the product includes dolomitic limestone as a means to adjust medium pH and provide calcium and magnesium. A nutrient charge that is specifically formulated to be compatible with mycorrhizae and to help get plants off to a great start is also incorporated along with wetting agent to aid in rapid and uniform wetting of the mix.

For best results, start plants on a sound fertilization program soon after planting, considering the water quality being used. Be mindful that fertility programs be geared toward the plant types grown in the conditions of which they are being grown.

***Sunshine #4 Aggregate Plus Mix with Mycorrhizae for professional Greenhouse and Hydroponic growers***

## Peatland Ecology Research Group - Developing Facts vs. Fiction

In the last issue of the Sun Gro'er we reported on the little known "secret" concerning peat bog restoration under the direction of Dr. Line Rochefort. But the "rest of the story" is the work being conducted by the Peatland Ecology Research Group (PERG) centered at the University of Laval in Quebec, Canada. This group is a network of world-class researchers working on various aspects of Sphagnum peatland ecology, restoration and environmental impact with the main objective to develop a knowledge base that would contribute to the responsible management of Canadian peatlands. Again, this function is supported from Canadian governmental agencies and also the Canadian Sphagnum Peat Moss Association (CSPMA).

What many people in the horticultural industry <u>do not realize</u> is the broad and thorough research that is being focused on this type of ecosystem. They are not just focused on restoring harvested Sphagnum peat bogs. But they also include other studies on the understanding of the various flora and fauna that make up the intricate workings of a peat bog ecosystem in order to know when restoration practices have truly been achieved.

The work being done within the PERG network is not just focused on ecology either. They also conduct work on the impact of peatland, peatland harvesting and restoration cycles on the generation of greenhouse gases. As you may know the topic of greenhouse gasses and their impact on climate change (aka "global warming") elicits a range of beliefs, opinions and/or passions. Two of the major greenhouse gases are carbon dioxide and methane. Two carbon based molecules.

Some horticulturists believe that the use of sphagnum peat is creating a major impact on climate change because sphagnum peat is essentially "buried" and degrading slowly and thus adding carbon dioxide to the atmosphere slowly. When it is harvested it speeds up this process.

These researchers are attempting to find out the facts of this matter by measuring carbon dioxide and methane emissions and <u>relating that to other anthropological activities</u>. This is exciting stuff.

What we think we know at this point is that the emanation of carbon dioxide from harvested peat bogs pales in comparison to other human activities or industries.

In a June 2008 report by Jason P. Cagampan and Maria Strack to the CSPMA entitled "Peatland disturbance and climate change: What is the role of Canada's horticultural peat industry?", it was reported that the amount of carbon dioxide emitted by 6 cubic foot bag (~ 4 CF bale) of peat moss is equivalent to 0.8% annual carbon dioxide emissions from a car.

This does not take into account all the carbon dioxide used to get fuel into a car and it does not take into consideration the number of acres of bogland restored since 2008. The point is that even this value, as low as it is, is shrinking.

And this does not consider the fact that peat moss is usually buried during the practice of gardening where any resulting carbon dioxide is slowly emitted and plants grown which then sequesters carbon dioxide. Which brings to bear another point highlighted in the 2008 report — That any judgment based on the use of peat moss should be through the vantage point of the life cycle of using this important horticultural resource.

***Rick Vetanovetz***

<u>*For more information*</u>:
**www.gret-perg.ulaval.ca**

***RIGHT: Dr. Line Rochefort discussing the ecological issues and value of proper bog restoration and how expediently restoring a peatland after harvesting ceases will dramatically bring a harvested peat land back to a functional bog.***

***And a final note.....***

**Welcome** Fafard

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