



BY DR. MICHAEL EVANS

# Rice HULLS 101

More and more growers are using PBH.  
What do you need to know to get started?

## Why rice hull products and PBH?

Of all the root substrate physical properties, drainage and air-filled pore space are often among the greatest concerns for growers. After irrigation, water or nutrient solution drains from the larger pores, and these relatively large pores become filled with air. This allows for gas exchange and provides important oxygen for the roots.

If your root substrate doesn't have enough large pores that drain, the substrate may retain too much water and the roots may not have adequate oxygen.

Such a situation may result in poor root development and increased disease incidence. In order to insure that their root substrate has large pores that drain and become air-filled, growers have typically incorporated materials such as perlite, 3/8-in. screened aged bark, pumice, large pieces of coconut coir or calcined clay into their root substrates. Over the past several years another material, parboiled rice hulls (PBH), has been introduced onto the market as a root substrate component designed to provide drainage and air-filled pore space in root substrates.

To understand what PBH is and how it functions, you need a clear understanding of rice hull products. Rice hulls are a byproduct of the rice milling industry and are primarily produced in Arkansas, Texas, Louisiana, Mississippi and California. Various types of rice hull products are available and some of these have been used in root substrates for many years.

Probably the most common rice hull product that has been used in root substrates has been composted rice hulls. However, one of the problems with this material is that no standards have been developed, and therefore what are often referred to as composted hulls may be composted or aged hulls.

**Aged hulls** are allowed to passively decompose so that the hull is oxidized to a point where it's brown in color. However, aged hulls are still largely intact.

**Composted hulls** are brown to black in color and most of the rice hull particles have been broken into smaller pieces as they have composted. Therefore, composted rice hulls have a much smaller particle size distribution and thus different properties from aged hulls. It's important to note that even with composted hulls, different methods of composting are often used, which may result in products with significantly different

Photos: Michael Evans



A comparison trial shows pansies grown in PBH (back row) versus perlite (front row). The percentage of perlite or PBH, from left to right, is 10%, 15%, 20%, 25%, 30%, 35% and 40%.

physical properties. True-composted rice hulls are typically used in a root substrate to provide for water-holding capacity.

Traditionally, **fresh rice hulls** had been avoided as a substrate component for two reasons. The first was that they were thought to cause nitrogen tie-up if used in a root substrate. However, fresh rice hulls decompose very slowly, and it was demonstrated that they did not result in significant nitrogen tie-up when used in a sphagnum peat-based root substrate at up to 40% of the total volume. A second reason was that fresh rice hulls typically were contaminated with both weed seed and remaining rice grains.

The material known as PBH is a brand of fresh rice hulls specifically from parboiled rice. **Parboiled fresh rice hulls** are canoe-shaped, yellow or tan in color and approximately 6 to 10 mm in length. This type of fresh rice hull has been exposed to very high-temperature water before being removed from the rice grain, dried and bagged. The product has thus been sterilized and is free of viable weed seed.

### PBH and the substrate's physical properties

Loose PBH has a similar bulk density and a slightly lower water-holding capacity than 6 to 8 mm perlite. However, PBH has a higher total pore space and a higher air-filled pore space as compared to a 6 to 8 mm perlite. When blended into a substrate, PBH provides for drainage and air-filled pore space. Substrates containing up to 20%

PBH have a similar water-holding capacity and air-filled pore space as peat substrates containing 20% perlite.

However, as the amount of PBH increases, the air-filled pore space increases at a greater rate than for perlite, so peat-based substrates containing at least 30% PBH have a higher air-filled pore space than peat-based substrates containing at least 30% perlite (Figure 1).

Substrates containing up to 25% PBH or 25% perlite have similar water-holding capacities. As the amount of PBH or perlite increases, the water-holding capacities decrease but at a faster rate in the PBH-containing root substrates than for the perlite-containing root substrates (Figure 2).

Therefore, peat-based substrates containing 20% or less PBH have similar properties to equivalent peat-based root substrates containing equivalent amounts of perlite. However, root substrates containing more than 20% PBH will generally have a higher level of drainage and air-filled pore space and a lower water-holding capacity than peat-



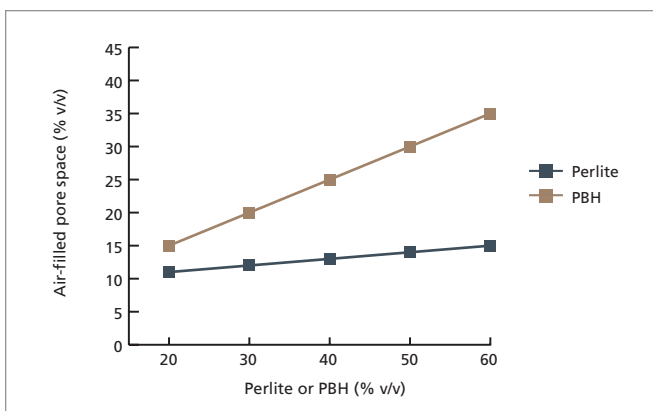
Vinca grown in root substrates of perlite (front row) and PBH (back row). The percentage of perlite or PBH, from left to right, is 10%, 15%, 20%, 25%, 30%, 35% and 40%.

## Points to Remember

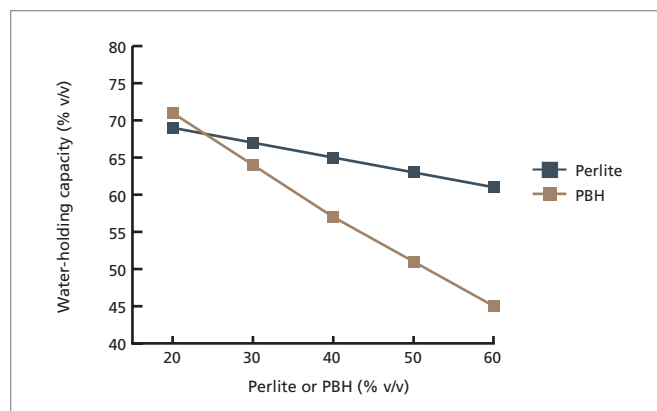
- PBH has been sterilized and, unless contaminated after the fact, does not contain viable weed seed.
- At 20% of the total volume of the root substrate, PBH provides a similar amount of drainage and air-filled pore space as 20% perlite.
- When more than 25% PBH is used in a root substrate, it provides a higher level of drainage and air-filled pore space than an equivalent amount of perlite.
- PBH in a peat-based substrate does not have significant impacts to the chemical properties of that substrate.
- The highest shoot and root growth occurred for plants grown in root substrates containing 20% to 30% PBH.

based substrates containing an equivalent amount of perlite.

These differences can be beneficial in that PBH provides a way to develop very well-drained root substrates with high air-filled pore space. However, with changes in root substrate physical properties, you may need to change the mineral nutrition and irrigation program. If you're interested in using PBH in your root substrate, you should experiment and learn how to most effectively use the material under your specific cultural conditions before making large-scale changes.



**Figure 1.** Root substrate air-filled pore space as affected by increasing amounts of PBH and perlite.



**Figure 2.** Root substrate water-holding capacity as affected by increasing amounts of PBH and perlite

## PBH and substrate chemical properties

Parboiled rice hulls have a pH near neutral to slightly alkaline. However, because of their low cation-exchange capacity, they have little effect of the substrate pH. In trials at the University of Arkansas, when used in the range of 20% to 40% of the total substrate volume, PBH-containing substrate had an initial pH that was similar to equivalent perlite-containing root substrates. Over a period of eight weeks in the greenhouse environment, PBH-containing substrates often had a slightly higher pH than equivalent perlite-containing substrates, especially when more than 40% of the root substrate was PBH. However, the pH differences never exceeded 0.2 units.

Parboiled fresh rice hulls had a low electrical conductivity. No practical dif-

ferences occurred in the concentration of nitrate, ammonium, zinc, copper, boron, molybdenum, sulfur in equivalent PBH and perlite-containing root substrates. Although, PBH-containing substrates contained higher concentrations of phosphorus, potassium, calcium and magnesium than equivalent perlite-containing substrates, the differences were not great enough to be of practical consequences.

Because of perlite's mineral origin, perlite-containing root substrates contained higher concentrations of iron than equivalent PBH-containing substrates. Parboiled fresh rice hulls did contain significant levels of amorphous silica, and the silica concentrations of PBH-containing substrates were higher than for perlite-containing substrates.

One potential concern related to the chemical properties of PBH has been that

they contain significant levels of manganese. However, when used in the range of 20% to 40% of the total volume of root substrate, the manganese concentrations were within the commonly recommended ranges for manganese. Overall, the use of PBH in a peat-based root substrate would not have significant impacts to the chemical properties of the root substrate and should not require growers to make changes to their mineral nutrition program.

## Plant growth trial results

In growth trials at the University of Arkansas, vinca, geranium, impatiens, marigold and pansy plants grown in PBH-containing substrates were similar to those grown in equivalent perlite-containing root substrates. Although plants were grown in substrates containing 10% to 40% PBH or perlite, the highest shoot and root growth occurred for plants grown in root substrates containing 20% to 30% PBH. Similar results have been found in grower-based plant growth trials using sphagnum peat-based root substrates with 20% to 30% PBH or perlite. Most anecdotal reports from growers have indicated best results from PBH when it constituted 20% to 25% of the total volume of the substrate.



Impatiens grown in a substrate of 30% perlite (left) and 30% rice hulls (right).

## Greener Growing



A grower trial shows impatiens grown in 20 PBH (left) and 20% perlite (right).



A side-by-side comparison of impatiens grown in 20% perlite (left) and 20% PBH (right).

Of course growing conditions vary from greenhouse to greenhouse. Therefore, the best course of action for is to conduct on-site trials in your greenhouse with varying rates to determine

how different PBH-containing substrates perform under the specific cultural conditions. You can then select the substrate that performs best under your specific conditions. ■

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