The Potential for Rice Hulls

How do parboiled rice hulls affect growing media's physical properties and plant growth?

By Jay Holcomb, Alan Michael, Stephanie Lenhart and John Rowe

Pore Space of Experimental Growing Media

Treatment	Aerated Pore Space (%)	Container Capacity (%)	Total Pore Space (%)
#1	12.3±3.8	64.3±5.6	76.5±8.3
#2	14.6±3.8	61.9±4.0	76.4±6.6
#3	15.9±7.1	61.3±2.1	77.1±7.7
#4	19.9±10.4	60.2±0.9	80.1±10.5
#5	9.6±4.5	67.9±2.5	77.5±5.3
#6	15.5±8.8	67.3±1.8	82.8±8.5
#7	15.1±6.2	63.7±1.6	83.1±5.7

Table 1.

Bulk Density and Volume of Solids in Experimental Media

Treatments	Bulk Density (g/cc)	Volume of Solids (%)
#1	0.125	12.5
#2	0.132	13.2
#3	0.134	13.4
#4	0.133	13.3
#5	0.126	12.6
#6	0.124	12.4
#7	0.130	13.0

Table 2.

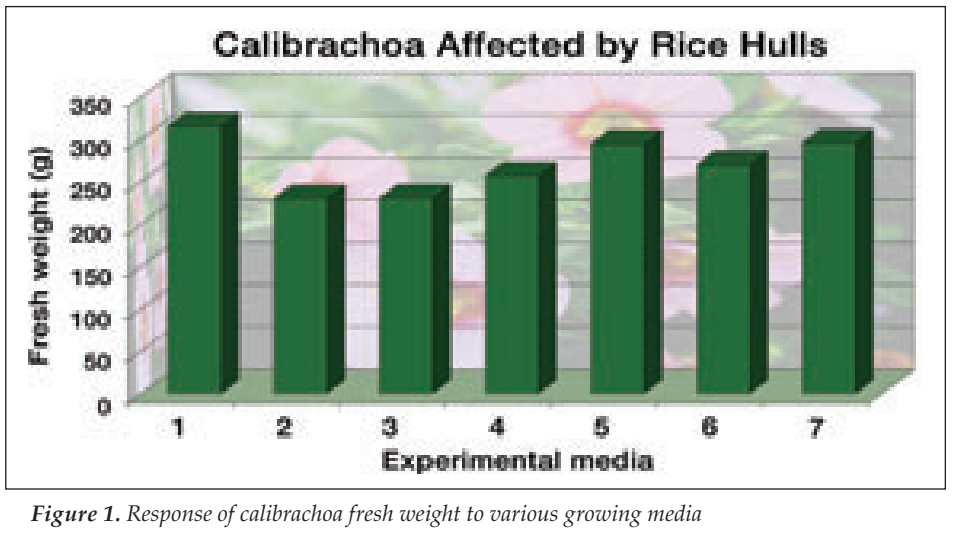

Figure 1. *Response of calibrachoa fresh weight to various growing media*

The demand for growing media components is ongoing, and growers are on the lookout for new, low-cost components. A new potential component, parboiled rice hulls (PBH), has become available. Media manufacturers and growers have asked whether there is an organic component (PBH) that might replace some peat moss in growing media, and some have used PBH as a replacement for perlite. This research was designed to gather more information about PBH and how it affected the physical properties of growing media when used as a component. The specific objectives were to determine:

- how PBH influences the physical properties of media and plant growth when PBH ratio is varied, and peat moss and coir ratios are decreased.
- how physical properties and plant growth will be affected when PBH is substituted for perlite and vermiculite in a growing media.

Results: Physical Properties

The aerated pore space, container capacity and total porosity are presented in Table 1, and bulk density and volume of solids are presented in Table 2.

In Table 1 (left), media 4 (which had 30 percent PBH), had the greatest aerated pore space, while media 5 had the least aerated pore space, with all other media intermediate. Media 5 had no PBH, no vermiculite and 15 percent perlite. Aerated pore space of 10 to 20 percent is considered very high, and low aerated pore space is thought to be from 2 to 5 percent. It is safe to conclude that all mixes had adequate aeration and that plants grown in those mixes were not adversely affected by poor aeration.

Media 7 had the highest total pore space, with media 6 a very close second. Medias 1 and 2 had similar, lower values. Total pore space should be about 85 percent. Media 6 and 7 approach that value, while all the other media are below that value.

In Table 2 (left), the bulk densities are low, as is typical of soilless growing mixes. The individual components have fairly low bulk densities, so the substitutions of one for another had only a small effect on bulk density. The volume of solids in each of the media varied, but not to a great extent.

Plant Growth

Calibrachoa fresh weight was affected by growing media treatments (Figure 1, left). The plants with the greatest fresh weight were in treatment 1, which was considered the control. Plants in treatments 2 and 3 had significantly less fresh weight than plants in treatment 1. Plants in the other treatments were not significantly different from those in treatment 1.

Some of the same trends were evident with impatiens, which were observed with calibrachoa; however, the treatment effects were not statistically significant. The trends looked similar, but we will conclude that statistically there was no effect of the growing media on impatiens growth (Figure 2, page 30). ▶

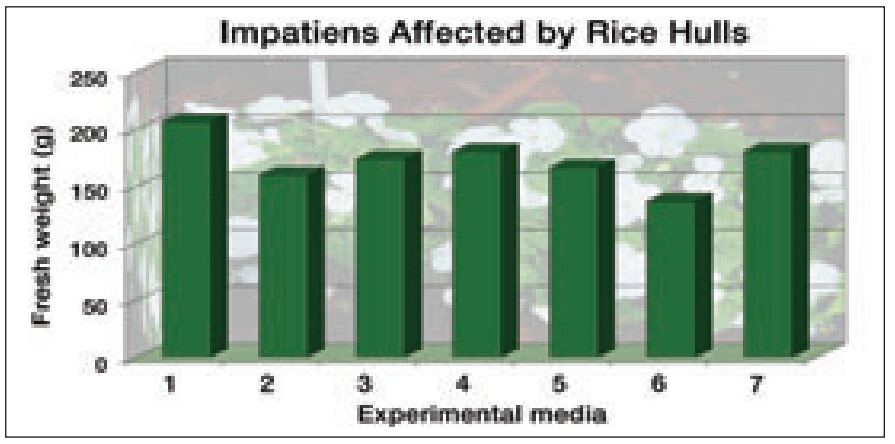

Figure 2. *Response of impatiens fresh weight to various growing media*

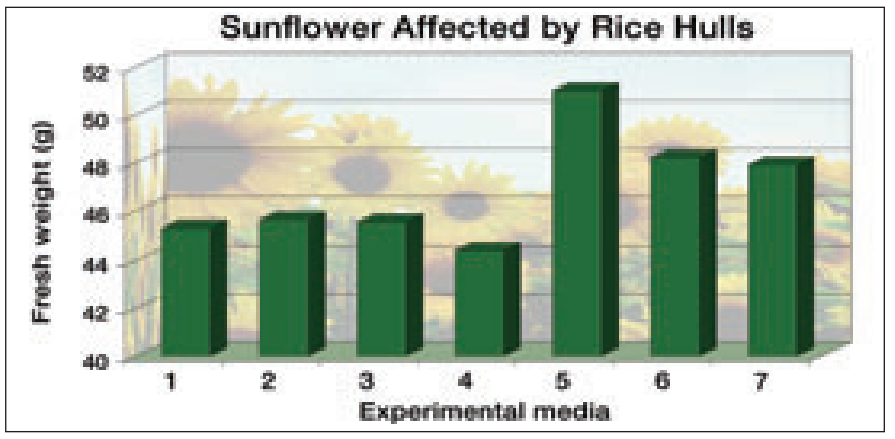

Figure 3. *Response of sunflower height to various growing media*

The sunflowers grown in media 5 (15 percent perlite and no PBH) were significantly taller than plants in any other media. The shortest plants were in media 4 (which had 30 percent PBH) and all other plants were intermediate. For sunflower, the data were plant height in contrast to fresh weight for the first two taxa. Generally, fresh weight and height are related, so it was surprisingly that the plants in treatment 5 were taller (Figure 3, left).

Heuchera was a perennial in contrast to the previous taxa, which were all grown as annuals. The pattern for fresh weight in heuchera was markedly different from that of the previous taxa (Figure 4, opposite left). Plants in media 6 (15 percent PBH) had the highest fresh weight followed by plants in media 5 (15 percent perlite). Plants in media 3 (smallest percentage of peat plus coir) had the least fresh weight, with plants in the other media intermediate. The heuchera was grown for a longer period of time because it seemed to be a slower-growing plant than the others grown as annuals. Whether the longer crop time influenced the results is unknown.

Figure 3b. *Comparison of sunflowers grown in media 1 compared to 5 (right)*

The poinsettia crop is commercially grown as a fall crop, so it was grown after the others had been harvested. The data for 'Early Orion

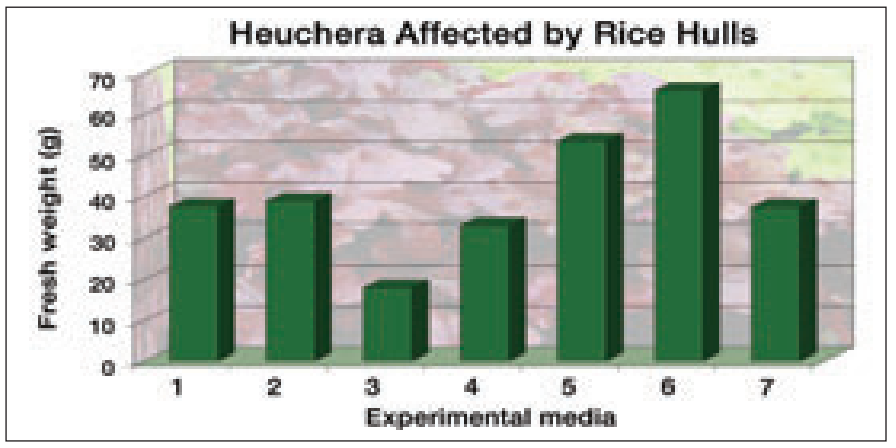

Figure 4. *Fresh weight of heuchera grown in various growing media*

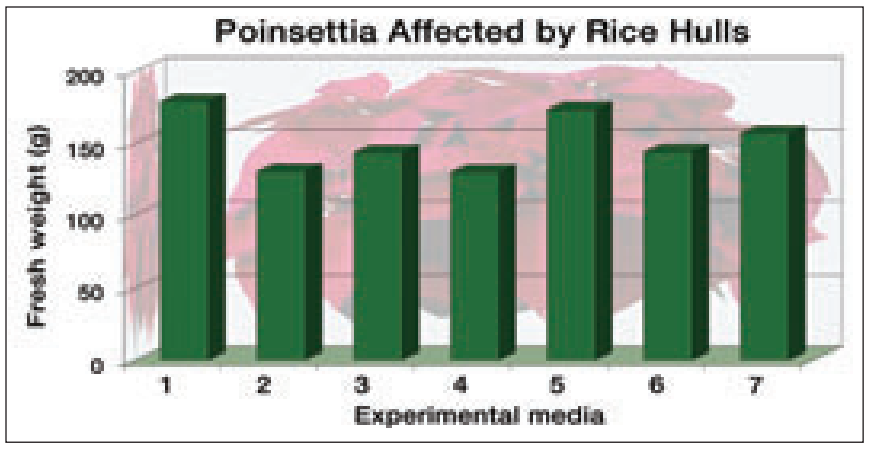

Figure 5. *Fresh weight of 'Early Orion Red' to various growing media*

Figure 4b. *Heuchera in the experimental media from 1 to 7 (left to right)*

Red' is presented in Figure 5 (opposite right) The trend in fresh weight was similar to that seen with calibrachoa, where plants in media 1, 5, and 7 had fresh weights that were not statistically different from one another. Plants in media 2 and 4 had the least fresh weight.

Media Tests

In addition, EC and pH were collected from a pour-through on selected pots from each treatment in the Landisville experiment and are presented in Figures 6 and 7 (page 32). Pour-through data were not collected for the poinsettia experiment.

The pH of media 1 was rather low compared to the other treatments. It's possible that there was some kind of pH effect, but trend for pH does not really follow the fresh weight trend, so it seems unlikely that pH would be affecting plant growth.

The treatments with the highest EC were media 1 and 4, which produced more plant fresh weight. Media 1 generally produced good plant growth, and 4 usually produced average to below-average plant growth. It is not as clear why the media in treatments 1 and 4 would take up higher levels of fertilizer from the ebb-and-flood table than other treatments. The fact that ➧

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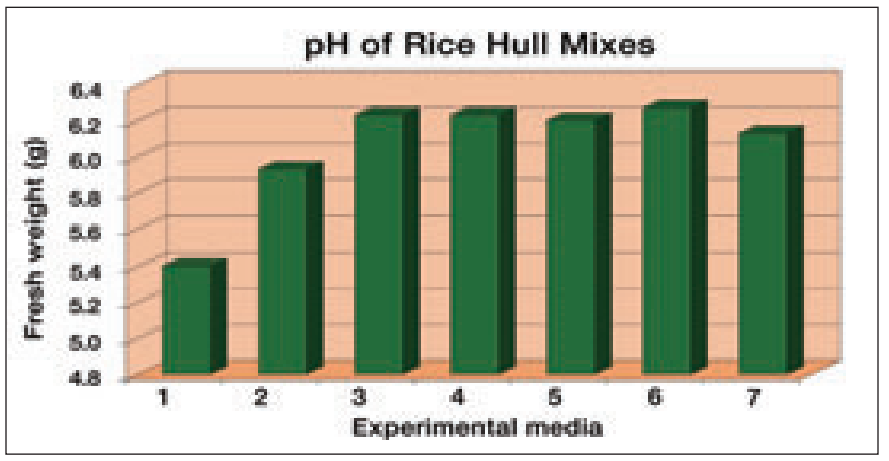

Figure 6. *The pH of a pour-through from various growing media*

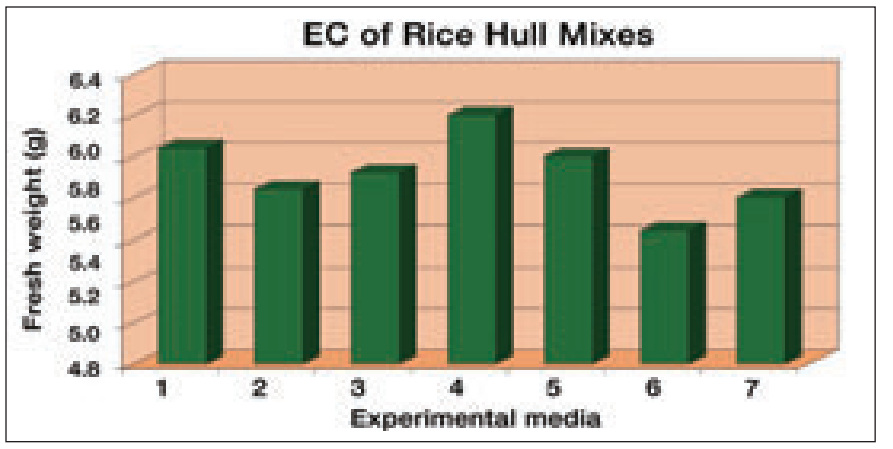

Figure 7. *The EC of a pour-through from various growing media*

plants grew well in 1 and average in 4 suggested that EC was not limiting plant growth. The nutrient status of all media as measured by EC was in a range considered normal for good plant growth.

Discussion

Media 1, 2 and 3 had decreasing levels of peat and coir replaced by increasing levels of PBH. There was never an instance where decreasing peat and increasing PBH increased growth. The probable explanation is that reducing peat and coir reduced the water-holding capacity of the media (Table 1). Apparently, under the conditions of this experiment (subirrigation), higher levels of peat and coir provided greater water availability, reflected in greater plant growth. For these three treatments, total porosity of the media was affected only slightly. Based on these three treatments, substituting PBH for peat and coir did not increase plant growth and, in some cases, may have reduced total growth.

For media treatments 5, 6, and, 7 perlite was substituted for PBH. Again, the water-holding capacity may be the factor to explain the plant responses. The water holding capacities of 5 and 6 were higher than 7 and there was never an instance where 7 was better than either 5 or 6. Aeration was lowest in 5, but at almost 10 percent there seems to have been adequate aeration so that there was no reduction in plant growth associated with low aeration. Total porosity was low in 5, but apparently not low enough to affect growth of any of the taxa tested. Heuchera was the one taxa that could not be explained by the physical property data: It grew very well in PBH at 15 percent; however, there are no physical properties to explain it, so perhaps there was some chemical factor that influenced growth.

In media 4, PBH replaced coir. For all taxa, 4 had the least plant growth. This media had high aeration and poor water-holding capacity. Because the plants had been responding to water-holding capacity, it is not surprising that this treatment did not produce very good growth.

In summary, PBH effectively substituted for perlite as a growing media amendment, but was not an effective substitute for peat moss. GPN

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