Two-Part Series

April Parboiled rice hulls in cutting propagation

May Parboiled rice hulls during finishing

Rice hulls mixed with peat in varying percentages produced cuttings similar in quality to those grown in traditional substrates.

Parboiled Rice Hulls In Propagation Substrates

Researchers at Purdue University found that parboiled rice hulls are a viable alternative to peat moss or perlite in vegetative cutting propagation mixes.

by **CHRISTOPHER J. CURREY, MATTHEW GRAY AND ROBERTO G. LOPEZ**

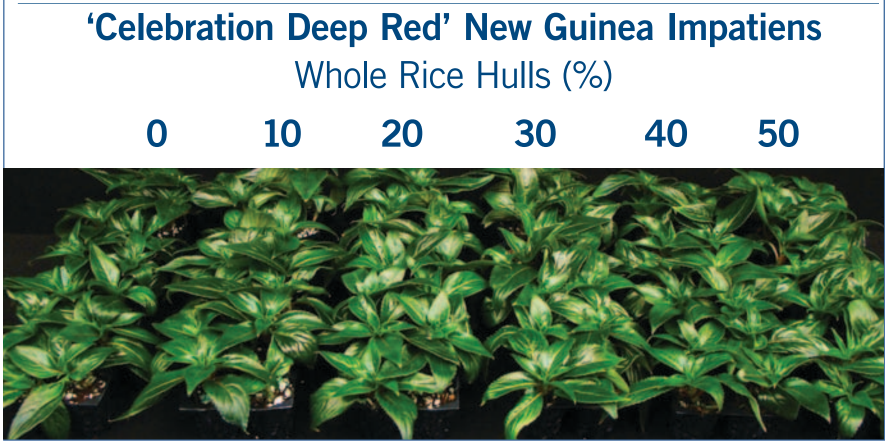
IT is fairly common for substrates used in cutting propagation to be comprised of sphagnum peat moss and perlite or other materials. While there is no doubting the usefulness and effectiveness of peat and perlite as substrate components, some growers are looking for alternatives.

Propagation substrates do have particular requirements compared to mixes used for finishing crops. In particular, they are formulated to have greater air space and drainage due to the frequent mist applications used in the first few weeks of propagation. Additionally, the small individual cell volume in propagation trays can result in a perched water table, where root initiation and development can be hampered by lack of oxygen in the space that is constantly filled with water, necessitating good drainage.

Rice Hulls As An Alternative

Fresh parboiled rice hulls are an agricultural byproduct of rice production. Although research has shown that replacing perlite, or in some instances peat, with whole or ground rice hulls, respectively, can work for finishing or growing-out greenhouse crops, we wanted to determine if substrates containing whole or ground rice hulls would work for rooting vegetative cuttings.

Fig. 1. Cuttings of 'Celebration Deep Red' New Guinea impatiens propagated in substrates containing 50 percent peat moss and (from L to R) 0 to 50 percent whole rice hulls and 50 to 0 percent perlite.



How The Trial Was Conducted

Cuttings of 'Celebrette Frost' and 'Celebration Deep Red' New Guinea impatiens *(Impatiens hawkeri)* were stuck in 105-cell trays filled with a propagation substrate comprised of the following:

- 50 percent peat moss and 0, 10, 20, 30, 40 or 50 percent whole fresh rice hulls or perlite
- 50 percent perlite and 0, 10, 20, 30, 40 or 50 percent ground fresh rice hulls or peat moss.

The substrates with varying proportions of different components are outlined in Table 1.

Cuttings were maintained in a propagation greenhouse with an air and substrate temperature set point of 73°F. During the first seven days of callusing, the average daily light integral (DLI) was maintained at about 5 $mol \cdot m^{-2} \cdot d^{-1}$. After seven days, cuttings were placed in a greenhouse with high-pressure sodium lamps operating for 16 hours per day with an average DLI of about 12 $mol \cdot m^{-2} \cdot d^{-1}$. Previous research at Purdue has shown that these environmental parameters produce high-quality rooted transplants.

Three weeks after being stuck in the various substrate treatments, the cuttings were harvested and data was collected.

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Table. 1. Proportion of peat moss, perlite and whole or ground fresh rice hulls mixed in varying proportions (by volume) used for cutting propagation.

	Substrate component (%)			
Mix	Peat moss	Perlite	Whole rice hulls	Ground rice hulls
1 (control)	50	50	—	—
Substituting whole rice hulls for perlite				
2	50	40	10	—
3	50	30	20	—
4	50	20	30	—
5	50	10	40	—
6	50	—	50	—
Substituting ground rice hulls for peat moss				
7	40	50	—	10
8	30	50	—	20
9	20	50	—	30
10	10	50	—	40
11	—	50	—	50

We recorded the percentage of cuttings that were fully rooted, measured stem length and caliper, and washed the substrate off the roots so we could separate roots and shoots to record the weight of each.

Quality Index Remained The Same Regardless Of Substrate Mix

The percentage of rooted 'Celebrette Frost' New Guinea impatiens in substrates was unaffected by the percentage of whole rice hulls replacing perlite. Although the percentage of cuttings rooted was unaffected when substrates contained 0 to 40 percent ground rice hulls, there was approximately a 12 percent loss when substrates contained 50 percent ground rice hulls. Similarly, stem length was slightly shorter for 'Celebrette Frost' cuttings propagated in substrate containing 50 percent ground rice hulls. There were no significant differences in root or shoot dry weight of 'Celebrette Frost' cuttings rooted in different substrates, and the root:shoot dry weight ratio was unaffected by whole or ground rice hulls.

We used something we called the "quality index," a value derived from an equation combining the total mass, root:shoot ratio and the ratio of stem caliper to stem length, to characterize the overall effect of propagation substrate and rooted cutting quality. The quality of rooted 'Celebrette Frost' cuttings, as measured by the quality index, was similar across propagation substrates, regardless of the composition of the mix.

'Celebration Deep Red' New Guinea impatiens cuttings responded similarly to 'Celebrette Frost' cuttings rooted in different substrates (Figs. 1 and 2). For example, there were no

Whole rice hulls can provide the greater air space and drainage required for cutting propagation.

significant differences in the percentage of 'Celebration Deep Red' New Guinea impatiens cuttings that were fully rooted across propagation substrates. The stem length of 'Celebration Deep Red' cuttings was unaffected by whole rice hulls.

However, while we did observe a slight (approximately ⅛-in), but statistically significant, reduction in stem length for cuttings rooted in substrate comprised of 50 percent ground rice hulls and 50 percent perlite, this has little commercial significance.

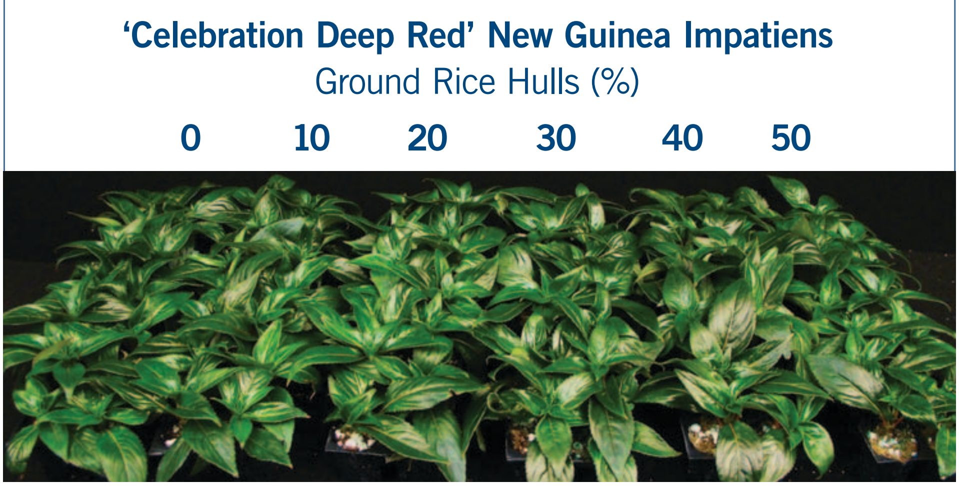
The shoot growth of 'Celebration Deep Red' cuttings was unaffected by ground rice hulls, but was slightly less for cuttings rooted in 50 percent peat moss and 50 percent ground rice hulls compared to cuttings rooted in the control substrate. Root growth, root:shoot ratio and quality index of 'Celebration Deep Red' New Guinea impatiens was unaffected by propagation substrate.

The most notable effect of either rice hull product was the effect of replacing peat moss with ground rice hulls on the number or percentage of fully rooted cuttings of 'Celebrette Frost.' At the highest percentage (50 percent) of ground rice hulls incorporated, there was a 12 percent reduction in the number of rooted cuttings. Interestingly, there was not a trend in fewer rooted 'Celebration Deep Red' cuttings when the mix contained 50 percent ground rice hulls. The potential for variation in rooting responses among cultivars or between species to ground rice hulls should be investigated further.

The Results Are Encouraging

Rice hulls appear to be a viable alternative substrate component for propagation mixes when rooting New Guinea

Fig. 2. Cuttings of 'Celebration Deep Red' New Guinea impatiens propagated in substrates containing 50 percent perlite and (from L to R) 0 to 50 percent ground rice hulls and 50 to 0 percent peat moss.



impatiens. Whole rice hulls appear to be a suitable replacement for perlite in a wide range of proportions. In this study we created a mix with up to 50 percent whole rice hulls without seeing any adverse effects. Therefore, using larger proportions of whole rice hulls in propagation mixes than we used in our study may warrant exploration. Alternatively, ground rice hulls appear to be suitable for replacing peat moss in modest proportions. The use of smaller rice hulls in varying proportions may be more suitable for replacing higher proportions of peat moss. Producers of rooted cuttings are encouraged to conduct small-scale trials in their own greenhouses to determine what substrate mixes are most suitable for them. **GG**

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