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Using Parboiled Rice Hulls In Substrates To Finish Greenhouse Crops

A study at Purdue University shows that parboiled rice hulls may work as well or better than peat and perlite in some finished crops.

by **ROBERTO G. LOPEZ** and **CHRISTOPHER J. CURREY**

HAVE you considered replacing perlite with whole parboiled rice hulls (PBH) or peat with ground PBH in your growing substrate for finishing spring bedding plants, but are not convinced they are an effective substrate component? Alternative substrates are a hot topic, as many growers are looking for more sustainable growing mixes, lower production costs and superior performance. However, alternative substrate components do not have the history and popularity that peat moss or perlite may enjoy.

In the April issue of *Greenhouse Grower*, we shared the results of our work propagating New Guinea impatiens cuttings in substrates containing whole or ground PBH as replacements for perlite or peat moss, respectively. In this second article of the two-part series, we will share our most recent research examining how whole and ground PBH work for finishing seed-propagated bedding plants in the northern U.S.

How The Study Was Conducted

At Purdue University (40 degrees north latitude), seedlings of *Celosia* 'Fresh Look Gold,' *Impatiens walleriana* 'Dazzler Blue Pearl,' *Pelargonium ×hortorum* 'Bullseye Scarlet' (geranium) and *Tagetes patula* 'Bonanza Flame' (marigold) were transplanted into 4.5-inch plastic containers filled with a substrate composed of the following:

- 70, 80, or 90 percent peat moss + 10, 20, or 30 percent whole PBH or perlite
- 40, 50, 60, or 70 percent peat moss, 10, 20, 30, 40, or 50 percent ground PBH, + 20 percent whole PBH or perlite.

The substrates with varying proportions of different components are outlined in Table 1. Peat-based substrates were mixed according to Table 1, and lime was incorporated at rates of 4.0 to 5.5 lbs. yd^{-3} based on the percentage of peat in the substrate.

The plants were grown in a double-polyethylene covered greenhouse from April to May with a temperature set point of a 70°F day/night and a daily light integral (DLI) ranging from 22 to 27 $mol \cdot m^{-2} \cdot d^{-1}$. Plants were hand-irrigated as necessary with acidified water supplemented with a combination of two water-soluble fertilizers (3:1 mixture of 15–5–15 and 21–5–20 NPK respectively), to provide 200 ppm nitrogen. When plants flowered, the plant height and marketability was recorded. Root and shoot dry mass was determined after four weeks for impatiens and marigold, after five weeks for celosia, and after seven weeks for geranium. pH and EC readings were taken after three weeks for impatiens, geranium, celosia and marigold and after six weeks for geranium.

Mix	Substrate component (percent)			
	Peat moss	Perlite	Whole rice hulls	Ground rice hulls
Substituting whole rice hulls for perlite				
1	90	--	10	--
2	90	10	--	--
3	80	--	20	--
4	80	20	--	--
5	70	--	30	--
6	70	30	--	--
Substituting ground rice hulls for peat moss				
7	70	--	20	10
8	70	20	--	10
9	60	--	20	20
10	60	20	--	20
11	50	--	20	30
12	50	20	--	30
13	40	--	20	40
14	40	20	--	40

Table 1. Proportion of peat moss, perlite and whole or ground fresh PBH mixed in varying proportions (by volume) used for finishing bedding plants.

Substrates With Rice Hulls Produced Excellent Quality

Shoot dry mass (SDM), a measure of above-ground growth, was not influenced by any of the substrate components (peat,

whole or ground PBH or perlite) for celosia, impatiens or marigold. However, SDM of geranium grown in 90 percent peat moss and 10 percent whole PBH was 72 percent lower than the other substrate treatments. Root dry mass (RDM) of celosia was significantly higher when grown in substrates containing peat and whole PBH compared to peat moss and perlite. Each crop responded somewhat differently to the varying proportions in the substrate. The proportions that produced the highest RDM for each crop are:

- **Celosia:** 70 percent peat moss + 30 percent whole PBH (76 percent greater compared to peat moss and perlite)
- **Impatiens:** 40 percent peat moss, 40 percent ground PBH + 20 percent perlite. (Fig. 1) However, RDM of impatiens was lowest when grown in a substrate containing 80 percent peat moss + 20 percent whole PBH.
- **Marigold:** 70 percent peat moss, 10 percent ground PBH + 20 percent whole PBH or 40 percent peat moss, 40 percent ground PBH + 20 percent perlite.
- **Geranium**: 50 percent peat moss, 30 percent ground PBH and 20 percent whole PBH or 50 percent peat moss, 30 percent ground PBH + 20 percent perlite.

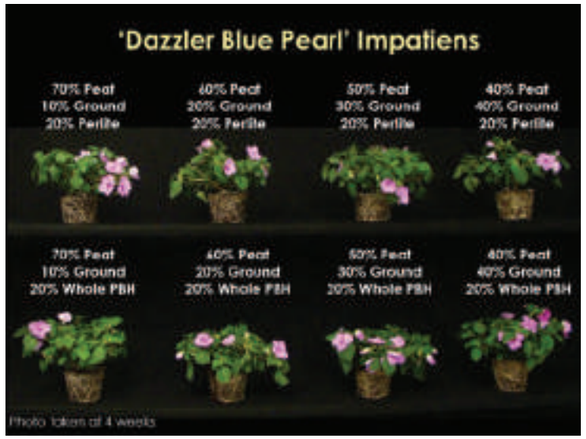

Fig. 1. Growth and development of *Impatiens* 'Dazzler Blue Pearl' grown in substrates containing 20 percent perlite or whole parboiled rice hulls and (from L to R) 70 to 40 percent peat moss + 10 to 40 percent ground parboiled rice hulls after four weeks.

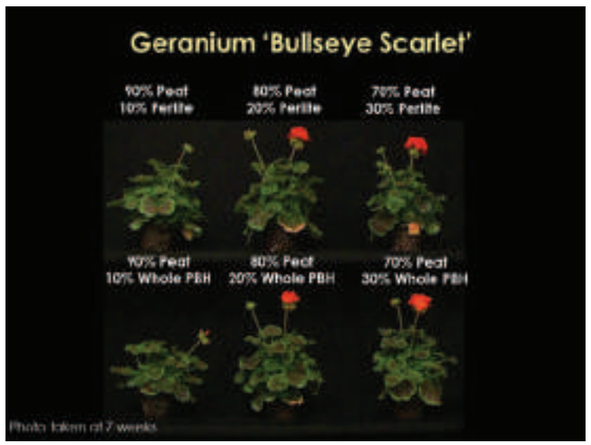

Fig. 2. Growth and development of 'Bullseye Scarlet' geranium grown in substrates containing (from L to R) 90 to 70 percent peat moss + 10 to 30 percent whole parboiled rice hulls or perlite after 7 weeks.

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The height of celosia, impatiens and marigold at flower was not influenced by any of the substrate components. However, geranium grown in 90 percent peat moss + 10 percent whole PBH were significantly shorter than plants grown in the other substrate treatments. Substrate pH and EC values of marigold three weeks after transplant were not influenced by any substrate component. The substrate pH of geranium slightly increased when the percentage of ground PBH increased above 10 percent when measured three weeks after transplant and gradually decreased by week six. However, the EC of the substrate was not influenced by any substrate component.

In the study presented here, when a crop of celosia, geranium, impatiens and marigold was finished or grown-out in substrates containing a combination of peat (40 to 50 percent) and ground PBH (30 to 40 percent) both not exceeding 80 percent and 20 to 30 percent whole PBH, overall growth and quality was comparable or higher than the standard peat and perlite mixes.

Additionally, the importance of using peat-based substrates that contain components that allow adequate drainage, such as perlite or rice hulls, is highlighted in this study. For example, root and shoot dry mass and plant height were negatively influenced when peat moss exceeded 80 percent as the substrate remained excessively wet.

Reflecting on our collective results from experiments evaluating whole and ground PBH as substrate components for greenhouse crop production, it appears that whole PBH may be a suitable replacement for perlite, while ground PBH may be suitable replacements for peat moss for substrates used in both propagation and finishing of bedding plants.

The Results Are Encouraging

Both whole and ground PBH appear to be viable alternative substrate components during finishing of bedding plants. Whole PBH appear to be a suitable replacement for perlite up to 30 percent and ground PBH appear to be a suitable replacement for peat up to 40 percent. Producers are always encouraged to conduct trials in their own greenhouses to determine what substrate mixes are most suitable for them as watering, species, cultivars and length of crop production may influence performance. **GG**

Roberto G. Lopez (**rglopez@purdue.edu**) is an associate professor and floriculture Extension specialist and Christopher J. Currey **(ccurrey@purdue.edu**) is a graduate student. The authors would like to thank the Riceland Foods for support and whole and ground parboiled rice hulls, Ball Horticulture for seeds, Everris for fertilizer, and Heartland Growers for peat moss and lime.