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PRODUCTION OF SOME INDOOR PLANTS USING NATURAL LOCAL MEDIA

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ABSTRACT

Peat moss is an important component of potting media for a variety of ornamental plants. In recent years, environmental concerns and the cost of peat have escalated. In addition, many laws have been proposed to recycle and make use of the organic wastes of different crops. To achieve this, straw of broad bean and composts of bagasse, broad bean and rice were used as substitutes for peat moss in this study.

Consistent results, that kept the same trend over the two seasons of this study, could be summarized in the following:

Using the broad bean compost medium resulted significantly in producing the tallest *Peperomia* plants, the highest leaf and branch number/plant, the heaviest shoot dry weight, and the heaviest fresh roots. The longest roots of *Syngonium* belonged also to plants grown on the broad bean compost. The highest values of the K% content of the three plants were observed in plants grown in the broad bean straw medium. The bagasse compost medium resulted significantly in the tallest *Schefflera* plants and the highest number of leaves/*Schefflera* plant, the heaviest fresh and dry roots of *Schefflera* and *Syngonium*, the heaviest shoot fresh and dry weights and the highest contents of total chlorophyll, N, P, and carbohydrate of the three plants *Peperomia*, *Schefflera* and *Syngonium*. The peat moss medium resulted in the longest *Peperomia* roots, while the rice compost medium produced the longest *Syngonium* plants.

It is recommended to use the straw or compost of many crops such as broad bean, sugar cane (bagasse) and rice as cheap natural media instead of the expensive imported peat moss.

Keywords: bean straw, bagasse, peat moss, rice straw, compost, *Peperomia*, *Schefflera*, *Syngonium*, natural media.

INTRODUCTION

Agricultural wastes, such as broad bean straw, bagasse and rice straw represent a big problem for our society. The continuous accumulation of these wastes causes a lot of harm to the environment. These media are a suitable harbor for the propagation of harmful insects and bacteria and a source for the evolution of pollutant gases in the atmosphere. It is necessary to get rid of these wastes by means of a scientific and economic method. A good approach to solve this problem is turning these wastes to media suitable for growing a lot of plants. Through this technique we can make use of these wastes and save a big sum of money needed for importing agricultural media from abroad.

Three ornamental plants, *Peperomia obtusifolia*, *Schefflera arboricola* and *Syngonium podophyllum* were used in this study. They are indoor foliage plants commonly used in indoor decoration because of their attractive appearance.

Peperomia obtusifolia (L.) A. Dietr.

Pepper face or Baby rubber plant; (Fam. Piperaceae, recently: Peperomiaceae):

Originated in tropical America and south Florida, long cultivated as a good dish-garden plant; succulent stem with reclining base and short petioles both striped maroon-brown, and waxy-green, fleshy obovate or spatulate, 5-8cm, concave leaves, obtuse or notched at apex, pale green beneath; growing to 30 cm high; stalk of flower spike minutely hairy, topped by slender, greenish-white flower spikes, resembling catkins. Used as low-maintenance houseplant for bright indirect light locations, (Everett 1981).

Schefflera arboricola Hayata (syn. *Heptapleurum sasakii*, *Heptapleurum arboricolum*) Hawaiian Elf, Dwarf Schefflera (Fam. Araliaceae):

Originated in Taiwan. A subtropic evergreen shrub with attractive dark green, glossy, palmate leaves densely covering flexible, green stems, which gently fan out into a rounded crown. Plants are usually seen with multiple stems sprouting from the base. Branching can be encouraged by pinching the stems, which forms a denser shrub. It can be pruned into a small tree over a period of years where it would make an accent or patio small tree. There is a cultivar available with variegated foliage. Propagation is by seed, cuttings, or air-layers, (Everett 1981).

Syngonium podophyllum Schott (syn. *S. angustatum*, *Syngonium nepthytis*, *Nephthytis triphylla*) African evergreen, Arrow-head vine. Fam. Araceae:

Originated in South America to Mexico. A tropical perennial rapidly-growing evergreen climbing herb. The juvenile leaves heartshaped or 3-lobed, very ornamental with silver white center and veining; the mature leaves are palmate and all green. Mature leaves alternate, simple, arrow-shaped, often mottled; flowers on a spadix surrounded by a spathe. It is an interesting shade plant. If allowed to climb trees or around a pole, syngonium develops large tropical leaves and wrist-thick stems, (Everett 1981).

Straws of many crops can be utilized either in the raw form or as compost for the potting medium in the production of ornamental plants. Moore (2005) declared that the ornamental horticulture industry uses a variety of materials as ingredients in growing substrates for many ornamental plants. There are many attributes that make growing substrates effective, including good aeration and drainage, availability at an acceptable price, and chemical attributes conducive for plant growth. In recent years there has been a trend in which more traditional organic components, such as sphagnum peat, have been partially replaced by an increasing array of waste-product compost. Plant response to increasing quantities of compost in the potting mix, and to different types of compost is variable. Raviv (2005) stated that compost is an organic matter that has undergone partial thermophilic, aerobic decomposition. This environmentally safe process is called composting. The combination of raw materials and the chosen composting method yields a wide range of characteristics, such as organic matter content, nutrient content, potential for disease suppressiveness and other physical, chemical, and biological properties. The two main horticultural uses of composts are as soil amendment and as an ingredient in container media. Soil-applied composts improve soil fertility mainly by increasing soil organic matter that activates soil biota. Composts are also used for substrates as low-cost peat substitutes, potentially suppressive against various soil-borne diseases. However, being relatively resistant to decomposition, raw materials should be subjected to long and well-controlled composting, which may be shortened using N. Composts serving as growing media may be produced from numerous organic wastes.

Composts can serve as a substitute for peat moss as mentioned by different workers. Ginwal *et al.* (2002) reported that potted *Dalbergia sissoo* seedlings performed well in pure compost or in mixtures of sand and compost or sand, soil and compost. Malusa *et al.* (2002) stated that both shoot and root growth and commercial evaluation of *Coleus* and *Chrysanthemum* plants grown in the media containing composts from urban green and from mixed matrix (in substitution of the peat fraction) were similar to those of the control (normal culture medium of the crop). Results indicated that the use of compost is commercially satisfactory as an alternative to peat in the preparation of cultural substrates for these crops.

MATERIALS AND METHODS

This study was carried out in the nursery of the Ornamental Plant Research Department, Horticulture Research Institute, Giza, Egypt in March of the two seasons of 2002–2003 and 2003–2004. The second season was an exact repetition of the first one. Three indoor plants were used, i.e. *Peperomia obtusifolia*, *Schefflera arboricola*, and *Syngonium podophyllum*, each in a separate experiment. For each one, a randomized complete bloc design was adopted, with 5 treatments (potting media); each comprised 3 replicates, with 5 plants in each replicate.

Straw of broad bean, rice and bagasse were used in this study. Part of the broad bean straw was used in its raw form. The other part besides both rice straw and bagasse were enriched to hasten composting by thoroughly mixing 1 liter of aqueous solution of ammonium sulfate (at 2 g/l) with each 1 kg of straw for 2 successive days. In the third day the ammonium sulfate was substituted with aqueous solution of commercial phosphoric acid 38% (at 0.4 cm/l). In the fourth day water only was added. These procedures were repeated 4 times (reducing solutions or water amount to the half) during which the three kinds of straw were stirred to allow aerial composting. A half-kilogram (± 100 g) of the potting medium was enough for each 20 cm pot.

Thus, the 5 treatments (potting media) were:

1 - Broad bean compost
2 - Broad bean straw
3 - Bagasse compost
4 - Rice compost
5 - Peat moss (as a control)

Analysis of these media before and after planting (1 year later) is shown in table (a).

Table (a). Media analysis before planting

	before planting			after planting		
	N%	P_2O_5%	K_2O%	N%	P_2O_5%	K_2O%
Broad bean compost	0.90	1.56	0.38	0.28	0.64	0.28
Broad bean straw	0.80	0.17	0.36	0.25	0.12	0.27
Bagasse compost	0.65	1.56	0.75	0.21	0.57	0.41
Rice compost	0.40	1.17	0.79	0.22	0.70	0.63
Peat moss	0.30	0.42	0.27	0.23	0.22	0.17

Data obtained in both seasons were the effects of straw kind on:

1 - Plant height (cm).
2 - Leaf number/plant.
3 - Branch number/plant.
4 - Shoot fresh weight (g).
5 - Shoot dry weight (g).
6 - Root length (cm).
7 - Root fresh weight (g).
8 - Root dry weight (g).

These data were statistically analyzed using SAS 1995 computer program, and means were compared by L. S. D. method according to Snedecor and Cochran (1980). Additional data obtained in the second season only were the effects of straw kind on:

9 - Total chlorophyll (mg/g FWT) according to Moran (19820).
- - Shoot content of N, P and K % (DWT) according to Jackson (1973).
- - Shoot content of total carbohydrates % (DWT) according to O.A.C. (1995).

RESULTS

1 - Effect of straw kind on plant height (cm) (Table 1, Plates 1-3):

a - *Peperomia obtusifolia*:

Table 1 shows that the kind of straw used in this experiment exerted a statistically significant effect on the plant height in both seasons. In the first season, highest plants were those grown in bean compost medium. Plants grown in bagasse compost and rice compost media were shorter than the previous ones. However, differences were insignificant. Plants grown in bean straw medium were significantly shorter than those grown in bean medium. In addition, differences between the height of the bean straw-grown plants and that of both bagasse compost- and rice compost-grown plants were insignificant. Significantly shortest plants were produced in the peat moss medium, although they were insignificantly different from the bean straw - grown plants.

In the second season, both bean and bagasse compost media kept their significant superiority over other treatments in producing the tallest plants without a significant difference between them. Bean straw, peat moss and rice compost media resulted in plants without any significant difference between them. However, the shortest plants were those grown in the peat moss medium.

b - *Schefflera arboricola*:

A significant influence was detected on plant height in both seasons of this study. Tallest plants in the first season were those grown on the bagasse compost medium. This position was shared, without any significant difference, with plants resulted from the bean compost medium. Height of plants grown in the rice compost medium came in the second category, followed with no significant difference with plants grown in the peat moss medium. Shortest plants were the outcome of using the bean straw medium. However, no significant difference was observed between the height of the later and that of the peat moss medium-plants.

The same trend was almost kept in the second season, as the highest plants were those brought up in the bagasse compost medium, followed with a significant difference by those grown in the bean compost medium. Other media, i.e. bean straw, peat moss and rice compost resulted in plants, the height of which was not significantly different.

c - *Syngonium podophyllum*:

The effect of straw kind was found to be statistically significant on the length of plants in the first and second seasons of this study.

Data obtained in the first one revealed that the significant tallest plants resulted by using the rice compost and bagasse compost media. Although, the shortest plants were a result of using the peat moss medium, length of plants grown on bean compost, bean straw and peat moss media were not significantly different.

In the second season, the highest significant record was confined to plants grown on the rice compost medium, followed by those grown on the bagasse compost medium. Length of plants resulted from the bean compost medium was not significantly from the corresponding record of the bagasse compost medium from one side, or from the bean straw medium from the other side. The later was also not significantly different from the shortest plants, which were grown on the peat moss medium.

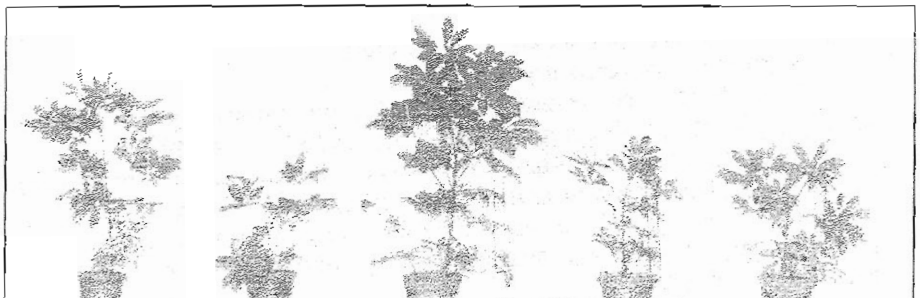
Table (1) - Effect of straw kind on plant height (cm)

		Season 1	
Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	31.33 a	70.33 a	45.33 b
Broad bean straw	26.33 bc	29.00 c	41.00 b
Bagasse compost	30.33 ab	76.00 a	60.33 a
Rice compost	28.67 ab	41.00 b	65.00 a
Peat moss	22.00 c	35.00 bc	40.67 b
LSD at 5%	4.42	10.71	10.40
		Season 2	
Broad bean compost	34.00 a	72.67 b	52.67 bc
Broad bean straw	21.33 b	34.33 c	47.00 cd
Bagasse compost	30.67 a	86.00 a	53.67 b
Rice compost	20.67 b	42.00 c	71.67 a
Peat moss	19.00 b	37.67 c	46.00 d
LSD at 5%	6.14	9.35	6.14

Bean straw | raw bean straw | bagasse | rice straw | peat moss

Media

Plate 1 - *Peperomia*



bean straw | raw bean straw | bagasse | rice straw | peat moss

Media

Plate 2 - *Schefflera*

bean straw | raw bean straw | bagasse | rice straw | peat moss

Media

Plate 3 - *Syngonium*

2 - Effect of straw kind on leaf number/plant (Table 2):

a - ***Peperomia obtusifolia***:

Straw kind proved to have a significant effect on leaf number/ plant in the first season. Bean compost medium scored the highest significant record, followed by bean straw and rice compost media, with no significant difference between the last two results. Lowest number of leaves/plant, were produced on bagasse compost and peat moss media, significantly indifferent from the corresponding numbers belonging to the rice compost medium.

In the second season, the bean compost medium preserved its significant superiority in inducing the highest leaf number/plant. However, this rank was occupied also by the bagasse compost medium, with a non-significant difference between those two treatments. The bean straw medium induced number of leaves/plant significantly not different from the number produced by using the bagasse compost medium from one side, or by using the peat moss and rice compost media from the other side. Number of leaves/plant in the peat moss medium was the lowest, although it was significantly not different from that of plants grown on the rice compost medium.

b - *Schefflera arboricola*:

Straw kind exerted a significant effect on leaf number/plant in the two seasons of this study. The trend of this effect was the same in both seasons. The significant highest number of leaves/plant was that obtained from plants grown on the bagasse compost medium in the first and second seasons. Leaf number of plants grown on the bean compost medium for the first and second seasons was significantly lower than the above-mentioned record. The lowest numbers in this concern were a result of using the bean straw medium in both seasons. However, results of using the peat moss and rice compost media (for the first and second seasons) were not significantly different from those of the bean straw medium.

c - *Syngonium podophyllum*:

The effect of straw kind on leaf number/plant was statistically not significant in the two seasons. However, in both seasons, the highest records were a result of using the rice compost medium, while the lowest ones were those of the bagasse compost medium.

Table (2) - Effect of straw kind on leaf number/plant

		Season 1	
Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	25.00 a	25.67 b	17.67 a
Broad bean straw	20.00 b	17.33 c	16.00 a
Bagasse compost	14.33 c	34.33 a	15.00 a
Rice compost	16.33 bc	19.00 c	18.67 a
Peat moss	12.67 c	18.67 c	16.67 a
LSD at 5%	4.78	5.94	N.S.
		Season 2	
Broad bean compost	25.33 a	27.67 b	25.67 a
Broad bean straw	19.00 bc	17.33 c	20.00 a
Bagasse compost	22.67 ab	37.33 a	19.67 a
Rice compost	17.00 c	18.33 c	27.67 a
Peat moss	14.67 c	19.00 c	24.67 a
LSD at 5%	4.55	7.22	N.S.

3 - Effect of straw kind on branch number/plant (Table 3):

a - *Peperomia obtusifolia*:

The effect of straw kind on branch number/plant was statistically significant, although the trend of this effect was not consistent in the two seasons of this work. In the first one, branch number was significantly higher in plants grown on bean compost, bean straw, peat moss and rice compost media. Bagasse compost-grown plants were significantly the lowest in their branch number. In the second season, highest significant number of branches/plant was a result of using the bean compost medium. This was followed without significant differences by plants grown on bagasse compost and rice compost media. Compared to the effect of bean compost medium, the lowest significant records were obtained after using the bean straw and peat moss media. However, the last two records were not significantly different from the results of bagasse compost and rice compost media.

b - *Schefflera arboricola*:

As the number of branches/plant did not exceed one branch only in both seasons, the effect of straw kind on this character was not significant.

c - *Syngonium podophyllum*:

In both seasons, the effect of straw kind on branch number/plant was insignificant. Irrespective of this, the highest numbers in this regard were those of plants grown on the bagasse compost medium, while the lowest ones belonged to plants grown on the peat moss and rice compost media, for the first and second seasons.

Table (3) - Effect of straw kind on branch number/plant

Media	Season 1		
	Peperomia	***Schefflera***	***Syngonium***
Broad bean compost	4.00 a	1.00 a	2.00 a
Broad bean straw	3.33 a	1.00 a	2.00 a
Bagasse compost	1.67 b	1.00 a	2.33 a
Rice compost	4.00 a	1.00 a	1.00 a
Peat moss	3.67 a	1.00 a	1.67 a
LSD at 5%	1.61	N.S.	N.S.
	Season 2		
Broad bean compost	4.67 a	1.00 a	2.33 a
Broad bean straw	2.67 b	1.00 a	1.67 a
Bagasse compost	4.00 ab	1.00 a	2.67 a
Rice compost	3.33 ab	1.00 a	1.33 a
Peat moss	2.67 b	1.00 a	1.33 a
LSD at 5%	1.42	N.S.	N.S.

4 - Effect of straw kind on shoot fresh weight (g) (Table 4):

a - *Peperomia obtusifolia*:

Shoot fresh weight was significantly affected in both seasons by the kind of straw used as a medium. The bagasse compost medium scored the significant highest record in this concern. Result of growing plants in the bean compost medium came next on a descending order with no significant differences between it and results of using either the bagasse compost medium or the rice compost one. Lowest fresh weight was observed in plants grown on bean straw medium. The later was not significantly different from fresh weight of plants grown on peat moss medium or those grown on the abovementioned rice compost medium.

In the second season the trend was almost the same. The bagasse compost medium kept its highest rank significantly regarding the fresh weight. Fresh weight of the bean compost-grown plants came next and was significantly lower. The remainder three media (bean straw, peat moss and rice compost) produced plants with no significant differences between their weights.

Table (4) - Effect of straw kind on shoot fresh weight (g)

Media	*Peperomia*	*Schefflera*	*Syngonium*
		Season 1	
Broad bean compost	143.33 ab	91.00 c	62.33 b
Broad bean straw	83.67 c	135.67 b	73.33 b
Bagasse compost	154.67 a	182.33 a	118.67 a
Rice compost	104.00 bc	90.33 c	60.33 b
Peat moss	102.33 c	73.67 c	60.33 b
LSD at 5%	39.74	30.73	21.70
		Season 2	
Broad bean compost	137.00 b	110.00 bc	83.33 b
Broad bean straw	85.00 c	123.33 b	62.67 c
Bagasse compost	158.67 a	172.00 a	118.00 a
Rice compost	103.33 c	88.33 cd	57.00 c
Peat moss	89.00 c	72.33 d	65.00 c
LSD at 5%	19.01	22.31	11.83

b - *Schefflera arboricola*:

The shoot fresh weight was significantly affected in both seasons by the kind of straw used as a medium. Plants grown on the bagasse compost medium were significantly the heaviest in the first and second seasons. They were followed by plants grown on the bean straw medium, in the first and second seasons. However, it should be mentioned that the result of using the bean compost medium in the second season was not significantly different from those of the bean straw medium from one side, or from those of the rice compost medium from the other side. Lightest plants in the first season were those grown on the bean compost, peat moss and the rice compost media, while the corresponding ones in the second season were those grown on the peat moss medium.

c - *Syngonium podophyllum*:

In the two seasons of this work the straw kind had a significant influence on shoot fresh weight. Highest significant weight in the first season was that of plants grown on the bagasse compost medium. Shoot fresh weights of plants grown on all other media, i.e. bean compost, bean straw, peat moss and rice compost were not significantly different.

In the second season, the bagasse compost medium kept its significant superiority in producing the heaviest plants. The bean compost medium came next. All other media, i.e. bean straw, peat moss and rice compost produced plants with no significant difference between their shoot fresh weights.

5 - Effect of straw kind on shoot dry weight (g) (Table 5):

a - *Peperomia obtusifolia*:

Straw kind influenced shoot dry weight significantly in both seasons. In the first season, both bean compost and bagasse compost media produced the significantly heaviest dry weight of plants. Lightest dry weight was that of plants grown on the peat moss medium. The outcome of using bean straw and rice compost media was plants, the dry weights of which significantly not different from those produced on either bean compost or bagasse compost on one side, or from the peat moss medium on the other side. Supremacy of the same two media, bean compost and bagasse compost was also significantly observed in the second season. Results of the other three media, i.e. bean straw, peat moss and rice compost came next with no significant difference in-between.

Table (5) - Effect of straw kind on shoot dry weight (g)

		Season 1	
Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	42.33 a	26.53 c	17.00 b
Broad bean straw	26.67 ab	60.33 b	13.97 bc
Bagasse compost	40.67 a	83.23 a	35.63 a
Rice compost	30.00 ab	23.23 c	9.63 c
Peat moss	20.00 b	17.53 c	16.43 b
LSD at 5%	N.S.	12.95	6.17
		Season 2	
Broad bean compost	40.67 a	37.33 c	30.33 b
Broad bean straw	16.67 b	63.33 b	19.67 c
Bagasse compost	41.67 a	87.67 a	41.33 a
Rice compost	19.67 b	27.00 d	17.00 d
Peat moss	19.67 b	24.00 d	18.00 cd
LSD at 5%	5.03	6.69	2.21

b - *Schefflera arboricola*:

The effect of straw kind on shoot dry weight was significant and somewhat similar in the two seasons. The bagasse compost medium scored the highest significant rank in this concern in the first and second seasons. The second rank was occupied by results of the bean straw medium (in the first and second seasons). Although shoot dry weight of plants grown on peat moss medium was the lowest, it did not differ significantly from results of the bean compost and rice compost media. However, in the second season plants grown on the bean compost medium had their dry weight, significantly lower than that produced by the bean straw medium. Dry weight of plants grown on the peat moss medium was the lowest, although it was not significantly different from that of plants grown on the rice compost medium.

c - *Syngonium podophyllum*:

Highest significant rank was held in both seasons by the bagasse compost medium as it resulted in the highest shoot dry weight for the first and second seasons. In the first season, the second category was occupied by the bean compost and peat moss media. Plants grew on the bean straw medium were not significantly different from those produced on the bean compost medium or from plants with the lowest significant record produced on the rice compost medium.

In the second season, the heaviest dry shoots were those grown on the bagasse compost medium. The second category of shoot dry shoot belonged to plants grown on the bean compost medium. Shoot dry weights resulting by using the bean straw and peat moss media were not significantly different. The later did not also differ significantly from lowest shoot dry weight of plants grown on the rice compost medium.

6 - Effect of straw kind on root length (cm) (Table 6):

a - *Peperomia obtusifolia*:

A significant effect was detected for straw kind on the root length in the two seasons of this study. In the first season, the significant longest roots belonged to plants grown on the peat moss medium, followed without any significant difference with those grown on the bean compost and rice compost media. Root length of plants grown on the bean straw medium was not significantly different from the corresponding records of bean compost, rice compost, and bagasse compost media. The later one produced the significant shortest roots, although they were not significantly different from roots produced on the bean straw medium. Results of the second season were almost similar. Although the bean compost medium produced the significant longest roots, the peat moss one resulted in roots, insignificantly different from the former record. Roots produced by using the bean straw and rice compost media were significantly shorter than those produced by using the bean compost medium only. The shortest roots were found in the bagasse compost medium. However, they were not significantly shorter than those of bean straw and rice compost media.

b - *Schefflera arboricola*:

Significance of the effect of straw kind on root length was confined to the second season only. Regardless of this, longest roots in the first season were those produced by using the bagasse compost medium, and the shortest ones belonged to plants grown on the rice compost medium. This effect turned to be significant in the second season. Highest significant record was produced by using the bagasse compost medium, although this rank was shared without any significant difference by those produced on the bean compost medium. Shortest roots belonged to plants grown on the rice compost and peat moss media. No significant differences were detected between length of roots of the bean straw medium-plants and those of the bean compost and bagasse compost media from one side, or those of the peat moss and rice compost media from the other side.

c - *Syngonium podophyllum*:

Straw kind exerted a significant effect on root length in both seasons. While the significant longest roots belonged only to plants grown on the bean compost in the first season, the significant highest rank was shared in the second season by the bean compost, peat moss and rice compost media. In the first season, root length of plants grown on the peat moss and rice compost media came next. Root length of plants produced on the bean straw medium was not significantly different from those of plants produced on the peat moss and rice compost media from one side, and on the bagasse compost medium from the other side. In the second season, plants grown on bean straw or bagasse compost media had roots insignificantly different in length.

Table (6) - Effect of straw kind on root length (cm)

		Season 1	
Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	32.00 ab	17.33 a	34.67 a
Broad bean straw	24.00 bc	17.33 a	23.33 bc
Bagasse compost	15.00 c	21.00 a	19.33 c
Rice compost	28.67 ab	15.33 a	28.33 b
Peat moss	35.00 a	18.33 a	28.00 b
LSD at 5%	9.36	N.S.	5.94
		Season 2	
Broad bean compost	29.67 a	26.00 a	38.00 a
Broad bean straw	20.67 bc	22.33 ab	21.67 b
Bagasse compost	18.33 c	26.67 a	18.33 b
Rice compost	22.67 bc	17.67 b	35.00 a
Peat moss	26.67 ab	19.33 b	31.33 a
LSD at 5%	6.88	6.15	8.13

7 - Effect of straw kind on root fresh weight (g). (Table 7):

a - *Peperomia obtusifolia*:

The significant influence of straw kind on root fresh weight was ascertained in both seasons. In the first one, heaviest fresh roots were a function of using the bean compost medium. Following, came root fresh weight of plants grown on the bagasse compost and peat moss media. Lowest records in this regard belonged to plants grown on bean straw and rice compost media. In the second season, situation was somewhat different. Heaviest fresh roots were obtained from the bagasse compost medium followed without any significant difference by those from the bean compost medium. Fresh weights of roots from the bean straw and peat moss media were not different significantly from those of the bean compost or the bagasse compost media. Lowest fresh weight was that of roots obtained from the rice compost medium. However, it was not different significantly from those of the bean straw or peat moss media.

b - *Schefflera arboricola*:

A significant influence was observed for straw kind on root fresh weight in the two seasons. In the first one, heaviest roots were those of plants grown on the bagasse compost medium. Fresh weight of roots obtained from the peat moss and rice compost media were significantly not different from the above-mentioned record. The bean straw medium resulted in roots, the fresh weight of which was not significantly different from those of the peat moss, rice compost and bean compost media. The later, i.e. the bean compost medium-plants had the lightest roots.

In the second season, significant heaviest roots were those of plants grown on the bagasse compost medium, followed by roots resulted from the bean compost medium. The peat moss medium was responsible of producing plants, the root fresh weight of which was significantly not different from those resulted by using either the bean compost from one side, or the bean straw and rice compost media. The last record was the lowest at all.

Table (7) - Effect of straw kind on root fresh weight (g)

Media	*Peperomia*	*Schefflera*	*Syngonium*
		Season 1	
Broad bean compost	28.67 a	20.67 c	31.33 b
Broad bean straw	17.33 c	23.67 bc	24.67 b
Bagasse compost	23.00 b	32.67 a	52.00 a
Rice compost	17.00 c	28.67 ab	26.67 b
Peat moss	22.00 b	30.00 ab	28.67 b
LSD at 5%	4.32	7.50	10.07
		Season 2	
Broad bean compost	23.67 a	31.00 b	51.67 b
Broad bean straw	20.33 ab	22.33 c	25.67 c
Bagasse compost	25.67 a	48.00 a	65.00 a
Rice compost	15.33 b	21.33 c	25.67 c
Peat moss	20.67 ab	28.00 bc	30.67 c
LSD at 5%	5.97	8.05	10.22

c - *Syngonium podophyllum*:

Root fresh weight was significantly affected in the first and second seasons by straw kind. In both seasons, the bagasse compost medium resulted in the heaviest fresh weight of roots for the first and second seasons. In the first season, there were no significant differences between all other media, i.e. bean compost, bean straw, peat moss and rice compost in their effect of the root fresh weight of plants grown on them. In the second season, root fresh weight of plants grown on the bean compost medium came next. Lowest significant fresh weights of roots were those of plants grown on the bean straw, peat moss and rice compost media, with no significant difference in-between.

8 - Effect of straw kind on root dry weight (g). (Table 8):

a - *Peperomia obtusifolia*:

Highest significant root dry weight was obtained in the first season by growing plants on the bean compost and bagasse compost media. Significantly lower records were those grown on the bean straw, peat moss and rice compost media. There was no significant difference between results of the last three media.

In the second season, the bagasse compost medium only produced the highest significant root dry weight. Statistically lower was the root dry weight of plants grown on the bean compost and bean straw media, with insignificant difference in between. Root dry weigh of plants grown on the peat moss medium was significantly not different from those resulted from the bean straw or the rice compost media. The later one produced roots of dry weight significantly lighter than the roots obtained by using the bagasse compost, bean compost and bean straw media.

Table (8) - Effect of straw kind on root dry weight (g)

		Season 1	
Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	13.50 a	12.67 bc	17.73 ab
Broad bean straw	9.47 b	12.00 c	10.27 c
Bagasse compost	12.93 a	20.33 a	21.77 a
Rice compost	9.53 b	13.33 bc	11.77 c
Peat moss	9.83 b	16.37 ab	14.37 bc
LSD at 5%	2.47	4.20	4.85
		Season 2	
Broad bean compost	12.00 b	17.33 b	20.00 b
Broad bean straw	10.33 bc	12.67 bc	11.07 c
Bagasse compost	14.67 a	27.33 a	24.67 a
Rice compost	7.60 d	11.00 c	10.73 c
Peat moss	9.30 cd	12.00 c	13.00 c
LSD at 5%	1.92	4.79	3.40

b - ***Schefflera arboricola***:

The effect of straw kind on root dry weight was found to be significant in the first and second seasons. In the first one, the significant highest dry weight was a result of using the bagasse compost medium. This rank was shared without any significant difference by roots resulted from the peat moss medium. Dry weight of roots belonged to plants grown on the bean compost and rice compost media was not significantly different from those of the peat moss medium or the bean straw one. In the second season, heaviest dry roots were the consequence of using the bagasse compost medium, followed with a significant difference by those obtained from the bean compost medium. Weight of dry roots of the bean straw medium was significantly not different from that produced by using bean compost, peat moss and rice compost media. The last two media, i.e. peat moss and rice compost media produced the significant lowest records in this concern. No significant difference was detected between the last two records.

c - ***Syngonium podophyllum***:

Significant heaviest dry root weight in the first season was a result of using the bagasse compost medium. However, those belonged to the bean compost medium did not differ significantly from the former. Root dry weight of plants grown on the peat moss medium was not significantly different from those of plants grown on the bean compost medium from one side or from plants grown on the bean straw and rice compost media from the other side. In the second season, the bagasse compost medium was responsible of producing the heaviest dry roots. Dry roots of plants grown on the bean compost medium came next. Lightest dry roots belonged to plants grown on the bean straw, peat moss and rice compost media, with no significant difference in between.

9 - Effect of straw kind on shoot content of total chlorophyll (mg/g FWT) (Table 9):

The bagasse compost medium resulted in the highest content of total chlorophyll (mg/g FWT) of the three plants *Peperomia*, *Schefflera* and *Syngonium*. The second rank in descending order was achieved by the medium composed of broad bean straw. The lowest content in *Peperomia* was found in plants grown in the raw broad bean straw media, while that of both in *Schefflera* and *Syngonium* was a result of using rice compost medium.

Table (9): Effect of straw kind on shoot content of total chlorophyll (mg/g FWT)

Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	0.50	0.94	0.78
Broad bean straw	0.39	0.90	0.67
Bagasse compost	0.68	1.00	0.84
Rice compost	0.46	0.61	0.64
Peat moss	0.43	0.72	0.66

10 - Effect of straw kind on shoot content of N % (DWT) (Table 10):

The N content of the three plants under study reached its utmost when using the bagasse compost medium. Peperomia and *Syngonium* achieved the second order in this respect in the broad bean straw medium, while that of *Schefflera* was found in the rice compost medium. Lowest content of N % resulted by using rice compost in case of *Peperomia*, the broad bean straw medium in *Schefflera or* peat moss in *Syngonium.*

Table (10): Effect of straw kind on shoot content of N % (DWT)

Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	0.63	0.36	1.35
Broad bean straw	0.55	0.65	1.27
Bagasse compost	0.91	1.09	1.39
Rice compost	0.45	0.82	0.93
Peat moss	0.55	0.45	0.92

11 - Effect of straw kind on shoot content of P % (DWT) (Table 11):

The P content reached its highest level in the three plants as a result of using the bagasse compost medium. The lowest levels were achieved in the three kinds of plants grown in the rice compost medium. However, performance of the raw broad bean straw medium was the lowest in case of *Syngonium* plants only.

Table (11): Effect of straw kind on shoot content of P % (DWT)

Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	0.45	0.20	0.21
Broad bean straw	0.36	0.30	0.18
Bagasse compost	0.72	0.82	0.22
Rice compost	0.35	0.10	0.18
Peat moss	0.61	0.19	0.19

12 - Effect of straw kind on shoot content of K % (DWT) (Table 12):

The lowest values of K content of the three plants under investigation were a result of using the broad bean straw medium.

Table (12): Effect of straw kind on shoot content of K % (DWT)

Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	0.47	1.04	0.53
Broad bean straw	1.61	1.43	1.72
Bagasse compost	1.21	1.13	1.14
Rice compost	1.48	1.18	1.50
Peat moss	1.40	1.06	1.36

On the contrary, the highest values of the same content were observed in plants grown in the raw broad bean straw medium. K content in plants grown in rice compost medium came in the second rank in a descending order.

13- Effect of straw kind on shoot content of total carbohydrates % (DWT) (Table 13):

The total carbohydrates content in the three plants scored the highest level when grown in the bagasse compost medium. The corresponding lowest values were detected in the same plants when grown in the peat moss medium. Rice compost medium achieved the second order in case of *Schefflera* and *Syngonium*. The same order for *Peperomia* was a result of using the broad bean straw medium.

Table (13): Effect of straw kind on shoot content of total carbohydrates % (DWT)

Media	*Peperomia*	*Schefflera*	*Syngonium*
Broad bean compost	29.34	27.5	32.80
Broad bean straw	20.45	33.40	33.72
Bagasse compost	32.93	35.69	42.90
Rice compost	24.40	35.37	34.35
Peat moss	17.99	24.55	32.69

DISCUSSION

Crop straws and composts are good substrates that can promote growth and even surpass the expensive peat moss as mentioned in a lot of papers. Badran *et al.* (2000) stated that faba bean straw increased N, P and K contents in the soil. Boas *et al.* (2004) found that the bean straw compost increased the fresh weight of the aerial part and the amount of N, K, Ca, Mg, B, Cu, Fe, S, and Zn in lettuce plants grown in plastic vases. These reports might account for the beneficial effects of using the broad bean compost medium in producing the tallest *Peperomia* plants, the highest leaf and branch number/plant, the heaviest shoot dry weight, and the heaviest fresh roots. The longest roots of *Syngonium* belonged also to plants grown on the broad bean compost. The highest values of the K% content of the three plants were observed in plants grown in the broad bean straw medium.

The effect of the bagasse compost medium in producing the tallest *Schefflera* plants and the highest number of leaves/*Schefflera* plant, the heaviest fresh and dry roots of *Schefflera* and *Syngonium*, the heaviest shoot fresh and dry weights and the highest contents of total chlorophyll, N, P, and carbohydrate of the three plants *Peperomia*, *Schefflera* and *Syngonium* might be explained in the lights of the findings of many researchers. Trochoulias *et al.* (1990) stated that five ornamental species (*Brachycome multifida*, *Hibiscus rosa-sinensis*, *Pandorea jasminoides*, *Schizocentron elegans* and *Trachelospermum jasminoides*) grew as well in media that included composted bagasse as in those including peat moss. Baca *et al.* (1991) found that the addition of sugarcane bagasse composts to soil increased Fe, Mn, Cu and Zn in the soil, in comparison with C and NPK. These organic materials also led to an increase in Fe, Cu and Zn uptake by plants. Plaza (2004) stated that general mechanical behaviour of prepared cane and bagasse is basically identical to that of soil (sand and clay). The soil type that most resembles bagasse is peat; in particular, Radforth Peat, which is highly fibrous and has little mineral content. It seems to display identical mechanical behaviour and other similarities to prepared cane and bagasse. Panichsakpatanaa and Weaver (2005) mentioned that compost of bagasse mixed with filter cake (from the sugar cane industry) has a potential for use in crop production.

The success of rice compost medium in producing the longest *Syngonium* plants may find an interpretation in the work of other researchers. Itoh and Iimura (1990) stated that contents of organic C and N in soil were maintained by the application of rice straw. Songnuang *et al.* (1991) indicated that application of rice straw compost increased soil available P, SO_4-S, N uptake and yield of rice. Best results were obtained by using 50 g N, 25 g P_2O_5 and 25 g K_2O together with about 10 kg compost. Murata *et al.* (1997) showed that application of rice straw compost increased total N and available soil N to alluvial upland soil. Elsharawy *et al.* (2003) stated that application of either cotton stalks or rice straw composts significantly improved the physical properties of the tested soil, i.e., bulk density, hydraulic conductivity and moisture constants namely, field capacity, wilting point and available water. Generally, rice straw compost was better than cotton stalks concerning the effect on chemically available N, P, K, Fe, Mn, Zn and Cu in the cultivated soil. HuiHe *et al.* (2003) stated that organic manures increased the yield of romaine lettuce. The greatest increase occurred with rice straw, followed by peat and maize straw. Muhrizal *et al.* (2003) reported that in cases of soil infertility related to aluminium (Al) toxicity, peat mixed with organic materials (especially rice straw) synergistically promoted complexation and chelation of monomeric Al, presumably forming Al-organic acid complex in the soil.

On the contrary, some authors found that peat moss was preferred to compost, and this may explain that the longest *Peperomia* roots belonged to plants grown on the peat moss medium. Estaun *et al.* (1999) stated that when the peach x almond hybrid GF677 was inoculated in a sandy soil, peat, or commercial peat-bark compost mix, immediately after the weaning stage, plants grown in peat were taller than plants grown in soil or in the compost-peat mix. Ribeiro *et al.* (1999) reported that growth of two containerized tree seedlings of *Pinus pinea* and *P. pinaster* (dry weight and plant height) increased with increasing doses of compost up to 50% (plus 50% sphagnum peat). The 50% compost treatment seemed to supply all P, Ca, Mg, Cu, Zn and Mn needed for satisfactory plant growth. Raising compost percentage to 75-100% (plus 25-0% sphagnum peat) led to a growth reduction, probably as a consequence of water stress since the available water of these substrates (13% and 5%, respectively) was quite low. Gad (2003) declared that peat moss alone produced the best vegetative and root characteristics (stem diameter, number of branches and leaves, fresh weight of leaves, branches and roots, leaf size, total leaf area/plant and shoot:root ratio) of potted *Ficus benjamina* compared to the other media. It was followed by peat + vermiculite and straw + vermiculite. GuoJu *et al.* (2005) stated that *Heliconia psittacorum* produced green leaves with normally developed cells and high cut flower yield when grown in soil and peat. The mixture of soil + mushroom compost + peat or soil + mushroom compost + sand inhibited growth and gave plants with leaves exhibiting chlorosis, densely arranged cells and damaged chloroplasts.

However, the three different plants used in this study responded differently to the potting media. Wilson *et al.* (2002) ascertained that the effects of media composition on plant growth and development varied with each species tested. *Gloxinia* generally were smaller with reduced flower development when grown in compost-based media as compared to peat-based media. *Justicia* were similar in size or smaller when grown in compost-based media as compared to peat-based media but flower development was unaffected. Growth indexes of *Lysimachia* (Primulaceae) were similar or slightly reduced by 12% and flower development was reduced by 16% in the second trial. Wilson *et al.* (2004a) evaluated the growth of 24 perennials using a commercially available peat-based soilless medium amended with 25-75% organic compost generated from yard trimmings. They mentioned that the use of 100% compost increased plant growth of 11 species, reduced plant growth of 6 species, and did not affect plant growth of the remaining 6 species tested, compared to the peat-based commercial control mix. Use of 50% compost in the medium increased plant growth of 8 species, reduced plant growth of 2 species, and did not affect plant growth of the remaining 14 species tested compared to the peat-based commercial control mix. Results suggest that compost can be a viable alternative to peat as a substrate for containerized perennial production. Ferrini and Nicese (2005) potted rooted cuttings of *Cornus alba* 'Elegantissima', Fam. Cornaceae and *Acer campestre* 'Elsrijk', Fam. Aceraceae in containers using different combinations of peat moss, composted yardwaste, pumice and raw fiber. They found that the effect of the different substrates was species-specific.

The role of straw or compost is not confined in improving chemical and physical characteristics of the potting media; it extends also in the biological respect. It exerts a promotive effect on nitrogen fixing bacteria. Sadasivam *et al.* (1986) showed that the addition of bagasse or paddy straw compost favoured the survival of *Azotobacter chroococcum* and *Azospirillum brasilense* in soil-based carriers. When Mukherjee *et al.* (1999) applied water hyacinth and paddy straw and compost to an alluvial sandy loam soil to study the changes in the microflora in soil, they remarked that paddy straw exerted the maximum stimulation on the population of non-symbiotic nitrogen fixing bacteria in soil.

In the mean time, straw and compost ameliorating effect could also be expounded on the lights of its effect on a lot of pathogens. Korayem (2003) mentioned that the water extracts of composts of some organic matter inhibited *Meloidogyne incognita* egg-hatching in tomato. Highest inhibition value was obtained by bean straw compost. Tomato yield was improved by incorporation of bean straw compost. Rose *et al.* (2003) evaluated potential disease control methods against root and stem rot of cucumber (*Cucumis sativus*) caused by *Fusarium oxysporum* f.sp. *radicis-cucumerinum*. They found that the use of greenhouse compost reduced seedling mortality. The suppression was partially eliminated by sterilization of the compost. Szymczak-Nowak and Tyburski (2004) mentioned that after compost application, leaf infestation of sugar beet by leaf spot (caused by *Cercospora beticola*) was significantly reduced. Farmyard manure, straw and compost application resulted in a lower infestation by powdery mildew (caused by *Erysiphe betae*) compared to mineral fertilizer application. Noble and Coventry (2005) stated that there is a suppressive effect of composts on soil-borne diseases such as damping-off and root rots (*Pythium ultimum*, *Rhizoctonia solani*, *Phytophthora spp.*), and wilts (*Fusarium oxysporum* and *Verticillium dahliae*). The disease suppressive effect of compost generally increased with rate of application. Sterilisation of composted materials generally resulted in a loss in disease suppressiveness, indicating that the mechanism was often or predominantly biological, although chemical and physical factors have also been implicated. Raviv *et al.* (2005) stated that root-galling index of cherry tomato (*Lycopersicon esculantum*) roots and number of eggs of the nematode *Meloidogyne javanica* were reduced by wheat straw compost. The compost, but not peat, reduced the incidence of crown and root-rot disease in cherry tomato as well as the population size of the causal pathogen, *Fusarium oxysporum* f.sp. *radicis-lycopersici*. Scheuerell *et al.* (2005) stated that suppression of seedling damping-off disease caused by *Pythium spp.* and *Rhizoctonia solani* is a potential benefit of formulating soilless container media with compost. When mixed with sphagnum peat moss and inorganic aggregates, 67% of the compost samples significantly suppressed *P. irregulare* damping-off of cucumber, 64% suppressed *P. ultimum* damping-off of cucumber, and 17% suppressed damping-off of cabbage caused by *R. solani*. Suppression of *Pythium* damping-off was related to the potential of compost to support microbial activity and a qualitative index of ammonia volatilization.

It could be concluded from this discussion that different crop wastes especially straw or compost of broad bean, bagasse and rice are very useful materials that can improve plant production, decrease amounts of chemical fertilizers, encourage nitrogen fixing bacteria and reduce the injury imposed by a lot of pathogens.

Feasibility study:

In November 2005, one bag of peat moss, of 55 kg was sold at £.E. 130. This means that each pot filled with 0.5 kg costs about £.E. 1.2, i.e. a hundred pots will cost £.E. 120. On the other hand, a bag of 50 kg bagasse, bean or rice straw were sold at an average of £.E. 10, i.e. the same pot will cost £.E. 0.10, i.e. a hundred pots will cost only £.E. 10. Concerning the chemicals used in composting, 500 g of ammonium sulfate (at £.E. 8 a kilogram) in addition to 50 cm of phosphoric acid (at £.E. 25 a liter) were needed for a hundred pots. A summary of this feasibility study is shown in Table 14.

Table (14): Summary of the feasibility study

	unit	price in £.E.	total quantity for 100 pots	costs for 100 pots in £.E.	Final costs
peat moss	55 kg bags	132	50 kg	120	120
bean straw	50 kg bags	10	50 kg	10	15.25
bagasse	50 kg bags	10	50 kg	10	15.25
rice straw	50 kg bags	10	50 kg	10	15.25
ammonium sulfate	kg	8	500 g	4	
phosphoric acid	l.	25	50 cm	1.25	

This means that using peat moss costs £.E. 120 for 100 pots, while using either one of the above-mentioned straws will cost only £.E. 15.25 for the same number of pots. In addition to this big deal of money saving, the environmental benefits mentioned above are beyond estimation.

Recommendation:

A big deal of different crop straw is produced every year as a by-product. A lot of farmers used to burn this straw to get red of it. This adds a big pollution problem to the already polluted atmosphere in many cities in Egypt. It is recommended to use the straw or compost of many crops such as broad bean, bagasse and rice as cheap natural media instead of the expensive imported peat moss.

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إنتاج بعض نباتات التنسيق الداخلى بإستعمال بيئات طبيعية محلية

فيصل محمد عبد العليم سعداوى ، بشرى برتى رزق الله ، أمل صلاح الفولى
قسم بحوث نباتات الزينة ، معهد بحوث البساتين ، مركز البحوث الزراعية ، الجيزة ، مصر

يعد البيت موس من المكونات الرئيسية لمخاليط زراعة نباتات الزينة فى الأصص. وفى السنوات الأخيرة إزداد الإهتمام بالبيئة وإرتفع سعر البيت موس كثيرا. وبالإضافة إلى ذلك ، فقد إقترحت الكثير من القوانين لإعادة تدوير والإستفادة من المخلفات الزراعية . ولتحقيق ذلك فقد إستعمل في هذه الدراسة قش الفول وكمبوست مصاصة القصب والفول والأرز كبدائل للبيت موس. ويمكن تلخيص النتائج التى تأكدت وحافظت على نفس الإتجاه خلال موسمى التجربة فيما يلى : تسبب إستعمال بيئة كمبوست الفول فى إنتاج أطول النباتات بالنسبة للبيبروميا وأكثرها من حيث عدد الأوراق والأفرع لكل نبات ، وأعلى وزن جاف للمجموع الخضرى وأعلى وزن رطب للجذور . وكانت نباتات السينجونيوم ذات الجذور الأكثر طولا هى تلك النامية فى بيئة كمبوست الفول . وقد جد أعلى محتوى من البوتاسيوم بالنسبة لنباتات البيبروميا والسينجونيوم والشيفليرا فى النباتات النامية فى بيئة كمبوست الفول . وتسببت بيئة كمبوست مصاصة القصب فى إنتاج أكثر نباتات الشيفليرا طولا، وأكثر عدد من الأوراق لنبات الشيفليرا الواحد ، وأثقل وزن رطب وجاف لجذور الشيفليرا والسينجونيوم ، وأكبر وزن رطب وأعلى محتوى من الكلوروفيل الكلى والنيتروجين والفوسفور والكربوهيدرات بالنسبة للنباتات الثلاثة . وتسببت بيئة البيت موس فى إنتاج أطول الجذور فى حالة البيبروميا ، بينما تسببت بيئة كمبوست الأرز فى إنتاج أطول النباتات بالنسبة للسينجونيوم . ولذلك ينصح بإستعمال مخلفات مختلف المحاصيل مثل قش وكمبوست الفول ومصاصة القصب والأرز بإعتبارها مواد طبيعية رخيصة بديلة للبيت موس الغالى الثمن والذى يستورد من الخارج .