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Comparison of Different Pot Mixtures Containing Perlite on Growth and Morphological Characteristics of Pothos (*Scindapsus Aureum* L.)

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Abstract

To Select an appropriate medium for the growth of plant is one of the problems of most greenhouse owners in production of pot ornamentals. So, current research was conducted to evaluate effect of some available media in mixtured by perlite on the growth of pothos. Study was based on a completely randomized design with 5 treatments, 8 measuring times and 6 replications in a fiberglass greenhouse of Gorgan University of Agricultural Sciences and Natural Resources during 2009-2010. The treatments include ratios of perlite+ leaf compost, perlite+ rice husk, perlite+ cocopeat, perlite+ composted forest trees and perlite+ mushroom compost. Parameters such as plant height, stem diameter, leaf number, leaf fresh and dry weight and chlorophyll content were measured. Moreover, plants were compared according to their overall shape and appearance. The results of data analysis showed that the effect of medium, measuring time and their interaction were significant in all traits. The marketing value of pothos including plant height, leaf number and chlorophyll content, had a better response in perlite+ leaf compost and perlite+ mushroom compost media.

Keywords: Compost, Perlite, Pothos, Pot mixture.

INTRODUCTION

The production of foliage plants is an important agricultural industry. There is a demand for tropical foliage plants in homes, hotels, business offices, airports and other public building as result of human being form natural environments (Dole and Wilkins, 2005).

Pothos (*Scindapsus aureum* or *Epipremnum aureum* L.) from Araceae is one of well-known foliage plants. It requires medium indirect light; tolerated bright light, but the lengthy and direct light of sun will scorch the leaves (Dole and Wilkins, 2005).

The various substrates are mixed to produce a better medium in cutting production of ornamentals (Altman and Freudenberg, 1983). However, considerable differences are observed between the qualities of cuttings grown on various media combinations (Moursy, 2001; Wilson, 1983), depends on the plant species and environmental conditions of the nursery. Although, effects of different pot mixtures on growth and development of some ornamentals are previously investigated (Verdonck and Gabriels, 1992), there are not such reports for ornamental pothos (Cottenie *et al*., 1982).

An appropriate growth medium would provide sufficient anchorage or support to the plant, serves as reservoir for nutrients and water, allow oxygen diffusion to the roots and gaseous exchange between the roots and atmosphere (Abad *et al*., 2002; Richards and Beardsell, 1986). The major growth media currently used in Kuwait are perlite and peat moss. There is an interest to subtitute current media by relatively inexpensive substrates that have a great importance to growers of the country. In order to reduce cost of imported expensive organic materials to be used in growth media, it is recommended to extend to a wide range of plant species grown in the growth media containing higher ratio of sand (Abo-Rezq *et al.*, 2009).

Perlite is recognized to have a unique importance as a superior growing media for hydroponic cultures (Robins and Evans, 2004). It is very useful for increasing aeration and drainage within the container due to its uniformity and lightness. In addition, because of the physical shape of perlite particles, it provides a suitable balance between moisture retention and aeration. Adding cocopeat into perlite enhanced the growth and productivity of gerbera (Paradiso and Pascale, 2008).

In an experiment on pothos plant, it was reported that Leaf number was higher in the media containing 3:1 leaf-mold/cocopeat mixture. It is concluded that these differences represent a direct effect on the rooting process and the substrates characteristics have the high importance in the quality of rooted cuttings (Khayyat *et al.,* 2007).

Awang *et al.* (2009) indicated that certain chemical and physical properties of cocopeat can be improved through incorporation of burnt rice hull and its positive effect was clearly reflected in the growth and development of *Celosia cristata*.

The shell of almond is also seems to be a good substrate for growing ornamental plants. *Ficus benjamina* in mixture of %20 almond shells and %80 peat had the high height, dry and fresh weight of shoot and root and nitrogen content of foliar (Lao and Jimenez, 2004). Younis *et al*. (2010) expressed the medium containing equal ratio of sand, silt, leaf compost and spent compost, showed the best result for the production of croton plants.

Jackson *et al*. (2005) reported that roots can grow effectively and vigorously in substrates containing cotton gin compost. For growing Cypress, maximum height was achieved in plants grown in mixtures containing spent mushroom compost (Benito *et al.*, 2005). So in the present research, a combination of major mentioned mediums were investigated to grow ornamental pothos in the condition of north of Iran.

MATERIAL AND METHOD

This study was carried out at a Quonset fiberglass greenhouse in Gorgan University of Agricultural Sciences and Natural Resources during 2009-2010. The experiment was based on a com-

Table 1: The amount of nutrients in the used substrates

Media	N (%)	Mg (mg/kg)	K (mg/kg)	P (mg/kg)	Fe (mg/kg)
Perlite	0.039	140	182	11	4.4
Leaf Mold	1.69	360	528	21	16.4
Rice Husk	2.04	160	671	190	23.0
Cocopeat	3.04	880	917	21	42.8
Mushroom Compost	1.11	680	880	250	2.6
Composted Bark of Forest Trees	3.34	1060	784	32	20.3

pletely randomized design with five treatments, eight measuring times and six replications. Treatments werecontained equal volume ratio of substrates, m_1: perlite+leaf compost, m_2: perlite+rice husk, m_3: perlite+ cocopeat, m_4: perlite+ spent mushroom compost and m_5: perlite+ composted bark of forest trees. Measurements were performed in eight times from December 2009 till July 2010 (a measurement of factors in each month).

The substrates were provided in volume ratio and three uniform pothos plantlets were transplanted into each pot with mouth diameter of 21 cm). Parameters such as plant height, stem diameter, leaf number, leaf fresh and dry weight and chlorophyll content were measured; and finally the plants were compared according to their overall visual appearance by a score of 1 to 10. During the study were used no fertilizer or nutrition materials. Irrigation and mist were carried out handy and uniformly for all treatments. The plants were irrigated each 10 days in cool months and each 4-7 days in warm months the pH and EC of was irrigation water 6.55 and 642 µs/cm, respectively). A sunshade of 30 percent was used for protecting plants from sunburn in warm months. All achieved data were analyzed using SPSS software.

The purpose of this study was to investigate the influence of growing substrates composition on growth and development of a popular indoor plant, golden pothos, and determination the effect of pot mixtures on the morphological characteristics of pothos.

RESULT AND DISCUSSION

The measurement of temperature showed the minimum temperature of the inside of greenhouse was about 12-14 ºC during cold season and 17 ºC and 25 ºC in spring and early summer, re-

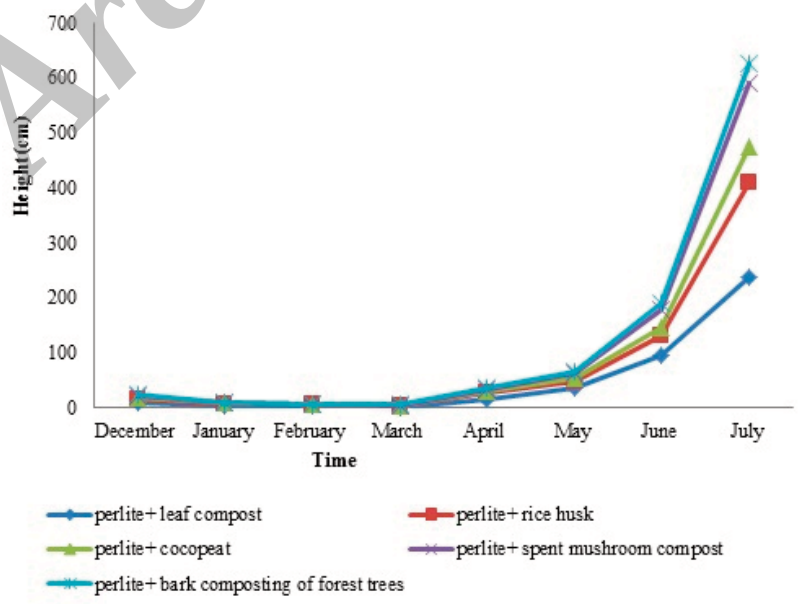

Fig. 1. Height of pothos during the time in different pot mixtures

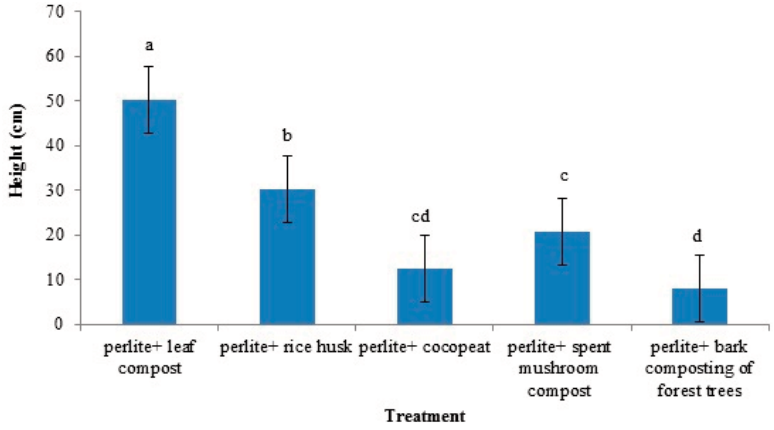

Fig. 2. Effect of different media on height of pothos plant

spectively. The humidity was retained 30-40% in greenhouse in all months comparatively. table 1 showed the amount of nutrients in the composition of the used substrates.

Analysis of potted medium reflected that a low nutrients medium, with low water-holding capacities, can be amended with different organic materials with at different rates (Younis *et al.,* 2010).

Plant height

Data analysis showed that the effect of media, time and their interaction on plants height were significant.

Interaction diagram shows that m1 substrate caused the longest plants height in all measuring months. The highest values of plant length (373 cm) had been seen in m1 treatment. According to Figure 1; the m1 medium had 250 cm growth only in final stage of measurement (July 2010). Current research showed that nitrogen content of substrate is important for increase in the plant growth. Substrate analysis showed that there is the most amount of N in cocopeat and composted forest trees, respectively, whiles the mixture of them is not caused to favorable condition in the growth of plant.

Figure 2 showed that the lowest height obtained at m5 medium containing forest trees bark compost+ perlite. It seems that the fresh organic material in forest trees compost caused to decrease

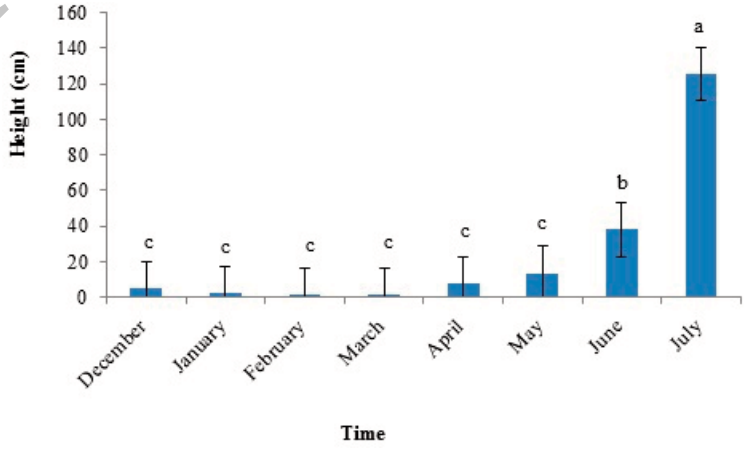

Fig. 3. The change of height at different times of year

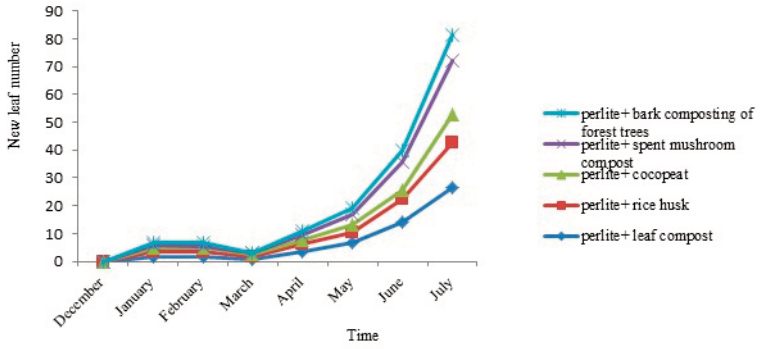

Fig. 4. Effect of different media and measuring time on new leaf number in pothos

the growth in this treatment. The plants cultivated in this substrate had no the desirable growth.

Effect of time on pothos growth showed that the height increased during December to July (Figure 3.) The growth increased slowly from December to March, but the plant height increase quickly after gradual warming of weather and increasing light level in April. The reason of this theorem is clear, because the pothos is a tropical and native plant in southeastern Asia (Malaysia and Indonesia) and New Guinea (Abd-El-Hadi and Shanan, 2010). It has the slight growth in cool and cloudy days of winter, but after April, the length plants of increases quickly due to air warming and higher light level into the greenhouse area; so the height of plants increased up to 126 cm just in July month. The difference of pothos height increases in December to March wasn't significant but in three final month, they had significant variations.

Although pothos plant had the better growth in warm seasons, but in addition to warm temperature, air ventilation is necessary for optimal growth and lack of ventilation may damage to foliage plants: moreover, because of increase in respiration the plant receives sufficient water (GhasemiGhehsareh and Kafi, 2009).

Leaf number

The presence of leaves on the cuttings may reflect earlier growth of root system, but the other environmental factors can also be involved (Khayyat *et al.*, 2007). Data analysis showed that the effect of media, time and their interaction on leaf number were significant. Results of figure 4 showed that substrate m1 was better than other pot media on leaf number, and July month caused the maximum new leaf number.

According to Figure 5; among various pot media, m_1 and m_2 had the maximum and mini-

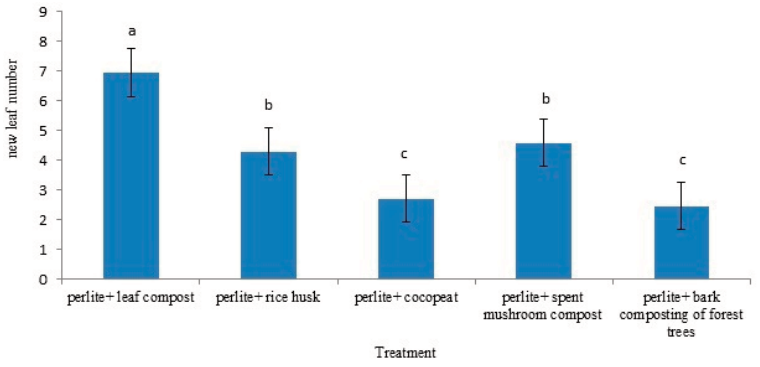

Fig. 5. Effect of different pot mixture on new leaf number in pothos

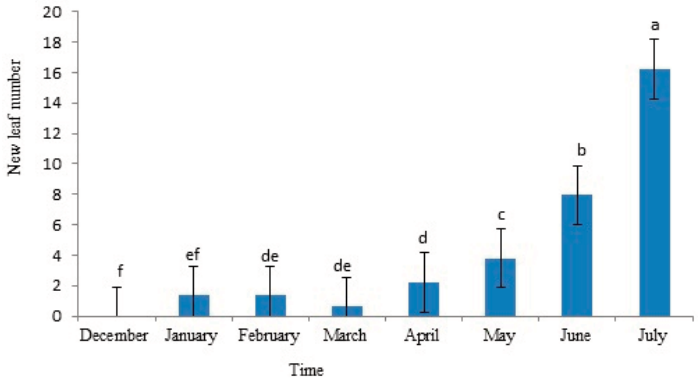

Fig. 6. The change of new leaf number at different times of year

mum of new leaf number, respectively. There wasn't significant difference between m_2 and m_4; also between m_3 and m_5 mixtures. But there were significant differences between m_1 and m_2 and m_4.

The effect of measuring time on new leaf number showed that new leaf number in each measurement stages were increased from December until July. It was due to gradual change of warm and light condition in greenhouse. In March month because of sudden cold and cloudy atmosphere, new leaf number and height was lower than previous month. According to the Figure 6; total new leaf number from December till May was the same of June (similar to height). Thus economic times for pothos production are after May month. Appearance of new leaf on the plant was due to more photosynthesis to produce new leaf.

Stem diameter

The result of data analysis showed that the effect of media, time and their interaction on stem diameter were significant.

Figures 7 and 8 show the effect of time and treatments on stem diameter of pothos. Effect of different pot mixtures onstem diameter factor (Figure 8) showed that m_4 and m_5 caused the thicker stem diameter, while these media had no appropriate effect on height and new leaf number. Benito *et al*. (2005) represented no differences in stem diameter in cypress affected by the growing media, which is in controversy with the finding of current experiment on pothos.

According to Figure 9, increase in stem diameter was ascending from December until March, whiles there is not an obvious change from April to July. In primary months of measuring, because of undesirable weather for plants growing (due to cool air and low light), the plants gen-

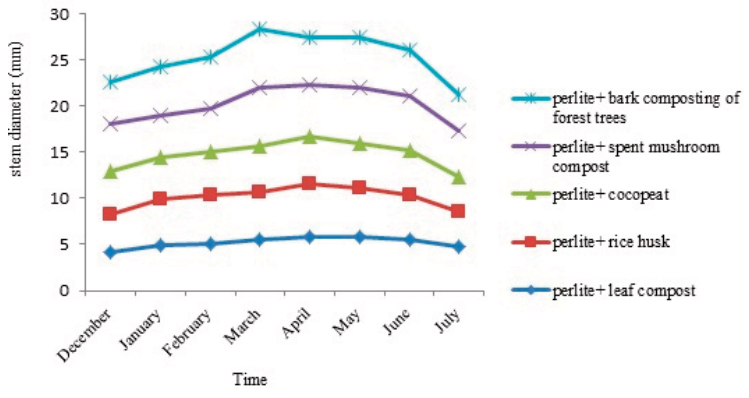

Fig. 7. Effect of different pot mixture and measuring time on stem diameter of pothos

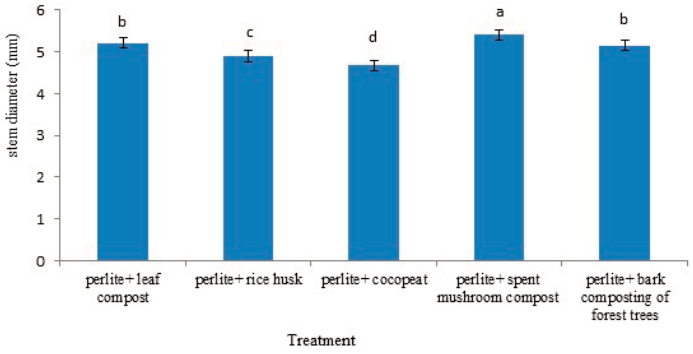

Fig. 8. Effect of different pot mixture on stem diameter of pothos

erated little leaf, but it increases the stem diameter. The plants increase their diameter for resistance against unfavorable situations (temperature decline, low light and etc.) but during weather warming, the plants produced new leaf and increase the height instead of adding diameter.

Chlorophyll

The result of Figure 10 showed that medium m_1 had the heighest chlorophyll, but it had not significant difference with medium m_4. The results of Ebrahimi *et al.* (2012) showed that cocopeat + perlite substrates had the most effect on chlorophyll a, chlorophyll b, total chlorophyll, and carotenoid in the old and young leaves of strawberry.

One of the physiological reasons of decreasing growth may be due to a disorder in the plant photosynthetic system. One of the ways to study disorders in photosynthesis is chlorophyll fluorescence (Soltani, 2004).

For synthesis of chlorophyll molecules, nitrogen and magnesium are necessary. Cocopeat and forest trees bark compost had the highest nitrogen and magnesium in compared with other substrates, but perlite+ cocopeat and perlite+ forest trees bark compost substrates had the minimum level of chlorophyll content.

Also the result of Hasanpur *et al*. (2009) on Lilium's flower showed substrate had not the significant effect on chlorophyll index, that it accordance with result of current experiment.

Leaf area

The result of data analysis showed that the effect of media, time and their interaction on leaf area, leaf fresh and dry weight were significant. Figure 11 showed the media containing leaf mold and spent mushroom compost had the most leaf area because of the most leaf number. But the media containing perlite + composted bark offorest trees and perlite+ cocopeat which had min-

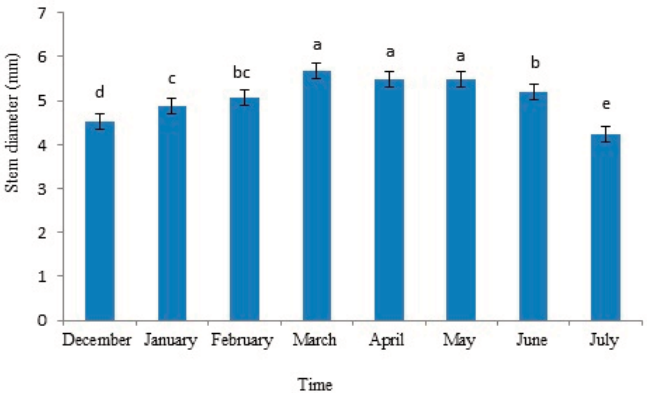

Fig. 9. Effect of different pot mixture and measuring time on stem diameter of pothos

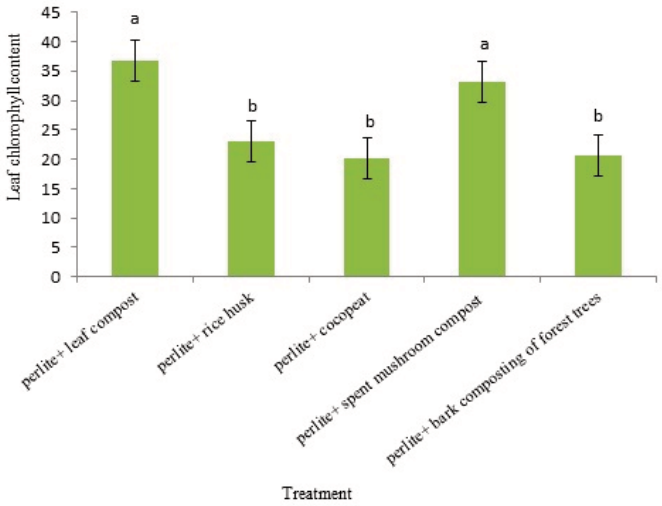

Fig. 10. Effect of different media on pothos leaf chlorophyll content

imum leaf number; they had the minimum leaf area too.

Matsiak and Nowak (1998) on Ficus benjamina and Khayyat *et al*. (2007) on Pothos plants found that the greatest leaf area was obtained in peat moss medium mixed with different media. Treder *et al.* (1999) mentioned that the greatest leaf area of different species of ficus plants obtained in peat moss media.

In Khayyat *et al.* (2007) report, higher leaf area in pothos was observed in the medium of peat moss/cocopeat (1:3 ratio). However, no significant differences were shown between recent media and cocopeat/peat moss (1:1 ratio) and cocopeat media.

Morphological evaluation

At the end of study, it was computed a numerical value to each plant according to its overall morphological appearance by using Amerin method (Amerin *et al*. 1965). For this evaluation, four characteristics were used: plant length, leaf color, leaf size and uniformity in growing leaves. Each factor contained maximum grade of 2.5 and all four factors may cause the maximum score level of 10. These numbers were then used for the comparison and determination of the best and worst media for pothos in this trial.

Finally the comparison between various substrates showed that media m_1 and m_4 were the best media in this trial. They caused similar results for higher new leaf number and higher length. While the media m_3 and m_5 were worst media because of little growth even after 8 months. The

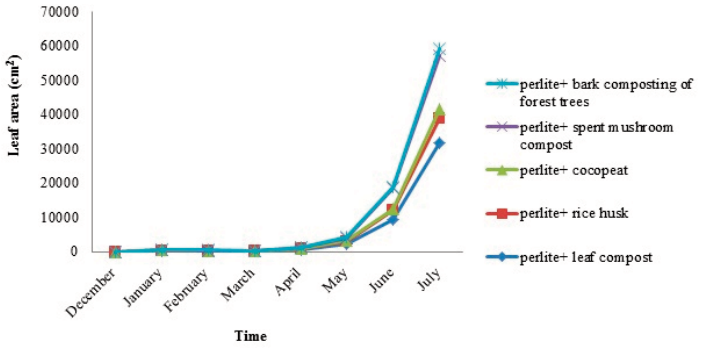

Fig. 11. Effect of different media and measuring time during the year on pothos leaf area

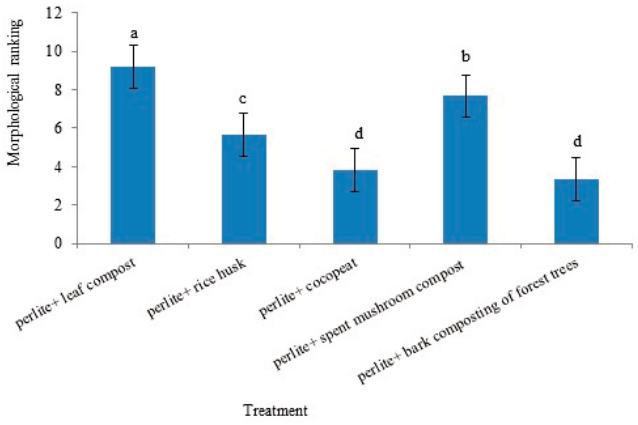

Fig. 12. Effect of different media on morphological evaluation of pothos

Fig. 13. Pothos plants in perlite + forest trees compost as worst media (in left side), perlite + leaf mold as best media (in right side)

media containing perlite with 5 composted bark of forest trees or cocopeat were not caused to a suitable growth of pothos, because the plants could not uptake necessary N, Mg and Fe elements, due to insolubility or unavailability of elements in the final pot mixture. Accordingly, it was observed the decrease in height, leaf number and chlorophyll. So the plants with suitable growth had better appearance and sale price.

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مقایسه مخلوط مختلف بستر حاوی پرلیت روی رشد و خصوصیات مورفولوژیکی پوتوس (*Scindapsus Aureum* L.)

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انتخاب بستر کاشت مناسب برای رشد گیاه یکی از معضلات بیشتر گلکاران در تولید گیاهان زینتی گلدانی است. بنابراین این تحقیق برای بررسی تاثیر بعضی بسترهای کاشت قابل دسترس در مخلوط با پرلیت روی رشد و نمو پوتوس است. این مطالعه بر اساس طرح کاملا تصادفی با ۵ تیمار، ۸ زمان اندازه‌گیری و ٦ تکرار در یک گلخانه با پوشش فایبرگلاس در دانشگاه کشاورزی و منابع طبیعی گرگان طی سال‌های ۲۰۱۰-۲۰۰۹ انجام شد. تیمارها شامل حجم مساوی از پرلیت + کمپوست برگ، پرلیت + شلتوک برنج، پرلیت + کوکوپیت، پرلیت + کمپوست درختان جنگلی و پرلیت + کمپوست قارچ بودند. صفاتی مثل ارتفاع گیاه، قطر ساقه، تعداد برگ، وزن تر و خشک برگ و مقدار کلروفیل برگ اندازه‌گیری شدند. همچنین گیاهان از نظر اندازه و شکل ظاهری نیز با هم مقایسه شدند. نتایج آنالیز داده‌ها نشان داد که اثر بستر کاشت، زمان اندازه‌گیری و اثر متقابل آن‌ها در تمام صفات معنی‌دار بودند. خصوصیات رشد مثل ارتفاع بوته، تعداد برگ و مقدار کلروفیل، که با ارزش بازاریابی این گیاه مرتبط است، در بسترهای پرلیت + کمپوست برگ و پرلیت + کمپوست قارچ بهتر از تیمارهای دیگر بودند. بنابراین، این بسترها می‌توانند برای تولید پوتوس با کیفیت در گلخانه‌ها استفاده شوند.

کلید واژگان: کمپوست، پرلیت، پوتوس، مخلوط گلدان.