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인공 토양에서의 양액을 이용한 고추의 재배 특성

Cultivate Characterics of Chili Growth using Nutrient Solution in Articifial Soil

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〈Abstract〉

Growing plant in potting media without soil is known as Soilless cultivation. This method is used mostly in greenhouse cultivation to increase horticultural commodities production. Peat moss is commonly utilized as potting media substrate because of its characteristic. However, peat moss price is high because of the quantity of peat moss in nature has been decreased. Recently, most of the research is conducted to find the alternative growing medium to cultivate horticulture plant in potting media. Perlite and rice husk ash were mentioned that had a potent as alternative growing media for seasonal plants to increase agriculture production due to the lack of production area. This study aimed to determine the effect of using different substrate and growth performance of chili. The method used was the soilless cultivation. The chili was planted in the pot with perlite media, rice husk ash media, and peat moss media. The chili was measured after 65 days after planting. The result showed that rice husk ash and perlite were more potentials in chili growth performance than peat moss. Rice husk ash had the significant result of plant height. While, Perlite effect on root length, plant weight, leaf length, and stem diameter. The best alternative for cultivation chili without substrate based on this research was perlite then rice husk ash and peat moss.

Keywords : Growth substrate, Soilless Cultivation, Growth performance, Chili

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1. Introduction

Chili is the most horticulture plant, which can be found in Korean restaurants as side dish. Chili is distinguished by its characteristics such as color, taste, and spiciness level. It makes chili becoming the essential economic commodities in South Korea after Chinese cabbage. Korea family cook their food by adding chili as a seasoning and consume chili for food supplementary [1] [2] [3]. Chili has an advantage for human health when is consumed appropriately. Chili was applied as traditional medicine, long time ago, because of its profit and chili had no side effect on the human body. Parallel with the growth of technology, these days many synthetic medicines are accessible for healing illness efficiently. In multiple studies of secondary metabolites on chili, the benefit of chili found as anticancer [4], antioxidant [5], anti-inflammatory [6], antitumor, antibacterial, analgesic, and antiviral at a large or inadequate level [7] [8]. Chili, mostly, is grown in tropical regions and sub-tropical regions, which demand proper moisture and light intensity. The soil on this climate is mainly utilized to cultivate chili as a growing substrate. In recent years, South Korea Government begin a program for producing chili in the greenhouse. The increase of chili planting areas by implementing greenhouse, based on Korean National Horticultural Research Center, reached 47.332 Ha since in 1997s. This result will positively raise the productivity of South Korea chili. The productivity of chili depends on generative period and the ability of chili to produce the fruit; however, the environment, chili genetic and variation of sowing media affect this phase. Planting Horticultural commodities in greenhouses are mostly taken a soilless cultivation as a method to grow a plant [9]. This method uses substrates that contain a combined of natural substances such as peat moss or rice husk ash and an artificial substance like rock wool, perlite, or sand. According to Raviv et al. 1986 peat moss is used widely due to its physical and chemical characteristic (High cation Exchange Capacity). In addition, in recent years, the quantity of peat moss in nature has been decreasing because peat, in wetlands, has been widely harvesting. This activity is increasing the environmental opposition. Many researchers have been searching for other substrates that can be substituted peat moss in the greenhouse as potting media because of environmental consideration and peat moss price growth. Rice husk ash and perlite have been reported can substitute peat moss as a substrate potting media. [10], [11], and [12] reported that variation of sowing media affects plant physiology, medium temperature, and organic materials. Yao, et al., 2008 found that characteristic of growing medium used have an impact on water and air exchange rate of seeding medium. However, only several studies have

examined into perlite and rice husk ash into greenhouse soilless substrates. In study of the correlation mixed substrate between perlite and coir on the chrysanthemums growth, Lee, et al., 1998 summarized that the leaf area and numbers of leaves of chrysanthemums are increased by mixing perlite and coir application. Perlite has multipurpose usage that makes perlite is widely used to cultivate many horticultural commodities for instance, melon, cucumber, lettuce, and rose [15] [16] [17] [18] [19] [20]. Perlite has also different particle size that important for maximizing root of plant. These particles can holding water greatly to provide air and water balance. Rice husk ash is a burned product from waste rice milling. These days, society are becoming to use rice husk ash as energy or alternative substrate for soilless potting media since the annual production of rice husk ash is around 100 million tons. Therefore, rice husk ash and perlite should have the high feasibility as an alternative substrate for soilless potting media. This research aims to determine the growth of chili in perlite and rice husk ash based substrates. The growth of chili in such different substrates is also compared to peat moss in a usual industrial greenhouse-potting medium.

2. Material and methods

The research was conducted at the bio institute of the Materials Manufacturing System Laboratory, Pusan National University, Miryang Campus, South Korea. The research method used was experimental research using randomized design complete with single factor consisting of three treatment where each treatment was repeated three times. The materials that used in this research were Perlite, Rice husk ash, Peat moss, Basic fertilizer, and Water. The tools that used in this research were water pump, water tank, hose, mini sprayer, scales, pot, digimatic micrometer, ruler, paper, and camera.

Observation of research begins by mixing water and basic fertilizer into water tanks. Then the pot that has been containing perlite, rice husk ash, and peat moss were put into the mini greenhouse. Each container was given a hose and mini sprayer to water the plants automatically every 9 am and 6 pm. Then six pieces of chili was planted in each pot. Research observations are plant height, plant weight, leaf length, leaf thickness, root length, root weight, and stem diameter. This observation variable was observed after 65 days after planting. Plant height, leaf length, and root length were measured using a ruler. Leaf thickness and stem diameter were measured using a digimatic micrometer. The weight of plants and weight of the roots in weigh by using analytic scales. Chili plants were cut into 3 cm before scale.

The data that have been collected were analyzed SPSS with a 5% error rate. If there is a significant difference, the data will be

tested by using Tukey's studentized range test.

3. Result and discussion

The results showed that the application of several potting media substrates media affects the growth of chili plant (table 1). The growth variables of chili plant that are significantly influenced are plant height and root length. Rice husk ash media showed a greater result to the plant height of chili with a value of 34.67 cm compared to another planting medium. While the perlite media showed a greater result to the root length of chili with a value of 16.33 cm compared to other growing media. Although peat moss had no significant result on the root weight and thickness of chili leaves, the peat moss medium had the highest value on both growth variables compared to 7.67 g for root weight and 0.32 mm for leaf thickness. Overall, the perlite media showed greatest results for four plant growth variables compared to peat moss media, which only influence two variables, and rice husk media that only affect one variable.

Greenhouse cultivation is most widely method to increase agricultural production that can control the growth aspect [9]. Greenhouse cultivation is usually used the growing substrate to grow horticultural commodities in potting media. Perlite, rice husk, and peat moss had been reported that suitable as the substrate for growing plant in potting media [21]. Perlite had been tested in several horticultural plants such as melon, cucumber, lettuce and rose (Szmid, et al., 1988) (Hochmuth & Hochmuth, 2003) (Rodriguez, et al., 2006) (Cantliffe, et al., 2003) (Frezza, et al., 2005) (Fascella & Zizzo, 2003). Perlite had been reported to have benefit for growing plant, which focuses on the root [22].

This research showed that perlite was more potent to chili growth, especially in root length. Root length of chili from perlite media was 16.33 cm. It was longer than root on rice husk and peat moss. Perlite showed the positive trend against root length, plant weight, leaf length, and stem diameter. The nutrient content in the perlite media causes a higher root value of the chili plant. The nutrients contained in the perlite are 3.5% K,

Fig. 1 Rice husk ash medium

Fig. 2 Peat moss medium

Fig. 3 Perlite medium

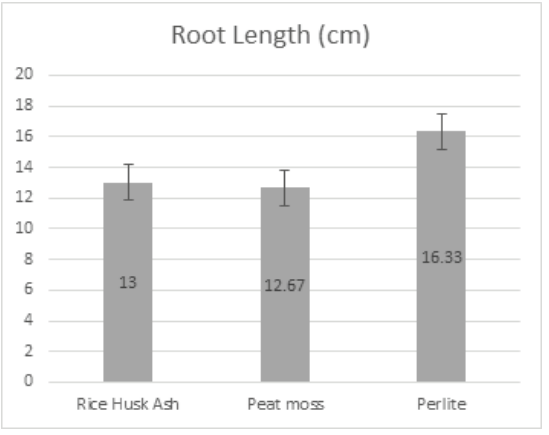

Fig. 4 Chili Root Length

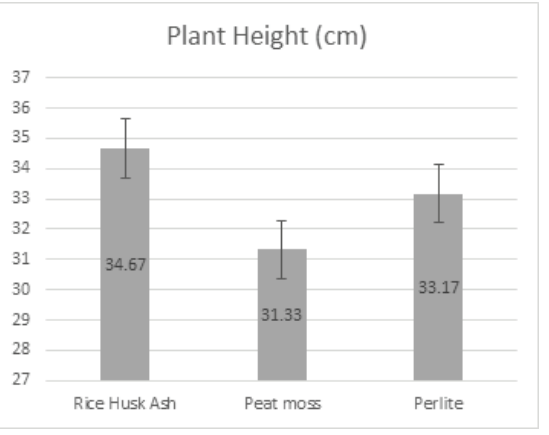

Fig. 5 Chili Plant Height

0.6% Ca, 0.2% Mg, 33.8% Si, 7.2% Al, 3.4% Na, and 0.6% Fe. The length of root value of chili plants grown using perlite media reaches 16.33 cm. The root length of chili's number is high because of the ability of perlite media to increase dissolved P, Ca and Mg concentration [23] and [24]. Plant weight of chili that was planted on perlite media had a heavy weight (12.67 g) and had the higher stem diameter of chili (6.01 mm). This finding showed that the value of plant weight has correlation on stem diameter of chili.

In this study, rice husk ash showed the high potency of chili plant height. The height of chili planted with rice husk ash is 34.67 cm. This value is higher than the value of chili that grown with perlite media and peat moss media. Plant height is influenced by the number of elements available on the growing media. The nutrient values of rice husk ash medium are 93.4% Si, 0.05% Al, 0.06% Fe, 0.31% Ca, 0.35% Mg, 1.4% K, 0.1% Na, 0.8% P. Rice husk ash is also used as bio char to increase soil aggregates and macro aggregate compositions [25]. In addition, the use of rice husk ash can improve soil chemical and physical properties of soil [26]. The ability of rice husk ash as the aggregate regenerator, chemical content, and physical properties increase the growth of chili plants. The properties of rice husk ash media have been shown to influence plant growth and improve crop yields. For example, the result of research that is conducted by Hossain indicating that the use of rice husk ash can increase the height of tomato plants. Furthermore, Liu et al., 2014 reported that the sweet potato production increases by using rice husk ash.

4. Conclusion

In this research, Perlite had more potential for chili growth than rice husk ash medium

Table 1. The effect of different potting media substrate on the growth of chili

Substrate	Root length (cm)	Root weight (g)	Leaf Thickness (mm)	Plant Weight (g)	Leaf length (cm)	Plant height (cm)	Stem Diameter (mm)
Rice Husk Ash	13.00a	6.33	0.31	11.00	8.67	34.67b	5.75
Peat moss	12.67a	7.67	0.32	10.33	7.83	31.33a	5.48
Perlite	16.33b	6.00	0.30	12.67	8.83	33.17ab	6.01
Significance							
Substrate	*	ns	ns	ns	ns	*	ns
ns: non-significant							

* Significant at $P < 0.05$

and peat moss medium according to its performance to growth chili. Rice husk ash substrate exposed the greatest performance for plant height. The differences between the result of this research and other research may be due to the substrate condition and environmental condition. Further studies also should be made to identify and evaluate the effect of using the alternative substrate as potting media in physical and chemical properties.d ginseng extract.

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