

Qualification of Expanded Clay Used as Substrate Culture

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Abstract : Qualification of expanded clay used as substrate culture was studied at Agricultural Technology Research Institute, Rajamangala University of Technology Lanna. The experimental design was completely randomized design (CRD) with 8 treatment of expanded clay: formula 1 (soil + rice husk); formula 2 (soil + rice bran); formula 3 (soil + resin beads); formula 4 (soil + rice husk + rice bran); formula 5 (soil + rice husk + resin beads); formula 6 (soil + rice bran+ resin beads); formula 7 (soil + rice husk + rice bran + resin beads); and formula (Soil). The burning condition was 600^o C for 8 hours. Results showed that expanded clay formula 2 gave the least weight (3.10 g) whereas formula 8 gave the highest weight (5.60 g). The expanded clay formula 4 gave the highest water content (0.84 g) while formula 3 gave the least water content (0.42 g). The pH of water immersed by expanded clay ranged from 6.06 to 7.72. *Pepperomia* planted in formula 5 gave the highest height of the growth rate. *Pepperomia* planted in formula 3 gave the highest canopy of the growth rate. The substrate culture did not affect the growth rate in leaves number, leaf width, leaf length, node length, node diameter, number of shoot, and the quantifications of leaf greenness (SPAD).

Keywords : Expanded Clay, Qualification and Substrate Culture

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1. Introduction

The several substrates are used for soilless crop production such as Sawdust, Vermiculite, Sand and expanded clay. Important factor in choosing the substrate for soilless crop production that substrate need to enough oxygen for respiration ; provide adequate moisture; the concentrations of ions should not be so high as to restrict the absorption of water and not be too low as to cause nutritional deficiencies; and the appropriate pH. (Sedibe, 2012). The Green Oak planted by Hydroponics technique, were that clay pellets after being baked, the size of grains became smaller but got more weight. expanded clay from Phangnga province with diameter at 3-5 mm. get most weight at 15.52 g./cup of medium (chaitayakul, 2008) , than this were study for culture substrates, soil was used as a witness, and perlite and clay balls were used as industrial substrates and biological material was composed of minitubers and plantlets obtained „in vitro”. At the end experiences were recorded minitubers number. Number of minitubers produced per plant, varied depending on different factors. (Andreea, 2010). The aim of research that the study of qualification of expanded clay on used to substrate culture.

2. Material and Method

The experimental design was completely randomized design (CRD), formulations expanded clay 8 treatments during (soil + rice husk ;formula 1, soil + rice bran;formula 2, soil + resin beads ;formula 3, soil + rice husk + rice bran ;formula 4 soil + rice husk + resin beads ;formula 5, soil + rice bran+ resin beads ;formula 6, soil + rice husk + rice bran + resin beads ;formula 7 and Soil ;formula 8) with diameter at 3-5 mm usually by burning at 600° C for 8 hours . The materials were used dried clay soil and process of expanded clay make practical use from knowledge earthenware group community Ban-Mon-Kaokaew Lampang province (in the north of Thailand). The expanded clay all treatments were tested with pepperomia and recorded the growth rate of height, canopy, number of leaves, leaf width, leaf length node length, node diameter, number of shoot and the quantifications of leaf greenness (SPAD).

3. Result

The result showed that expanded clay composed of soil + rice bran (formula 2) gave the least of weight (i.e. 3.10 g) different with soil (formula 8) that gave high of weight (i.e. 5.60 g) (Table 1). The expanded clay composed of soil + rice husk + rice bran (formula 4) gave the highest of water content (i.e. 0.84 g) different whit soil + resin brads (formula 3) that gave least of water content (i.e. 0.42 g) (Table 1). The pH of water immerse expanded clay ranged from 6.06 to 7.72 (Fig. 1).

Table 1 Weight and water content qualification for substrate culture of expanded clay 8 treatment used burning at 600^o C

Treatment	Weight (g.)	water content (g.)
formula 1	4.39ab	0.67bc
formula 2	3.10c	0.55bc
formula 3	3.57bc	0.42c
formula 4	4.73ab	0.84a
formula 5	5.21a	0.82ab
formula 6	5.14a	0.79b
formula 7	4.66ab	0.52bc
formula 8	5.60a	0.66b
Significant	ns	*

Values within a column followed by the letter are not significantly by Duncan's New Multiple Rang Test at 95% ns = non significant and * = significant

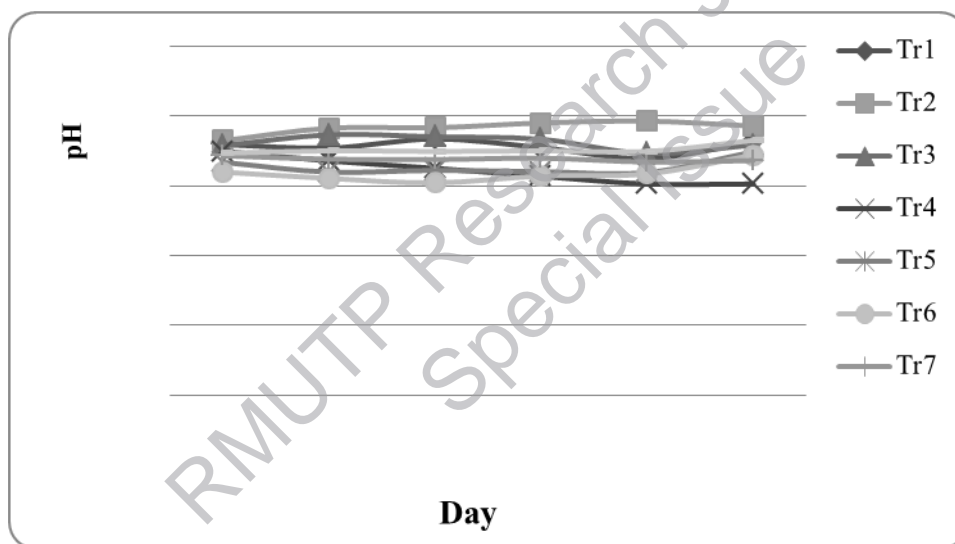


Fig. 1 pH of water immerse expanded clay 7 treatments at 1 – 10 day

The growth rate of height of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600^o C. The growth rate of height of pepperomia were planted at 15 and 30 days showed that the substrate culture did not affect on the growth rate of height (i.e.1.96 -5.98 and 10.94-27.23 %, respectively) (Table 2). Pepperomia were planted in formula 5 at 45 and 60 days gave the highest of the growth rate of height (i.e. 65.42 and 72.92 %, respectively) (Table 2).

Table 2. The growth rate of height of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	15 days	30 days	45 days	60 days
formula 1	4.11	27.23	27.31 b	30.89 b
formula 2	3.13	15.33	14.59 b	18.87 b
formula 3	5.98	20.63	21.19 b	25.22 b
formula 4	4.35	22.92	27.41 b	30.29 b
formula 5	5.00	17.50	65.42 a	72.92 a
formula 6	1.96	10.94	19.32 b	24.02 b
formula 7	4.81	19.22	30.98 b	34.92 b
formula 8	5.79	17.53	30.78 b	34.72 b
Significant	ns	ns	*	*

Values within a column followed by the letter are not significantly by Duncan's New Multiple Rang Test at 95% ns = non significantly and * = significant

Pepperomia were planted in formula 3 at 15 30 45 and 60 days gave the highest of the growth rate of canopy (i.e. 61.52, 59.61, 67.99 and 75.78 %, respectively) (Table 3).

Table 3 The growth rate of canopy of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	15 days	30 days	45 days	60 days
formula 1	23.67 b	40.75 ab	36.88 b	42.99 b
formula 2	21.97 b	38.13 ab	47.22 ab	51.03 ab
formula 3	61.52 a	59.61 a	67.99 a	75.78 a
formula 4	23.48 b	34.49 ab	40.51 ab	46.96 ab
formula 5	22.64 b	35.29 ab	38.22 b	37.99 b
formula 6	23.02 b	38.44 ab	41.46 ab	49.97 ab
formula 7	25.28 b	33.33 b	45.53 ab	50.56 ab
formula 8	16.27 b	23.53 b	27.50 b	33.24 b
Significant	*	*	*	*

Values within a column followed by the letter are not significantly by Duncan's New Multiple Rang Test at 95% * = significant

The growth rate of leaves number of pepperomia were planted in substrate culture at 15 to 60 days that the substrate culture did not affect on the growth rate of leaves number (i.e. 8.33 - 29.56 50.00 -112.70 77.16-146.03 and 123.81-217.86 %, respectively) (Table 4).

Table 4 The growth rate of leaves number of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	15 days	30 days	45 days	60 days
formula 1	8.33	62.50	125.00	145.83
formula 2	8.33	51.85	95.37	133.33
formula 3	18.65	75.79	138.49	169.05
formula 4	9.52	112.70	141.27	161.11
formula 5	29.56	108.33	91.47	217.86
formula 6	30.95	97.62	146.03	165.87
formula 7	16.99	111.43	140.16	173.33
formula 8	19.05	50.00	77.16	165.48
Significant	ns	ns	ns	ns

ns = non significantly

The growth rate of height of pepperomia were planted at 15 and 30 days showed that the substrate culture did not affect on the growth rate of height (i.e. 1.96 -5.98 and 10.94-27.23 %, respectively) (Table 2). Pepperomia were planted in formula 5 at 45 and 60 days gave the highest of the growth rate of height (i.e. 65.42 and 72.92 %, respectively) (Table 5).

The substrate culture did not affect on the growth rate of leaf width (i.e. 8.33 -29.56 50.00 -112.70 77.16-146.03 and 123.81-217.86 %, respectively) (Table 5).

Table 5 The leaf width of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	15 days	30 days	45 days	60 days
formula 1	4.93	5.30 a	5.43	3.76 ab
formula 2	4.47	4.76 ab	4.80	4.13 a
formula 3	5.23	5.46 a	5.63	3.80 ab
formula 4	5.16	5.43 a	5.63	4.26 a
formula 5	5.23	5.73 a	5.73	4.03 a
formula 6	4.73	4.93 ab	5.20	3.93 a
formula 7	4.76	5.20 ab	5.56	4.00 a
formula 8	5.03	5.26 a	5.40	3.67 ab
Significant	ns	*	ns	*

Values within a column followed by the letter are not significantly by Duncan's New Multiple Rang Test at 95% ns = non significantly and * = significant

The substrate culture did not affect on the growth rate of leaf length (i.e. 6.43 -7.46 7.16 -7.96 7.50-8.26 and 4.90-6.53 %, respectively) (Table 6).

Table 6 The leaf length of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	15 days	30 days	45 days	60 days
formula 1	7.06	7.50	8.00	6.00
formula 2	6.90	7.43	7.73	6.53
formula 3	7.20	7.83	8.16	6.16
formula 4	7.16	7.53	7.50	6.40
formula 5	7.46	7.96	7.60	6.23
formula 6	6.43	7.16	7.43	6.43
formula 7	7.00	7.66	8.26	5.93
formula 8	7.00	7.33	7.60	4.90
Significant	ns	ns	ns	ns

ns = non significantly

The substrate culture did not affect on the growth rate of Node length, Node diameter, Number of shoot and the quantifications of leaf greenness (SPAD) (i.e. 2.43 -3.26 0.52-0.68 2.66-4.33 and 54.40-60.86 %, respectively) (Table 7).

Table 7 The Node length, Node diameter, Number of shoot and the quantifications of leaf greenness (SPAD) of pepperomia were planted in substrate culture of expanded clay 8 treatments used burning at 600° C

Expanded clay	Node length (cm)	Node diameter (cm)	Number of shoot	The quantifications of leaf greenness (SPAD)
formula 1	2.73	0.58	4.33	58.10
formula 2	2.56	0.67	3.66	60.86
formula 3	2.43	0.62	3.33	60.36
formula 4	3.00	0.59	3.00	59.63
formula 5	2.90	0.52	3.66	55.10
formula 6	2.53	0.60	3.00	59.23
formula 7	3.26	0.68	2.66	58.86
formula 8	2.56	0.57	3.00	54.40
Significant	ns	ns	ns	ns

ns = non significantly

4. Discussion

The features of materials treatment are expanded clay product had difference appropriate structure to use for the development of crops using substrate (weight, water content and pH). The rice bran and rice husk for soil mix structure had features on weight, water content expanded clay product. Baked clay pellets, are suitable for hydroponic systems in which all nutrients are carefully controlled in water solution. The expanded clay are inert, pH neutral and do not contain any nutrient value. (wikipedia, 2013) This experiment was conducted to study the properties of expanded clay offered mixtures of various materials. Which need to be tested on the growth and development of plants grown in the soilless culture for the next.

5. Conclusion

The expanded clay did not affect on the growth of pepperomia but the expanded clay formula 2 gave the least of weight and formula 4 gave the highest of water content.

6. Reference

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