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R Girija
M.Sc. Scholar, Department of Floriculture and Landscaping, Post Graduate Institute of Horticultural Sciences, SKLTGHU, Mulugu, Siddipet, Telangana, India

N Seenivasan
Professor (Hort.) and Controller of Examinations, Department of Floriculture and Landscaping SKLTGHU, Mulugu, Telangana, India

D Laxminarayan
of Research, Department of Floriculture and Landscaping, SKLTGHU, Mulugu. Telangana, India

P Prasanth
Associate Dean, Department of Floriculture and Landscaping, College of Horticulture, Rajendranagar, SKLTGHU, Hyderabad, Telangana, India

S Praneeth Kumar
Scientist, Crop Physiology, Floriculture Research Station, SKLTGHU, Rajendranagar, Hyderabad, Telangana, India

Corresponding Author:
R Girija
M.Sc. Scholar, Department of Floriculture and Landscaping, Post Graduate Institute of Horticultural Sciences, SKLTGHU, Mulugu, Siddipet, Telangana, India

Effect of hydrogel incorporated growing media under various irrigation intervals on growth and quality of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden

R Girija, N Seenivasan, D Laxminarayan, P Prasanth and S Praneeth Kumar

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Abstract
Climate change and shrinking urban land have intensified the need for vertical gardens as sustainable solutions. This study, conducted in summer 2024 at the College of Horticulture, Rajendranagar, evaluated Golden Pothos (*Epipremnum aureum*) growth under hydrogel-incorporated growing media and three irrigation intervals using a Factorial Completely Randomized Design with 15 treatments and 3 replications. Media combinations included cocopeat, red earth, vermicompost, and biochar (rice husk or wood) with hydrogel doses (20 g or 40 g). Results revealed that M2 (cocopeat + red earth + vermicompost + rice husk biochar + 40 g hydrogel) under daily irrigation (I1) consistently produced superior vegetative growth: vine length (38.56 cm), branch number (2.00), leaf count (22.40), stem diameter (5.52 mm), petiole length (11.50 cm), leaf area (42.70 cm²), and root number (10.00). In contrast, red earth alone (M5) with five-day irrigation (I3) recorded the lowest values (vine length 26.40 cm, branch number 1.00, leaf count 13.57, stem diameter 3.05 mm, petiole length 7.76 cm, leaf area 22.01 cm², root number 2.00). Findings confirm that rice husk biochar and hydrogel synergistically enhance soil structure, nutrient retention, and water availability, while frequent irrigation maximizes vegetative and root development. The M_2I_1 combination proved optimal, highlighting its potential for climate-resilient vertical garden systems in urban environments.

Keywords: Golden pothos, *Epipremnum aureum*, vertical garden, hydrogel

Introduction
Climate change has intensified the need for sustainable living spaces, and vertical gardens are emerging as effective tools to improve air quality and reduce urban heat while enhancing aesthetics (Payak *et al*., 2021) [1]. With shrinking land availability and rising high-rises, vertical gardens have become a key component of modern garden design (Kumar, 2018) [2]. The success of these systems largely depends on the growing medium, where alternatives like cocopeat, vermicompost, and biochar have shown promise in supporting plant growth (Lehmann *et al*., 2011; Rajkovich *et al*., 2012) [3, 4]. Biochar, in particular, improves soil properties and carbon sequestration, while carbonized rice husks enhance water retention (Haefele *et al*., 2009) [5]. Hydrogels further contribute by conserving water, improving soil porosity, and supporting ornamental plant growth under moisture stress (Changela *et al*., 2022) [6]. Together, these innovations highlight the potential of vertical gardens as climate-resilient solutions for urban environments.

Materials and Methods
The study, titled *"*Effect of Hydrogel-Incorporated Growing Media under Various Irrigation Intervals on Golden Pothos (*Epipremnum aureum*) for Vertical Garden*"*, was conducted in summer 2024 at the College of Horticulture, Rajendranagar. Using a Factorial Completely Randomized Design with 15 treatments and 3 replications, Golden Pothos plants were grown in 4 × 5 inch pots. Media combinations enriched with 2 doses of hydrogel (20 g or 40 g) and three

irrigation intervals (alternate day, once in three days, and once in five days) were tested to evaluate their impact on plant growth and quality, with results analyzed and interpreted through statistical methods and prior research. Media compositions are M_1 - Cocopeat+ Red Earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel, M_2 - Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel, M_3 - Cocopeat + Red Earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel, M_4 - Cocopeat + Red Earth + Vermicompost + Wood Biochar (2:1:1:1) +40 g hydrogel, M_5 - Red earth (Control). The three irrigation intervals are I_1-one day irrigation interval, I_2-three days irrigation interval and I_3-five days irrigation interval.

Plant height (or) vine length (cm)
The height of the plant or vine length was measured using a measuring scale from base of stem till tip of vine at 45 and 90 days after planting and the mean plant height was calculated and expressed in centimeters.

Number of branches per vine
The number of branches per plant was counted at 45 and 90 days after planting and the mean number of the branches per plant was calculated.

Number of leaves per vine
The number of leaves per vine was counted at 45 and 90 days after planting and the mean number of the leaves per plant was calculated.

Stem diameter (mm)
The stem diameter was measured using a venire calipers at 45 and 90 days after planting and the mean stem diameter was calculated and expressed in millimeters.

Petiole length (cm)
The petiole length was measured from the point of emergence to the stem leaf interaction point using a measuring scale at the 45 and 90 days after planting and the mean petiole length was calculated and expressed in centimeters.

Leaf area (cm2)
The leaf area was measured at 90 DAP using leaf area meter and the mean leaf area was calculated and expressed in centimeters square.

Number of roots
90 DAP with the help of sharp blade roots were separated from the cuttings on the paper and numbers of roots were counted on each selected plant. Mean number of roots per plant or vine calculated.

Statistical Analysis
The data obtained from all the above experiment were tabulated and subjected to statistical analysis (ANOVA) as per the method given by panse and sukhatme (1985). The appropriate standard error of mean SE (m+/-) and the critical difference (CD) were calculated at 5% level of significance. The data have been depicted by suitable graphs and graphs and with appropriate tables.

Results and Discussion
Plant height (cm)
At both 45 and 90 days after planting, vine length of Golden Pothos was significantly influenced by hydrogel-enriched growing media, irrigation intervals, and their interactions. At 45 and 90 DAP, the maximum vine lengths (23.46, 35.74 cm) was recorded in M_2 (Cocopeat + Red earth + Vermicompost + Rice husk biochar with 40 g hydrogel), while the shortest (18.17, 28.16 cm) was in M_5 (Red earth). Irrigation intervals showed similar trends, with the one-day interval (I_1) producing the longest vines (24.86, 36.68 cm), compared to three-day (I_2, 21.09, 32.73 cm) and five-day (I_3, 18.16, 29.48 cm).
The interaction effect was most pronounced in M_2I_1 (27.26, 38.56 cm), whereas the lowest (16.08, 26.40 cm) was in M_5I_3. The results are in coordination with Asadi *et al*. (2021) [44], Li *et al*. (2023) [47], Dawlatzai *et al*. (2018) [45], Sahana and Sugirtharan (2021) [46]. These results confirm that rice husk biochar and hydrogels, combined with frequent irrigation, significantly enhanced vine elongation by improving soil structure, nutrient retention, and water availability, whereas longer irrigation intervals restricted growth due to moisture stress.

Number of Branches
The number of branches in Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions at both 45 and 90 days after planting. At 45 and 90 DAP, the maximum branch count (1.31, 1.58) was recorded in M_2 (Cocopeat + Red earth + Vermicompost + Rice husk biochar with 40 g hydrogel), while the lowest count (1.02, 1.07) was observed in M_5 (Red earth). Irrigation intervals showed a similar trend, with I_1 (one-day interval) producing the highest branch count (1.41, 1.77) and the lowest in I_3 (1.00, 1.03). The interaction effect was most pronounced in M_2I_1 (1.60, 2.00), while the minimum (1.00, 1.00) was noted in M_5I_3**.**
The superior performance of rice husk biochar (RHB) in M_2I_1 can be attributed to its ability to improve soil fertility, nutrient retention, and water-holding capacity, thereby enhancing vegetative growth (Ahmad, 2016; Vural *et al*., 2025) [7, 8]. Hydrogels also played a critical role, as higher concentrations increased water availability around roots, buffered plants against moisture stress, and promoted branching through enhanced cell division and elongation (Johnson & Woodhouse, 1991; Mohebi, 2019; Kumar *et al*., 2018; Anupama *et al*., 2005) [9, 10, 13, 14]. Frequent irrigation further supported branch proliferation, as higher soil moisture improved plant water potential and vegetative growth, consistent with earlier findings in various crops (Mishra *et al*., 2019; Piri & Sharma, 2006) [11, 12].

Number of Leaves
At both 45 and 90 DAP, leaf count per vine in Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions. At 45 and 90 DAP, M_2 (cocopeat + red earth + vermicompost + rice husk biochar + 40 g hydrogel) recorded the highest leaf number (15.52, 20.08), while the lowest was in M_5 (8.66, 14.93). Irrigation intervals showed similar trends, with I_1 (one-day interval) producing the maximum (15.91, 20.65) and I_3 (five-day interval) the minimum (10.91, 16.05). The interaction effect peaked in M_2I_1 (18.60, 22.40)**,** while M_5I_3 (7.60, 13.57) was the lowest.
These findings highlight the synergistic role of rice husk biochar and hydrogel in enhancing leaf proliferation by improving soil porosity, nutrient uptake, and moisture retention (Masinde *et al*., 2022; Adebajo *et al*., 2019; Rema *et al*., 2019) [15, 16, 17]. Hydrogel further boosted leaf production by maintaining soil moisture and nutrient supply (Johnson & Woodhouse, 1990) [9]. Frequent irrigation also promoted leaf growth, consistent with earlier reports in chrysanthemum (Goto *et al*., 2001) [18], mustard (Mishra *et al*., 2019; Singh & Singh, 2014) [12, 20], and other crops (Hassanein, 2015) [19].

Stem diameter (mm)

At both 45 and 90 DAP, stem diameter of Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions. At 45 and 90 DAP, the largest stem diameter was recorded in M_2 (4.60, 4.71 mm) while the smallest was in M_5 (3.40, 3.48 mm). Irrigation intervals showed clear differences, with I_1 (4.96, 5.15 mm) outperforming I_2 (4.23, 4.30 mm) and I_3 (3.39, 3.49 mm). The interaction effect was strongest in M_2I_1 (5.35, 5.52 mm) and the lowest was in M_5I_3 (3.01, 3.05 mm)**.**

These findings confirm that biochar improves substrate porosity, aeration, and nutrient uptake, thereby enhancing stem thickness (Masinde & Wahome, 2022; Adebajo *et al*., 2019; Varela Milla *et al*., 2022) [15, 16, 21]. Hydrogel supplementation further promoted vascular differentiation and stronger stems through gradual water release (Mangaiyarkarasi *et al*., 2020; Deenavarman *et al*., 2018; Tarun Kumar *et al*., 2016) [22, 23, 24]. Frequent irrigation also supported stem diameter expansion by maintaining plant water status, consistent with studies in grapevine and carnation (Ru *et al*., 2021; Kazaz *et al*., 2010) [25, 26]. Overall, hydrogel-enriched biochar media combined with alternate day irrigation (I1) consistently produced the thickest stems, highlighting their synergistic role in vegetative growth.

Petiole length (cm)

At both 45 and 90 DAP, petiole length of Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions. At 45 and 90 DAP, the longest petiole was recorded in M_2 (9.91, 10.33 cm), while the shortest was in M_5 (7.98, 8.27 cm). Irrigation intervals showed clear differences, with I_1 (10.01, 10.39 cm) outperforming I_2 (9.24, 9.64 cm) and I_3 (8.35, 8.62 cm). The maximum interaction effect was observed in M_2I_1 (10.95, 11.50 cm), while the lowest was in M_5I_3 (7.46, 7.76 cm)**.**

These results highlight the synergistic role of rice husk biochar and hydrogel in enhancing petiole elongation by improving silicon enrichment, porosity, and water retention (Karam *et al*., 2022; Kartika *et al*., 2018; Adebajo *et al*., 2019; Rema *et al*., 2019) [16, 17, 27, 28]. Hydrogel supplementation sustained turgor pressure and promoted cell elongation in petiole tissues (Madhu Bala, 2018; Vidyashree, 2018; Kumar *et al*., 2016) [24, 29, 30]. Frequent irrigation further supported continuous cell expansion, consistent with findings in taro, clover, and thale cress (Silva *et al*., 2008; Enkhbat *et al*., 2022; Tsukaya *et al*., 2002) [31, 32]. Overall, M_2I_1 consistently produced the longest petioles at both stages, confirming that hydrogel-enriched biochar media combined with daily irrigation is most effective for vegetative growth.

Leaf area (cm2)

At both 45 and 90 DAP, leaf area of Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions. At 45 and 90 DAP, the maximum leaf area was recorded in M_2 (28.42, 36.53 cm²)**,** while the lowest was in M_5 (19.36, 25.48 cm²). Irrigation intervals showed clear differences, with I_1 (29.84, 38.21 cm²) outperforming I_2 (25.73, 34.03 cm²) and I_3 (20.15, 25.90 cm²). The highest interaction effect was observed in M_2I_1 (32.10, 42.70 cm²), while the lowest was in M_5I_3 (17.80, 22.01 cm²).

These findings confirm that biochar enhances microbial activity and nutrient uptake, thereby increasing leaf area (Graber, 2010) [35]. Hydrogel supplementation improved water retention and sustained turgor pressure, promoting leaf expansion (Al-Harbi *et al*., 1999; Yazdani *et al*., 2007) [33, 34]. Frequent irrigation further supported leaf development, consistent with reports linking water stress to reduced cell division and smaller leaf area (Rascio *et al*., 1990; Beese *et al*., 1982; Adeoye *et al*., 2014) [36, 37, 38]. Overall, M2I1 consistently produced the largest leaf area at both stages, highlighting the synergistic role of hydrogel-enriched biochar media with daily irrigation in maximizing vegetative growth.

Number of roots

At both 45 and 90 DAP, root number in Golden Pothos was significantly influenced by hydrogel-enriched media, irrigation intervals, and their interactions. At 45 and 90 DAP, the maximum root count was recorded in M_2 (5.42, 6.87), while the lowest was in M_5 (2.05, 2.23). Irrigation intervals showed clear differences, with I_1 (6.12, 7.66) outperforming I_2 (4.36, 4.92) and I_3 (2.45, 2.84). The highest interaction effect was observed in M_2I_1 (7.80, 10.00), while the lowest was in M_5I_3 (1.90, 2.00).

These findings confirm that rice husk biochar improves soil structure, porosity, and nutrient retention, thereby enhancing root initiation and branching (Thavanesan & Seran, 2018; Kartika *et al*., 2018; Adebajo *et al*., 2019; Rema *et al*., 2019; Masinde & Wahome, 2022) [15, 16, 17, 28, 39]. Hydrogel supplementation sustained moisture availability, promoting continuous root elongation and lateral root formation (Madhubala, 2018; Deenavarman & Lourdusamy, 2018; Singh *et al*., 2020) [23, 29, 40]. Frequent irrigation further supported root proliferation, consistent with studies in soybean, rice, and grapevine where higher water availability enhanced root growth (Bui *et al*., 2022; Yang *et al*., 2022; Zhang *et al*., 2024; Ru *et al*., 2021) [26, 41, 42, 43]. Overall, M_2I_1 consistently produced the highest root counts at both stages, highlighting the synergistic role of hydrogel-enriched biochar media with daily irrigation in maximizing root development.

Table 1: Effect of hydrogel incorporated growing media under various irrigation intervals on plant height or vein length (cm) of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	Vine Length (cm)							
	Different Irrigation Intervals (I)							
	45 DAP				90 DAP			
	I_1	I_2	I_3	MEAN (M)	I_1	I_2	I_3	MEAN (M)
M_1	25.18	21.64	18.22	21.68	37.82	33.46	29.72	33.67
M_2	27.26	23.38	19.74	23.46	39.78	35.68	31.76	35.74
M_3	24.26	20.92	17.98	21.05	36.74	32.42	28.66	32.61
M_4	26.12	22.52	18.76	22.47	38.56	34.54	30.86	34.65
M_5	21.46	16.96	16.08	18.17	30.49	27.58	26.40	28.16
MEAN (I)	24.86	21.09	18.16		36.68	32.74	29.48	
Factors	**SE(m)±**		**CD (5%)**		**SE(m)±**		**CD (5%)**	
(M)	0.20		0.59		0.30		0.87	
(I)	0.16		0.46		0.23		0.67	
Factors (M X I)	0.35		1.02		0.52		1.51	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 2: Effect of hydrogel incorporated growing media under various irrigation intervals on number of branches of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	Number of Branches							
	Different Irrigation Intervals (I)							
	45 DAP				90 DAP			
	I_1	I_2	I_3	MEAN (M)	I_1	I_2	I_3	MEAN (M)
M_1	1.47	1.20	1.00	1.22	1.88	1.53	1.00	1.47
M_2	1.60	1.33	1.00	1.31	2.00	1.67	1.07	1.58
M_3	1.40	1.13	1.00	1.18	1.87	1.47	1.00	1.44
M_4	1.53	1.27	1.00	1.27	1.93	1.60	1.07	1.53
M_5	1.07	1.00	1.00	1.02	1.20	1.00	1.00	1.07
MEAN (I)	1.41	1.19	1.00		1.77	1.45	1.03	
Factors	SE(m)±		CD (5%)		SE(m)±		CD (5%)	
(M)	0.024		0.071		0.033		0.096	
(I)	0.020		0.055		0.026		0.074	
Factors (M X I)	0.042		0.122		0.057		0.166	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 3: Effect of hydrogel incorporated growing media under various irrigation intervals on number of leaves of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	Number of Leaves Per Vine							
	Different Irrigation Intervals (I)							
	45 DAP				90 DAP			
	I_1	I_2	I_3	MEAN (M)	I_1	I_2	I_3	MEAN (M)
M_1	17.20	14.00	11.77	14.32	21.53	19.23	16.47	19.07
M_2	18.60	15.57	12.40	15.52	22.40	20.23	17.60	20.08
M_3	16.40	13.60	10.60	13.53	20.83	18.40	15.63	18.29
M_4	17.80	14.60	12.20	14.87	22.00	19.60	17.00	19.53
M_5	9.57	8.80	7.60	8.66	16.40	14.83	13.57	14.93
Mean (I)	15.91	13.31	10.91		20.65	18.46	16.05	
Factors	SE(m)±		CD (5%)		SE(m)±		CD (5%)	
(M)	0.13		0.38		0.17		0.50	
(I)	0.10		0.30		0.13		0.39	
Factors (M X I)	0.23		0.66		0.30		0.87	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 4: Effect of hydrogel incorporated growing media under various irrigation intervals on stem diameter (mm) of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	Stem Diameter (mm)							
	Different Irrigation Intervals (I)							
	45 DAP				90 DAP			
	I_1	I_2	I_3	MEAN (M)	I_1	I_2	I_3	MEAN (M)
M_1	5.18	4.48	3.39	4.35	5.35	4.54	3.47	4.45
M_2	5.35	4.63	3.82	4.60	5.52	4.71	3.89	4.71
M_3	4.91	4.37	3.21	4.16	5.26	4.42	3.38	4.35
M_4	5.30	4.51	3.54	4.45	5.43	4.63	3.67	4.58
M_5	4.04	3.15	3.01	3.40	4.18	3.20	3.05	3.48
MEAN (I)	4.96	4.23	3.39		5.15	4.30	3.49	
Factors	SE(m)±		CD (5%)		SE(m)±		CD (5%)	
(M)	0.042		0.121		0.011		0.031	
(I)	0.032		0.094		0.008		0.024	
Factors (M X I)	0.072		0.210		0.019		0.054	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 5: Effect of hydrogel incorporated growing media under various irrigation intervals on petiole length (cm) of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	**Petiole Length (cm)**							
	Different Irrigation Intervals (I)							
	45 DAP				**90 DAP**			
	I_1	**I_2**	**I_3**	**MEAN (M)**	**I_1**	**I_2**	**I_3**	**MEAN (M)**
M_1	10.17	9.45	8.41	9.34	10.54	9.88	8.64	9.69
M_2	10.95	9.84	8.94	9.91	11.50	10.26	9.24	10.33
M_3	10.14	9.24	8.22	9.20	10.42	9.64	8.42	9.49
M_4	10.36	9.65	8.70	9.57	10.78	10.08	9.02	9.96
M_5	8.44	8.04	7.46	7.98	8.72	8.32	7.76	8.27
MEAN (I)	10.01	9.24	8.35		10.39	9.64	8.62	
Factors	**SE(m)±**		**CD (5%)**		**SE(m)±**		**CD (5%)**	
(M)	0.008		0.023		0.091		0.265	
(I)	0.006		0.018		0.071		0.205	
Factors (M X I)	0.014		0.040		0.158		0.459	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 6: Effect of hydrogel incorporated growing media under various irrigation intervals on leaf area (cm^2) of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	**Leaf Area(cm^2)**			
	Different Irrigation Intervals (I)			
	At the end of experiment			
	I_1	**I_2**	**I_3**	**MEAN (M)**
M_1	40.09	35.35	26.42	33.95
M_2	42.70	38.41	28.48	36.53
M_3	39.54	32.30	25.12	32.32
M_4	40.98	37.38	27.47	35.27
M_5	27.73	26.70	22.01	25.48
MEAN (I)	38.21	34.03	25.90	
Factors	**SE(m)±**		**CD (5%)**	
(M)	0.31		0.89	
(I)	0.24		0.69	
Factors (M X I)	0.53		1.55	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Table 7: Effect of hydrogel incorporated growing media under various irrigation intervals on number of roots of golden pothos (*Epipremnum aureum* Linden and Andre) for a vertical garden.

Different Media Incorporated with Hydrogel (M)	**Number of Roots**			
	Different Irrigation Intervals (I)			
	At the end of experiment			
	I_1	**I_2**	**I_3**	**MEAN (M)**
M_1	8.60	5.00	2.60	5.40
M_2	10.00	6.60	4.00	6.87
M_3	7.80	4.80	2.40	5.00
M_4	9.40	6.00	3.20	6.20
M_5	2.50	2.20	2.00	2.23
MEAN (I)	7.66	4.92	2.84	
Factors	**SE(m)±**		**CD (5%)**	
(M)	0.05		0.15	
(I)	0.04		0.12	
Factors (M X I)	0.09		0.26	

M_1	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 20 g hydrogel	I_1	:	One day interval
M_2	:	Cocopeat + Red earth + Vermicompost + Ricehusk Biochar (2:1:1:1) + 40 g hydrogel	I_2	:	Three day interval
M_3	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 20 g hydrogel	I_3	:	Five day interval
M_4	:	Cocopeat + Red earth + Vermicompost + Wood Biochar (2:1:1:1) + 40 g hydrogel			
M_5	:	Red earth(control)			

Conclusion

From the study demonstrated we can say that Golden Pothos growth parameters—including vine length, branch number, leaf count, stem diameter, petiole length, leaf area, and root number—were consistently maximized in M_2 (cocopeat + red earth + vermicompost + rice husk biochar in 2:1:1:1 ratio along with 40 g hydrogel/5kg media) under alternate day irrigation (I_1)**.** In contrast, the lowest values were observed in M_5 (red earth alone) with five-day irrigation (I_3)**.** These findings may confirm that the synergistic use of rice husk biochar and hydrogel, combined with frequent irrigation, significantly enhances vegetative growth and root development by improving soil structure, nutrient retention, and water availability. Among all tested combinations, we can say that M_2I_1 proved optimal, ensuring maximum vegetative performance of Golden Pothos under vertical garden conditions.

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