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Growth and Yield of Indoor-Cultivated Mustard Microgreens against the Duration of LED Irradiation and Variations in Planting Media

Pertumbuhan dan Hasil Microgreens Sawi yang Dibudidayakan Indoor terhadap Lama Penyinaran LED dan Variasi Media Tanam

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ABSTRAK

Keterbatasan lahan pertanian saat ini mendorong kegiatan budidaya dilaksanakan dengan pemanfaatan ruang terbatas seperti budidaya indoor dengan memanfaatkan teknik penyinaran dan penggunaan media tanam yang bervariasi. Tujuan penelitian ini adalah untuk mengevaluasi pertumbuhan dan hasil *microgreens* sawi yang dibudidayakan secara indoor terhadap pengaturan lama penyinaran serta komposisi media tanam yang bervariasi. Penelitian ini menggunakan rancangan *split plot* dengan mengujikan perlakuan lama penyinaran LED 0, 10, dan 20 jam/hari, serta perlakuan variasi media tanam yaitu 100% tanah, 100% kompos, penambahan 50% kompos maupun *cocopeat*, serta kombinasi media tanam kompos dan *cocopeat* terhadap budidaya *microgreens* sawi yang dibudidayakan dalam kotak ruang tanam. Hasil penelitian menunjukkan bahwa lama penyinaran hanya berpengaruh terhadap tinggi tanaman pada periode tanam ke-1 dan 2, perlakuan komposisi media tanam memberikan pengaruh terhadap semua peubah yang diamati dalam dua periode tanam, sedangkan interaksi lama perlakuan berpengaruh sangat nyata terhadap tinggi tanaman periode tanam ke-1 dan panjang akar perode tanam ke-2. Perlakuan M3 (50% tanah + 50% kompos) pada L1 (lama penyinaran 10 jam/hari) memberikan peningkatan tinggi serta hasil berat segar tanaman tertinggi dalam dua periode tanam. Perlakuan M1 (Media 100% tanah) menghambat pertumbuhan *microgreens sawi*, sedangkan perlakuan L0 (penyinaran 0 jam/hari) pada semua perlakuan media tanam menunjukkan gejala etioliasi. Jadi, lama penyinaran 10 jam/hari dengan penambahan 50% kompos mampu memberikan hasil terbaik secara kualitas maupun kuantitas terhadap nilai pH, serta pertumbuhan dan hasil *microgreens* sawi.

Kata kunci: *Brassica juncea L., cocopeat*, kompos, *light emitting diode, microgreens*

ABSTRACT

The limitations of agricultural land currently encourage cultivation activities to be carried out with the use of limited space such as indoor cultivation by utilizing irradiation

techniques and the use of varied planting media. This study aimed to evaluate the growth and yield of indoor-cultivated mustard microgreens to the irradiation duration and the composition of varied planting media. This study used a split plot design with the treatment of LED irradiation duration of 0, 10, and 20 hours/day, and the variations of planting media, 100% soil, 100% compost, addition of 50% compost and cocopeat, and a combination of compost and cocopeat planting. The study results showed that the irradiation only affected the plant height in the both planting periods. The treatment of the composition of the planting media had significant effect on all variables observed in the two planting periods, while the interaction had a very significant effect on the plant height on 1st planting period and root length on 2nd planting period. The treatment of 50% soil + 50% compost on LED 10 hours/day had the highest yield of fresh weight in two planting periods. The use of 100% soil media inhibited the growth of mustard microgreens, while the irradiation of 0 hours/day in all planting media treatments showed the symptoms of etioliation. So, the treatment of 10 hours/day irradiation with the addition of 50% compost is able to provide the best results in quality and quantity against the pH value and the growth and yield of mustard microgreens.

Keywords: *Brassica juncea L.*, *cocopeat*, compost, *light emitting diode*, *microgreens*

INTRODUCTION

Vegetable indoor cultivation is one method to meet food needs amid the current limitations of agricultural land and anticipating in area of suboptimal land. It is caused by the conversion of agricultural land into non-agricultural land (Hardjoloekito et al., 2023). The main factors of agricultural land conversion are a decrease in agricultural land productivity, an increase in the economic needs of farmers, population, the construction of public facilities, and the government policies (Nainggolan, 2017). The low productivity of agriculture land found in suboptimal land and also caused by the land degradation (Sirappa & Titahena, 2015). The results of the regression test indicate that the decline in agricultural yields is strongly influenced by the agricultural area due to land conversion (Harini et al., 2018). Therefore, indoor cultivation is the alternative methods to still be able to meet the food needs, especially vegetables for the community.

One of the plant cultivation recommended to be conducted indoors is microgreens. The study results showed that some types of microgreens vegetables from the Brassicaceae family were rich in macro and micronutrients such as Ca, K, Fe, and Zn more than adult vegetables (Xiao et al., 2016). Not only high nutrient content, microgreens can also be grown simply in a small space by adapting indoor farming (Zhang et al., 2021) to produce fresh vegetable stock from home (Parida, 2020). The cultivation of microgreens indoors can be supported by the use of lamps as artificial light (Brazaityte et al., 2016). LED irradiation affects metabolic processes in plant growth (Monostori et al., 2018). The experiments related to the use of LEDs at 24 hours/day irradiation duration gave an increase in fresh weight, phytochemical content and antioxidants of microgreens which were higher than 16 hours/day LED irradiation (Shibaeva et al., 2022). Not only the duration of irradiation, but the growing media also greatly affects the yield and quality of microgreens (Di Gioia et al., 2017). The ideal planting medium for plant growth is to have good porosity, a good aerase and drainage system, the ability to retain water, and a neutral pH, and is able to provide nutrients for plant (Schafer & Lerner, 2022).

The potential for increased yield and nutrition of microgreens can be achieved through testing appropriate microgreens cultivation techniques, but the use of varied organic planting media compositions is still very rarely used in the cultivation of

microgreens. During that time, the cultivation of microgreens using rockwool tends to be more expensive and cannot be used repeatedly. Organic growing media has good chemical, biological, and physical characteristics in supporting plant growth, besides being relatively inexpensive and easy to find (Carlile et al., 2015), (Sardar et al., 2022). Research related to the combination of the two treatments of irradiation and the composition of planting media has not been widely carried out in the cultivation of microgreens. Therefore, this study aimed to evaluate the growth and yield of indoor-cultivated mustard microgreens against the setting of irradiation duration and the composition of varied planting media.

MATERIALS AND METHODS

The study was conducted from November 2020 to January 2021 in Ogan Ilir, South Sumatra using planting space boxes. The temperature in the planting room box during the study ranged from 25.8 to 29.7°C. The measurement of growth variables and mustard microgreens results was carried out at the Seed Technology Laboratory of the Department of Agricultural Cultivation, Faculty of Agriculture, Universitas Sriwijaya, while the measurement of the pH value of planting media was carried out at the Biology, Chemistry, and Soil Fertility Laboratory, Department of Soil Science, Faculty of Agriculture, Universitas Sriwjaya.

The study was done using box of planting room, so it was designed with a Split Plot Design with 3 replications, which the main plot was the duration of LED irradiation consisting of 3 levels, consisted of 0 hours/day (L0), 10 hours/day (L1), and 20 hours/day (L2). While the sub plot was planting media with 5 levels of treatment consisted of: M1 = 100% soil; M2= 100% compost; M3= 50% soil + 50% compost (v/v); M4= 50% soil + 50% cocopeat (v/v); M 5= 50% compost + 50% cocopeat (v/v).

Planting Preparation

Planting preparation was carried out by preparing planting media, namely compost, cocopeat, and topsoil taken in the arboretum then dried and sifted. The planting media was weighed according to a predetermined composition in the form of a percentage of volume per volume (v/v), then put into a planting container and labeled. Seeds were planted as many as 45 seeds/containers by sowing on planting media and then closed. Seeds that were already planted were left in a state of no lighting for 1 x 24 hours to stimulate seed germination (Thankappan et al., 2018). The planting was carried out as many as two planting periods using the same medium and planting method with an interval of two days after the first harvesting. It aimed to evaluate the effectiveness and efficiency the using of organic planting media for the optimal growth of microgreens

Setting Of LED Irradiation Duration

The duration setting of irradiation was carried out in the box of the planting room. Making planting room boxes used wood and plywood materials covered with aluminum foil with a box size of 40 cm x 40 cm x 30 cm, installed with LED grow light. The best lamp installation distance for plant growth was 20 cm from the surface of the planting media (Susilowati et al., 2015). The 0, 10, and 20 hours/day light irradiation length setting was switched on at the same time and turned off according to the settings of each treatment.

Evaluation of the Growth and Yield of Mustard Microgreens

Measurement of growth and yield variables of mustard microgreens during two planting periods was carried out at the Laboratory of Seed Technology, Department of Agricultural Cultivation, Faculty of Agriculture, Sriwijaya University. Measurements were made after the harvest, i.e. 9 DAP (days after planting) having the characteristics of cotyledon to be developed into a pair of leaves (Xiao et al.,

2016). The observed variables included the plant height (cm), root length (cm), and plant fresh weight (mg). the measurement of plant height and root length was performed by first cleaning the harvest using water and tissue, then placing microgreens on millimeter block paper to measure the height and length of each microgreens unit in each treatment. The fresh weight measurements were performed by weighing the entire microgreens section per treatment unit using analytical scales to make measurements more accurate (Saputro et al., 2018).

Analysis of pH Value

The pH value of the planting media was analyzed at the Laboratory of Biology, Chemistry, and Soil Fertility, Department of Soil Science, Faculty of Agriculture, Universitas Sriwjaya. The analysis of the pH media was carried out before planting, after harvesting the 1st and 2nd planting periods. It was performed by electrochemical method using eleotrids and millivoltmeters or pH meters (Park et al., 2019). The measured pH value was the actual acidity using H2O solution (Getaneh & Kidanemariam, 2021). Measurements were carried out by weighing a sample of the planting media as much as 10 g per treatment and then putting it in a film tube, then dissolving it in 10 mL H2O (Soil Survey Staff, 2022) and then homogenized for ± 30 minutes using an automatic shaker. The homogeneous planting media solution was then measured using a pH meter by inserting the electrodes (which have been calibrated in pH 4 and 7 buffer solutions) into the soil solution, then reading the numbers that appear on the pH meter. The results of the pH measurements were then categorized at very acid, acid, neutral, alkaline, to very alkaline levels (United States Department of Agriculture, 2020).

Data Analysis

The obtained data were analyzed using Analysis of Variance (ANOVA) with significance level 0f 0.05 in excel program, to find out the influence of treatment factors and the interaction between treatment factors on the observed variables. The significant influence treatment was continued with the Least Significance Different (LSD) test at the 5% test level to find out the difference between the treatment levels.

RESULTS AND DISCUSSION

Analysis of Variance

The results of the diversity analysis showed that the length of LED irradiation had a very significant influence effect on the height change of mustard microgreens plants in the two planting periods and had an insignificant influence on other changers (Table 1). The treatment of the composition of the planting media had a significant effect on the fresh weight of plants in the 1st planting period and had a very significant effect on the plant height variables and the pH value of the media in both planting periods, as well as on the root length and fresh weight of the plants in the 2nd planting period (Table 1). The interaction among the length of light treatment in all treatments of the planting media composition showed a very significant effect on plant height in the 1st planting period and root length in the 2nd planting period (Table 1).

The treatment of irradiation duration had an insignificant influence on almost all observed changes except the plant height because the plants in the form of microgreens were generally not very sensitive to light stimuli. The needs of plants for light were different so that the duration of light needed by plants to grow optimally was also different (Osnato et al., 2022). The duration of irradiation received by the plants varies depending on the growth phase, in which the seedling (young) phase of some plant organs have not worked optimally in the reception of light for the process of photosynthesis (Bielczynski et al., 2017). Some organs of plant growth in the young phase were not

very sensitive to light stimulaion, so the resulting reaction tends to be the same (Matsoukas et al., 2013).

Based on the tests that have been carried out, it was known that the composition of the growing media has an effect on the growth and yield of mustard microgreens that were cultivated indoors. Planting media was an important component of plant cultivation, a good planting media will directly affect the absorption of water and nutrients for the growth of theplants. The composition of the organic matter planting media significantly affected all production yield variables in terms of height, fresh weight, number of leaves, and plant root weight (Sardar et al., 2022).

Plant Height

The results of the LSD at the test 5% of interaction of both treatment showed that plant height in treatment of 0 hours (L0) was significantly different from 10 and 20 hours/day (L1 and L2) in all planting media compositions (Table 2). Irradiation treatment of 0 hour/day (L0), differences in the composition of the planting media was significantly different plant heights, except for planting media containing compost (M3) (v/v) and compositions of 50% compost + 50% cocopeat (M5) (v/v).

Table 1. F value for the treatment of irradiation, planting media composition, and the interaction of both treatments on the observed variables

Observed Variables	F Value		
	L	M	LxM
Plant height (cm)			
1st planting period	112.30**	47.16**	9.99**
2nd planting period	70.81**	47.41**	1.44ns
Root lenght (cm)			
1st planting period	3.74 ns	0.51ns	1.29 ns
2nd planting period	5.61 ns	19.42**	3.81**
Plant fresh weight (mg)			
1st planting period	2.63 ns	3.29*	0.86 ns
2nd planting period	4.16 ns	6.56**	0.62 ns
pH value			
1st planting period	0.31 ns	323.88**	0.17 ns
2nd planting period	0.09 ns	95.02**	1.22 ns

Note: * = significant effect; ** = very significant effect; ns = non significant effect; L= irradiation duration; M = planting media composition; LxM = interaction

Table 2. Plant height of mustard microgreens to the interaction of both treatment in 1st planting period

Planting Media Composition	Plant Height (cm)		
	Irradiation Duration (hours/day)		
	0	10	20
M1 (100% soil)	5,10w b	3.77w a	3.18w a
M2 (100% compost)	8.52z b	4.72x a	4.01y a
M3 (50% soil + 50% compost)	7.79y b	4.54x a	4.33y a
M4 (50% soil + 50% cocopeat)	5.89x b	4.04w a	3.57x a
M5 (50% compost + 50% cocopeat)	7.84y b	4.50x a	4.29y a

Note: Notations (a,b) in the same row mean that they were not significantly different in the LSD 5% with $LSD_{0.05(a,b)}$ = 0.80. Notations (w,x,y,z) in the same coloumn mean that they were not significantly different in the LSD 5% with $LSD_{0.05(w,x,y,z)}$ = 0.80

Then, at 10 and 20 hours/day of light irradiation (L1 & L2), the composition of the planting media containing compost (M2, M3 and M5) gave significantly different results from the treatment without compost (M1 & M4). Based on the results obtained, it was shown that for the 1st planting period, the composition of the planting media 100% compost (M2) produced the highest average of 8.52 cm which was significantly different from other planting media compositions at 0 hours/day of light exposure (L0), and 4.72 cm but not significantly different from other compost treatments at 10 hours/day of light exposure (L1), while the soil composition enriched with 50% compost (M3) (v/v) produced the highest average of 4.33 cm at 20 hours of lightening/day (L2) and not significantly different from other compost treatments (Table 2).

Based on the results in both planting periods, it was obtained that, mustard microgreens produce the highest plant height in conditions without lighting grown on loose compost media. The addition of organic matter in the form of compost and cocopeat was thought to have different influences on increasing the growth of mustard microgreens. The organic matter content help to stabilize the soil aggregate (Sarker et al., 2018). It caused the planting medium to become much crumble, loose, and have good porosity for the growth of plant, also the water absorption.

But these underexposed conditions cause mustard microgreens to be etiolated, easily lying down and turning yellow (wilting). Treatment of light duration of 0 hours/day or without light was able to produce microgreens plant height which was higher and significantly different compared to other light treatments. This happens because in the absence of light it could cause the auxin hormone to activate which stimulates the elongation of plant cells. (Ogunyale et al., 2014). The conditions for the growth of mustard microgreens that lack light cause etiolation so that the plants grow abnormally, the stems were long but easily overturned and the plants have a pale (yellow) color (Jedynak et al., 2022).

Root Lenght

The LSD test result at the test 5% of interaction treatment showed that the planting medium of 50% compost + 50% cocopeat (M5) (v/v) showed the highest average of 4.78 cm but was not significantly different from the treatment of enriched soil 50% compost (M3) (v/v) at 0 hours/day of light exposure (L0), while at 10 and 20 hours/day of light exposure (L1 and L2), M5 produced the highest average root length, respectively 5.58 cm and 5.53 cm, but not significantly different from the treatment of 100% compost (M2) at each treatment of 10 and 20 hours/day (Table 3). In general, almost all the long treatments of irradiation on each composition of the growing medium were insignificantly different from each other in the 2nd planting period (Table 3). The research by Monostori et al. (2018), LED irradiation affects metabolic processes in plant growth, also indirectly affected the growth of root length.

The addition of organic matter in the form of compost and cocopeat was thought to have different influences on increasing the growth of mustard microgreens. The giving of compost could improve some soil properties such as total pore space, capillary pores, and solidify soil aggregates to create the structure of the planting medium to become much crumble (Barus, 2016). Cocopeat has a high porosity, good water holding ability that it could maintain the moisture of the medium well (Taofik et al., 2019). This was in line with the obtained study results which the growth of mustard (Taofik et al., 2019) (Taofik et al., 2019)microgreens roots tended to be better in planting media containing organic matter, both compost and cocopeat, thus impacting the growth of other plant parts (Kuzucu, 2019). Plant Fresh Weight

The highest average fresh weight of plants in the 1st planting period was obtained from the treatment of 100%

compost (M2) planting medium of 50.73 mg and insignificantly different from the soil treatment enriched by 50% compost (M3) (v/v) nor the composition of 50% compost + 50% cocopeat (M5) (v /v) (Table 4). The highest average in the 2nd planting period was obtained in the treatment of soil enriched with 50% compost (M3) (v/v) of 88.9 g, but not significantly different from all treatments enriched with organic growing media either 50% compost or 50% cocopeat . Media 100% soil tends to give the lowest yield because the soil was easily compacted so that water absorption was disturbed and could inhibit plant growth (Table 4).

The given of organic media include compost and cocopeat tend to increase the water movement in planting media to meet the plant needs for growing, because it become more loose or crumble. It supported by Kuzucu (2019) said that the addition of organic planting media both compost and cocopeat gave the good result for the growth of root length of plant and affected the growth of other plant parts include plant height. The height and fresh weight of the plant correlate with each other, the higher the plant was, the more increase in fresh weight of the plant will be (Matsui et al., 2016).

The addition of organic matter could presumably improve water absorption for the growth of mustard microgreens. The highest increase in fresh weight of mustard microgreens plants by 49.95 mg was found in the irradiation duration of 10 hours/day (L1) with a planting media composition of 50% soil + 50% compost (M3) (v/) (Table 5). High fresh weight was one of the criteria for a good harvest in the growth of mustard microgreens. Overall, the irradiation duration of 0 hours/day in all planting media compositions produces the highest fresh weight of mustard microgreens plants during the two planting periods, Yet, the mustard microgreens produced at 0 hours/day irradiation duration had a less good physical appearance of microgreens than in 10 or 20 hours/day irradiation duration. Plants undergo etiolation symptoms, namely yellowing leaves, small stems, and tend to look wilted and easily laid down due to lack of light (Jedynak et al., 2022). As a result, the planting mustard microgreens should be considered for cultivation by irradiating 10 or 20 hours/day using lamps on compost-enriched media.

Based on considerations in terms of quality and quantity of mustard microgreens that was produced in this study, it was obtained that the fresh weight produced by the growing media 50% soil + 50% compost between planting periods was quite large compared to the use of other compost growing media compositions both at 10 and 20 hours/day light duration. Basically, the light duration of 10 and 20 hours/day was equally good in helping to increase the fresh weight of mustard microgreens, but with a light duration of 10 hours/day it was good enough to increase the yield of fresh weight of mustard microgreens, and it could save electricity use compared to the duration longer light duration. The benefits of technology in cultivation were that in addition to increasing crop production, it was also expected to reduce production costs to obtain profits and feasibility in the cultivation business being carried out (Díez, 2017).

pH Value

The results of the 5% BNT test showed that the pH value of the planting media enriched with 50% compost increased the highest from pH 3.58 to 5.67, while the addition of 50% cocopeat could increase the soil pH value from 3.58 to 3.87 (Table 6). Based on the results of the LSD test 5% the effect of the composition treatment of the growing media on the pH value of the growing media in the 1st and 2nd planting periods (Table 6), it was obtained that in both planting periods, the 100% compost (M2) treatment gave the highest average pH value and was significantly different from all other planting media composition

treatments. Table 6 also shows an increase in pH values after the 1st planting period. Broadly speaking, differences in the composition and type of planting media used will produce various pH values as well.

Table 3. Root length of mustard microgreens to the interaction of both treatment in 2nd planting period

Planting Media Composition	Root Lenght (cm)		
	Irradiation Duration (hours/day)		
	0	10	20
M1 (100% soil)	3.22wx a	2.66w a	2.52w a
M2 (100% compost)	3.14w a	5.21yz b	5.39x b
M3 (50% soil + 50% compost)	3.68xy b	3.35wx b	2.18w a
M4 (50% soil + 50% cocopeat)	2.22w a	4.25xy b	3.31w ab
M5 (50% compost + 50% cocopeat)	4.78y a	5.58z a	5.53x a

Note: Notations (a,b) in the same row mean that they were not significantly different in the 5% LSD test with $LSD_{0.05(a,b)} = 1.24$. Notation (w,x,y,z) in the same coloumn mean that they were not significantly different in the LSD 5% with $LSD_{0.05\ (w,x,y,z)} = 1.11$

Table 4. Plant fresh weight (mg) of mustard microgreens in 1st and 2nd planting period to the treatment of planting media composition

Planting Media Composition	Plant Fresh Weight (mg)	
	1st Planting Period	2nd Planting Period
M1 (100% soil)	25.49a	42.23a
M2 (100% compost)	50.73c	88.7b
M3 (50% soil + 50% compost)	39.1bc	88.9b
M4 (50% soil + 50% cocopeat)	33.9ab	77.6b
M5 (50% compost+ 50% cocopeat)	40.50c	76.9b
$BNT_{0.05}$	11.53	16.89

Note: Numbers followed by the same notation in the same column were not significantly different on the $BNT_{0.05}$ test

Table 5. Increase in plant fresh weight (mg) to plant fresh weight in soil media

Planting Media Composition	Increase in Plant Fresh Weight (mg)	
	Irradiation Duration (hours/day)	
	10	20
M2 (100% compost)	49.58	30.83
M3 (50% soil + 50% compost)	49.95	38.63
M4 (50% soil + 50% cocopeat)	49.24	28.84
M5 (50% compost+ 50% cocopeat)	32.75	16.28

Table 6. pH value in 1st and 2nd planting period to the treatment of planting media composition

Planting Media Composition	Intial pH	pH Value of Planting Media	
		1st Planting Period	2nd Planting Period
M1 (100% soil)	3.58	4.31_a	4.54_a
M2 (100% compost)	6.84	7.17_e	7.04_d
M3 (50% soil + 50% compost)	5.67	5.74_c	6.33_b
M4 (50% soil + 50% cocopeat)	3.87	4.49_b	4.75_a
M5 (50% compost+ 50% cocopeat)	5.09	6.82_d	6.60_c
$BNT_{0.05}$		0.16	0.26

Note: Numbers followed by the same notation in the same column were not significantly different on the $BNT_{0.05}$ test

Differences in the composition and types of organic matter that was added were thought to give varied results which have an effect on the pH value of the media as well as the growth and yield of mustard microgreens. The composition of existing organic matter could improve the physical properties of the media such as increasing the capacity of water absorption and air exchange, improving the biological and chemical properties of the planting media including increasing nutrient levels, microorganism activity, and the pH value of the media (Carlile et al., 2015).

Based on the observations, the addition of compost tends to produce a higher pH increase than the other treatments. Compost was known to have a neutral-to-alkaline pH (Kim et al., 2018), while cocopeat has a pH that tends to be neutral (Jusoh et al., 2021). The increase in pH value between planting periods was thought to be due to further decomposition of organic matter from the growing media or from harvesting residue during the 1st planting period during the planting process.

Organic matter added to the soil will undergo a further decomposition process and then release of alkaline cations which causes an increase in the concentration of OH- ions so that the pH value of the media increases (Msimbira & Smith, 2020). Measurement of the pH value of the media after the 2nd planting period, several treatments of the growing media have decreased the pH value. This was because the decomposition process of the two planting periods, in addition to producing OH ions, also results in the accumulation of organic acids, where the accumulation of excess organic acids could increase H+ ions which causes a decrease in pH. (Johan et al., 2021).

CONCLUSION

In conclusion, the duration setting of irradiation provides an increase in the height of mustard microgreens plants, while the use of organic planting media compositions (consisting of soil, compost, and cocopeat) can increase the pH value, growth and yield of mustard microgreens cultivated indoors. The irradiation of lamp for 10 hours/day with a planting media composition of 50% soil + 50% compost gives the best results, particularly the fresh weight of mustard microgreens plants. The microgreens can grow optimally on organic growing media that is used repeatedly in several planting periods.

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