Utilization of Date Palm Waste Compost as Substitute For Peat Moss

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Utilization of Date Palm Waste Compost as Substitute For Peat Moss

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Abstract. This investigation was conducted to evaluate the utilization of compost production using finely grinded date palm wastes and residues (particle size 0.5 cm), to examine its performance a substitute of potting media in comparison with commercial peat moss. Factors influence the rate of composting efficiency such as moisture content; aeration and temperature were treatments (culture substrates) with four replications were arranged in a completely randomized design. The treatments were commercial peat moss used as control; un-composted date palm residues (DP-0); composted date palm residues for 15 weeks (DP-15) and composted date palm residues for 30 weeks (DP-30). The physicochemical properties of substrates were measured before plant cultivation. During the duration of plant growth irrigation rate, temperature, humidity and pest control for all treatments were similar. Some growth and fruit quality parameters for strawberry plants were measured at the end of growth period. The results revealed that bulk density (BD), cation exchange capacity (CEC) and essential mineral nutrients (N, P and K) were increased, while organic matter (OM), organic carbon (Oc) and C/N ratio were decreased gradually by the end of composting time. DP-30 showed the most appropriate physicochemical properties compared with the other treatments, including peat moss. This could be attributed to improve the physicochemical properties of this substrate due to satisfactory enhanced compost maturity which would have been achieved by the end of 30 weeks' incubation time, since the source, particle size (0.5cm) and composting process were the same for all date palm substrates. Therefore, the average rate of increase in plant growth characteristics and the improvement of fruit quality parameters were differed significantly depending on composting duration and connected to preference of suitable physicochemical properties enhanced in DP-30. The general trend observed in this investigation strongly suggestes the importance of potential benefits of the economically appropriate uses of the composted date palm materials (DP-30) for full substitution for peat moss in horticulture.

1. Introduction

Soil in Iraq is progressively degraded due to soil organic matter depletion, desertification, intensive use of chemical fertilizer, salinization, water scarcity, accelerated soil erosion and nutrient imbalances are major problems generated as a result of mismanagement, diverse agricultural practice and war conflicts threatening the economic livelihood of the population in Iraq. These problems in soil cause to expand soilless culture that attracts scientific interest and exploitation local materials for use as growing media with specific physicochemical properties [1]. Soil organic matter is one of the most important constituents of soil due to its direct and indirect effects on plant growth (Bot and Beni ties, 2005) which created a suitable environment for root growth of plants and soil microbes [2].

The proper application of organic matter is a critical issue in sustainable management of arid and semiarid areas. Such organic matter contribute to plant growth through their effect on the physical, chemical and biological properties of the soil [3], maintaining soil structure [4], enhancing water-holding capacity, providing metabolic energy and supplying the nutrients to plants [5].Several investigators demonstrated that the organic residues, including animal manures, sewage sludge and plant wastes, after proper composting, could be used with very desirable results as growth media [6] with favorable effecting on plant growth [7];[8];[9] as increased substrates porosity and water holding capacity [10].

Characteristics of substrates include holding water, nutrients, providing good aeration to root system, light weight, free pathogenic organism, low cost and availability [11]. Peat moss has been the most widely used in the potting media [12] as a stable material, light weight and readily available. It is considered a premier substrate, due to its desirable physicochemical characteristics such as slow degradation rate, high water holding capacity, low bulk density and high nutrient exchange capacity [13]; [14]. Many studies were carried out for search of new peat substrates because of high price, especially in countries without peat moss resources and environmental constraints [15]. There have been widely used alternatives to peat moss as horticultural media include, animal manure [16], food waste, saw dust [17], rice straw, sugar cane trash [18], municipal solid waste [19], crumb rubber [20] and date palm wastes [21]. Date palm (Phoenix dactylifera L.) belong to Arcaceae family is a monocotyledon plant within palm tree family [22], one of the oldest tropical and sub tropically trees. It has been cultivated since ancient times where it originated in North Africa and the Middle east [23] to water scarcity, negligence, salinity and [24]. Nearly 15 million date palm trees were completely destroyed leaving behind millions of discarded crownless trunk trees, huge accumulated wastes and annual seasonal trimming of the palm trees. An imported feature of sustainable agriculture is its lower dependence on chemical fertilizers and recycling of on farm residues to maintain and /or improve solleruny. The application of agro-waste materials, especially after proper composting, as organic rowing, culture is an alternative trail to alleviate the negative impact of its accumulation and/or avoid the environmental pollution. [25] concluded that recycling agriculture wastes is a must for environment as well as economical saving, and this will increase agricultural production and improve its quality. [26] suggested that various biomass and residues produced by the palms and Shea tree industry can be fully harnessed for organic fertilizer production in order to increase crop production.

The enormous amount of date palm wastes thrown into the environment, in Iraq, besides the discarded dates being generated by the date palm agro-industry, data processing industries and spoiled wastes pose serious environmental problems. Also, hold immense potential as raw materials for bioprocessing towards hamessing the wastes of date palm efficiently. Unfortunately, there is no appropriate management and optimization procedure for the adequate usage of these agricultural waste materials. The date palm residues as agricultural wastes are rarely utilized in Iraq. The increase in demand for suitable organic substrate has focused research om the search for local available affordable (low cost) with sufficient physicochemical properties. These date palm wastes consist of cellulose, hemicellulose, lignin and other compounds which would be utilized in many biological processes. The utilization of these wastes in the production of compost is very important from the environmental, agricultural and industrial point of view. Thus, there is an urgent need to find suitable and beneficial application for this waste. The aim of this investigation is to evaluate the utilization importance of date palm waste compost in comparison with the commercial imported peat moss.

2. Materials and Methods

The first paragraph after a heading is not indented (Bodytext style) The present investigation was carried out at AL-Anbar region in Iraq in 2021 to study the bioconversion of date palm wastes and residues into valuable products (compost). Experimental treatments consisted of four growing soilless media (substrates). A commercial Peat moss was used as control (commercial horticultural media, 20-80 mesh size sphagnum, sunshine, Canada). Finely grinded date palm wastes with particle size < 0.5cm (non-composted date palm: DP-0); date palm wastes composted forl5 weeks (DP-15) and date palm wastes composted for 30 weeks (DP-30). Composting process was adapted by the method described by [27] At first, different parts of date palm wastes (Trunk, leaflets, midrib and fond) were collected randomly from 10 different widely separated locations. Thus, the palm wastes were then cleaned, chopped, crushed, and grinded into fine particles using a horizontal grinder. These finely grinded materials were mixed thoroughly, sieved and separated to obtain a mesh particle Size < 0.5 cm by sieve (Electromagnetic and Digital sieve shaker. TZBA200N, BWB Technologies Ltd Berks, UK). The sieved palm waste was mixed thoroughly and equally into three portions. One portion was kept in cold place and prepared as un-comipo iposted date palm (DP-0), treatment (2). For achieving composting process, the other two poruo ions of the sieved palm waste were kept separately inl.5 m' plastic bags for controlling temperature. The moisture content of the mixed waste materials was adjusted to 65% at the start of the experiment. As a fermentation starter, some amounts of animal fertilizer (200 gram sheep manure), mineral N (450 gram urea fertilizer) and P (200 gram superphosphate) were added to the waste and the bags were placed in hot condition (30 c). Several air holes were made on the bags for respiration, and the moisture was adjusted to 65%. Every week, the materials (waste) in the plastic bags were taken out, mixed thoroughly and put into the bags again; this was repeated regularly for 15 weeks and prepared as (DP-15), treatment (3), and also repeated regularly for 30 weeks and prepared as (DP- 30) treatment (4). Some parameters were monitored during composting such as, temperature, odor, color and moisture content.

Strawberry (Fragaria x ananassa cv. Mark) plants were grown in unheated greenhouse under natural light during spring. Plant roots were put in fungicides (Mancozeb and Captan) before planting. Plants were planted in 10 L pots filled with different substrates. The experiment was carried out using a completely randomized design in a greenhouse with four treatments and four replications. One plant was grown per pot (replicate). Average day/night temperatures were 28/18 c', respectively. Relative humidity was 37%-60% during the growth period. During plant growth, plant pots were fertigated with papadopolus nutrient solution formula [28]. PH was adjusted until 5.5 - 6.0. Irrigation was done by hand. During plant growth, irrigation rate, temperature, humidity, pest control for all treatments were similar. The main physicochemical characteristics of the culture media were measured before plant cultivation, including bulk density (Bd), total porosity and water holding capacity (WHC) were measured [29] cation exchange capacity CEC was measured [30]; electrical conductivity (EC) and PH [31]. Organic matter (OM) and Organic carbon (OC) were estimated as mentioned by several investigators [32]. Nitrogen of culture media was determined using the kjeldhal method [33]. After a hydrochloric digestion of the sample ash, nutrients analysis for K (Photometric; JENWAY, PEP-7 Jenway, Dunmow, UK), P (Spector photometric; pyeunicam Hitachi U-1100 Tokyo, Japan). Some important growth indices were determined at the end of growth period including, number of runner, petiole length, leaf number, leaf area, crown number, crown diameter, root dry weight, shoot dry weight, plant dry weight, root/shoot ratio, number of flowers, number of fruits, fruit fresh weight, fruit length, fruit width, fruit volume, yield and marketable fruit. Data was analyzed by software SAS. The range test was used to find significant differences in the means.

3. Results and Discussion

Comparison of some physicochemical properties of peat moss and date p palm substrates are shown in table 1.

Table 1. Physicobemical properties of different substrates before planting

Substrak	BD Gcm^{-3}	Porosity%	WHC%	pH	$ECds.m^{-1}$	CEC $Cmolkg^{-1}$	C/N %	N %	P %	K %%	OC %	OM %
peatmass	0.186 a	71.22 a	87.76a	5.0 a	0.97 a	105.22 a	52.87 a	0.78 a	0.05	0.020a	42.23a	67.76 a
Dp-0	0.157b	87.52b	73.22b	7.80b	2.10b	88.32b	58.50b	0.80a	0.20b	0.455b	53.82b	89.10b
DP-15	0.188a	80.12b	85.12a	7.52b	3.060c	98.61a	25.82c	1.17b	0.31b	0.673b	34.76c	52.41c
DP-30	0.284c	73.18a	88.10a	7.43b	3.57c	129.63c	19.42d	1.42c	0.49c	0.847c	30.79c	44.37d

BD: BulkDensity , WRC : Water Holding Capacity EC Electrical Conductivity , CEC Cation Exchange Caspacity , C/N : Carbon to Nitrogen ration OC Organic Carbon . OM: Organic matter. Menans followed by some letter are not significantly different according to Duncans muttible Range Test P<0.05

As shown in (table 1) the lowest (0.157 gm) and the highest (0.248 gm) bulk density (Bd) related to DP- 0 and DP-30, respectively. No significant differences were found between bulk densities in peat moss (0.186 gm) and DP-15(1.88 gm. The highest value of total porosity related to DP-0 and DP-15 (87.52% and 83-78%, respectively) compared to those of peat moss (71.22%) and DP- 30 (73.12%). [34] claimed that the bulk density values between 0.1 and 0.3 g.cm-3 were acceptable. It appears that the increase in composting time, from 0 to 15 weeks and 30 weeks, increased the average values of bulk density and reduced total porosity. It is generally agreed that porosity percentage considered an index for root media aeration. Also, total porosity of the media is important and root container media should contain 50% to 85% pore space. It was reported that the increase in composting of wastes caused a compression of the mass, decreased the porosity and increased the bulk density [35];[36] claimed that porosity affects the balance between water and air content for each moisture level. It is generally agreed that increasing bulk density values leads to decrease in total porosity and increased water retention capacity [37]; [38]. The increase in bulk density and the decrease in porosity reported in this work (table 1) agree with other investigations [39]; [40]; [41] found gradual reduction in total porosity percentage and it was much lower after 270 days (75%) compared to zero day (91.75%).
The water holding capacity (WHC) is characterized as absorbed and detained water. The water holding capacity value was lowest in DP-0 (76.22%) compared to that of peat moss (87.76%). The average values of WHC appeared to increase gradually with increasing composting time for 5 weeks (85.12%) and 30 weeks (88.10%) and became significantly higher than that of peat moss. It seems that the higher value of total porosity in the (DP-0) mirrored the decrease in WHC value in this substrate. Some investigators [42] found that WHC of coco peat was higher than that of uncomposted date palm peat, but total porosity was much higher in the date palm peat than that in coco peat. The results of [43] showed that WHC in peat moss was higher than un-composted date palm peat. [44] found that composting date palm peat for 3 months raised from 78.25% to 83.5% compared to un-composted date palm peat.

The lowest and the highest values of PH were recorded in peat moss and DP-30 (5.0 and 7.43, respectively). Hernando et al. (23) reported that compost products usually have a near to neutral or slightly alkaline PH with high buffering capacity. The PH values of the date palm compost at initial time before composting were slightly alkaline (PH7.8). During composting process, PH values decreased gradually possibly due to the formation of organic acids. Then, the PH tended to stabilize due to humus formation of composting activity [45]; [46]; [47]. The lowest value of EC was recorded with peat moss (0.97dsm) compared with the date palm substrates. The values of EC appeared to increase in the date palm substrates with increasing composting time (2. 10 dsm', 3.06 dsm and 3.57 dsm", respectively). The increment in EC values occurred in DP-30 may be due to loss of biomass through the biotransformation of organic materials and also, to release of some content as mineral elements [48]; [49]. [50] proposed that EC value of 4.0 dsm' is a level considered tolerable by plants. The EC values measured in DP-30 was 3.57dsm. On the other hand, the values of CEC were higher in peat moss (105.22 Cmol kg') than those of DP-0 and DP-15 (88.32 Cmol kg' and 98.61Cmol kg, respectively), but lower than that of DP-30 (129.63 Cmol kg'). It must be noted that most of the amounts of EC and CEC were related to DP-15 and DP-30. In this context the increased values of CEC throughout the composting process was reported by [51] due to changing of organic matters and transforming into humus, whenever humification was more increased, the CEC went higher and compost quality was improved. It may be suggested that the more surface area in the smaller particles of the date palm wastes (< 0.5 cm) may have caused more decomposition of organic matter and more production of organic acids. This would have caused decreased in the weight of the composted date palm waste and consequently increased the concentration of mineral elements and raised EC. In addition, the increase in the composting time could have increased microbial activity and the release of more solutes which had eventually raised the EC in the media. The initial value of CN ratio in the composted raw date-palm material dropped gradually with the increase in the composting time (58.50%, and 19.24%, for Dp-0, Dp-15 and DP-30, respectively). The data reflects a negative correlation existed between CN ratios and composting time of date palm substrate from 0, 15 and 30 weeks (58.50, 25.82 and19.0, respectively). The CN ratio is considered reliable parameter for following the development of the composting process [52]; [53]. Some investigators reported that raw materials blended to provide a CN ratio of 25:1 to 30:1 are ideal for active composting [54]; [55]. The decrease in CN ratio can be taken as reliable index of compost maturity when combined with other factors as panted out by [56] . During decomposition carbon losses mainly as CO2, the carbon content of the compostable materials decreased with time and N content per unit material increased, which resulted in the decrease of CN ratio. [57] reported that the loss in carbon as CO2 during the composting process is more than the loss in N. Data in table (1) shows that, generally, higher concentrations of N, P and K were found in the date palm residues than in peat moss, irrespective of composting duration. Also, the concentrations of N, P and K seem to low gradually with increasing composting time. It agreed that peat moss is Ponents (N, P and K), thus it requires frequent or regular use of fertilizer if used as substrate. Thus, the highest concentrations of N, P and K were found in DP-30. Date palm residues is an Organic material during composting process the mineralization of organic matter occur and change the organic forms of N and P to mineral forms. The available K in organic substrate related to chemical characteristics of this media, is very high [58]. The quantity and form of N present in compost shape the quality of the material for its agronomic use [59]; [60]. Nitrogen is necessary for proper growth and yield of strawberry [61]; [62]. Potassium may improve the fruit quality and the increased phosphorus content increased yield, berry size and weight of strawberry. The concentration of N was increased gradually during composting process 0, 15 and 30 weeks (0.92% to 1.35% and 1.60%), respectively, and reached a value at the end of composting process (DP-30) almost twice that recorded for peat moss (table, 1). The concentrations of P and K followed the same order of that of N. The increase in the concentrations of N, P and K during composting process could be due to the net loss of dry mass as loss of organic C as C02. Also, total N can be increased by the activities of associative N fixing bacteria at the end of composting process [63]. These results are in agreement with those reported by Abdel [64]; [65]; [66]. The increase in total nitrogen may be due to the higher oxidation of non- nitrogenous organic materials and partially to the N2- fixation by non- symbiotic nitrogen fixers as indexed by the increase in organic nitrogen. [67] stated that as carbon is lost from the compost pile, the compost becomes more condensed and air spaces within the pile become smaller, therefor weight of the initial matter is decreased and it increases mineral elements concentrations. [68] explained the diverse mineral composition of heart of data palm tree to absorb minerals from the soil and accumulate these minerals in its tissues like other plant species such as mushroom which agreed with the finding of [69]; [70]. Results in table (1), clearly indicate that composting date palm wastes (Particle size < 0.5 cm) for 30 weeks (DPP-30) had significantly increased the concentrations of N, P and K compared with those of peat moss. This would be a potentially benefit for horticultural media preparation. Significantly higher percentages of OC (53.82%) and OM (89.10%) were recorded in DP-0 compared with other substrates.

The percentages of OC and OM found in peat moss (42.23% and 67.76%, respectively) were higher than those found in DP-15 (34.86% and 52.41%, respectively) and also higher than those found in DP-30 (30.79% and 44.37%, respectively). Both, the percentages of OC and OM were reduced significantly with increased the duration of composting process which may indicate the turnover of compost to maturity. The loss in the content of OM during the decomposition duration may indicate that the rate of decomposition was high in the date palm composting treatments, especially after 30 weeks (DP-30). This could be attributed to the content of these treatments, especially C/N ratio (19.24), which may be suitable for microbial population and the enzymatic activities. The organic matter degradation was revealed by the organic loss, which is directly related to microbial respiration as mentioned by [71]. Growth components of strawberry plants differed substantially between peat moss and date palm substrates and among date palm substrates.

Table 2. Effect of peat moss and date palm substrates on growth parameters of straw berry plant

substres	Runners number	Petiol length (cm)	l.eaf number Leaf plant $^{-1}$	Leaf area (cm)	Crowns number	Crown dlameter (cm)	Root dry weight (gm)	Shoot dry weight (gm)	Plant dry weight (gm)
peatmass	3.5a	13.70a	33.14a	613.21a	3.54a	2.54a	9.42a	29.84a	39.34a
Dp-0	2.3b	10.60b	26.55b	442.14b	2.12b	1.73b	7.25b	21.14b	28.39b
DP-15	2.7b	11.14b	31.42a	604.21a	3.20a	2.1b	8.61a	25.27c	33.88c
DP-30	3.7a	13.84a	37.86c	793.62c	5.86c	2.73a	11.67c	32.91a	44.58a

Means followed by letter are not significantly different according to (Duncan's Multiple Range test, P<0.05).

As shown in (table 2) Strawberry plants grown in non-composted date palm substrate (DP-0) showed the lowest average values in number of runner, petiole length, leaf number, leaf area, crown number, root dry weight, shoot dry weight and plant dry weight compared with those of respective plants grown in other substrates. Comparing growth indices of plants grown in DP-15 and peat moss (table 2) showed that leaf number, leaf area, root dry weight remained insignificantly different, but number of runner, petiole length, crown number, shoot dry weight and plant weight were significantly lower in plants grown in DP-15 than those of respective plants grown in peat moss. On the other hand, the means of leaf number, leaf area, root dry weight, shoot dry weight and plant dry weight were significantly higher in plants grown in DP-15 compared with those of respective plants grown in uncomposted date palm substrate (DP-0), while the number of runner, petiole length, crown number and root: shoot ratio showed insignificant differences. However, plants grown in DP-30 showed significant increase in the means of leaf number, leaf area, root dry weight, shoot dry weight and plant dry weight compared with those of respective plants grown in peat moss. The number of runner, petiole length and crown number remained insignificantly different between plants grown in DP-30 and those grown in peat moss. There was substantial variability among date palm substrates in this work, the lowest and the highest means of growth indices occurred in plants grown in DP-0 and DP-3, respectively. The means of growth indices of plants grown in DP-15 were intermediate between those of plants grown in DP-0 and DP-30. These results clearly demonstrate that composted date palm materials improved the growth indices in strawberry plants more than that of non-composted date palm substrate. It also reveals that increasing the composting time for 30 weeks increased the means of growth indices more than those of DP-0, DP-15 and peat moss. The performance of plants grown in DP-30 is markedly influenced by the extended period of composting time compared with DP-15 and consequently led to improvement in the physicochemical properties such as Bd, porosity, WHC and CEC of raw material of date palm (DP-0). Fruit quality parameters are shown in Table 3, the lowest average mean of number of flowers, number of fruits, fruit fresh weight, fruit width, yield and marketable fruit were produced on plants grown in DP-0 compared with those on respective plants grown in peat moss and DP-30. However, fruit fresh weight and fruit width remained insignificantly different between DP-15 and DP-0. Also, fruit length and fruit volume showed insignificant differences among treatments. Plants grown in Dp-30 produced the highest number of flowers, number of fruits, yield and marketable fruit compared with other treatments including, peat moss. Mean fruit fresh weight and fruit width produced by plants grown in Dp-30 (15.59 g fruit and 3.0 cm, respectively) were similar to those produced on respective plants grown in peat moss (14.61 g fruit and 3.0 cm, respectively), but significantly higher than those of plants grown in Dp-0 (1.28 g fruit and 2.6 cm) and Dp-15 (11.60 g fruit and 2.6 cm) respectively.

Table 3. Effect of peat moss and date palm substrates on fruit parameters and yield of strawberry plant

Treatment	Number of Flowers Flower *plant $^{-1}$	Number of Fruits Fruit plant $^{-1}$	Fruit Fresh Weight Gm Fruit ^{1}	Fruit length Cm Fruit ^{1}	Fruit Width Cm Fruit ^{1}	Fruit Volume Cm ^{3} Fruit ^{1}	Yield Cm plant ^{1}	Marketable Fruit Cm plant $^{-1}$

Peatmass	40.12a	23.65a	14.61a	3.3a	3.a	11.25a	345.52a	160.54a
Dp-0	34.20b	18.32b	11.60b	3.4a	2.6b	12.10a	212.5b	80.75b
DP-15	40.0a	22.40a	12.28b	3.3a	2.6b	11.75a	275.0c	126.52c
DP-30	44.36v	27.13c	15.59a	3.5a	3.0a	11.75a	422.95d	194.88d

DP-Uncomposted date palm peat: Dp -15-Date palm perat composted for 15 weeksDP-30-date palm peat composted for 30 weeks.

As shown in (table 3) the effects on some fruit qualities seem to follow a specific pattern in which better fruit quality related to plants grown in Dp-30, and those of plants grown in peat moss were second in the lowest values of fruit qualities. The observed increase in yield per plants grown in Dp-30 may be resulted as net increase in number of flowers, number of fruits, fruit fresh weight and fruit width. [72] claimed that the number of strawberry flowers and fruits are related to number and diameter of crowns which can be used to predicted plants yield potential. Inflorescence appears from apical meristem that is originated from the crown. [48] suggested that increase in crown branches may be origin of flower. The number and diameter of crown recorded in this work were higher on plants grown in Dp-30 which seem to be in line with the higher values of number of flowers and number of fruits (table 3). In the present study, fruit quality parameters seem to be equal or better in plants grown in Dp-30 than those grown in the peat moss. There is mounting evidence that substrates had a significant effect on the plant growth, composition of leaf, total yield and fruit quality [25]; [28]; [44]; [41]; [40]; [63]; [33]. The role of date palm straw as soil conditioner has been suggested by many workers [30]; [29]; [10]; [18]; [20]. [12] reported that the quality of strawberry and desirable fruit production greatly depend on suitable choice substrate and cultivars. [18] showed that growth and yield of cucumbers plant were significantly higher in date palm substrate than soil, but generally had no significantly differences as compared with perlite substrate. [49] stated that selection of ideal substrate from various materials is imperative for productivity of each crop. And the results of [50] illustrated that composting time of 6 months' size 0.5-1.0 cm can be considered as a proper treatment for palm waste in soilless culture. The overall results recorded in this investigation showed reliable parameters for the development of the composting process occurred in DP-30 treatment which can be taken as evidence of the degradation of the organic date palm materials and the maturity of compost. Biodegradability of lignocellulosic materials was enhanced by pretreatment included physical grinding and milling Thus, the smaller particle size of the date palm materials (0.5 cm), adapted for this work, provided more surface area which might be most effective at increasing enzymatic hydrolysis [45]; [33]; [55]. The gradual reduction in the 0C and OM and the narrowing C/N ratio [14] with the increase in the value of CEC [32] may reflect the fermentation process and chemical changes in the composted materials [22] and indicate that the rate of decomposition was high in DP-30 treatment. Also, the fine particles close to each other could have hold more water (increase in WHC) and nutrient elements suitable to crop growth [11]; [69]; [40]. The percentage of essential elements (N%, P% and K%) measured in the DP-30 were much higher than those found in peat moss. Biodegradability aflonoclliodc material was enhanced by retreatment.

4. Conclusion

Little attention has been given to utilization of date palm wastes. The results of this investigation clearly demonstrate that proper composting of finely grinded date palm materials (particle size < 0.5 cm) for duration time of 30 weeks (DP-30) with adjusted stable composting conditions (aeration, moisture content and temperature) achieved best suitable physicochemical properties, specifically increased bulk density (Bd), water holding capacity (WHC), cation exchange capacity (CEC) and essential mineral nutrients (N, P and K) content, and decreased organic matter(OM), organic carbon (0C) and CN ratio. This date palm substrate (DP-30) presented sufficiently valuable physicochemical properties better than other treatments, including peat moss. This end compost media may be taken as an indicative of an acceptable progressed maturity which was appropriate to maintain significantly higher production of number of leaves, leaf surface area and biomass. It also created significant differences on qualitative and quantitative indices in strawberry fruit (number of fruits, yield and marketable fruits) equivalent or superior to that in peat moss. The present findings highlight the importance evaluation of the proper compost potential benefit produced from date palm materials and its ability to improve physicochemical properties as substrate medium which can be used with a great promise as substitute for imported commercial peat moss. It is recommended that further research study should be extended on a large scale for the complete exploitation to a wide range of plant species. In the meantime, the utilization of date palm compost on organic farms appears to be a most viable way to help solve the current problem of waste accumulation.

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