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(Original Article)

Can Compost Be an Alternative to Germination Media for Growing Lettuce Seedlings in Nurseries?

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Abstract

Four types of plant compost, peanut shells (PS), palm waste (PW), sorghum waste (SW), and banana waste (BW) were examined as growing media after mixing each of them with cork (C), perlite (P), or sand (S) in a ratio of 2:1 (V:V), compared to the control mixture (peatmoss: perlite) of the same ratio. All three mixtures of PS and the mixture of PW+P competed well with the control in all studied growth parameters due to their optimum characterization. Mixing the tested composts with P always gave the best results. After 14 days of seeding, the highest germination percentages of lettuce seeds were in control (98.34%), PW+P (98.16%), PS+C (97.83%), and PS+P (96.36%), whereas the lowest was in BW+S (2.77%). Banana waste compost mixtures showed a clear delay of 8 days in germination due to their high EC (9.54 dS/m) and high pH values (8.58). The highest significant value of shoot fresh weight was achieved in all PS compost mixtures in addition to PW+P. Total cost and net profit were calculated in peatmoss and perlite without including banana waste compost in the comparison. The highest net profit was obtained with PS compost mixes (PS+C, PS+P, and PS+S) with a net profit of \$2.6, \$2.4, and \$2.1, respectively, followed by palm waste compost mixes (PW+C, PW+P, and PW+S) with a net profit of \$2.06, \$2.04, and \$2.1, respectively. The physicochemical characteristics of the peanut shell and palm waste compost mixtures suggests it could be an economical germination media replacement for peatmoss.

Keywords: *Compost Palm waste, Compost Peanut shell, Compost Sorghum waste, Compost Banana waste, Inorganic Germination media cork perlite and sand.*

Introduction

Growth media or growth substrate refers to any material, natural or artificial, organic or inert, in pure or mixed form, with the primary purpose of acting as a medium for growth and development of plants by giving the root system anchoring, support, water, and oxygen (Rojas *et al.* 2007).

Ideal growing media for plant germination should have a pH of 5.0-6.5, electrical conductivity (EC) less than 500 (µS/cm), bulk density of 400 kg/m^3, cation exchange

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capacity (CEC) of 200 (mmol/100 g), P content of 5-50 mg/kg, water holding capacity of 60-100%, air space of 10-30%, and total porosity of 50-80%(Robbins and Evans 2013; Méndez *et al.,* 2015: and Farghly *et al.* 2020).

Growing media for container plant production frequently uses sphagnum peatmoss (Mariotti *et al*., 2023). The ability of peatmoss to hold moisture, as well as its good structure and sterility, are well known (De Grazia *et al.* 2007 and Schmilewski 2008). According to Mariotti *et al*. (2023) and Lee *et al.* (2021), it is an extremely costly and non-renewable substrate. In addition, compared to other substrates, it has poor nutritional content and an acidic pH (Brown *et al*. 2000). Also, the production of peatmoss began to decrease due to climate fluctuations in temperature and carbon dioxide gas emissions (Slate *et al.,* 2024). Therefore, there is a need to use another sustainable growing medium that is cheap, efficient, renewable, and environmentally friendly (Barrett *et al.,* 2016).

Utilization of organic waste is considered a part of sustainable agriculture (Molari *et al.,* 2024). Organic waste is a serious environmental problem that can cause environmental contamination if it is not properly handled (Hernández-Rodríguez *et al*., 2017). However, organic waste that is composted or vermicomposted must be evaluated as substrates and organic fertilizers (Younis *et al.* 2022). Composting's primary goal is to produce a stable product that is high in vital nutrients that plants can easily access (Mondini *et al.* 2003). Avilés and Tello (2001) discovered that seedling germination, growth, and development are significantly impacted by the stability of composts. Furthermore*,* Richmond (2010) discovered that adding organic fertilizers to substrate mixtures greatly enhanced the chemical characteristics of the substrates, which in turn boosted plant performance. However, due to their physical characteristics, such as salinity, high pH, and increase of residual breakdown over time, composts are not as commonly utilized as is in growing media (Raviv, 2013).

Ready-to-eat veggies are in high demand these days since customers are becoming more interested in convenient and healthy foods (Hyldelund *et al.* 2020). Lettuce (*Lactuca sativa L.*), a member of the Asteraceae family, is a food that is good for health since it contains a lot of vitamins, minerals, dietary fiber, and antioxidant components (Mulabagal *et al.,* 2010; Rolnik and Olas 2021). The annual global production of lettuce is around 21 million tons, primarily grown in regions with mild climates (Shatilov *et al.,* 2019). Fresh is how it is traditionally used (Poštić *et al.,* 2021). In an organic or conventional agricultural system, lettuce can be cultivated in open fields or any kind of protected space (Llera *et al.,* 2022). Lettuce is mostly grown in growing media made of organic compost or peatmoss in protected areas. According to Saber *et al*. (2019), adding peatmoss to organic compost increased the green weight of lettuce plants.

The aim of this study was to compare the effects of peatmoss + perlite as a medium with four different types of media made from different plant composts (peanut shell, palm waste, sorghum waste, and banana waste) mixed in 2:1 (V:V) proportions with either perlite or cork or sand on lettuce (*Lactuca sativa* L.) seed germination and seedling growth.

Materials and Methods

Four compost piles were made from four different wastes (peanut shells, palm wastes, sorghum wastes, and banana wastes). A ratio of 50 kilograms of old compost to 200 kilograms of the previously mentioned wastes were used as microbial inoculants. Composting the waste took six and half months from 12/21/2022 until it reached maturity on 6/5/2023. Twelve treatments were prepared by mixing each compost with one of three materials (sand, cork or perlite) in a ratio of 2:1 (volume: volume). The sand used in construction was repeatedly rinsed with tap water before using distilled water. Cork used was passed through a sieve with 5 mm opening diameters. Commercial granular perlite was brought from the popular market used by nursery owners. Control treatment was the well-known mixture (peatmoss: perlite) with the same ratio. Physical and chemical analyses were determined of the four types of compost in addition to peatmoss before mixing them. Table 1 illustrates this.

The study was conducted at the greenhouse facility of Faculty of Agriculture, Assiut University, Assiut, Egypt. Within the greenhouse, the temperature varied between 18°C and 23°C. Seeds of Romaine lettuce (cv. Vivian) were directly sown in seedling polystyrene trays filled with 13 different mixtures. Twelve mixtures were made using different mixtures of organic composts (peanut shells, palm waste, sorghum waste and banana waste) and inorganic materials (gift cork, perlite, or sand), in addition to the control mixture (peat moss: perlite). Lettuce seeds were sown in the greenhouse on October 20, 2023. Treatments were replicated three times using three germination trays for each treatment. The germination rate (%) was tracked for each day and for each of the thirteen treatments until the fourteenth day. The experiment continued for 25 days until harvest on November 15, 2023, for the vegetative measurements and estimates to be taken.

Table 1. physical and chemical characteristics of composts made from, peanut shells (PS), palm waste (PW), sorghum waste (SW) and banana waste (BW) with peatmoss (PM).

Property	PM	PS	PW	SW	BW
pH (1:5)	4.96±0.0088	7.8±0.0058	7.03±0.0058	7.05±0.0058	8.58±0.0058
EC (dS/m)	0.39±0.006	3.757±0.012	2.51±0.009	5.97±0.006	9.54±0.018
Total nitrogen (%)	0.70±0.009	3.64±0.012	1.47±0.012	1.75±0.015	1.89±0.012
Total phosphorus (%)	0.04±0.006	1.87±0.012	2.34±0.015	0.84±0.015	0.96±0.009
Total potassium (%)	0.03±0.006	1.38±0.012	0.95±0.006	0.64±0.012	3.55±0.159
C/N ratio	66.66±0.017	5.34±0.012	14.87±0.012	10.48±0.212	9.95±0.015
Organic matter (%)	90.55±0.017	37.14±0.012	41.92±0.012	35.02±0.012	35.93±0.017
Organic carbon (%)	46.66±0.017	19.42±0.012	21.86±0.017	18.34±0.012	18.80±0.115
Water-holding capacity (%)	77±0.577	53.38±0.577	53.14±0.577	54.81±0.058	56.09±0.577
Density of Particle (g/cm^3)	1.17±0.012	0.88±0.017	0.97±0.012	1.34±0.012	0.49±0.012
Density of Bulk (g/cm^3)	0.35±0.012	0.41±0.012	0.45±0.017	0.54±0.009	0.45±0.006
Porosity (%)	69.57±0.058	52.3±0.012	53.06±0.017	59.7±0.009	8.16±0.023

PM: peat moss, PS: peanut shells compost, PW: palm wastes compost, SW: sorghum wastes compost, BW: banana wastes compost. Three replications' means are shown for each value.

Analysis of the utilized composts' properties and composition

Using a Beckman pH meter, pH was estimated in the 1:5 (media: water) ratio. With the use of the salt bridge, EC was measured (Farghly *et al.*, 2020). Weight loss upon igniting at 430° C for 24 hours was used to determine the media's organic matter (OM) content. The dry weight of a known sample volume was measured to calculate the bulk density (BD). The following formula was used to calculate it:

$$BD= \frac{1}{4} Ms/Vt$$

(where Ms is the mass (g) of the oven-dried organic waste and Vt is the total volume (cm^3) of the organic waste) (Bao 2000). According to Weindorf and Wittie (2016), the calculated hexane technique is known as particle density (PD). The technique outlined in (Choudhary *et al.* 1995) was used to calculate the media's water-holding capacity, Table (1).

Using plastic rings with a 40 mm diameter and a stainless steel screen with apertures less than 2 mm installed at the bottom, the water holding capacity (WHC) was calculated. To achieve maximal saturation, rings containing approximately 25 g of material were uniformly compacted and submerged to half in deionized water for a whole day. The covered rings were kept above glass funnels to drain any remaining water. Soils that had absorbed water were weighed after 30 minutes and left to dry overnight in order to calculate the WHC (Choudhary *et al*., 1995).

The total nitrogen (N), phosphorous (P), and potassium (K) amount in the row media was measured by precisely weighing the dried media before being added to a beaker for further digestion. A solution of sulfuric acid and hydrogen peroxide was used for the wet ashing process (Navarro *et al.* 1993). With the use of a micro Kjeldahl's distilling machine, 5 mL of the digested sample was distilled with 20 mL of 40% sodium hydroxide into an Erlenmeyer flask holding 10 mL of an indicator solution mixed with boric acid for total N content determination. Following distillation, the distillate's total nitrogen content was ascertained by titrating it with a standardized sulfuric acid solution containing 0.01 N (Jackson 1973). Using a spectrophotometer and a sulfuric acid system, total phosphorus was measured by the stannous chloride phosphor molybdic acid method (Jackson, 1973). To determine total K, the flame photometer method was used (Page *et al*., 1982)

The total nitrogen (N), phosphorus (P), and potassium (K) amounts in the row media were measured by precisely weighing the dried media before being added to a beaker for further digestion. A solution of sulfuric acid and hydrogen peroxide was used for the wet ashing process (Navarro *et al*. 1993). Total N content determination. According to Jackson (1973). Using a spectrophotometer and a sulfuric acid system, total phosphorus was measured by the stannous chloride phosphor molybdic acid method (Jackson, 1973). To determine total K, the flame photometer method was used (Page *et al*., 1982).

Growth measurements and chemical analysis of lettuce seedlings

Lettuce seedlings shoot height (SHL, cm) were measured using a meter ruler. Leaf number (LN) was also counted at 25 days from planting. Leaf chlorophyll content was measured by taking the average of the device’s readings for all the lettuce leaves that could be measured (SPAD-502, Minolta, Japan). Shoot (SFW) and root (RFW) fresh weights (g) of lettuce seedlings were recorded at harvest time after 25 days of planting. After cleaning and washing with tap and distilled water, whole plant samples were dried in an oven (70° C) for dry weight measurements (PDW). After being grinded, the samples were kept for chemical examination.

The lettuce seedlings' total N, P, and K were measured. Initially, 420 mL of concentrated H_2SO_4, 14 g $LiSO_4.H_2O$, 0.42 g selenium powder, and 350 mL of H_2O_2 were used to digest plant samples (Parkinson and Allen 1975). To determine the total nitrogen concentration, according to (Jackson 1973). Total phosphorus and total K were measured as mentioned above (Jackson 1973; Page *et al*., 1982).

Analytical Statistics

A completely randomized design was used for the experiment (CRD). The CoStat 6.303 software used analysis of variance (one way-ANOVA). Using analyses of variance and Duncan's multiple range test for mean comparison, means were deemed different when $p < 0.05$ (Steel and Torrie, 1980).

Results and Discussion

Influence of medium combinations on lettuce seed germination rate

Table (2) and Fig. (1) provide data that illustrates the germination process development from the third to the fourteenth day after planting. A significant difference ($p <0.05$) was detected between the germination mixtures and the control treatment. On the third day following seeding, the control treatment recorded the highest germination rate (95%), followed by the mixture PS+C and P (peanut shell: cork and perlite) and with the mixture PW+P (palm waste: perlite), with a germination rate of 30%.

The germination percentage continued to increase from the fourth day until the eighth day. On the eighth day, the highest germination percentage appeared in the control (P+P) (peatmoss: perlite) with a germination percentage of 96.17%. The germination percentage in the control was higher than the germination percentage in the PS+P, PW+P, and PS+C mixtures by 11.02, 15.18, and 16.22%, respectively. Meanwhile, it was higher than the germination mixtures of PS+S and PW+S by 33.72 and 47.75%, respectively. The remaining mixtures had poor germination.

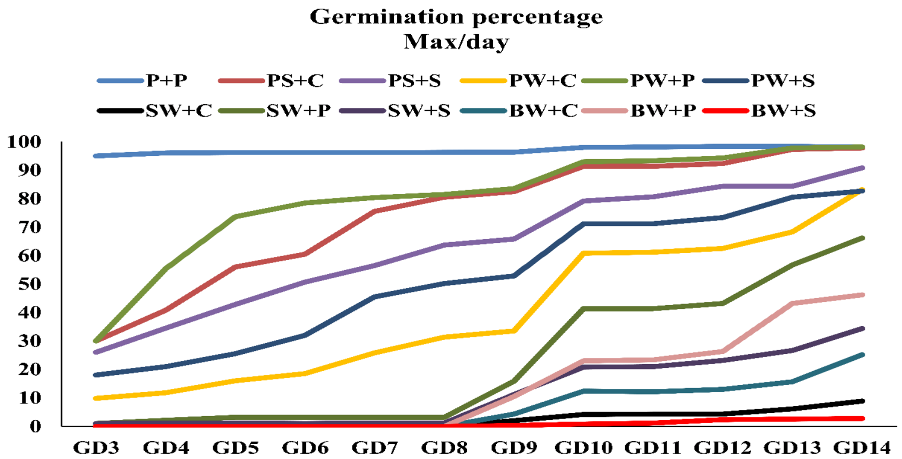

Fig 1. Daily germination percentage in the control and different examined mixtures

GD (3 - 14): Germination rate from the third day until the fourteenth day, P: peat moss, PS: peanut shells compost, PW: palm waste compost; SW: sorghum waste compost; PW: banana waste compost; C: cork; P: perlite; S: sand.

The three replications' mean is shown by each value. According to Duncan's test, means with different letters indicate a significant difference at $p < 0.05$.

Table 2. Represents the tracking of the germination rate in the different mixtures in addition to the control during the fourteen days

Max/day	GD3	GD4	GD5	GD6	GD7	GD8	GD9	GD10	GD11	GD12	GD13	GD14
P+P	95±0.29a	96±0.29a	96±0.17a	96±0.17a	96±0.17a	96±0.17a	96±0.17a	98±0.29a	98±0.17a	98±0.17a	98±0.17a	98±0.17a
PS+C	30±0.58b	41±0.44d	56±0.58d	61±0.29c	76±0.29c	81±0.29d	83±0.29d	91±0.33d	91±0.17d	92±0.17d	97±0.17b	98±0.17a
PS+P	30±0.29b	60±0.17b	72±0.33c	79±0.29b	81±0.58b	86±0.29b	87±0.17b	92±0.17c	92±0.17c	93±0.17c	96±0.17c	96±0.19b
PS+S	26±0.29c	35±0.29e	43±0.44e	51±0.33d	57±0.29d	64±0.33e	66±0.44e	79±0.17e	81±0.33e	84±0.17e	84±0.44d	91±0.17c
PW+C	10±0.17e	12±0.44g	16±0.58g	19±0.50f	26±0.44f	31±0.33g	34±0.29g	61±0.17g	61±0.17g	63±0.00g	68±0.17f	83±0.17d
PW+P	30±0.58b	55±0.33c	74±0.33b	79±0.29b	80±0.17b	82±0.29c	84±0.29c	93±0.29b	93±0.17b	94±0.17b	98±0.44ab	98±0.17a
PW+S	18±0.29d	21±0.58f	26±0.29f	32±0.58e	46±0.29e	50±0.17f	53±0.44f	71±0.44f	71±0.17f	73±0.17f	81±0.29e	83±0.44d
SW+C	0±0.00g	0±0.00j	0±0.00j	0±0.00i	0±0.00i	0±0.00j	2±0.29k	4±0.17l	4±0.17l	4±0.17l	6±0.17k	9±0.17i
SW+P	1±0.00f	2±0.17h	3±0.17h	3±0.17g	3±0.17g	3±0.17h	16±0.44h	41±0.44h	41±0.17h	43±0.17h	57±0.17g	66±0.17e
SW+S	1±0.00f	1±0.17i	1±0.17i	1±0.00h	1±0.17h	1±0.17i	11±0.17i	21±0.33j	21±0.00j	23±0.17j	27±0.17i	34±0.17g
BW+C	0±0.00g	0±0.00j	0±0.00j	0±0.00i	0±0.00i	0±0.00j	4±0.33j	12±0.17k	12±0.17k	13±0.17k	16±0.17j	25±0.17h
BW+P	0±0.00g	0±0.00j	0±0.00j	0±0.00i	0±0.00i	0±0.00j	11±0.29i	23±0.29i	23±0.17i	26±0.17i	43±0.17h	46±0.17f
BW+S	0±0.00g	0±0.00j	0±0.00j	0±0.00i	0±0.00i	0±0.00j	0.3±0.33l	1±0.17m	1±0.17m	2±0.17m	3±0.03l	3±0.15j

GD (3 - 14): Germination rate from the third day until the fourteenth day, P: peat moss, PS: peanut shells compost, PW: palm waste compost; SW: sorghum waste compost; PW: banana waste compost; C: cork; P: perlite; S: sand. The three replications are shown by each value. According to Duncan's test, means with different letters indicate a significant difference at $p < 0.05$.

Germination started to appear on the ninth day in the banana waste compost mixtures (BW+C, BW+P, and BW+S) and the sorghum waste compost mixture and gift cork SW+C were with the following germination percentages: 4.33, 10.5, 0.33, and 2%, respectively. The low germination percentage of banana waste mixture could be due to its low percentage of porosity (8.16%) and high EC (9.54 dS/m) and pH (8.58) values as shown earlier in table 1. According to Huang *et al.* (2024), there is a relationship between salinity concentration and germination rate. Water salinity or high EC causes a 50% loss in germination. Furthermore, research indicated that it contains some strong germination inhibitors such as abscisic acid (Han and Yang, 2015; Carrera-Castaño *et al*., 2020; Hu *et al*., 2020; Wei *et al*., 2023 and Vaidya *et al*., 2023.Starting from the tenth day, germination percentage stabilized to some extent in the control medium (peatmoss: perlite) from 98.16 to 98.34 until the fourteenth day of germination.

Based on the obtained results, mixtures of peanut shell and palm waste had the highest germination percentages, after the control peatmoss mixture. This was likely because the mixtures had most of the characteristics needed for ideal growth, as shown in Table (1) in our results, and as mentioned by earlier authors (Robbins and Evans 2013; Farghly *et al*., 2020). Also, an elevated amount of melatonin, a potent antioxidant, was discovered in palm waste (Wu *et al*., 2021; Hassan and Zain Al-Abidin, 2022) and peanut shells (Verdi *et al*., 2022), which might contribute to the high germination percentages.

Impact of germination medium on lettuce seedling growth and uptake of N, P and K

Plant growth traits of lettuce plants grown on various media mixtures are presented in Fig (2). The highest significant value of shoot fresh weight (SFW) was achieved in all peanut shell compost mixtures in addition to the germination mixture PW+P, with increases by 35.91, 30.45, 19.61 and 22.37% over the control, respectively. The highest significant results for the different measured parameters were in PS+S (for LN), PS+P (for SHL), PS+C (for RL), PS+C (for PDW), and PS+C (for Chlorophyll). The following germination combinations, however, had the lowest significant values for these characteristics: RFW (BW+S, BW+P, and SW+C), LN (SW+C), SHL (BW+S and BW+P), RL (BW+P and BW+S), PDW (BW+S) and Chlorophyll (BW+S) (Fig 2 and 3).

All compost combinations made from banana waste had the lowest significant values for N, P, and K, which was less than the control by 55.31, 49.19, and 71.41%, respectively.

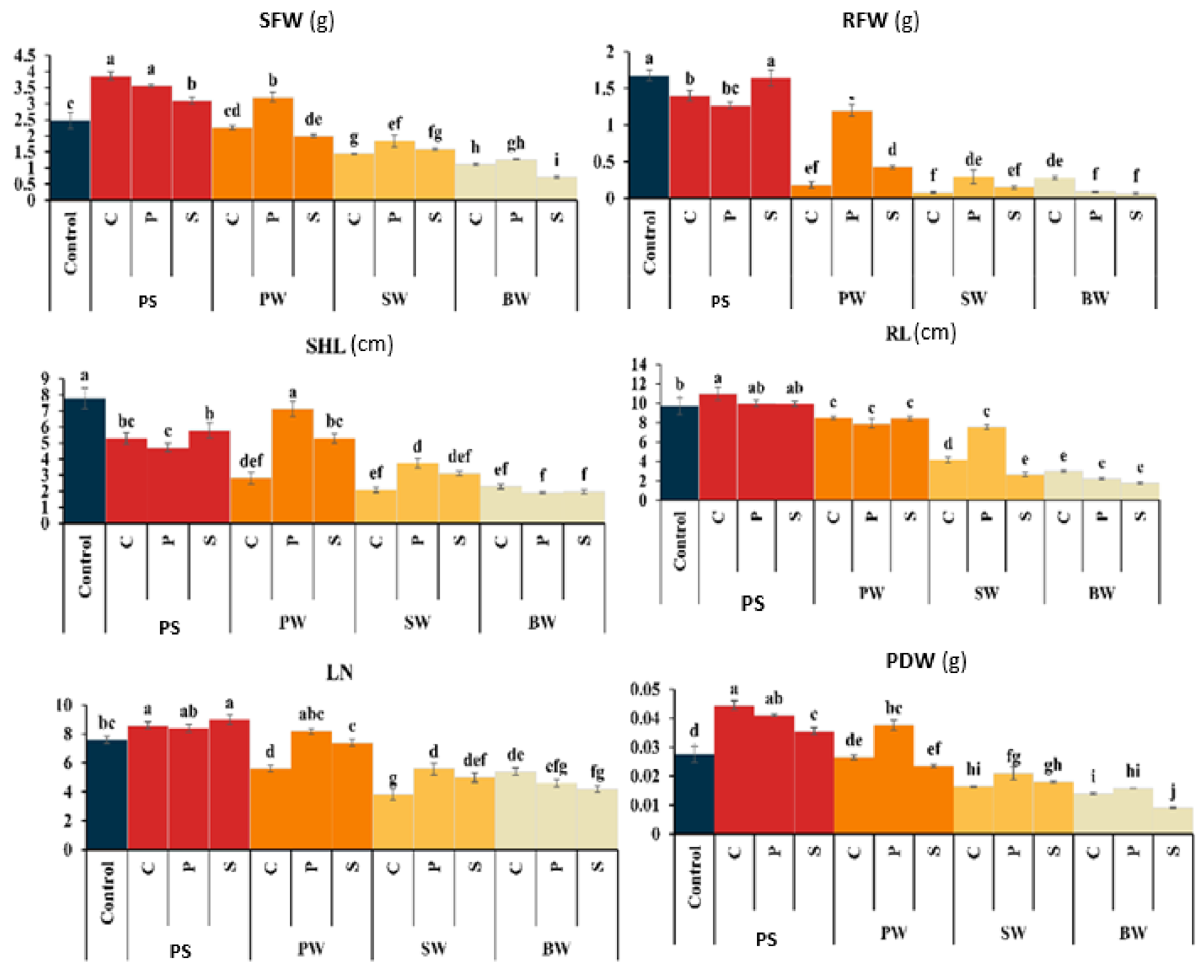

Figure 2. The impact of different germination media types on specific vegetative development metrics in 25-day-old Lactuca sativa seedlings. SFW, shoot fresh weight; SHL, shoot length; RL, root length; PDW, plant dry weight; LN, leaf number; RFW, root fresh weight; Control, (peatmoss: perlite); PS, compost made from peanut shells; PW, compost made from palm waste; SW, compost made from sorghum waste; BW, compost made from banana waste; C, mixing materials of cork; P, mixing materials of perlite; S, mixing materials of sand. The three replications' mean are shown by each value. According to Duncan's test, means with different letters indicates a significant difference at $p < 0.05$.

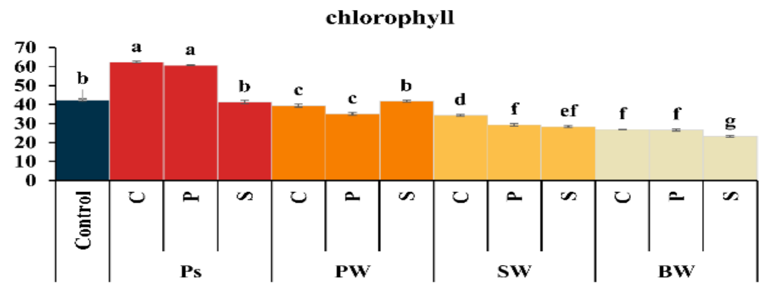

Fig 3. Effect of Germination media type on chlorophyll content in *Lactuca sativa* seedling (25 days old). Control, (peatmoss: perlite); PS, compost made from peanut shells; PW, compost made from palm waste; SW, compost made from sorghum waste; BW, compost made from banana waste; C, mixing materials of cork; P, mixing materials of perlite; S, mixing materials of sand. The three replications' mean are shown by each value. According to Duncan's test, means with different letters indicate a significant difference at $p < 0.05$.

Figure 4 discloses that the uptake of N, P, and K varied significantly ($p < 0.05$) among all the growth media that were discussed. All PS and PW mixes, when compared to the control, generally increased N and P uptake. In contrast, lettuce absorbed more K from all tested media than from the control. While the most significant values of P and K uptake were found in (PS+C and PW+P) and (PS+C, PS+P, and PW+P), respectively. The highest significant N uptake values were found in PS+C and PS+P. Plants grown on PS+C and PS+P absorbed more N than the control by 2.03 and 1.98 fold, respectively, and more P than control by 0.83 and 0.75 fold, respectively. Lettuce plants grown on PW+P, PS+P, and PS+C absorbed more K than the control by 4.74, 4.64, and 4.54 times. Plants grown on BW+S, on the other hand, had the lowest N (0.129 g/plant), P (0.004 g/plant), and K (0.416 g/plant) uptake levels.

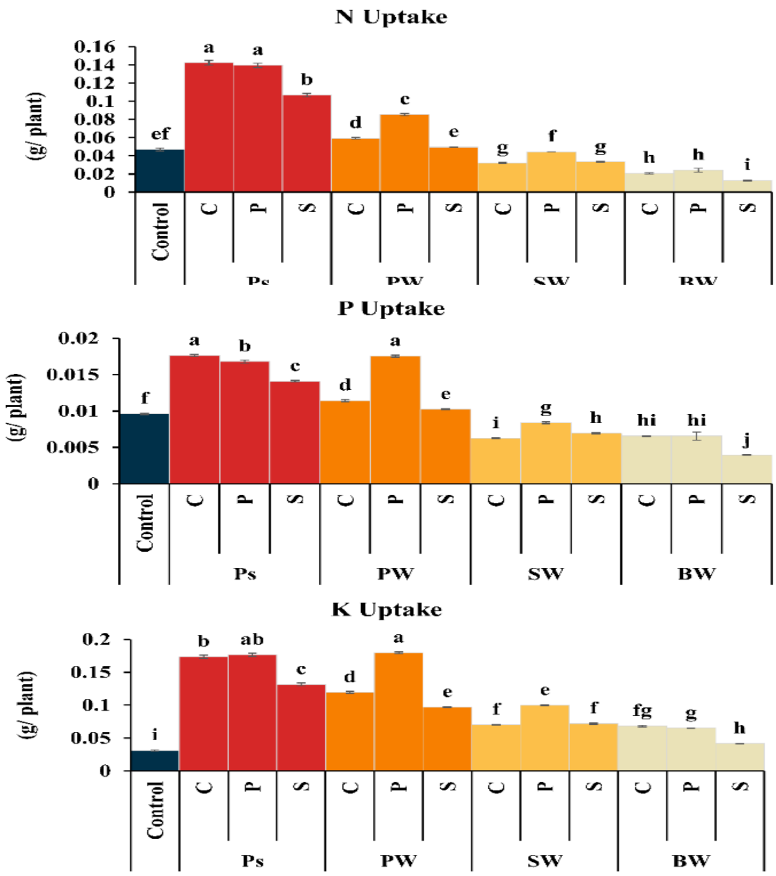

Fig. 4. The influence of different germination media types on the uptake of nitrogen (N), phosphorus (P), and potassium (K) by Lactuca sativa seedlings. Control, (peatmoss: perlite); PS, compost made from peanut shells; PW, compost made from palm waste; SW, compost made from sorghum waste; BW, compost made from banana waste; C, mixing materials of cork; P, mixing materials of perlite; S, mixing materials of sand. The three replications' mean is shown by each value. According to Duncan's test, means with different letters indicates a significant difference at $p < .05$.

By looking closely, we will find that the highest uptake of N and P was achieved in peanut shell compost mixtures. It is expected that N absorption by lettuce seedlings increased in peanut shell mixtures due to the increased availability of the element, as clear in Fig (4). While we attribute the increased uptake of P to the fact that the available N in peanut shells is present in the form of nitrate (NO_3) groups, and this form encourages the uptake of phosphorus. Indeed, Weil *et al.* (2021) mentioned that adding

N to Hoagland's solution in the form of nitrate (NO_3) led to the improvement of the growth of lettuce seedlings and the uptake of other elements compared to the form of ammonium nitrogen (NH_4). Therefore, we believe that what distinguishes PS and PW from peatmoss is the high content of nutrients in PW.

The tested germination media's total cost and net profit

The tested germination combinations were compared to the well-known peatmoss+ perlite growing media using the total cost and net profit figures (Fig. 5). Yield of lettuce seedlings grown on BW mixes was too low to be considered as a commercial yield, therefore, P+P, PS+C, PS+P, PS+S, PW+C, PW+P, PW+S, SW+C, SW+P, and SW+S were not included in the economic comparison.

The net profit varied between 1.2, 2.06, 2.4, 2.09, 2.06, 2.04, 2.1, 1.5, 1.44, and 1.46$, whereas the corresponding total cost varied between 1.0, 0.15, 0.2, 0.11, 0.14, 0.16, 0.1, 0.12, 0.15, and 0.09$ (USA dollars). In contrast to SW+S, which had the lowest total cost, P+P was used to record the highest total cost. The following is an ascending order of the total costs of the various growth media: SW+C< SW+C < PS+C = SW+P< PW+P< PS+P <P+P. SW+S< PW+S< PS+S< SW+C< PW+C < PS+C. Net profit of the different growing media can be put in the following descending order: PS+C>PS+P> PS+S> PW+S> PW+C> PW+P>SW+C>SW+S> SW+P> P+P.

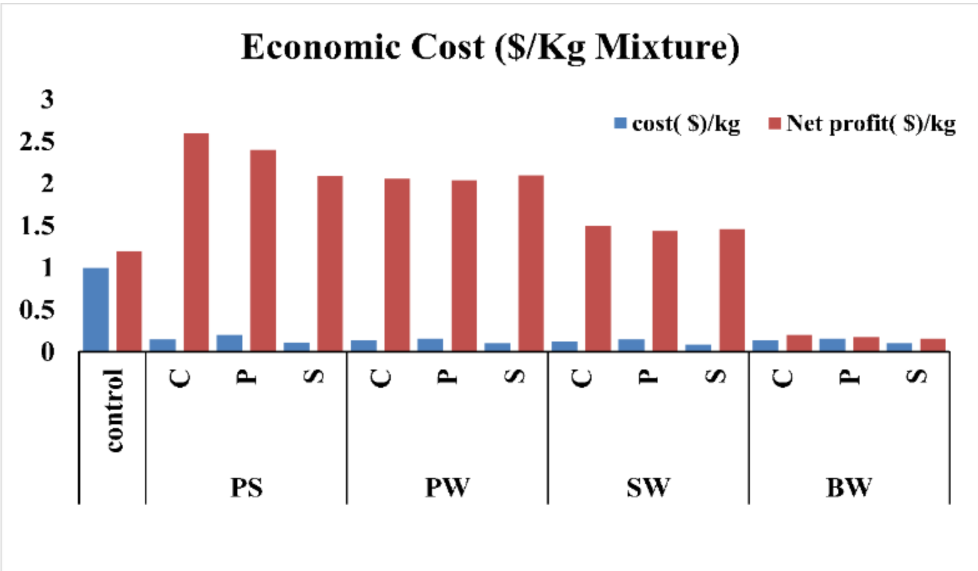

Fig 5. Economic costs and profits of the examined growing mixtures. Control: (peatmoss: perlite), PS: peanut shells compost, PW: palm waste compost; SW: sorghum waste compost; BW: banana waste compost; C: cork; P: perlite; S: sand.

Economically, the net profit for peanut shell waste and palm waste mixtures is much higher than the net profit for peatmoss, Type equation here. which encourages their use, environmentally and economically. Rashwan, *et al.* (2021) said that peatmoss (*Sphagnum* spp.), is currently an expensive material and a nonrenewable resource with variable properties. Therefore, its use should be gradually reduced. Hence, there are numerous attempts aiming to reduce the use of peatmoss as a bulk substrate and to search for high-quality, locally available and low-cost alternatives to peatmoss.

Conclusion

Four different forms of compost were utilized: peanut shell, palm waste, sorghum waste, and banana waste, each were mixed with three materials (cork, perlite, and sand) resulting in twelve mixtures in addition to the control mixture (peatmoss: perlite) (2:1). Comparing seed germination in these combinations to the control, the compost mixtures made from peanut shells and palm trash performed the best. However, more research should be conducted to identify the reason for the lack of germination of lettuce seeds in banana waste compost and the weak germination of the sorghum waste compost mixtures. Upon conducting an economic analysis of this experiment, we found that the highest net profit was achieved by the use of peanut shell mixtures, followed by cork, perlite, sand, then palm waste compost mixtures, compared to the control. Indeed, this study has opened new avenues for environmental sustainability by exploiting waste that may cause environmental problems. At the same time, the work also identified new economic alternatives to peatmoss, which is known to be expensive, causing bad climatic changes (such as global warming and carbon dioxide emissions), and is also threatened by its future shortage.

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هل يمكن أن يكون الكومبوست بيئة إنبات بديلة لزراعة شتلات الخس في المشاتل؟

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الملخص

تم عمل أربعة أنواع من الكمبوست النباتي وهم قشور الفول السوداني ومخلفات النخيل ومخلفات الذرة الرفيعة ومخلفات الموز كبيئات نمو بعد خلط كل منها مع الفلين أو البيرلايت أو الرمل بنسبة 2:1 (ح:ح) مقارنةً بخليط التحكم (البيتموس: البيرلايت) بنفس النسبة. تنافست جميع الخلطات الثلاثة من PS وخليط PW+P جيدًا مع الضبط في جميع معايير النمو المدروسة نظرًا لخصائصها المثلى. كان خليط الكمبوست المختلف مع P دائمًا أفضل النتائج. بعد 14 يومًا من الزراعة كانت أعلى نسب إنبات لبذور الخس في خلطات الكنترول (98.34%) و(98.16%) PW+P، و(97.83%) PS+C، و PS+P (96.36%)، بينما كانت أقلها في (2.77%) BW+S. أظهرت خلطات كمبوست مخلفات الموز تأخيرًا واضحًا في الإنبات لمدة 8 أيام بسبب ارتفاع EC (9.54 dS/m) وقيم pH العالية (8.58). تم تحقيق أعلى وزن خضري في جميع مخاليط سماد PS بالإضافة إلى PW +P تم حساب التكلفة الإجمالية وأقل صافي ربح في البتموس والبيرلايت دون ان تتضمن الخلطات المختلفة لكمبوست مخلفات الموز في المقارنة. تم الحصول على أعلى صافي ربح مع خلطات كمبوست قشر الفول السوداني PS + C، PS PS + S + P مع صافي ربح قدره 2.6 دولار، 2.4 دولار، و2.1 دولار، على التوالي، تليها خلطات كمبوست مخلفات النخيل PW + C، PW + P، PW + S مع صافي ربح قدره 2.06 دولار، 2.04 دولار، و2.1 دولار، على التوالي. تشير الخصائص الفيزيائية والكيميائية والاقتصادية لخليط سماد قشر الفول السوداني ونفايات النخيل إلى أنه يمكن أن يكون بديلاً اقتصاديًا لوسط الإنبات للبيتموس.

الكلمات المفتاحية: *بيئات الإنبات الغير عضوية الفلين والبيرلايت والرمل، كمبوست مخلفات النخيل، كمبوست قشر الفول السوداني، كمبوست مخلفات الذرة الرفيعة، كمبوست مخلفات الموز.*