Alternative Growing Media for Producing Squash Transplants in North Sinai Region

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ABSTRACT

The objective of this study was to use alternative media for producing summer squash (*Cucurbita pepo*) transplants in the North Sinai Region. The experiment was conducted at the research farm in Faculty of Environmental Agricultural Sciences, Arish University, during the summers of 2021 and 2022. Different growing media for producing transplants of squash, cv. Escandrany, were used, including five substrate media: a control treatment of peat moss + vermiculite (commercial media), commercial media + biochar, commercial media + sawdust, commercial media + soil, and commercial media +chicken manure, all growing media were used at rate 1:1(v:v). The parameters that have been measured were; the germination percentage, and its rate, quality of transplants as (height of transplants, number of leave, fresh weight, stem diameter, dry weight and growth vigor), leaf photosynthetic pigments contents and N, P and K contents of the transplants leaves. Results showed that using commercial media, commercial media + sawdust, and commercial media + biochar led to increasing the germination percentage and improved transplants morphology characters (transplants height, number of leave, fresh weight, stem diameter, dry weight and growth vigor), leaf photosynthetic pigments content and N, P and K contents compared to commercial media + soil and commercial media + chicken manure, which had the lowest values. In addition, the economic study showed that the use of sawdust and biochar for production of squash transplants led to reduce the cost of transplants production by rate of 3.87% and 0.66%, respectively compared to control treatment.

Keyword: Squash transplants, Growing media, Wastes.

INTRODUCTION

One of the most well-known vegetable crops is summer squash (*Cucurbita pepo L.,*) which is a member of the Cucurbitaceae family. Its functional components play a major role in modulating major risk factors for some chronic diseases. It is also packed with many important vitamins, minerals, and antioxidants, in addition, a high fiber content and a low-calorie count.

Peat-moss that, used as a production substrate for producing vegetable transplants is currently seen as an expensive, non-renewable resource with undesirably variable properties characteristics, and its use should be gradually reduced (Ceglie *et al.*, 2015 and Chrysargyris *et al.*, 2018). Therefore, some studies aimed to reduce the use of peat-moss as a bulk substrate and search for alternative growing media that are high quality, low-cost substitutes and locally available. Thus, reusable, or recyclable local materials, not derived from non-renewable resources, should be preferred as growing substrates to produce the vegetable transplants (Ceglie *et al.*, 2015). So, using agricultural wastes, whether in its raw form; such as; sawdust, or by converting it into biochar as agricultural substrates for the production of the vegetable transplants, is a safe way to dispose of agricultural wastes, which alleviates the negative effect on the environment - and reducing the rise of fumes and gases such as carbon dioxide into the atmosphere, that reducing global warming. In addition, this is considered a new product that can be used again in agricultural production processes and that agree with sustainable development strategy.

Generally, the production of vegetable transplants with agricultural wastes is advantageous and a great substitute for peat in terms of improvement of soil characteristics and seedlings growth and their high abundance (Do & Scherer, 2013 and Abdel Maksoud *et al.*, 2020). Peat moss and compost combinations can improve possible poor properties of single materials, like heterogeneity and high salinity. Also, Atif *et al.* (2016) demonstrated that using composted vegetable wastes can offer all or some of the essential requirements for seedling growth. These wastes include biochar and sawdust. Application of a mixture of peat and agricultural wastes compost to a growing substrate led to lower the pH of the medium, increase water retention, and improve aeration (Tang *et al.,* 2016).

Biochar is a solid organic residue that is obtained from biomass pyrolysis, it's the result of pyrolysis, which involves heating biomass such as wood, leaves, or manure in a closed container with little to no

DOI: 10.21608/asejaiqjsae.2023.319340

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Received, September 05, 2023, Accepted, October 01, 2023.

available air, its solid organic residue that is high in carbon content (Lehmann & Joseph, 2009 and El-Gamal *et al.*, 2017). Biochar rising carbon sequestration capacity in soils so globally proposed use as an organic amendment to mitigate climate change, contributes to improving physicochemical and biological soil characteristics of soil health, it is produced by the thermal decomposition of organic material at relatively low temperatures (< 700 Cº) and a limited supply of oxygen(O2) (Lehmann and Joseph, 2009). Furthermore, Sohi *et al.* (2010) recorded the significance of using these wastes for making biochar as an effective method of recycling trash into materials of value.

Sawdust is the smallest particle of wood. This is considered wastes from the wood working industry. In terms of value, wood waste is superior to peat and manure, because they contain more valuable substances. It is suitable for use as a growing medium. In comparison to imported growing medium (peat-moss), it is more economical, and the more of studies have shown that organic growing media promoted the growth of transplants (Tzortzakis & Economakis, 2008 and Maboko & Du-Plooy, 2013). Likewise, it has a lot of useful and necessary nutrients for seedlings, such as nitrogen, lignin, and cellulose. Sawdust considered a good loosening agent that improve the soil structure through the prevents cracking and crusting. In addition, sawdust is capable of absorbing and retaining liquid, which allows it to be used wherever moisture needs to be reduced. It is also working on the soil processing by soil microorganisms into nutrients necessary for seedlings growth. For many years, sawdust was also the standard growing medium for the greenhouse industry in Alberta and Argentina (Sawan and Eissa, 1996).

Organic manure as decomposer plays an important role in improving the health and transplants growth. Chicken manure is one of the best nutrient boosts you can give your soil and an excellent source of nutrients, where its nitrogen and phosphorus contents are at least twice as high as about of the other of farm manures such as cow manure. Chicken manure, when properly handled, is the most valuable of all manures produced by livestock (Charles and James, 1995).

Therefore, this study focused on evaluating the percentage and rate of germination and the morphological characters of squash transplants under using low-cost waste agricultural and locally available as alternative seedling media for producing summer squash transplants.

MATERIALS AND METHODS

Experimental design:

The objective of this study was to use alternative growing media for producing summer squash (*Cucurbita pepo*) transplants in the North Sinai Region. The Experiment was carried out during the summer seasons of 2021 and 2022 at The Experimental Farm, Faculty of Environmental Agricultural Sciences, Arish University, North Sinai, Egypt. Different growing media that were used included five substrate media; peat moss and vermiculite (v/v) (commercial media) as a control treatment (pv), commercial media + sawdust (pvs), commercial media + local soil (pvls), commercial media +chicken manure (pvc). All growing media were used at rate 1:1(v:v). The media of sawdust, and chicken manure compost were composted for three months before being used aiming to complete the analysis. An analysis of the irrigation water and substrate media that used in the production of summer squash transplants as shown in Tables No. (1, 2 and 3).

Foam trays (84 eyes) were used in this study. Seeds of squash. cv Escandrany were sown in 15^{th} March and 15^{th} April in both seasons of 2021 and 2022, respectively. The trays were washed well with water, then left until they dried. After that, a plastic sheet was placed, and the different growing media were spread on it, and each media was separately stirred well until homogeneity occurred. Then the trays were filled with the media, and a cavity was made inside each eye, and a single seed of squash are placed inside the eyes, then the trays are covered with a thin layer of the growing media designated for each tray. The trays were irrigated until water came out from the bottom of the trays, then trays are stacked on top of each other, and an empty tray is placed at the bottom and top of the trays. Then they are wrapped well with plastic they are inspected three days after the packing and once they have first seed germinated, the trays were spread out on the tray holders, then they were constantly followed by irrigation in the greenhouse (nursery). The experiments were carried out using a complete randomized block design with three replications. Whereas each replication involved five trays in three replicates.

Squash Seeds were equally watered daily in the morning to ensure non-limiting water availability throughout the duration of the nursery period. Seedlings nutritional requirements were provided entirely by the growth media treatments alone. Over two weeks after sowing seeds daily observations were recorded (seeds germination, were recorded as emerged when the hypocotyls appeared above the surface of the growing medium).

Table 1. Chemical analyses of irrigation water

EC (dS/m)	pH	Soluble ions ($meq.l^{-1}$)						
		Cations				Anions		
		K^+	Na^+	Mg^{++}	Ca^{++}	Cl^-	HCO_3^-	CO_3^{--}
2.53	7.5	20	41	28	11	92	8	0

Table 2. Chemical analyses of studied transplants growing media.

Treatments	Soluble ions ($meq.l^{-1}$)						
	Cations				Anions		
	K^+	Na^+	Mg^{++}	Ca^{++}	Cl^-	HCO_3^-	CO_3^{--}
commercial media (control)	0.3	4.1	1.31	2.81	8.02	0.5	0
commercial media + sawdust	0.4	4.4	1.05	2.36	7.61	0.6	0
commercial media + biochar	0.2	4.8	1.18	2.23	7.61	0.8	0
commercial media + soil	0.8	5.5	0.83	1.66	7.89	0.9	0
commercial media + chick manure	0.7	5.9	0.99	1.81	8.5	0.9	0

Table 3. Some properties of studied transplants growing media.

Treatments	EC (dS/m)		pH		N %	P %	C %	C/N ratio
	Before Sowing	Before Transp.	Before Sowing	Before Transp.				
commercial media (control)	1.36	1.39	7.55	7.20	1.5	0.2	33.4	22.27
commercial media + sawdust	1.35	1.37	7.45	7.14	1.8	0.13	36.3	20.17
commercial media + biochar	1.31	1.35	7.81	7.49	1.4	0.49	29.6	21.14
commercial media + soil	1.42	1.44	7.46	7.29	2.4	0.33	36.6	15.25
commercial media + chick manure	1.75	1.79	8.85	8.58	3.2	3.0	38.2	11.94

Measurements:

Germination Percentage:

The days up to emergence and the overall number of germinated seeds, were counted. The following formula was used to determine the seed germination percentage (SG%) (ISTA, 1996):

$$\text{Germination Percentage} = \frac{\text{No. seeds germinated}}{\text{Total No. of seeds sown}} \times 100$$

Where: No. of seeds germinated = No. of final healthy seedlings

Germination Rate:

According to Ranal and de Santana (2006) the germination rate (number of days required for maximum germination) was calculated by following formula:

$$\text{Germination Rate} = \frac{\text{No.germination seeds after four days}}{\text{Germination Percentage}}$$

Transplants morphology measurements:

Ten transplants were selected randomly from each treatment (each tray) to determinate the morphological characters of the transplants at age 15 days after sowing seeds. The height of the seedlings and stem diameter were measured from the base to the highest apex of the seedling. The formula below was used to calculate the leaf area of seedling^{-1} (Ackley, 1964).

$$\text{Leaf/area transplants} = \frac{\text{Leaves fresh weight (g)}}{\text{Fresh weight of disks}} \times \text{area of disks } (cm^2)$$

The average fresh and dry weight of transplants at 25 days age, was recorded for transplants per each treatment. Where, the fresh weight of transplants was determined then dried in an oven at 70°C to constant weight for determination of the dry weight. The chlorophyll a, b, and carotenoids were extracted and measured by using the technique outlined by Moran (1982). The seedlings vigor index was calculated to the following equation (Abdul-Baki and Anderson, 1970), SVI = seedling length× (cm) germination percent/100. The dried materials were ground and used to determine NPK., according to Bremner and Mulvaney (1982), Piper (1950); Brown and Lilliand (1946) respectively.

Economic Efficiency (%):

Economic efficiency (%) for studied transplants growing media was calculated according to the local market price of growing media types and transplants price as follows:

$$\text{Transplants cost} = \frac{\textit{Total cost}}{\textit{number of healthy seedlings}}$$

Relative transplant price production (%) is the result of dividing the Transplant price production by the Transplant price production of the control diet, assuming that the REE of the control diet is 100%.

Statistical analysis

In accordance with Snedecor and Cochran (1980), data were computed and statistically examined. For comparing means, Duncan's multiple range tests were utilized (Duncan, 1958).

RESULTS AND DISCUSSION

Germination Percentage and its rate

The data in Table (4) show significant effect of using different types of growing media on germination percentage and its rate of summer squash seedlings. The germination percentage was recorded the highest values with application of peat moss and vermiculite (commercial media) as a control, commercial media + sawdust and commercial media + biochar in both seasons with values of 82.14, 79.76 and 77.38%, respectively, in first season, and 79.76, 77.38 and 76.19% in second season, respectively. However, the lowest values of germination percentage were recorded with application of commercial media +soil, commercial media +chicken manure.

These findings suggested that peat moss has important functions for seedlings because it retains water, nutrients and continuously supplies them to seedlings. It features air pockets or pores to supply oxygen to the seedling roots. As a result, it offers water and oxygen supports for seedling growth and a reliable continuous water supply system without cutting the oxygen to the seedling roots, leading to the reported development of a good rooting substrate as reported by Michel (2010). In addition, peat can lower the pH of the medium, improve aeration, and increase water retention when application of a mixture of peat and horticultural waste compost to a growth substrate, as previously mentioned, this is consistent with the results in Table (3) for the analysis of the peat moss growth environment when mixed with diverse agricultural environments, it was found to reduce , the pH of the environment (Tang *et al.*, 2016), and the use of mixtures of horticultural waste compost and peat moss can improve possible poor properties of single materials, like high salinity and heterogeneity (Atif *et al.*, 2016). Thus, it indicated a significant increase in germination percentage. Also, these results agree with Hafeez *et al.* (2017) they claimed that using biochar considerably enhanced the germination rate and seed vigor of soybean seedlings. Additionally, Uslu *et al.* (2020) showed that biochar could raise the percentage of seed germination.

Regarding germination rate, the best results were observed with the application of commercial media + sawdust, commercial media + biochar and (commercial media) as a control respectively in both seasons since this recorded values of 0.60, 0.47, and 0.41, respectively, in the first season and 0.59, 0.44, and 0.40, in the second one respectively. On the other hand, the application of commercial media + soil and commercial media + chicken manure showed the lowest values of seedling germination rate. These results agree with according to Abdel-Razzak *et al.* (2018) they found that seeds of tomato, hot pepper, cucumber, and summer squash were germinated more quickly in substrate mixtures enriched with 5% and 10% tomato waste compost (TWC). The negative effects of the germination rate, which was observed by chicken manure media may be due to that it is composed of concentrated nutrients, especially nitrogen. So it was very strong (or "hot"), and can burn the roots of the seedlings as previously mentioned, in addition an increase in the percentage of salinity in the media this is consistent with the results in Table (3) for the analysis of the chicken manure and soil growing media, so resulting in negatively affects the percentage and rate of germination.

Seedlings morphology:

Data in Table (5) show significant differences among studied treatments for seedlings morphology of summer squash as follows traits studied:

Table 4. Effect of growing media on the germination percentage and its rate of squash seedlings.

Treatments	Germination Percentage (%)		Germination rate	
	1st season	2nd season	1st season	2nd season
commercial media (control)	82.14a	79.76a	0.41c	0.40c
commercial media + sawdust	79.76 b	77.38b	0.60 a	0.59a
commercial media + biochar	77.38 b	76.19b	0.47 b	0.44b
commercial media + soil	50.00 c	52.38c	0.22 d	0.19d
commercial media + chick manure	10.71d	13.10d	0.09e	0.08e

[a,b,c] The Duncan's multiple range test revealed that values with the same alphabetical letter(s) did not statistically differ at the 0.05 level of probability and Means in the same columns with different superscripts are significantly different ($p \leq 0.05$).

Seedlings height

Data in Table (5) show that in terms of seedlings height, the highest values were found with the application of (commercial media) (14.67 cm), commercial media + biochar and commercial media + sawdust at 13.83 and 13.67 cm, respectively, in the first season, as well as 16.33, 14.83, and 14.83 cm, respectively, in second season. On the contrary, the lowest values were recorded with commercial media + soil, commercial media +chicken manure of squash seedlings. These findings support by Yamato *et al.* (2006) they found that mixture of peat and sawdust led to a good rooting substrate for seedlings and nitrogen, lignin, cellulose and it is capable of absorbing and retaining liquid, which allows it to be used wherever moisture needs then led to improve quality of seedling. Also, Ernsting (2011) reported that sawdust contains a lot of nitrogen, cellulose, and lignin. It’s a good loosening agent that improves soil structure and prevents cracking and crusting. It is capable of absorbing and retaining liquid, which allows it to be used wherever moisture needs to be reduced and it is soil processing by soil micro-organisms which is reflected in the quality of seedlings. In addition, the use of rice-husk char (perhaps biochar) increases the seedling's height, root biomass, and ultimate biomass of lettuce and cabbage (Carter *et al.,* 2013). In addition, peat can lower the pH of the medium and improve water retention, aeration, carbon (C), and various other macro- and microelements for seedlings when combined with biochar, this is consistent with the results in Table (3) for the analysis of the biochar growth environment. Additionally, it supplies oxygen and a reliable continuous water supply system without cutting the oxygen to the seedling roots, resulting in a good rooting environment for seedlings, and biochar increases seedling productivity by reducing the effects of abiotic stress factors including drought by increasing soil water holding capacity (WHC) and by maintaining the nutrient content by improving cation exchange capacity, as reported by Carter *et al.* (2013). These results may be because biochar contains a high concentration of stable organic carbon as well as eluted carbon. Several macro and microelements can be stored in the mineral fraction of biochar, which may act as a source of mineral substances for microorganisms in the soil (Saletnik *et al.,* 2016). This is in line with Table (3') analysis of the outcomes of the peat moss and biochar mixture.

Number of leaves per Seedling

Results in Table (5) showed that the sowing squash seeds in peat moss and vermiculite achieved the highest value of leaves number per seedling followed by commercial media + sawdust and commercial media + biochar; (4.00, 4.00, and 3.83), in the first season, and 3.83, 3.67, and 3.50, respectively, in the second season) with no significant difference among them. Where in both seasons. Meanwhile, the lowest values were recorded with commercial media + soil, commercial media +chicken manure. These results agreed with Logendra *et al.* (2001) they reported that sawdust caused increase the photosynthetic, which led to increases productivity. Also, Nichols and Savidov (2009) observed that the productivity of bell pepper and long English cucumber increased when sawdust was applied in comparison to perlite (as an inorganic substrate).

Seedling fresh weight

Presented data in Table (5) show significant effects for media on seedling fresh weight, where the highest values of seedling fresh weight were recorded with the application of commercial media, and commercial media + sawdust with no significant difference followed by commercial media + biochar treatment in both seasons. The obtained values were 4.50, 4.50 and 3.67 g, in the first season as well as 4.87, 4.58 and 3.30 g, respectively, in the second season.

On the other hand, the lowest values were obtained for fresh weight with commercial media + soil, commercial media +chicken manure.

These results may be due to that biochar improved soil physicochemical properties like pH, cation exchange capacity, soil water holding capacity, seedling-nutrient retention, microbial activity, and nutrient availability as reported by Lehmann and Joseph (2009). This is consistent with the results in Table 3 for the analysis of the biochar growth environment. The obtained results here are in agreement with Northup (2013) showed that seedlings grown in media containing biochar at 30% blended with 70% sphagnum peat were the best. Many biochar based substrates produced seedlings with shoot dry mass greater. In addition biochar decreased stomatal resistance and stimulating foliar (transpiration) gas exchange, and photosynthesis by increasing the electron transport rate of photo system and the relation between effective photochemical quantum yield (Haider *et al.,* 2015). Also, Khan *et al.* (2019) and Uslu *et al.* (2020) reported that, biochar significantly improved shoot and root dry weights, biomass of tomato seedlings.

Leaf Area

Data in Table (5) show significant effects for growing media on the leaf area of squash seedling.

Table 5. Effect of growing media on the vegetative characters of squash transplants.

Treatments	Seedling height (cm)	No. of leaves seedling^{-1}	seedling fresh weight (g)	Leaf area (cm^2)	Stem diameter (cm)	Seedling dry weight (g)	Growth vigor
				1st season 2021			
commercial media (control)	14.67a	4.00a	4.50a	47.8a	3.60a	0.55a	12.05a
commercial media + sawdust	13.67b	4.00a	4.50a	48.7a	3.63a	0.53a	10.90b
commercial media + biochar	13.83b	3.83b	3.67b	35.9b	3.40a	0.42b	10.70b
commercial media + soil	12.17c	3.17c	2.83c	34.4c	1.93b	0.38c	6.09c
commercial media + chick manure	9.25d	2.66d	1.98d	22.1d	1.51c	0.22d	0.99d
				2nd season 2022			
commercial media (control)	16.33a	3.83a	4.87a	57.8a	3.77a	0.61a	13.02a
commercial media + sawdust	14.83b	3.67a	4.58a	48.7b	3.83a	0.59a	11.48b
commercial media + biochar	14.83b	3.50a	3.30b	45.9b	3.53a	0.48b	11.30b
commercial media + soil	11.50c	2.83b	2.65c	34.4c	2.07b	0.36c	6.02c
commercial media + chick manure	9.53d	2.47c	2.08d	26.2d	1.48c	0.25d	1.25d

[a,b,c] The Duncan's multiple range test revealed that values with the same alphabetical letter(s) did not statistically differ at the 0.05 level of probability and Means in the same columns with different superscripts are significantly different ($p \leq 0.05$).

Table 6. Effect of growing medium types on Leaf photosynthetic pigments contents of summer squash transplants.

Treatments	Chl.a (mg. g^{-1} F.W.)	Chl.b (mg. g^{-1} F.W.)	Chl.a+ b (mg. g^{-1} F.W.)	Chl.a/b (mg. g^{-1} F.W.)	Carotenoids (mg. g^{-1} F.W.)	Total Chl (a+b+ Carotenoids)
				1st season 2021		
commercial media (control)	0.315a	0.362a	0.677a	0.871b	0.665a	1.342a
commercial media + sawdust	0.284a	0.330b	0.614c	0.861b	0.591b	1.205b
commercial media + biochar	0.301a	0.349ab	0.650b	0.864b	0.493c	1.143c
commercial media + soil	0.212b	0.277c	0.489d	0.771b	0.315d	0.804d
commercial media + chick manure	0.198b	0.217d	0.415e	0.912a	0.272e	0.687e
				2nd season 2022		
commercial media (control)	0.333a	0.350a	0.683a	0.951a	0.642a	1.325a
commercial media + sawdust	0.311a	0.339a	0.650a	0.921a	0.603b	1.253ab
commercial media + biochar	0.327a	0.347a	0.674a	0.943a	0.518c	1.192b
commercial media + soil	0.225b	0.262b	0.487b	0.859a	0.337d	0.824c
commercial media + chick manure	0.205b	0.209c	0.414d	0.981a	0.284e	0.698d

[a,b,c] The Duncan's multiple range test revealed that values with the same alphabetical letter(s) did not statistically differ at the 0.05 level of probability and Means in the same columns with different superscripts are significantly different ($p \leq 0.05$).

The highest values of leaf area were recorded with the application of peat moss and vermiculite (commercial media) and commercial media + sawdust followed by commercial media + biochar in both seasons (48.7, 47.8 and 35.9 cm^2, respectively, in the first season, while these values were 57.8, 48.7 and 45.9 cm^2, in the second season). On the other hand, the lowest values were recorded with commercial media + soil, commercial media +chicken manure. These results may be due to biochar and sawdust minimizing the impact of abiotic stress factors such as drought through increased soil water holding capacity (WHC) and by maintaining the nutrient content through improved cation exchange capacity, so it enhances seedling productivity as reported by Yamato *et al.* (2006). They added that eluted carbon (C) and stable organic carbon (C) are both present in high concentrations in biochar. Additionally, according to Michel (2010), peat moss is added to help seedlings receive nutrients and water continually. It features pores or air pockets that allow seedlings to receive oxygen. Additionally, due to a number of its physical characteristics, such as high porosity and water holding capacity (WHC), slow degradation ratio, and low bulk density, as well as favorable chemical characteristics, such as high cation exchange capacity (CEC), as previously mentioned, this is consistent with the results in Table (2, 3) for the analysis of the peat moss growth environment. Carter *et al.* (2013) who discovered that biochar treatments increased the end biomass, root biomass, and leaf production of lettuce and cabbage in all cropping cycles. In addition, Fascella (2015) stated that sawdust contains a lot of nitrogen, lignin, and cellulose. It is an effective loosening agent that enhances soil structure, guards against crusting and cracking, and promotes seedling growth. Hence, mixing both the biochar and sawdust with the peat moss improved the quality of the seedlings and the percentage of germination.

Stem diameter

Data in Table (5) showed that the highest values of stem diameter were recorded with application of, commercial media + sawdust (3.63 cm), commercial media (3.60 cm), and commercial media + biochar (3.40 cm) in the first season, but in the second season the values were 3.83, 3.77, and 3.53, respectively. The lowest value was recorded with commercial media + soil and commercial media +chicken manure in both seasons.

Seedling dry weight

Presented data in Table (5) appeared significant effects for growing media on seedling dry weight. The highest values of seedling dry weight were recorded with the application of commercial media, commercial media + sawdust, and commercial media + biochar treatments in both seasons. Where recorded values of 0.55, 0.53, and 0.42 g, in the first season and recorded 0.61, 0.59, and 0.48 g, respectively, in the second one. On the other hand, the lowest values of seedling dry weight were obtained with commercial media + soil and commercial media +chicken manure.

Growth Vigor

Results in Table (5) reported that the highest values of growth vigor per seedling were recorded with application of peat moss and vermiculite (commercial media) followed by commercial media + sawdust and commercial media + biochar in both seasons. (12.05, 10.90, and 10.70, in the first season, and 13.02, 11.48, and 11.30, respectively, in the second season) with no significant difference among them. Meanwhile, the lowest values were recorded with commercial media + soil, commercial media +chicken manure. Dhanda *et al.* (2004) indicated that seed vigor index are among the other germination traits are most sensitive to drought stress.

Leaves photosynthetic pigments content

Significant differences for contained seedling leaves of chlorophyll, and carotenoids were detected among studied treatments in both seasons (Table 6). The highest values of Chl. a, Chl. b, Chl. a+b, Chl. a / b and carotenoids were noted in both seasons, by commercial media, commercial media plus sawdust, and commercial media plus biochar treatments. These findings might be explained by the impact of agricultural wastes on vegetative development (Table 5), where, higher vegetative growth especially, leaves area, that reflected on higher photosynthetic prosses.

Seedlings leave N, P, and K content

Data in Table (7) demonstrate significant effects on seedlings' N, P, and K contents. In both seasons, the application of commercial media, commercial media + sawdust, and commercial media + biochar resulted in the greatest N, P, and K values, while the applications of commercial media + soil and commercial media + chicken manure resulted in the lowest values. These effects are positive might be because there were more nutrients available, which led to improved root development and enhanced physiological activity of the roots to absorb nutrients, which increased the concentration of those nutrients in seedling leaves (El-Sherif, 2006), this is in line with the findings of the analysis of growth media (sawdust, biochar), which revealed that these environments are rich in nutrients and C/N. These findings are presented in Tables **(**2 and 3).

Table 7. Effect of growing medium type on contents of N, P, and K of squash transplants leaves.

Treatments	N (%)	P (%)	K (%)
		1st season 2021	
commercial media (control)	1.275a	0.071a	0.416a
commercial media + sawdust	1.212a	0.063a	0.367b
commercial media + biochar	1.233a	0.067a	0.415a
commercial media + soil	0.971b	0.045b	0.285c
commercial media + chick manure	0.789c	0.033b	0.212d
		2nd season 2022	
commercial media (control)	1.147a	0.063a	0.386a
commercial media + sawdust	1.094a	0.053ab	0.348b
commercial media + biochar	1.120a	0.062a	0.374a
commercial media + soil	0.864b	0.041b	0.270c
commercial media + chick manure	0.753c	0.037b	0.222d

[a,b,c] The Duncan's multiple range test revealed that values with the same alphabetical letter(s) did not statistically differ at the 0.05 level of probability and Means in the same columns with different superscripts are significantly different ($p \le 0.05$).

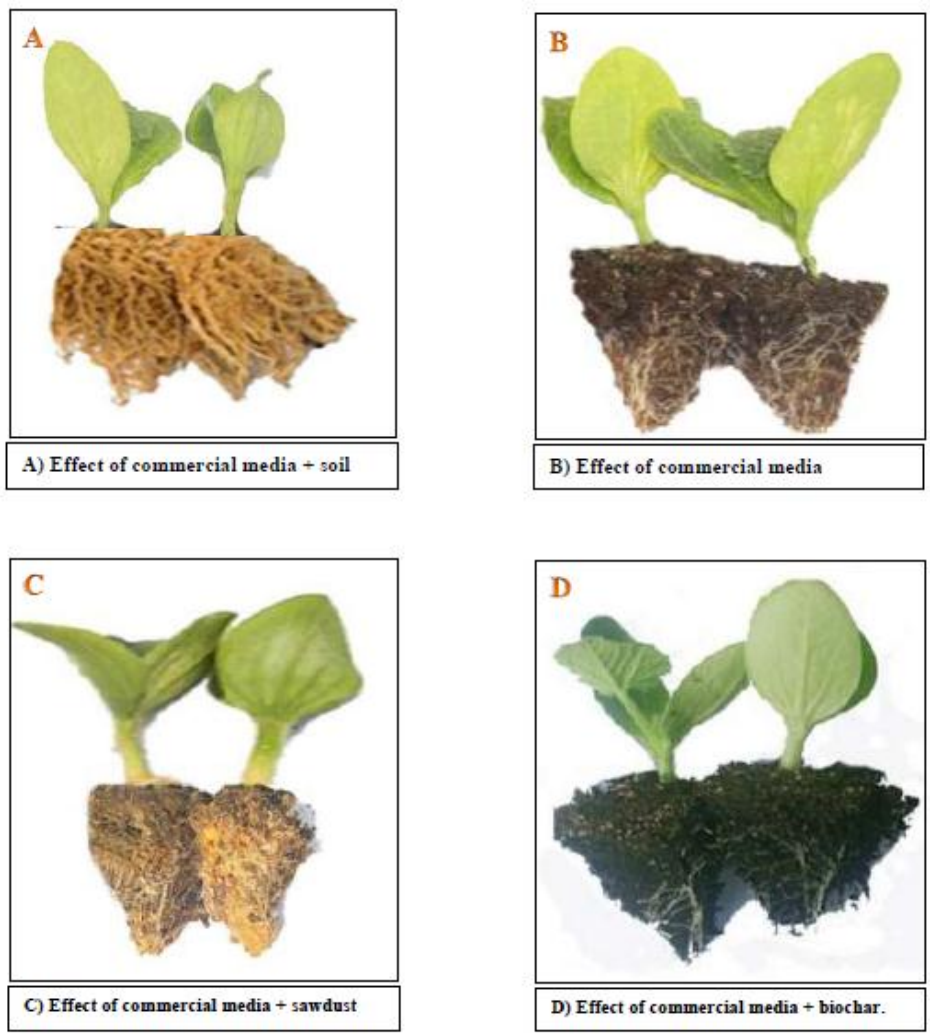

Fig.1. Photo showed the effect of alternative growing media on morphology seedlings of summer squash.

Table 8. Effect of Economic evaluation of medium type of squash seedlings (mean of the two seasons).

	(pv)	(pvs)	(pvb)	(pvls)	(pvc)
Management cost/tray (L.E)	82	82	82	82	82
Growing media cost/tray (L.E)	15	8.5	9.5	7.5	9
Total cost/tray (L.E)	97	90.5	91.5	89.5	91
No. of eyes in seedling tray	84	84	84	84	84
Germination percentage (%)	80.95	78.57	76.79	51.19	11.91
No. of seedling/tray	68	66	65	43	10
Transplant price production (L.E)	1.43	1.37	1.42	2.08	9.10
Relative transplant price production (%)	100.00	96.13	99.44	145.91	612.93

(pv): control treatment; (pvs): commercial media + sawdust;
(pvb): commercial media + biochar; (pvls): commercial media + local soil; (pvc): commercial media +chicken manure.
Management cost= Seed costs + labor cost + fertilizer cost + pesticide cost + irrigation cost
Total cost= management cost + growing media cost
Transplant price production (L.E) = Total cost per tray (L.E) / No. of seedling per tray

Economic efficiency:

Economic evaluation of using different growing medium types of commercial media for the production of summer squash transplants is shown in Table (8) and Fig (1). The best seedling price production (LE) was recorded with (pvs) commercial media + sawdust (1.37) followed by (pvb) commercial media+ biochar (1.42), (pv) commercial media (1.43) then (pvls) commercial media + local soil (2.08) respectively. Finally, the highest value of seedling price production was recorded by using (pvc) commercial media + chicken manure (9.10). The results in Table (8) showed the relative seedling price was decreased by rate 3.87% and 0.66% in commercial media + sawdust and commercial media+ biochar respectively compared with control treatment. Conversely, the relative seedling price was increased by rate 45.91% and 512.93% in commercial media + soil and commercial media + chicken manure, respectively, compared with control treatment.

CONCLUSION

Depending on these results we recommend using sawdust and biochar for producing transplants of summer squash under the Arish region, North Sinai conditions.

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الملخص العربي

استخدام بيئات نمو بديلة لإنتاج شتلات الكوسة بمنطقة شمال سيناء

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الهدف من هذه الدراسة هو استخدام بيئات نمو بديلة لإنتاج شتلات الكوسة في منطقة شمال سيناء. أجريت التجربة خلال فصلى صيف ٢٠٢١، و٢٠٢٢ – بالمزرعة التجريبية– بكلية العلوم الزراعية البيئية– جامعة العريش– شمال سيناء مصر–داخل المشتل. تم استخدام بيئات نمو مختلفة لإنتاج شتلات الكوسة صنف اسكندرانى حيث تم استخدام خمس بيئات: المعامله الأولى كنترول والتي كانت تتكون من البيتموس+ الفيرميكوليت بنسبه ١: ١ على أساس الحجم (البيئة التجارية)، المعاملة الثانية مكونة من البيئة التجارية + الفحم الحيوي، المعاملة الثالثة المستخدمه مكونة من البيئه التجارية + نشارة الخشب، المعاملة الرابعة المستخدمه مكونة من البيئه التجارية + التربة، المعاملة الخامسة مكونة من البيئة التجارية + سبله الكتكوت، كل ذلك بنسبه ١: ١ على أساس الحجم مع البيئة التجارية. الصفات التي تم قياسها هي: نسبة الإنبات، معدل الإنبات، جودة الشتلات والتي تم التعبير عنها من خلال الصفات المورفولوجية للشتلات (طول الشتلات، عدد الأوراق، الوزن الرطب، قطر الساق، الوزن الجاف وقوة النمو)، محتوى الأوراق من صبغات الكلوروفيل ومحتوى الأوراق من النيتروجين والفوسفور والبوتاسيوم. وقد أظهرت النتائج أن استخدام البيئة التجارية والبيئة التجارية + نشارة الخشب والبيئة التجارية+ الفحم الحيوي أدى إلى زيادة نسبة الإنبات وتحسين شكل الشتلات (ارتفاع الشتلات، عدد الأوراق، الوزن الرطب، قطر الساق، الوزن الجاف وقوة النمو)، محتوى الأوراق من صبغات الكلوروفيل ومحتوى الأوراق من نيتروجين وفسفور وبوتاسيوم مقارنة بالبيئة التجارية + التربة والبيئة التجارية + سبلة الكتكوت الذي كان له أقل القيم. بالإضافة إلى ذلك، فقد أوضحت الدراسة الاقتصادية أن استخدام نشارة الخشب والفحم الحيوي كبيئات لإنتاج شتلات الكوسة قلل من تكلفة إنتاج الشتلات بنسبة ٣,٨٧٪ و٠,٦٦٪ على التوالي مقارنة بالكنترول.

الكلمات الدالة: شتلات الكوسة، بيئات النمو، المخلفات النباتية.