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Using different organic wastes to improve the quality of desert soils and barley (*Hordeum vulgare*) plant growth

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Abstract

The concept of the public in food safety, as well as environmental aspects, has newly improved to crops cultivated with organic fertilizers instead of chemical fertilizers. A study was conducted on various organic wastes for the improvement of desert soils and the growth of *Hordeum vulgare* plants. Desert soil sample, *Hordeum vulgare* plants, different organic wastes (Waste food and Animals waste), were used in a completely randomized design with three replications. Five treatments were used included T1=control (without composts), T2=25%, T3=50%, T4=75% and T5 100% with composts. Soil chemical properties were influenced by the use of waste compost amendments. There was a decrease in the soil pH from 8.7 to 7.0 at 50% waste food and mixed compost treatments. The EC and TDS were increased under composite treatments however, the treatments at 75% waste food compost gave high values for the CEC 38.75 cmol/kg. The exchangeable Ca, Mg, Na, K, N were increased in compost treatments. NO3 was increased from 1.29 mg/kg (in control) to 1.41 mg/kg in soil treated with 75% food waste compost. Among composts, the applications of food waste compost at 10% gave the highest plant height (18.1 cm), the number of plant leaves (6), and root biomass (6.77g dry weight). The use of various composts particularly food waste compost can be used in desert soils to improve crop growth and yield of *Hordeum vulgare* crop.

Keywords: Compost; Desert soil; Food waste; Manure; Soil amendment.

1. Introduction

Organic waste is generated as a result of a consumerist lifestyle, typically from all our daily activities in a large variety. Organic waste generation rates will be more than double over the following twenty years in lower-income countries and on the other side, the costs of managing organic waste have risen. About five times in low-income countries and four times in lower-middle-income countries of wastes. The ever-increasing amounts of wastes are related to public and environmental health issues and odour from the landfills. The re-use of organic wastes for agricultural purpose to improve soil properties and increase crop yield is a good solution for minimizing these problems [1]. The most of the organic wastes pollute the water, air and soils. Particularly, solid wastes after burning produce CO_2 and NO_2, thus, these factors may cause for depleting the ozone layer [2].

Hydrogen sulphide also methane is released into the atmosphere and is poisonous to human's healthy beings. Soil quality refers to the capability of a precise category of soil to function, within natural or managed ecosystem limits, to sustain plant and animal productivity, maintain or improve the quality of water and air, besides support human health and habitation [3]. Due to the low levels of organic matter, desert soil is of poor quality [4].Organic matter is very

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important to the quality of any soil [5] and the use of both human and animal wastes as fertilizers and soil amendments on desert soils have been practiced since antiquity. The use of organic wastes has the potential to reduce some of the negative environmental effects associated with organic waste disposal and improve soil qualities, due to increased plant growth and yield. The essential nutrients (N, P, K, Mg and Ca) significantly perform a major role in the cropping system while nutrient unbalance issues are caused by nutrient deficient and light soil. Also, plants uptake nutrients from the soil as they grow, so these nutrients must be replaced. The recycling of essential plant nutrients is significantly assisted through the use of organic wastes in agriculture, sustaining soil security as well as protecting the environment from unwanted hazards. Organic wastes are the most common source of N and organic matter, optimizing soil properties characteristics and microbial activity that are related to the fertility of the soil. Bio-waste and food waste increase the content of N, CEC, water holding capacity (WHC) and microbial biomass in soil. With extensive tillage operations without the addition of organic matter, soil health is degrading. The OM content in soil can be increased by the adding of organic wastes for instance food waste, bio-waste, manure, sewage sludge, etc [5, 6]. Manure is a waste that enhances soil characteristics by contributing nutrients and increasing microbial and enzyme activity. Moreover, it decreases the toxicity of some heavy metals. These organic wastes have a powerful positive impact on the physical, chemical, and biological qualities of the soil, as well as promoting plant growth and thus improving the yield of crops. Food waste includes uneaten food and food preparation leftovers from residences, commercial establishments such as restaurants, institutional sources like school cafeterias, and industrial sources like factory lunchrooms. Normally, the majority of food waste is disposed of in a landfill [7]. Nowadays it is a public concern for reusing food waste as the environmentally sound as well as cost-effective usage of the biomass [7, 8]. Food waste also contains vital nutrients and it would be more beneficial to recycle them for agricultural purposes. Composting is a well-known method to manage food waste for converting material like a hygienic, humus-rich, and stable product that acts as a soil conditioner as well as a growth promoter for crop plants [9].

Improper waste management is a common practice that is not safe and can be replaced with safer waste management methods such as composting. The world is tending towards improving environmental and human health. Composting, which is a type of organic fertilizer, can help to achieve this goal. Focus on composting will cause a shift in the usage of chemical fertilizer in favour of compost. This shift will invariably promote environmental and human health by reducing the number of poisonous chemicals released into the environment. Composting is the technique of using microbes to convert degradable organic waste foods and into stable products. Composting is a long-used technology, though it has some shortcomings that have reduced its extensive usage and efficiency [10]. Transformation of organic (degradable) wastes can be aerobic or anaerobic, and compost is formed when aerobic conditions are fulfilled. When organic wastes are treated aerobically, biogas, as well as effluents that can be used as bio-fertilizers, is formed [11]. Composting is a safe way to dispose of wastes. Composting is an aerobic process where complex degradable materials are degraded and transformed by microorganisms into organic and inorganic by products [12]. Composting is the process of converting various degradable wastes into compounds that can be reused as bio-fertilizers and soil supplements [13]. Heavy metal-contaminated soil can be remedied with compost. Compost has been beneficial in degrading chlorinated and non-chlorinated hydrocarbons, wood preserving chemicals, solvents, heavy metals, pesticides, petroleum products besides explosives in soil [14].Hence, the study was undertaken to develop the soil quality of desert soils using locally available biomass compost waste material in the soil.

2. Material and methods

The study was carried out at the Department of Environmental science, Faculty of Engineering and Technology, Sebha University, Libya in 2019.

Soil sampling for the experiment: The experimental soil was collected from the uncultivated area from Brack city Al-Shatii South of Libya. Soil samples were collected at a depth of 0 to 20 cm using a standard soil sampling procedure. The sample was air-dried and sieved through a 2 mm sieve.

Plant: Barley (*Hordeum vulgare*) was used as the test plant as it is used as green fodder andin the manufacture of silage [15].

2.1. Different composts preparation

2.1.1. Waste food compost

Cooked and uncooked kitchen waste, vegetable, fruit and bread residues were used to prepare waste food compost, and test its role in improving the fertility of soil as well as plant productivity. The organic waste is cut and placed in anaerobic conditions with the addition of a little regular water when necessary to prevent drying of the treatment and stirring twice a day till becomes slightly smelly and similar to soil (Fig 1a-c).

Figure 1a-c Waste food compost (a) Waste food, (b) Dried waste food and (c) after mixing of waste food

2.1.2. Animal manure compost

Animal wastes consisting of goat and sheep manure were used as animal fertilizer in the treatments to test its role in improving soil fertility and plant productivity Animal manure was collected and placed in anaerobic conditions, with the addition of regular water when necessary to prevent dehydration. The change continues until the colour of compost changes, the smell disappears, and the material becomes grey, and the fermentation period for this fertilizer took three months. Air dry sheep manure was collected and kept in polythene bags for usage in the experiments (Fig 2 a-b).

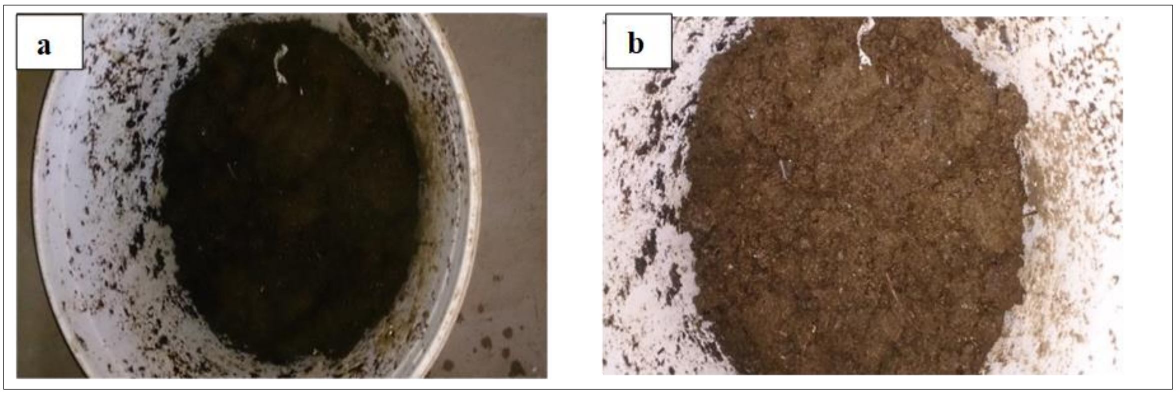

Figure 2a-b Mixing of different composts (a) Before mixing compost and (b) After mixed compost

2.1.3. Mixed composts

Equal quantities (1:1w/w) of waste food compost and animal manure compost were used for the same previous purpose. An amount of animal manure compost and waste food compost manure was mixed after preparing them in a ratio for testing in treatments

2.1.4. Soil physico-chemical properties

The water holding capacity tested soil was determined by placing 100 g of tested soil in PVC columns with fine mesh cloth at the bottom. The samples were submerged in water for 48 hours before draining. The samples were weighed both before and after drying in an oven at 60 C for 4 days [16]. The water holding capacity (WHC) (% volume) was calculated as [wet weight dry weight)/volume] × 100. Soil texture was assessed via by pipette method [17]. The soil pH, EC and TDS were determined in water solution 1:1 [18]. Where the soil pH of the soil solution was measured using the pH meter - ELE model 3310 [19] and the electrical conductivity (EC) was measured by an electrical conductivity meter and it was calculated in dS/m unit at 25 °C by following equation [19].

$$EC25^{º} = ECt \times f$$

Where: Ect = conductivity measured at any temperature; f = correction factor.

The total dissolved salts were calculated manually from the values of electrical conductivity according to the equation mentioned by Aishah and Elssaidi [5] ,Organic matter was done followed by was determined using potassium dichromate volumetric method [20], extractable phosphorous and potassium were determined using by AB-DTPA method [18] . The Na, Ca, Mg and NO3 were analysed using ammonium acetate pH 7.0 [21]. Calcium and magnesium ions were determined by titrimetric method with EDTA using E. B. T and Murexid reagents [18]. Sodium and potassium ions were estimated via a Flame photometer [18]. The NO3 were estimated via spectrophotometer at λ 220 and 275 nm [18].

However, the total bacterial counting of the soil samples was estimated before and after the cultivation process by dilution method, 1 gram of soil samples was placed in a tube with a capacity of 10 ml distilled water and shaken well. Then, one ml of the sample was taken and planted on pre-prepared Petri dishes by the environment of the nutrient agar separately, at a rate of three replicates for each sample. After that, they were incubated at 25 °C for three days. The developing bacterial colonies were counted on the plates [22].

2.1.5. Composts Analysis

The chemical properties have been tested for all types of composts after drying by air for three days. A fifty (50) grams of compost was taken and 250 ml of distilled water (fertilizer solution 1:10) was added. The pH and EC of the composts solution were measured by pH meter - ELE model 3310and the electrical conductivity (EC) by electrical conductivity meter. The concentrations of sodium were measured using a flame photometer [18].

2.1.6. Pot Experiment

The pot experiment was conducted at the Environmental Science Department, Faculty of Engineering and Technology, Sabha University, Libya. The study was conducted under controlled conditions in the laboratory. Three replications of one kilogram of desert soil were placed in plastic pots and well homogenized. Five treatments used to test plants, which included T1 –control 0% (without Composts), T2 = 25% Composts, T3=50% Composts, T4=75% and T5 100% Composts. The pots were watered with enough water equal to field capacity. *Hordeum vulgare* was cultivated as a test crop on soils treated with various rates of compost according to recommended agronomic practices. Six seeds per pot were planted. With three replications, the experiment was conducted in a completely randomized design (CRD).

2.1.7. Data Recording

Measuring tape was used to measure the height of the plant starting from the base of *Hordeum vulgare* plants to the tip of fully developed leaves. The plants were harvested 6 weeks after planting when they had reached their maximum root and biomass development. The soil and roots were separated from each other by immersing the roots and the rhizosphere soil into a bucket of water and carefully loosening the soil in the bucket. The roots separated from soil masses were washed out by applying a jet of water from tap water. A digital balance was used to determine the fresh weight of plants per pot immediately after harvesting. A measuring tape was used to measure the root length, after drying all of the harvests at 105°C for 48 hours, the total dry shoot and root biomass was determined [23].

3. Results and discussion

3.1. Soil Physico-chemical properties of experimental soil

The Physico-chemical characteristics of the studied soil before planting are shown in Table 1.The percentage (%) sand, silt also clay of the soil before use of amendments was95.04, 3.56and 1.40 % respectively that indicating the sandy soil.

The pH of the soil was 8.7 which indicate that the soil is alkaline, EC was 0.33dS/m indicating non-saline and soil field capacity (FC) was 16.00%.The exchangeable Na, K content of the soil was 0.40mg/kg. While exchangeable Ca was 30 mg/kg. However, the amount of Na, Ca, K, Mg, and OM in the arid soil was low and the pH of the soil indicates that it is alkaline. The NO3content of the tested soil was 1.09mg/kg which is considerably low. The available phosphorus content of the desert soil was very low compared to the critical levels (5.48 mg/kg) this in line with [5]. The primary purpose of NO_3 is to work as a source of nitrogen for the nutrition and growth of plants as well as soil microorganisms. The results showed that the number of micro-colony in tested soil was 44×10-5 CFU bacterial colony/1ml.

Table 1 The Physico-chemical properties of the soil before planting

Properties	Units	Data	
Texture	Sand%	95.04	Sandy soil
	Silt%	3.56	
	Clay%	1.40	
pH	-	8.70	
EC	dS/ m	0.33	
FC	%	16.00	
TDS	mg/l	211.20	
CEC	cmol /kg	5.71	
OM	%	0.30	
Na	mg/kg	0.40	
K	mg/kg	0.40	
Ca	mg/kg	30.00	
Mg	mg/kg	1.20	
P	mg/kg	5.48	
NO_3	mg/kg	1.09	
Bacterial colony count	Bacterial colony/1ml (CFU)	44×10^{-5}	

3.2. Compost chemical properties

Composting is a crucial agricultural practice that assists in the recycling of organic waste. The practice of recycling organic food waste compost as a crop fertilizer can be eco-friendly, both solving a waste management issue and minimizing chemical fertilizer costs. Composts were subjected to chemical analysis to determine the concentration of the nutrients present in them. The composition of the two kinds of composts is given in Table 2. The results obtained (Table 2) indicated noteworthy differences between the two types of tested composts. There were noteworthy differences between pH the two types of composts. The pH value of the animal waste compost was neutral (7.10) and acid for food waste compost (5.90).The availability of plant nutrients is mainly dependent on the pH of the growth media. The best pH values are between 6 and 7for most of the plants. The EC values were similar for the two types of tested composts (6.90dS/m). High salts concentration can harm plants. The EC value is critical for greenhouse potting mixes and critical for farmland use, especially in dry areas. The best EC value is not higher than 4.0 dS/m [24].

The TDS and Na concentrations were not significantly different between the two types of tested composts. Additionally, compost mainly contains mixed nutrients (Table 2). The Potassium (K) content was higher in the compost of food waste (287.50mg /kg) compared to animal waste compost (256.60mg/kg). The K is an element that is necessary for plant growth. It promotes plant growth, carotene, and chlorophyll contents [25]. It assistances the vigour and plants colour. It is needed for the plant to produce sugars, resist disease as well as survive adverse weather conditions such as drought and cold. Potassium deficiency in plants can cause scorching and browning of the tips of older leaves, which progresses to the total leaves with time. Potassium deficit could also be correlated to weak stalks. However, Ca content was higher in the animal waste compost (98.00mg /kg) compared to food waste compost (70.00mg kg). Similarly, Mg content was higher in the animal waste compost (22.8 mg/kg) compared to food waste compost (3.60 mg/kg), animal manure is widely recognized as a significant source of nutrients for improving soil structure and crop yields. While food waste compost had higher phosphorus (P) content (20.60 mg/kg) than animal waste compost (15.70 mg/kg). The phosphorus is a necessary component of the complex nucleic acid plant structure that controls protein synthesis. Therefore, it is critical for plant cell division, the formation of new tissue, also transformations of complex energy. The addition of P fertilizer to soil promotes root growth and often hastens maturity in plants. P deficiency causes stunted growth, poor seed and fruit development, delayed maturity, and there could be a change in the colour of the matured leaves to characteristic dark blue to blue-green colouration in plants. Compost is informed to have the exact amount of P for plant growth [5, 26]. Agreeing to Kammoun, et al. [27], composts are worthy sources of substantial P required for plant growth. On the other hand, nitrate (NO_3) content was higher in the animal waste compost (3.01 mg/kg) compared to food waste compost (1.46 mg/kg). According to Khater [26] the criteria of nitrogen (N), phosphorous (P) and potassium (K) in organic fertilizer are stated that N content must not be less than 1.00%, but the P and K content must not be less than 1.50%. In addition, the fertilizer must be the source of calcium, zinc, and copper, besides other essential micronutrients in the range from 0.01 to 0.05%. Nitrate (NO3) is a form of inorganic nitrogen (N) naturally occurring in soils. Nitrate ions are immobilized and taken up by microorganisms then changed into organic forms and released back to the soil in plant-available forms when dead soil organism's are decomposing or fed upon. However, ammonium, as well as nitrate-nitrogen, is a plant-available N form, but high values of ammonium nitrogen can harm plants and its concentration in compost must be less than 500 mg/kg dry weight. In aerobic conditions, ammonium nitrogen is easily changed into nitrates. The concentration of nitrate-nitrogen must be between 200 and 500 mg/kg dry weight of compost. Low values show a lack of plant-available nitrogen [24].

Table 2 Compost chemical properties

Properties (Units)		Animal waste compost	Food waste compost
pH	-	7.10	5.90
EC	dS/m	6.90	6.90
TDS	mg/L	4.41	3.90
Na	mg/kg	409.30	403.60
K	mg/kg	256.60	287.50
Ca	mg/kg	98.00	70.00
Mg	mg/kg	22.80	3.60
P	mg/kg	15.70	20.60
NO_3	mg/kg	3.01	1.46

According to Ayilara et al. [16] the factors affecting composting are long-duration composting, the mechanism behind it, the styles of composting besides prospects. The separation of mono-fertilizers from compost, the development of strips to test for pathogens, heavy metals, and an odour-trapping approach could all help to improve composting procedures. The ability of an organism to degrade organic matter is depending on its ability to create enzymes that degrade cellulose., hemicellulose, also lignin. The more complex a substrate is the enzyme needed to organic matter biodegrade [28]. Also, odour is continuously a common issue in composting. Insects degenerate large biomolecules of wastes into forms of nutrients that can be recycled to assist plant growth. It is imperative to note that some insect species which have been tagged "problematic" might be of benefit during composting [29, 30].

3.3. Effects of different types of composts on sandy soil properties

Composts contribute to the good fertility of the soil [10]. The data in Table 3 shows the impact of amendments on the parameters of sandy soil. The amendments improved the sandy soil's characteristics slightly. As the results show, the soil alkalinity was slightly decreased because of a significant decrease in pH for all treatments. There was an appreciable decrease in the pH of soil from 8.7 to 7.00 at 50% waste food and mixed compost treatments. The pH of the soil is an indicator of soil acidity or alkalinity. It is defined as the negative logarithm of the activity of hydrogen ions in a soil suspension. It was observed that EC and TDS were increased under compost treatments, over the control. The increase in EC is typically attributed to the level of TDS of the composts that would accrue in the soil when the composts usage, which causes accumulate less soluble salts in the sandy soil, this in agreement with Fuentes et al. [31] who noticed that using organic wastes enhanced EC. Similarly, CEC values were increased under compost treatments compared to the control treatment. In treated soil by waste food compost, CEC was found to increase following wastewater application, this indicates nutrient accumulation as a result of applied waste food compost, where the higher value was 38.75cmol/ kg for 75% waste food compost treatment. It further was showing a direct effect of waste food compost on sandy soil chemical characterization. Compost treatments influenced the amounts of OM. The higher rate of waste food application (75%) resulted in a greater amount of OM (12.2%). While the rate of 75% of animal waste resulted in 20.8% OM but the higher the rate of 75% of mixed compost resulted in 18% OM. As a result of the addition of manure, OM increased significantly compared to a mineral fertilizer application. Similar reports were found by numerous researchers [5, 8, 32] and that OM in the soil is increased through the adding of organic wastes. Organic wastes, for instance, manure and food waste are worthy sources of plant nutrients. Soil organic matter is necessary for maintaining soil fertility also reducing nutrient losses. Organic matter is defined as the present ratio of the dry amendment. Low values less than 30% generally indicate that organic matter has been mixed with soil or sand [24]. Moreover, the results showed that the evaluated Ca, Mg, Na, K, Nin adding to P was improved via the application of composts (Table 3). Mostly, composts treatments increased the Ca, Mg, Na, K, N and P in tested soil. The exchangeable Ca, Mg, Na, K, N were increased under compotes treatments, over the control treatment. Composts amendments increase macronutrients in treated soil. Fuentes et al. [31] found that the organic wastes used enhanced the availability of soil nutrients, such as available N and P contents were enhanced in soil. Moreover, by the addition of compost, available P was higher than in the untreated soil. Organic amendments increase macronutrients in soil [31]. NO3concentrations are consistently lower in no-treated soil (control) than in treated soils and were related to the number of composts applied. It found that the concentration NO_3 was increased from 1.29 mg/kg in control to 1.41 mg/kg in soil treated with 75% food waste compost, and form 1.29 mg/kg in control to 1.26 mg/kg in soil treated with 75% animal waste compost, and form 1.29 mg/kg in control to 1.36 mg/kg in soil treated with 75% mixed compost. The availability of P in treated soil varies after application of organic wastes composts, where the higher value was recorded 42.4mg/kg for 75% mixed compost treatment, flowing by 31.1 mg/kg for 75% waste food compost treatment and 27.6 mg/kg for 75% animals compost treatment. Soil fertility is related to the mineralization of nutrients in organic matter and their release into the soil solution in plant-available form. Mineralization occurs as a result of normal biological cycles in the soil, and it can be encouraged by the addition of high-quality compost.

Table 3 Effects of compost treatments on soil properties

	Treatments	**pH**	**EC**	**TDS**	**CEC**	**OM**	**Ca**	**Mg**	**Na**	**K**	**NO_3**	**P**	**Bacterial colony forming unit (CFU)**
	(%)		**dS/ m**	**ppm**	**cmol/ kg**	%	**………………mg/kg………………**						**$\times 10^{-5}$**
control	0	8.7	0.330	211.2	5.71	0.3	30	1.2	0.04	0.04	1.29	6.02	44
Waste food	5	7.2	9750.	612.4	25.33	0.8	30	3.6	0.10	0.06	1.35	12.8	183
	10	7.4	8140.	520.9	26.31	4.00	34	3.6	0.12	0.09	1.29	14.1	415
	25	7.6	2.31	162.56	27.32	4.8	60	3.9	0.16	0.20	1.38	14.5	210
	50	7	2.540	147.8	35.81	8.0	76	8.4	0.96	0.23	1.35	29.5	256
	75	7.8	313.	212.4	38.75	12.2	88	10.8	1.6	0.30	1.41	31.1	186
Animal waste	25	7.7	4360.	149.12	33.4	2.8	30	3.6	0.06	0.06	1.30	10.5	135
	50	7.6	2.33	279.04	35.87	4.2	58	15.6	0.1	0.91	1.28	19.2	150
	75	7.9	8312.	531.84	36.9	20.8	86	20.4	0.1	1.01	1.26	27.6	162
Mixed	5	7.4	6110.	391.04	25.2	1.8	40	3.6	0.08	0.09	1.29	9.3	246
	10	7.6	9160.	586.24	28.9	7.00	50	6	0.06	0.11	1.30	11.0	216
	25	7	1.279	818.5	30.1	14.0	60	9.6	0.14	0.23	1.33	16.2	143
	50	7.7	352.	1050	32.1	14.5	64	10.8	0.21	0.47	1.37	25.0	147
	75	7.6	283.	2099	37.8	18.0	86	15.6	0.19	0.49	1.36	42.4	175

Composts play a significant role in soils, both in their chemical structure and as a medium for biological activity. The enhancement of soil biology is one of the most important benefits of compost use. The results of the current study indicated the impact of various composts on the biological characteristics of tested soil (Table 3). Microbial activity increased in the order: Waste food compost >Mixed compost >Animal waste compost >Control. However, the microbial activity was higher in the compost amended soils when compared with the control soils (44 ×10-5 CFU Bacterial colony/1ml), where the higher number was recorded 256×10-5 Bacterial colony/1ml for 50% waste food compost treatment, followed by 246×10-5 (CFU) Bacterial colony/ ml for 5%. Mixed compost treatment and 162×10^{-5} bacterial colony forming unit/ml for 75% animal waste compost treatment. Both the microbial community in the compost substrate and the soil-borne microbiota of soils are stimulated by composts. The application of compost has increased microbial activity in comparison to the control soils due to the presence of organic matter in compost which affords food to the microorganisms, it might be soundly said that these microorganisms have an important role in determining the functioning of the soil structure depend on the supply of available carbon, the resident microbial community is the important factor in the biodegradation and conversion process during composting [32].

3.4. Effects of composts application on in of tested plant (*Hordeum vulgare*)

As a result of its various positive effects on the physical, chemical and biological soil characteristics, Compost contributes to the improvement of crop quality and stabilization as well as productivity. Table 4 shows the effect of composts treatments on *Hordeum vulgare* height. The maximum plant height (18.1cm) was obtained from the pot that received 10% waste food compost treatment. The findings demonstrated that a moderate amount of compost increases the height of the plant's studies. *Hordeum vulgare* grown in pot treated with 25,50 and 75% waste food compost were shown the negative effect on plant growth, might be due to fewer nutrients over composting, the applications of animals' manure compost gave the highest value (16.1 cm) of plant height at 5% treatments, followed by mixed compost at 50% treatment (13.5 cm). The purpose of the agronomic assessment of compost is to determine the impact of the composts on the growth of tested plants. As a result of the nutrients present in the composts, compost has been informed to improve crop yield [33, 34]. It is, consequently very important to assess the nutritional worth of composts and as well add nutrient-rich substrate to increase its nutritive and agronomic values. Compost has been shown to enhance crop yields due to the nutrients present in them [33, 35]. Manner compost has been shown low nutrient status, which did not increase the growth of the tested plant. It is, hence very important to investigate the nutritional value of composts and as well add nutrient-rich substrate to increase its nutritive besides agronomic value. But tested plants could not grow at 25%, 50%, 75% waste food compost and animals compost treatments. On other hand, *Hordeum vulgare* was grown successfully under 50% mixed compost treatment. Organic materials with a high C:N ratio is unsuitable for microorganisms to use, making them difficult to compost and reducing their potential to release nutrients [36].

Table 4 Effect of various composts on the plant height of *Hordeum vulgare* during the planting period

Treatments	duration	Plant height (cm)		
		Food waste compost	Animals waste compost	Mixedcompost
Control	1th week	0	0	0
	2nd week	3.3	3.5	3.12
	3rd week	3.5	4.35	7.1
	4th week	4.9	7	5.6
	5th week	7.35	9.3	7.25
	6th week	6.2	8.05	5.85
	mean	4.21	5.36	4.82
% 5	1th week	0	0	0
	2ndweek	0	5.6	0
	3rd week	0	10.6	0
	4th week	8.7	13.8	7.02
	5th week	13.1	15.7	8.5
	6th week	15.8	16.1	9.6

	mean	6.27	10.30	4.17
% 10	1th week	0	0	0
	2nd week	0	4.36	1.5
	3rd week	4.9	3.8	1.9
	4th week	11.3	12.5	7.5
	5th week	12.3	12.7	7.7
	6th week	18.1	12.9	11.4
	mean	7.77	7.71	5.00
%25	1th week	0	0	0
	2nd week	0	0	1.5
	3rdweek	0	0	1.2
	4th week	0	0	2
	5th week	0	0	3.6
	6th week	0	0	6.1
	mean	0	0	2.40
%50	1th week	0	0	0
	2ndweek	0	0	0
	3rdweek	0	0	0
	4th week	0	0	1.5
	5th week	0	0	7.5
	6th week	0	0	13.5
	mean	0	0	3.75
%75	1th week	0	0	0
	2ndweek	0	0	0
	3rd week	0	0	0
	4th week	0	0	0
	5th week	0	0	0
	6th week	0	0	0
	mean	0	0	0

Table 5 shows the impact of composts on several plant growth characteristics such as plant height, leaf number, and biomass of *Hordeum vulgare*. The growth of the tested plant was enhanced via different composts treatments. Among the composts, the applications of food waste compost at 10% gave the highest Number of the plant leaves (6), and the highest root biomass (15.91g wet weight and 6.77g dry weight). However, the applications of mixed compost at 10% gave the highest plant biomass (8.65 g wet weight, 3.50g dry weight). The pot experiment confirmed that the optimum food waste compost and animals waste compost rate for the test plant (*Hordeum vulgare*) is in the range of 5 to 10% for mixed compost. The lower rates of the compost gave better reports for plant growth whereas, greater rates depressed plant growth [37].

The application of organic composts has proven their positive effects on the growth enhancement of several crops. In addition, the application of various composts such as tea compost, fruit wastes, poultry manure and other animal composts positively increased different growth parameters of crops. On the other hand there are some negative effects associated with compost application. Some composts could increase soil salinity or have some heavy metals that may cause animal and human health. Besides this composts could make more water retention with low air holding capacities [38]. Hence, there is a great need to assess and analyse the composition of composts to assure safe and optimum compost application. Furthermore, pollutant migration and transformation can be discovered before compost applications [39, 40, 41, 42]. There should be proper knowledge about the handling, application rates and suitable timing are needed to reduce or even avoid negative impacts on soils and the environment.

Table 5 Effect of various composts on the plant number of leaves and plant biomass of *Hordeum vulgare* during the planting period

Treatments	Rates	Number of leaves	Shoots		Roots	
			Wet Weight	Dry Weight	Wet Weight	Dry Wight
			………………… (g) …………………			
Control	0%	4	0.79	0.12	0.89	0.22
Food waste compost	5%	4	4.77	0.91	15.91	6.77
	10%	6	7.07	1.74	11.08	2.56
	25%	0	0	0	0	0
	50%	0	0	0	0	0
	75%	0	0	0	0	0
	mean	2	2.368	0.53	5.398	1.866
Animals waste compost	5%	3	0.57	0.16	0.83	0.04
	10%	4	1.50	0.26	3.41	0.45
	25%	0	0	0	0	0
	50%	0	0	0	0	0
	75%	0	0	0	0	0
	mean	1.4	0.414	0.084	0.848	0.098
Mixed compost	5%	4	6.79	1.53	6.87	0.5
	10%	4	8.65	3.50	5.81	2.56
	25%	2	0.10	0.4	0.03	0.19
	50%	1	0.17	0.07	0.13	0.04
	75%	0	0	0	0	0
	mean	2.2	3.142	1.1	2.568	0.658

4. Conclusion

Composting is the natural decomposition and recycling of organic waste into a humus-rich soil supplement. Compost created from animal and food waste can be used as a vital nutrition source in agricultural fields while also helping to reduce environmental pollution. The application of various composts greatly influenced and improved essential nutrients and organic matter of the tested sandy soil. The various composts applied to the soil influenced the plant growth parameters of barley (*Hordeum vulgare*).The lower rates of the compost gave better results for the plant growth parameters. However, food waste compost showed better results among the composts applied to the tested soil. Hence, this study could be used as an indicator for future research to improve desert soils for better crop cultivation.

This study discovers the use of different types of organic wastes to improve the Quality of desert soils and barley (*Hordeum vulgare*) Plant Growth. Our findings show that the reuse of organic composts has been proven good environmental conditions for agriculture development and desert soils restoration. In addition, the study will help the researchers and growers to explore such bare soils for the improvement and make able for crop cultivations using by such type of organic wastes. Thus, a new way area can be focused in future particularly in water shortage areas.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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