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Effect of Irrigation Method and Compost Type on the Growth and Yield of Broad Bean (Vicia faba L.)

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Abstract

A field experiment was became performed at the College of Agriculture and Marshlands, University of Thi-Qar, 2022-202**3**, to study the consequences of irrigation methods (surface irrigation and basin irrigation) and compost kind (local and imported) soil properties consisting of (bulk density, moisture content, field capacity and mean weighted diameter) and growth indicators (plant height, number of branches per plant, leaf area, number of leaves per plant, and dry weight of plant) as well as the yield of broad beans (number of pods per plant, number of seeds pod, weight of 100 seeds, plant yield, and total seed yield).

The experiment was conducted according to a split-plot system in a randomized complete block design, with main plots representing irrigation methods and subplots representing compost types, in triplicate, resulting in a total of 18 experimental units. Least significant differences (L.S.D) at the 0.05 probability level were used to compare treatments.

The results showed that basin irrigation outperformed surface irrigation, and local compost was superior to imported compost in improving physical soil properties by reducing bulk density, increasing moisture content and field capacity and mean weighted diameter. Additionally, both the growth indicators and yield were significantly improved by increasing plant height, number of branches per plant, leaf area, number of leaves per plant, dry weight of the vegetative part per plant, number of pods per plant, number of seeds per pod, weight of 100 seeds, individual plant yield, and total seed yield.

I. Introduction

Vicia faba L., commonly called a broad bean, is one of the crucial wintry weather legume plants characterized with the aid of its excessive protein content material, making it a enormous supply of green protein. Thus, it performs an important position inside the eating regimen of populations, specifically people with restricted profits. Furthermore, it's miles crucial for enhancing soil fertility houses via the procedure of nitrogen fixation in the soil (Kandil, 2007). Broad beans are broadly cultivated as an crucial meals crop within the Middle East and are applied not simplest for human consumption however also in animal feed production. Additionally, they serve as green manure in poor soils, and their useful results stem from the interest of rhizobial bacteria (Chafi and Bensoltan, 2009). Therefore, attention must be given to their cultivation and the adoption of optimal management practices for both soil and crop to achieve the best growth and yield.

Irrigation is a fundamental pillar for increasing agricultural production worldwide, and its importance amplifies in arid and semi-arid regions where rainfall is insufficient for crop growth and reaching economic production stages. Due to the increasing demand for water driven by diverse human activities, it is necessary to reconsider water exploitation, distribution, and consumption efficiency. Soil and water management programs are critical in this regard, particularly the selection of appropriate irrigation methods that achieve the highest water use efficiency while maintaining good physical properties of the soil and providing favorable conditions for plant growth.

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Irrigation methods are divided into traditional methods, such as surface irrigation, and advanced irrigation technologies, such as sprinkler and drip irrigation, both surface and subsurface. Surface irrigation is among the most common and simplest methods, characterized by low initial costs, and is preferred for soils that have good water retention capacity and low permeability, such as clayey and loamy soils. However, due to water wastage through surface runoff, evaporation, and deep percolation, this method exhibits low efficiency in water use, (Jasim el al.,2017, Al-Ruwaishdi,2014 and Abedi-Koupai et al., 2001). Therefore, continuous evaluation of the irrigation system is essential, particularly in estimating irrigation efficiency.

Basin irrigation is one agricultural practice aimed at reducing salt effects. Salts tend to move and accumulate at the top of the furrow, depending on the nature of water movement, especially when evaporation rates from the soil surface are high. This keeps plant roots away from the direct effects of salts, particularly in shallow furrows (Abdullateef el al., 2022 and Ati et al., 2016).

Compost is produced through the fermentation processes of plant and animal residues, which go through several stages marked by gradual temperature changes. Initially, the temperature rises above 65°C, followed by a decrease to ambient temperature, indicating that the compost is maturing. It also features an unpleasant odor and a spongy texture. The fermentation process necessitates aeration and moisture levels of approximately 50%, Al-Taii et al., 2014.Adding compost to the soil improves its physical properties, such as reducing bulk density and increasing the soil's water-holding capacity. It also enhances soil structure and increases its productivity, which positively reflects on crop growth and boosts yield per unit area, (Adugna.,2016 and Edwards et al,.2011) . Salman and Abdul Wahab (2016) observed a significant increase in some growth traits of the turnip crop when using compost. Additionally, Abdul Hamid, Bahia (2022) found that the addition of 20 tons of compost per hectare increased turnip yield to 44.96 tons per hectare, compared to the control; where the lowest value of 33.12 tons per hectare was obtained.

The aim of the study is to investigate the effects of surface irrigation, basin irrigation, and both local and imported compost on the physical properties of the soil, as well as on the growth and yield of broad beans. The study seeks to determine which irrigation method and type of compost improved the soil and plant characteristics.

II. Materials and Methods

A field experiment become performed at the Agricultural Research and Experiment Station of the College of Agriculture and Marshlands all through the wintry weather season of 2022-2023 to analyze the effects of irrigation strategies (surface and basin) and compost type (local and imported) compared to a manage without compost addition. The compost was applied prior to planting and blended into the surface layer at a rate of 20 tons in per hectare.

The experiment was organized using a split-plot design within a randomized complete block framework. In this setup, the main plots represented different irrigation methods, while the subplots corresponded to various types of compost. Three replicates were added to the test, resulting in 18 test sets. Least significant differences (L.S.D) at the 0.05 level of significance were used to compare treatments.

Before planting, soil preparation and tillage were conducted using a four-body moldboard plow to a depth of 25-30 cm. This was followed by double-disc harrowing to a depth of 7 cm to ensure the soil was smooth.

Two types of compost were utilized: the local compost produced from the decomposition of Kino Karpus residues, obtained from the Agricultural Extension Directorate in Thi-Qar Governorate, and the imported compost. These two types were compared against the control treatment. Both compost types were analyzed and utilized in the experiment, as shown in Table 1.

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Table 1: Some properties of the compost used in the experiment.

Local Compost			
O.M	**C**	**EC**	**pH**
8.32 %	30.76 %	1.32 mmohs cm^{-1}	6.2
Water Holding Capacity	**C/N**	**SI**	**CEC**
%19.23	15.29	1.10	34.12 meq $100g^{-1}$
Imported Compost			
O.M	**C**	**EC**	**pH**
7.12 %	26.33 %	2 mmohs cm^{-1}	6.8
Water Holding Capacity	**C/N**	**SI**	**CEC**
%17.45	14.77	1.22	30.32 meq $100g^{-1}$

After finalizing the experimental layout, the local variety of broad beans was planted according to the treatments, with a spacing of 75 cm between rows and 20 cm between holes. Soil and water samples were collected and analyzed, as shown in Table 2.

Table 2: Some physical properties of the soil in the experimental field.

Soil Texture			Organic Matter (%)	Bulk Density (mg m^{-3})	Water Content %
Silt %	**Sand %**	**Clay %**			
371	63	565	%1.34	1.292	12.16
Water	**EC (ds m^{-1})**	**pH**	**CEC meq $100g^{-1}$**	**EC (ds m^{-1})**	**pH**
	3.04	7.72	33.05	2.65	7.33

The soil physical properties were studied :

Bulk Density : The bulk density of the soil was measured using the core sampling method which described by Black et al. (1983)

Soil Moisture Content : The soil moisture content was estimated using the method described by Black et al. (1965).

Field Capacity: determined using the pressure plate extractors.

Weighted Mean Diameter: It estimated using the method described by Black et al. (1965).

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The following growth and yield traits were studied:

A. Vegetative Growth Traits:

(a). Plant Height (cm): Measured using a measuring tape from the base of the plant to the top leaf after the flowering stage was complete.

(b). Number of Branches per Plant: Counted after the flowering stage was completed.

(c). Leaf Area per Plant (cm^2): Measured by taking leaf samples and determining the leaf area through the dry weight of the leaf. The leaf was first weighed, then placed in a square of known area, weighed again, and dried in an electric oven at 70°C until completely dry. The leaf area for each experimental unit was then calculated.

(d). Number of Leaves per Plant: Calculated as the average from ten plants in each experimental unit.

(e). Dry Weight Plant (g): To determine this, we calculated the average weight of ten plants in each trial. After harvesting, the plants were thoroughly washed to remove soil and debris. We then extracted the plant parts from the roots. Weight was measured by balance after volume drying of the plants at 70 °C for 48 h in an electric oven.

B. Yield Traits and Components:

(a). Number of Pods per Plant: Calculated as the average from ten plants in each experimental unit.

(b).Number of Seeds per Pod: Calculated as the average from ten plants in each experimental unit.

(c). Weight of 100 Seeds (g): 100 seeds were sampled, counted and weighed using a sensitive balance, ensuring a moisture content of 10% .

(d). Individual Plant Yield (g plant^{-1}): Calculated by multiplying the number of pods per plant by the number of seeds per pod, and then the weight of one seed

(e) .Total Seed Yield (ton ha^{-1}): Collected ten plants from each trial and weighed the seed yield after thorough drying. The weight was then converted to tons per hectare. After cleaning the seeds, they were placed in containers of known weight and dried in an oven at 70°C until their weight stabilized, then the yield was adjusted based on 10% moisture content.

III. Results and Discussion

I. Effect of irrigation system on soil physical characteristics:

Bulk Density (g cm^{-3}**):**

The results in Table (3) show a significant effect of irrigation method on soil bulk density. The results indicate that surface irrigation recorded the highest bulk density value of 1.23 g cm^{-3}, while basin irrigation recorded the lowest bulk density value of 1.21 g cm^{-3} in areas relying on basin irrigation.

Moisture Content(%) :

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From Table (3), it can be seen that the different types of irrigation used have an effect on soil moisture content. The results illustrate that basin irrigation is better than surface irrigation, with the highest moisture content value of 27.13%, while areas that depend on surface irrigation had the least value of 25.58%.

Field Capacity (%) :

From Table (3), it can be seen that the irrigation method used has an effect on a soil's field capacity. The results show that basin irrigation is better than surface irrigation, achieving the maximum field capacity value of 36.32% compared to surface irrigation's 35.66% .

Weighted Mean Diameter (mm):

From Table (3), it can be seen that the irrigation method applied has a significant impact on the weighted mean diameter. The results illustrate that basin irrigation is better than surface irrigation, recording the highest weighted diameter value of 0.45mm while surface irrigation had the lowest value of 0.42mm.

Table (3) Effect of irrigation system on soil physical characteristics

Irrigation Method	Bulk Density g cm^{-3}	Moisture Content %	Field Capacity %	Weighted Mean Diameter mm
Surface Irrigation	1.23	25.58	35.7	0.42
Basin Irrigation	1.21	27.13	36.32	0.45
L.S.D	0.0033	0.25	0.42	0.0021

Effect of Compost Type on soil physical characteristics:

Bulk Density(g cm^{-3}**):**

The results in Table (4) also show that the type of compost used has a considerable effect on the bulk density of the soil. Local compost showed better result than imported compost in disturbing bulk density as shown in the table which recorded bulk density 1.19 g/cm^3. Conversely, the treatments with imported compost and without soil amendment had density rates of 1.21 g/cm^3 and 1.26 g/cm^3, respectively.

Moisture Content (%):

As shown in Table (4), the type of compost had a significant effect on the soil moisture content. As can be seen in table the local compost achieved higher moisture content rate of 29.57% in comparison with the imported. In contrast, imported compost and control treatments showed the rates of moisture content of 27.23% and 22.58%, respectively.

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Field Capacity (%)

The results in Table (4) show a significant effect of compost type on the field capacity of the soil. The table indicates that the local compost outperformed the imported compost in increasing moisture content at field capacity, with a recorded field capacity rate of 38.82%. In comparison, the treatments using imported compost and no soil amendment recorded field capacity rates of 35.91% and 33.23%, respectively.

Weighted Mean Diameter (mm):

The results in Table (4) indicate a significant effect of compost type on the weighted mean diameter of the soil. The table shows that the local compost outperformed the imported compost in increasing the weighted mean diameter, with a recorded rate of 0.49 mm. In comparison, the treatments using imported compost and no soil amendment recorded rates of 0.46 mm and 0.36 mm, respectively.

Table (4) Effect of Compost Type on soil physical characteristics.

Compost Type	Bulk Density g cm^{-3}	Moisture Content %	Field Capacity %	Weighted Mean Diameter mm
Control	**1.26**	**22.58**	**33.23**	**0.36**
Imported	**1.21**	**27.23**	**35.91**	**0.46**
Local	**1.19**	**29.57**	**38.82**	**0.49**
L.S.D	**0.004**	**0.301**	**0.52**	**0.006**

Effect of irrigation system on plant growth characteristics of broad bean crop:

As detailed in Table (5) , there are notable differences between the two irrigation methods. The Basin irrigation method showed the highest distribution in several growth traits: plant height reached 73.78 cm, with 5.67 branches per plant, 2549.78 cm^2, leaf area , 315.56 leaves at per plant, and dry weight 65.56 g . Also The Surface irrigation method resulted in lower values of plant height of 50.11 cm, 3.11 branches per plant, leaf area of 1277.11 cm^2, 213.89 number of leaves per plant and dry weight of 51.33 g. These findings emphasize the importance of selecting the right irrigation method for successful broad bean crop growth and yield.

Table 5: Effect of Irrigation Method on the Vegetative Growth Traits of Broad Bean Crop.

Irrigation Method	Plant Height (cm)	Number of Branches per Plant	Leaf Area (cm^2)	Number of Leaves per Plant	Dry Weight of the Plant (g)
Surface Irrigation	50.11	3.11	1277.11	213.89	51.33

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Basin Irrigation	73.78	5.67	2549.78	315.56	65.56
L.S.D	**2.191**	**1.265**	**52.351**	**8.155**	**2.662**

Effect of Compost Type on the Vegetative Growth Traits of Broad Bean Crop

As shown in Table (6) , there are significant differences among all compost treatments. The local compost treatment resulted in plant height, number of branches per plant, leaf area, number of leaves per plant, and dry weight, which are recorded of 71.67 cm, 5.17 branch per plant, 2327.50 cm^2 leaf area, 297.67 leaf per plants, and 65.33 g, respectively. In contrast, the control treatment produced the lowest products, with 53.50 cm for plant height, 3.83 branch per plant, 1430.17 cm^2 leaf area, and 235.83 leaves per plant, and 52.17g dry weight respectively.

Table 6: Effect of Compost Type on the Vegetative Growth Traits of Broad Bean Crop.

Compost Type	Plant Height (cm)	Number of Branches per Plant	Leaf Area (cm^2)	Number of Leaves per Plant	Dry Weight of the Plant (g)
Control	**53.50**	**3.83**	**1430.17**	**235.83**	**52.17**
Imported	**60.67**	**4.17**	**1982.67**	**260.67**	**57.83**
Local	**71.67**	**5.17**	**2327.50**	**297.67**	**65.33**
L.S.D	**3.107**	**0.628**	**89.080**	**8.450**	**2.709**

Effect of Irrigation Method on the Yield Traits of Broad Bean Crop

As shown in Table (7) , there are significant differences between the two irrigation methods. The basin irrigation method achieved the highest number of pods per plant, number of seeds pods, 100 seed weight, individual plant yield and total yield per hectare, which are averaging 8.44 pods, 4.33 seeds, 134.56 g per plant, 17.889 g per plant, and 4227.89 kg ha^{-1} of total seed yield , respectively. In contrast, the surface irrigation showed the lowest number of pods per plant 5.44 pods, 2.56 seeds per pod, 93.67 g weight of 100 seeds per plant, 36.78 g individual plant yield per plant, and 3100.00 kg ha^{-1} of total seed yield, respectively.

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Table 7: Effect of Irrigation Method on the Yield Traits of Broad Bean Crop.

Irrigation Method	Number of Pods per Plant	Number of Seeds per Pod	Weight of 100 Seeds (g)	Individual Plant Yield (g plant^{-1})	Total Seed Yield (kg ha^{-1})
Surface	5.44	2.56	93.67	36.78	3100.00
Basin	8.44	4.33	134.56	57.22	4227.89
L.S.D	**1.656**	**0.478**	**9.597**	**4.561**	**90.201**

Effect of Compost Type on the Yield Traits of Broad Bean Crop

As shown in Table (8), there are significant differences among all compost treatments. The local compost treatment produced the highest number of pods per plant, number of seeds per pod, 100-seed weight, individual plant yield, and total yield, averaging 8.17 pods, 4.17 seeds, and 131.67 g per plant, 54.17 g per plant and 3986.50 kg ha^{-1}, respectively. In contrast the control treatment produced lowest values compare with local compost, which are 7 pods and 3.33 seeds per plant, 113.50 g per plant and 3619.83 kg ha^{-1}, respectively. In contrast, the treatment (no change) produced the lowest rates, measuring 5.67 fruits, 2.83 seeds, 97.17 g per plant, 39.50 g per plant, and 3385.50 kg ha1, respectively

Table 8: Effect of Compost Type on the Yield Traits of Broad Bean Crop.

Compost	Number of Pods per Plant	Number of Seeds per Pod	Weight of 100 Seeds (g)	Individual Plant Yield (g plant^{-1})	Total Seed Yield (kg ha^{-1})
Control	5.67	2.83	97.17	39.50	3385.50
Imported	7.00	3.33	113.50	47.33	3619.83
Local	8.17	4.17	131.67	54.17	3986.50
L.S.D	**0.587**	**0.736**	**4.607**	**3.314**	**46.327**

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Effect of the Interaction between Irrigation Method and Compost Type on soil physical characteristics:

The results shown in Table (9) demonstrate that the interaction treatment between basin irrigation and local compost significantly excelled in soil physical characteristics and recorded the highest values on moisture content , field capacity, and weighted mean diameter and lowest values of bulk density. In contrast, the interaction treatment of surface irrigation with the control (no addition) produced the lowest values of field capacity and moisture content and weighted mean diameter and highest values of bulk density.

Table 9: Effect of the Interaction between Irrigation Method and Compost Type on Soil Physical Properties.

Compost Type					
Soil Properties	**Irrigation**	**Control**	**Imported**	**Local**	**L.S.D**
Bulk density	**Surface**	1.27	1.23	1.2	**0.0057**
	Basin	1.25	1.19	1.17	
Moisture content	**Surface**	21.43	26.27	29.03	**0.426**
	Basin	23.10	28.19	30.11	
Field capacity	**Surface**	33.03	35.03	38.92	**0.735**
	Basin	33.43	36.79	38.73	
weighted mean diameter	**Surface**	0.35	0.43	0.47	**0.0081**
	Basin	0.37	0.48	0.52	

Effect of irrigation and compost type interactions on plant growth characteristics of broad bean crop

The results shown in Table (10) demonstrate that the interaction treatment between basin irrigation and local compost significantly excelled in plant height, leaf area, number of leaves per plant, and dry weight of the plant. This interaction treatment achieved the highest averages for plant height, leaf area, number of leaves per plant, and dry weight, which were 86.00 cm, 3046.33 cm^2, 352.67 leaves $plant^{-1}$, and 71.00 g, respectively. In contrast, the interaction treatment of surface irrigation with the control (no addition) produced the lowest values, measuring 44.00 cm for plant height, 828.00 cm^2 for leaf area, 193.33 leaves $plant^{-1}$, and 43.00 g for dry weight. However, there was no significant effect of the interaction on the number of branches per plant.

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Table 10: Effect of the Interaction between Irrigation Method and Compost Type on the Vegetative Growth Traits of Broad Bean Crop.

Compost Type					
Properties	**Irrigation**	**Control**	**Imported**	**Local**	**L.S.D**
Plant Height (cm)	**Surface**	**44.00**	**49.00**	**57.33**	**3.680**
	Basin	**63.00**	**72.33**	**86.00**	
Number of Branches per Plant	**Surface**	**2.67**	**3.00**	**3.67**	**N.S**
	Basin	**5.00**	**5.33**	**6.67**	
Leaf Area (cm²)	**Surface**	**828.00**	**1394.67**	**1608.67**	**104.531**
	Basin	**2032.33**	**2570.67**	**3046.33**	
Number of Leaves per Plant	**Surface**	**193.33**	**205.67**	**242.67**	**10.339**
	Basin	**278.33**	**315.67**	**352.67**	
Dry Weight of the Plant (g)	**Surface**	**43.00**	**51.33**	**59.67**	**3.324**
	Basin	**61.33**	**64.33**	**71.00**	

Effect of the Interaction between Irrigation Method and Compost Type on the Yield Traits of Broad Bean Crop

The results shown in Table (11) demonstrate that the interaction treatment between basin irrigation and local compost significantly excelled, achieving the highest values for the number of pods per plant, weight of 100 seeds, individual plant yield, and total yield, which were 10.00 pods, 160.00 g, 62.00 g per plant, and 4410.67 kg ha^{-1}, respectively. In contrast, the interaction treatment of surface irrigation with the control (no addition) produced the lowest values, measuring 4.67 pods, 84.67 g, 26.33 g per plant, and 2729.00 kg ha^{-1}, respectively. However, there was no significant effect of the interaction on the number of seeds per pod.

Table 11: Effect of the Interaction between Irrigation Method and Compost Type on the Yield Traits of Broad Bean Crop.

Compost Type					
Properties	**Irrigation**	**Control**	**Imported**	**Local**	**L.S.D**
Plant Height (cm)	**Surface**	4.67	5.33	6.33	**3.680**
	Basin	6.67	8.67	10.00	

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Number of Branches per Plant	**Surface**	2.00	2.33	3.33	**N.S**
	Basin	3.67	4.33	5.00	
Leaf Area (cm²)	**Surface**	84.67	93.00	103.33	**104.531**
	Basin	109.67	134.00	160.00	
Number of Leaves per Plant	**Surface**	26.33	37.67	46.33	**10.339**
	Basin	52.67	57.00	62.00	
Dry Weight of the Plant (g)	**Surface**	2729.00	3008.67	3562.33	**3.324**
	Basin	4042.00	4231.00	4410.67	

II. Discussion

According to Abedi-Koupai et al. (2001), basin irrigation has proved to be better in terms of bulk density changes because, in surface irrigation, high-pressure water rapidly flows in and compacts the soil, filling pores between the soil particles with different sizes. Basin irrigation facilitated an improved moisture-holding capacity due to its slower water infiltration, thereby allowing enough time for the soil to absorb moisture. Besides, it makes a better soil structure and thus makes larger pores that improve its water-holding capacity and reduce evaporation losses. The low moisture content in soils using surface irrigation was due to the compaction of the soil in a hard layer that results from the rapid flow of water and therefore increases soil density, leading to high evaporation of water. Moreover, surface runoff carries away water from the root zones, and this limits the water supply to the plants (Abdullateef el al., 2022 and Jasim el al., 2017). The greater performance of basin irrigation in attaining a higher field capacity is due to the slow infiltration of water that provides enough retention and also enlargement of field capacity. In surface-irrigated soils, the governing causes of the lower field capacity are attachment to soil erosion and subsequently reduced porosity, which diminishes water retention capacity followed by low field capacity (Abdullateef el al., 2022 and Ati et al., 2016). The superior performance of basin irrigation in achieving a higher weighted diameter is attributed to improved soil structure and maintained porosity, which allows roots to spread and bind soil particles, thus increasing the weighted diameter. Surface irrigated soils, on the other hand, have a lower weighted diameter due to soil compaction and erosion, which leads to the formation of smaller particles.

The efficiency with which local compost reduced bulk density was outstanding and this can be directly linked to its organic matter, which aids in the disintegration of soil particles and increases the porosity and structure of the soil. Such changes promote the circulation of air and water in the soil, improving the physical properties of the soil, and reducing the bulk density. In contrast, the bulk density of the soil which received the imported compost is likely to be higher because of the presence of inorganic or remade constituents which can be detrimental. In addition, the chemical makeup of the imported compost can have negative consequences on the soil infrastructure leading to some level of creeping soil disintegration (Adugna, 2016, Nahar et al, 2006).Another factor which contributed to the local compost being used was its ability to retain moisture. This was possible due to local composts organic matter acting as a water holding material. These materials help to retain moisture in the soil and helps in improving the ability of the soil to absorb water, increases moisture content, and also helps in enhancing the structure of the soil, which leads to the creation of larger pores. On the other hand, the imported compost is likely to contain materials that cause lower moisture retention in the soil such as higher concentrations of salts. Furthermore, because of it chemical composition, the imported compost is bound to result in higher rates of evaporation of moisture from the soils.

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The existing superior performance of a local compost in increasing field capacity was ascribed to the role of its organic constituents on the soil structure porosity and its water retention capability. Moreover, the organic materials also aid in the formation of air channels which assists in the movement of water and enhances field capacity. On the other hand, some inorganic constituents of the imported compost may lower the soil water retaining capacity.

This increased weighted mean diameter for the local compost treatment is attributed to organic matter that enables the formation of larger and more complex particles. The structure improvement leads to increased soil aeration and moisture retention, which factors in the greater weighted mean diameter. Other compost's particles, however, may be bound with too many of its fellow particles, thus reducing the weighted mean diameter due to a lesser degree of size variation. This unforgiving composition could, however, explain why other composts contain lower fractions of the mean diameter.

The positive change in vegetative traits from basin irrigation can be assigned to the dependable water retention feature of soil in shallow basins, as well as the lowered degree of irrigation water. This improves the efficiency of water usage and positively aids in plant growth. However, surface irrigation brings about lower efficient water usage resulting from higher volumes of irrigation water as well as leeching of nutrients deeper than the root zone (Masoud, 2017). Basin irrigation contributes greatly to the increase in crop yield and its value due to its components because of the diminished soil salinity because salts are moved to the surface of the basins and the beneficial effects of the basin on the formation of the strong root system.

The addition of compost increased yields and properties, and local compost performed better than imported compost. This superiority is attributed to compost's ability to chelate nutrients and low soil pH, creating nutrients that can be easily taken up by plants Also, low pH, low salinity, carbon-nitrogen ratio it is good, high carbon, high in local compost compared to imported compost displayed in cation-exchange capacity (Table 1) These factors significantly improved soil physical productivity properties, increasing both broad bean crop growth and productivity Besides, local manure was more capable of holding water than imported manure, helping to maintain water levels and providing readily available nutrients for plant absorption. This led to improvements in the chemical and biological characteristics of the soil (Noor et al., 2020), resulting in its superiority over other treatments.

III. Conclusions

The results demonstrate that irrigation methods significantly affect soil physical properties. Basin irrigation contributes to improving soil properties such as porosity, field capacity, and bulk density, while surface irrigation may lead to negative effects such as increased density and compaction. Therefore, farmers and water resource managers should consider selecting the appropriate irrigation method based on local soil characteristics and crop requirements.

The results demonstrate that the use of local compost positively affects the physical properties of the soil compared to imported compost. The local compost contributes to improving bulk density, moisture content, field capacity, and weighted mean diameter. Therefore, the use of local compost is recommended as part of soil management strategies to enhance agricultural productivity.

From the study, we conclude that basin irrigation and local compost significantly enhance the vegetative growth traits and yield components of the broad bean crop.

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