Effect of Different Levels of Cow Manure and Radish Cultivars on Growth, Yield, and Quality Characteristics of Radish (*Raphanus sativus* L.)

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Abstract

This research was conducted at the College of Agriculture/University of Dhi Qar /Al -Mustafawiya area Latitude: 31.05 North , Longitude: 46.26 East to study the effect of levels of ground cow manure and some different varieties of radish plants on the growth, morphology and productivity of radish plants. *Raphanus sativus* L. was used with four levels of organic fertilizer (0, 2.5, 5, and 7.5 tons/dunum) and four radish varieties: American red radish, local radish, Indian radish ,white radish and American According to design RCBD Number of repetitions 3 Blok . The following results were obtained: The American white disc variety (d) significantly excelled on all other varieties (pα 0.05) in leaf area (cm²), dry matter, Tuberous root weight, fruit diameter, root weight, and disc weight. Variety (b) significantly excelled all other varieties (: $P \leq 0.05$) in plant height and leaf dry weight. No significant difference was observed between the varieties in leaf fresh weight or the number of leaves. The results were as follows: The treatment (7.5 tons/75 t/ha) of Ground cow manure i.e., 3.600 kg/2001 m²) excelled on all other organic fertilizer levels in leaf area, dry matter, vegetative matter, fruit diameter, fresh leaf weight, plant height, root weight, and head weight compared to the control treatment. It did not differ significantly from the O2 and O3 treatments in fruit diameter and fresh leaf weight. There was an interaction between different varieties and levels of cow manure. The O3 treatment showed a significant interaction with the local variety (b) in leaf area, fresh leaf weight, dry weight, and plant height. while, the O3 treatment showed a significant interaction with the American white radish variety (d) in dry matter weight, vegetative matter, head weight, fruit diameter, and number of leaves.

Keywords: cow manure, radish, varieties, organic fertilizer

Introduction :

The radish plant is a member of the Brassicaceae family and has the scientific name *Raphanus sativus* L. Its cultivation is widespread in most countries of the world, especially the Arab world. It is grown for its fresh leaves and roots. Its original habitat was China, then it spread to other parts of the world (Asian Radish, 2006). Its composition includes multiple substances, which were analyzed by [24] It was found that 100 g of radish contains the following compounds: water contain less than 0.2g of fat), Energy per 16g: 16 kcal (kilocalories, protein (0.68 g), fat (5.1 g), fiber (1.6 g), carbohydrates (3.40 g), sugars (0.68 g), magnesium, calcium, potassium, sodium, zinc, phosphorus, and iron (25, 10, 223, 39, 0.28, 20, and 0.34 mg, respectively). It contains most vitamins in varying proportions, with vitamin C and vitamin K being particularly high. (14.8, 1.3) mg.

The remaining vitamins are present in very small quantities, including thiamine, riboflavin, niacin, vitamin B6, and folate. Due to the increased demand for it, its content of these important substances, the increasing population in the world, and its use as a treatment for some diseases, including indigestion [23], bile duct problems, and lowering cholesterol in the body [12] and others, efforts have been made to increase its global and local demand. Several techniques have been used, including adding various

ISSN 2072-3857

fertilizers such as N, P, and K to increase its productivity, and organic compounds and fertilizers have been used to increase and improve its efficiency and the efficiency of this plant worldwide. It is one of the important vegetables in the presence of vitamins, minerals, fibers and plant proteins that are used in the human diet and throughout the world. In order to reduce the damage of chemical fertilizers due to the components they produce in the soil and the plant, the use of these chemical fertilizers has been reduced without their harm, and the use of organic fertilizers has been adopted, and some of them have been used in order to obtain good and abundant production and growth in a proportion that meets the needs of humans in very healthy environmental conditions far from pollutants. The growth and production of the radish plant depends greatly on the soil and climatic conditions, and nutrition and soil fertility play the main role in controlling this growth and productivity. Therefore, the matter is important for optimal fertilization through organic fertilizers and the use of different varieties to increase productivity and improve growth traits in general. Therefore, the aim of this experiment is to use different levels of ground cow manure to determine and study its effect on the morphological traits of various red radish varieties, increasing their growth and productivity. The experiment also aims to investigate the interaction between different varieties and levels of manure in improving plant growth and productivity.

Materials and Methods:

The required materials are:

1- Local red radish seeds (designated as 'b'), American red radish seeds (designated as 'a'), Indian red radish seeds (designated as 'c'), and American disc (white) radish seeds.

2- Sufficient quantities of NPK fertilizer (20, 20, 20).

3- Ground cow manure is available at four levels: Level 1 (O0) without the addition of organic fertilizer; Level 2 (1O) at a rate of 1,200 g per experimental unit (1,200 m²), equivalent to 2,500 kg per dunam (2.5 tons per dunam); Level 3 (O2) at a rate of 2,400 g per experimental unit (5 tons per dunam); and Level 4 (O3) at a rate of 3,600 g per experimental unit (7.5 tons per dunam per day).

The plot of land was then divided into three blocks and four varieties of radish, with four levels of ground cow manure (4 x 4 x 3 m), totaling 48 experimental units, each measuring 1,200 m².

The land was identified and marked out, then plowed, smoothed, leveled, and divided into rectangles measuring 1 x 1,200 m, totaling 48 experimental units, with a total area of 1,200 m². The physical and chemical properties of these rectangles were then tested.

Table (1) shows the studied physical and chemical properties of the soil

units	**values**	Traits
	8.13	pH
ds.m^{-1}	**3.16**	EC
%	**0.40**	Organic Matter
ppm	**0.8**	Total Nitrogen
ppm	**0.15**	Total Phosphorus

ISSN 2072-3857

ppm	**5**	Lime
%	**3.5**	Gypsum
%	**55**	Sand
%	**10**	Clay
%	**35**	Silt
Sandy loam	**Sandy loam**	Texture

As shown in Table (1), these experimental units were smoothed after plowing, and barriers were placed between each experimental unit at a distance of 50 cm. Then, each plot was divided into rows with 20 cm between each row, and the seeds, distributed equally on the rows and in each experimental unit, were sown at an average of O1 (1200 g) per plot, O2 (2400 g) per plot, and O3 (3600 g) per plot. The seeds were sown on 24/12/2025, and 10 g NPK fertilizer (20-20-20) was applied at a specified rate 20 days after sowing and was reapplied after 40 days.

. The plants were harvested on 18/2/2026, and the morphological traits of the plants were studied after the completion of the cultivation operations. The following traits were studied according to what [7] mentioned, Data were analyzed using GenStat software, and analysis of variance (ANOVA) was performed at a significance level of $P \leq 0.05$.The following traits were recorded:

1- Leaf length (cm): Leaf length was measured from the point where the leaves attach to the soil in the plant to the top of the leaf for five plants in each experimental unit, and the average was calculated.

2- Number of leaves/plant: Leaves were removed from five plants, and the average number was recorded.

3- Percentage of dry matter for the whole plant, leaves, and roots: Random samples of five plants from each experimental unit were taken and dried in an electric oven at a temperature of 65-70°C until the weight stabilized. The average dry matter for the whole plant, leaves, and roots was then calculated.

4- Root diameter (cm): Root diameter was measured using a Vernier caliper for five plants per plot, and the mean was calculated.

5- Average root weight (g/plant): The root diameter of five plants from each experimental unit was measured, and the average was calculated.

6 Leaf area was estimated using graph paper based on length × width with an appropriate correction factor\: Five plants from each experimental unit were weighed directly on a balance, and the average weight of the total vegetative weight, fresh leaf weight, and fresh root weight for each of the five plants was calculated and recorded.

7. Leaf area was measured using a graph paper. The leaves were distributed on the graph paper, and the leaf area was calculated by multiplying the length by the width.

8. Root diameter was measured using a compass.

9- Soil physical and chemical properties were analyzed according to Page et al. (1982), including electrical conductivity, pH, organic matter, nitrogen, phosphorus, calcium, gypsum content, and soil texture using the soil texture triangle..

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Results and discussion

Table (2) effect of some radish varieties and different levels of ground cow manure on the leaf area (cm^2).

Cow manure levels (kg) per 1.200 g/ m2 fertilizer unit (kg)					**Variety**
average kg	**O3 3.600kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O_0**	
96.7	**117**	**102**	**92.3**	**75**	(a) American
89.8	**126**	**108.3**	**73.3**	**51**	(b) Local
76	**85.7**	**87**	**76. 3**	**55**	(c) Indian
91.9	**108.5**	**113.7**	**84.7**	**61.3**	(d) White Disc
	109.3	**102.8**	**81. 6**	**60.6**	**average**
L.S.DV=6.66 0.05	**L.S.D.F=6.66** **0.05**		**L.**	**L.S.D. D*V=13.36** **0.05**	**13.36**

Table (2) shows that the different varieties of disc radish exhibited a significant difference in leaf area. The American (a), local (b), Indian (c), and American white (d) varieties recorded leaf area averages of 96.7, 89.8, 76, and 91.9 cm^2, respectively. All varieties significantly excelled the Indian red radish treatment (pα 0.05) in leaf area, which reached 76 cm^2. Regarding the effect of adding different levels of ground cow manure on the leaf area of the radish plant, treatments of 1.200 g/m^2 (O1), 2.400 g/m^2 (O2), and 3.600 g/m^2 (O3) each showed significant differences (pα 0.05) compared to the control treatment, which recorded an average reading. 60.6 g/m^2. Treatment 1O significantly excelled all other fertilization treatments, and treatment O2 significantly excelled treatment O3. Regarding the interaction between different varieties and levels of cow manure, the local treatment (b) at cow manure level O3 showed the highest significant difference among the interaction treatments, recording an average of 126 cm^2, surpassing all other treatments, with a p-value of 0.05 .

ISSN 2072-3857

Table (3) Effect of different disc radish varieties and different levels of cow manure on estimated plant root length (cm).

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0 0**	Variety
7.92	**9.67**	**8.33**	**8.33**	**5.33**	(A) American Red Disc
9.25	**9.33**	**9.67**	**9.33**	**8.67**	(b) Local Red
8.71	**8.50**	**9.67**	**9.5**	**7.67**	(c) Native American Red
8.42	**8.5**	**8.83**	**9.0**	**8.87**	(d) American White
L.S.D.V=1.062 0.05	**8.88**	**9.12**	**8.92**	**7.37**	Moderate
L.S.D.F=1.062 *0.05*		**L.S.D = f**Xv= 2.125 **0.05**			

Table (3) shows that the local variety (b) excelled the American variety (pα 0.05) in root length. No significant differences were found between varieties (d and c) and the remaining varieties. Regarding the effect of different levels of cow manure on root length, the O1, O2, and O3 fertilizer treatments showed a significant difference (pα 0.05) in root length compared to the control treatment (O0) without fertilizer addition. No significant differences were found among the O1, O2, and O3 treatments. Table (3) also shows the interaction between varieties and levels of organic fertilizer. No significant differences were found in the interaction between varieties and levels of organic fertilizer, except for the significant interaction observed in all interactions of all treatments combined with the control treatment, which had a root length of 5.33 cm .

Table (4) effect of some radish varieties and levels of ground cow manure on the number of leaves.

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0 0**	**Variety**
10.08	**10.67**	**11.33**	**11.33**	**7.0**	(A) American Red Disc
10.08	**12,00**	**11,67**	**9,33**	**7.33**	(b) Local Red
10.00	**11.67**	**10**	**11.44**	**7**	(c) Native American Red

ISSN 2072-3857

11.0	**11.33**	**12.33**	**13**	**7.33**	(d) American White
L.S.D.V=1.142 **0.05**	**11.45**	**11.33**	**11.25**	**7.17**	average
L.S.D.F=1.142 ***0.05***		**L.S.D F = fXv= 2.284** **0.05**			

Table (4) shows that no significant differences (pα 0.05) were observed for any of the radish varieties used. Regarding the effect of cow manure levels on the number of leaves, treatments O2, O3, and O1 showed significant differences compared to the control treatment (O0) without fertilizer addition. However, no significant difference was found between levels O1 and O3. As for the interaction between varieties and organic fertilizer levels, the interaction treatment of American White (d) with level O3 resulted in the highest value of (13) leaves. The interaction treatments of the four varieties without organic fertilizer addition were significantly excelled.

Table (5)Effect of some radish varieties and levels of ground cow manure on the total dry matter weight of the radish plant, estimated in g/plant

average **kg**	**O3** **3.600kg/unit**	**O2** **2.400 kg/unit**	**O1** **1.200 kg/unit**	**O0** **0**	Variety
4.479	**5.933**	**4.407**	**4.310**	**3.27**	(A) American Red Disc
3.975	**6.047**	**4.6**	**3.023**	**2,23**	(b) Local Red
4.324	**5.80**	**5.050**	**3.963**	**2.483**	(c) Native American
4.587	**6.40**	**4.667**	**4.150**	**3.133**	(d) American White
	6.045	**4.681**	**3.86**	**2.778**	**average**
L.S.D.V= 0.343 **L.S.D.F=0.343** **0.05**		**L.S.D = f**Xv= 0.688 **0.05**			

Table (5) shows that the American (a), local (b), Indian (c), and American White (d) radish varieties recorded average dry weights of, 4.479 3.975, 4.587, and 4.324 g/plant, respectively.

The American (a), Indian (c), and American White (d) varieties significantly excelled the local (b) variety in total dry weight, yielding the lowest average (3.975 g/plant). Regarding the effect of increasing the levels of ground

ISSN 2072-3857

organic fertilizer added in the experimental units on the average total dry weight of radish plants, all treatments (O1, O2, and O3) showed significant differences (pα 0.05) compared to the control treatment (O0).The treatment with organic fertilizer O3 also showed significant differences (pα 0.05) compared to the control treatment (O0). In treatments O1 and O2, treatment O2 also showed significant differences compared to treatment O1. This indicates an increase in dry matter with increasing levels of fertilizer applied in the experiment. Regarding the interaction between the variety and organic fertilizer levels, the greatest significant increase in total plant dry weight was observed in the white variety (d) at organic fertilizer level O3. This treatment recorded an average total plant dry weight of 6.047 g/plant. Significant differences (pα 0.05) were recorded with all interacting treatments except for the varieties interacting at the O3 fertilizer level, where no significant difference was found.

Table (6) shows the role of different radish varieties and levels of ground cow manure in vegetative weight productivity.

average kg	**O3 3.600kg/unit**	**O2 2.400kg/unit**	**O1 1.200kg/unit**	**O0 0**	Variety
29.93	**39.67**	**30.49**	**27.24**	**22.33**	(A) American Red Disc
26.73	**40.30**	**31.62**	**20.03**	**14.97**	(b) Local Red
28.71	**38.67**	**33.67**	**25.9**	**16.59**	(c) Native American
30.38	**43**	**31.17**	**27.67**	**19.67**	(d) American White
L.S.D.V=2.17	**40.41**	**31.74**	**25.21**	**18.93**	**average**
L.S.D.F =2.81 ***0.05***		**L. S.D= FXV= 4.341** ***0.05***			

Table (6) shows that the different varieties of American radish (a), local (b), Indian (c), and white American (d) recorded average vegetative weights of (30.38, 28.7, 26.73, and 29.33) g/plant, respectively. All varieties (a) and (d) significantly excelled varieties (c) and (b) at a significance level of pα 0.05. No significant difference was observed between treatments (a) and (d). Regarding the effect of ground cow manure levels on the total vegetative weights of the plants, treatments O1, O2, and O3 showed significant differences (pα 0.05) compared to the control treatment (O0) without the addition of organic fertilizer. The table illustrates the significant difference between the three treatments O1, O2, and O3. Treatment O3 significantly excelled both Treatment O1 and Treatment O2, with Treatment O2 significantly excelled on Treatment O1.

Regarding the interaction between varieties and levels of ground cow manure, the American White variety (d) treatment at the O3 level recorded an average plant weight of 43 g/plant. This treatment significantly excelled all other treatments in terms of plant weight, with the exception of treatments for varieties (a) and (b) at the same O3 level.

ISSN 2072-3857

Table (7) effect of radish varieties and levels of ground cow manure on the diameter of the fruit disc.

average kg	**O3 3.600kg/unit**	**O2 2.400kg/unit**	**O1 1.200kg/unit**	**O_0**	Variety
8.5	**11.33**	**8.38**	**7.67**	**6.67**	(A) American Red Disc
10.625	**11**	**8.67**	**11.50**	**7.33**	(b) Local Red
9.417	**8.33**	**10**	**6.0**	**3.33**	(c) Native American
10.66	**10.67**	**12.67**	**11**	**8.33**	(d) American White
	10.33	**9.92**	**9.54**	**6.42**	**average**
L.S.D.V=1.265 0.05		**L.S.D. f**Xv=2.53			

The results showed a significant advantage for treatments (b, c, and d), which recorded averages of (10.625, 10.66, and 9.417) cm respectively, over the Indian variety (a), which recorded 8.5 cm. Regarding the effect of ground cow manure levels on radish disc diameter, there was a significant difference between treatments. All organic fertilizer levels (O1, O2, and O3) showed a significant increase in radish disc size compared to treatment (O0). However, there was no significant difference between the three fertilizer treatments (O1, O2, and O3) at the following settings (10.33, 9.92, and 9.54) cm.As for the interaction between plant varieties and the levels of added cow manure on disc yield, the best interaction treatment recorded the highest disc size (12.67 cm) for treatment (d) and level O2. This interaction was significantly different for all other treatments except... Varieties (a) and (b) at the organic fertilizer level O3, and variety (b) at the O1 level .

Table (8) effect of different radish varieties and levels of ground cow manure on the fresh weight of the leaves.

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0 0**	Variety
18.08	**21.33**	**21,67**	**15.0**	**14.33**	(A) American Red Disc
18.58	**25**	**23.67**	**14.67**	**11.5**	(b) Local Red
17	**21.33**	**16.67**	**17**	**13.**	(c) Native American

ISSN 2072-3857

17.67	**23.33**	**18.67**	**14.67**	**13.67**	(d) American White
L.S.D.V=2.334	**22.83**	**20.67**	**15.33**	**13**	**average**
L.S.D f= 2.334		**L.S.D = v**Xf= 4.667 **0.05**			

Table (8) and the recorded data showed no significant differences in leaf fresh weight between the cultivars.However, significant differences were observed with varying levels of ground cow manure in leaf fresh weight. O1, O2, and O3 levels differed significantly in the treatment without organic fertilization, and the two treatments showed a difference in leaf fresh weight at O0.The best interaction treatment for leaf fresh weight was treatment (b) at the O3 fertilizer level, reaching (25) g/plant. Significant differences were observed between this treatment and some other interaction treatments, including those with O2 and treatments (c) and (d) at the O2 fertilizer level.

Table (9) effect of different radish cultivars and cow manure levels on radish plant height.

average **kg**	**O3** **3.600 kg/unit**	**O2** **2.400 kg/unit**	**O1** **1.200 kg/unit**	**O_0**	Variety
17.67	**22.33**	**19.33**	**16.60**	**13.00**	(A) American Red Disc
26.33	**35.00**	**29.67**	**24.67**	**18.0**	(b) Local Red
20.17	**26.33**	**21.00**	**18.33**	**15**	(c) Native American
18.48	**22**	**21.33**	**17**	**13.33**	(d) American White
L.S.D.V=1.764 **0.05**	**2642**	**22.83**	**19**	**14,83**	**average**
l.sd f= 1.764 **0.05**		**L.S.D = f**Xv=3.528 **0.05**			

The American (a), local (b), Indian (c), and American White (d) varieties recorded average heights of 17.67, 26.33, 20.17, and 18.48 cm, respectively. Variety (b) exhibited the highest average height among all varieties. The effect of organic fertilizer levels on plant height was significantly higher with increasing organic fertilizer levels compared to the control treatment O0. Treatments O1, O2, and O3 differed significantly, with treatment O3 recording the highest average height at 26.42 cm. Regarding the interaction between varieties and organic fertilizer levels and its effect on plant height, the most significant and

ISSN 2072-3857

highest-value treatment was the interaction with variety (b) at the O3 fertilizer level, which recorded a height of 35 cm.

Table (10) effect of different disc radish varieties and cow manure levels. Ground root weight in g/plant

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0 0**	Variety
1.958	**3.50**	**2.567**	**1.43**	**0.133**	(A) American Red Disc
3.546	**5.633**	**5.483**	**1.533**	**0.133**	(b) Local Red
4.547	**5.70**	**5.30**	**5.11**	**2**	(c) Native American
4.583	**5.6331**	**5.4**	**2.3**	**2**	(d) American White
L.S.D.V=0.135 0.05	**5.117**	**4.588**	**2.343**	**1.067**	**average**
L.S.D.F = 0.135		**L.S.D = f**Xv=0.271 **0.05**			

It was shown in Table (8) that there is a significant difference at a significance level of pα of 0.05 between the four cultivated varieties of radish plants. The cultivars differed significantly among themselves in the weight of the roots. The American (a), local (b, Indian (c) and American white (d) varieties recorded root weight rates of (1.958, 3.546, and 4.547). 4.583 g, respectively, and the best in terms of root weight was the variety (d), followed by ((c), then the local ((b) and finally the variety (a).

As for the effect of the levels of ground organic fertilizer on root weights only, the O1, O2, and O3 treatments excelled the comparison treatment, which had an average of 1.067 g. With an increase in the level of ground organic cow fertilizer, it increased significantly between the treatments, as the O3 fertilization treatment excelled all of them morally, then the O2 treatment excelled the O1 treatment. As for the interaction between varieties and levels of organic fertilizer in average root weights, it reached ((c) at the significant level of O3 and amounted to (5.70) g. It differed significantly from the remaining overlapping treatments, with the exception of treatments (b) and (d) at the O3 level of cow manure.

ISSN 2072-3857

Table (11) effect of different varieties of disc radishes and levels of ground cow manure on the weight of the fruit disc of radish plants.

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0 0**	Variety
11.97	**18.33**	**11.44**	**10.09**	**8**	(A) American Red Disc
8.96	**15.30**	**11.52**	**5.03**	**3,97**	(b) Local Red
11.71	**17.67**	**16.67**	**8**	**4.50**	(c) Native American
13.46	**23**	**11.83**	**13**	**6**	(d) American White
L.S.D.V=1.215 0.05	**18.57**	**12.86**	**9.03**	**5.62**	**average**
L.S.D.F=1.215 *0.05*		**L.S.D = f**Xv= 2.430 **0.05**			

Table (11) shows the variation in fruit disc weights for radish plants according to the different varieties used. The four varieties recorded average fruit disc weights of (11.97, 8.96, 11.71, and 13.46) g, respectively. All treatments significantly excelled treatment (C), with treatment (d) showing the best results, surpassing (a) and (c). No significant difference was observed between varieties (a) and (c) in average fruit disc weight.Regarding the effect of increasing organic fertilizer levels on the average fruit disc weight of the root, treatments O1, O2, and O3 significantly excelled the control treatment O0. Treatment O3 excelled treatments O1 and O2, which showed a significant difference, with treatment O2 outperforming treatment O1 in average fruit disc weight.Regarding the interaction between varieties and organic fertilizer levels, the most significant interaction was observed for variety (d) when treated with organic fertilizer O3, recording a weight of (23 g/plant). This demonstrated a significant advantage over all other treatments in the experiment.

ISSN 2072-3857

Table (12) effect the differences in leaf dry weight among radish varieties.

average kg	**O3 3.600 kg/unit**	**O2 2.400 kg/unit**	**O1 1.200 kg/unit**	**O0**	Variety
2.862	**3.060**	**3.373**	**2.893**	**1.787**	(A) American Red Disc
3.059	**4.013**	**3.743**	**2.827**	**1.653**	(b) Local Red
2.687	**3.573**	**3.757**	**2.827**	**1.903**	(c) Native American
2.687	**3.573**	**2.78**	**2.507**	**1.887**	(d) American White
L.S.D.V=1.416	**3.255**	**3.248**	**2.655**	**1.813**	**average**
L.S.D =6.387 ***0.05=0.1416***		**L.S.D = f**Xv= 2.655 **0.05**			

Table (12) shows that varieties (d, c, b, and a) recorded average dry leaf weights of (2.862, 3.059, 2.687, and 2.687) g, respectively. Variety (b) significantly excelled the other varieties in dry leaf weight at a significant level of pα 0.05.Regarding the effect of organic fertilizer levels, a significant difference was observed between the different fertilizer levels in the average dry weight of leaves. Treatments O3, O2, O1, and O0 recorded averages of 1.813, 2.655, 3.248, and 3.255 g, respectively.All fertilizer levels significantly excelled the control treatment O0. Treatments O1 and O3 also excelled the control treatment, with O1 being particularly significant. The variation between varieties and organic fertilizer levels was also noteworthy. For example, at the O3 fertilizer level, the variety (b) treatment showed an average dry leaf weight of 4.013 g.

Discussion :

Table (12, 11 , 10, 9, 8, 7, 6, 5, 4, 3, 2) clearly shows differences between radish varieties in leaf area, plant height, number of leaves, vegetative weight, total dry weight, fresh and dry leaf weight, root length, root diameter, fruit diameter, etc. These differences are evident among the varieties, as detailed in the recorded results. These findings align with those of many researchers who have observed variations within the same plant variety. These varieties differ in their response to fertilization or nutrient absorption, in their chemical composition, and in their absorption of certain elements over others. Furthermore, their internal structure varies. Experiments have shown that the increase in dry and vegetative weight in radish varieties is due to differences in the genetic traits of the varieties in the soil and their nutrient requirements. This is consistent with the findings of [8] as well as those of [2] who indicated that the genetic traits between Varieties can alter the traits of plants growing in the soil, causing significant differences in these traits between varieties of the same plant. [5] also observed similar differences between different varieties of the same species in growth parameters and indicators due to varying genetic traits. This

ISSN 2072-3857

leads to differences in soil and climatic requirements, resulting in noticeable variations among them. [20,25] concluded that the increase in plant leaves, height, green and dry weight, and stem and root diameter after the addition of organic fertilizers is attributed to the genetic conditions responsible for plant growth, nature, and consequently, development. [13] observed a significant increase in the local radish variety compared to the Red Round radish at concentrations of 2 and 4 ml/L of added humex. The local variety excelled the others in leaf length, root length, stem length, root diameter, and height. While the variety did not significantly affect the percentage of root and leaf dry matter or the number of leaves, the effect of adding organic fertilizers on different radish varieties was observed. Increasing the levels of ground cow manure improved the plant's morphological growth traits, both compared to the control group and in comparison with other treatments. Kahatri et al. (2019) noted that adding different sources of organic fertilizers affected the growth and composition of radish crops. Similarly, [17] indicated that increasing organic fertilization levels can lead to increased crop growth and improved traits because it enhances nutrient availability and improves soil physical, chemical, and biological properties. This allows the plant to easily penetrate the soil and respire more effectively.

The results in Tables 2, 3, 4, 5, 6, 7, 6, 7, and 12 show significant differences between the addition and increase of cow manure levels when compared to each other or to the control treatment. Different radish varieties exhibited significant differences in leaf number and length, fresh and dry leaf weight, vegetative and total plant weights, plant dry matter, root length and weight, root diameter, fruit weight, and leaf area. Under these levels of organic matter, different radish varieties showed significant differences in plant growth traits. The added organic matter and increasing its levels played a major role in enhancing radish plant growth traits such as leaf number, total dry weight, fresh weight, root weight, root length and diameter, fruit weight, fresh and dry leaf weight, and total plant weight. These results are consistent with many studies conducted on radish plant growth, which found that different types and levels of organic fertilizers... The addition of compost led to significant differences in radish plant growth traits such as dry and fresh weights, root weight, number and length of leaves, biomass, root diameter, and fruit weight. A significant difference was observed at the 0.05 significance level for these added fertilizers compared to the control treatment without additives, or among the added fertilizers themselves. This difference is attributed to variations in the types of organic fertilizers, their composition, the degree of nutrient release, and the quantity of available nutrients. [1] observed, through their study of adding compost with chemical fertilizer according to the recommended application rates (25%, 50%, 75%, and 100%), its effects on radish plants, growth traits, and morphological indicators. The results indicated that adding compost with nutrients is an effective strategy for improving radish crop traits. [21] observed that adding levels of compost with chemical fertilizers... Different types of organic fertilizers for radish plants affected the productivity and yield, both quantitatively and qualitatively, across the studied varieties. [8] observed that adding compost from the Akito Capers plant at levels of 0, 2.5, 5, and 7.5 tons/dunum resulted in a significant increase ($P\alpha$ 0.05) in both local and Indian radish varieties. Increasing the concentration of compost also significantly improved radish growth traits, particularly leaf area, root mass, biomass, dry weight, and root weight in sandy loam soils, compared to the control treatment.

[14] observed the effect of different organic fertilizers derived from manure on the growth and yield of radish plants. Poultry manure (PM), goat manure, field manure (FYM), biogas byproducts (Recommended dose of fertilizers (RDF)), and a control treatment were applied. The nitrogen and phosphorus

ISSN 2072-3857

content of these manures varied, and all of these compounds affected radish traits and growth, including leaf size and number, root length and diameter, growth period, biomass, root mass, and plant height, compared to the control treatment. The PM treatment excelled all other treatments in radish growth, yield, and the studied morphological traits. The FYM treatment resulted in a significant increase in root diameter compared to the other organic fertilizer treatments, which did not differ significantly in root diameter. The same treatment also recorded the highest significant plant heights for radish. Compared to the control treatment and other organic fertilizer treatments, this study aligns with the findings of [10] who investigated the effects of various organic fertilizer types on radish plant traits over a 60-day period. The organic fertilizer treatments vermicompost, goat manure, poultry manure, and field manure resulted in a significant increase in radish leaf length compared to the control treatment. The PM treatment (poultry manure and field manure) also produced a significant increase in root length compared to the control treatment and the vermicompost and goat manure treatments over 60 days. Furthermore, the PM treatment resulted in the most significant increase in radish root diameter compared to the other fertilizer treatments.These results are consistent with those obtained by [26] in their study of organic compounds from sheep, rabbit, poultry, chicken, and compost manure. Seaweed, lemon residues, and heater residues were also used. It was noted that the best residue for radish cultivation and its effect on growth traits was chicken droppings, which caused a significant increase in plant growth after the release of nutrients compared to the remaining residues. This led to a significant increase in plant height, dry matter, stem weight, leaf count, and nitrogen productivity compared to the control treatment. [13] confirmed that adding the organic compound Humex at a specific concentration led to a significant increase in the number of leaves, the percentage of leaf and root matter, and the average root weight. Root diameter also increased significantly at 4 ml/L compared to 2 ml/L and the control treatment.

We can conclude that adding organic matter, whether compost or manure, significantly affects the traits and growth of radish plants. Furthermore, increasing the concentration of these residues significantly increases the degree of improvement in radish plant traits and growth. This variation in concentration, type of residue, composition, nature, and nutrient content leads to different effects on the plant. This effect can be attributed to several factors, including: First, the addition of organic fertilizers, essential for radish plant growth and increased crop yield, results in a high-quality and abundant harvest. These residues and organic fertilizers release nutrients for the plant and may improve soil properties (physical, chemical, and biological) (Neghamish, 2020). They also release various nutrients and synthesize a single fertilizer that increases radish crop yield and growth [9,19]

Second: Increasing the addition of organic matter increases the availability of nutrients, enhances decomposition efficiency, and releases nutrients to the plant, which in turn improves its growth traits. Organic matter may also secrete growth regulators and other substances that further promote plant growth (Neghamish, 2020).Increasing the addition of organic matter increases the availability of nutrients, enhances decomposition, and releases nutrients to the plant, which in turn improves its growth traits. The results were consistent with those obtained by Zaid et al. (2018) in their study of organic compounds from sheep, rabbit, poultry, chicken, compost, seaweed, lemon residue, and heater residue. They observed that the most beneficial residue for radish cultivation and its impact on growth traits was chick manure, which significantly increased plant growth after the release of nutrients compared to the remaining residues. This resulted in a significant increase in plant height, dry matter content, stem weight, leaf count, and nitrogen productivity compared to the control treatment. [13] confirmed that adding the organic compound Humex at a

ISSN 2072-3857

concentration of 84/L significantly increased the number of leaves, the percentage of dry matter in leaves and roots, and the average root weight. Root diameter also increased significantly at a concentration of 4 ml/L compared to 2 ml/L and control tretment .We can conclude that adding organic matter, whether compost or manure, significantly affected the traits and growth of radish plants. Furthermore, increasing the concentration of these wastes significantly increased the degree of growth and traits of radish plants. This is because the difference in concentration, type of waste, composition, nature, and nutrient content led to varying effects on the plants. This effect can be attributed to several factors, including:

1-Adding organic fertilizers necessary for radish plant growth and increased crop yield to obtain a good quality and abundant harvest. These wastes and organic fertilizers release essential nutrients for the plant and may improve soil properties (physical, chemical, and biological studies, Neghamish, 2020). They also release various nutrients and synthesize a single fertilizer that increases radish crop productivity and growth[9,19] .

2- Increasing the addition of organic matter increases the availability of nutrients, enhances decomposition efficiency, and releases nutrients to the plant, which in turn improves its growth traits. Organic matter may also secrete growth regulators and other substances that further promote plant growth (Neghamish, 2020).

3- Some plants increase the availability of nitrogen (N) in the soil, and some organisms increase the availability of phosphorus in the soil and its leaves, stimulating plant growth. These elements increase the frequency of photosynthesis, leading to increased plant growth.

4- Some added organic compounds, such as chelating compounds, are responsible for the synthesis of amino acids, such as tryptophan, which is important in the production of oleoresin-1 (AAA). AAA is responsible for increasing cell division in lateral meristematic tissues, particularly vascular cadmium tissue, thus increasing the diameter, branches, and vegetative mass of the plant [4]..

5- Increased release of nitrogen (N), phosphorus (P), and other elements leads to increased nutrient addition. Organic matter increases chlorophyll, cell size, and the number and area of foliage, as well as indoleacetic acid [22].

6- Increased vegetative growth may also be attributed to the genetic factors specific to the variety [3].

7- Adding organic matter improves the physical, chemical, and biological properties of the soil. It enhances soil physical conditions such as permeability and bulk density. Microorganisms activate the biological decomposition processes of organic matter, secreting enzymes and hormones that break down organic matter and providing the plant with complete, readily available nutrients, thus increasing plant growth [15].

8- Organic matter increases water absorption, retention, and moisture, and increases water consumption by microorganisms, thereby increasing... Fresh weight and vegetative weight [11].

9- Organic matter increases the release of nutrients, particularly nitrogen, and enhances the efficiency of organic matter synthesis and the production of manufactured materials. It also increases dry matter, as fertilizer contains sufficient amounts of nitrogen, phosphorus, and potassium (N, P, K) that are involved in physiological and biological processes, including food production, cell division and elongation, energy production, and increased dry matter in plants [6,16] who observed that adding organic matter increased the vegetative and dry matter content of broccoli and pepper plants.

ISSN 2072-3857

10- Organic matter increases the activity and effectiveness of soil microorganisms because it serves as a source of energy and organic carbon for heterotrophic and autotrophic organisms. It provides readily available food, and these microorganisms decompose organic matter, releasing various nutrients.

11- Microorganisms accelerate the decomposition of organic matter. In winter, organic matter is darker or browner in color, absorbs heat, and provides warmth for soil organisms. This, in turn, increases the activity and effectiveness of organisms that decompose and break down organic matter, converting it into inorganic (mineral) compounds. These compounds serve as a source of plant nutrition, promoting growth and productivity (Neghamish, 2020).

Conclusions and Recommendations:

1- Different radish varieties exhibited variations in growth traits and indicators depending on their genetic makeup, soil composition and composition, and the specific requirements of the variety.

2- The added organic matter significantly increased the growth of all varieties and the studied growth traits. This increase was substantial with increasing levels of added organic matter compared to the control treatment and with lower concentrations.

3- The level of ground cow manure added to radish plants was significantly dominant at 3.6 kg/dunum compared to the other levels for the varieties.

Recommendation:

The varieties differed in root diameter, fruit weight, and crop taste. The American white disc variety (d) was the most recommended and preferred, yielding the best fruit weights. We recommend avoiding the local variety (b) due to its low productivity, excessive vegetative growth, and limited root and fruit development.

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