Open Access

Phytopathogenomics and Disease Control., *2024, 3(2)221-232*
ISSN (Online):2957-5842; ISSN (Print):2957-5834
DOI: https://doi.org/10.22194/Pdc/3.1041
https://societyfia.org/journal/PDC

Society for Innovative Agriculture

Effect of Manure Addition on the Growth, Yield, and Disease (Leaf Spot) Resistance of Different Varieties of Okra

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Okra is a popular vegetable crop grown throughout the world during the spring and summer seasons. It is valued for its edible green seed pods. It is a member of the hibiscus family, Malvaceae with floral characteristics, originated from tropical Africa, and was first cultivated in Egypt in the 12th century. Numerous biotic and abiotic variables, such as illnesses and insect pests, are negatively affecting okra production. One of them, leaf spot, is a dangerous fungal disease that can appear in okra-growing regions. Okra as ladyfinger or bhindi in Pakistan is a widely cultivated vegetable crop that holds significant economic importance in the country. A field experiment was designed using a randomized complete block design (RCBD) with three replications. The study involved different levels of poultry manure and various okra varieties. Manure was applied in the following amounts per hectare: 0 tonnes, 5 tonnes, 10 tonnes, 15 tonnes, and 20 tonnes. The okra varieties used were Sabzpari, F1 Green gold, Super Lady, Saloni, Swat Green, and Kiran. Data collected included: Plant height: Measured from the bottom to the tip of the plant using a measuring scale. Fruit length: Measured using water displacement and vernier calipers. Stem girth: Measured 2 inches above the soil surface using a digital caliper. Fruit weight: Determined using a digital scale. Number of fruits per plant: Counted and averaged. Yield per plant: Total weight of fruits harvested from each plant. Number of leaves and spot leaf disease: Leaves counted and checked for fungal disease.Fresh pod weight: Weighed using a digital scale. Application of manure 20 tonnes ha-1 exhibited significant maximum results with 136.96 complaint height, 5.39 cm fruit length, 3.30 cm stem girth, 10.62 g fruit weight, 3.57 number of fruits plant^{-1}, 725.31 g yield plant^{-1}, 10.19 number of leaves plant^{-1} and 10.33 g fresh pod weight. In contrast, okra treated under control exhibited the lowest performance, 118.17 cm plant height, 2.50 cm fruit length, 2.57cm stem girth, 7.75g fruit weight, 2.84 number of fruits plant^{-1}, 315.99 g yield plant^{-1}, 5.38 number of leaves plant^{-1} and 8.62 g fresh pod weight. Among the okra variety, Kiran yielded the best results, with 129.93 cm plant height, 4.25 cm fruit length, 3.01 cm stem girth, 9.48 g fruit weight, 3.29 number of fruits plant^{-1}, 563.74 g yield plant^{-1}, 8.29 number of leaves plant^{-1} and 9.67 g fresh pod weight. On the other hand, the variety Sabzpari showed the lowest performance, with 125.58 cm plant height, 3.65 cm fruit length, 2.86 cm stem girth, 8.88g fruit weight, 3.14 number of fruits plant^{-1}, 478.37 g yield plant^{-1}, 7.29 number of leaves plant^{-1} and 9.31 g fresh pod weight. After going through the findings of the present research, it has been suggested that the Application of manure@ 20 tonnes ha-1 can be an effective growth regulator for okra crops, leading to improved growth and increased yields. Spot leaf disease on okra leaves affects the leaves due to fungal infection.

Keywords: RCBD, varieties of Okra, disease resistance, manure, Plant height, Fruit length, Stem girth, Fruit weight, Number of fruits per plant, yield per plant, number of leaves, biotic and abiotic variables.

INTRODUCTION

Okra is a well-known garden ornamental plant that grows during spring through summer months across the globe. These are the vivid green seed pods that are used as highly nutritious meals (Akpa *et al.,* 2019). The pound is another member of

Rafee, M., M.S. Jaffar, U. Kalsoom, M.B. Khan, Z.U. Haq and S. Ali. 2024. Effect of manure addition on the growth, yield, and disease (leaf spot) resistance of different varieties of okra. Phytopathogenomics and Disease Control 3:221-232.
[Received 15 Apr 2024; Accepted 24 May 2024; Published 18 Jun 2024]

the hibiscus family, Malvaceae, and is characterized by floral features. It is believed that it came from tropical Africa and was grown in Egypt over the 12th century before. In Pakistan, okra (known as ladyfinger or bhindi) is a commonly defined crop that holds great economic importance along with large-scale cultivation of horticulture. This acreage is understood to have these characteristics because of its nutritional value, different uses in the kitchen and it can adapt to any climatic condition (Shah *et al.,* 2018). Okra, being one of the valuable cash crops, can not only serve as an important income-generating activity for the farmers but can also be a profitable venture. It is mainly the Middle Eastern countries, Europe, and North America that are demanding okra. The banana flesh has immense potential in export earnings for the country (Iqbal *et al.,* 2015). Due to its adaptability to diverse agro-climatic regions from fertile plains to hilly areas, okra proves to be a convenient crop for growing in Pakistan. It can be grown during the Kharif (summer) as well as Rabi (winter) seasons, which enables its availability for crop production during the whole year. This situation helps to increase the availability of this vegetable throughout the year (Siddiqui *et al.,* 2016; Hassan *et al.,* 2017).

Various animal manures including cow dung, chicken manure, and rabbit and goat farm manure are used as organic matrices for the experimental process (Adekiya *et al.,* 2020). A lover, or organic fertilizer, obviously had a pH, carbon, nitrogen, and water-soluble calcium, magnesium, and potassium increase in soil. The fact that almost every time leads to this is clear evidence that our yields increased thereby output too (Lulu *et al.,* 2022). The reason for this is that they supply some nutrients that are necessary for the plants to develop appropriately and grow quickly, making organic fertilizers one of the highest quality fertilizers usable in agriculture. Based on a study published by Khandhaker *et al.,* (2017), chicken manure as well as vermin compost have a positive impact on the growth of okra and it also increases the crop weight by 51%. Furthermore, it recorded increased smaller sizes of okra when fertilized with poultry-growing manure (Tiamiyu et al., 2012).

Poultry manure, a by-product of the thriving poultry industry, contains a blend of essential nutrients including nitrogen, phosphorus, and potassium, which are vital for plant growth and development. Additionally, poultry manure is enriched with organic matter that can enhance soil structure, water retention, and nutrient-holding capacity. Incorporating poultry manure into agricultural systems presents an opportunity to recycle organic waste, reduce reliance on synthetic fertilizers, and contribute to sustainable farming practices. Numerous biotic and abiotic variables, such as illnesses and insect pests, are negatively affecting okra production.

One of them, leaf spot, is a dangerous fungal disease that can appear in okra-growing regions (Raniet al., 2019; Nwoke & Nwogbo, 2020).

Many researchers have documented organic, together with inorganic fertilizers on okra crop yield enhancement. However, it might be the case that organic and inorganic fertilizers may react differently when added to the soil in comparison to soil physical parameters, crop yields, and quality since they have differing chemical compositions/qualities (Chen *et al.,* 2016). It is generally imaginable that the fact that nowadays the world depends on the amounts of fertilizers to boost the fertility of the soil. Organic manure may contain animal, plant, or not only one, or two of these types of organic components, which are composite fertilizers. In contrast to the manure from various animals such as goats, pigs, and cows, poultry produce has a relatively higher nutrient content per unit of quantity (Akanni et al., 2005).

Animal manures, when used efficiently and effectively in agriculture, play a vital role in promoting sustainable crop productivity. They achieve this by immobilizing essential nutrients that are prone to leaching, a process where nutrients are washed away from the soil by water. Manures contain a variety of nutrients, including nitrogen, phosphorus, and potassium, along with organic matter. When these nutrients are applied through manures, they are released into the soil slowly and are stored for extended periods. The slow release of nutrients from manures means that they continue to nourish crops over an extended period (Hirel *et al.,* 2011).

MATERIALS AND METHODS

A field experiment was conducted to evaluate the effect of manure addition on the growth, yield, and disease (spot leave) resistance of different varieties of okra. The experiment was designed using a randomized complete block design (RCBD) two-factorial design with three replications. There were five treatments i.e. 0, 5, 10, 15, and 20 tones ha-1 poultry manure per hectare. The verities are also treatment.

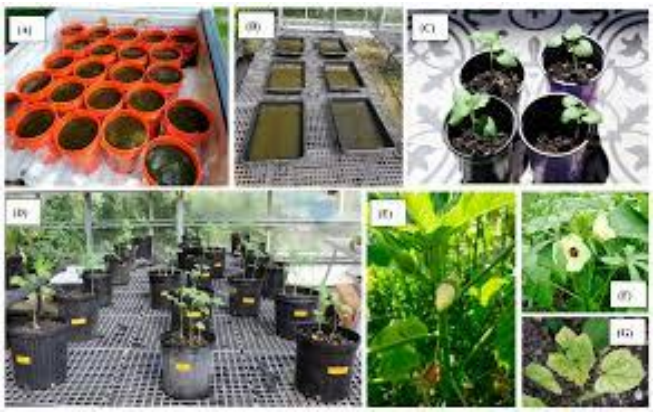

Figure 1. Okra growth and disease

***Treatments Details*:** The details of treatments are furnished as follows:

Factor 1= manure application

P1= 0 tones ha-1 manure per hectare P2= 5 tones ha-1 poultry manure per hectare P3=10 tonnes-1poultry manure per hectare P4= 15tonnes ha-1 poultry manure per hectare P5= 20tonnes ha-1 poultry manure per hectare.

Factor 2 = Okra varieties V1=Sabzpari, V2=F1Greengold, V3= Super lady, V4= Saloni, V5=swat green, V6= Kiran.

***Data Collection*:** The following data was collected for comparison among treatments.

Plant height (cm): At maturity, plant height was measured by randomly selecting each plot using a measuring scale and then averaging the height of a representative plant from the bottom to the tip of the plant.

***Fruit length (cm)*:** The volume of fruit is measured by the water displacement. The Axial damnation, length (longest diameter), thickness (shorter diameter), and width were measured using Venire caliper.

***Stem girth (cm)*:** The stem girth was measured from the base of the plant (2 inches above soil surface) using a digital caliper.

***Fruit Weight (g)*:** The fruit weights were determined by a digital scale.

***Number of fruits per plant*:** The selected plant fruit was counted in each plot and then averaged.

***Yield per plant (kg)*:** After harvesting, the selected plant fruits were weighed on a digital scale.

***Number of leaves and spot leaf disease*:** The selected plant leaves were counted in each plot and then averaged and examined how fungal (spot leaf) disease affects okra leaves.

Fresh pod weight (gm): The fresh pod weight was determined by a digital scale.

Data Analysis

***Statistical analysis*:** The data was processed statistically through Statistics x Ver.8.1 Software (Gomez and Gomez, 1984).

RESULTS

***Plant height (cm)*:** The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 1, the maximum plant height (136.96 cm) was observed with the Application of Poultry manure @ 20 tonnes ha-1, followed by poultry manure addition @ 15 tonnes ha-1, poultry manure addition @ 10 tonnes ha^{-1} and Application of Poultry manure@ 5 tonnes ha-1 with an average plant height of 132.52 cm, 128.08 cm, and 123.64 cm, respectively. The minimum plant height with an average of 118.17 cm was observed to be under control. The variety Kiran showed the maximum plant height (129.9 cm), followed by Swatgreen (129.19cm), Saloni (128.31cm), Superlady (127.57cm), R.K.F1 (126.66 cm), while the minimum plant height (125.58 cm) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha^{-1} and variety Kiran resulted in the maximum plant height (138.81 cm), whereas the interaction control and the variety Sabz pari resulted in the minimum plant height (114.14 cm). This suggests that the Application of Poultry manure@20 tonnes ha^{-1} can be an effective growth regulator for okra crops, leading to improved growth and increased yields. The results are further compared with the study of the observed increase in plant height among the okra plants supplemented with poultry manure aligns with previous research in other crops. The study by Gupta and Yadav (2015) on okra cultivation demonstrated that poultry manure supplementation led to improved plant growth and biomass accumulation.

Table 1. Plant height (cm) of okra varieties and influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	114.14	116.57	118.12	118.86	120.31	121.05	118.17E
Application of Poultry manure@ 5 tonnes ha^{-1}	121.77	122.53	123.27	124.01	124.75	125.49	123.64D
Application of Poultry manure@ 10 tonnes ha^{-1}	126.23	126.97	127.71	128.45	129.19	129.93	128.08C
Application of Poultry manure@ 15 tonnes ha^{-1}	130.67	131.41	132.15	132.89	133.63	134.37	132.52B
Application of Poultry manure@ 20 tonnes ha^{-1}	135.11	135.85	136.59	137.33	138.07	138.81	136.96A
Mean	125.58F	126.66E	127.57D	128.31C	129.19B	129.93A	
		Treatments			Varieties		T x V
±SE		0.2684			0.2940		0.6574
LSD0.05		0.5372			0.5885		1.3159

***Fruit length (cm)*:** The fruit length of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 2, the maximum fruit length (5.39 cm) was observed with the Application of Poultry manure@ 20 tonnes ha-1, followed by the application of Poultry manure@ 15 tonnes ha-1, Application of Poultry manure@ 10 tonnes ha-1 and Application of Poultry manure@ 5 tonnes ha-1 with an average fruit length of 4.67 cm, 3.95 cm, and 3.23 cm, respectively. The minimum fruit length with an average of 2.50 cm was observed under control. The variety Kiran showed the maximum fruit length (4.25 cm), followed by Swat green (4.13 cm), Saloni (4.01 cm), Super lady (3.89 cm), R. K. F1(3.77 cm), while the minimum fruit length (3.65 cm) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum fruit length (5.69cm), whereas the interaction control and the variety Sabz pari resulted in the minimum fruit length (2.20 cm). The LSD test indicated that the differences in fruit length between treatments and varieties were significant at a level of ($P<0.05$). This is consistent with research (John et al., 2004) that found that PM has important nutrients linked to increased photosynthetic activities, which support the growth of roots and vegetables. For every reproductive attribute tested, poultry dung was used. This is consistent with the research of Dauda et al. (2008).

Stem girth (cm): The stem girth of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 3, the maximum stem girth (3.30 cm) was observed with the Application of Poultry manure@ 20 tonnes ha-1, followed by the application of Poultry manure@ 15 tonnes ha-1, Application of Poultry manure@ 10 tonnes ha-1

Table 2. Fruit length (cm) of okra varieties as influenced by application of poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	2.20	2.32	2.45	2.57	2.69	2.81	2.50E
Application of Poultry manure@ 5 tonnes ha^{-1}	2.93	3.05	3.17	3.29	3.41	3.53	3.23D
Application of Poultry manure@ 10 tonnes ha^{-1}	3.65	3.77	3.89	4.01	4.13	4.25	3.95C
Application of Poultry manure@ 15 tonnes ha^{-1}	4.37	4.49	4.61	4.73	4.85	4.97	4.67B
Application of Poultry manure@ 20 tonnes ha^{-1}	5.09	5.21	5.33	5.45	5.57	5.69	5.39A
Mean	3.65F	3.77E	3.89D	4.01C	4.13B	4.25A	
		Treatments		Varieties		T x V	
±SE		2.1253		2.3283		5.2063	
LSD0.05		4.2543		4.6603		0.0104	

Table 3. Stem girth (cm) of okra varieties as influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	2.49	2.52	2.56	2.59	2.62	2.65	2.57E
Application of Poultry manure@ 5 tonnes ha^{-1}	2.68	2.72	2.75	2.78	2.81	2.84	2.76D
Application of Poultry manure@ 10 tonnes ha^{-1}	2.87	2.90	2.93	2.96	2.99	3.02	2.94C
Application of Poultry manure@ 15 tonnes ha^{-1}	3.05	3.08	3.11	3.14	3.17	3.20	3.12B
Application of Poultry manure@ 20 tonnes ha^{-1}	3.23	3.26	3.29	3.32	3.35	3.38	3.30A
Mean	2.86F	2.89E	2.92D	2.95C	2.98B	3.01A	
		Treatments		Varieties		T x V	
±SE		1.5943		1.7463		3.9053	
LSD0.05		3.1913		3.4963		7.8173	

and Application of Poultry manure@ 5 tonnes ha-1 with an average stem girth of 3.12 cm, 2.94 cm, and 2.76 cm, respectively. The minimum stem girth with an average of 2.57 cm was observed under control. The variety Kiran showed the maximum stem girth (3.01 cm), followed by Swat green (2.98 cm), Saloni (2.95 cm), Super lady (2.92 cm), R. K. F1(2.89 cm), while the minimum stem girth (2.86 cm) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum stem girth (3.38 cm), whereas the interaction control and the variety Sabz pari resulted in the minimum stem girth (2.49 cm). The LSD test indicated that the differences in stem girth between treatments and varieties were significant at a level of ($P<0.05$). Nweke et al. (2013) have discovered comparable outcomes. The results of Ufera et al. (2013), who reported that the treatment of poultry manure created the largest stem girth, corroborated the conclusion. According to Alphonse and Saad (2000), the application of poultry manure improved the vegetative development of okra. This may have been caused by the manure's higher nutritional content, quick mineralization, ideal C/N ratio, and growth-promoting agents. These findings concur with those of Makindae and Ayoola (2012).

Fruit weight (g): The fruit weight of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 4, the maximum fruit weight (10.62 g) was observed with the Application of Poultry manure@ 20 tonnes ha-1, followed by the application of Poultry manure@ 15 tonnes ha-1, Application of Poultry manure@ 10 tonnes ha-1 and Application of Poultry manure@ 5 tonnes ha-1 with an average fruit weight of 9.90 g, 9.18 g, and 8.46 g, respectively. The minimum fruit weight with an average of 7.75 g was

Table 4. Fruit weight (g) of okra varieties as influenced by application of poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	7.47	7.59	7.71	7.80	7.91	8.04	7.75E
Application of Poultry manure@ 5 tonnes ha^{-1}	8.16	8.28	8.40	8.52	8.64	8.76	8.46D
Application of Poultry manure@ 10 tonnes ha^{-1}	8.88	9.00	9.12	9.24	9.36	9.48	9.18C
Application of Poultry manure@ 15 tonnes ha^{-1}	9.60	9.72	9.84	9.96	10.08	10.20	9.90B
Application of Poultry manure@ 20 tonnes ha^{-1}	10.32	10.44	10.56	10.68	10.80	10.92	10.62A
Mean	8.88F	9.00E	9.12D	9.24C	9.35B	9.48A	
		Treatments			Varieties		T x V
±SE		3.8453			4.2123		9.4193
LSD0.05		7.6973			8.4313		0.0189

Table 5. Numbers of fruit plant^{-1} of okra varieties as influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	2.76	2.79	2.83	2.86	2.89	2.92	2.84E
Application of Poultry manure@ 5 tonnes ha^{-1}	2.96	2.99	3.02	3.05	3.08	3.11	3.03D
Application of Poultry manure@ 10 tonnes ha^{-1}	3.14	3.17	3.20	3.23	3.26	3.29	3.21C
Application of Poultry manure@ 15 tonnes ha^{-1}	3.32	3.35	3.38	3.41	3.44	3.47	3.39B
Application of Poultry manure@ 20 tonnes ha^{-1}	3.50	3.53	3.56	3.59	3.62	3.65	3.57A
Mean	3.14F	3.17E	3.20D	3.23C	3.26B	3.29A	
		Treatments			Varieties		T x V
±SE		3.1433			3.4433		7.7003
LSD0.05		6.2923			6.8933		0.0154

observed under control. The variety Kiran showed the maximum fruit weight (9.48 g), followed by Swat green (9.35 g), Saloni (9.24 g), Super lady (9.12 g), R. K. F1(9.00 g), while the minimum fruit weight (8.88 g) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum fruit weight (10.92 g), whereas the interaction control and the variety Sabz pari resulted in the minimum fruit weight (7.47 g). The LSD test indicated that the differences in fruit weight between treatments and varieties were significant at a level of ($P<0.05$). The outcomes aligned with the research conducted by Premshekar and Rajashree, (2009), which suggested that the fruit weight response of crops to poultry manure application could be ascribed to enhanced physical and biological characteristics of the soil, which in turn improved the plants' access to nutrients.

***Numbers of fruit plant^{-1}*:** The numbers of fruit plant-1 of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 5, the maximum number of fruit plant-1 (3.57) was observed with the Application of Poultry manure@ 20 tonnes ha-1, followed by the application of Poultry manure@15tonnes ha- 1, Application of Poultry manure@ 10 tonnes ha-1 and Application of Poultry manure@ 5 tonnes ha-1 with an average number of fruit plant-1 of 3.39, 3.21 and 3.03, respectively. The minimum number of fruit plant-1 with an average of 2.84 was observed under control. The variety Kiran showed the maximum numbers of fruit plant-1(3.29), followed by Swat green (3.26), Saloni (3.23), Super lady (3.20), R. K. F1 (3.17), while the minimum numbers of fruit plant-1 (3.14) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum numbers of fruit plant-1 (3.65), whereas the interaction control and the variety Sabz pari resulted in the minimum numbers of fruit plant-1 (2.76). The LSD test indicated that the differences in numbers of fruit plant-1 between treatments and varieties were significant at a level of ($P<0.05$). The outcomes were consistent with the research conducted by Onwu et al. (2014), which suggested that applying chicken manure can raise okra output. Premsekhar and Rajashree made a related observation (2009).

***Yield plant^{-1} (g)*:** The yield plant-1 (g) of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of ($P<0.05$). According to the results presented in Table 6, the maximum yield plant-1 (725.31 g) was observed with Application of Poultry manure@ 20 tonnes ha-1, followed by application of Poultry manure@ 15 tonnes ha-1, Application of Poultry manure@10 tonnes-1 and Application of Poultry manure@5 tonnes ha-1 with an average yield plant-1 of 623.31 g, 521.31 g and 419.31, respectively. The minimum yield plant-1 with an average of 315.99 g was observed under control. The variety Kiran showed the maximum yield plant-1 (563.74 g), followed by Swat green (546.66g), Saloni (529.57 g), Super lady(512.49 g), R. K. F1(495.44 g), while the minimum yield plant-1 (478.37 g) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum yield plant-1 (767.84 g), whereas the interaction control and the variety Sabz pari resulted in the minimum yield plant-1 (272.63 g). The LSD test indicated that the differences in yield plant-1 between treatments and varieties were significant at a level of ($P<0.05$). Furthermore, the present results concurred with the okra research conducted by Premsekhar and Rajashree, (2009), which suggested that

Table 6. Yieldplant^{-1}(g) of okra varieties as influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	272.63	289.96	307.21	324.60	342.07	359.47	315.99E
Application of Poultry manure@ 5 tonnes ha^{-1}	376.81	393.81	410.81	427.81	444.81	461.81	419.31D
Application of Poultry manure@ 10 tonnes ha^{-1}	478.81	495.81	512.81	529.81	546.81	563.81	521.31C
Application of Poultry manure@ 15 tonnes ha^{-1}	580.81	597.81	614.81	631.81	648.81	665.81	623.31B
Application of Poultry manure@ 20 tonnes ha^{-1}	682.81	699.81	716.81	733.81	750.81	767.81	725.31A
Mean	478.37F	495.44E	512.49D	529.57C	546.66B	563.74A	
		Treatments			Varieties		T x V
±SE		0.2069			0.2266		0.5067
LSD0.05		0.4141			0.4536		1.0144

improved soil physical and biological qualities resulting from increased crop nutrient supply could be the cause of the increased crop yield brought about by the application of organic manure. Furthermore, it supported the findings of Akande *et al.* (2003) that applying organic manure might change the characteristics of the soil, potentially improving crop productivity.

***The number of leaves plant-1 and spot leaf disease*:** The numbers of leaves plant-1 of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green, and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of (P<0.05). It was discovered that 28ºC and pH 6.5 were the ideal values for the fungus's development. At pH 10.5 and 5ºC, the fungus showed the least amount of development. According to the results presented in Table 7, the maximum number of leaves plant-1 (10.19) was observed with the Application of Poultry manure@ 20 tonnes ha-1, followed by the application of Poultry manure@ 15 tonnes ha-1, Application of Poultry manure@ 10 tonnes ha-1 and Application of Poultry manure@ 5 tonnes ha-1 with an average number of leaves plant-1 of 9.00, 7.79 and 6.59, respectively. The minimum number of leaves plant-1 with an average of 5.38 was observed under control. The variety Kiran showed the maximum numbers of leaves plant-1 (8.29), followed by Swat green (8.09), Saloni (7.89), Super lady (7.69), R. K. F1 (7.49), while the minimum numbers of leaves plant-1 (7.29) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment Application of Poultry manure@ 20 tonnes ha-1 and variety Kiran resulted in the maximum number of leaves plant-1 (10.69), whereas the interaction control and the variety Sabz pari resulted in the minimum number of leaves plant-1 (4.88). The LSD test indicated that the differences in the numbers of leaves plant-1 between treatments and varieties were significant at a level of (P<0.05). According to Tindall (1992), the application of organic fertilizers increased in leaves, confirming the fertilizer's significance for plant growth. According to Akanbi

Table 7. Number of leave splant^{-1} of okra varieties as influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	4.88	5.07	5.27	5.48	5.68	5.89	5.38E
Application of Poultry manure@ 5 tonnes ha^{-1}	6.09	6.29	6.49	6.69	6.89	7.09	6.59D
Application of Poultry manure@ 10 tonnes ha^{-1}	7.29	7.49	7.69	7.89	8.09	8.29	7.79C
Application of Poultry manure@ 15 tonnes ha^{-1}	8.49	8.69	8.89	9.09	9.29	9.49	9.00B
Application of Poultry manure@ 20 tonnes ha^{-1}	9.69	9.89	10.09	10.29	10.49	10.69	10.19A
Mean	7.29F	7.49E	7.69D	7.89C	8.09B	8.29A	
		Treatments			Varieties		T x V
±SE		2.2113			2.4223		5.4153
LSD0.05		4.4253			4.8483		0.0108

Table 8. Fresh pod weight (g) of okra varieties as influenced by application poultry manure.

Treatments	Varieties						Mean
	Sabz pari	R.K.F1	Super lady	Saloni	Swat green	Kiran	
Control	8.43	8.51	8.58	8.65	8.74	8.82	8.62E
Application of Poultry manure@ 5 tonnes ha^{-1}	8.89	8.96	9.03	9.10	9.17	9.24	9.07D
Application of Poultry manure@ 10 tonnes ha^{-1}	9.31	9.39	9.46	9.53	9.60	9.67	9.49C
Application of Poultry manure@ 15 tonnes ha^{-1}	9.74	9.81	9.88	9.95	10.02	10.09	9.91B
Application of Poultry manure@ 20 tonnes ha^{-1}	10.16	10.23	10.30	10.37	10.44	10.51	10.33A
Mean	9.31F	9.38E	9.45D	9.52C	9.59B	9.67A	
		Treatments			Varieties		T x V
±SE		3.5873			3.9303		8.7873
LSD0.05		7.1813			7.8663		0.0176

et al.'s (2000) experiments, the availability of nutrients, particularly nitrogen, affects a plant's capacity to develop vegetatively.

Fresh pod weight (g): The fresh pod weight of okra varieties Sabz pari, R. K. F1, Super lady, Saloni, Swat green and Kiran were treated with different poultry manure levels. The result indicates that the effect of varieties by different treatments was significant at a level of (P<0.05). According to the results presented in Table 8, the maximum fresh pod weight (10.33 g) was observed with the application of poultry manure @ 20 tonnes ha-1, followed by poultry manure @ 15 tonnes ha-1, application of poultry manure @ 10 tonnes ha-1 and application of poultry manure @ 5 tonnes ha-1 with an average fresh pod weight of 9.91 g, 9.49 g, and 9.07 g, respectively. The minimum fresh pod weight with an average of 8.62 g was observed under control. The variety Kiran showed the maximum fresh pod weight (9.67 g), followed by Swat green(9.59 g), Saloni(9.52 g), Super lady (9.45 g), R. K. F1(9.38 g), while the minimum fresh pod weight (9.31 g) was observed in the Sabz Pari. The interactive effect of treatments and varieties, the treatment application of poultry manure @ 20 tonnes ha-1 and variety Kiran resulted in the maximum fresh pod weight (10.51 g), whereas the interaction control and the variety Sabz pari resulted in the minimum fresh pod weight (8.43 g). This finding may have implications for the varieties' culinary qualities. Regarding plant heights, leaf area, and number of branches per plant, the results are consistent with those of Sabatu, (2016), who observed similar things while working with similar varieties in Zuru. Harper (2016) states that fresh pod production must be taken into consideration to make any meaningful decisions (Khatoon et al., 2017). Organic fertilizers Poultry manure was used directly from poultry farm operations (Adekiya et al., 2020).

DISCUSSION

The study revealed significant differences in the growth parameters of okra when treated with various levels of poultry manure, as indicated by the data (P<0.05). The maximum plant height of 136.96 cm was observed with the application of poultry manure at 20 tonnes ha-1, followed by lower applications, and the minimum plant height of 118.17 cm was observed under control conditions. Lastly, among all the trees, the Kiran was the tallest tree, and the SabzPari was the shortest. The interim pact of treatments and varieties let us reach the result that 20 tonnes of ha-1 manure in the Kiran variety was optimum as the maximum plant height was 138. 2. 67 X 2. 57 (PLT) has grown better than that of the control treatment on Sabz Pari which has been 1. 46 ft. 14 cm. supporting this is a prior study by a group of researchers including R. K. Gupta and M. Yadav (2015), who have established that poultry manure is capable of having a remarkable impact on plant growth and biomass increase. As for fruit length, the fruit length after applying poultry manure at a rate of 20 tons/hectare was the longest, which was 5. 966 cm. 8. 0 inches were measured for cucumber at the highest amount of manure, and a progressive decrease in size was noticed at the lower levels of manure application, only 2. 55 inches being recorded in the control treatment. Meantime, the pluot 'Kiran' demonstrated the longest fruit length from 'Sabz Pari,' which had the minimum length. The highest fruit length was found from 5 lengths. With the supplement of 20 Mg of poultry manure ha-1 and Romyqar variety, a length of 68 cm was obtained. However, the Kiran variety and shoots of `sabzriyaki` resulted in the shortest cut among all. Thus, the research coincides with the findings of J. et al. (2004) and Dauda and Dauda (2008) that poultry manure serves to heighten vegetative growth and promotes reproductive features through its mineral content.

The most pronounced august was also recorded in the animals at the pedigree, with a maximum diameter of 18. 0 cm. Over a period of 4 years, we have measured a rate of 200 kgm2/ha overall years, and the minimum diameter of 8 cm. 57 cm under control. The frequency of Khalo's growing was also shown as the wildest, but Sabz Pari's most clearly had the thinnest. Their top stem had 3 cm stem diameters after the application of 10 tonnes ha-1 of poultry manure and 50 kg ha-1 of Kiran. Such experiments involving Corylus avellana, with the first treatment being 38 cm and the control treatment being the minimum girth of 2 cm, were carried out on Sabz Pari. 5 cm. Their outcome is in agreement with the results of Nweke et al. (2013) and Ufera et al. (2013) which provide evidence that poultry manure is a source of significant increase in stem girth due to its high nutrient content and rapid mineralization. In conclusion, [fruit size] is the highest of all. The recommended rate of manure 20 tons ha-1), 62 g weight was recorded, and the decreasing weight level was related to lower manure levels for lesser weight. The lowest weight was 7 g for manure. 75 g was accumulated in the absence of enzymes. Variability cultivar Kiran demonstrated a higher pedigree weight, and the lowest seed weight was shown by Sabz Pari. The application of 20 tonnes of ha-1 manure and the Kiran variety cause the highest fruit weight being 10. On the one hand, the reflecting mirrors' weight in the reject confirms itself as 92g, and on the other hand, Sabz Pari gets ones with the minimum net weight which is 7 g. 0. 65 lbs. This data is from Premshekar and Rajashree's (2009) research that chicken manure has the tendency to improve soil's properties and the amount of available nutrients thereby leading to high-caliber quality fruits with large weight. The usage strategy of poultry manure had a major impact on a range of growth features of okra plants such as total length, width, leaf length of stem, weight of fruit, number of pods per plant, productive pod weight in plants, total leaf rosette in a plant, and fresh fruit weight. Those results signify the necessity of an organic fertilizer to improve the okra's growth and effectiveness.

The highest canopy for the different poultry manure rates of 20, 15, 10, and 5 tonnes ha-1 were 136. 96 cm, 132 cm, 132 cm, and 82 cm respectively. 52 cm, 128. 08 cm, and 123. 64 cm, respectively. The vegetation control experiment was minimum in plant height (118. 17 cm) which is the optimum plant height for a grass lawn. Kiran's was the highest plant from the lot, which reached 129 cm. Sabz Pari was exceptional in this area (256. 10 cm), whereas another brand, Utipar, had the minimum area (125. 58 cm). Interaction Hahn poultry manure (20 tonnes ha-1) and the Kiran variety were found to be the optimal condition which had the biggest plant height (138 cm). 34 cu. inch (control treatment with SABZ Pari) was the smallest compared with the (3. 54 cu. inch) of the treatment that put the Abadan Pari. The latter result demonstrates poultry manure contributed maximal to plant height and this association is well supported by the findings of Gupta and Yadav (2015) who attained similar results in okra cultivation. The application of poultry manure also significantly affected the fruit length of okra. The maximum fruit length (5.39 cm) was observed with 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with average lengths of 4.67 cm, 3.95 cm, and 3.23 cm, respectively. The control had the shortest fruit length (2.50 cm). Variety-wise, Kiran had the longest fruits (4.25 cm), while Sabz Pari had the shortest (3.65 cm). The highest fruit length (5.69 cm) was observed with the combination of 20 tonnes ha-1 and Kiran, and the lowest (2.20 cm) with the control and Sabz Pari. This is consistent with John et al. (2004), who highlighted the nutrient-rich nature of poultry manure that enhances photosynthetic activity and fruit development.

Like the stems, the girths also carried the same pattern, which was presented with the maximum girth (3. 30 cm) observed at 20, 15, and 10 tonnes ha-1. Their average girths were 3, 3, and 2 cm, respectively. 12 cm, 2. 94 cm, and 2. 76 cm, respectively. The control became the thinnest one (2. 57 cm in diameter). With article type, Kiran measured with the maximum stem girth (3). On the other hand, the fluctuation depths of opposing tides were among the least depths with (0. 285 m) and (2. 86 cm), respectively, measured in the Sabz Pari study. With the 20 tonnes of interactions with Kiran, its total stem girth generated the most volume (3). The findings from the experiment that compared the length of seeds after possible seed treatment with an environmentally friendly group of microorganisms and control that was not treated showed that the latter had the minimum size (2. 49 cm), while the control with Sabz Pari had the shortest (2. 8 cm). Such findings are in agreement with what was stated by the research of Ufera et al. (2013) and others (Alphonse and Saad 2000) which proposed an increase in vegetative growth with the use of poultry manure. The season in poultry manure application was found to influence fruit weight in a significant way. The heaviest fruit (10. 62. g) was produced for for instance in the 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with average weights that is 9. 90 g, 9. 18 g, and 8. 46 g, respectively. In every experimental treatment, the average fruit weight was different: in the control group the greatest heterogeneity of fruit weight was observed (7. 75g). Statistically, the state to grow the heaviest fruits, Kiran was the topmost (9. Tengram marked the best result among the presented companies (48 g), while Sabz Pari had the worst result, an anathema was near to Tengram (31 g) and Tiura had the best performance (6. 69 g). The fact of dosage of 20 kg/ha and Kiran leading to the greatest mass of fruit (10 kg) is unquestionable. Moreover, the production of skeletal muscle for pigs on the Gulati wheatlow control diet was markedly decreased 73. 47 g) than the ones on the Gulati wheat-lactoferrin-fed diet 54. 36 g). These outcomes are by the studies (Premsekhar and Rajashree, 2009) which explain that poultry manure mostly tends to improve the physicochemical properties of the soil, thereby increasing the fruits as well. The number of fruits per plant was also significantly affected by poultry manure application. The maximum number of fruits per plant (3.57) was observed at 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with averages of 3.39, 3.21, and 3.03, respectively. The control had the minimum number (2.84). Among varieties, Kiran had the highest number of fruits per plant (3.29), while Sabz Pari had the lowest (3.14). The interaction of 20 tonnes ha-1 and Kiran resulted in the maximum number of fruits per plant (3.65), and the control with Sabz Pari had the minimum (2.76). This finding is consistent with Onwu et al. (2014), who also noted increased okra output with poultry manure application.

The maximum yield per plant (725.31 g) was observed with 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with average yields of 623.31 g, 521.31 g, and 419.31 g, respectively. The control had the lowest yield (315.99 g). Among the varieties, Kiran had the highest yield per plant (563.74 g), while Sabz Pari had the lowest (478.37 g). The interaction of 20 tonnes ha-1 and Kiran produced the highest yield (767.84 g), while the control with Sabz Pari had the lowest (272.63 g). These results support the findings of Akande et al. (2003), who reported improved crop productivity with organic manure application. The application of poultry manure significantly increased the number of leaves per plant. The highest number (10.19) was observed with 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with averages of 9.00, 7.79, and 6.59, respectively. The control had the fewest leaves (5.38). Among varieties, Kiran had the most leaves per plant (8.29), while Sabz Pari had the fewest (7.29). The interaction of 20 tonnes ha-1 and Kiran resulted in the highest number of leaves per plant (10.69), and the control with Sabz Pari had the lowest (4.88). These findings align with Akanbi et al. (2000), who highlighted the importance of nutrient availability for vegetative growth.

The fresh pod weight was also significantly affected by poultry manure application. The maximum fresh pod weight

(10.33 g) was observed at 20 tonnes ha-1, followed by 15 tonnes ha-1, 10 tonnes ha-1, and 5 tonnes ha-1, with averages of 9.91 g, 9.49 g, and 9.07 g, respectively. The control had the lowest fresh pod weight (8.62 g). Among the varieties, Kiran had the maximum fresh pod weight (9.67 g), while Sabz Pari had the minimum (9.31 g). The interaction of 20 tonnes ha-1 and Kiran produced the highest fresh pod weight (10.51 g), while the control with Sabz Pari had the lowest (8.43 g). This result is consistent with the findings of Sabatu, (2016) and Harper, (2016), who noted similar improvements in fresh pod production with organic fertilizers.

***Limitations of the study*:** The study had some limitations. It was conducted under specific conditions which may not represent all growing environments. The results might vary with different soil types, weather conditions, and farming practices. The study only tested a limited number of okra varieties and poultry manure levels, so the findings may not apply to other varieties or manure applications. The measurements were taken at specific growth stages, and different timings might yield different results. Also, the study focused only on certain growth parameters, potentially missing other important factors affecting okra growth and yield. Lastly, the study relied on statistical software for data analysis, which might introduce some margin of error.

***Conclusion*:** After going through the findings of the present research, it was concluded that the Application of Poultry manure@ 20 tones ha-1 showed superior results in terms of plant height, fruit length, stem girth, fruit weight, number of fruits plant-1, yield plant-1, number of leaves plant-1, spot leaf disease on okra leaves effect the leaves due to fungal infection and fresh pod weight as compared to other concentrations of Application of Poultry manure@ 15 tones ha-1. The study found that different levels of poultry manure significantly affected the growth of okra. The tallest plants and the longest fruits were observed with 20 tonnes of poultry manure per hectare. The variety Kiran generally performed the best, with the tallest plants, longest fruits, thickest stems, and heaviest fruits, especially when combined with the highest manure level. Sabz Pari showed the least growth under control conditions without manure. Overall, the application of poultry manure at higher levels improved plant height, fruit length, stem girth, and fruit weight. These results support previous research indicating that poultry manure enhances plant growth and productivity by improving soil nutrients and properties.

***Authors' contributions statement*:** M. Rafee, M. B. Khan, U. Kalsoom designed, and completed the experiments; Sulaman supervised the whole research; Z. U. Haq and S. Ali prepared and finalized the draft.

***Conflict of interest*:** The authors declare no conflict of interest.

***Acknowledgment*:** The authors express appreciation for the support and guidance received from their supervisor and the Department of Horticulture Baluchistan Agriculture College Quetta, Pakistan.

Funding*:** This research did not receive specific grants from public, commercial, or non-profit agencies Ethical ***statement: This article does not contain any studies regarding humans or Animals.

***Availability of data and material*:** We declare that the submitted manuscript is our work, which has not been published before and is not currently being considered for publication elsewhere.

***Code availability*:** Not applicable.

Consent to participate: All participants involved in this study provided informed consent before their participation.

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