

# Biochar and Animal Manures for Greater Turnip Yield

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# Introduction

- Soil biology and fertility are dependent on soil microorganisms that promote crop production.
- Animal manures are contributors of soil fertility due to their microbial content.
- Biochar helps to provide suitable habitat for soil microbes to allow them to decompose soil organic matter (Shen et al. 2016).
- Application of biochar as a soil amendment was proposed to enhance plant nutrients availability, soil electrical conductivity (EC), soil organic matter (Haipeng et al. 2017), retention of soil water content, soil microbial population, and crop yield (Ferreira et al. 2017).

## Objectives

The objectives of this investigation were to:

- 1) assess the impact of soil amendments [sewage sludge, horse manure, chicken manure, vermicompost, commercial organic fertilizer, inorganic fertilizer, and no-mulch native soil] on turnip root, shoot, and plant weight
- 2) assess the impact of biochar added to SS, HM, CM, Vermi, Org, Inorg, and NM on the root, shoot, and plant weight of three varieties of turnips, *Brassica rapa* (Purple Top White Globe, Scarlet Queen Red and Tokyo Cross) grown under field conditions.

## Materials & Methods

- The experimental study included a RCBD of 63 field plots (3 turnip varieties × 7 treatments × 3 replicates) of 4 ft. length and 3 ft. width each used for biochar treatments and 63 plots used for no-biochar treatments for comparison purposes.
- The seven soil treatments included sewage sludge, horse manure, chicken manure, vermicompost (worm castings), commercial inorganic fertilizer (NPK 19-19-19), commercial organic fertilizer (Nature Safe NPK 10-2-8), and no-mulch (NM native soil) was used as control treatment. The native soil is silty loam (2.2% organic matter, pH 6.2) that has 56% silt, 38% clay, and 6% sand.
- The impact of soil amendments on yield of 3 varieties of turnip (*Brassica rapa* var. Purple Top White Globe (PTWG), var. Scarlet Queen Red (SQR), and var. Tokyo Cross (TC) was investigated.
- Prior to planting, each soil amendment was added to native soil and roto-tilled to a depth of 15 cm (~ 0.5 ft.) topsoil. Seeds of turnip, *Brassica rapa* were planted in a freshly tilled soil at 18-in in-row spacing and drip irrigated as needed.

A)



B)



C)



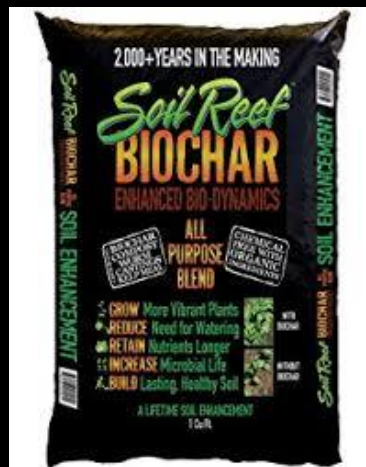
D)



E)



F)



Biochar was obtained from Wakefield Agricultural Carbon (Columbia, MO) and added to soil amendments at the rate of 10% (w/w).



Purple Top White Globe  
(PTWG)



Tokyo Cross Hybrid  
(TC)



Scarlet Queen Red Stem  
(SQR)



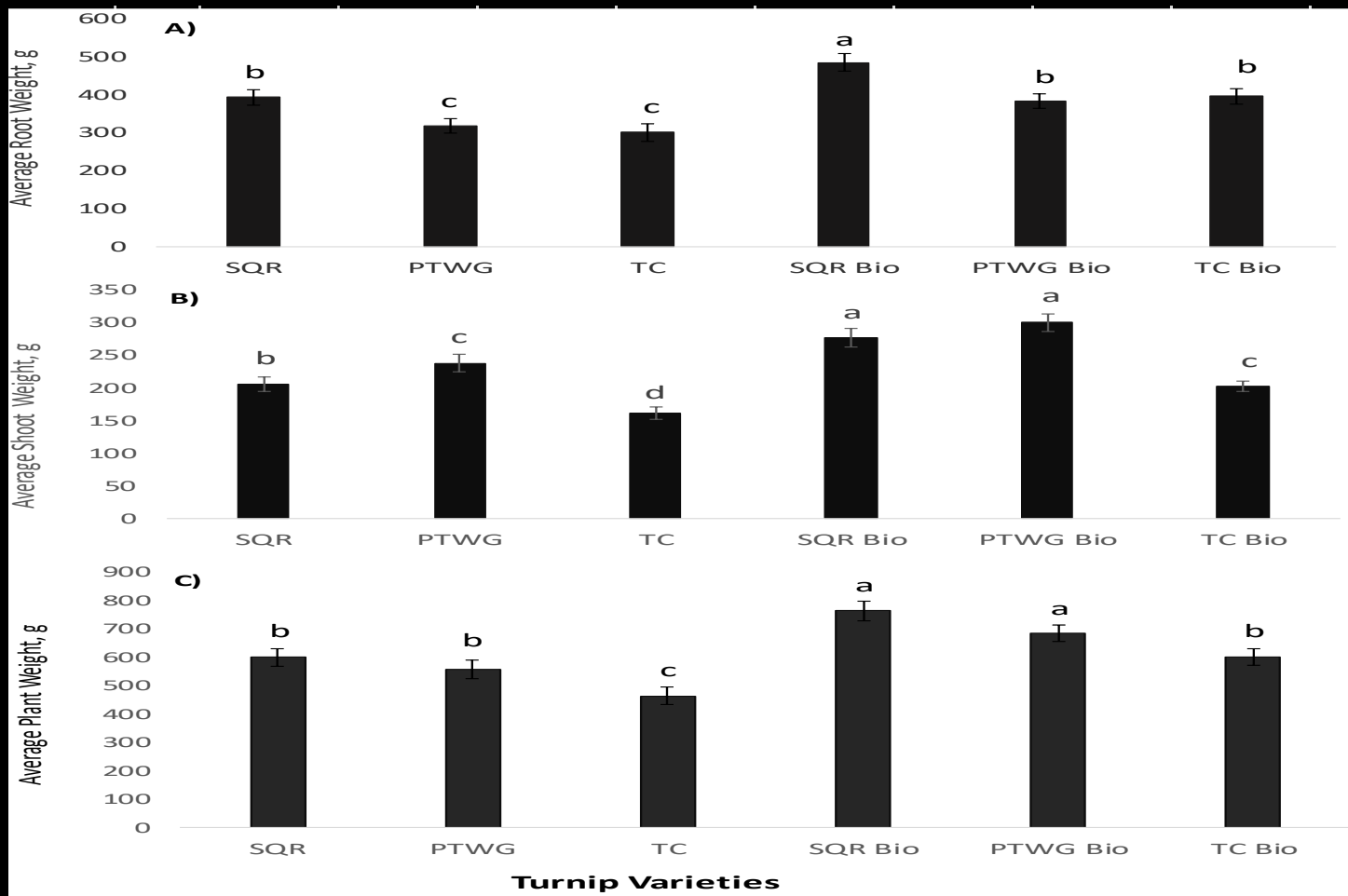


Figure 1 revealed that varieties grown in soil treated with biochar had significantly ( $P \leq 0.05$ ) greater root, shoot, and plant weight compared to the same varieties grown in soil not amended with biochar.

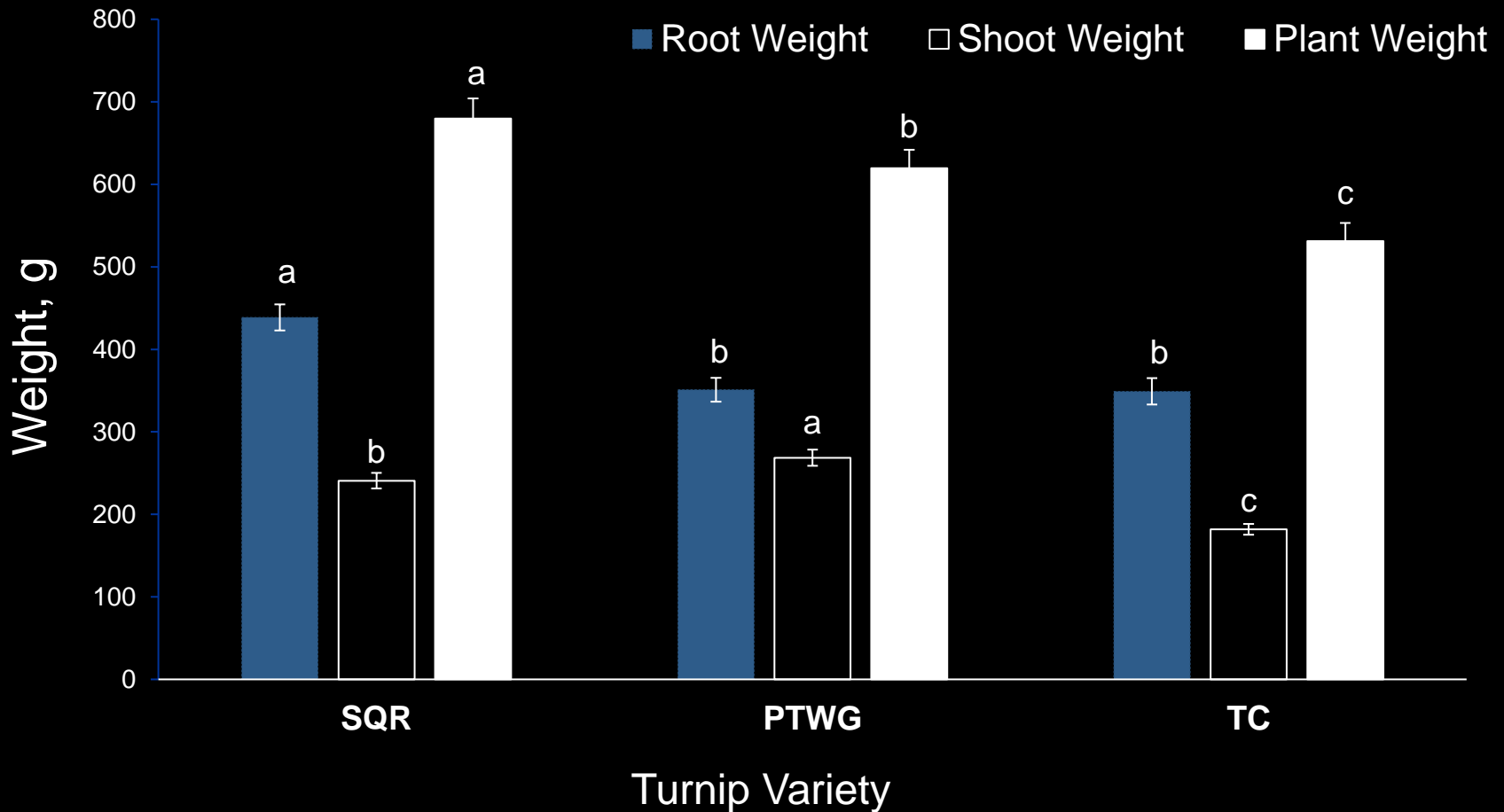
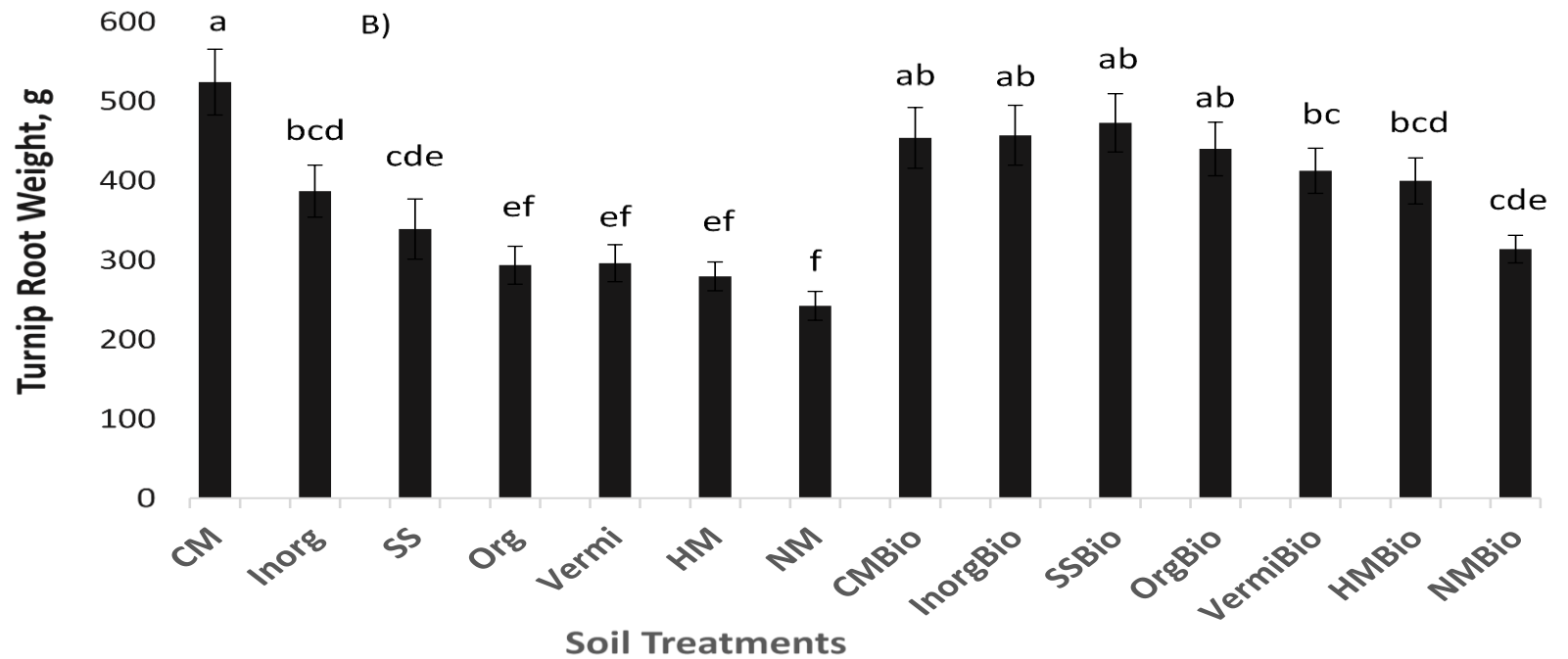
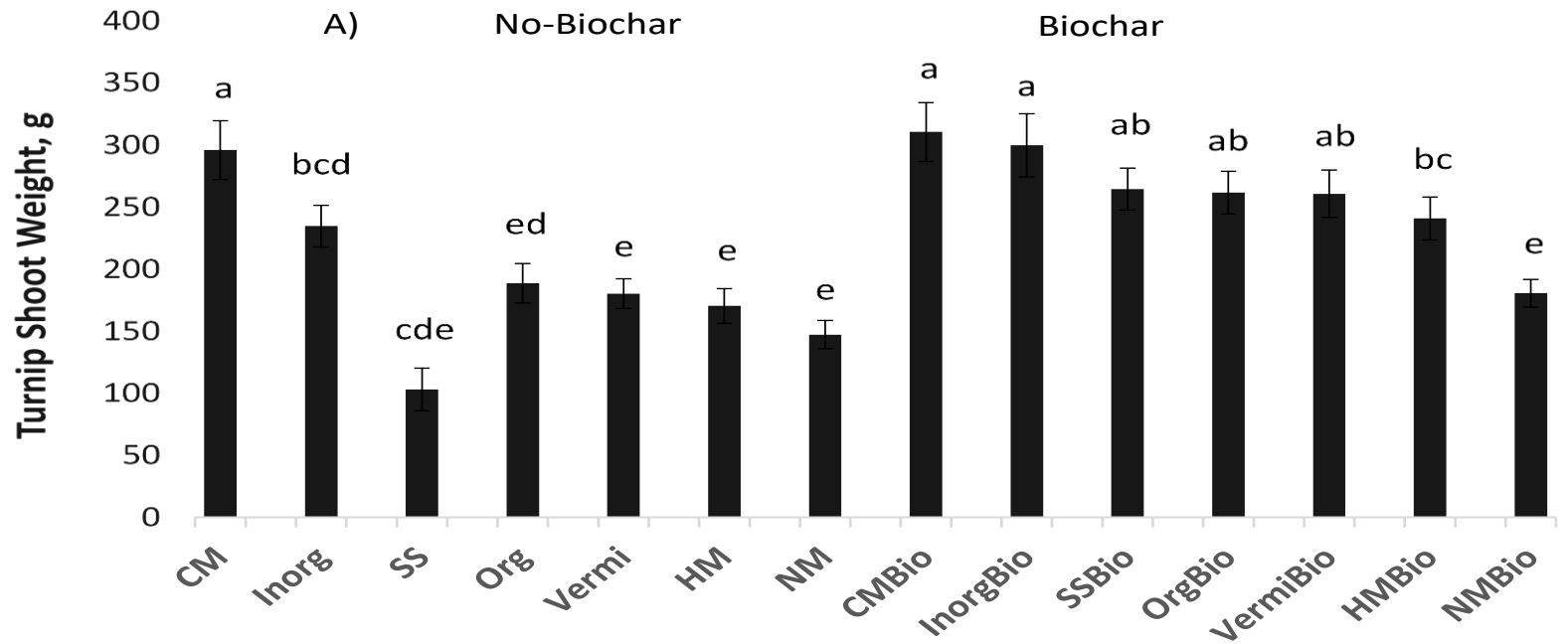
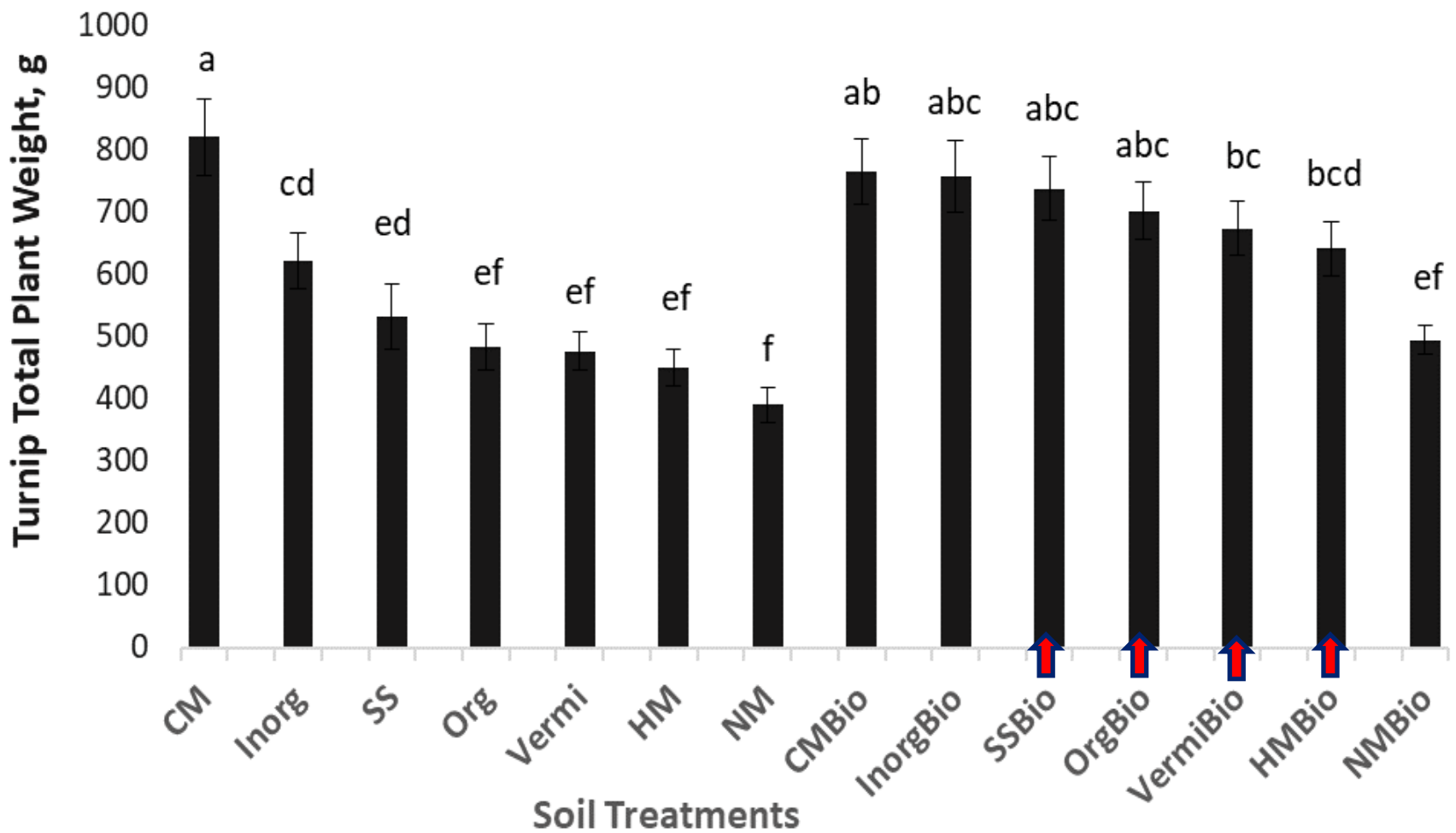


Figure 2, regardless of soil amendments, variety SQR significantly increased turnip root yield compared to the PTWG and TC varieties. Whereas, variety PTWG had the greatest shoot weight compared to SQR and TC. Accordingly, SQR is a candidate turnip variety for better yield. As a result, turnip varieties can be arranged based on their yield in a descending order as follows: SQR > PTWG > TC.







Overall turnip shoot, root, and total plant weight obtained from CM amended soil not amended with biochar was significantly ( $P \leq 0.05$ ) greater (295.9, 524.4, and 820.3 gm, respectively) compared to yield obtained NM treatment (147.3, 242.5, and 389.8 gm, respectively). Similar results were obtained when biochar was added to CM.

## Conclusion

1- We recommend variety SQR for growing turnips.

2- Biochar added to SS, Org, Vermicompost, and HM significantly increased plant weight from 522.3, 482.5, 476.5, and 450.2 g into 737.5, 701.9, 673.3, and 640.8 g plant<sup>-1</sup>, respectively. This increase represents 22, 39.3, 45.5, 41.3, and 42.3% increase in plant weight, respectively due to addition of biochar.

## References

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# Thank You

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