International Journal of Agricultural and Applied Sciences, June 2023, 4(1): 85-93
https://www.agetds.com/ijaas
ISSN: 2582-8053
https://doi.org/10.52804/ijaas2023.4114

Research Article

Under Long -Term Field Experiment The Effects of Organic and Inorganic Fertilizers Application on Maize Growth and Soil Organic Carbon Sequestration

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(**Received:** 12/02/2023; **Revised:** 29/03/2023; **Accepted:** 30/05/2023)

ABSTRACT
A long-term field experiment was established in 1996 at Çukurova University Research and Application Farm, Adana, Turkey. The design of experiment was The Randomized Complete Block Design (RCBD) with 5 different fertilizer treatments: control (no fertilizer), Mineral fertilizer (NPK), Animal manure (25-ton ha^{-1}), Compost (25-ton ha^{-1}) and Compost + Mycorrhiza (10-ton ha^{-1}). Maize seeds were sown and harvested in 2022. At harvest, soil samples (at 0-15 and 15-30 cm depths) and plant samples were taken from each plot. Soil and plant total carbon and N concentrations were determined by a CN elemental analyzer. The soil organic carbon (OC) was estimated as the difference between total and inorganic C. Results show that carbon concentration in the grain, shoot, and root samples of maize plants were higher in fertilized plots than in control treatments. Compost and animal manure treated soil had higher OC concentrations at both sampling depths. The highest values of soil OC at 0-15 cm depth were obtained in animal manure applied plots.Generally, organic fertilizer application increased soil OC % concentrations and contributed to the soil carbon budget. The PCA analysis also revealed that a majority of the plant and soil parameters clustered more closely with organic fertilizers compared to the control and mineral counterparts.
Keywords: Maize, Soil Organic carbon, Organic and Mineral fertilizer, Carbon Sequestration, Long-term field experiment

INTRODUCTION
Since the Industrial Revolution, more agricultural products have been used in order to meet the nutritional and energy needs arising due to rapid population growth. Furthermore, the soils have been more intensively used and remain under the pressure of chemical fertilizers in order to increase agricultural production. Intensive agricultural practices and uncontrolled application of fertilizers negatively affected soil microbial activity and soil productivity (Aksahin et al., 2021). Intensive exploitation of agricultural lands not only has a negative effect on sustainability but also reduces the amount of organic matter in the soil, thus increases the emission of carbon dioxide (CO_2) and other greenhouse gases (GHGs) to the atmosphere. The atmospheric concentration of CO_2 gas was 280 ppm before the industrial revolution (Ortas et al., 2017), and it has reached 420 ppm in 2022 (SOEST, 2022).
The increase in GHGs concentration in the atmosphere give rise to numerous adverse conditions on our planet. Global warming and climate changes are at the forefront of these negative situations. These changes bring many disasters and affect agriculture, which directly affects human life and constitutes the main source of nutrition. It is vital that agricultural systems are manageable in order to reduce CO_2 emissions, which are shown as the main cause of global warming (Ortas, 2022). It is necessary to develop and implement a number of agricultural methods in order to reduce the emission of greenhouse gases and to bind CO_2 into the soil. The application of organic fertilizers, such as compost and manure, to the soil is a significant process that has been practiced for many years. The well-known organic fertilizers such as animal manure, compost and mycorrhizal fungi, make substantial contributions to the incorporation of organic materials into the soil. Consequently, they have a positive impact on soil carbon sequestration and the enhancement of soil fertility (Aksahin et al., 2021).
In light of the above information, the objective of this study is to investigate the potential effects of applying organic fertilizers (including mycorrhizal inoculation) and inorganic fertilizers to the soil. Specifically, we aim to determine whether such applications can increase the overall carbon content and organic carbon content of the soil. Additionally, we seek to evaluate whether these applications will have a long-term impact on the soil carbon budget. The hypothesis tested is that organic fertilizer sources applied to the soil under field conditions will increase the total carbon and organic carbon of the soil.

MATERIALS AND METHODS

The trial was established in Adana, (in the eastern part of the Mediterranean region of Turkey) at Çukurova University Research Farm, on the Menzilat soil series (Typical Xerofluvents) in 1996 and continues to function today. The image of the trial area is given in Figure 1, and the soil properties are given in Table 1. The trial consists of 5 applications, and the applications applied in the trial are listed as follows. (i) control; (ii) conventional N-P-K fertilizers (160 kg N ha^{-1} as K_2SO_4, 83 kg K ha^{-1} and 26 kg P ha^{-1} as $(NH_4)_2SO_4$, as 3Ca $(H_2PO_4)_2H_2O$); (iii) compost at 25 Mg ha^{-1}; (iv) animal manure at 25 Mg ha^{-1}; and (v) mycorrhiza inoculated compost at 10 Mg ha^{-1}. Before each trial, organic fertilizers (animal manure, compost and mycorrhizae) were thrown onto the soil surface just before planting and were layered with a disc harrow to a depth of 15 cm. Soil samples were taken from 2 different depths (0-15 cm and 15-30 cm) for each parcel in 2022. Grain, shoot and root samples were taken on the same date. Soil samples taken were dried at room temperature, ground and passed through a 2 mm sieve for soil analysis. In addition, the soil was ground again and passed through a 0.25 mm sieve to determine the total C and N concentrations. C and N analyzes of soil and plant samples were performed by the dry burning method at 900°C using a CN elemental analyzer (Fisher-2000).

Table 1. Characteristics of Menzilat Soil in 1996 (Ortas and Lal, 2014).

Parameters	Unit	0-15cm Depth		15-30 cm Depth	
Clay		318.8	±30.6	333.4	±21.8
Silt		360.9	±87	379.5	±13.4
Sand		320.3	±23.0	287.2	±16.4
Organic C Soil		0.96	±0.08	0.78	±0.08
İnorganic Carbon	g kg^{-1} soil	3.77	±0.35	3.97	±0.42
Total N		0.08	±0.01	0.07	±0.01
CEC	$Cmol^{+}$ kg^{-1}	20.50	±2.00	17.90	±1.64
pH	H_2O	7.58	±0.66	7.60	±0.71
Salt	%	0.05	±0.00	0.04	±0.00
P		22.60	±2.16	20.20	±2.00
Fe		5.43	±0.82	5.66	±0.58
Mn	mg kg^{-1}	5.74	±0.32	5.31	±0.59
Zn		0.52	±0.05	0.23	±0.02
Cu		1.86	±0.19	1.56	±0.16
AMF spores	10 g^{-1} soil	64.00	±11.70	44.00	±2.62

Mean of three replicates ±SD.

Using a calcimeter (of the Schibler type), the total $CaCO_3$ concentration was measured in order to ascertain the amount of inorganic C. SOC concentration was calculated by deducting inorganic C from the total amount of C in the soil (Ortas et al., 2013; Ortas and Bykova, 2020). The obtained data were analyzed by using Tukey in the Anova statistical model with the JMP16 statistical software to evaluate the effects of different treatments on soil properties. In addition, principal component analyze (PCA) were performed with the help of XLSTAT-14 Statistical Software, and correlation analysis with the Origin Pro package program.

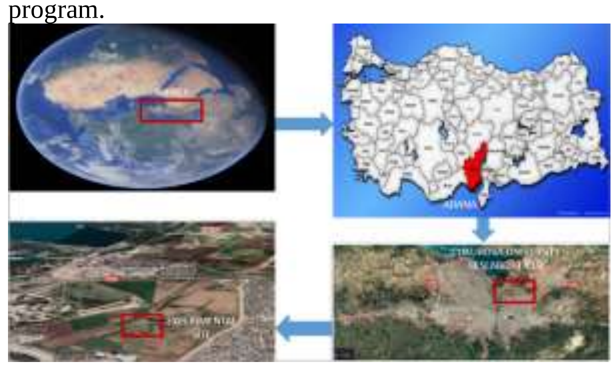

Figure 1. A View of the Trial Area (Aksahin et al., 2021)

RESULTS AND DISCUSSION

Total Soil Organic carbon, Nitrogen and Phosphorus

In the field experiment where different organic and inorganic applications were applied for a long time, the total organic carbon and total nitrogen content of the soil are given in Figure 2. The plots in which different long-term organic treatments were applied gave higher results than the control application. When the results obtained were examined, it was seen that the highest results were obtained in the plots where organic fertilizers were applied at both depths. According to the results obtained, there were differences between the fertilizers, but these differences were not statistically significant.

When the total organic carbon data were examined, the highest value (53.92 Mg ha^{-1}) was obtained in the plot where animal manure was applied at 0-15 cm soil depth, while the lowest value (31.67 Mg ha^{-1}) was obtained in the control. At the 15-30 (R 15-30) cm depth of the soil, the highest total organic carbon value (57.23 Mg ha^{-1}) was obtained in the plot where mineral fertilizer was applied, while the lowest value (16.86 Mg ha^{-1}) was obtained in the control application (Figure 2).

When we increase the amount of carbon stored in the soil, especially organic carbon, we both reduce the greenhouse gas effect and increase the microbial activity living in the soil. Increasing microbial activity is very important for plant and soil health. Increasing the amount of organic carbon in the soil has a positive effect on plant growth, and as a result, it is extremely important to reduce the atmospheric CO_2 concentration (Aksahin et al., 2021). Long-term application of organic fertilizers to the soil instead of mineral fertilization can increase the microbial activity of the soils and will also add organic carbon to the soils. Adding organic matter to the soil significantly affects soil carbon dynamics such as soil carbon pool (Ortas et al., 2013). Batjes (1996) noted that predicted global warming could have significant effects on the size of the soil organic carbon pool and directly affect the atmospheric greenhouse gas concentration. Previous studies on the subject support our findings. For instance, compost, animal manure, and compost+mycorrhiza applications applied to the soil was

reported to increase the SOC and N % compared to the control (Ortas et al., 2013).
When the total nitrogen data were examined, the lowest value in R-0-15 was obtained in the control (2.83 Mg ha^{-1}) application, while the highest value (4.57 Mg ha^{-1}) was obtained in the plot where animal manure was applied. Looking at the nitrogen data at a depth of 15-30 cm, the lowest value (3.10 Mg ha^{-1}) was obtained in the control, while the highest value (3.76 Mg ha^{-1}) was obtained in the application of mineral fertilizer (Figure 2).

Studies on the subject have reported that soil organic carbon and nitrogen are related to organic fertilizers applied to the soil. Organic fertilizer application to the soil increases the organic carbon and total nitrogen content of the soil (Bokhtiar and Sakurai, 2005). Malhi et al. (2006) reported that the amount of TN and TOC was lower in areas where stubble (organic mulch) was not applied than in areas where stubble was applied.

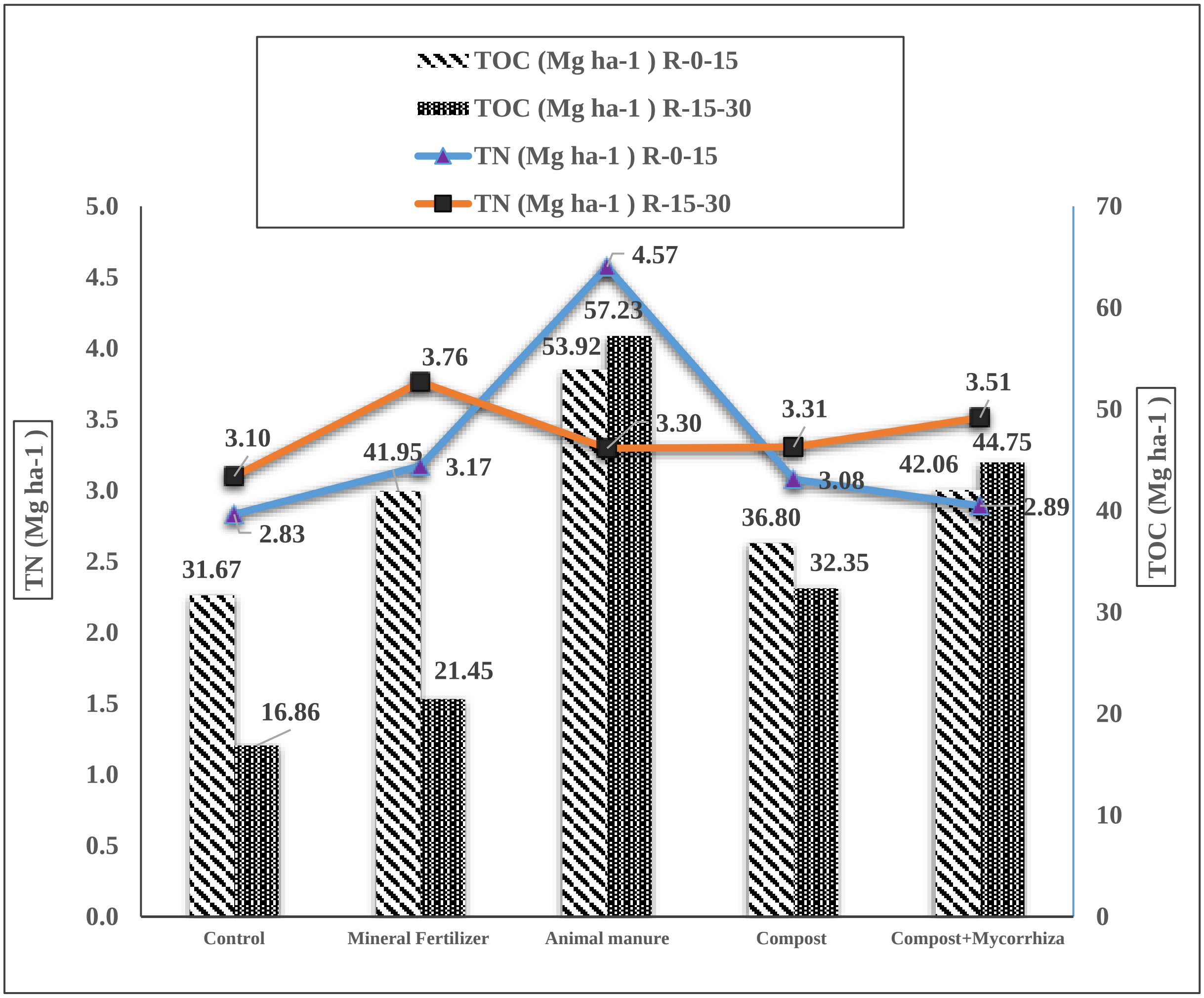

Figure 2. Soil Total Organic Carbon (TOC) and Soil Total Nitrogen.

In the study examining the effect of organic and inorganic fertilizers applied to the soil for a long time, the changes in the available phosphorus (P_2O_5) of the soil were revealed and given in Figure 3. According to the results, animal manure at both depths had the highest values, while the control had the lowest values. While the values obtained in animal manure were given for 0-15 cm depth and 15-30 cm depth (171.91 P_20_5 kg ha^{-1} and 171.40 P_20_5 kg ha^{-1}), respectively. The lowest values were obtained for both depths in the control application, with 40.32 kg ha^{-1} of P_20_5 for the 0-15 cm depth and 83.94 kg ha^{-1} of P_20_5 for the 15-30 cm depth (Figure 3).
Erdal and Aydemir (2003) reported that rose pulp applied at increasing doses resulted in significant increases in the P content of the soil. Lee et al. (2004), NPK + applied to paddy soils for 31 years, investigated the changes that compost (straw origin) brought about in the phosphorus fractions of the soil, It was determined that the continuously applied fertilizer increased the total and inorganic phosphorus content in the plow layer of the soil, while the amount of mineral P did not change when only inorganic fertilizer was applied (NPK). The researchers concluded that the time dependent increase in total P, inorganic P, and extractable phosphorus was closely related to the availability of phosphorus accumulated in the soil.

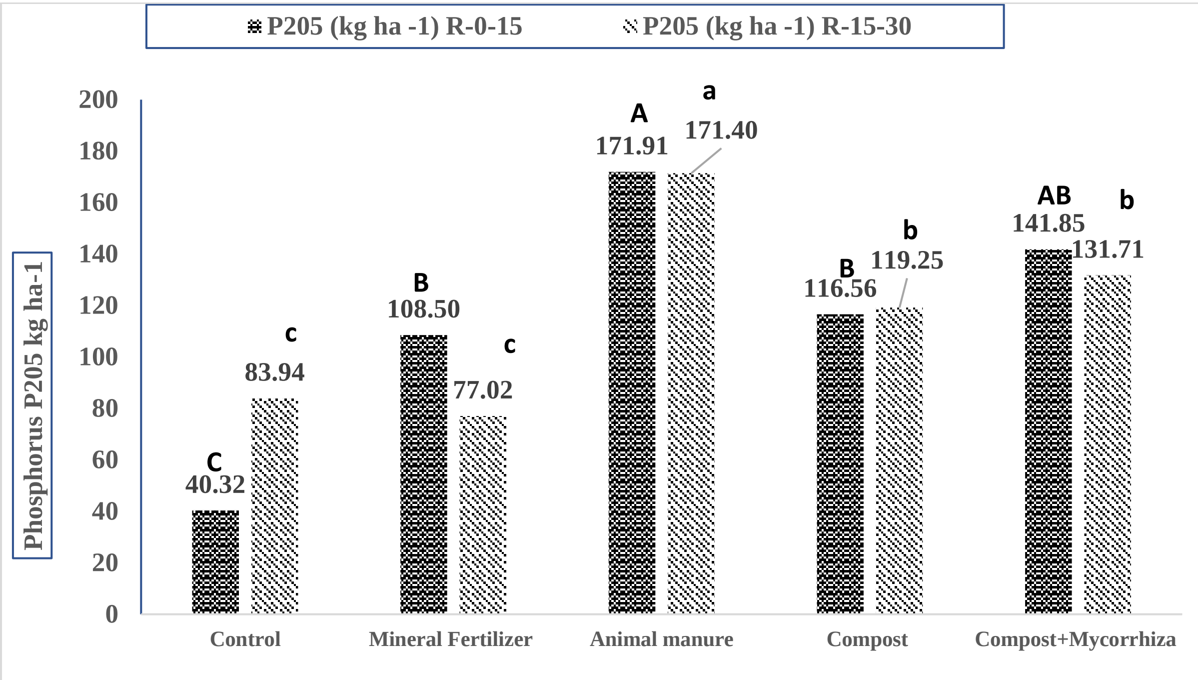

Figure 3. Available (can be taken) P_2O_5 Values in Kilograms Per Hectare at Different Depths.

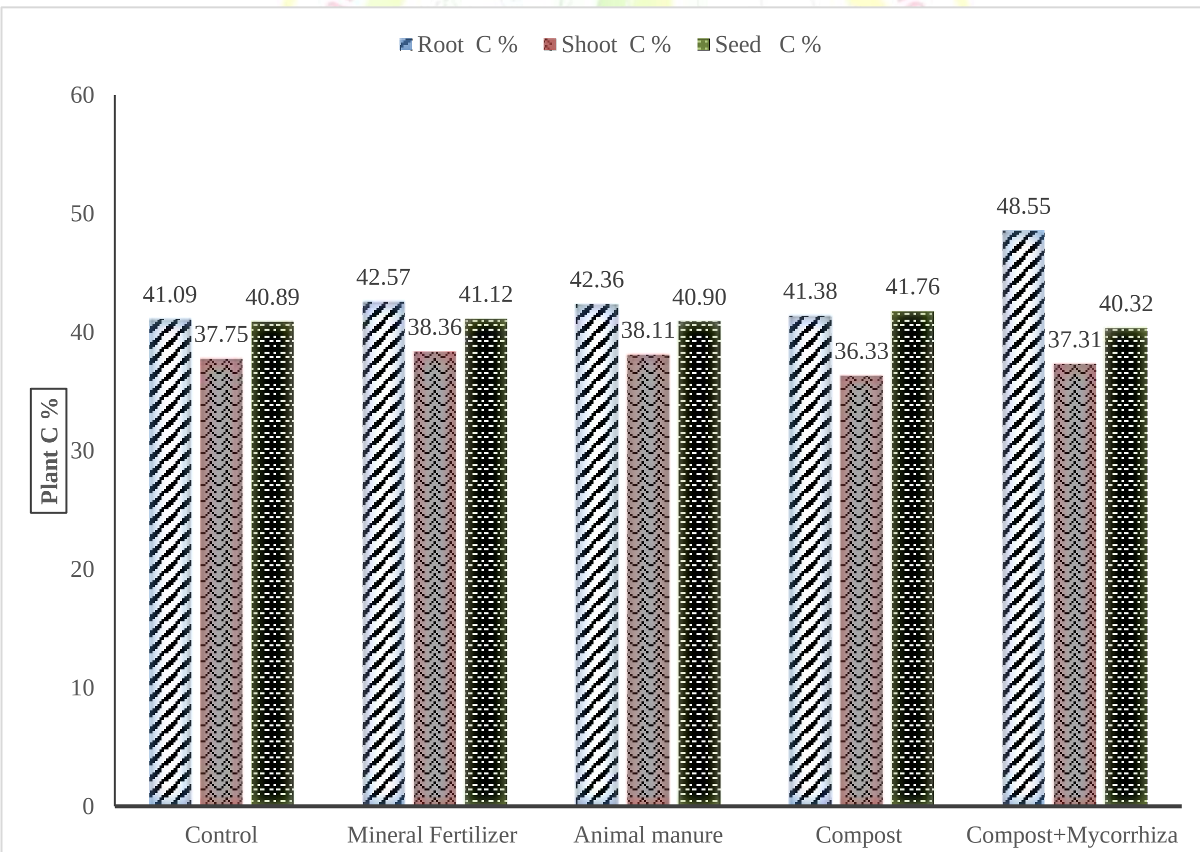

Figure 4. Carbon Percentages in Different Parts of The Plant Under Different Treatments.

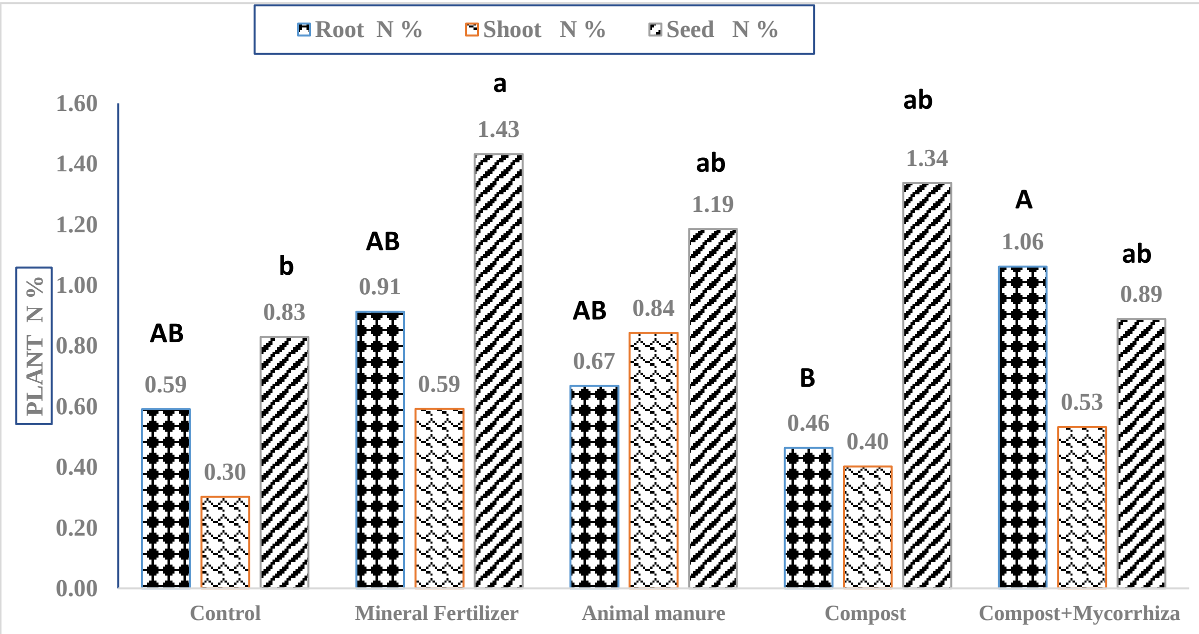

Figure 5. Nitrogen Percentages in Different Parts of The Plant Under Different Treatments.

The Carbon and Nitrogen Percentages of the Plant

Figure 4 shows the percentage carbon contents of the plant sections (root, root, and grain) of the maize plant grown in the field experiment with various fertilizers. The parameters that were acquired after applying various organic and inorganic applications for a long time showed differences between the treatments, although these changes were not statistically significant.

When the collected data are evaluated, it becomes clear that the pots with organic fertilizer applied had the greatest values in comparison to the control. Compost plus mycorrhiza produced the highest root carbon percentage (48.55%), inorganic fertilizer produced the highest shoot carbon percentage (38.36%), and compost produced the highest seed carbon percentage (41.76%). The nitrogen percentage values of the maize plants were different in between organic and inorganic fertilizers applications (Figure 5). The differences between the nitrogen percentages in the root and the grain were found to be statistically significant, while the difference in the shoot nitrogen percentage data was not. The highest root, shoot and seed N % values were obtained in compost+mycorrhiza (1.06 %), animal manure (0.84 %) and inorganic fertilizer (1.43%) applications, respectively. The lowest root, shoot and seed N % concentrations were obtained in compost (0.46 %), control (0.30 %) and control (0.83 %) respectively (Figure 5.)

When the % C and % N concentration of the plant (seed, shoot and root) were examined, it was seen that in the all treatments, especially organic fertilizer applied samples have higher concentrations than the control. Özkan et al. (2013) reported that different organic and inorganic fertilizers, applied in greenhouse pepper cultivation, increased N % compared to control. It was also reported by (Chirinda et al., 2012) that the root C was higher in spring barley and wheat than in organic fertilizer-based inorganic systems. Also preciously (Aksahin et al., 2021) in the same field experiment conditions, animal manure, compost and com+myorriza treated plants C and N concentrations were higher than in control application. The information obtained and the literature support each other.

P, K and Zn Concentrations in Different Parts of The Plant Tissue

The zinc concentration values of the maize plant are given in Figure 6. The highest seed zinc concentration was obtained in the compost application as 22.80 mg Zn kg^{-1}, while the lowest zinc concentration was obtained as 11.96 mg kg^{-1} in the control application. Considering the root zinc concentrations, the highest zinc concentration was obtained in animal manure application as 24.25 mg kg^{-1} , while the lowest zinc concentration was obtained in mineral fertilizer application as 10.20 mg kg^{-1} . When we look at the shoot concentrations of the maize plant, the highest concentration was 61.10 mg kg^{-1} in the control application, but the lowest zinc concentration was 35.77 ppm in the inorganic fertilizer application (Figure 6).

Potassium (K) concentrations of the maize plant is given in Figure 7. The highest seed K concentration was 0.39% found in compost + mycorrhiza application, while the lowest K concentration (0.32%) was in mineral fertilizer application. The highest K concentration in the root was obtained as 1.39 % in compost application, while the lowest K concentration was obtained in the control application as 0.25 %. The highest maize shoot K concentration was measured in the control application, as 0.98%, the lowest K was 0.76% in the compost + mycorrhiza application (Figure 7).

Phosphorus (P) concentrations of the maize plant are given in Figure 8. When the phosphorus concentrations of maize plants were examined, the highest seed P concentrations were obtained as 0.25 % in animal manure, compost and compost+mycorrhiza applications, while the lowest seed phosphorus concentrations were obtained as 0.22 % in inorganic fertilizer and control applications. The highest shoot P concentration was mesured in animal manure treated plots at 0.29%, and the lowest shoot P concentrations were found in inorganic fertilizer at 0.12%. When we look at the root P concentration, the highest concentration was obtained in the compost application as 0.26 %, but the lowest root phosphorus concentration was obtained as 0.08 % in the inorganic application (Figure 8).

In previous studies about the effect of different organic and inorganic fertilizers on the nutrient content of the plants, it has been seen that the effect of organic fertilizers on plant nutrient intake and content is generally positive. Kan (2011) compared organic and inorganic fertilizers, and in his study, the highest P content (15.059%) and the highest zinc content (0.108 ppm) were obtained from a 20 t ha^{-1} organic fertilizer application. Zafer et al. (2019) reported that the highest values in terms of K content were obtained in chicken manure compared to control and chemical fertilizers in their study to determine the effects of solid vermicompost and chicken manures on yield, some quality characteristics, and the plant nutrient content of lettuce. Kocabaş et al. (2007) reported in their study with various organic fertilizers that the highest P content in Sage (*Salvia officinalis*) was observed with the application of sheep manure + cattle manure. They also found that the highest K values were associated with chicken manure applications, while the highest Zn value was observed in the control application. (Aksahin and Gülser, 2019), conducted a study by using organic wastes, in where they found a statistically significant increases in the P concentration of plants with higher doses of tea waste application. They also found an increase in K content with tea waste applications. These findings are consistent with the present research results.

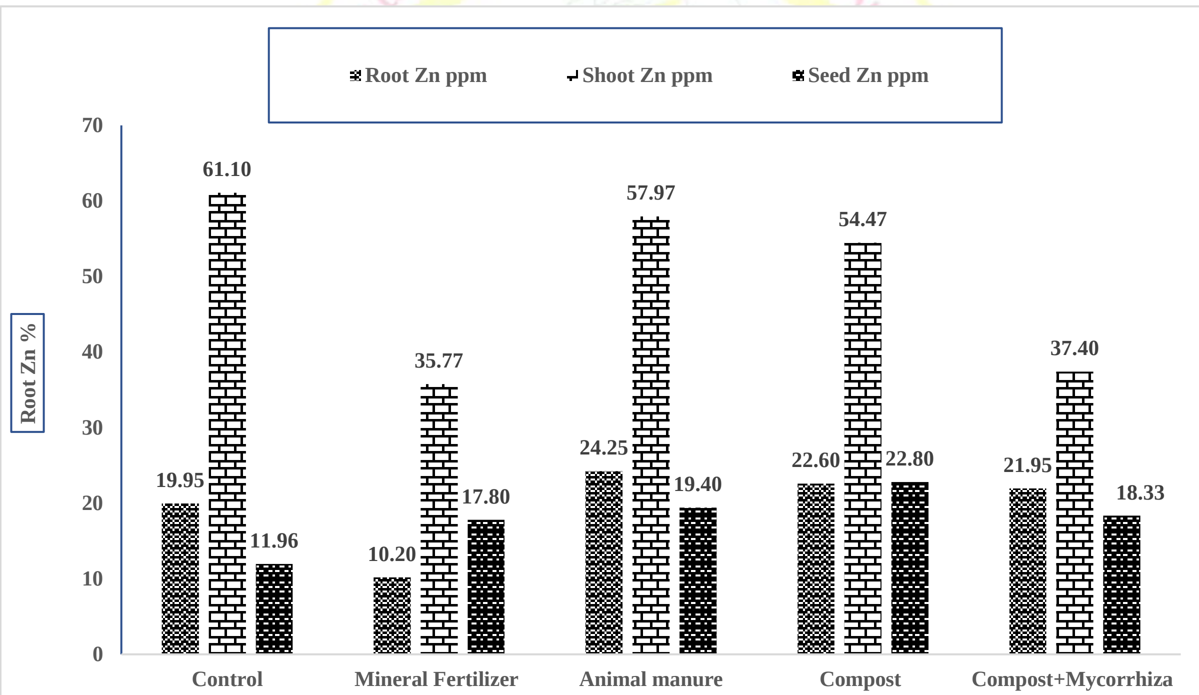

Figure 6. Zinc concentration in different parts of the plant.

Correlation and Principal Component Analysis (PCA)

The correlation of the parameters obtained as a result of the application of different organic and inorganic fertilizers is given in Figure 9. When the data obtained are examined, it is seen that there is a positive correlation between the total organic carbon content of the soil and the nitrogen uptake of the plant and the total N and P of the soil, and this correlation is statistically significant. Addationaly, it is observed that there is a positive correlation between the total nitrogen content of the soil and the nitrogen uptake of the plant, and this correlation is statistically significant. However, it is also seen that there is a negative correlation between the total nitrogen content of the soil at a depth of 15-30 cm and the zinc uptake of the plant (Figure 9).

Principal component analysis (PCA) analysis technique was applied in order to determine the relationships between applications and parameters in the data obtained as a result of the application of different organic and inorganic fertilizers. Result of PCA analysis are given in Figure 10. When the results of different organic fertilizer applications are examined, it is seen that there is a 38.77 percent change in the F1 value in the x-axis and a 26.74

percent change in the F2 value in the y-axis. Since the obtained F1+F2 value is over 60% (65.51%), it is seen that the data in the PCA analysis are well-explained. It is seen that Eingenvalue values are above 1 for all F values. There is a positive correlation between the application of organic fertilizers and the measured parameters, as can be seen by the fact that the majority of the parameters obtained as a result of the application of organic and inorganic materials cluster in the areas where they are present. It is seen that control and inorganic fertilizers are not much effective on the parameters obtained compared to organic fertilizers aplications. Also it has been observed that plant-related parameters are mainly clustered in the area where compost is manly applied. Aksahin et al. (2021) reported that the plant parameters clustered in the area where the compost was located in the data obtained in their study. Applications of compost plus mycorrhiza and animal manure were found to have greater effects on the soil's overall carbon, nitrogen, and phosphorus contents. When organic fertilizers were supplied, all parameters—aside from root nitrogen, shoot carbon, and nitrogen % at 15–30 cm depth—clustered in the favorable region. As a result, it can be shown that the treatments of animal manure, compost, and compost plus mycorrhiza had a favorable impact on the parameters measured (Figure 10).

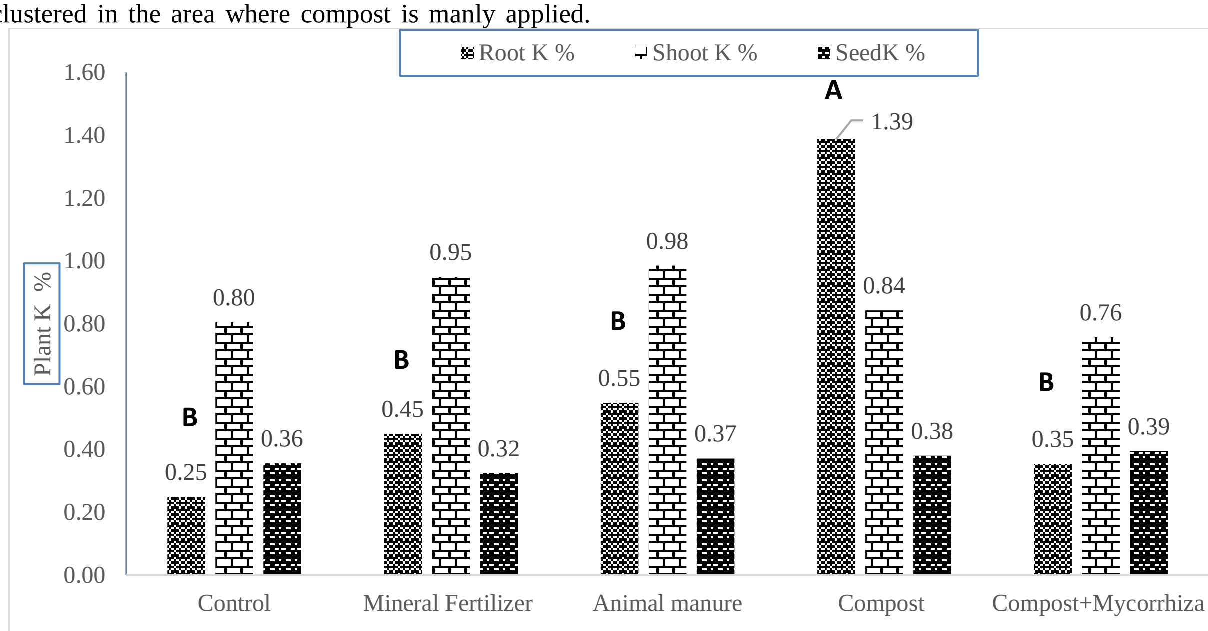

Figure 7. Potassium percentages in different parts of the plant.

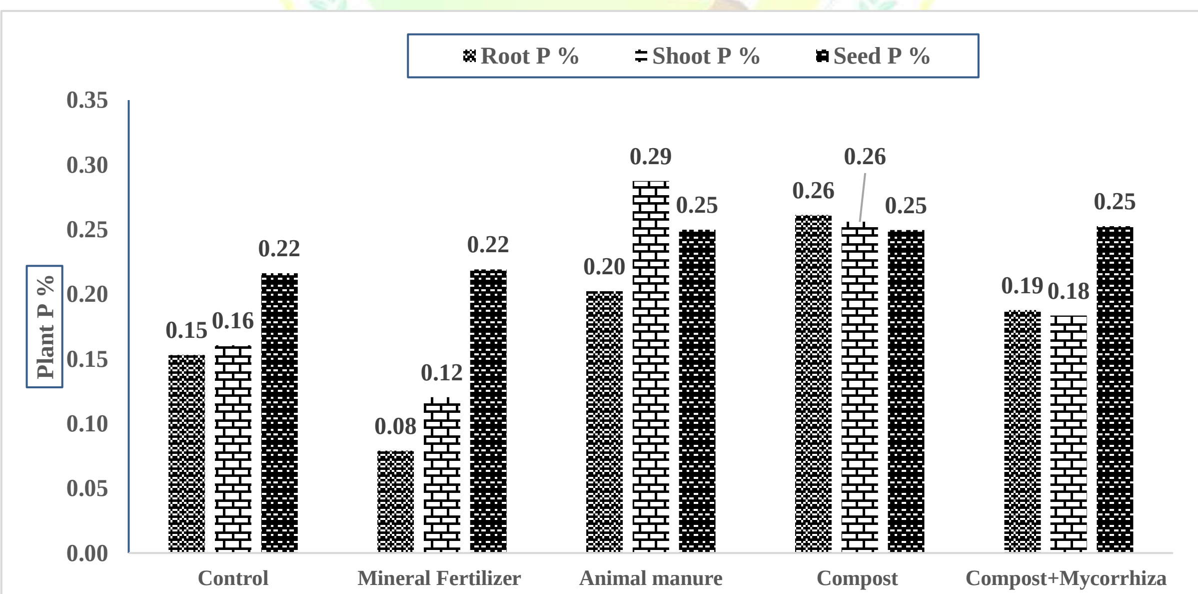

Figure 8. Phosphorus percentages in different parts of the plant.

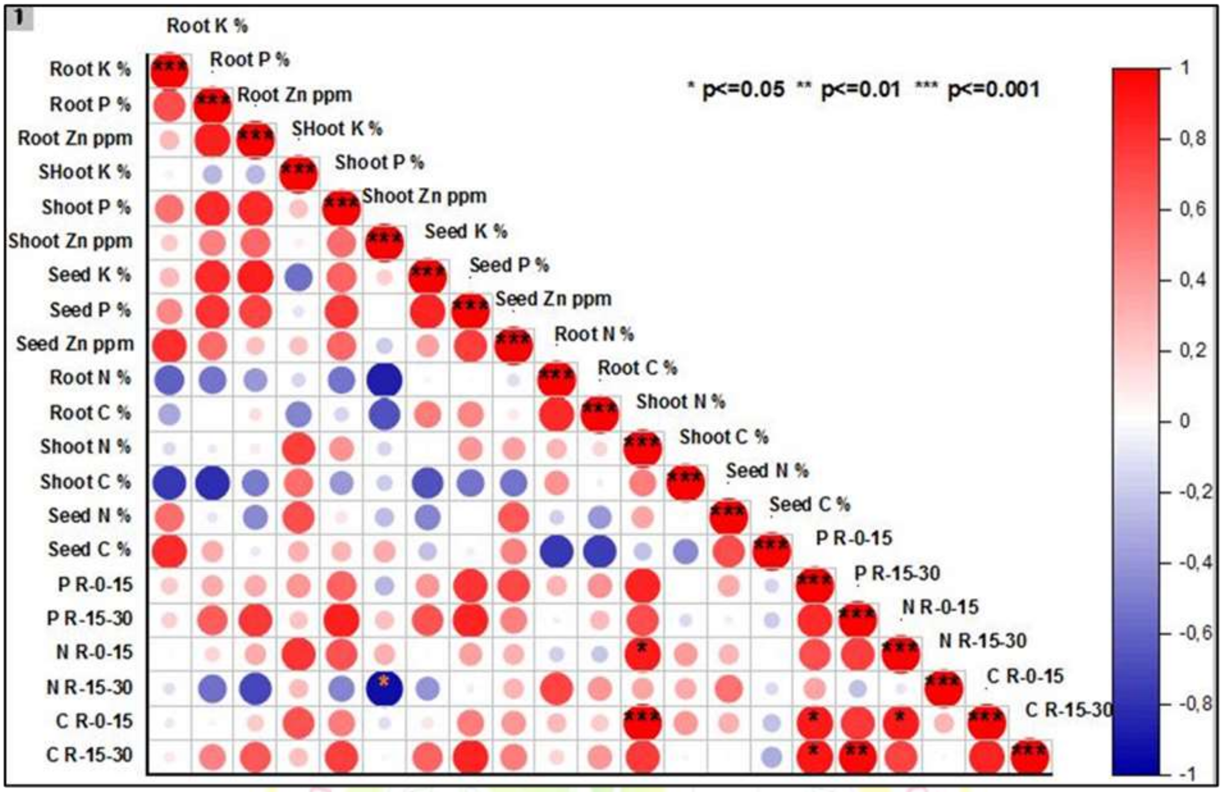

Figure 9. Correlation of Soil and Plant Parameters obtained by the application of different Organic and Inorganic applications. *R 0-15 (Represents the region 0-15 cm depth) R 15-30 (Represents the region 15-30 cm deep).*

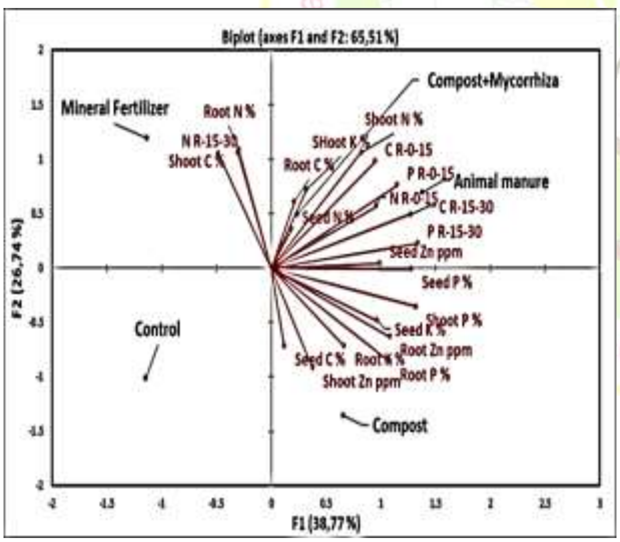

Figure 10. Principle component analysis (PCA) of soil and plant parameters obtained by the application of different Organic and Inorganic applications. *R 0-15 (Represents the region 0-15 cm depth) R 15-30 (Represents the region 15-30 cm deep).*

CONCLUSION

The obtained results in the study, in which different organic and inorganic fertilizer applications were applied, are given in the form of substances. The highest soil total organic carbon, total nitrogen and P_2O_5 concentration were obtained in animal manure applied plots. The highest plant (root, shoot and seed) carbon and nitrogen concentrations were generally obtained in organic fertilizers treated plots. The highest values of phosphorus and potassium concentrations in all parts of the plant were obtained in the plots where organic fertilizers were applied. The highest root and seed Zn concentrations were obtained in animal manure and compost, while the highest root zinc concentration was obtained in the control treated plots. The PCA analysis results shown that almost all the parameters obtained were clustered in the plots where organic fertilizers were applied.

CONFLICT OF INTEREST

The author here declares that there is no conflict of interest in the publication of this article.

REFERENCES

Aksahin, V., and Gülser, F. 2019. Bazı organik materyallerin ve inorganik gübrelerin çemenin (trigonella foenum graecum) besin elementi içeriğine etkileri. *Mediterranean Agricultural Sciences* 47-53.10.29136/mediterranean.560381

Aksahin, V., Işik, M., Öztürk, F., and Ortaş, I. 2021. The effects of long-term application of organic and inorganic fertilizers on soil and plant Nitrogen-Carbon contents. *International Journal of Agricultural and Applied Sciences* **2** (2): 75-81.https://doi.org/10.52804/ijaas2021.2212

Batjes, N. H. 1996. Total carbon and nitrogen in the soils of the world. **47** (2): 151-163.

Bokhtiar, S., and Sakurai, K. 2005. Effects of organic manure and chemical fertilizer on soil fertility and productivity of plant and ratoon crops of sugarcane. *Archives of Agronomy Soil science* **51** (3): 325-334.

Chirinda, N., Olesen, J. E., and Porter, J. R. 2012. Root carbon input in organic and inorganic fertilizer-based systems. *Plant Soil & Tillage Research* **359** (1): 321-333.

Erdal, İ., and Aydemir, O. 2003. Gül posasının doğrudan ve zenginleştirilmiş formunun tarımda kullanılabilme olanakları. Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi **7** (1): 20-26.

Kan, A. 2011. Ekmeklik buğdayda (Triticum aestivum L.) organik ve inorganik gübrelerin bitki besin elementi kapsamları üzerine etkisi. *Bitkisel Araştırma Dergisi* (**1**): 1-5.

Kocabaş, I., Sönnmez, İ., Kalkan, H., and Kaplan, M. 2007. Farklı organik gübrelerin adaçayı (Salvia fructicosa Mill.)'nın uçucu yağ oranı ve bitki besin maddeleri içeriğine etkileri. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi* **20** (1): 105-110.

Lee, J. S., Cho, H. S., Park, J. J., and Kim, J. W. 2004. Effect of organotins polluted sediment on the ark shell transplanted from organotins free area. *In:* Symposium and conference of the Society for Environmental Toxicology and Health. 126-127.

Malhi, S. S., Lemke, R., Wang, Z., and Chhabra, B. S. 2006. Tillage, nitrogen and crop residue effects on crop yield, nutrient uptake, soil quality, and greenhouse gas emissions. Soil Tillage Research 90 (1-2): 171-183.

Ortas, I. 2022. İklim Değişimlerinin ve Gıda Talebinin Tarımı Üzerinde Yaratacağı Olumsuz Etkileri Belirlemek İçin Çakılı Denemelerin Önemi. *Çukurova Tarım ve Gıda Bilimleri Dergisi* **37** (2): 179-197.

Ortas, I., Akpinar, C., and Lal, R. 2013. Long-term impacts of organic and inorganic fertilizers on carbon sequestration in aggregates of an Entisol in Mediterranean Turkey. *Soil Science* **178** (1): 12-23.

Ortas, I., and Bykova, A. 2020. Effects of long-term phosphorus fertilizer applications on soil carbon and CO(2)flux. *Communications in Soil Science and Plant Analysis* **51** (17): 2270-2279. https://doi.org/10.1080/00103624.2020.1822381.

Ortas, I., and Lal, R. 2014. Long-term fertilization effect on agronomic yield and soil organic carbon under semi-arid Mediterranean region. *Journal of Experimental Agriculture International*, **4** (9): 1086-1102.

Ortas, I., Lal, R., and Kapur, S. 2017. Carbon Sequestration and Mycorrhizae in Turkish Soils. In "Carbon Management, Technologies, and Trends in Mediterranean Ecosystems" (S. Ersahin, S. Kapur, E. Akca, A. Namli and H. E. Erdogan, eds.), Vol. 15, pp. 139-149.978-3-319-45035-3; 978-3-319-45034-6.

Özkan, C. F., Asri, Ö., Demirtaşi, E., and Arı, N. 2013. Örtüaltı biber yetiştiriciliğinde organik ve kimyasal gübre uygulamalarının bitkinin beslenme durumu ve bitki gelişimi üzerine etkileri. *Toprak Su Dergisi*, 2 (2): 96-101.

SOEST. 2022. CO2 level just passed an important benchmark– a measure of humanity's war on nature. Retrieved from https://www.soest.hawaii.edu/soestwp/announce/news/co2-level-just-passed-an-important-benchmark/

Zafer, Ü., Demir, H., Sönmez, İ., and Polat, E. 2019. Farklı organik gübre uygulamalarının kıvırcık salatada (Lactuca sativa L. var. crispa) verim, kalite ve bitki besin elementi içeriklerine etkileri. *Mediterranean Agricultural Sciences*, **32**: 63-68.

Citation: Aksahin, V.; Gulunay, B.N.; Coban, D. and Ortas, I. 2023. Under Long -Term Field Experiment, The Effects of Organic and Inorganic Fertilizers Application on Maize Growth and Soil Organic Carbon Sequestration. *International Journal of Agricultural and Applied Sciences*, 4(1): 85-93. https://doi.org/10.52804/ijaas2023.4114