Effects of organic fertilizers from varied sources on plants and soil under different climatic conditions in Jordan

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NARC

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NEXUS

Introduction

The practice:

Local farmers used to apply synthetic fertilizers to their crops which harms:

- The environment.
- Polluting the water aquifers
- Destroys the system of beneficial micro-organism in the soil.

Organic waste…The alternative

Available in huge amounts.

Multi-source: plant , animals, sludge.

Cheap.

Nutritive.

Local trail

Technical concept on implementing Field Experiments for Testing Locally Produced Compost

Objectives

- Testing the use of compost under varied field conditions (rainfall and under irrigation using saline water).
- Investigate compost impact on soil properties and fertility
- Determine effect of using compost on Okra productivity .
- Inform on accumulation (if any) of heavy metals in the soil or plant.

Climate and locations

Plants were grown using two varied water sources for irrigation as follows:

- Fully under rainfall at Maru (420 mm long term average) in Irbid governorate
- Fully under irrigation at Khalediyah Station (133 mm long term average rain) by using saline water (7.6 dS m^{-1})

Organic inputs:

From GIZ established factories:

1. **Plant Wastes-Compost**: produced by Irbid Municipality.

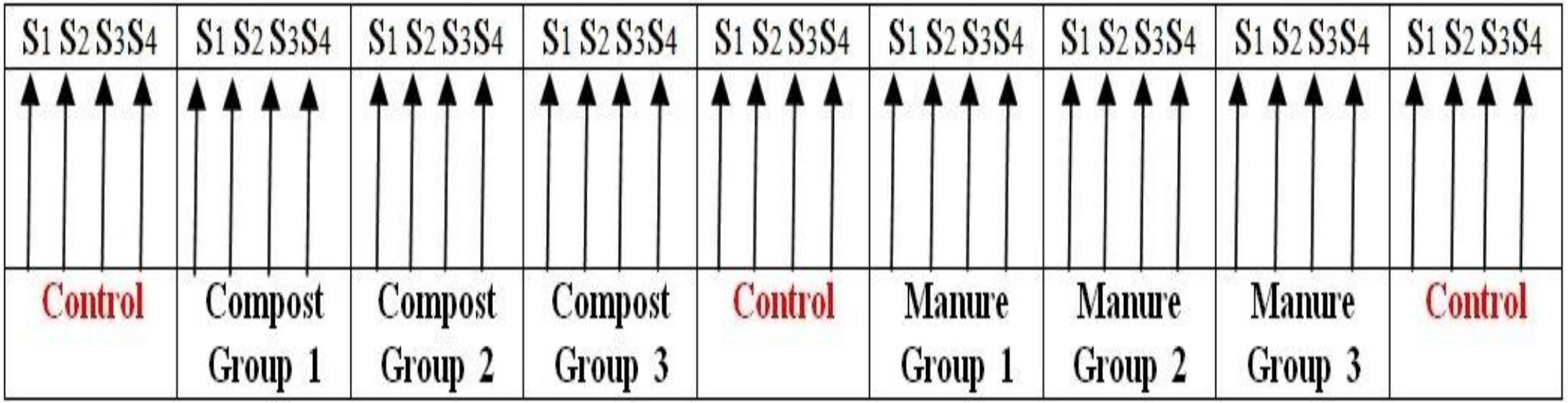
1. **Cow/Chicken-Manure**: produced by Future Pioneers in Mafraq Municipality.

Field design

Treatment	Groups of treatment (Application Rate/ Plot)			No. of plots/rep.	Total no. of plants/plot
	GROUP 1 DW OM	GROUP 2 DW OM	GROUP 3 DW OM		
Compost	35 t/ha	70 t/ha	105 t/ha	3	160
Mature manure	35 t/ha	70 t/ha	105 t/ha	3	160
Control	Untreated Group (zero-organic input application)			3	160

* Plot area: 20 m^2 (2 X 10 m).
* Spacing in plots: 0.5 m between rows and 0.25 m between plants.

Treatments Randomization



Chemical analysis

Material	Analysis Parameters
Soil	Texture
	Soil Organic Matter
	EC
	PH
	Available NPK
	CEC
Plant	Heavy metals in soil (Pb,Cd,Cr,Ni,Mo,and Co)
	Heavy metals accumulated in plants biomass(Pb,Cd,Cr,Ni,Mo,and Co) Micronutrients in leaves (Mg,Fe,Ca,Mn)
Compost and stabilized manure which be used	Organic matter
	NPK
	Heavy metals(Pb, Cd,Cr,Ni,Mo,and Co)

Crop data

- Emergence
- Mortality%
- 1st flowering
- Stem width
- Leaf width and length
- Plant height
- Fruit yield (fresh and dry)
- Chlorophyll /SPAD

Organic material

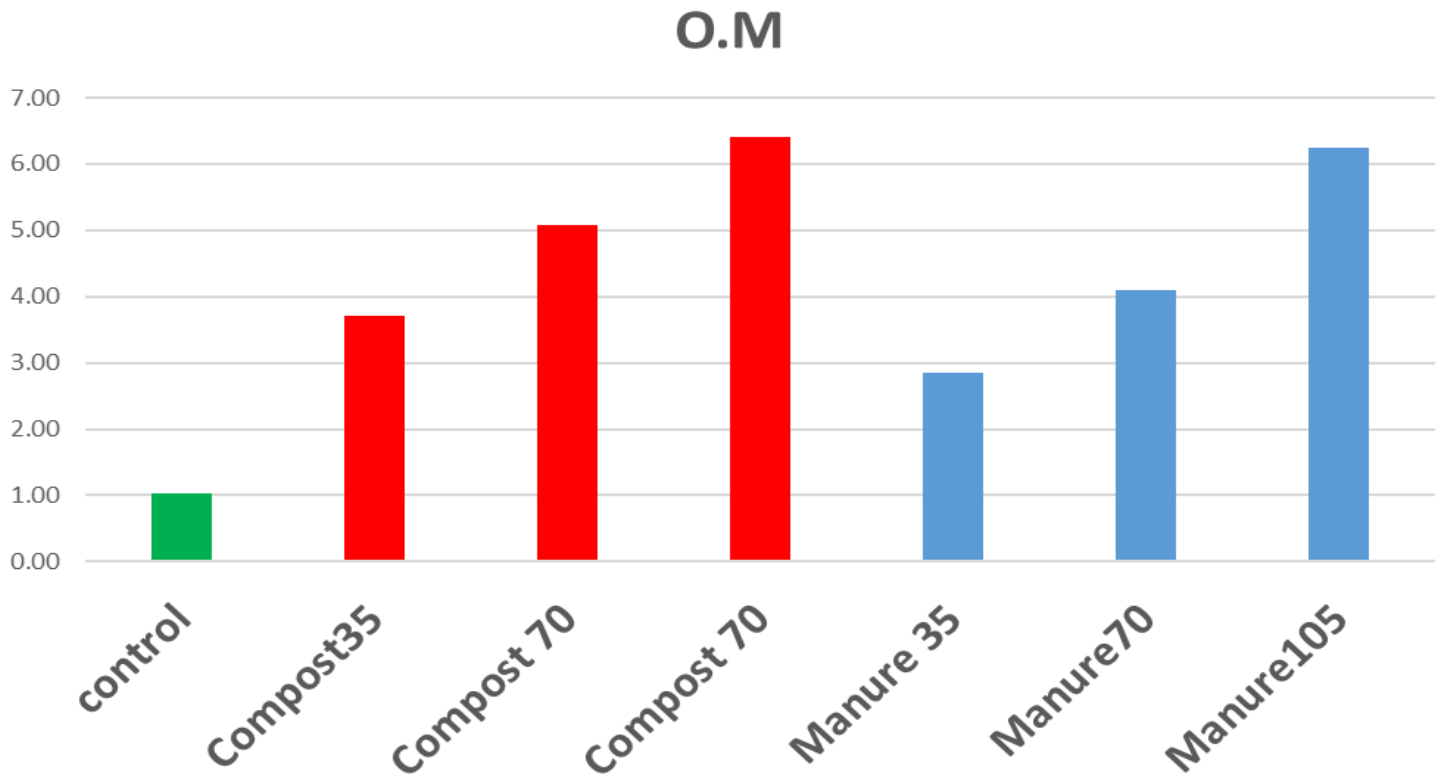
Application in December

Results

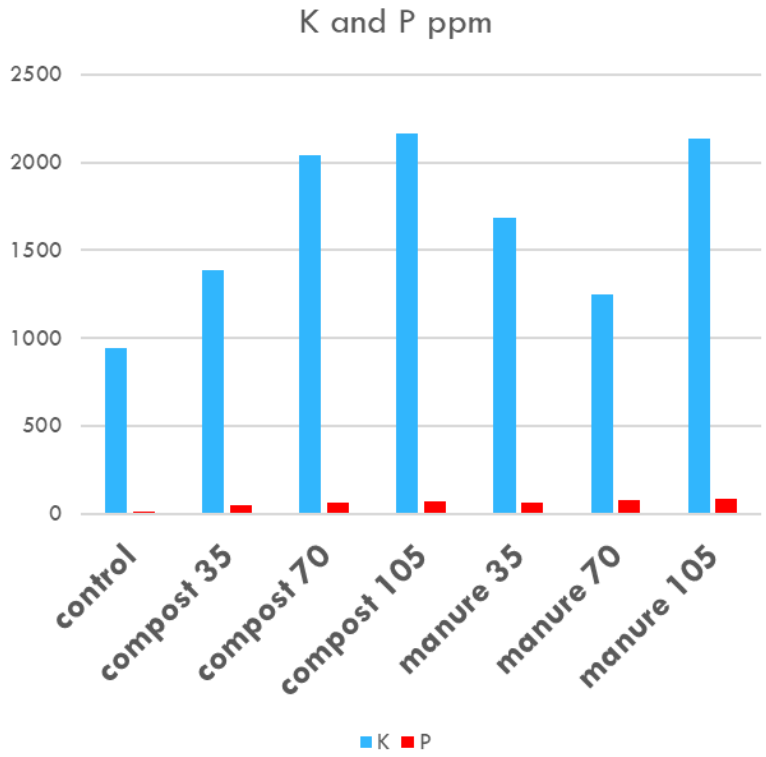
Weather data

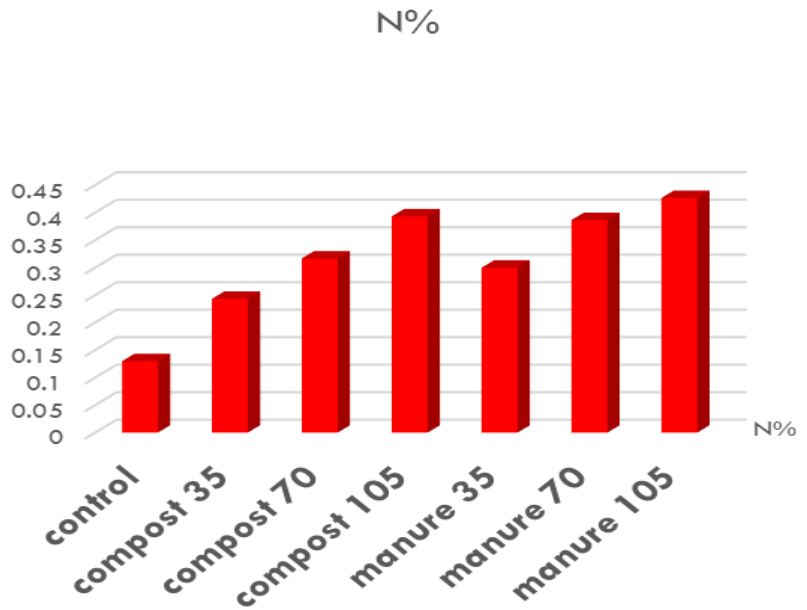
	Rainfall (mm)					
Month	Maru site			Al-Khalediyah site		
	2020/2021	2021/2022	2022/2023	2020/2021	2021/2022	2022/2023
October	0.0	0.0	20.1	0.0	0.0	0.0
November	63	62.2	10.4	0.0	0.0	0.0
December	49	49	52.1	28.0	28.4	25.0
January	107	107.5	162.3	29.7	23.6	29.0
February	138	138.0	68.1	41.0	37.5	34.0
March	43	48.0	47.8	3.5	20.7	44.5
April	0.0	12.5	0.0	0.0	0.0	0.0
Total	**400**	**417.2**	**360.7**	**102.2**	**110.2**	**132.5**
Long term annual average	**420**			**133**		

The addition of organic manure and compost to the soil improved soil fertility by increasing soil content of **organic matter** content (OM),

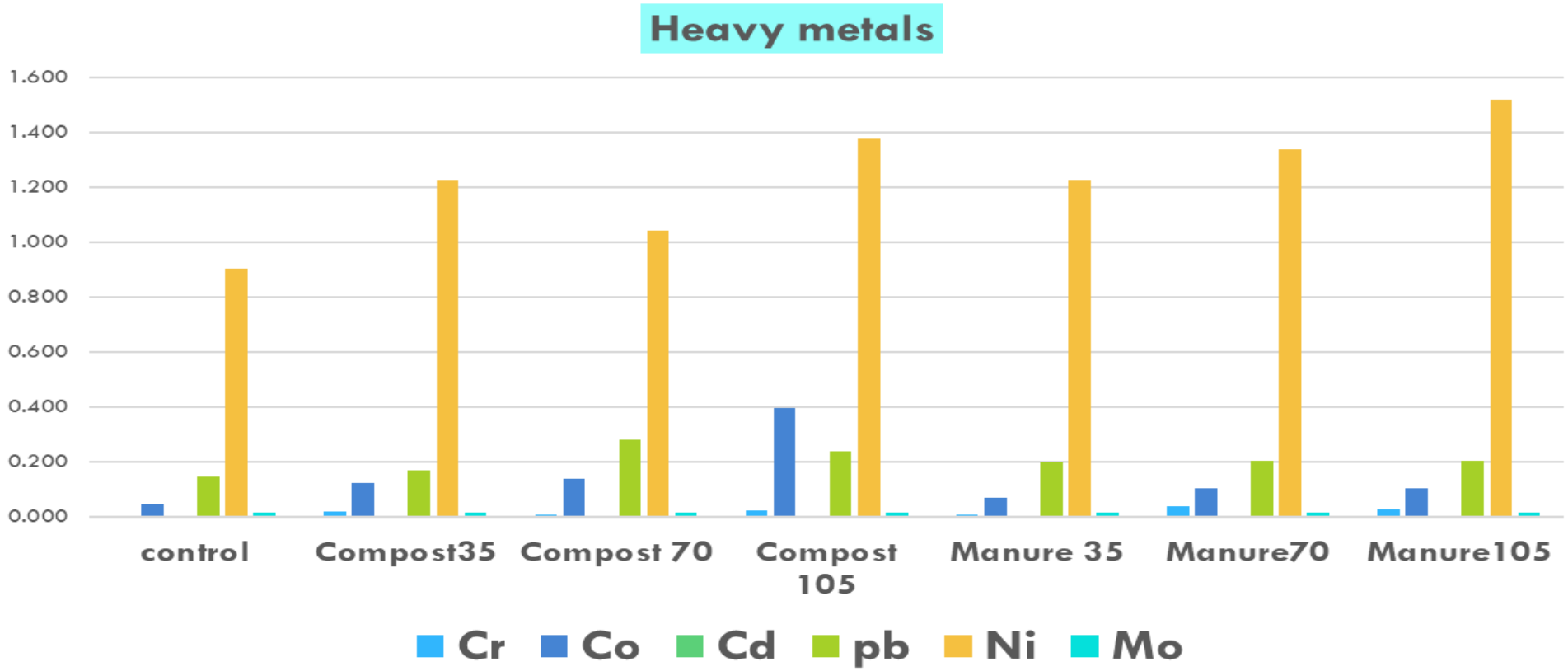


N, P, and K also their content in soil increase as application rate increase from compost and/or organic manure as compared with control

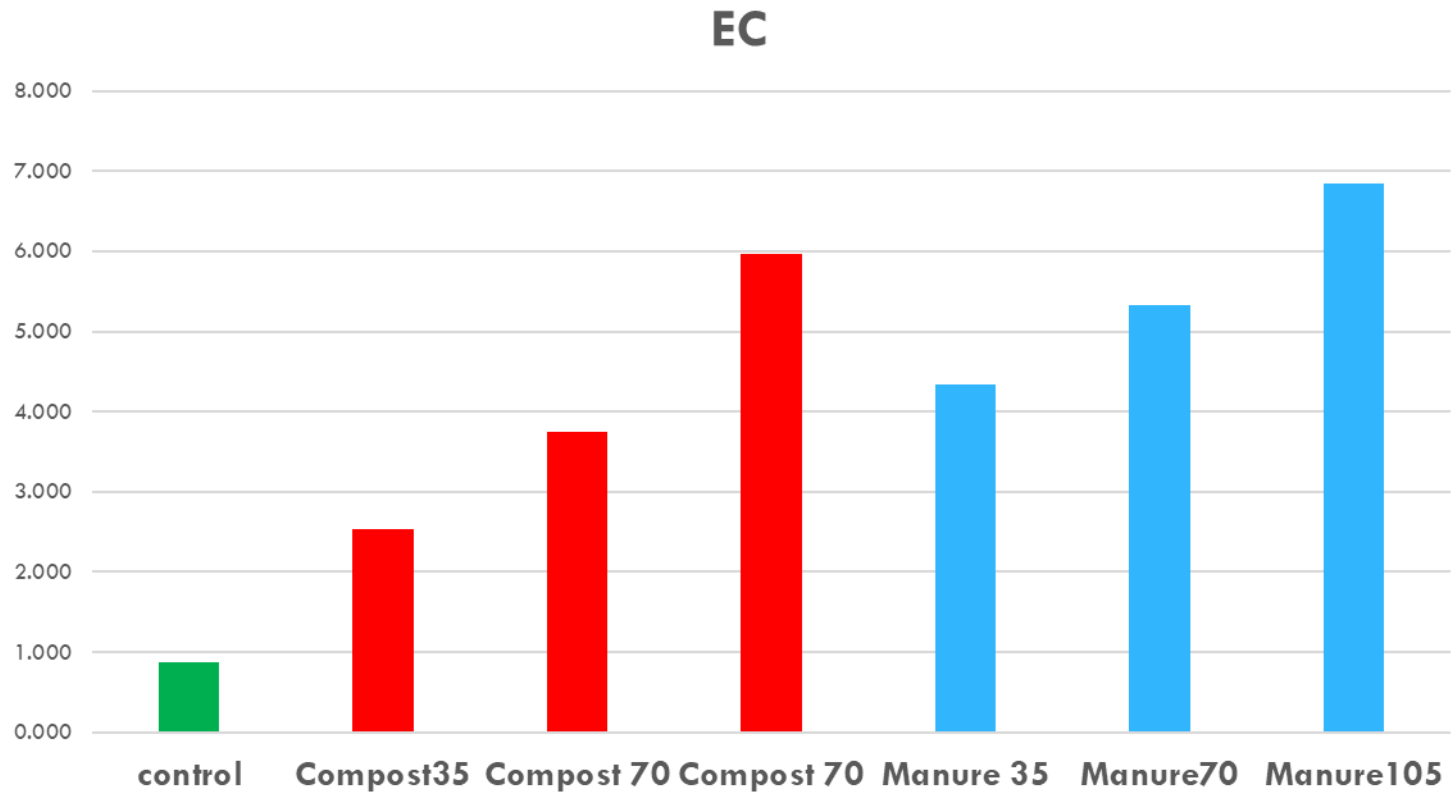




Heavy metals in the soil (Cr, Cd, Co and Mo) concentration were not affected by adding organic fertilizer, while Ni increased.

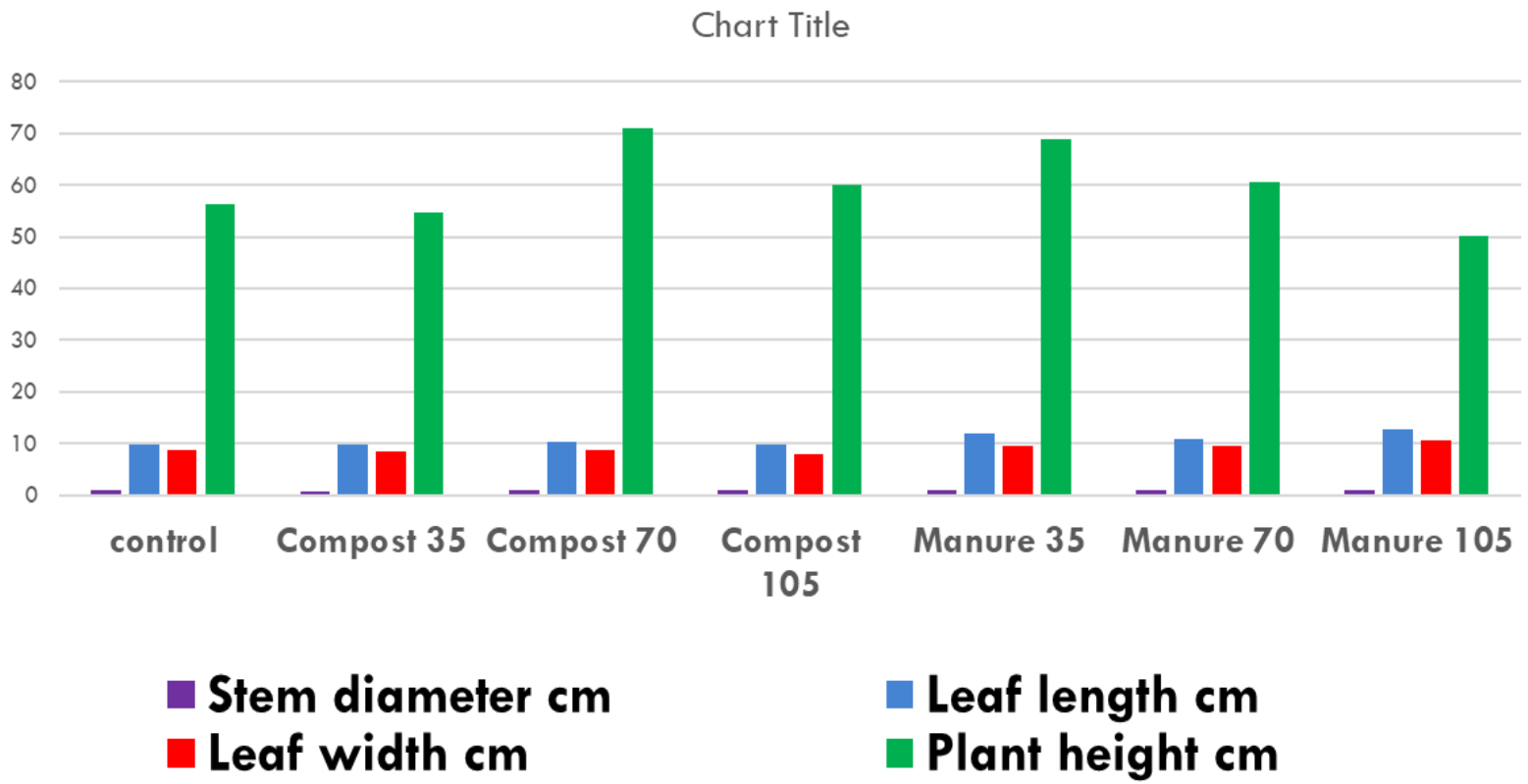


The most significant problem that may affect the crop by using organic manure compared with compost is **salinity** accumulation which with time may cause soil deterioration and decrease plant growth and yield.



Crop data

- Addition of organic inputs on okra grown developed thicker stems and **increase** leaf length , plant height and producing larger leaves over the compost and the control .

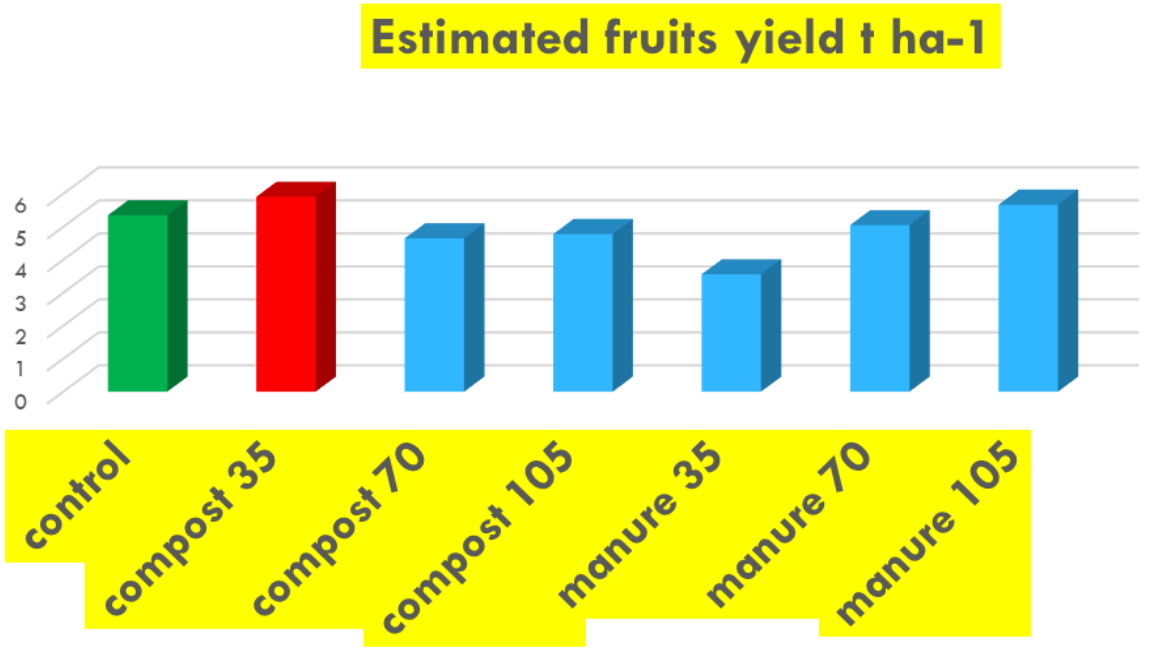


Okra yield under rainfall condition

Okra grown under rainfall growing condition ; the greatest mean fruit production (**3.16 t ha^{-1}**) was attributed to the plants received the compost organic treatments (35 and 70 t ha^{-1}).

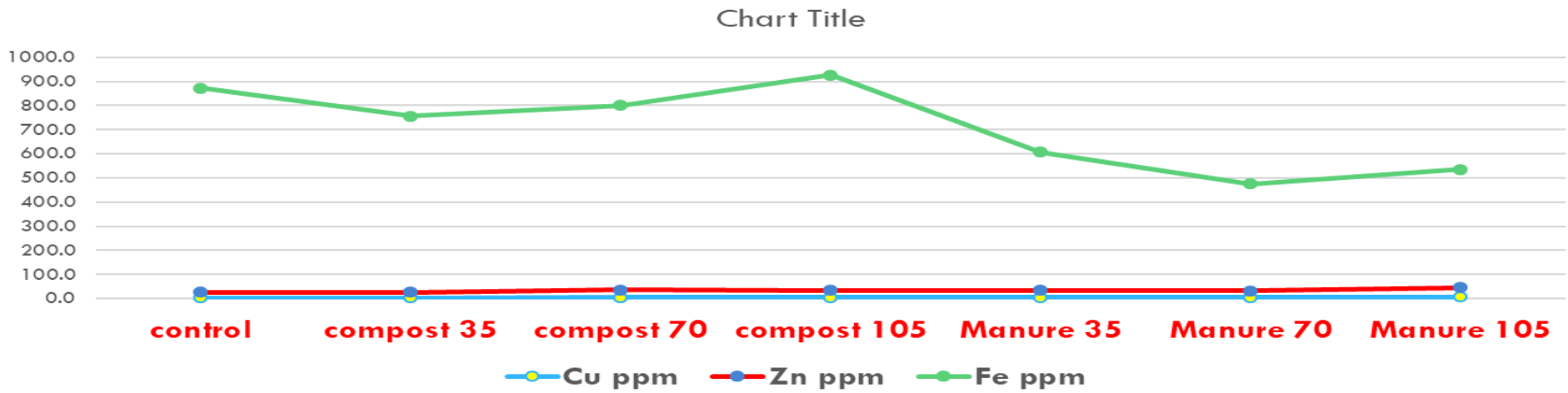
Okra yield under saline water irrigation

The effect of organic inputs application reflected positively on the okra yield over the untreated control treatment okra grown under irrigation by using saline water, yield varied according to the varied organic treatments, and the greatest fruit yield (**1.3 t ha^{-1}**) attribute to the compost treatments (35 t ha^{-1}).



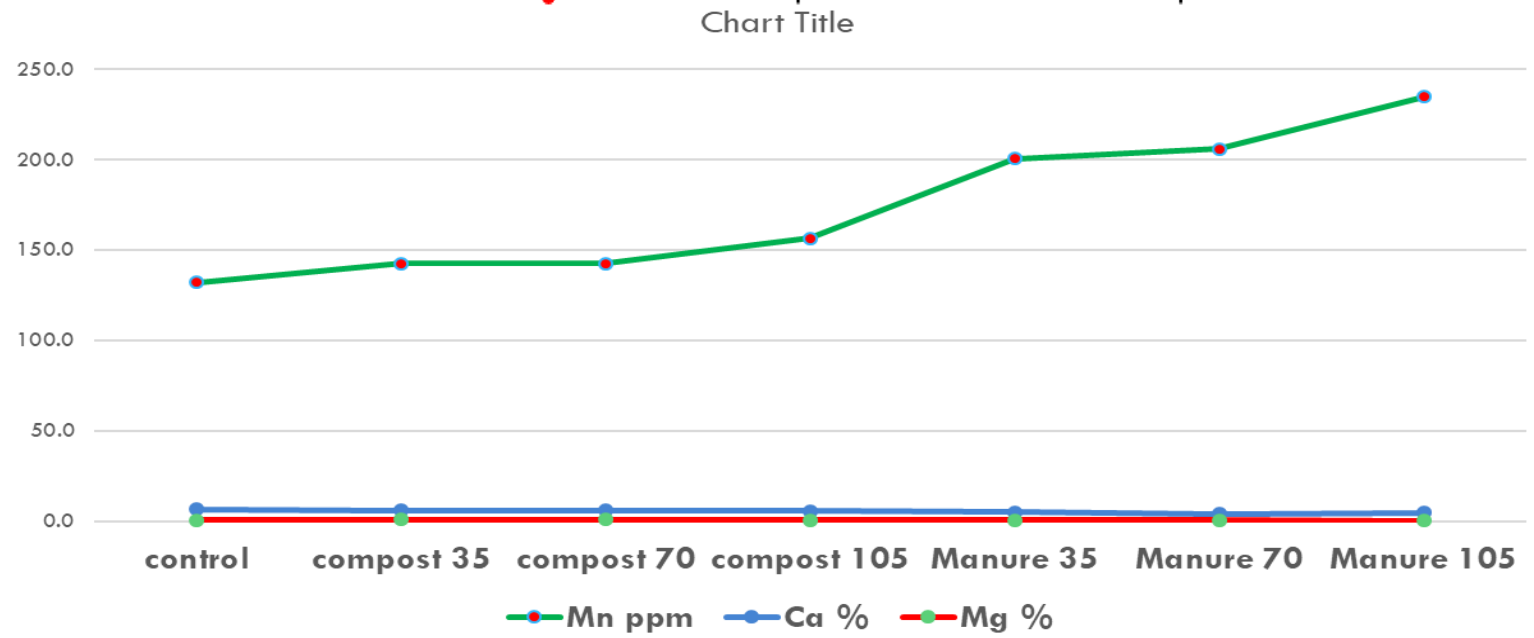
Minerals in okra leaves

- Okra leaves mineral`s content under the growth of drought and salinity conditions showed no significant difference for **Cu** content in the **compost** treatments as compared with control treatment.
- Whereas the **Cu** content **increased** with increasing the application rate and in **manure** treatments that was higher than control and compost treatments.
- **Zn** leaf content in the manure treatments was much higher than compost and control treatments.
- **Fe** leaf content in the compost treatments was higher than both manure and control treatments



Minerals in okra leaves

- *Mn* leaf content after using the manure was higher than the compost and control.
- Manure application rates not affected on *Mg* concentration in leaf whereas compost treatments gave higher concentration of Mg leaf compared with contro
- *Ca* leaf content found to be much higher in the compost treatments as compared with manure treatments



Heavy metals content in okra leaves

- Mo, Co, Pb , Cr and Cd is lower than detection limit
- Ni concentration in leaves increase with increasing application rate of compost and/or Manure

Information dissemination

Varied events….Work shops, field visits, training courses, meetings.

CONCLUSIONS

- **Salinity** was accumulated in soil treated with organic matter as compared with control treatment.
- Soils treated with organic manure over two sites were **higher salinity** observed compared with organic compost.
- In general **fertility** for soils treated with organic manure and/or organic compost was increased with cumulative application over three seasons of the two studies sites .
- No obvious accumulation of soil **heavy metals** (Cr, Cd, Co, Pb, and Mo) for all treatment levels, however the Ni is questionable.

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Thank you