

SOIL LAYERING TRIAL USING ORGANIC AMENDMENTS TO ENHANCE CROP PERFORMANCE IN SANDY DESERT SOILS OF ABU DHABI

BIOCRAFT STRAIGHT OR COMPLEX FERTILIZERS MANUFACTURING L.L.C , ABU DHABI, UAE

INTRODUCTION

The UAE's desert environment presents major challenges for agriculture, with sandy soils lacking organic matter, moisture-holding capacity, and essential nutrients. Traditional cultivation practices in such soils often fail without significant inputs. To address this, a soil layering technique incorporating organic materials was tried to improve soil fertility, water retention, and overall crop performance. This method uses readily available organic waste and compost materials to create a productive growing medium over poor sandy soil.

OBJECTIVE

- To test a soil layering method using a mix of organic materials to improve the fertility of sandy soils in Abu Dhabi.
- To evaluate plant establishment, root development, and vegetative growth 30 days after planting.
- To assess the potential benefits of organic layering in improving yield and vegetative parameters such as leaf count and root mass.
- To explore the feasibility of this technique for small-scale or urban agriculture in arid zones.

MATERIALS AND COMPOSITION

Trial Location: Abu Dhabi, Al wathba, UAE

Trial Date: 25th October 2024

Plot Size: 5 m × 5 m

Plot Depth: 40 cm

Soil Layering Structure:

- Bottom 10 cm: Coarse sand layer (to promote drainage)
- Top 30 cm: mixture of the following organic components:
 - Compost 30%
 - Vegetable waste 20%
 - Straw 10%
 - Terrabionic (vermicompost) 20%
 - Manures 20%

Additionally, Microbionic (liquid biofertilizer) was applied during the mixing phase to activate microbial populations and enhance nutrient cycling in the growing medium.

DATA COLLECTION PARAMETERS

Laboratory analysis was conducted on the amended soil mixture to determine key chemical and biological properties. The following parameters were analyzed:

- pH level
- Electrical Conductivity (EC)
- Available Nitrogen (N), Phosphorus (P), and Potassium (K)
- Organic Matter Content
- Microbial Activity (Total Viable Count)
- Cation Exchange Capacity (CEC)

These results provided baseline data to support observed plant responses and confirm the fertility enhancement of the trial medium.

Soil Parameters: Moisture retention, soil surface temperature

Plant Growth Parameters (measured at 30 Days After Planting - DAP):

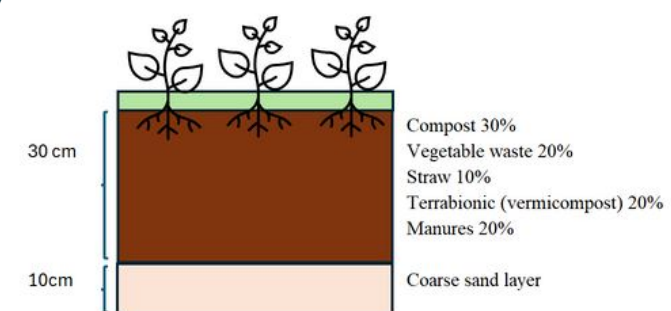
- Germination rate
- Root system development (length, mass, spread)
- Number of green leaves
- Plant height and leaf color
- Early flowering or budding
- Fresh biomass
- Visual Observations: Leaf color, turgidity, signs of pests or nutrient deficiencies

NORMAL UAE SANDY SOIL CONDITIONS

- Texture: Coarse sand
- Organic Matter Content: Less than 0.5%
- pH: 8.0-8.5
- Water Holding Capacity: Very low
- Structure: Poor aggregation, high infiltration rate
- Nutrient Availability: Deficient in nitrogen, phosphorus, and potassium

METHODOLOGY

- A 10 cm coarse sand base layer was laid at the bottom of the plot.
- A 30 cm thick organic mixture layer was uniformly applied above the sand.
- Microbionic liquid was added to the mixture before planting.
- Crops were directly sown or transplanted into the prepared bed.
- Irrigation was provided using both manual watering and a drip irrigation system.



BED PREPARATION

CROPS PLANTED



RADDISH



TOMATO



CUCUMBER



FABIA BEAN



SUNFLOWER



WHEAT



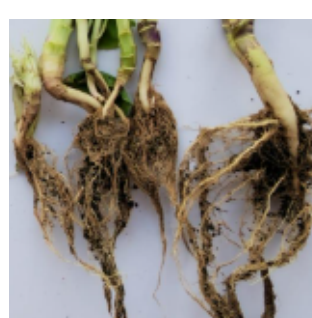
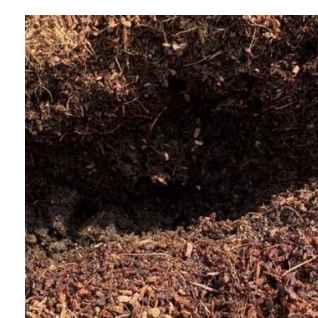
COTTON



WATERMELON

OBSERVATIONS AT 30 DAYS AFTER PLANTING

- Strong plant establishment across most crops
- Well-developed root systems with lateral spread and taproot depth
- Crops exhibited 10% more green leaves
- Early vigor noted in sunflower, wheat, and leafy greens
- Moisture retention was effective, with reduced irrigation needs
- Estimated 10% increase in biomass/yield potential



RESULTS AND DISCUSSION

The soil layering method significantly enhanced the growth environment in sandy soils. The combination of coarse sand for drainage and an organic top layer led to noticeable improvements in root formation, water retention, and early vegetative growth. The addition of Microbionic liquid biofertilizer enhanced microbial activity and nutrient availability. The plants demonstrated better resilience and faster development than typically seen in untreated sandy plots. This method supported diverse crop types, indicating its suitability for integrated desert farming systems.

- Key Results of Analysis:
- pH @20°C: 7.42
 - Electrical Conductivity @25°C: 1.37 dS/m.
 - Organic Matter: 21.2%
 - Humic Acid : 5.33%
 - Potassium: 20.4 mg/L
 - Calcium: 53.0 mg/L
 - Magnesium: 1.82 mg/L
 - Nitrogen: 0.56 %
 - Phosphorous: 1.2 mg/kg
 - Heavy Metals (mg/kg): Lead (<0.01), Mercury (<0.001), Cadmium (<0.01), Arsenic (<0.01), Nickel (3.83), Chromium (2.64), Zinc (1.10), Copper (0.63)

CONCLUSION

This trial validates the use of a two-layer soil system with organic amendments to enhance plant performance in Abu Dhabi’s sandy soils. Observations at 30 days showed stronger root development, increased foliage, and an estimated 10% yield improvement. This cost-effective method can be scaled for home gardens, urban agriculture, and larger desert farms. Future studies should include long-term productivity and soil biology assessments.

ORGANIC MIX SUMMARY - 1 M² (30 CM DEPTH)

Component	Percentage (%)	Volume (m³)	Estimated Weight (kg)
Compost	30%	0.09	54
Vegetable Waste	20%	0.06	30
Straw	10%	0.03	5
Terrabionic	20%	0.06	39
Manures	20%	0.06	33
Total	100%	0.3	161

ORGANIC MIX SUMMARY - 25 M² (30 CM DEPTH)

Component	Percentage (%)	Volume (m³)	Estimated Weight (kg)
Compost	30%	2.25	1,350
Vegetable Waste	20%	1.5	750
Straw	10%	0.75	112.5
Terrabionic	20%	1.5	975
Manures	20%	1.5	825
Total	100%	7.5	4013

- Bulk densities used for estimation (approximate):
- Compost: 600 kg/m³
 - Vegetable Waste: 500 kg/m³
 - Straw: 150 kg/m³
 - Terrabionic: 650 kg/m³
 - Manure: 550 kg/m³

PROGRESS HIGHLIGHTS

