

Evaluation of composts for improving fertility and productivity of soils in United Arab Emirates

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Introduction

The application of organic matter has received increasing attention recently, not only because of the beneficial effects of organic matter application, but also due to the increasing availability of cheap sources of organic matter, such as sewage sludge and compost.”

Source: REINHARD F. HUTTL AND MARIO FUSSY

Organic matter management, 2001

Soil Protection and Re-cultivation, Brandenburg University of Technology, Cottbus, Germany



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Main Issues

- Beneficial effects
- Increasing availability
- Policy Implication



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Beneficial effects



Beneficial effects

Emir. J. Agric. Sci. (1992) 4: 92-100

A Comparative Study of Water Retention Among A Sandy Soil And Composts in Al Ain, U.A.E. (Short Communication).

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Beneficial effects

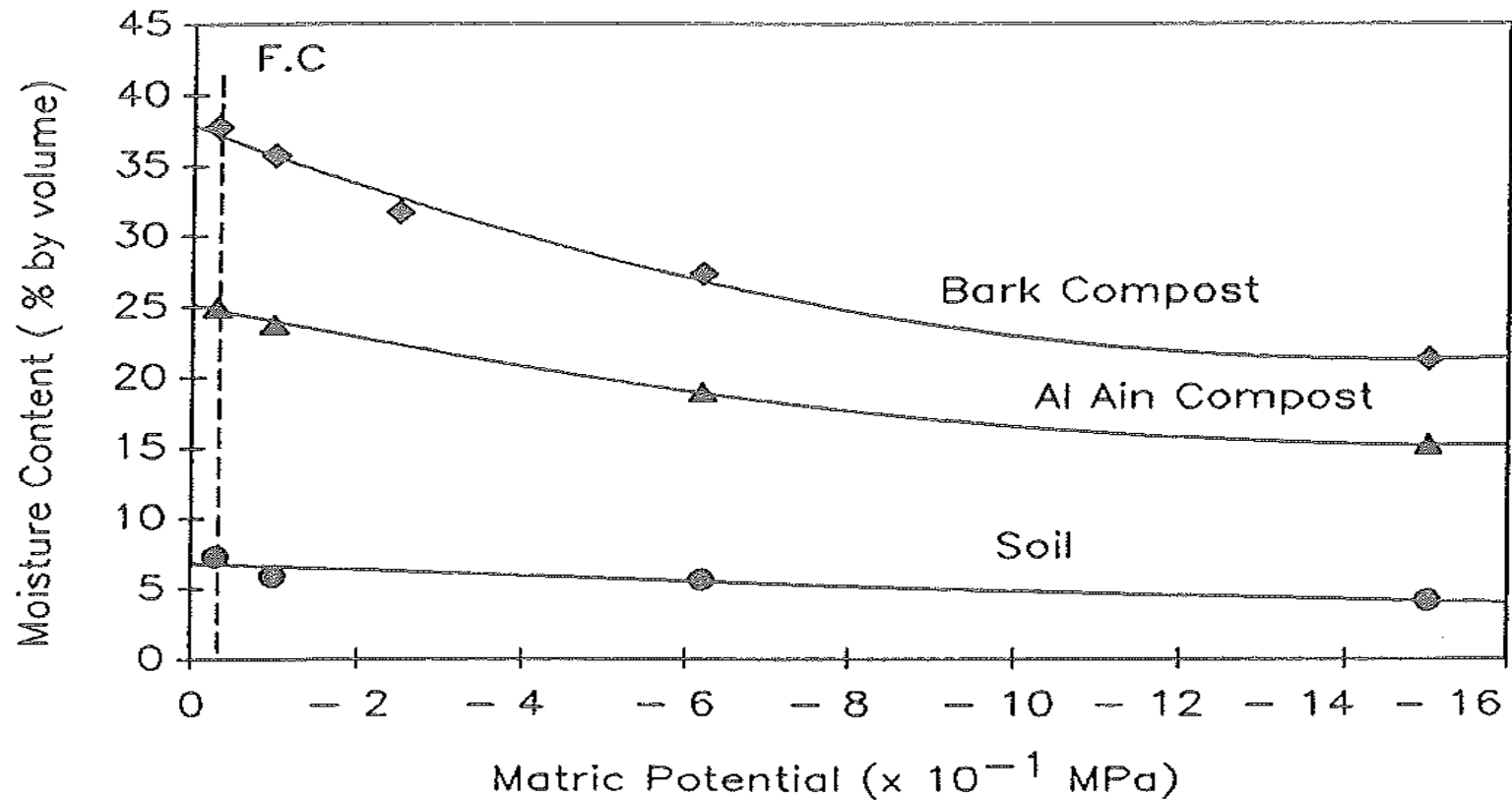
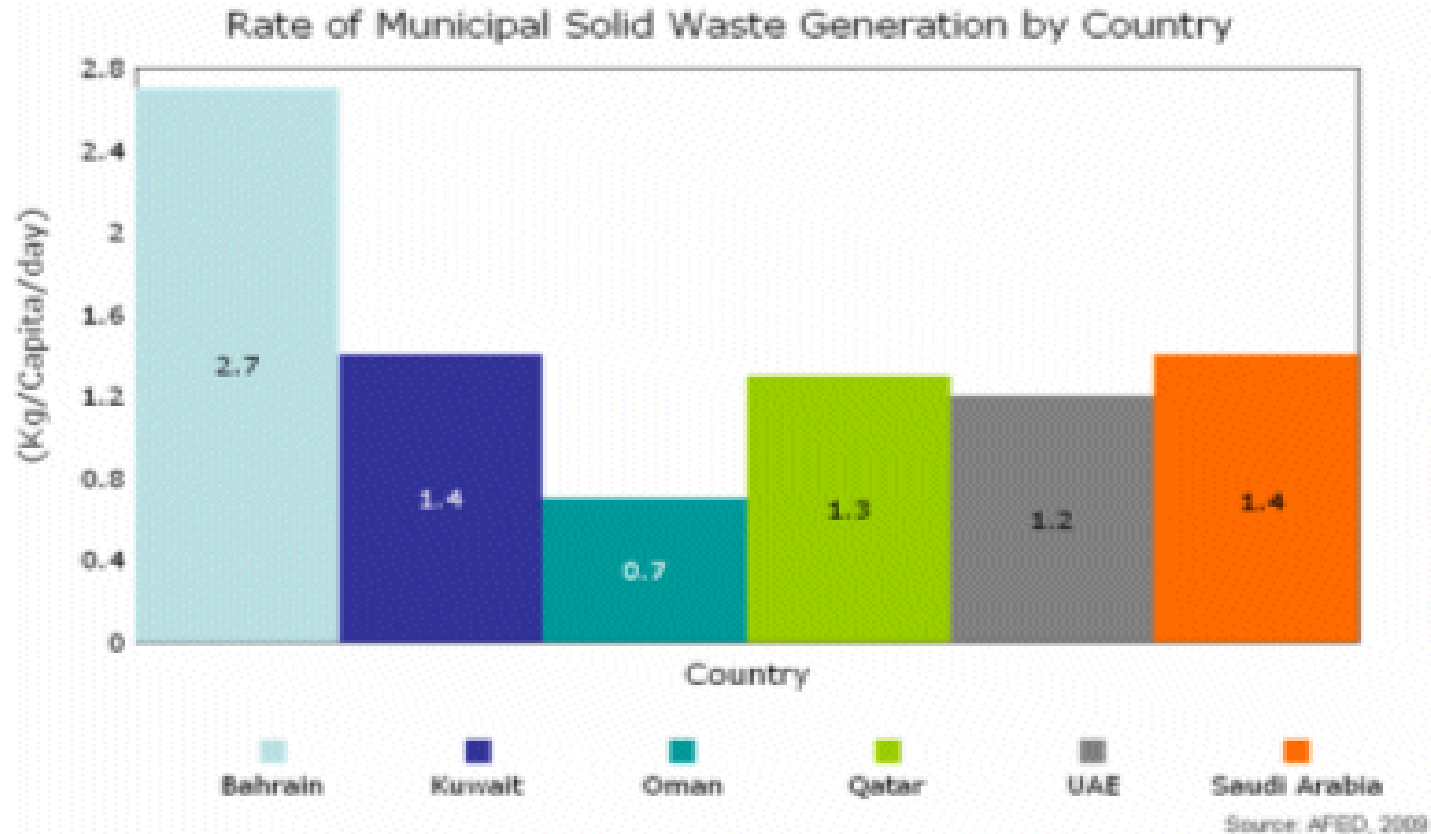


Figure 2. Soil and compost moisture characteristic curves

Increasing availability



Solid Waste Management in GCC: Challenges & Opportunities

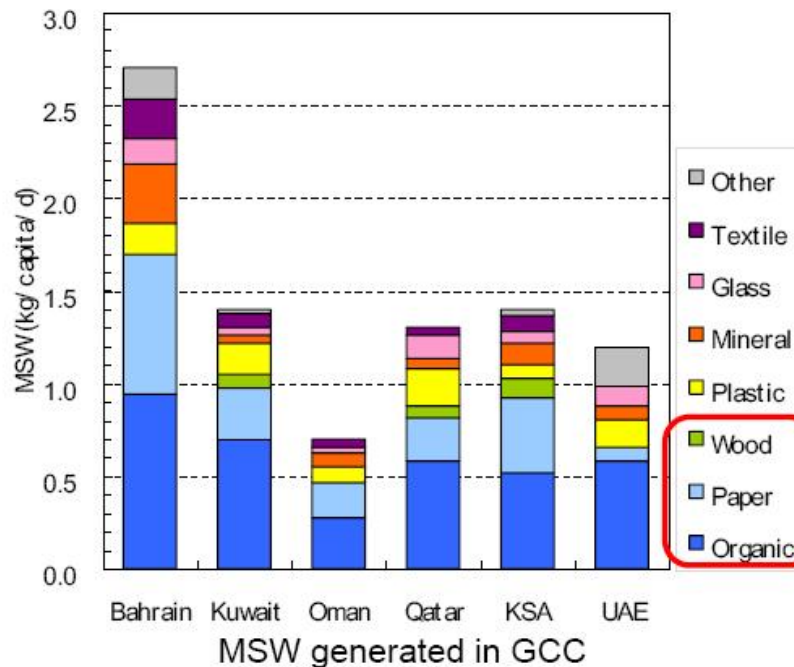
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By Vivek Gautam, Sr. Research Analyst, South Asia & Middle East, Environmental & Building Technologies Practice

Contribution of Materials to Municipal Solid Waste – GCC Countries

Background: Municipal solid waste (MSW)

■ MSW is a source of valuable materials or pollutants?



Disposal to open pit

Biodegradable portion > 50%



Municipal sewage sludge

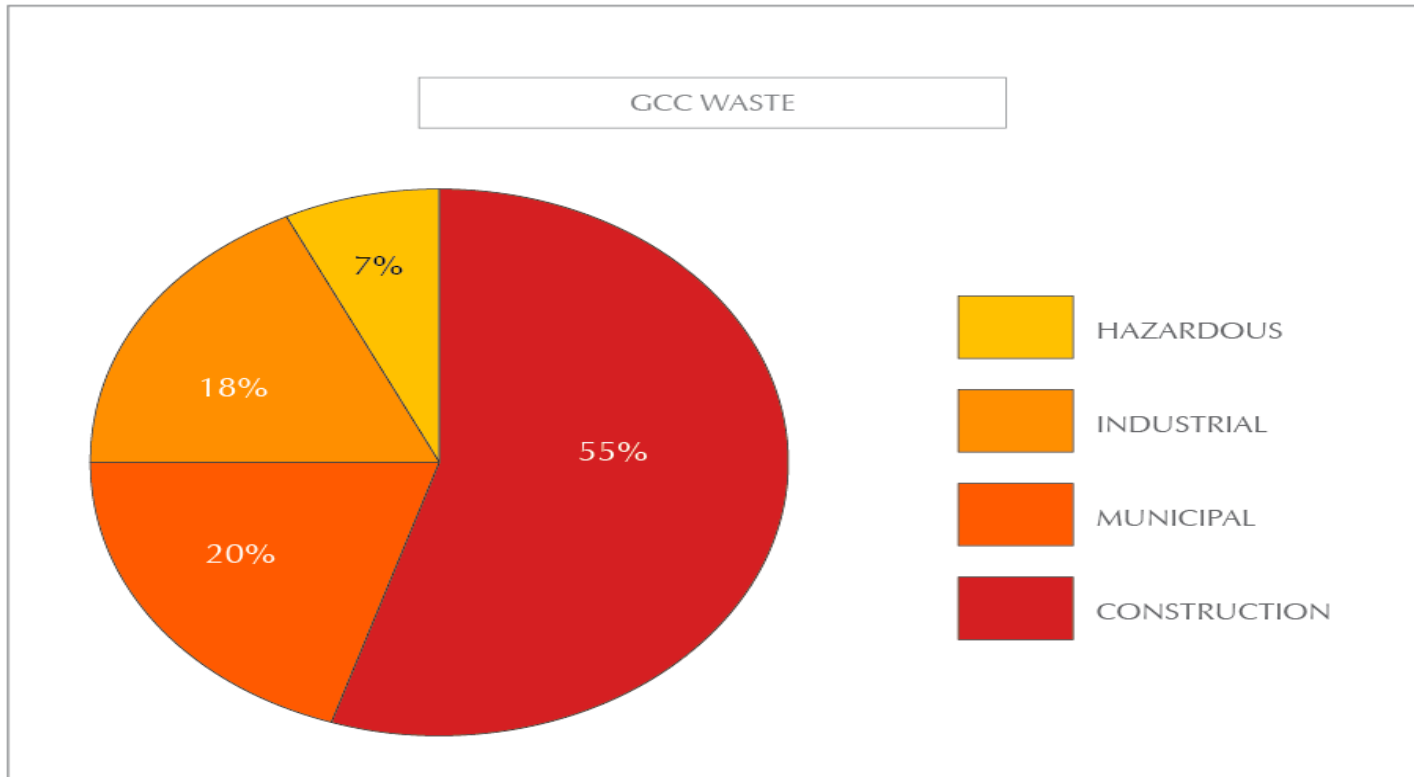
Source: 2008 AFED (MSW data of 2004 or 2007)
Ref.: MSW Average in Arab World = 0.7 ka/capita/d



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Municipal Solid Waste Production in GCC Countries



120 million tons of waste produced in GCC in 2010

Compost Sample Collection

Bee'ah Materials Recovery Facility(MRF) – Sharjah

Total annual production 30,000 ton of which 95% used by Municipality

Waste Water Treatment Plant, Dubai Municipality

Total annual sludge production (4000-5000 ton)



Compost Sample Collection

**Municipal Solid Waste (MSW)
& Compost Plant Al-Ain**

Total production 10,000 ton.

Four Types of Compost

Fully domestic base

Half domestic and half green

Fully based on green matter

Half animal manure and half green



Characteristics of Compost Samples

Sample	pH	EC dS m ⁻¹	N %	P %	K %	OM %
Abu Dhabi (Compost used at ICBA)	6.98	12.58	0.57	0.87	0.60	30.28
Bee'ah Sharjah	6.81	9.19	2.5	1.92	0.50	42.49
Al-Ain	7.38	7.35	0.87	0.92	0.40	34.48
DM Dubai (Sludge)	6.23	4.6	5.85	4.04	0.45	71.80

Abu Dhabi (Compost): Green matter; Bee'ah Sharjah (compost): Green matter + Sewage sludge(70:30)
Municipal Solid Waste(MSW) & Compost Plant Al-Ain (compost) : Green matter; DM, Dubai: Sewage Sludge



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Characteristics of Compost Samples

- Significant variation of OM, N, P, K contents in the four samples observed indicating the effect of different sources of MSW was used for composting
- Organic matter content of composts varied from 30.28% (Abu Dhabi Compost) to the highest 71.80% (Dubai sewage sludge)
- P ranged between 0.87-4.04%
- K ranged between 0.40-0.6%
- Nitrogen also varied, highest being for sewage sludge (5.85%) and the lowest for Abu Dhabi compost (0.57%)
- EC (1:1) ranged between 4.6 dS/m (sludge) and 12.58 dS/m (Abu Dhabi compost)



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Incubation Study

Dynamics of Available N (NH_4 , $\text{NO}_3 + \text{NO}_2$), P, K

Objectives

To Study:

- The dynamics and nutrients availability (Immobilization / mineralization of N, P) from compost material
- The efficiency in short & long term (Release of available N and P over time) of compost material



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Incubation Study



Soil per container: 100 g



Incubation Temperature: 30 °C

Treatments

Control (no compost)

- 10 tons ha⁻¹ (0.44 %) compost
- 20 tons ha⁻¹ (0.88 %) compost
- 40 tons ha⁻¹ (1.76 %) compost
- Sampling intervals: 0, 5, 10, 20, 30, 45, 60 days
- Replicates: 3 per treatment per sampling interval

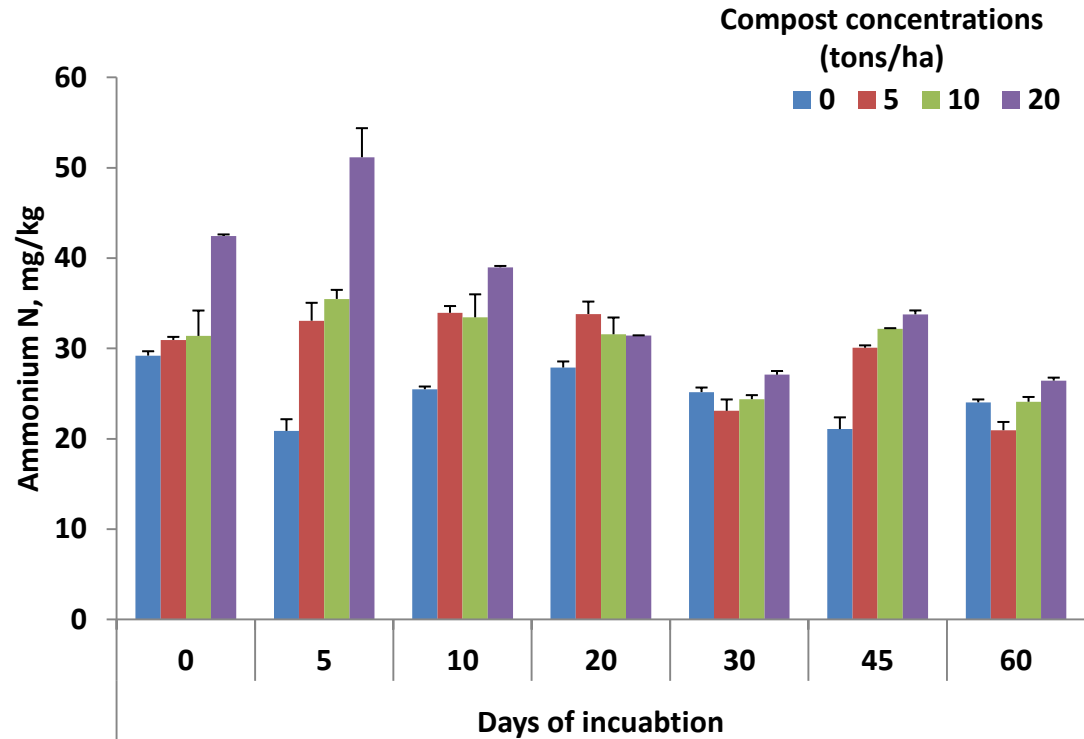
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Accumulation of mineral N (NH_4) during incubation

- Increased mineralization is observed with the increase of compost application rates
- Overall maximum NH_4 accumulation is observed within first week of application where 20 tons compost was applied

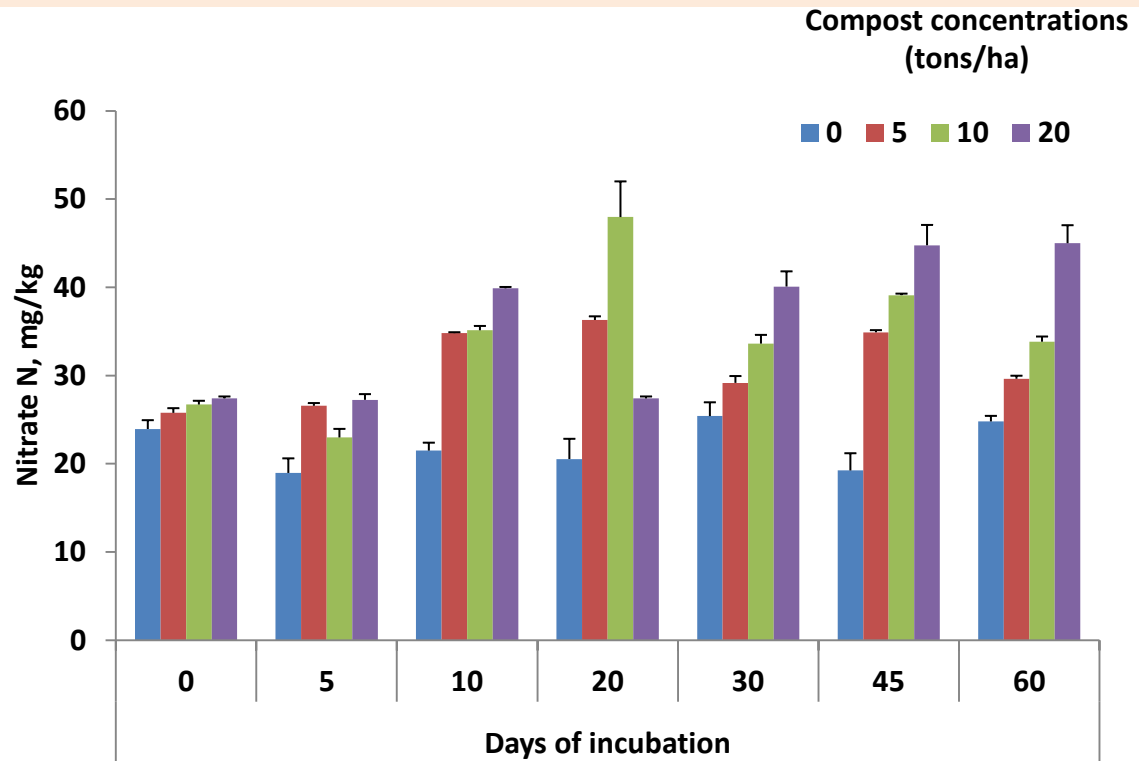


Changes in the concentrations of available NH_4 -N in the soils with the application of different rates of composts over 60 a period of days



Accumulation of mineral $\text{NO}_3\text{-N}$ during incubation

- Increased mineralization is observed with the increase of application rates of compost
- Overall maximum NO_3 mineralization is found after 6th week of application where 20 tons compost was applied. Exception being after 20 days with 10 tons application.

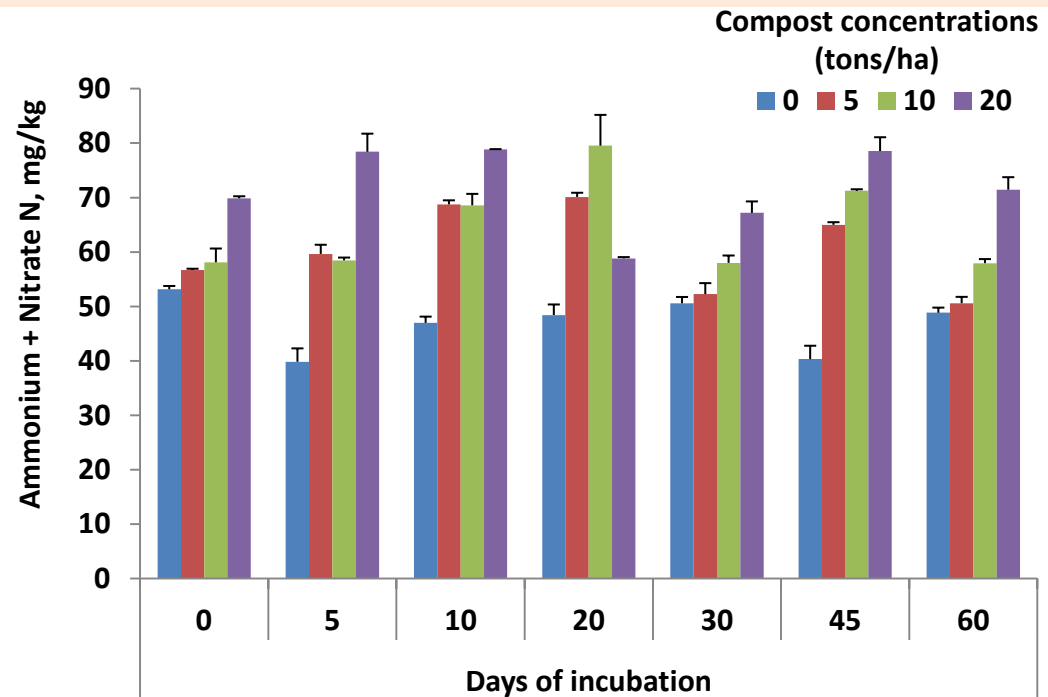


Changes in the concentrations of available $\text{NO}_3\text{-N}$ in the soils with the application of different rates of composts over 60 a period of days



Accumulation of mineral N (NH_4 and NO_3) during incubation

- Net increase of mineralization is observed with the increase of application rates of compost
- Maximum net mineralization is observed after first week of application where 20 tons compost was applied



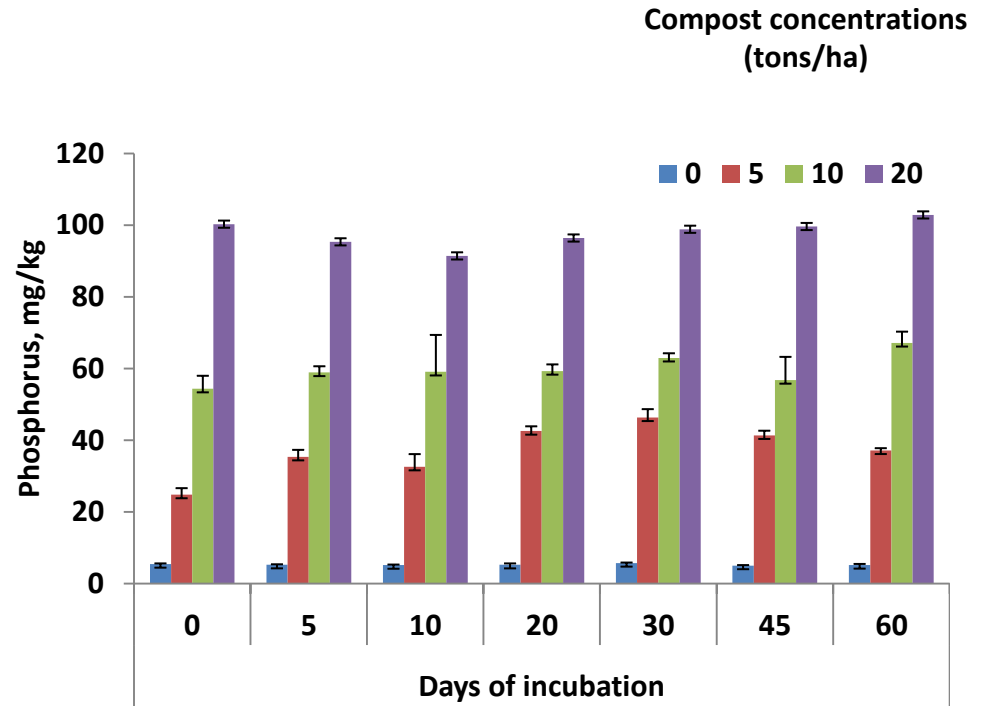
Changes in the concentrations of net available $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$ in the soils with the application of different rates of composts over 60 a period of days



Effect of incubation on soil P concentration

Incubation Study

- Increased P mineralization is observed with the increase of compost application rates
- Maximum P mineralization is found within first interval and remains consistent

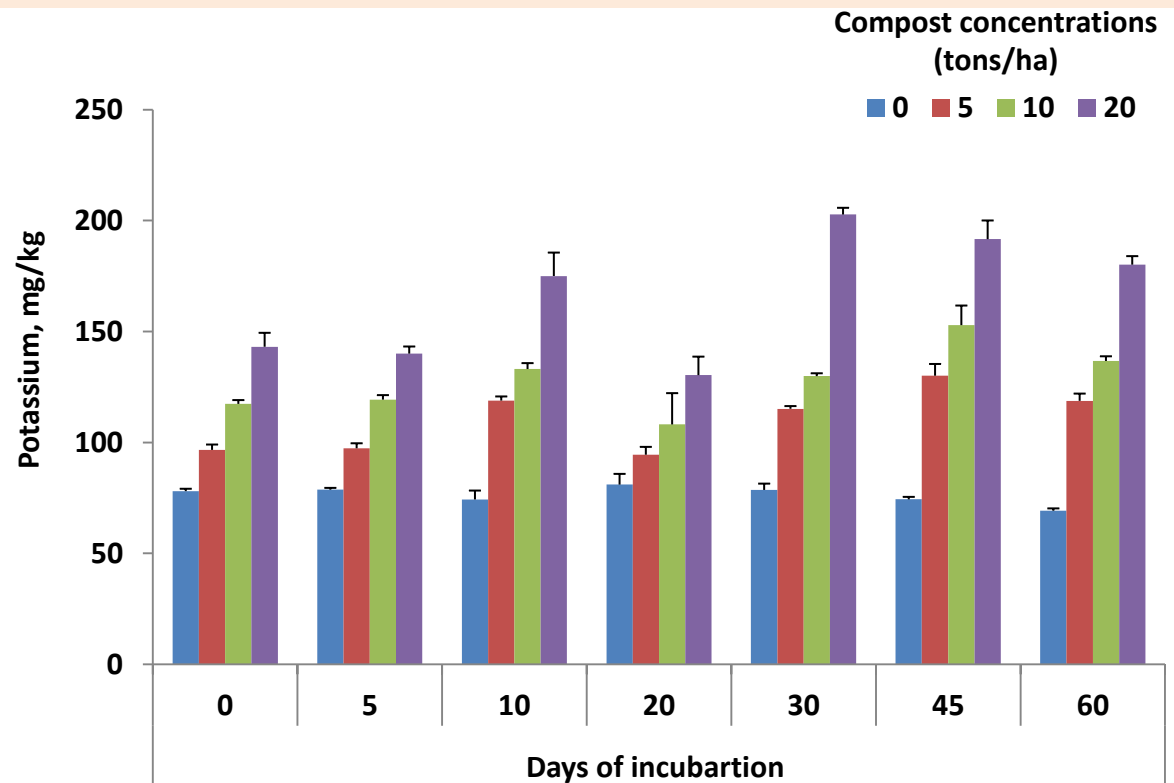


Changes in the concentrations of available P in the soils with the application of different rates of composts over 60 a period of days



Effect of incubation on soil K concentration

- Increased K mineralization is observed with the increase of compost application rate
- Minimum mineralization is observed within first interval and remains consistent within 3 interval and then increased from 4th interval

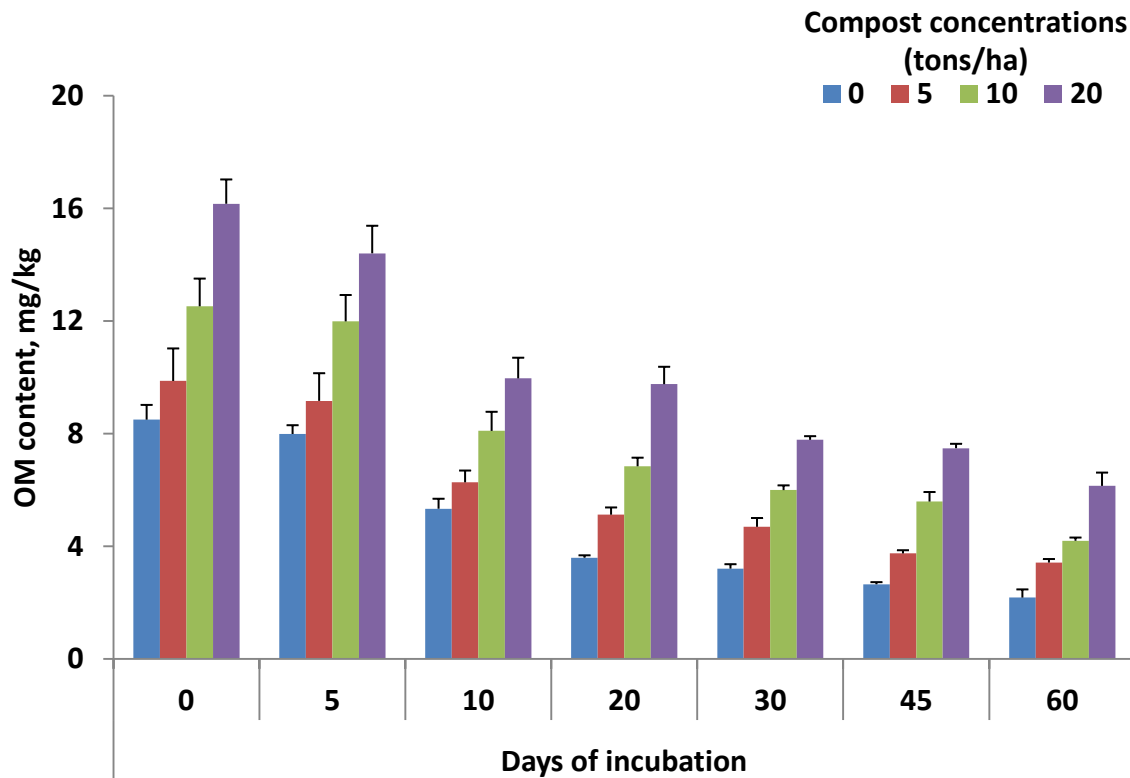


Changes in the concentrations of available K in the soils with the application of different rates of composts over 60 a period of days



The effect of compost concentrations on organic matter content

- Similar trend of weight loss is observed over time
- Relative rate of decomposition increased with the increase of application rate
- Gradual increase of OM decomposition is evident over time

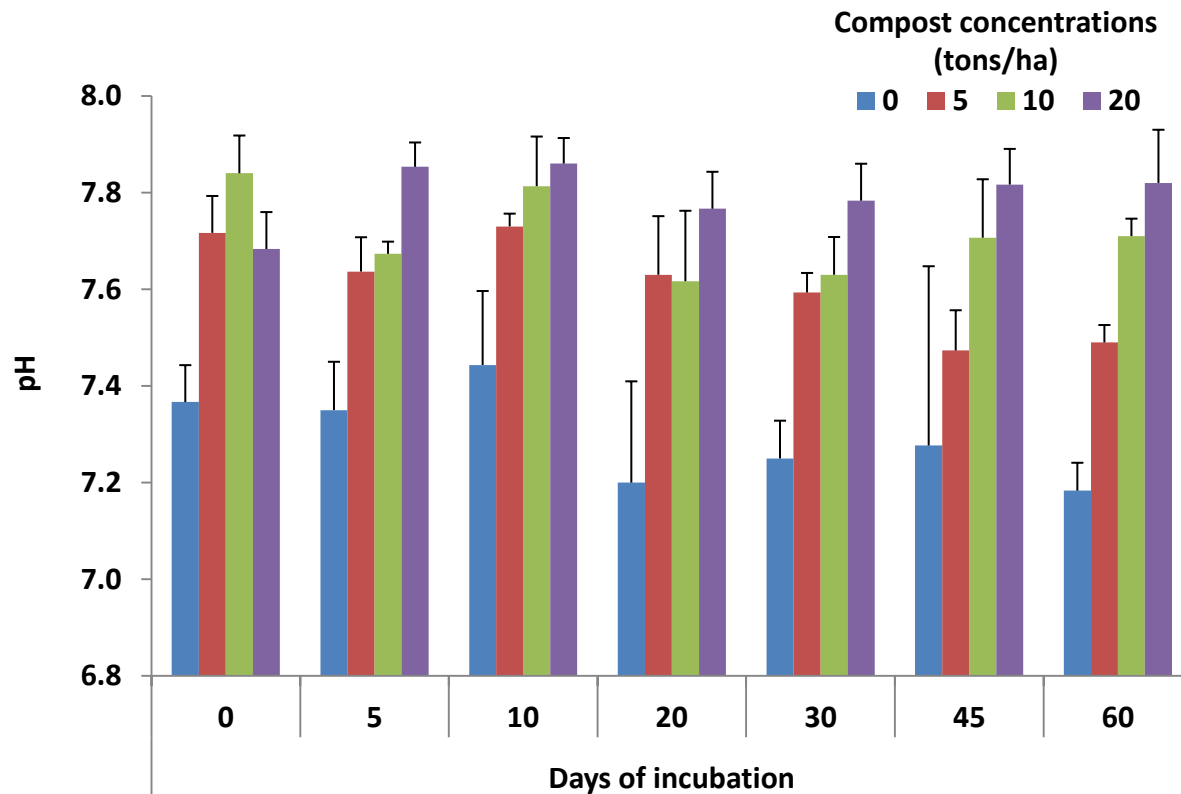


Changes in the concentrations of organic matter in the soils with the application of different rates of composts over a period of 60 days



The effect of compost concentrations on pH

Insignificant increase of pH observed with the increasing application rates of compost on soil pH as compare to control over a period of time



Changes in soils pH with the application of different rates of composts over a period of 60 days



Future Plan

- To establish soil types based recommendations for optimum use of composts
- Introduce new technology (biochar and bio-fertilizer) in UAE
- Use of Biochar as a means to stabilize composts and sequester carbon
- Improve the efficiency of composting process and stabilize composts through the use of appropriate microorganisms

