Drainage Research Institute
National Water Research Center
Ministry of Water Resources and Irrigation

Soil Remediation for Controlling Nutrients Pollution in Water

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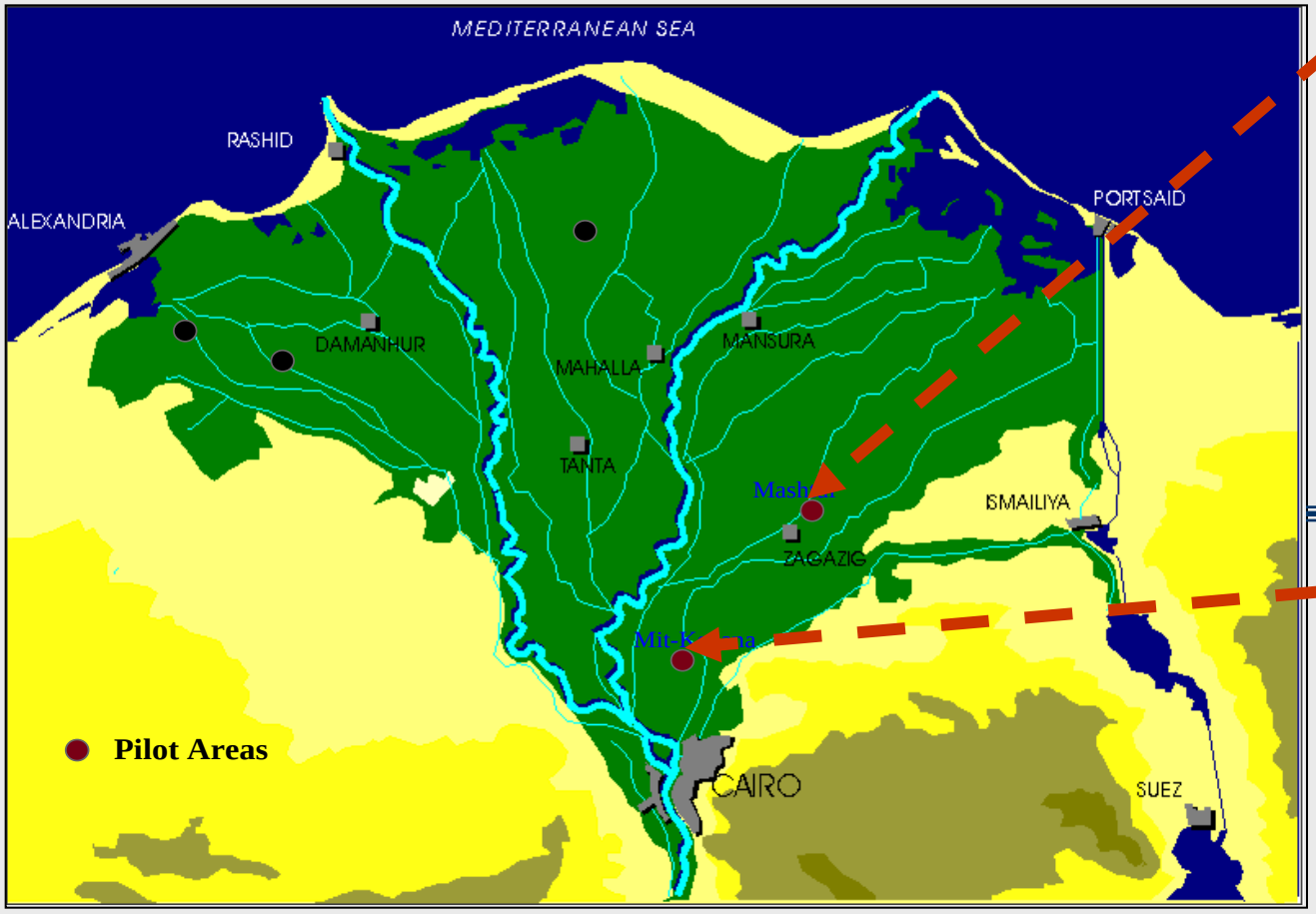
Problem Definition

- Increasing consumption of fertilizers in agriculture
- Leaching of fertilizers into drainage water and causing environmental pollution

Study Objectives

- Assess the efficiency of soil remediation for controlling fertilizers pollution
  - Investigate the extent of soil aquifer remediation taking place in the unsaturated zone of the soil
  - Assess the efficiency of soil remediation for fertilizers pollution during the travel of the natural percolated drainage water from top to soil layer to the interface with groundwater table under a given soil conditions of two different types of soils

Methodology



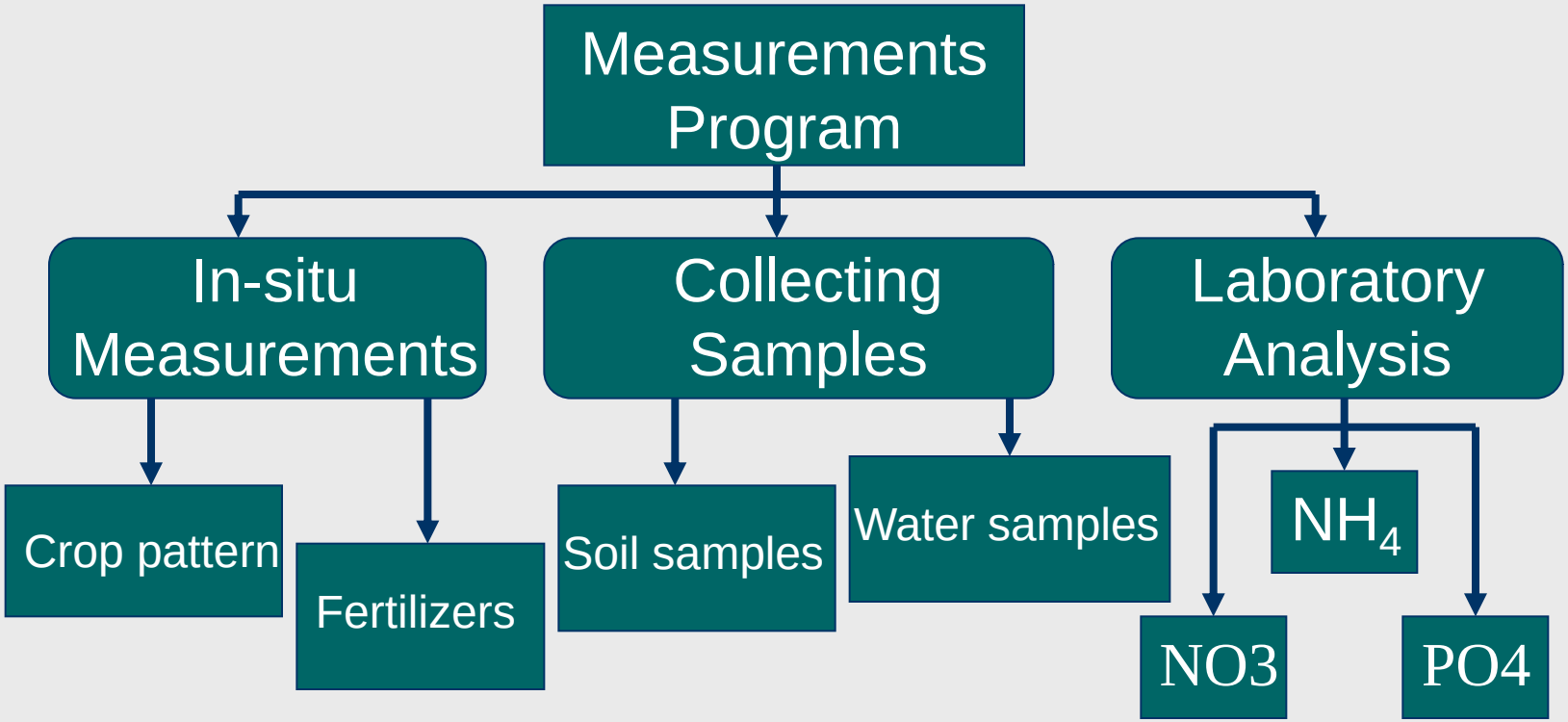
MPA:

- Located in the southeastern part of the Nile Delta
- 260 feddans
- Clayey soil contains about 35 % silt and 65 % clay

Mit-Kenana:

- Located north west of Cairo
- 830 feddans
- Sandy soil

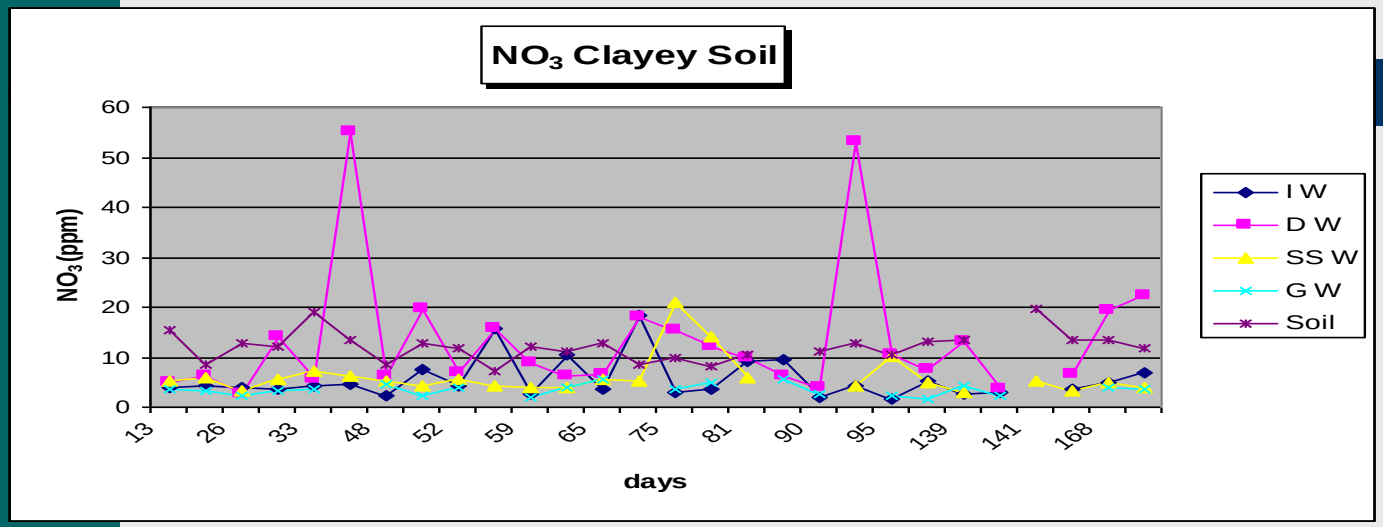
Measurements Program

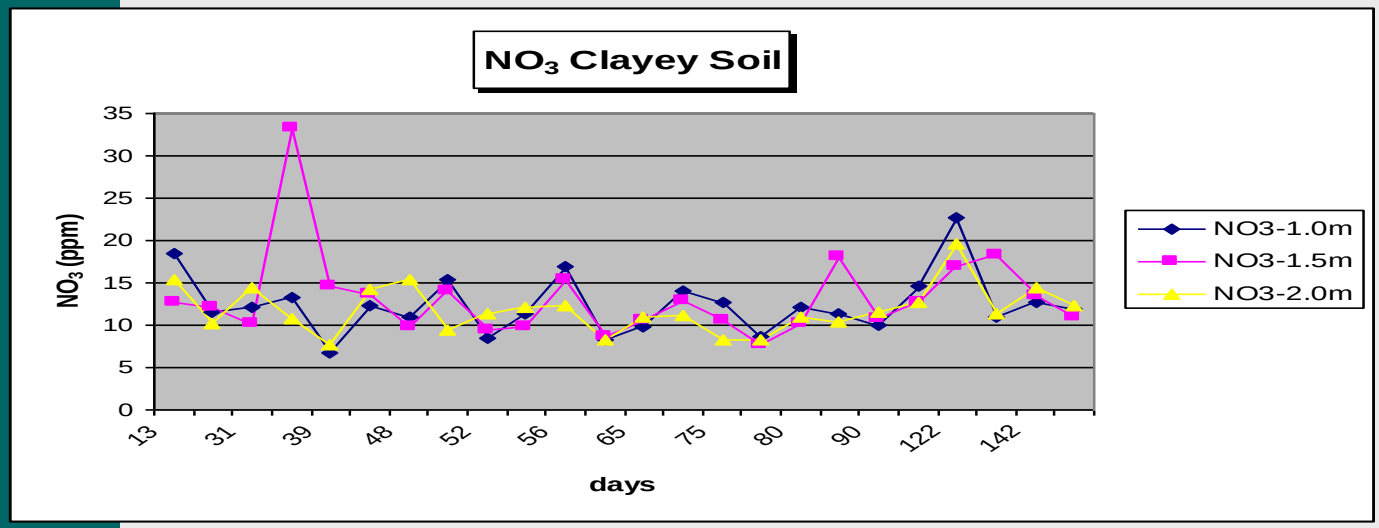


Fertilizers Application

Crop Type	Year	Fertilizers Type		
		Calcium Nitrate	Urea	Ammonium Sulphate
Wheat (33%)	*1992*		150 kg/fed (Dec-Jan)	
	2005-2006		100 kg/fed (Jan-Feb)	100 kg/fed (Dec-Jan)
Berseem (300%)	*1992*	No Fertilization		
	2005-2006		200 kg/fed (Nov-Dec)	100 kg/fed (Oct-Nov)
Rice (100%)	*1992*			150 kg/fed (May- Jul)
	2005-2006		200 kg/fed (Jul-Aug)	100 kg/fed (Jun-Jul)
Maize (100%)	*1992*	150 kg/fed (Jun-Jul)		
	2005-2006		300 kg/fed (Jun-Jul)	

Results & Discussion





SS W:

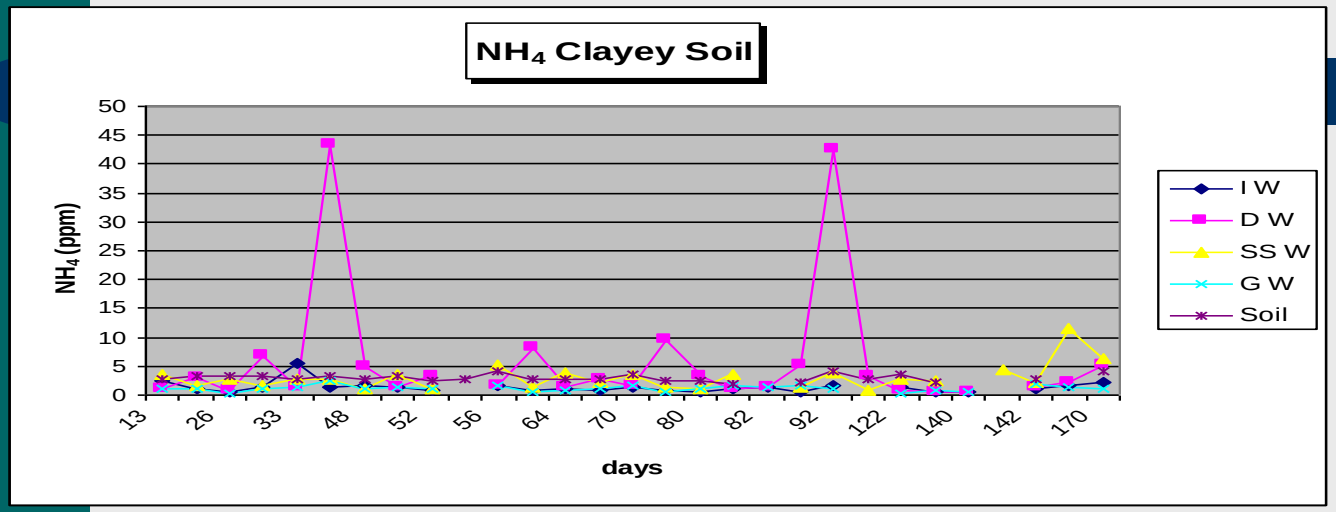
decreased from 13.36 to 6.08 ppm (54%)

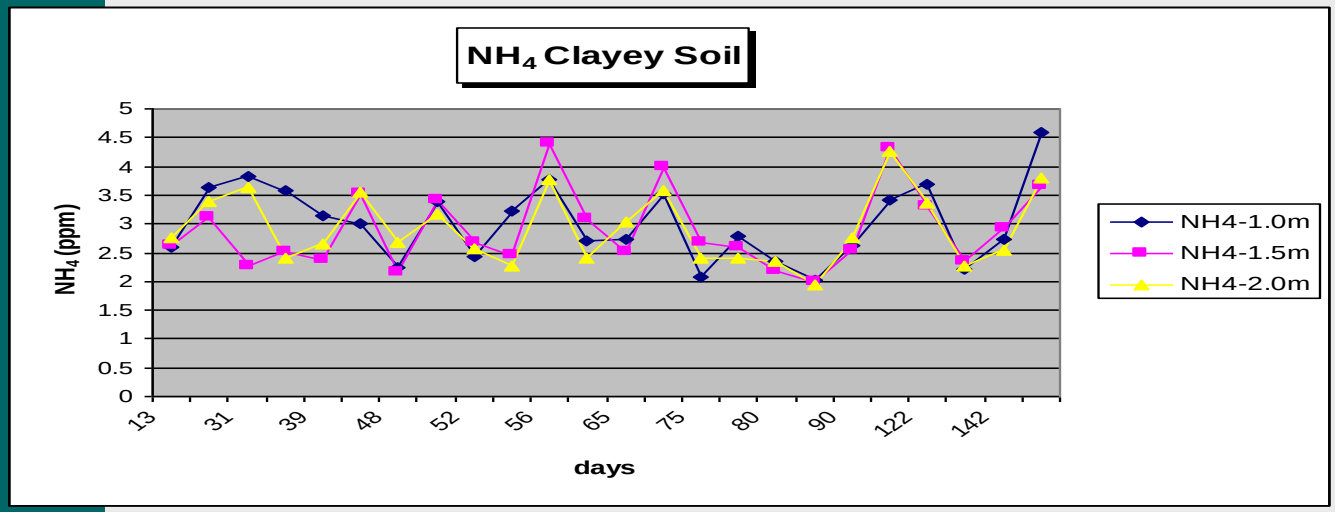
GW:

decreased from 13.36 to 3.48 ppm (74%)

Highest concentration in soil depth of 1.5 m

Results & Discussion





SS W:

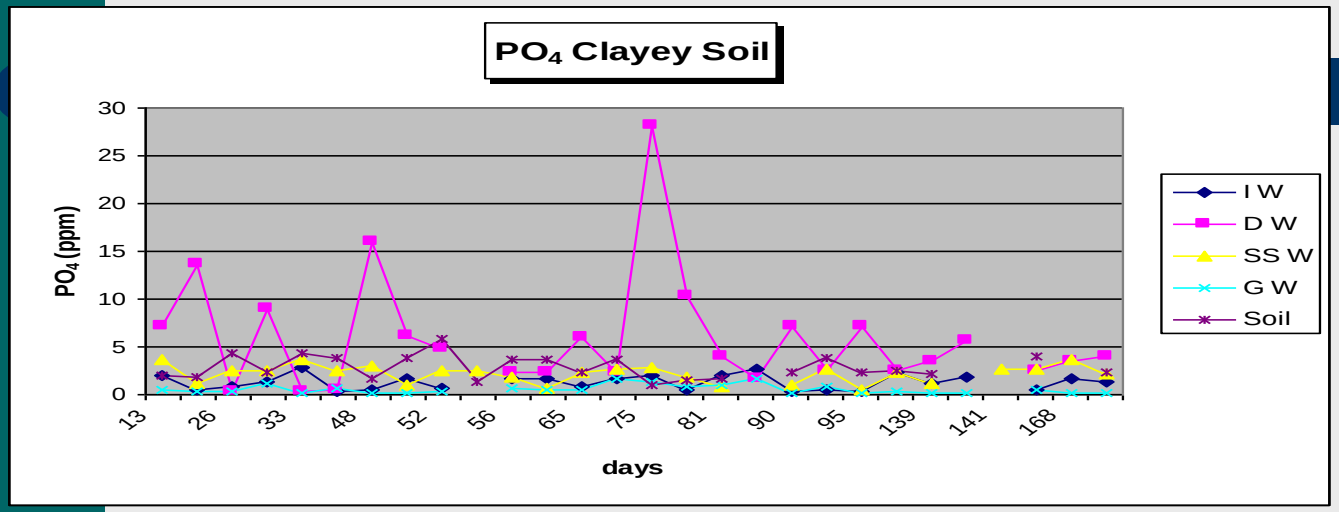
decreased from 5.9 to 3.05 ppm (48%)

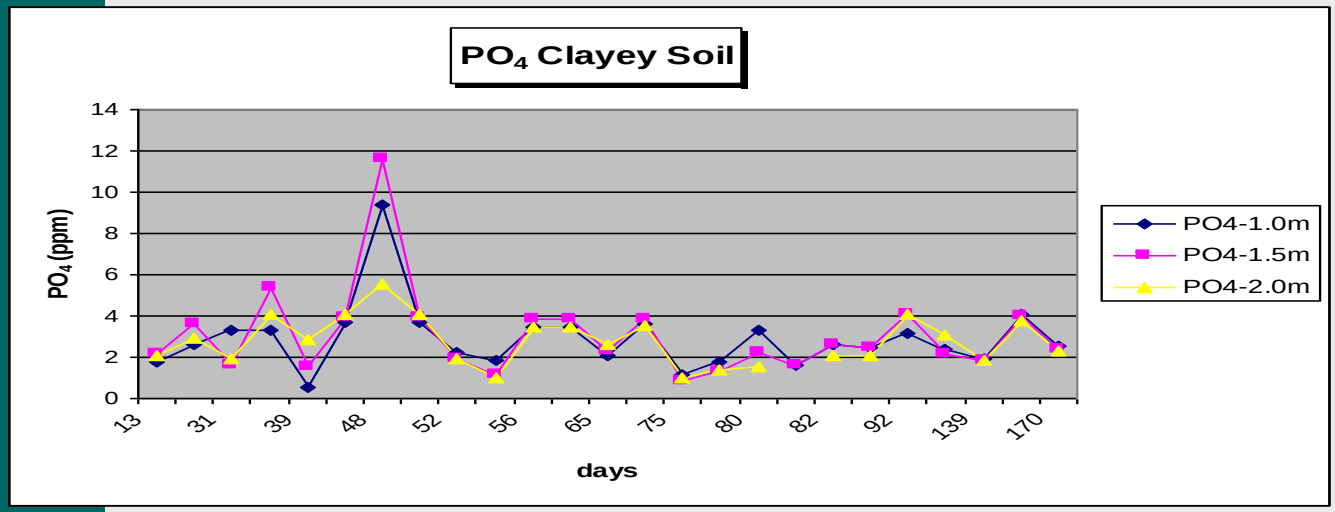
GW:

decreased from 5.9 to 1.19 ppm (80%)

Concentrations in the 3 soil depths are nearly equal

Results & Discussion





SS W:

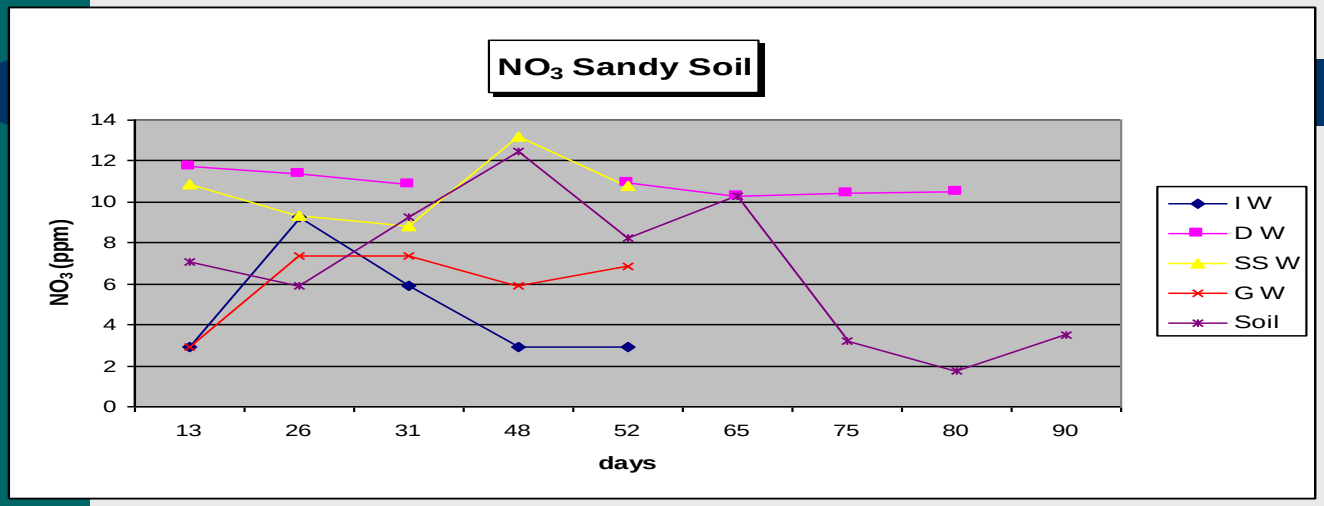
decreased from 5.92 to 2.18 ppm (63%)

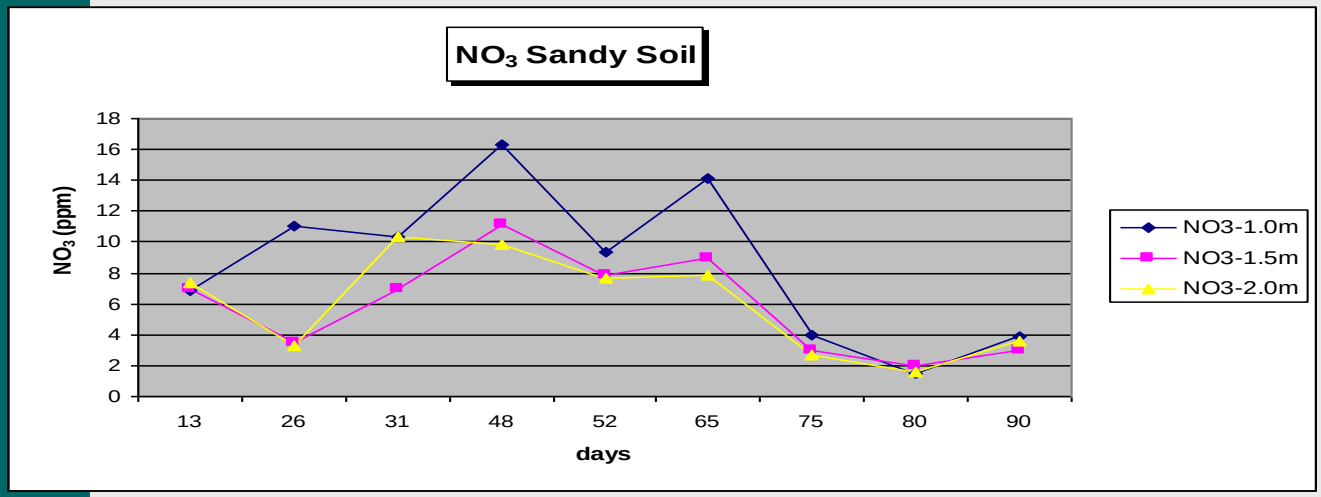
GW:

decreased from 5.92 to 0.57 ppm (90%)

Highest concentration in soil depth of 1.5 m

Results & Discussion





SS W:

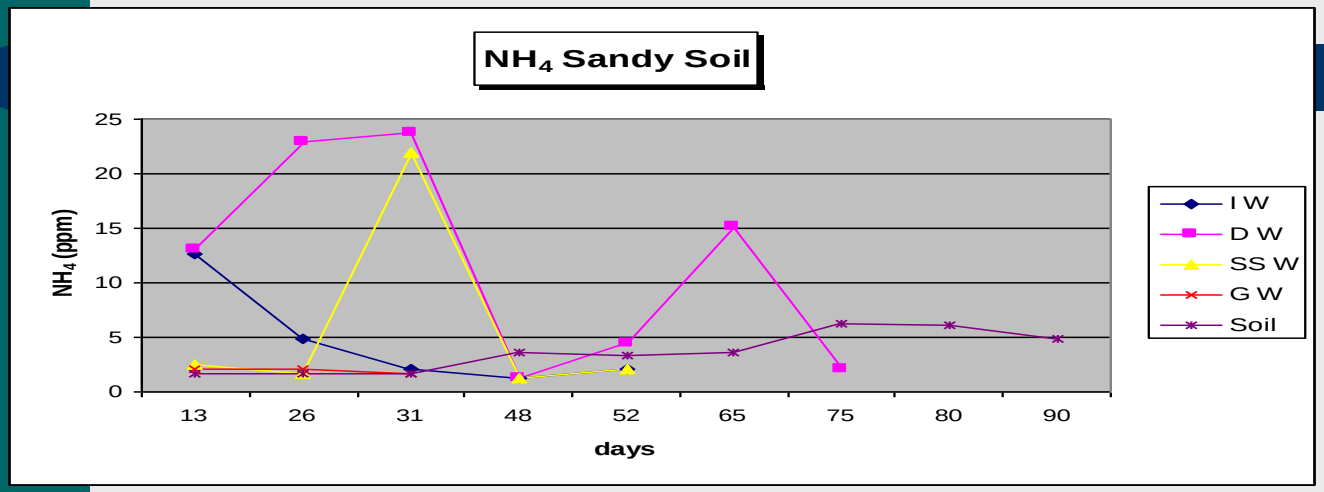
decreased from 10.87 to 10.62 ppm (2%)

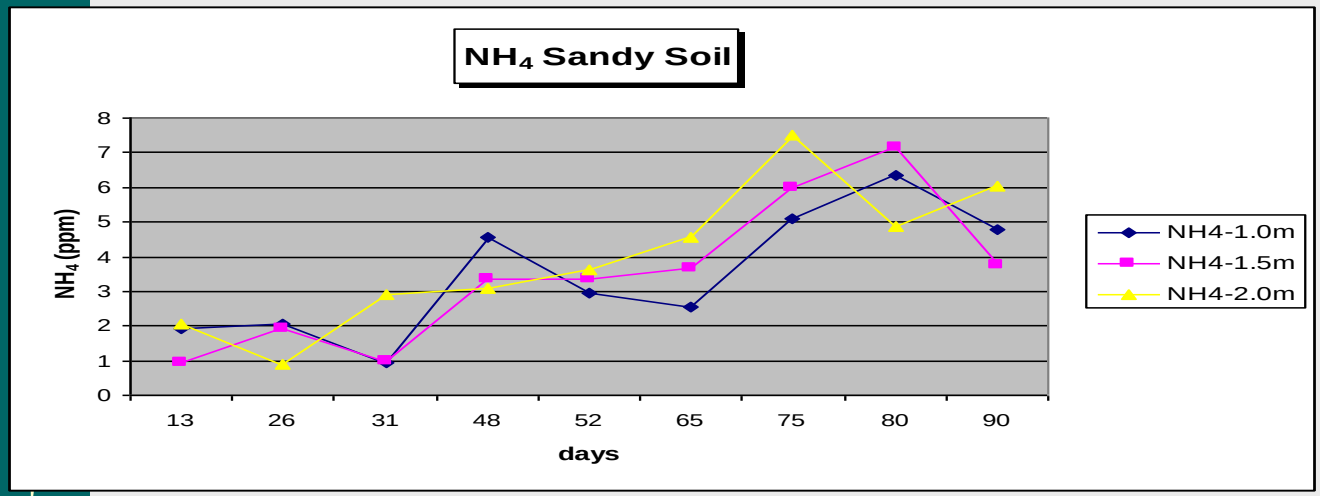
GW:

decreased from 10.87 to 6.08 ppm (44%)

Highest concentration in soil depth of 1.0 m

Results & Discussion





SS W:

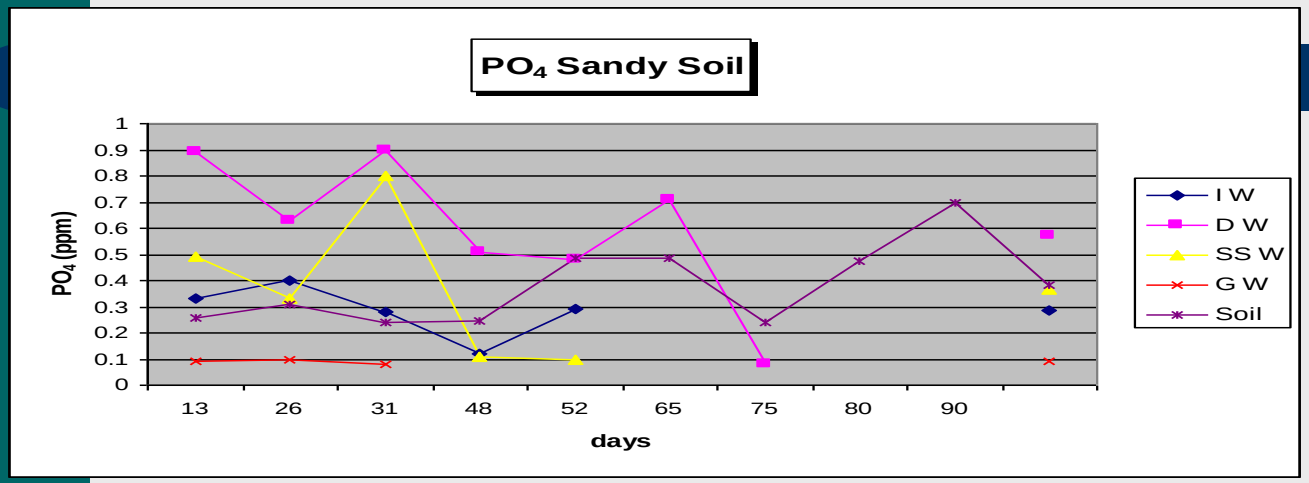
decreased from 11.82 to 6.47 ppm (45%)

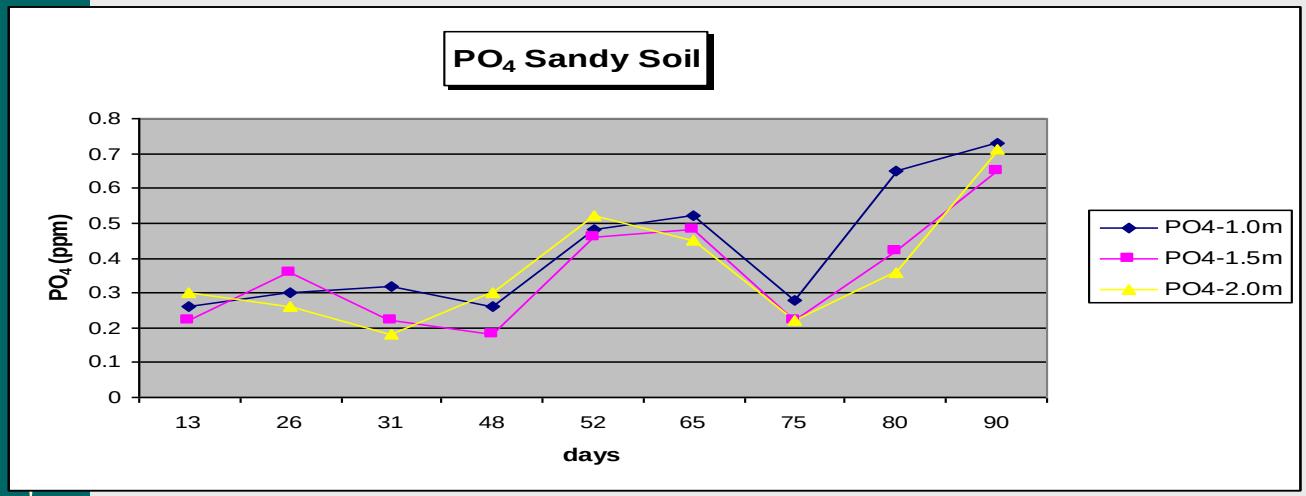
GW:

decreased from 11.82 to 1.91 ppm (84%)

Concentrations in the 3 soil depths are nearly equal

Results & Discussion





SS W:

decreased from 0.57 to 0.37 ppm (35%)

GW:

decreased from 0.57 to 0.09 ppm (84%)

Highest concentration in soil depth of 1.0 m

Conclusions

- In case of clayey soil the removal percentage of nitrate (NO3) by soil remediation is equal to about 54% for subsurface water and 74% for groundwater.
- In case of clayey soil also the removal percentage of Ammonia (NH4) is equal to about 48% for subsurface water and 80% for groundwater.
- In the case of total phosphate (PO4) the removal percentage is equal to about 63% for subsurface water and 90% for groundwater.
- For sandy soil it was found that the removal percentage of nitrate (NO3) by soil remediation is equal to about 2% for subsurface water and 60% for groundwater.

Conclusions

- It also could be concluded that the removal percentage of Ammonia (NH4) by soil remediation is equal to about 45% for subsurface water and 84% for groundwater.
- It was also found that for the total phosphate (PO4) the removal percentage by soil remediation is equal to about 35% for subsurface water and 84% for groundwater.
- Generally it could be concluded that the soil remediation for fertilizers pollution in clayey soil is more effective than sandy soil.
- It is undoubted that the adoption and utilization of soil remediation for the natural percolated drainage water before recharge to groundwater is a worth considering alternative due to its efficacy in reducing the fertilizers pollutants.

Conclusions

- The drainage water is renovated as it percolates through the soil prior to entering groundwater.
- The soil remediation mechanisms include a series of physical, biological and chemical processes within the soil profile.
- The main evaluating for soil remediation relies on natural processes to polish drainage water. This depends on the unsaturated zone soil composition.

Thank You

For Your

Kindly

Attention