

## Introduction

- Soil surface characteristics influence to a great extent water infiltration and redistribution characteristics.
- Tillage is one of the farmer's practices that influence soil surface and properties.
- Research reports are yet to agree on the advantages of different tillage system.
- Responses of infiltration and root growth due to tillage depend on soil type, climate and management practice
- Research efforts at identifying an appropriate tillage system along side management practice that reduce soil surface disruption to improve crop productivity are of paramount importance.

The objectives of this study were to determine the effect of tillage and poultry manure application on infiltration rate and maize root development

## Methods

### Location:

FUNAAB Abeokuta, Nigeria Latitude 7°14' N and Longitude 3°26' E, in 2008 and 2009

### Experimental Design:

Split-plot factorial design with three replications

- **Main plot:** Tillage systems (zero, minimum and conventional tillage)
- **Sub-plot:** Poultry manure (0, 10 and 20 Mg ha<sup>-1</sup>)
- **Statistical analysis:** Data collected were analysed using analysis of variance (ANOVA) MIXED MODEL procedure in Statistical Analysis System (SAS, 1999). Significant means were separated using LSD at 5% level of probability.

The poultry manure (PM) was incorporated into the soil 2 weeks before planting under minimum tillage (MT) and conventional tillage (CT) and spread evenly on the surface under zero tillage (ZT) to minimize soil surface disturbance.

**Content of the PM:** The PM used contained 264 g kg<sup>-1</sup> organic carbon, 21.4 g kg<sup>-1</sup> total nitrogen, 40.2 g kg<sup>-1</sup> total phosphorus, 1.2 g kg<sup>-1</sup> total potassium and 27.2 g kg<sup>-1</sup> calcium.

### Maize planting and root mass determination:

Maize (DMR-ESR-Y) planted at 50 cm x 75 cm at 2 seeds per hole. Root mass was determined at 4, 8 and 12 WAP using excavation method (Böhm, 1979)

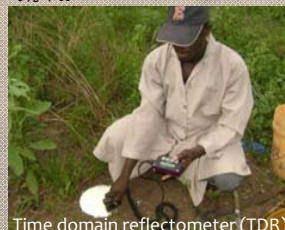
### Measurement of infiltration characteristics

Near-saturation water intake was measured in each plot using a disc permeameter with the procedure described by CSIRO (1988)

The water head applied was -2 cm. Volumetric soil water content was determined at the beginning and end of each infiltration run using (TRD).

The cumulative infiltration, steady state flow and hydraulic conductivity were determined following the equations and CSIRO (1988) manual and Infiltration rate (IR) was calculated using Philips' equation (Philips, 1957):

$$IR = \frac{1}{2}S \cdot t^{-\frac{1}{2}} + A$$



## Results

Table 1: Effect of tillage on field unsaturated water flow at the end of each of the two years of the study

Year	Tillage	CI (cm)	Sorptivity (cm hr <sup>-1/2</sup> )	SSF (cm hr <sup>-1</sup> )	K <sub>s</sub> (cm hr <sup>-1</sup> )	IR (cm hr <sup>-1</sup> )
2008	CT	3.32	3.55	9.17	8.50	9.53
	MT	3.93	3.79	10.98	10.25	11.34
	ZT	2.87	3.13	8.11	7.59	8.50
	LSD (P<0.05)	0.36	0.22	1.23	1.18	1.23
2009	CT	2.15	2.41	6.40	6.09	7.12
	MT	2.30	2.46	7.02	6.69	7.79
	ZT	2.15	2.45	6.79	6.46	7.35
	LSD (P<0.05)	ns	ns	ns	ns	ns

Table 2: Effect of poultry manure on field unsaturated water flow at the end of each of the two years of the study

Year	PM rate (Mg ha <sup>-1</sup> )	CI (cm)	Sorptivity (cm hr <sup>-1/2</sup> )	SSF (cm hr <sup>-1</sup> )	K <sub>s</sub> (cm hr <sup>-1</sup> )	IR (cm hr <sup>-1</sup> )
2008	0	3.19	3.54	8.26	7.52	8.55
	10	3.55	3.65	9.56	8.89	9.94
	20	3.38	3.27	10.45	9.93	10.87
	LSD (P<0.05)	0.36	0.22	1.23	1.18	1.23
2009	0	2.73	2.86	8.20	7.77	8.79
	10	2.08	2.36	6.53	6.23	7.29
	20	1.79	2.10	5.48	5.23	6.19
	LSD (P<0.05)	0.36	0.20	1.12	1.08	1.10

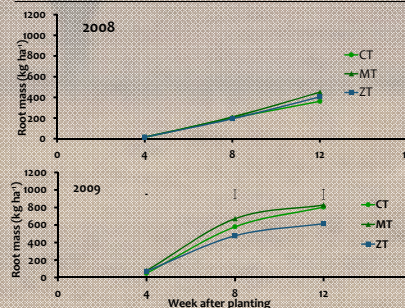


Figure 1: Effect of tillage on root mass during the 2008 and 2009 cropping

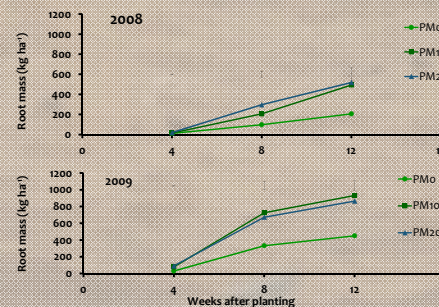


Figure 2: Effect of poultry manure on root mass during the 2008 and 2009 cropping

## Conclusion

- Immediately after tillage, infiltration was higher under conventional tillage operation but declined over time due to soil surface disruption under raindrop impact leading to pore sealing and slaking.
- Application of poultry manure, especially at 20 Mg ha<sup>-1</sup>, could serve as an amendment to reducing rapid percolation of water in a gravelly sandy soil and hence minimise nutrient leaching.
- Though, mechanical impedance under zero tillage may reduce maize root growth compared to conventional tillage; minimum tillage alongside application of poultry manure had the best effect on maize root development.

## Recommendation

- Application of 20 Mg ha<sup>-1</sup> poultry manure is recommended in soils dominated by gravelly sandy texture.
- Conservation practices such as minimum tillage should be adopted to maintain and sustain soil productivity.

## References

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## Affiliation

Department of Soil Science and Land Management  
Federal University of Agriculture, Abeokuta, Nigeria

