

**ASSESSMENT OF SOIL HEALTH USING NEMATODE
ASSEMBLAGE AND SOIL CHARACTERISTICS IN
ARENOSOLS, CAMBISOLS AND VERTISOLS IN KENYA**

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Introduction & Justification

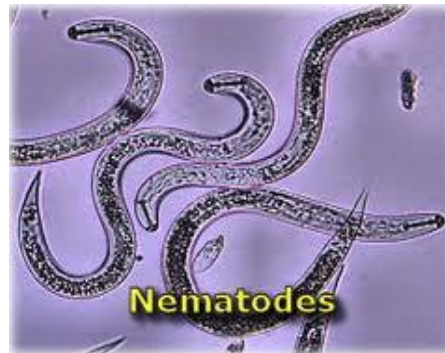
Dwindling Cropland due to soil degradation in Kenya necessitate the **Need to optimize on under-utilized available croplands in Kenya (Diversification)**

Farming Practices



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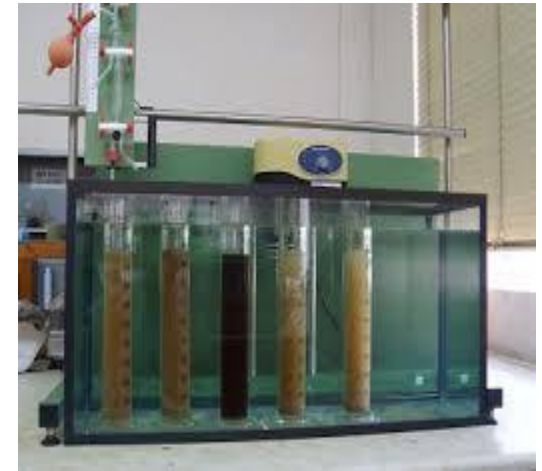
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Nematodes
Bioindicators

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Soil Properties



Objectives

General Objective:

To assess soil health by using nematodes as a bio-indicator in **Vertisols** , **Arenosols** and **Cambisols** soil groups of Kenya.

Specific Objectives:

1. To determine how different **seasons, soil groups, sites, and disturbance levels influence nematode assemblage.**
2. To determine how different seasons, soil groups, sites, and disturbance levels influence **relationship of nematode assemblage and soil chemical properties.**
3. To determine **land use and socio-economic practices influencing soil health** in the soil groups.

Methodology

Nematode Data :

▶ Microscopic morphological Genus Level ID at $\times 400$

- Sample size - 192 soil samples per season each 200cm^3
- Seasons – 3 (*Cold dry, Warm rainy, Hot dry*)
- Soil Groups – 3 {*Vertisols(32), Cambisols(32), Arenosols(32)*}
- Sites – 2: North (*Murang'a*) and South (*Machakos & Makueni*)
- Disturbance Levels – 2 (*Natural and Tilled soils*)

▶ Abundance and Frequency of Nematodes- OV, Pr, BV, FV, HV

▶ Diversity Indices (*Shannon, Genus Richness & Evenness*)

▶ Soil Food web – **Maturity indices:** *MI, PPI, FI, $\Sigma MI, MI\Sigma 2-5$*

▶ Ecological Disturbance- **Functional Indices:** *EI, BI, SI*

Soil Properties:

- Sample size - 192 soil cores each 200cm^3
- pH- H_2O - pH meter.
- C - Walkley and Black (1934)
- Total N - Micro-Kjeldhal
- Ca & Mg - Atomic Adsorption Spectroscopy (AAS)
- Na & K - flame photometry
- Texture (**Temperature, Sand%, Silt%, Clay%**) – Hydrometer method

Socio Economic Survey :

- Sample size- 150 Farms {*North (75), South (75)*}
- Determining- Land Use Practices **and** Socio-economic **Information**

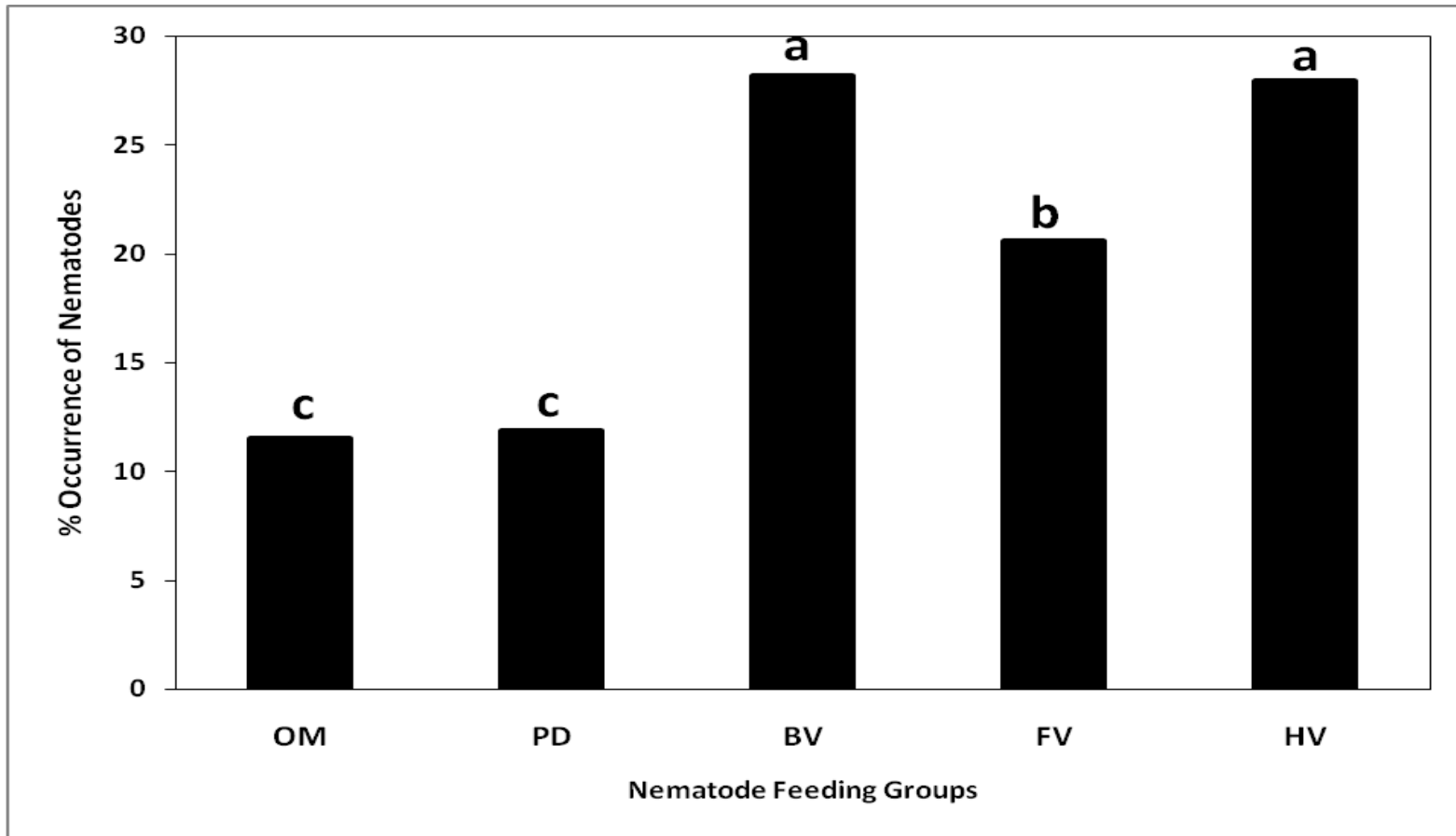
Data Analysis

- Data was subjected to Analysis of Variance (ANOVA) using:
 - SAS (ver. 9)
 - Canoco (Ver. 4)
 - SPSS (ver. 20)
 - Ms. Excel (2007)
- Significant ($P \leq 0.05$) differences between the Seasons, soil Groups, Sites and disturbance levels were separated using Tukey Kramer Test.

Nematode Abundances

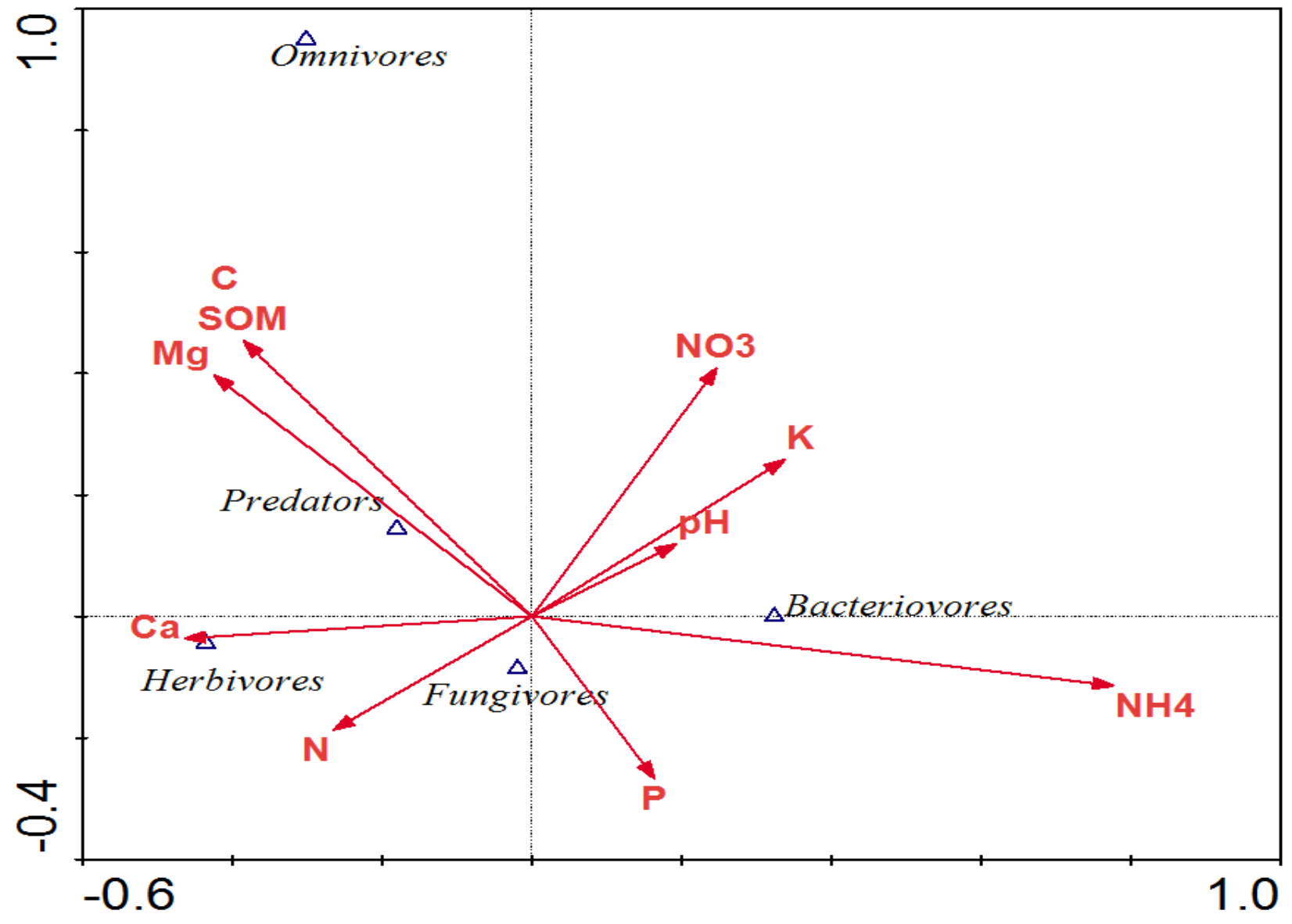
Variables		P Value	Mean/200cm ³
Seasons (n=192)	Season 1	< 0.0001	68.38 ^b
	Season 2		93.01 ^a
	Season 3		51.61 ^c
Sites (n=288)	North	< 0.0001	88.23 ^a
	South		53.77 ^b
Soil Groups (n=192)	Vertisols	0.003	65.75 ^b
	Cambisols		82.07 ^a
	Arenosols		65.17 ^b
Disturbance Levels (n=144)	Natural	< 0.0001	97.74 ^a
	Tilled		62.08 ^b

Frequencies of occurrence of Nematode Feeding Groups



OV: Omnivores **PD: Predators** **BV: Bacterivores** **FV: Fungivores** **HV: Herbivores**

Relationship Between Nematodes and Soil Chemical Properties



Nematode Ecological Disturbance Indices

		PPI	MI	MI2-5	ΣMI	ΣMI2-5	FI
Soil Groups	Cambisol	2.6	2.0	2.1	2.3	2.4	1.3^a
	Vertisol	2.5	2.0	2.1	2.3	2.4	1.2^b
	Arenosol	2.5	2.1	2.2	2.0	2.3	1.2^b
Seasons	Season 1	2.5	1.9^b	2.1^b	2.2^b	2.3^b	1.3
	Season 2	2.6	2.1^a	2.2^a	2.3^a	2.4^a	1.3
	Season 3	2.5	2.0^{ab}	2.1^{ab}	2.3^a	2.4^{ab}	1.2
Site	North	2.6	2.0	2.2^a	2.2	2.4	1.3
	South	2.5	2.0	2.1^b	2.3	2.3	1.3
Disturbance Levels	Natural	2.6	2.2^a	2.4^a	2.4^a	2.5^a	1.2^b
	Disturbed	2.5	1.9^b	2.1^b	2.2^b	2.4^b	1.3^a

PPI= Plant Parasitic Index MI = Maturity Index FI = Fertility Index

Nematode Food Web Indices and Nutrient Cycling

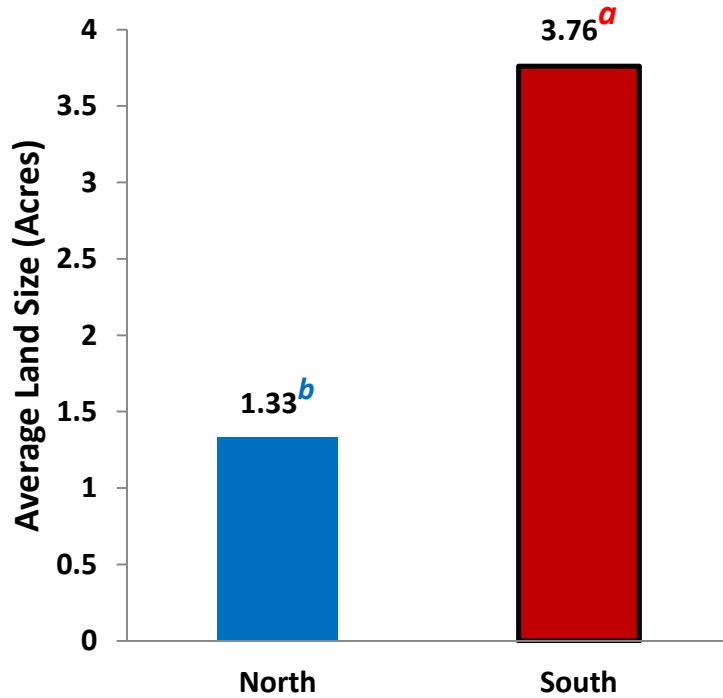
		BI	EI	SI
Soil Groups	Vertisols	54.81	33.24^a	23.51
	Cambisols	55.90	33.78^a	21.25
	Arenosols	58.18	27.50^b	22.66
Seasons	Season 1	57.29^a	34.43^a	14.80^c
	Season 2	49.49^b	34.97^a	30.96^a
	Season 3	62.19^a	25.0^b	21.71^b
Sites	North	46.57^b	41.62^a	26.68^a
	South	66.29^a	21.06^b	18.16^b
Disturbance Level	Natural	46.36^b	30.29	39.63^a
	Disturbed	59.74^a	31.91	16.54^b

BI – Basal Index

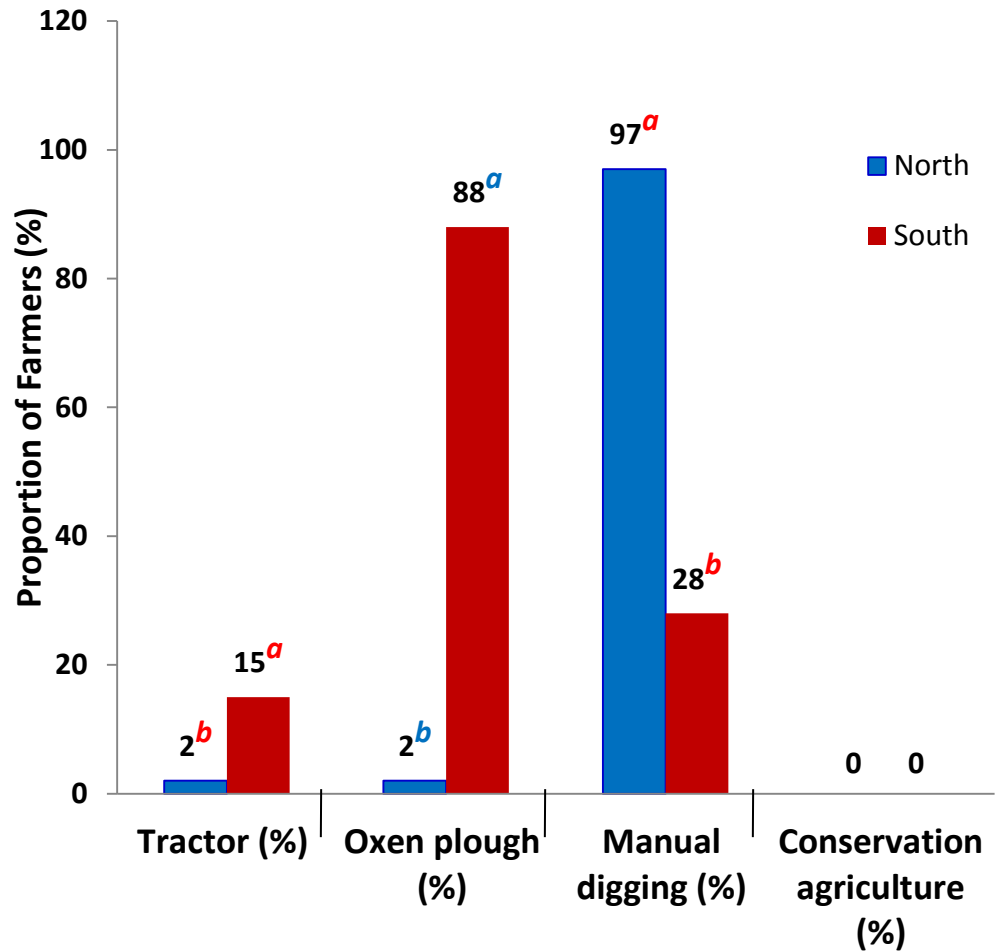
EI – Enrichment Index

SI – Structure Index

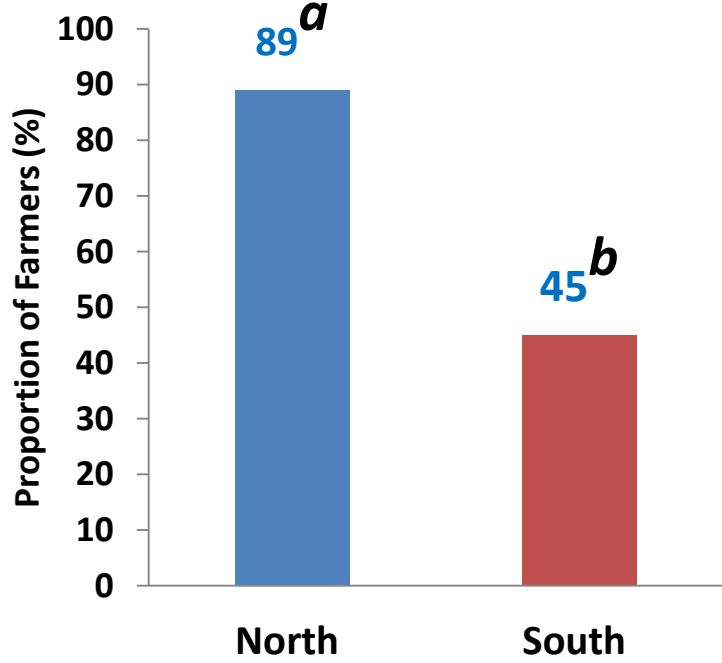
LAND SIZES



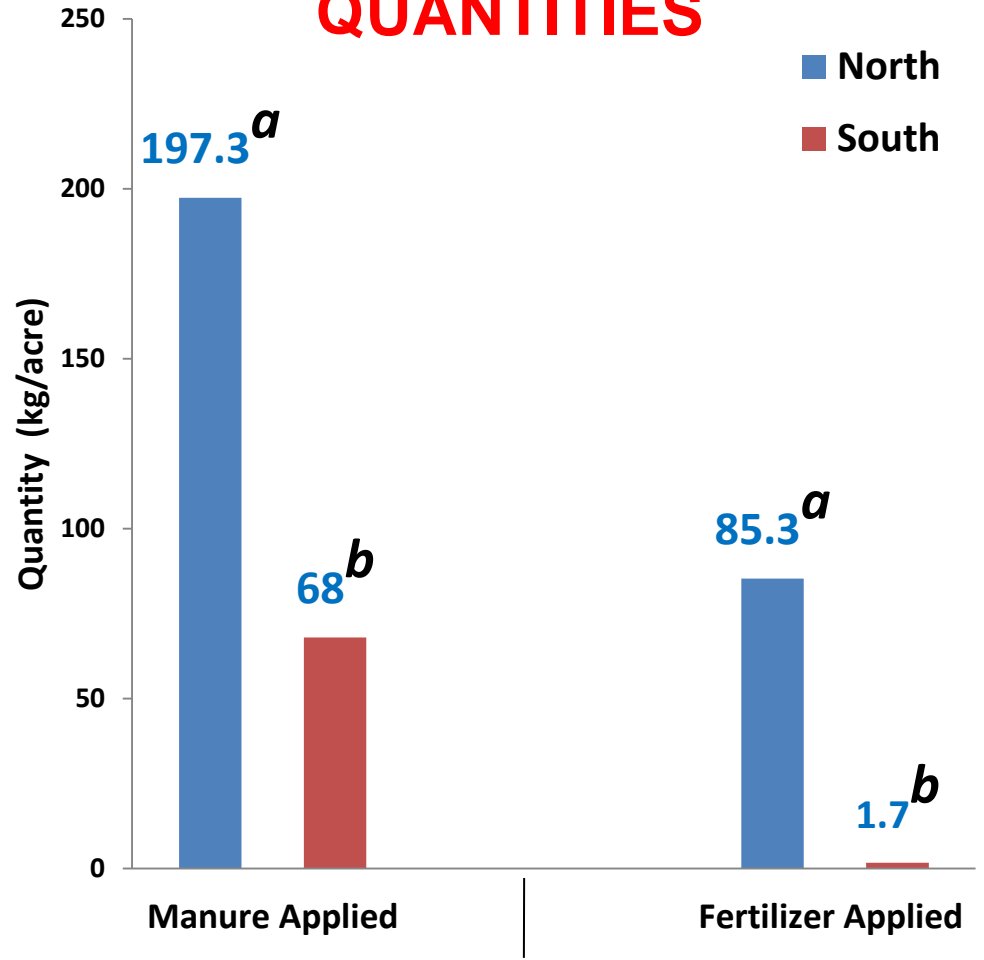
TILLAGE METHODS



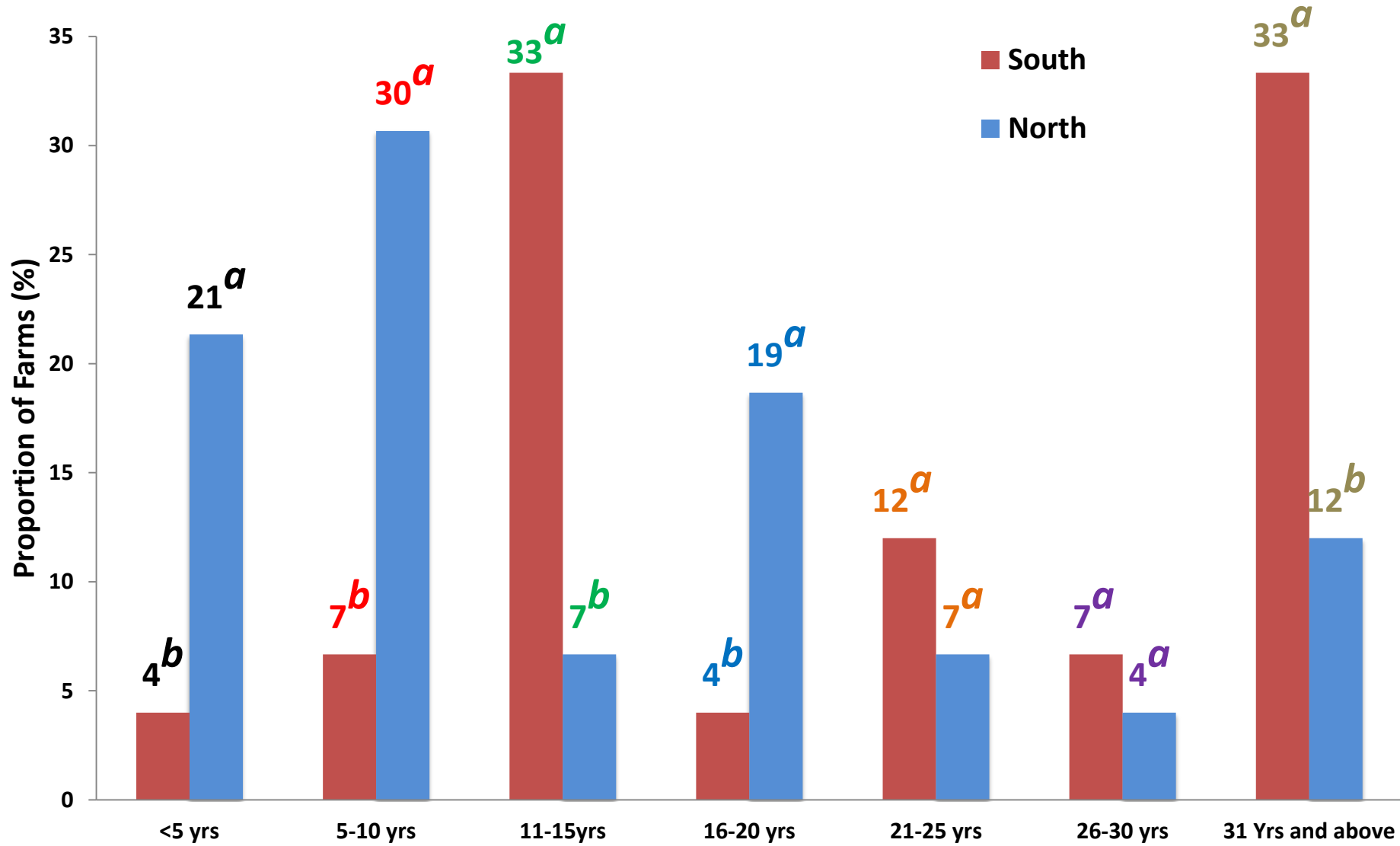
AMENDMENT APPLICATION



AMENDMENT QUANTITIES



Duration of Crop Cultivation



Conclusions....

- **Nematodes Assemblage and Diversity** affected by changes in:
 - Seasons – **S1 to S2 to S3**
 - Soil Groups – **SOM, N, Ca, NH₄⁺, NO₃, pH**
 - Sites – **North** better than **South**
 - Disturbance Levels – **Natural soils doing better**
- There exists relationships btw **Nematode Communities & Soil Properties**
- Land use Practices by man do influence **Soil Health**:
 - Tillage methods
 - Ammendment application
 - Duration of Crop cultivation
 - Intercropping and Crop rotations

Nematodes can be applied as Bio-indicators of Soil health!!!

Acknowledgements

- **God**
- **Committee of supervisors**
- **Crop Protection n LARMAT depts.**
- **Lecturers and colleagues**
- **Sampling and Extraction team**

**You made the journey
exciting!!!!**

Thank You