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Enhancing Phytosanitary Systems for Healthy Plants, Safe & Sustainable Trade"

INTERNATIONAL YEAR OF PLANT HEALTH 2020

Sub-theme: **Pest Surveillance in Phytosanitary Systems**

Farming practices and soil properties that influence spread and population density of potato cyst nematodes in smallholder farms in Nyandarua County

Presented by:

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Introduction

- Potato (*Solanum tuberosum* L.) is an important staple food crop in Kenya
- The area under potato in Kenya is about 212 976 ha with a production of 2 million tonnes
- However, its productivity has been declining due to several factors including biotic and abiotic factors

Introduction cont'd

- Potato cyst nematodes (PCN) are plant parasitic nematodes

- It was first reported in Kenya in 2015 by *Mwangi et al.,* and is classified as a quarantine pest

Problem Statement

- PCN poses a significant threat to potato production:
  - Since its cause severe economic damage to potato
  - Causes yield reduction of up to 100% in heavily infested soils
  - Seed potatoes infected by PCN are rejected
  - Seed potato farms infected by PCN are usually condemned

Justification

- PCN is wide spread and is in high density in potato farms in Nyandarua
- Information on factors PCN spread and build-up is scanty
- Necessitate a study to investigate on site specific factors contributing to the rapid spread and build-up of PCN

Environment

- Soil physic-chemical characteristics
- Temperature
- Rainfall
- Altitude

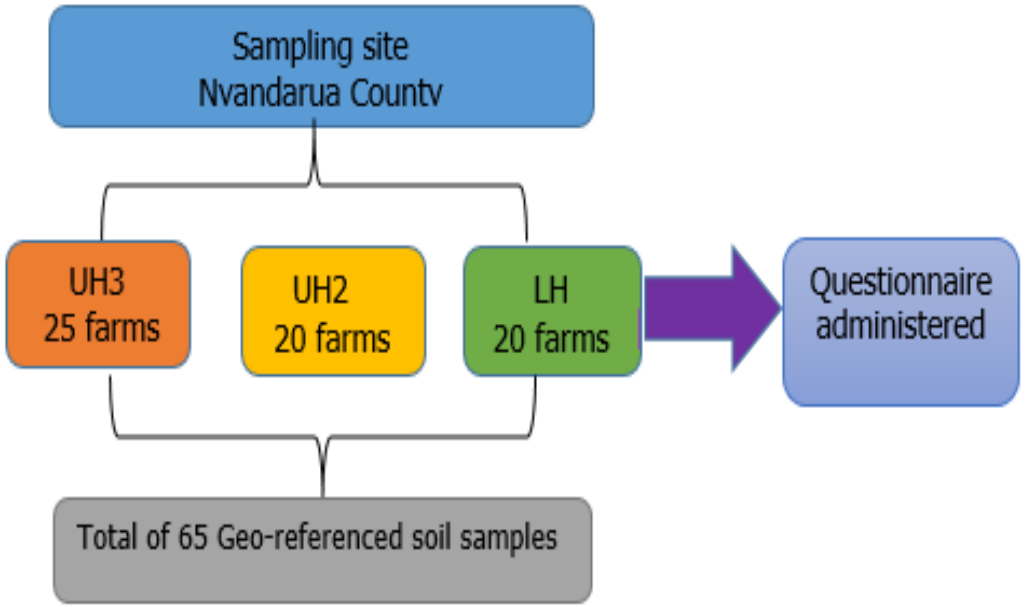
Farming practices

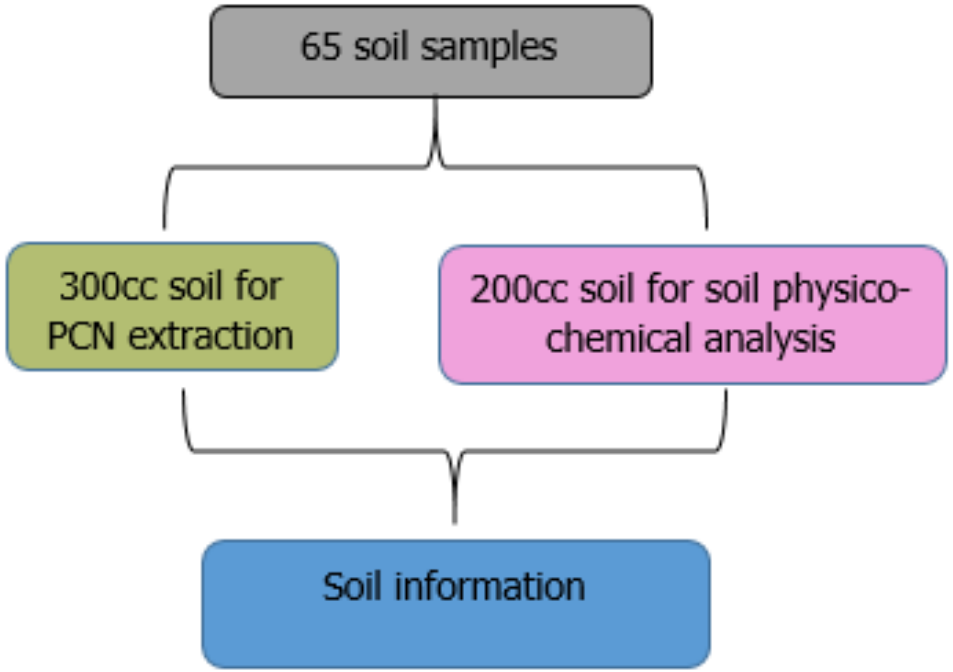
- Susceptibility
- Cropping pattern
- Diseases
- Rotation
- Seed source
- Source of spread

Objective

To identify the site specific factors that could be contributing to the spread and population build-up of the PCN in smallholder farms of Nyandarua County

Methodology





Data collection and analysis

Data collected

PCN data

Cyst count

Soil properties

- **Physico-properties (Loam, silt, clay)**

Survey

- **farming practices information**

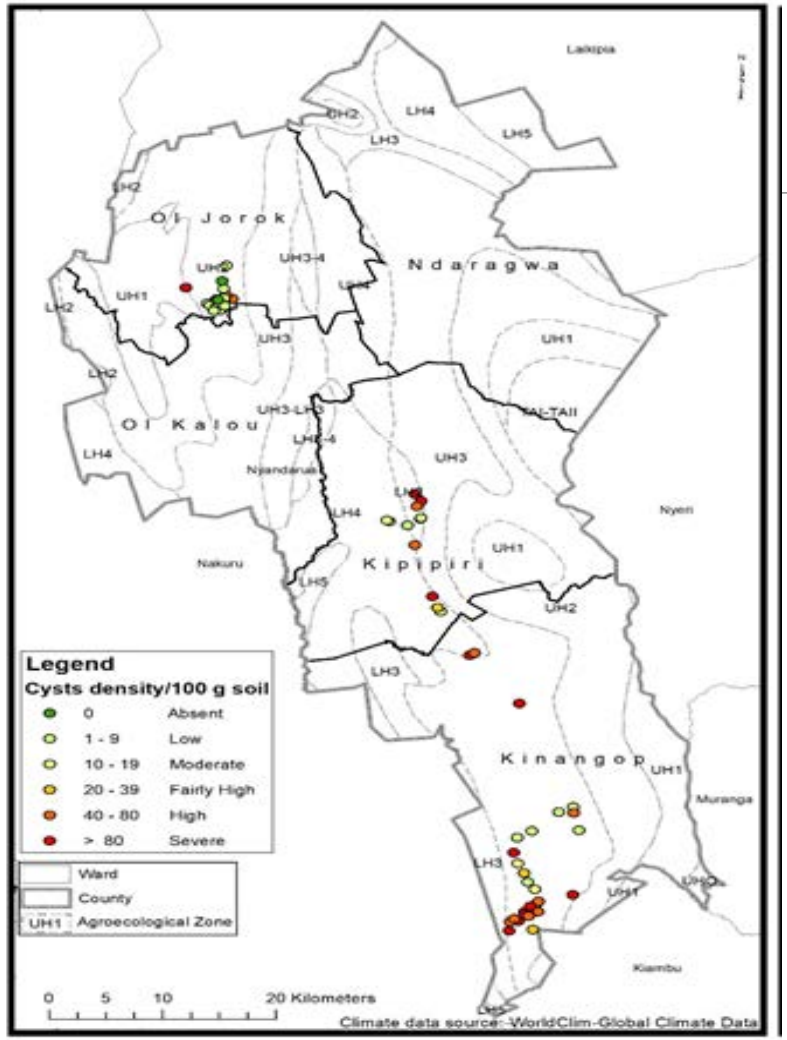
Data analysis

Data was subjected to analysis of variance using SPSS and comparison among the soil properties and PCN count

Frequency of occurrence of PCN

Geo referenced sites and PCN density and its % occurence

- **Absent**-(0 no cyst) - 3.5 %
- **Low-**(1-9 cysts) – 40%
- **Moderate** - (10-19 cysts)- 6.2%
- **Fairly**- (20-39 cysts)- 4.2%
- **Fairly high-** (40-80)- 21.5%
- **Severe**- (0ver 80 cysts)- 24.6%



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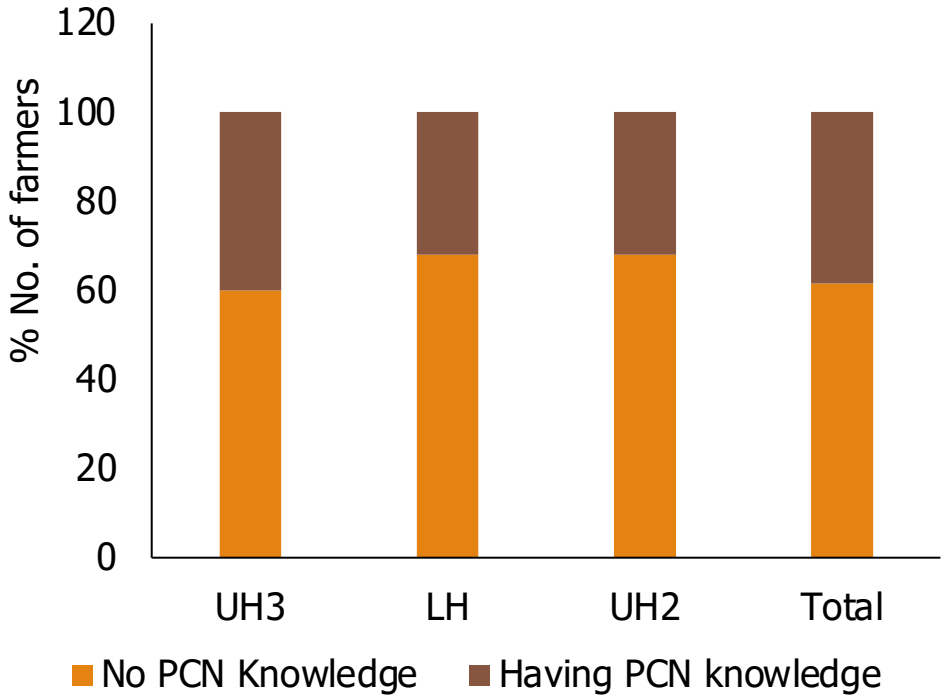
Farmer's knowledge on PCN

A total of 40 (61.5%) farmers out of 65 were not aware of PCN as a potential threat to potato production



Relationship between PCN densities with temperature, rainfall level and altitude

- A negative relationship between the ambient temperature and PCN population density was observed
- There was an increase in the number of cyst with increase in rainfall
- PCN density increased with an increase in altitude

Altitude, annual rainfall, ambient temperature in relation to PCN population density of three agro-ecological zones in Nyandarua

AEZs	Altitude (m.a.s.l)	Annual rainfall (mm)	Ambient temperature (°C)	Mean cysts/300cc soil
LH	1299-2990	800-1000	15-25	63.1a
UH2	2370-2430	1000-1250	11-20	203.7b
UH3	2500-2700	1000-1500	11-20	289.2b

Effects of soil physical properties on potato cyst nematode population density

- Sandy clay loam soil had a significantly higher number of cysts/300cc of soil in all the three AEZ compared to other soil textural classes
- The lowest mean cysts 2.0 cysts /300cc soil were registered in sandy clay soils in UH2.

AEZs	Soil classification	Soil texture			PCN population density in 300cc soil		
		% Sand	%Silt	% clay	Sample number	Mean	Standard Deviation
LH	Clay Loam	43	19	29	3	4.3	3.3
	Loam	45	32	23	10	107.2	202.4
	Sandy Clay	48	16	36	1	**2.0**	
	Sandy Clay Loam	54	21	26	5	**229.6**	361.2
	Sandy Loam	51	28	18	1	177.0	
UH3	Clay	34	18	44	1	49.0	
	Clay Loam	42	25	33	10	194.5	253.8
	Loam	44	24	32	2	214.5	39.6
	Sandy Clay	49	15	37	3	76.2	115.5
	Sandy Clay Loam	51	22	27	9	**460.1**	386.2
UH2	Clay Loam	39	29	32	4	96.9	105.1
	Loam	46	33	22	4	154.3	190.5
	Sandy Clay Loam	50	22	28	10	**458.5**	415.2

Potato crop cycles in relation to PCN population density

- Farms where four potato crop cycles were grown per year had significantly higher cyst counts of 302 cysts/ 300cc
- Farms with only one potato crop in a year had the least cyst count of 38.5 cyst/300cc

Number of potato crops grown in the same field per year in relation to mean population density

No. of potato cycles/year	Agro ecological zone							
	LH		UH3		UH2		Total	
	Number of infested samples	Mean No. of PCN/300 cc soil	Number of infested samples	Mean No. of PCN/300 cc soil	Number of infested samples	Mean No. of PCN/300 cc soil	Number of infested samples	Mean No. of PCN/300cc soil
One	1	62	3	27.7	1	25.5	5	**38.5**
Two	8	131.8	8	281.3	7	305.0	23	236.5
Three	11	139	12	154.5	12	301.9	35	158.4
Four	0	0	2	**302.0**	0	0	2	**302.0**

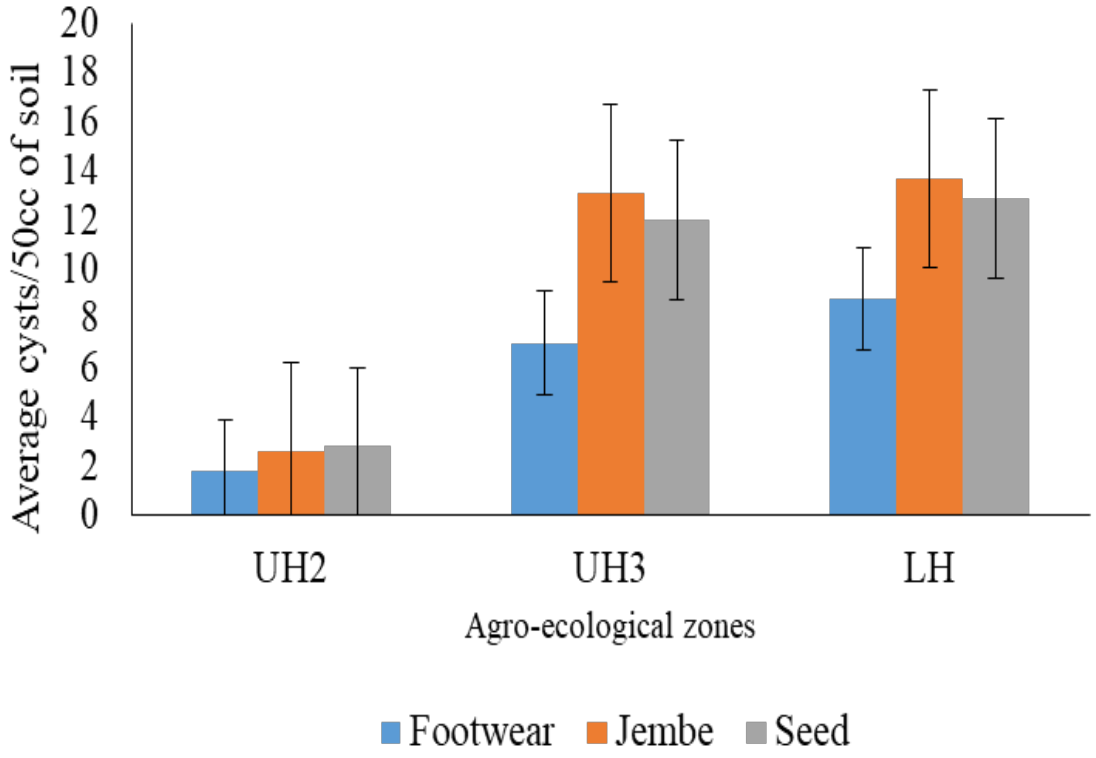
Relationship between seed source and PCN population density

- 92.3 % of the farmers used informal seed and had significantly (P≤0.05) high cyst 200.7cysts /300cc
- 7.7 % of farmers used certified seed which had significantly (P≤0.05) low cyst 60.2 cysts /300cc

	Agro ecological zone							
Seed source	LH		UH3		UH2		Total	
	No. of farms	Mean number of cysts/ 300cc soil	No. of farms	Mean of cysts/ 300cc soil	No. of farms	Mean number of cysts/ 300cc soil	No of farms	Mean number of cysts/ 300cc soil
Informal seed	18	247.3	22	69.6	20	303.41	60	200.7
Formal seed	2	29.7	3	4.3	1	26.2	5	60.2

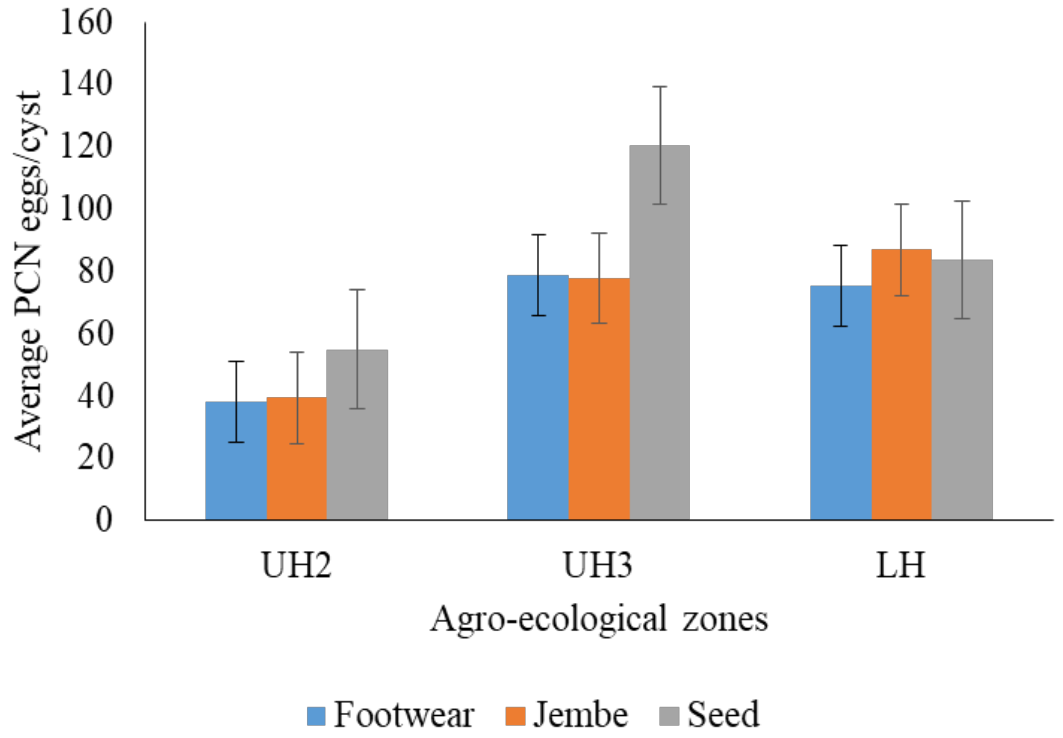
Farm equipment, seed potato and jembes in relation to PCN spread

- A significantly (P≤0.05) low number of cysts were recovered from UH2 soils having 1.8, 2.6, 2.8 cysts/50cc from footwear, farm tools and seed respectively
- Cysts adhering onto farm tools, foot wear and seed ranged from 2.6 to 13.7, 1.8 to 8.8, and 2.8 to 12.9 cysts/50cc soil respectively.



Farm tools, foot wear and seed potato in relation to PCN population density.. Cont'd

- A significant (P≤0.05) high number of viable eggs 120.4 /cyst were recovered from soil adhering to seed in UH3
- Significantly low number of PCN eggs were recovered from footwear, farm tools and seed with 38.2, 39.4 and 54.9 viable eggs/cyst respectively in UH2



Conclusion

The results of this study suggest that:

PCN population density is influenced by many factors that include;

Environment

- ✓ Altitude- high altitude
- ✓ Temperature – low temperature
- ✓ Rainfall- high rainfall
- ✓ Soil texture- Sandy clay loam soil

Farming practices;

- ✓ short rotation accelerated PCN population density
- ✓ Seed source- informal seed influenced high PCN density

Primary spread of PCN is by:

- ✓ Seed, foot wear and farm tools

Recommendations

The findings underscore the need to promote long crop rotation, planting of disease free tubers and field sanitation (farm tools and foot wear) as strategies to reduce the spread and build-up of PCN

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