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Farmer perceptions of cassava green mite pest impact in eastern Kenya

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Abstract
Casssava (*Manihot esculenta* Crantz) root has been fronted as a food security staple in Africa. A household survey was carried out to determine farmer knowledge of cassava green mite (CGM) in eastern Kenya. Male headed households dominated those involved in cassava production. A majority (74%) of those cultivating cassava were above 50 years of age who had produced the crop for over 10 years. Cultivar preference was highest (90.3%) on good root taste and mealiness followed by high root yield (74.2%). This high perception of taste and mealiness show a community whose cassava root utilization was basically for food security and of little other economic use. Cultivar preference due to tolerance to pests and diseases (32.3%) was sixth. Only 29.1% of the farmers could recognize presence of CGM pest on their crop. This demonstrated the need for improved plant health dissemination tools on the part of the extension personnel and their collaborating field researchers.

Keywords: preference, cultivar, pest spider mite, households.

1. Introduction
Cassava crop *Manihot esculenta* (Crantz) is reported to be tolerant to low moisture and poor soils in most regions of Sub Sahara Africa (SSA) [1, 2]. It is considered a food security crop in the eastern African region [3]. Being mostly a crop of the tropics, improved genotypes have led to higher root yield and various utilization options [3, 4, 5]. With the increased climate change scenario where some regions are no longer considered potential for legume and cereal staples, cassava production is reported as the food insurance crop in most SSA countries [6, 7]. Most agro-industries for cassava utilization have fronted for animal nutrition and industrial raw material processing [8, 9 10]. The major pests of cassava in Africa are; cassava mealybug *Phenacoccus manihoti* Mat-Ferr, several whitefly species and cassava green mite (CGM) complex [11, 12, 13, 14, 15]. While the mealybug menace has been brought under control in most regions of the continent after release of a parasitoid wasp in the early 1990s, the CGM continue to cause yield loss in dry low tropics and subtropics of Africa [16, 17]. Various whitefly species reportedly transmit viral diseases like cassava brown streak viral disease (CBSVD) and cassava mosaic viral disease (CMVD) [18]. Cassava green mite of the *Mononychellus* species was reported to have spread from east African to the rest of western and central Africa regions in the 1970s [19, 20, 21].
Farmer perceptions of cassava green mite (CGM) pest of the *Mononychellus* species has been least considered in most countries of Africa [22, 23, 24]. Biological control of CGM has been reported as widely successful in the humid warm regions of SSA with less success in drier regions [25, 26]. Thus, farmer perceptions on the impact of CGM on root yield loss and options for the pest mite control are limiting [27]. The pest mite presence confirmation on cassava in the field could be the beginning point to consider before implementing control options [28, 29]. The present study aimed at investigating farmer perceptions on CGM presence on cassava in eastern Kenya and knowledge of pest management options.

2. Materials and methods
A survey in six sub-counties of eastern Kenya was carried to characterize cassava production /cultivation households in the period of October-December 2014. A structured questionnaire was developed to capture household demographic data and crop production acreage as well variety preference. Some 120 farms were visited in six sub-counties. Acreage of cassava crop in the six counties to indicate importance of the cassava crop in the six sub-counties was captured. Further, root taste and color of each cultivar was scored across the different altitude

range. Local landraces among the cultivars were also captured across the eastern region. Sub-county farmers' experience in years of cassava production was scored to compare production trend from the region. Education level was comparatively scored as a measure in knowledge of pest status on cassava. Thus, ability for farmers to know and recognize the mite pest the CGM was considered important indicator towards crop improvement. Each sub-county varietal adoption of local or improved varieties was scored. Cultivar preferences grown in eastern Kenya were either of local or improved varieties; in some cases both cultivars. Root quality and color, yield and dry matter content among other attributes were captured in the questionnaire as important preference indicator of the crop production among farmers. Farmer's inability to recognize yield loss was scored as an indicative reason to control CGM pest on cassava.

Data analysis included both qualitative and quantitative analyses for the table data sets presented. SAS software [30] was used to carry out data analyses. Comparative sub-county crop production acreage, altitude range and tuber colour significance difference was carried out at 5% level using Fishers Least Significant Difference (LSD) (GLM PROC), where Student Neumann Keuls Post Hoc Test was used to differentiate means.

Table 1: Household characterization and cassava green mite pest perception in eastern Kenya counties

Variable	Mean	Standard Deviation	Overall results
Sex of household (1=male; 0=female)	0.94	0.25	>93% males
Age of household (years)	59.81	15.80	74% of farmers-≥50 years old
Years in school of household head (1= no school;2= primary education; 3= secondary education; 4=tertiary education)	2.61	0.88	55% of farmers - secondary school
No. local varieties	1.10	0.70	84% farmers grow local varieties
No. improved varieties	0.35	0.49	35% farmers grow improved varieties
Attributes of CGM symptoms by farmers (0=none; 1=disease; 2=drought; 3=blight; 4=pests)	1.94	1.06	58% farmers attribute CGM presence to drought

3. Results

3.1. Characterization of cassava cultivation households

Out of the 120 visited farms only 31 (25.8%) grew cassava from a few plants to 0.5 ha. Male headed households dominated cassava cultivation at 93% in the six sub-counties (Table 1). Of all cassava cultivation households, 74% of heads were at ≥50 years of age. In the same scenario 55% of the heads were of at least of secondary level of education. Further, at least 39% of the farmers involved in cassava cultivation had >10 years of crop production experience. A total of 81% of the farmers could not recognize presence of CGM on cassava. Some 58% of farmers attributed CGM presence to drought effects as only 35% grew improved varieties.

3.2. Household cassava cultivar preference

The results showed that the highly preferred three cultivars among the households were Kitwa, Kiseliseli and Kithambalala (Table 2). The least preferred cultivar was KARI, Katumani, Kikamba, Kisungu and Kipandameno, each cultivated by at least one or two farmers in the sub-counties. Improved cultivars were KARI, Katumani, Agriculture and Kiseliseli. The rest of the cultivars totaling nine were local landrances collected by farmers as far as coastal Kenya. Binti-adhumani and Kipandameno were specifically reported to have originated from Kwale of the coastal region of Kenya.

Table 2: Spatial scatter of cassava varieties by-name among households in eastern Kenya

Names	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Kisimba	x																														
Kitwa	x	x	x	x															x	x	x	x	x	x		x	x	x		x	x
Katumani		x																							x						
KARI																													x		
Kiseliseli				x	x	x	X	x						x	x																
Kisungu								x					x																		
Kithambalala									x	x	x	x																			
Binti-adhumani										x	x																				
Yangayeu												x																			
Agriculture														x																	
Kikamba								x																							
Kipandameno															x																
Mwiitumwandiku																x	x	x													

Farmers' criteria on preference of cultivation of specific cassava cultivars were scored highest for good root taste and mealiness at 90.32% (Table 3). The highest county score (22.58%) was from Makueni Sub-county. The second highest score was on high tuber yield at 74.18% with same Makueni Sub-county leading at 19.35% score. Cultivar disease and pest tolerance attribute preference was fairly low at 32.27% from all counties, after root high dry matter (51.62%), root good cooking ability (45.17%) while short crop cycle and ease of peeling were similar (38.72%). The least score of cultivar attributes were early maturity, smooth root shape and non-branching, all at 3.23%.

Table 3: Percentage (%) criteria for choice of cassava cultivar cultivation at farm level

	Sub Counties						
Variable criteria	Kathonzweni	Makueni	Mwingi	Mwala	Nzambani	Nzaui	Total (%)
Good taste mealiness	19.35	22.58	12.90	16.13	9.68	9.68	90.32
High tuber yield	12.90	19.35	6.45	12.90	12.90	9.68	74.18
Pest disease resistance	3.23	9.68	3.23	6.45	6.45	3.23	32.27
Short crop cycle	12.90	9.68	0	6.45	9.68	0	38.71

High dry matter	12.90	9.68	3.23	9.68	9.68	6.45	51.62
Market demand	3.23	6.45	3.23	0	12.90	0	25.81
Non leave shedding	3.23	3.23	0	0	0	0	6.46
Good cooking ability	9.68	9.68	9.68	0	6.45	9.68	45.17
Drought tolerance	6.45	3.23	3.23	3.23	0	0	16.14
Low root spoilage	6.45	9.68	3.23	0	0	6.45	25.81
Easy of peeling	9.68	9.68	6.45	3.23	3.23	6.45	38.72
Many branches	6.45	0	3.23	3.23	3.23	0	16.14
Non fibrous roots	6.45	3.23	3.23	0	0	0	12.91
Non woody root	6.45	0	0	0	0	3.23	9.68
Early maturity	0	0	0	0	3.23	0	3.23
Not branching	0	3.23	0	0	0	0	3.23
Improving soil texture	0	0	3.23	3.23	0	0	6.46
Smooth root shape	0	0	0	3.23	0	0	3.23

3.3 Cassava acreage and tuber preference

Farmers in the six counties cultivated cassava at < 0.05 ha, showing a low crop enterprise preference (Table 4). There was no significant ($F_{2, 5} = 0.69$, $P > 0.05$) acreage difference among sub-counties. Farmers in sub-counties of Makueni, Kathonzweni, Nzambani and Nzaui preferred brown tuber cassava roots while in Mwala it was mostly the white tubers. Mwala Sub-county led with highest significant ($F_{2, 5} = 3.12$, $P < 0.05$) altitude (1246.3m) among the other areas.

Table 4: Cassava acreage, altitude and tuber colour among the landrace cultivars in the counties

Sub-county	Cassava acreage (ha)	Altitude range (m)	Tuber colour (1=brown, 2= white)
Makueni	0.02a	1177.0ab	1b
Kathonzweni	0.01a	1022.8b	1b
Mwala	0.04a	1246.3a	2a
Mwingi-west	0.03a	1262.0a	1.3b
Nzambani	0.01a	1248.3a	1b
Nzaui	0.01a	1110.7ab	1b
Mean	0.02	1177.8	1.2
Cv%	2.3	6.7	19.3
F-value	0.69	3.12	6.7
P	0.6819	0.0505	0.0043

Same letters within columns denote no significant difference (P>0.05, df = 2, 5) at 5% level (Fishers Least Significant Difference Test)

3.4 Farmer pest mite recognition

Ability for farmer recognition of cassava green mite was low among the sub-counties sampled (Table 5). Only 29.1% of farmers recognized CGM damage, with those in Kathonzweni Sub-county leading with 9.7%. Yield loss associated with presence of CGM pest was reported by a total of 32.4%, where farmers in Nzambani led with 9.7%. A further assessment on if CGM was actually responsible for root yield loss had only total 9.7% associating the root loss to CGM presence on cassava.

Table 5: Farmers recognition of cassava green mite (CGM) damage, yield loss and general perception pest presence

Sub-county	Farmer CGM damage recognition (%)	Farmer (%) yield loss recognition	Farmer (%) associating low yield to CGM
Makueni	6.5	6.5	6.5
Kathonzweni	9.7	3.2	3.2
Mwala	3.2	6.5	0.0
Mwingi-west	6.5	6.5	0.0
Nzambani	3.2	9.7	0.0
Nzaui	0.0	0.0	0.0
Total (%)	29.1	32.4	9.7

4. Discussion

4.1. Cassava cultivation

Male heads dominated (93%) the households involved in cassava production in eastern Kenya. It was also discerned that majority (74%) of the farmers involved in cassava production were above 50 years where the young were least interested in the crop. It would mean that young farmers did not value cassava crop as being important in eastern Kenya. Only the elderly were positively responsive to cassava production indicated by the >10 years cultivation experience. Further, considering the age of such farmers and lack of university education could explain the low (19%) recognition of CGM on cassava [23]. Otherwise 58% of the farmers attributed CGM presence on cassava to drought effects. Further, only 35% grew improved cassava varieties in eastern Kenya showing lack of knowledge on good agronomic attributes on most developed varieties.

4.2. Variety preference

Farmers identified choice of cassava cultivars by the local names where Kitwa, Kiseliseli and Kithambalala were the most preferred. These cultivars were least bitter and had good root quality of dry matter as reported of being of similar preference traits in Uganda and Cameroon ([23, 24]). The improved varieties like KARI and Katumani were among the least preferred due to probably higher cyanogens potential and poor dry matter levels comparable to the local varieties as some farmers reported. Farmers' criteria for cultivation of specific cultivars were highest on good root taste and mealiness (90.3%). The second score (74.2%) on preference was high root yield while dry matter (51.6%) was third among farmers. Pests and diseases preference (32.3%) was sixth in ranking after good cooking ability (45.2%) and short crop cycle in tie with ease of peel (38.7%). These root characteristics point to a community whose utilization of cassava root is based on food security. Cultivar preference due to market demand was low (25.8%) tying with low root spoilage criteria. This translates to a lack of market for the root yield both for food and industrial sectors of the country as whole. In general cassava acreage production was low (< 0.1 ha/farm) in the nine sub-counties indicating a crop whose importance was quite low, as cereals and legumes take precedence of eastern Kenya. The tuber/root colour preference showed no altitude relationship among the farmers in the sub-counties as most farmers preferred the brown tubers to the white ones.

4.3. Pest mite knowledge

A low percentage (29.1%) of the farmers recognized CGM presence on cassava. Even yield loss due to CGM was only a total of 32.4% with insignificant difference among the sub-

county. In most cases it is reported that yield loss was likely compounded by other environmental factors but not directly from CGM attack [27]. Further, yield loss had indicated that CGM caused the highest damage on cassava leaf during severe drought period. At such period, leaf biomass loss could be as high as > 60% on some varieties [28, 29].

The present results on farmer perceptions of CGM pest on cassava indicate that majority of farmers in eastern Kenya lack knowledge of the CGM impact on cassava root yield loss. An enhanced dissemination tool to inform the farmers on the mite damage is important as they continue to cultivate cassava for their food security as market options are missing. Otherwise, biological, cultural and judicial acaricide use as management options for CGM control was available for implementation during the dry spell [29].

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6. References

1. Hillocks RJ. Cassava in Africa. In: Hillocks RJ, Thresh JM, Bellotti A (eds). Cassava: Biology, Production and Utilization, CABI Publishing, Wallingford, UK, 2002, 41-53.
2. Fermont AM, van Asten PJ, Tittonell P, van Wijk MT, Giller KE. Closing the cassava yield gap: an analysis from small-holder farms in East Africa. Field Crops Research 2009; 112:24-36.
3. Mohammad L, Kamau JW, Bugusu BA, Kariuki CW, Ndolo PJ, Munga TL *et al. Ex-ante* appraisal on innovations for cassava productions and processing in spatially separated but inter-linked markets. In: Akorado MO, Ngeve JM (eds). Proceedings of the International Society for Tropical Root Crops – Africa Branch, Seventh Triennial Symposium, Cotonou, Republic of Benin, 1998, 137-147.
4. Jennings DL, Iglesias C. Cassava breeding. Cassava: Biology, production and utilization. In: Hillocks RJ, Thresh JM, Bellotti AC (eds). CABI-Publishing, 2002, 149-155.
5. Westby A. Cassava utilization, storage and small scale processing. Cassava: Biology, production and utilization. In: Hillocks RJ, Thresh JM, Bellotti AC (eds). CABI-Publishing, 2002, 281-316.
6. Von Braun J. The World Food Situation: New Driving Forces and Required Actions. IFPRI's Biannual Overview of the World Food situation presented to the CGIAR Animal General Meeting, Beijing, 2007, 334-336.
7. Ferris RS, Whyte B, Khizzah A, Legg J. Opportunities in commercializing cassava in East and Southern Africa. African Crop Sci 1997; 6:1427-1433.
8. Gomez GG. Use of cassava products in pig feeding. In: Muchin D, Nyrold S (eds) Proceedings of the Expert Consultations on the Use of Roots, Tubers, Plantains and Bananas in Animal Feeding. CIAT, Cali, Colombia, 1991, 21-25.
9. Quenyh NL, Cecil J. Sweetness from starch: a manual for making maltose from starch. FAO, Rome, 1996, 37.
10. Padmaja G, George M, Balagopalan C. Ensiling as innovative biotechnological approach for conservation of higher cyanide cassava tubers for feed use. In: proceedings of the Second International Scientific Meeting Cassava Biotechnology Network, Bogor, Indonesia. CBN. Cali. Columbia, 1994, 784-794.
11. Herren HR, Bennett FD. Cassava pests, their spread and control. In: Hawksworth DL. (ed). Advancing Agricultural Production in Africa. Proceedings of CAB's First Scientific Conference, Arusha, Tanzania. Farnham Royal UK. Commonwealth Agricultural Bureau (CAB) Slough, 1984, 110-114.
12. Megevand B, Yaninek JS, Friese DD. Classical biological control of cassava green mite. Symposium XI of the International Conference of Tropical Entomology. Africa–Wide Biological Program of Cassava Pests. Insect Sci Appl 1987; 18:871-874.
13. Yaninek JS, Herren HR, Gutierrez HP. The biological basis for the seasonal out breaks of cassava green mites in Africa. Insect Sci Appl 1987; 8:861-865.
14. Gutierrez J. The cassava green mite in Africa: one or two species (Acari: Tetranychidae). Exp Appl Acarol 1987; 3:163-168.
15. Yaninek JS. Cassava green mite intervention technologies. Afr Crop Sci J. 1994; 2(4):361-367.
16. Herren HR, Neuenschwander P. Classical biological control of cassava insects and mites in Africa. Ann Rev Entomol 1991; 36:257-283.
17. Kariuki CW, Hanna R, Toko M. The impact of a predatory mite, *Typhlodromalus aripo* De Leon (Acari: Phytoseiidae) on cassava green mite population and yield of cassava in the field. African Crop Science Proceeding 2005; 7:1401-1405.
18. Alicai T, Omongo CA, Maruthi MN, Hillocks RJ, Baguma Y, Kawuki R *et al.* Re-emergence of cassava brown streak disease in Uganda. Plant Disease J. 2007; 91:1-24.
19. Nyiira ZM. Report on investigation on cassava mite, *Mononychellus tanajoa* (Bondar). Department of Agriculture, Kawanda Research Station. Annual Report, 1972, 14.
20. Byrne DH, Guerrero JM, Belloti AC. The cassava mites. Trop Pest Manag 1982, 29:378-394.
21. Yaninek JS, Herren HR. Introduction and spread of the cassava green mite, *Mononychellus tanajoa* Bondar (Acari: Tetranychidae). An exotic pest in Africa and search for appropriate control mrethods. Rev. Bull Entomol. Res 1988; 79:1-13.
22. Elias M, Rval L, McKey D. Perceptions and management of cassava (*Manihot esculenta* Crantz) diversity among Makushi Amerindians of Guyana (South America). J Ethnobiol. 2000; 20(2):239-265.
23. Tumuhimbise R, Melis R, Shanahan P, Kawuki R. Farmers' perceptions on early storage root bulking in cassava (*Manihot esclulenta Crantz*) in eastern and Central Uganda and their implications for cassava breeding. World J Agric Sci. 2012; 8(4):403-408.
24. Njuke E, Hanna R, Kirscht H, Araki S. Farmers' perceptions and criteria for cassava variety preference in Cameroon. Afr. Stud. Monographs 2013; 34(4):221-234.
25. Yaninek JS, Hanna R. Cassava green mite in Africa: a unique example of successful classical biological control of a mite pest on a continental scale. Borgemeister, P, Borgemeister, C, Langewald, J (eds), Biological control in IPM systems in Africa, CABI, 2003, 61-75.
26. Onzo A, Hanna R, Negloh K, Sabelis MW, Toko M. Biological control of cassava green mite with exotic and indigenous phytoseiid predators: Effects of intraguild predation and supplementary food. Biol Contr 2005; 33:143-152.
27. Mutisya DL, El-Banhawy EM, Khamala CPM, Kariuki CW. Management of cassava green mite *Mononychellus*

progresivus (Acari: Tetranychidae) in different agro-ecological zones of Kenya. Syst Appl Acarol 2015; 20(1):39-50.
28. Yaninek JS, De Moraes GJ, Markham RH. In: Handbook on the cassava green mite, *Mononychellus tanajoa* in Africa: a guide to its biology and procedures for biological control. International Institute of Tropical Agriculture. Cotonou, Benin, 1989, 43-51.
29. Mutisya DL, El-Banhawy EM, Khamala CPM, Kariuki CW, Miano D. Determination of threshold of cassava green mite (Acari: Tetranychidae) on different cassava varieties. J Plant Pest Sci. 2014; 1(2):79-86.
30. SAS Version 8 software. SAS Institute Inc., Cary, NC. USA, 2001.