Adoption of Banana Tissue culture and Nutrient Enhancement Technologies to curb the HIV-Poverty-Malnutrition cycle Among People Living With HIV and AIDS (PLWHAs) in the Lake Victoria Basin

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Background

- Globally 34 million PLWHAS (UNAIDS, 2013).
- Sub-Saharan Africa- the greatest burden
  - 23.5 million (69 percent) of all PLWHAs
  - Aprox 1.6 million new HIV infections ; 1.2 million AIDS-related deaths
- Eastern Africa is the 2nd most affected 4.6 million PLWHAs
  - Kenya (6.1%), Uganda (7.2%) , Tanzania (5.1%)
- Highest prevalence in the Lake Victoria basin (LVB)
- HIV and AIDS Affects the most productive age (15 - 49 years)
- Global efforts- significant gains especially in accessibility to ARTS

The Vicious cycle of poverty and malnutrition

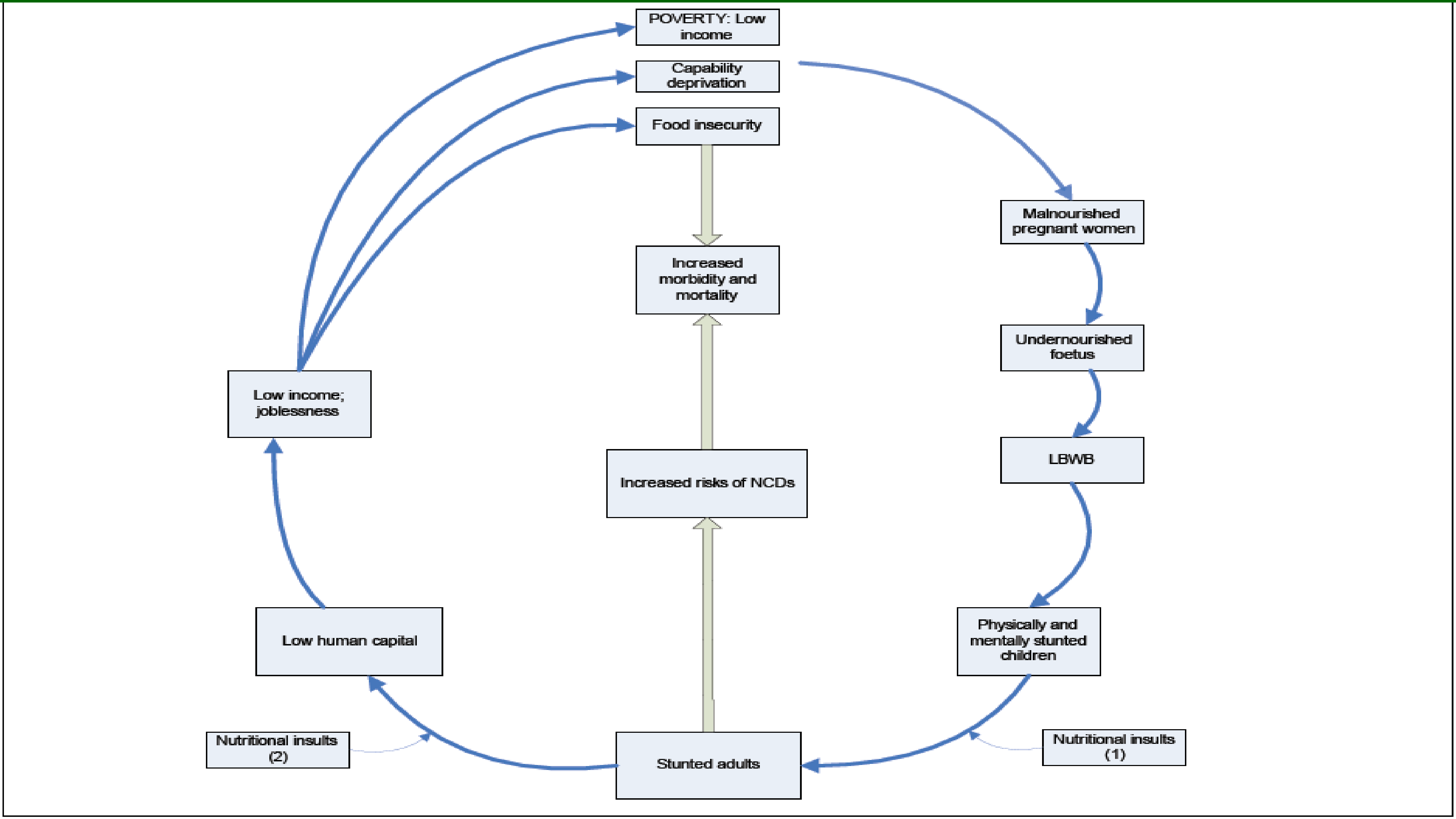
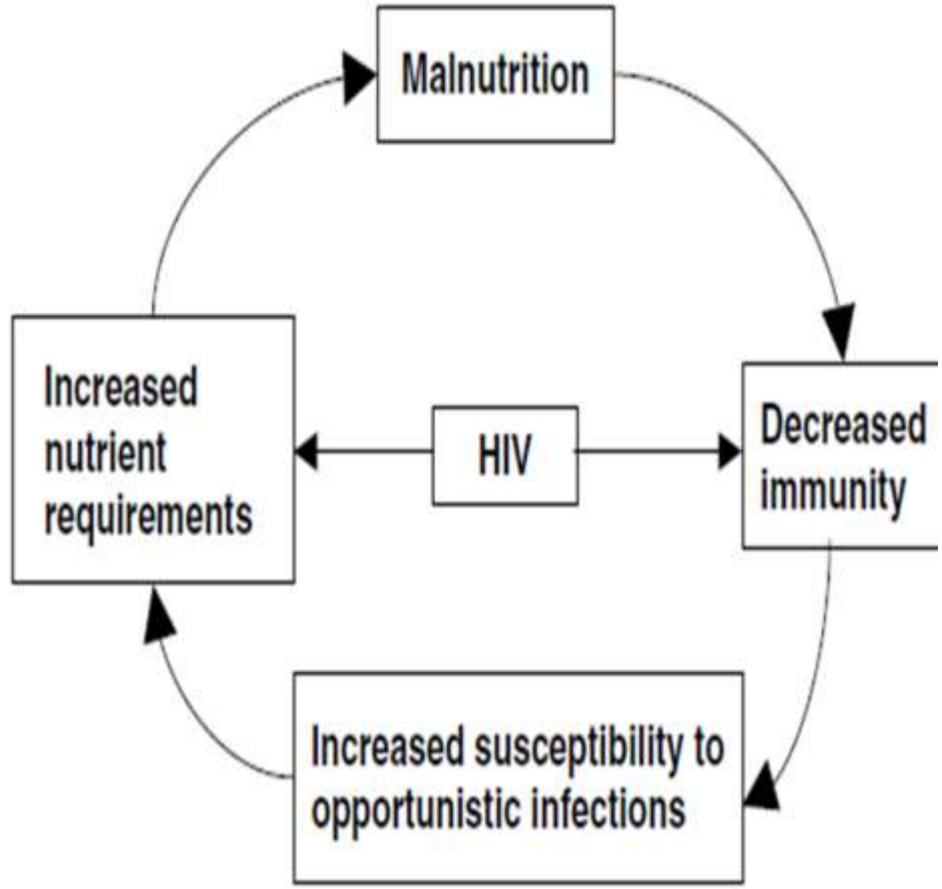


FIGURE 1
The vicious cycle of poverty and malnutrition

HIV promotes the Vicious, Poverty-Malnutrition-Cycle

- **Poverty sets the stage for the spread of the epidemic**
- Malnutrition is a cause and a consequence of poverty
- HIV- Directly affects nutritional status (uptake and needs of PLWHAs
- Indirect- socio-economic consequences



Need Practical Holistic Interventions to Break the Cycle

Banana TC technology transfer technology using best practices

Nutrition intervention

– Intercropping bananas with nutrient – rich indigenous vegetables .

- Introduce nutrient enhanced banana flour

Food and Nutritional Security, Sustainable production systems, wealth creation

Why Banana

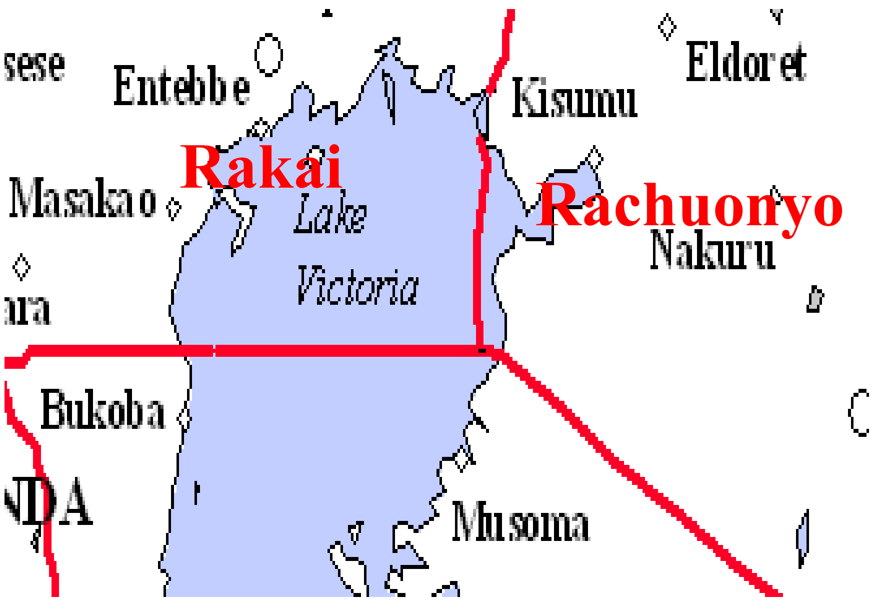
- Important multipurpose crop
  - Food, feed, income,envt conservation
- Possibility for Nutrient enhancement
- All year round crop
- Yield can be increased by up to 30% through the use of TC seedlings coupled/ good crop management practices.

OBJECTIVES

- To disseminate banana tissue culture technology among PLWHAs .
- To determine the effect of nutrient enhanced banana flour on nutrient intake of PLWHAs
- To assess the impact of adoption of Nutrient enhancement and Banana TC technologies on the livelihoods of PLWHAs

STUDY SITES

- LVB highest poverty and HIV prevalence
- High potential for banana production
- Banana is a major staple
- Limited dissemination/ awareness and adoption of TC technology in the LVB.
- Production below potential



STUDY DESIGN

- **PRAS**
  - Status of banana production;
    preferred varieties
    TC awareness level
  - Nutritional status of respondents
- **Dissemination of Banana TC technology**
  - In vitro protocol optimisation
  - On farm demonstrations & Performance trials
- **Nutrient enhancement**
  - develop a banana based nutrient enhanced flour
  - Interventional Study to determine the benefits of nutrient enhanced banana flour to PLWHAs

Methodology-TC

- Supply seedlings
- Explain the tissue culture process
- Organise farmer visits to lab

Experimental evaluation of performance of TC bananas on farmer's fields

Methodology-Nutrient Enhancement

- A banana based nutrient enhanced food supplement composition:
    - banana flour (61%)
    - soybean flour (39%)
    - multi-nutrient fortificant pre-mix (0.2%),
    - 459.7 kcal
    - 15% protein
    - substantial levels of vital vitamins and minerals
- distributed to 15 respondents and their nutrient intake estimated.

Results- Tissue Culture

- Preferred varieties-‘Bluggoe’ ABB (Ngombe); Ney Poovan AB (‘Kasukari’ or sweet banana) AB
- Criteria =taste, market value, yield, drought tolerance, availability of planting materials ,shelf life.
- TC technology awareness level – 5%
- Over 50% of the respondents reported inadequate harvests.
- Farmers indicated willingness to adopt other banana varieties provided they met these criteria.
- The banana product was well accepted and increased energy and nutrient intake by the recipients.

Field Establishment TC- Day 0

CV Williams

CV Kasukari

Green House- Field- Market

Growth and fruit parameters of 'Kasukari' AB and 'Bluggoe ABB plants during the first production cycle. (conv=Conventional;TC =Tissue culture TLF=Total number of leaves at Flowering; TLH= Total number of leaves at Harvest;L:W= Leaf length to width ratio; DF = Number of days to flowering; DH= Number of days to harvest; NF=Number of fingers in central hand;LF=external length of finger of central hand; GF= Girth of central finger of central hand. (n=60)

Cultivar	Type of sucker planted	TLF	TLH	Leaf length (cm)	leaf width (cm)	Leaf index L:W	DF	DH	NF	Bunch weight (Kg)	LF (cm)	GF (cm)
Kasukari AB	TC	15	7	92	41	2.2	328	423	13	16	15	14
	CV	16	6	113	66	1.7	364	576	18	6	10	7
Bluggoe ABB	TC	13	6	106	61	1.7	354	465	15	40	17	15
	CV	12	6	107	67	***1.6***	429	490	12	20	17	14

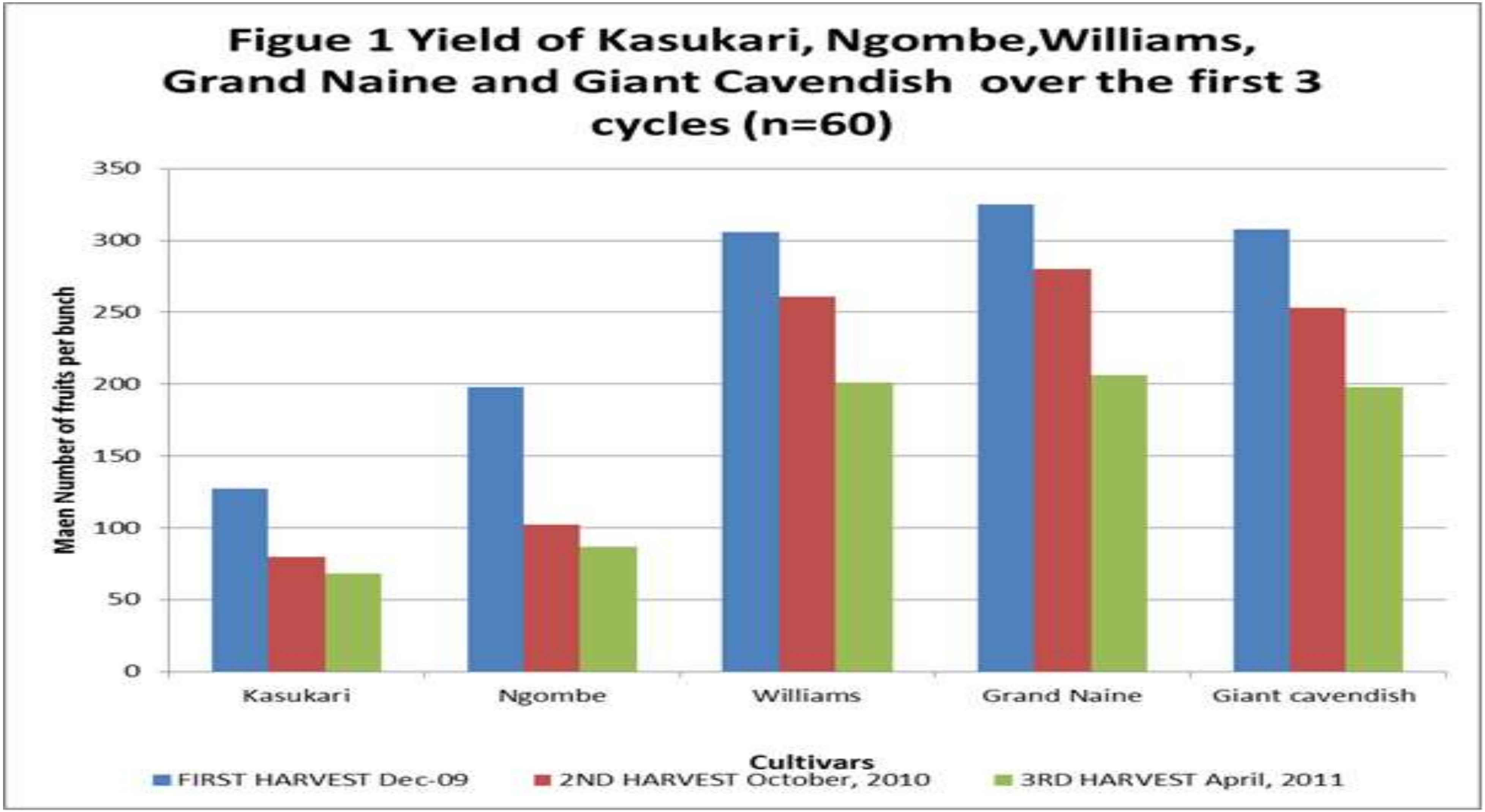
Observations: **Earliness, broader leaves, more fingers,x2 bunch weight, larger fruits**

Increased Banana Cultivation

Number of different banana cultivars established by group members in their fields

Members	Sweet Banana (Kasukari)	Grand Naine	Nyoro	Giant Cavendish	Total
1	4	4	4	2	14
2	5	3	2		10
3	4	2	2		8
4	2	3	1	1	7
5	2	4	2	2	10
6	6		1	3	10
7	3	3	1	3	10
8	4	2	2	2	12

Yield reduction vs production cycle



Results- Nutrient Intake of PLWHAs in Rakai

Nutrient	Weekend	% of RDA	Weekday	% of RDA	RDA
Energy (kcal)	**1676.2**	**69.8**	**1594.7**	**66.4**	**2400**
Protein (%)	12.1	70%	12.2	66	12-15
Fat (%)	**14.1**	**47**	**18.1**	**60.3**	**30**
Vitamin A (mcg)	975.8	195.2	975.3	195.1	500
Vitamin C (mg)	114.1	253.6	139.7	310.4	45
Vitamin E (mg)	8.4	168	7.0	140	5
Vitamin B1 (mg)	**0.8**	**72.7**	**0.9**	**81.8**	**1.1**
Vitamin B2 (mg)	**0.8**	**72.7**	**0.8**	**72.7**	**1.1**
Vitamin B6 (mg)	2.4	184.6	2.3	176.9	1.3
Folate (mcg)	**249.6**	**62.4**	**206.0**	**51.5**	**400**
Calcium (mg)	259.4	25.9	229.7	23	1000
Zinc (mg)	6.7	104.7	6.8	106.3	6.4
Iron (mg)	**12.9**	**64.5**	**11.9**	**59.5**	**20mg**

Contribution of Banana to Energy Intake for PLWHA in Rakai District

Percentage of energyfrom *matooke*	Weekday	Weekend
Kcal (average value)	612.8	610.8
Classification based on amount of energy from *matooke*	**% of respondents**	**% of respondents**
< 10%	10	10
10-30%	26.7	23.3
30-50%	30	36.7
> 50%	33.3	30

Nutritional Enhancement of Banana

Nutrient	**Nutrient enhanced banana**	**Banana flour**
Energy (kcal)	459.7	211
Protein %	15.2	2.37
Fat (%)	9.63	0.28
Iron (mg)	12.0	0.7
Vitamin B_1 (mg)	0.4	0.11
Vitamin B_2 (mg)	0.6	0.146
Folate (mcg)	120	9
Vitamin A (mcg)	312.4	15.1
Zinc (mg)	2.3	0.27
Selenium	5.3	2.4

Acceptability of Nutrient Enhanced Banana Flour

- Average consumption was found to be 66g per person and the limiting factor was the amounts available
- 73% of respondents indicated that they liked the product very much
- 87% revealed that they were willing to consume the product daily
- All respondents mentioned increase in available food options as a benefit

Contribution of Nutrient Enhanced Banana to Nutrient Intake

	Daily intake from nutrient enhanced banana		
Nutrients	**Weekday**	**Weekend**	**% of RDA supplied by diet**
Energy (kcal)	256.9	257.85	73.2
Protein (%)	11.59	11.63	73
Fat (%)	6.48	6.5	93.1
Vitamin A (mcg)	2101.16	2108.97	>100
Vitamin E (mg)	0.16	0.16	>100
Vitamin B_1 (mg)	0.27	0.27	74.5
Vitamin B_2 (mg)	0.4	0.41	99.1
Folate (mcg)	80.7	81	69.5
Zinc (mg)	1.55	1.55	>100
Iron (mg)	2.36	2.36	64.5

Intercropping with Indigenous Vegetables

Healthier, Happier, Families

Community Outreach

demonstration farm learning resource

Training of farmers and in-Service Teachers

Other Positive Outcomes

Capacity Building

- Improved farming and crop management practices
- Recipes for better nutrition
- Gender awareness




Highlights/ Conclusions

- Nutrient enhanced banana increased energy, iron, folic acid, vitamins B1 and B2 but levels remained below RDA;
- To obtain RDA levels of these critical nutrients, PLWHA would have to increase consumption of nutrient enhanced banana to 204g.
- establishment of both TC and non-TC orchards should be accompanied by training on good crop management practices
- involvement of farmers in the whole research process encouraged faster adoption of the technologies.
- The project had other positive outcomes and attracted interest beyond the PLWHA groups.

Way Forward

- Establishment of on-farm nurseries managed by the groups
- Green house and field tests
- Monitor adoption and Benefits of the 2 technologies with respect to food /nutritional security and income.
- Acceptability studies in the larger community
- Widespread dissemination of TC in collaboration with KARI
- Demonstrating and publicizing processing of banana to minimise postharvest losses
- Explore PPP for large scale production of banana flour/products

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THANK YOU
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