

# Improving Nutrition and Income Generation with African Indigenous Vegetables: Selected Lessons Learned

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# Obj. 1 Hypothesis: Appropriate interventions can increase access to and consumption of AIVs among producers & consumers in Kenya & Zambia.

**Lesson 1. Developing & identifying the most effective intervention methods toward improved access, affordability, availability, and adoption of AIVs must be based on solid survey consumer data**

Pilot survey's conducted indicated:

1. AIVs very popular- but not consumed regularly!
2. Kenya's and Zambians would opt to consume AIVs (at greater frequency and quantities) but don't due to issues of access, affordability, availability, with many unaware of their nutritional benefit.
3. Preference for specific AIVs and their popularity drives our R&D.



AIV	Rarely	Sometimes	Everyday
Green Maize (fresh)	66.7	29.4	3.9
Amaranth	24.1	<b>69.0</b>	<b>6.9</b>
Nightshade	46.2	<b>53.8</b>	0
Spider Plant	39.1	<b>60.9</b>	0
Cowpea	59.1	<b>40.9</b>	0
Jute Mallow	23.1	<b>76.9</b>	0
Kale	26.1	<b>69.6</b>	<b>4.3</b>
Sweet potato leaves	28.6	<b>71.4</b>	0
Orange sweet potato	64.3	<b>35.7</b>	0
Okra	26.9	<b>73.1</b>	0
Ethiopian mustard	35.3	<b>64.7</b>	0
African eggplant	41.4	<b>58.6</b>	0
Other AIVs	28.6	<b>71.4</b>	0



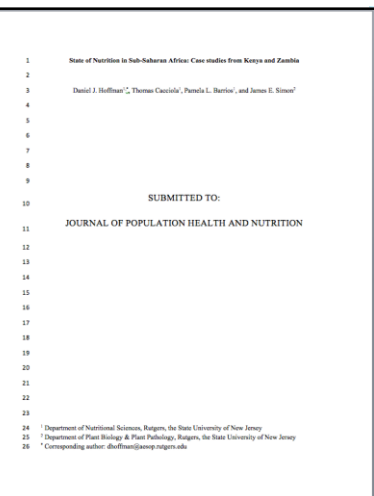
# Women's Dietary Diversity

## Lessons Learned from Pilot Study in Kenya and Zambia

- Collected data on household consumption and dietary diversity.
- Data were used to inform subsequent baseline data collection conducted in 2016

Average score of WDD was below 5, indicating low dietary diversity

WDD is a robust outcome that will allow for differentiation between groups studied in 2017 and 2018.



# Consumer Surveys to compare effect of production and nutrition-education interventions

50 pilot survey of households in Kenya and Zambia were completed to guide our larger one.

500 households with at least one woman of childbearing age and at least one child were surveyed in both Kenya and Zambia in 2016 to evaluate baseline AIV consumption in communities prior to intervention activities.

125 households will now either be provided with: (T1) Nutrition education intervention activities; (T2) Production intervention activities; (T3) Both types of intervention activities; and (T4) A Control group treatment

<p><b>Quadrante 1- CONTROL GROUP-</b> They are found in similar exposure and knowledge on AIVs AIV production sites</p> <p>- Will NOT be given any intervention</p> <p>-*Being monitored on nutritional aspects *</p> <p>Suitable Site selected: TRANS NZOIA</p>	<p><b>Quadrante 3- TREATED GROUP-</b> they are found in similar exposure and knowledge on AIVs AIV production sites</p> <p>- They will be given behavioral change communication as an intervention</p> <p>*Being monitored on nutritional aspects *</p> <p>Suitable Site selected: BUNGOMA</p>
<p><b>Quadrante 2- CONTROL GROUP-</b> They are found in similar exposure and knowledge on AIVs AIV production sites</p> <p>- ONLY PRODUCTION intervention will be given to the populace of the region</p> <p>*Being monitored on nutritional aspects*</p> <p>Suitable Site selected: KISUMU/NANDI</p>	<p><b>Quadrante 4- TREATED GROUP-</b> They are found in similar exposure and knowledge on AIVs AIV production sites</p> <p>- Will be given both PRODUCTION SKILLS and BEHAVIORAL CHANGE COMMUNICATION</p> <p>*Being monitored on nutritional aspects*</p> <p>Suitable Site selected: BUSIA</p>

Follow-up consumption surveys to be conducted following intervention activities to quantitatively evaluate the effect of each intervention approach.



# Sites of Surveys and Interventions in Zambia and Kenya



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**Lesson 2: 98.8% producers want access to better management practices, technology and pest management**



# Obj. 2: Hypothesis: Appropriate promotion and expansion of availability of AIVs at the local level will strengthen market access and sales for producers of AIVs:

In each Zambia and Kenya, 300 AIV producers and 75 intermediaries were surveyed to identify the most substantial bottlenecks in productivity to guide the focus of production interventions.

**Lesson 3:** Growers report AIV requires same level of management and skills as vegetables and report difficulties in:  
 \*Access to seeds and plant materials; unaware of improved germplasm; identification of problems with some current AIVs; high price of fertilizers and farm credit limiting, and insect problematic with a few AIVs. **75% of producers cant access credit** (agric. inputs after medical bills identified as primary use of credit)

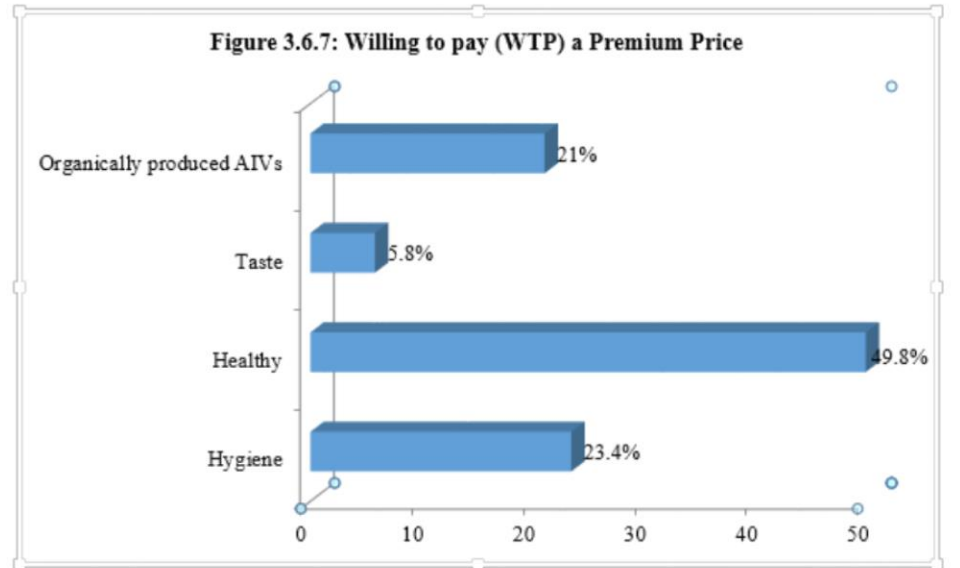
A vast majority (88%) of the respondents felt that there was no difference in overall farming experience between the production and sale of AIVs compared to other vegetable (Table 3.6.5).

Table 3.6.5: Existence of difference between production and sale of AIVs

S.NO	Particulars	Frequency	Percent
1.	No	256	88
2.	Yes	35	12
	Total	291	100

The respondents attributed their willingness to pay a premium (Figure 3.6.7) for certain improved characteristics like healthiness (50%), hygiene (23%), taste (6%), and organically produced AIVs (21%) if they were to buy their AIVs in the market.

Figure 3.6.7: Willing to pay (WTP) a Premium Price



Amongst the respondents, about 61% had sold AIVs in the past 2 years (Table 3.6.6). Orange sweet potato ranked first at 318 kg in terms of quantity sold (Table 3.6.7) in the last completed



S.No	Particulars	Very much	Much	Moderate	A little	Not at all	Total
1	Amaranth	119	56	35	1	1	212
	%	56.1	26.4	16.5	0.5	0.5	100
2	Nightshade	11	10	4	1	0	26
	%	42.3	38.5	15.4	3.8	0	100
3	Spider plant	46	10	14	4	0	74
	%	62.2	13.5	18.9	5.4	0	100
4	Cowpea	75	31	12	4	0	122
	%	61.5	25.4	9.8	3.3	0	100
5	Jute mallow	23	8	4	1	0	36
	%	63.9	22.2	11.1	2.8	0	100
6	Kale	17	7	4	2	0	30
	%	56.7	23.3	13.3	6.7	0	100
7	Sweet Potato Leaves	165	90	17	2	6	220
	%	75	40.9	7.8	0.9	2.7	100
8	Orange Sweet Potato	108	21	14	38	0	181
	%	59.7	11.6	7.7	21	0	100
9	Okra	83	38	5	3	1	130
	%	63.8	29.2	3.8	2.3	0.8	100
10	Other	8	10	1	0	0	19
	%	42.1	52.6	5.3	0	0	100

The buyers were also asked to rank their preferences in characteristics that they look for when they buy AIVs (Table 3.6.18). Appearance (34%) and freshness (18.4%) were ranked the most for amaranth. These two characteristics were ranked at 36% each for nightshade, at 29% and 20% for spider plant. It was nutritive quality (31%) and freshness (8%) for cowpea. Appearance (19%) and marketability (11%) topped the list for jute mallow, and for kale it was 27% and 13% respectively. Appearance (34%) and tolerance towards diseases and pests (8%) topped the list for sweet potato leaves. Nutritive quality (24%) and appearance (17%) topped the list for orange sweet potato and it was freshness (30%) and appearance (20%) for okra. In general the top two characteristics that the buyers look for when they buy AIVs is appearance and freshness.



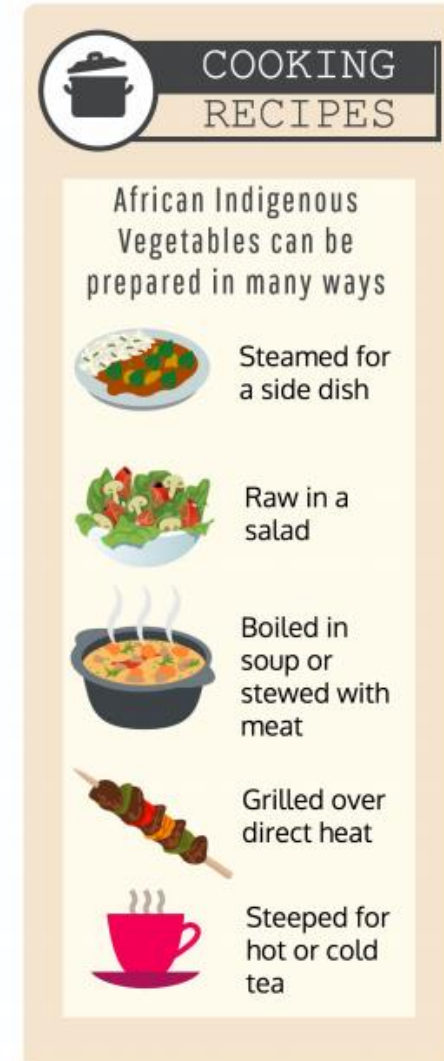
# Nutrition Education Intervention (BCC)

500 Individuals in Kenya and Zambia will be provided with on-going nutrition education trainings (BCC):

- Nutrition content of AIVs
- Recommended intake amount
- Health Applications
- Recipes and meal preparations



**Lesson 4 Learned:** Parents, grandparents and even school teachers far more excited about AIVs when they understand their nutritional content! Source of pride, source of tradition, easy to collect yet still perceived to be wild harvested not cultivated and “undervalued”.





# Obj. 3. Determine best management practices for AIV production, increase capacity and access to AIVs

Participatory research prioritized by survey results to provide accurate information and recommendations for farmers

- Cultural practices
- Management technologies
- Improved seed & storage
- Integrated pest management
- Irrigation and drought tolerance

**Lesson 5: 90.9%** producers ant better AIV seed quality.  
**Lesson 6: 75%** of producers want training for production during dry seasons & drought.



**Common pests and diseases of amaranth, nightshade and spider plant in East Africa**

*J.S. Tenenak*

Common insect pests of traditional African leafy vegetables depend on the crop and crop growth stage. Seedling can be attacked by cutworms (large caterpillars), grubs, thrips, larvae and crickets that inhabit the soil and attack the sprouts from beneath the surface or at ground level. Outbreaks of flea beetles and **bagrada** bugs can also destroy seedling (particularly spider plants), along with birds, with domestic fow, e.g., chickens and the wild birds, e.g., weaver (quailfinch), that prefer young plants and new growth.

By the crop grows and enters the vegetative stage, a complex of foliar pests can be found. These include aphids, flea beetles, caterpillars, stem weevils, spider mites, **hempflings**, and again birds. Not all of the pests are found on all of these crops. Spider plants have the fewest foliar pests, while nightshade and amaranth have similar numbers of pests, but not all the same species, e.g., **hempflings** on nightshade and stem weevils on amaranth.

As the crop matures and begin producing flowers followed by seeds, the complex of pests again changes. Caterpillars, **bagrada** bugs, and birds feed on the flowers, fruits and seeds, and can cause serious damage. Many other insects, particularly hemipterans (true bugs), also feed on the seeds, but these usually do not cause serious damage.

Other insects found on traditional African leafy vegetables including whiteflies, stemhoppers, **grasshoppers**, leaf feeding beetles and grasshoppers, but these insects rarely cause serious problems on a consistent basis.

Common Pests	Common Diseases
New seedlings and early growth stage	
Cutworms (caterpillars)	Damping off
White grub beetles	
Crickets	
Flea beetles	
<b>Bagrada</b> bugs	
Birds	
Vegetative to flowering stage	
Aphids	Leaf spots/early blight
Flea beetles	Bacterial wilt
Caterpillars	Lava blight
Stem weevils	Stem rot



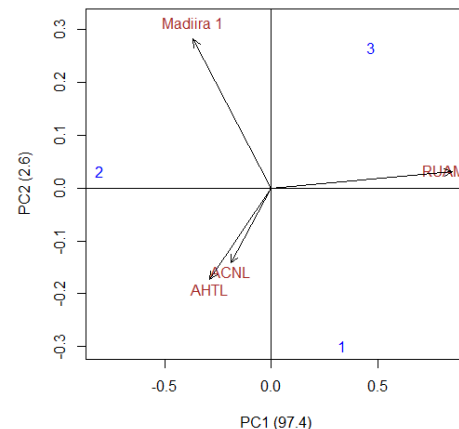
Solar Dryer < \$100 to build



# Obj. 4. Evaluation of nutrient composition of AIVs:

## Determining the content and stability of micronutrients in AIVs

**Lesson 8: Many of the AIVs are Nutrient rich and can be submitted to USDA for inclusion.**



**Result:** Spiderplant flower rapidly ca. 1 month field limiting production. We then screened populations for photoperiodicity. **In 2016 we identified spiderplants that remain vegetative for >6 months, and now field testing. This could be transformative!**



### Lesson 7: Selection and breeding for micronutrients possible.

2017. Brynes, D., F. Dinssa, S. Weller and J.E. Simon. Elemental micronutrient content and horticultural performance of vegetable amaranth types. JASHS: (in press).

**Result: A new high Fe Amaranth being developed by us with new variety release expected in 2017/2018.**

AMMI results		Fe	Ca	Mg	Zn	Total Yield	Height	Spread
Env	<.0001	0.0009	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
rep(env)	0.6617	0.264	0.0194	0.0113	0.045	0.0453	0.0001	
Gen	<.0001	0.002	0.0366	0.004	<.0001	<.0001	0.0004	
env*gen	0.0004	0.0009	0.0624	0.3097	0.0085	0.0035	0.088	

Results of additive main effects and multiplicative interaction effect (AMMI) analysis of the four accessions which were grown in common across the three environments: PI 674263, AC-NL, AH-TL, and Madiira 1.



# Increasing Access: Peri-Urban; Urban, Schools

Evaluating Sack-Gardens: Tumaini Center for Street Boys, Kenya



**Lesson 9: Linking to Youth** by providing training in AIV production, can create entry point to new generation, urban settings and reach more families for accessing fresh healthy produce and possible new income generation opportunities



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