

GRAIN AMARANTH IN UGANDA

History, progress and prospects




Dorothy Nakimbugwe, PhD
Dept. Food Technology & Nutrition
Makerere University



- Background

- State of malnutrition
(global, developing
countries & uganda)



The double mal-nutrition
tragedy in developing
countries!

Uganda (& other developing
countries) are facing both
under & over-nutrition

Overweight & Diet-related

NCDs

- Diet-related NCDs (CVDs, cancer & diabetes) - 60% (56.5 million) of global deaths
- 80% of CVD deaths occur in low and middle income countries
- Childhood obesity on the increase in low- and middle-income countries, esp. in urban settings (schools)
- The prevalence increasing at an alarming rate
 - Globally, in 2010 > 42 million under-fives overweight
 - Close to 35 million are in developing countries

Overweight children in Africa!

- In Africa % of overweight children
 - 4% (4 million) -1990 to 8.5% (13.5 million) -2010)
- Asia, children overweight increased
 - 3.2% in 1990 to 4.9% in 2010 (13 => 15 million)
- Fastest overweight increase in Africa!!



Under-nutrition in Uganda

Under-fives

- Stunting 38.1%
- Underweight 15.9%
- Wasting 4%
- 60% deaths directly/indirectly due to malnutrition

Other nutritionally vulnerable:

- Women of reproductive age
- People Living with HIV/AIDS
- The elderly




Long term effects of mal-nutrition

- Undernourished children => obese adults, tend to develop NCDs at an earlier age and in more severe form
- Overweight and obese children => obese adults => more likely to develop NCDs like diabetes and CVDs at a younger age
- Raised BMI increases the risks of cancer of the breast, prostate, colon, kidney, endometrium & gallbladder
- Chronic overweight & obesity contribute significantly to osteoarthritis, a major cause of disability in adults
- Being overweight increases the risk of heart attacks &



Trends affecting dietary habits

- Working mothers with limited time to prepare foods – need for **convenient foods**
- Available convenient foods are high in fat & sugars, low in fibre & low in micronutrients
 - (cited by WHO as one of the factors leading to increased obesity in Africa)



What can we do to prevent mal-nutrition?

CAUSES

- Un-healthy/un-balanced diets, physical inactivity

PREVENTION

- Healthy dietary habits (eating wholesome foods)

- Promote the **availability and accessibility** of healthy foods

愬 (Tasty, convenient, affordable)



R&D into convenient, nutritious foods

- Goals:

- Nutrient enhancement

- ☙ Increased digestibility & bio-availability of micronutrients

- ☙ Reduction in anti-nutrients

- Convenience

- ☙ Reduced preparation time

- ☙ Packaging to suit variety of uses/users

- ☙ individual/institutions/school-going children/family

- Using locally available foods

- ☙ Affordable (compared to similar imports)

- Highly acceptable foods – mouth-wateringly tasty!



- Dietary diversification

- Including nutritious neglected or marginalized Foods – the case of *Amaranthus sp.* grain

Consumption of grain amaranth



Grain amaranth plants



Freshly harvested Grain amaranth



History of GA in Uganda

- Grown & consumed in 2 Districts in Eastern Uganda in 2006
- Currently grown and consumed in at least 10 Districts around Uganda
- Considered a food/nutrition security crop
- Gaining popularity as a livelihoods crop (processing & value-added products)

Community-demanded R&D (2005/2006)



AMARANTH RESEARCH FOCUS



Activities

- Research Grants: IUCEA, Nestlé Foundation, McKnight Foundation, CSRL/ISU
- Community-based, participatory Research
- Human capacity building (Graduate students)
- Publications


Why Grain amaranth

- Consumption of grain amaranth is reported to have nutritional and health benefits
 - General improvement in well-being
 - Prevention and improvement of specific ailments & symptoms of:
 - ☞ severe malnutrition - increase in BMI of people formerly wasted by HIV/AIDS
 - ☞ Improved appetite, fast healing of mouth sores and herpes zoster, and weight gain for PLWHAs
 - Higher milk production for breast feeding mothers



Grain amaranth & diet-related NCDs


- Animal studies: Amaranth oil => lower total serum triglycerides and low density lipoproteins (LDLs) - associated with CVDs
 - The serum LDL lowering effect attributed to tocotrienols (unsaturated forms of vitamin E) and squalene in amaranth oil
 - Affect cholesterol biosynthesis in humans
- Squalene & tocotrienols - believed to have anti-oxidative activity



10 Reasons to consume G. Amaranth

Amaranth = "everlasting" (Greek)

1. High in protein – important for growth, body building and repair
2. Amaranth protein is well balanced in essential amino acids – similar to milk
3. The proteins in amaranth (albumins and globulins) are highly digestible.
4. Amaranth has a high calcium – important for teeth and bone strength
5. Amaranth is high in iron – important for preventing anaemia
6. Amaranth is high in fibre –lowers body cholesterol & prevents colon cancer.
7. Amaranth is lower in carbohydrate than other grains – good for weight control
8. Amaranth is low in fat and is a good source of polyunsaturated fatty acids – important for preventing heart diseases
9. Amaranth is high in anti-oxidants such as vitamin E (in similar amounts to olive oil) – for heart health, anti-cancer and anti-ageing
10. Consumption of grain amaranth improves glucose & lipid metabolism – beneficial to diabetics



Nutrition & Health benefits of grain amaranth are explainable by its nutritional characteristics

Grain amaranth can contribute to nutritional needs of

VU

Nutrient	%	
	White amaranth	Golden amaranth
Protein	12.37	13.04
Carbohydrate	63	63.4
Lipid	6.89	7.29
Fiber	6.33	7.01
Ash	2.85	3.60

- Higher protein content than other cereals
- Superior protein quality (High in essential amino acids)
- High in essential fatty acids

High Protein Quality of GA

Amino Acid	Content (g/100 g protein)				FAO/WHO Reference
	White amaranth	Golden amaranth	Maize	Beans	
ASPARTIC ACID	7.929	7.492	7.48	10.61	
GLUTAMIC ACID	19.248	19.720	18.37	13.29	
SERINE	6.462	6.090	4.51	4.85	
GLYCINE	8.983	8.700	3.85	3.3	
HISTIDINE	3.346	2.997	5.5	2.28	
ARGININE	9.853	10.295	5.5	4.99	
THREONINE*	2.291	2.030	3.63	4.01	4.0
ALANINE	4.216	4.447	5.72	3.75	
PROLINE	4.812	4.833	6.49	3.25	
TYROSINE	3.941	4.108	4.07	2.94	
VALINE*	4.812	4.785	4.51	5.41	5.0
METHIONINE*	2.200	2.513	1.76	1.04	3.5
CYSTEINE	0.275	0.193	2.31	0.09	
ISOLEUCINE*	4.491	4.350	4.29	4.06	4.0
LEUCINE*	6.279	6.187	13.75	7.1	7.0
PHENYLALANINE*	4.629	4.592	3.63	4.96	6.0
LYSINE*	6.233	6.670	3.41	5.87	5.4

*Essential amino acids

Essential Fatty acid composition of GA

Fatty acid	Content (mg/g)	
	White	Golden
Palmitic acid	1.92	2.31
Stearic acid	0.17	0.21
Oleic acid	2.19	1.92
Linoleic acid	2.8	2.41

- 6.9-7.4% oil
- Oil was made up predominantly of unsaturated fatty acids
- High levels of the essential fatty acid
- linoleic acid

Micronutrient composition of Grain amaranth

Nutrient	Content (mg/g)
Iron	17.4
Zinc	3.7
Sodium	31
Potassium	290
Calcium	175
Vitamin C	4.5
Niacin	1.45
Riboflavin	0.23
Thiamine	0.1

High in micronutrients

Amaranth grain production and value addition for improved livelihoods in the Lake Victoria Basin (LVB)

First Research Project

supported by Sida and VicRes (2007)





Research aim & Objectives

Increase GA production & utilization by HH in the LVB for improved livelihoods

Specific objectives:

1. Determine current KAPs related to GA production and utilization
2. Determine optimum agronomic conditions and cultural practices for production of GA in the LVB
3. Compare return on investment of GA production to common substitute crops
4. Develop protocols for use of GA in nutrient-dense, value-added, shelf-stable food products

PROMOTING PRODUCTION AND UTILIZATION OF GRAIN AMARANTH FOR IMPROVED NUTRITION IN UGANDA



THE McKNIGHT FOUNDATION

John H. Muyonga, Michael Ugen, Jenipher bisikwa, dorothy nakimbugwe, dorothy masinde, AbduMalik Muyinda and julius wambete

OBJECTIVES

- Identify agro-ecological zones with high potential for grain amaranth production in Uganda
- Determine optimum growing conditions and practices for grain amaranth production in Uganda
- Develop processing recipes and protocols for acceptable and nutritious products from grain amaranth
- Promote production, utilization and marketing of grain amaranth in Uganda
- Assess the effect of promoting grain amaranth production, processing and consumption on nutritional status, food security and income of participating communities.

Outputs & Outcomes


- A growing body of scientific knowledge and expertise on grain amaranth
 - Agronomy Manual & leaflet for production of GA in Eastern Africa
- Nation-wide popularization of GA
- Scientific publications
- Amaranth products in all leading supermarkets in Kampala
- More product development research (a Ready-to-Use Therapeutic Food (RUTF

Publications/Manuscripts




EFFORTS TO PROMOTE AMARANTH PRODUCTION AND CONSUMPTION IN UGANDA TO FIGHT

- **Chapter 8** Using Food Science and Technology to Improve Nutrition and Promote National Development



Effect of Inorganic and Organic Fertilizers on the Performance and Profitability of Grain Amaranth (*Amaranthus caudatus*, L.) in western Kenya

Journal of Agricultural Sciences, No. 1, Amaranthus September, 2011

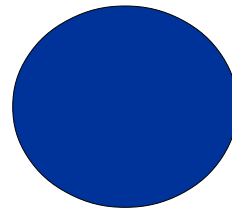
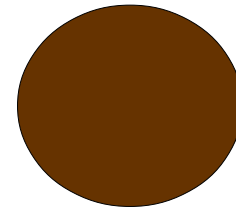
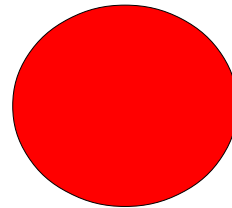
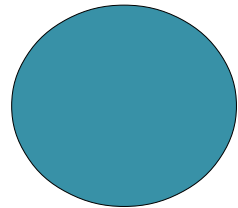
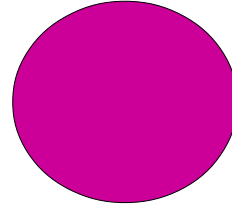


Economic Evaluation of Grain Amaranth production in Kamuli District, Uganda

Journal of Agricultural Science and
Technology

Authors: MUGISHA Johnny, KWIKIRIZA
Norman, AINEBYONA Roland,
NAKIMBUGWE Dorothy, MASINDE M.
Dorothy & NYANKANGA O. Richard

Public-private partnerships – from research to commercialization



Making nutritious foods more readily available helps consumer choices



Pure grain amaranth flour



- High in protein (12-13%)
- High quality protein & well balanced high lysine, deficient in most grains
- Has x2 the level of calcium in milk, x5 the level of iron in wheat, high in potassium and vit. A, E, C and folic acid
- Low in fat (7%) predominantly poly-unsaturated fatty acids, high essential linoleic fatty acid
- Suitable for: vulnerable individuals who need extra essential nutrients

Bean-amaranth composite flour- for sauce/porridge



- High protein, energy, vitamins & minerals
- Low fat & high fibre
- High phytochemicals (anti-oxidants)
- Rich in lignans - role in preventing osteoporosis
- May help reduce blood cholesterol levels
 - plant phytosterols in dry beans

Amaranth-based composite flour for porridge



- Has amaranth, millet and soy flour
- Has all the nutritional & health benefits amaranth
- Higher protein from soybeans
- High B-complex

The amaranth health bar



- From popped GA
 - Carry the nutritional benefits of G. amaranth
- Also have nutritional benefits of groundnuts
- High energy from honey and sugar
- Valuable snacks

Flexible packaging

Various pack sizes – flexible use & budgets

- Family Packs

- Nutrient-enhanced cookies
- Healthy Bars
- Flours

- School Packs: Cookies & Health Bars

- 25 Individually wrapped health bars
- 30 packs of 4's (1 serving) convenient to pack in school/work snack boxes

- Customized institutional packs – all products



Consumer awareness; media role

- New vision
- The Daily Monitor
- The East African Business Week
 - Bukedde TV
 - WBS
 - NTV
- Hospitals and health centers
- Sales outlets – supermarkets
- Exhibitions
- Online (Website, Facebook, Twitter)

High public interest



Nutritious products for school feeding



Kampala kids face high obesity risk

New Vision – Uganda

Tuesday, 17th
May, 2011



<http://www.newvision.co.ug/D/9/37/744105>

Nutreal staff serving Nutreal
cookies to school pupils

Food & Nutrition security/incomes for rural farmers



Grain amaranth: A hope for nutrition problems in Uganda

New Vision
– Uganda's
leading Daily

Tuesday, 27th
March, 2007



A farmer in Kamuli stands beside her

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She made it despite being physically-handicapped

New Vision –
Uganda's leading
daily

Tuesday, 16th
August, 2011

<http://www.newvision.co.ug/D/9/756/76280>



**Sara Sandra Oguti in
her amaranth grain
garden**

F:\PRESENTATIONS\She made it despite being physically.doc

Amaranth farmers enjoy Nutreal products (Background: amaranth field)





- Thanks for your attention!