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Trees for improved nutrition

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I. Introduction

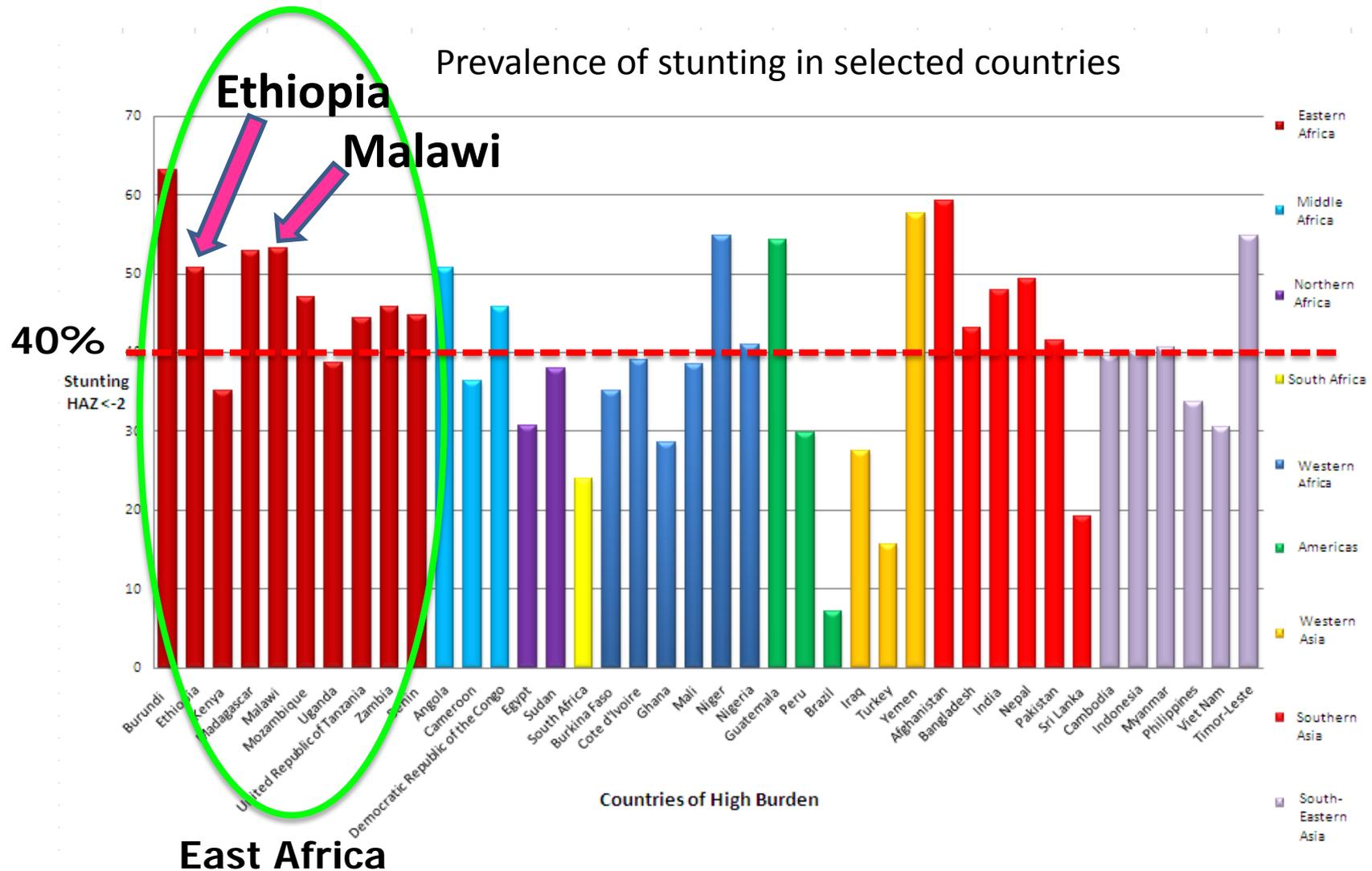
- Forests, agroforests and trees have important roles in food provision, but their values are often neglected in development and policies.

Products and services from trees:

- Food production: Fruits and nuts, leaves and seeds for vegetables, spice and as staple food
- Income generation: surplus of subsistence production, cultivation of cash crops, collection of products from the wild
- Service functions: soil fertility, microclimate, pollination

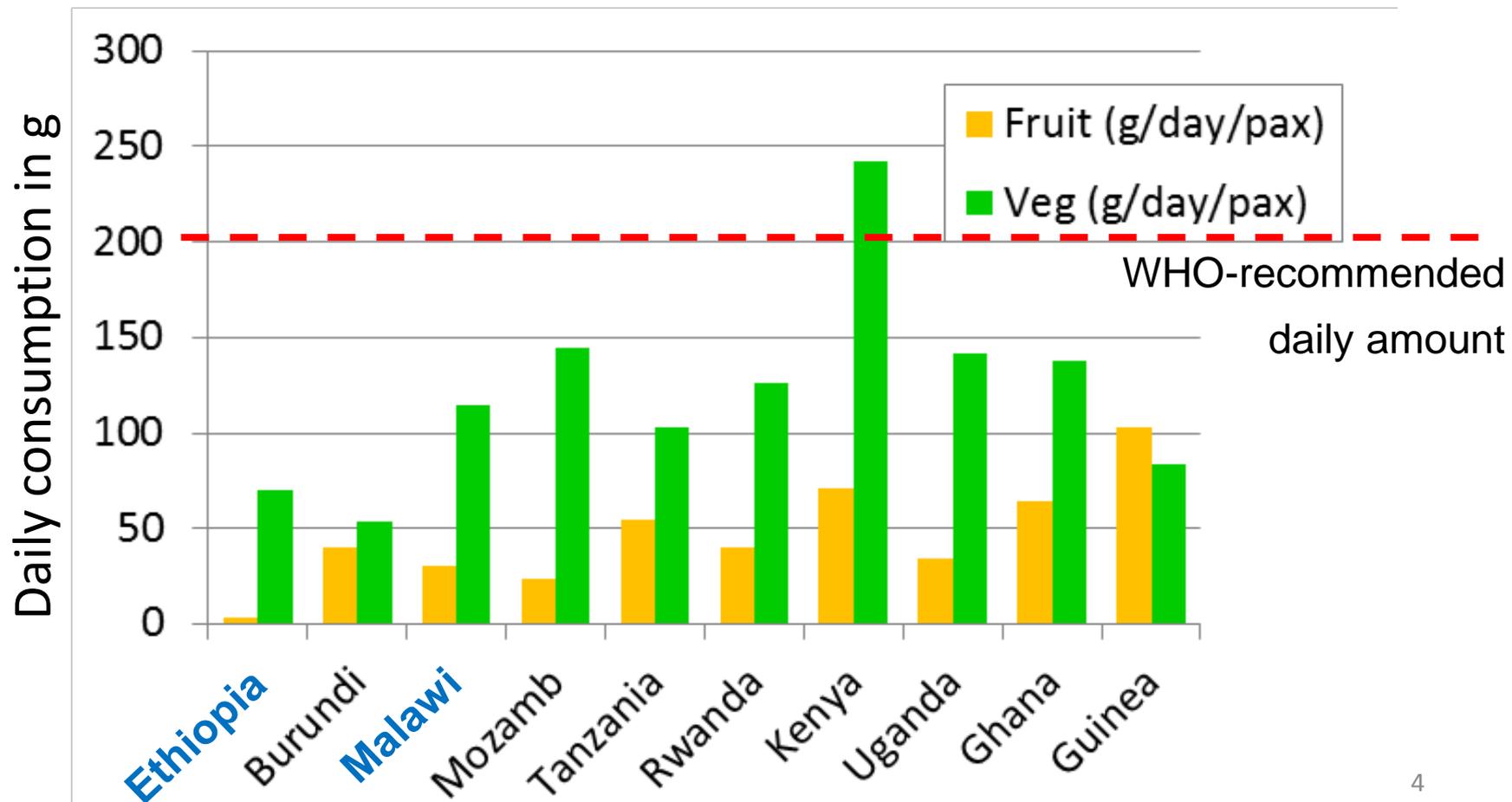


Burden of malnutrition: Stunting rates



Consumption of fruits and veggies

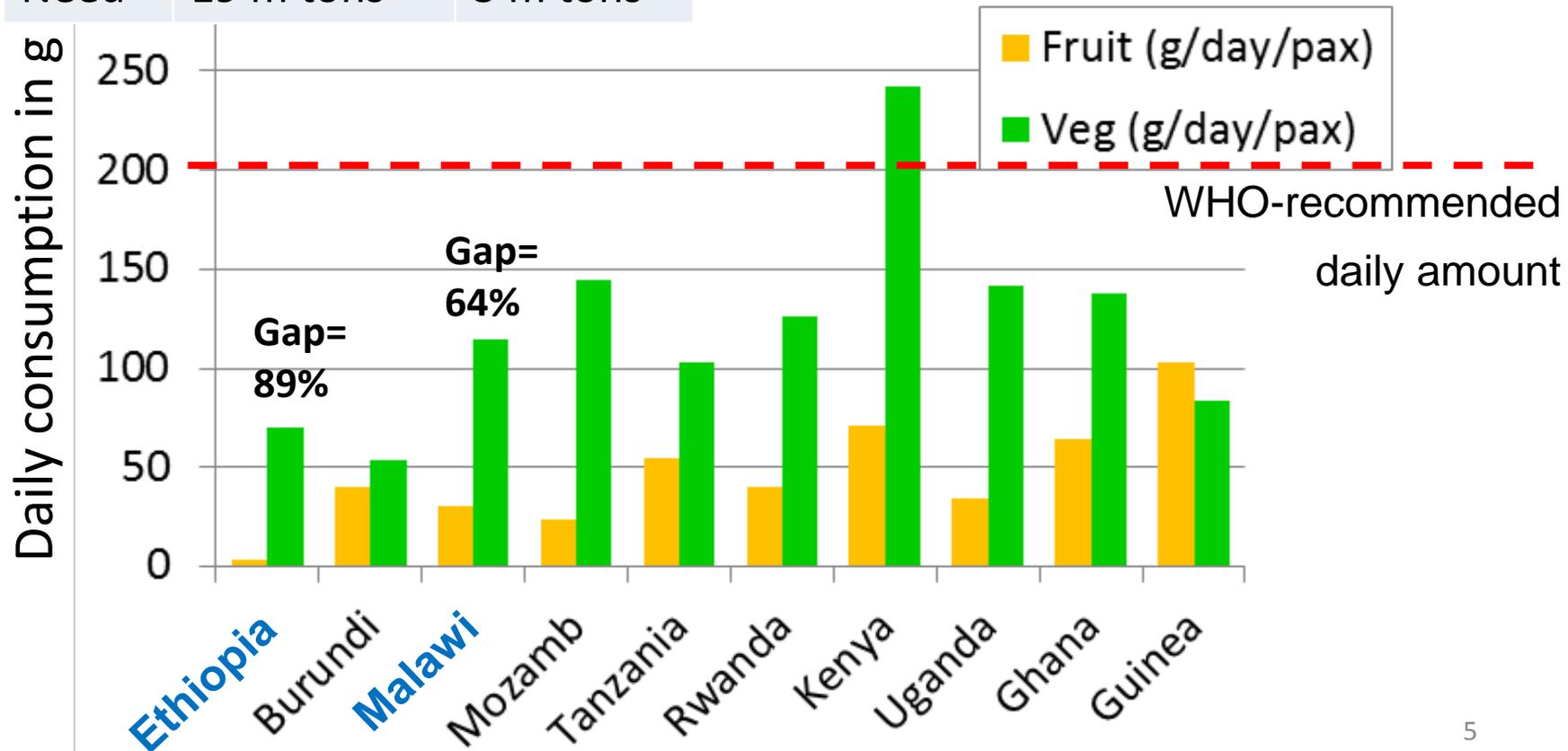
- Example from 10 countries of sub-Saharan Africa (Ruel et al. 2005)



Supply-demand ratios for fruits and veggies

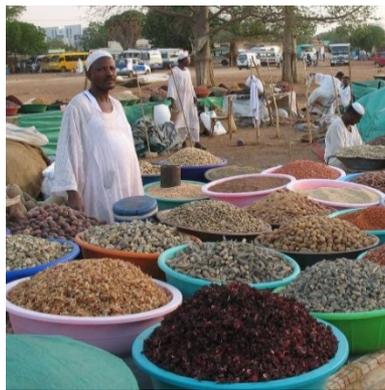
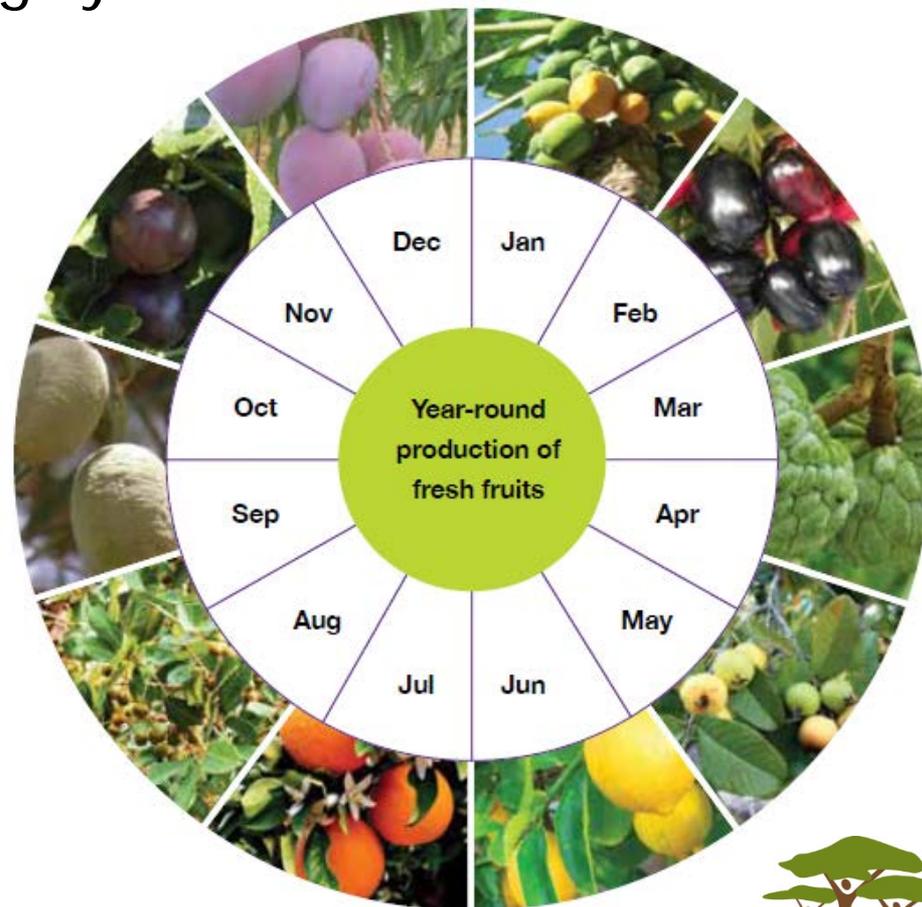
(Siegel et al. 2005. Do we produce enough fruits and vegetables to meet global health need?)

	Ethiopia	Malawi
Supply	2 m tons	1 m ton
Need	19 m tons	3 m tons



II. Examples, case 1: Fruit tree portfolios

- Set of fruit tree species with different harvest seasons to be integrated into farming systems.
- Year-round fresh fruit availability supports dietary diversity of farmer families.
- Potentially income source to communities year-round.



Further information:

<http://blog.worldagroforestry.org/index.php/2015/08/04/first-fruit-tree-portfolios-established-in-kenya-in-a-novel-approach-to-improve-year-round-nutrition/>

Importance of tree products for F & N security

- Tree products provide an easily available source of micronutrients



Table 1: Nutrient contents of selected tree products.

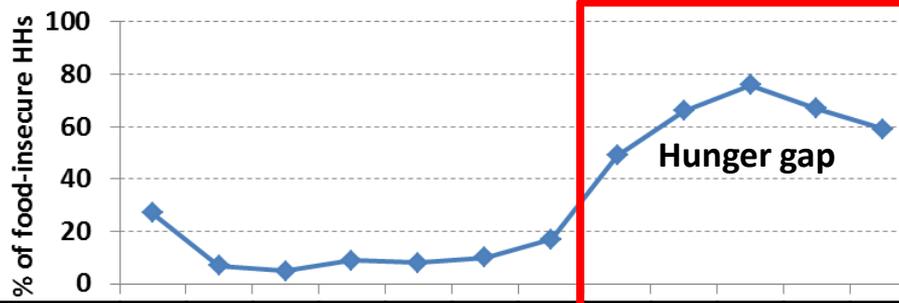
Species	Vit C (mg/100 g)	Vit A (RE) (mg/100 g)	Iron (mg/100 g)	Calcium (mg/100 g)
<i>Adansonia digitata</i>	150-500	0.03-0.06	1.7	360
<i>Grewia tenax</i>	N.A.	N.A.	7.4	610
<i>Tamarindus indica</i>	3-9	0.01-0.06	0.7	260
<i>Ziziphus mauritiana</i>	70-165	0.07	1.0	40
Mango	28	0.04-0.4	0.1	10
Orange	51	0.07	0.2	54
Moringa leaves	164	0.74	6.1	434

Sources: Freedman (1998) Famine foods. <http://www.hort.purdue.edu/newcrop/FamineFoods/>; Fruits for the Future Series, ICUC; Fineli (<http://www.fineli.fi/>), etc.



Year-round fruit diversity for nutrition

Machakos baseline data (ICRAF 2014, EC Fruit Project, 300 households, 4 Focus Group Discussions)



➔ Ripe fruits available year-round

English name	Species name	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tickberry	<i>Lantana camara</i>												
Pawpaw	<i>Carica papaya</i>												
Mango	<i>Mangifera indica</i>												
Banana	<i>Musa x paradisiaca</i>												
Loquat	<i>Eriobotrya japonica</i>												
Mulberry	<i>Morus alba</i>												
Tamarind	<i>Tamarindus indica</i>												
Waterberry	<i>Syzygium spp.</i>												
Custard apple	<i>Annona reticulata</i>												
Guava	<i>Psidium guajava</i>												
Pomegranate	<i>Punica granatum</i>												
White sapote	<i>Casimiroa edulis</i>												
Wild medlar	<i>Vangueria madagascariensis</i>												
Lemon	<i>Citrus limon</i>												
Orange	<i>Citrus sinensis</i>												
Chocolate berry	<i>Vitex payos</i>												
Avocado	<i>Persea americana</i>												
Passionfruit	<i>Passiflora edulis</i>												
Jacket plum	<i>Pappea capensis</i>												
Desert date	<i>Balanites aegyptiaca</i>												
Bush plum	<i>Carissa edulis</i>												
	Available species	4	7	8	7	9	8	6	5	6	4	3	4



Source: K. Kehlenbeck, unpublished data

Provitamin A supply from diverse fruit trees



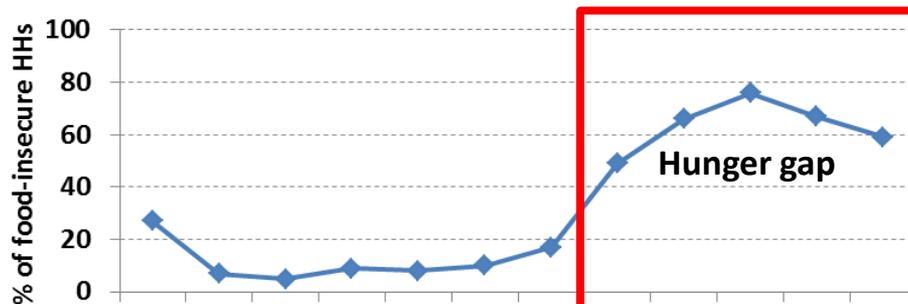
Species name	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	P.Vit A
<i>Lantana camara</i>													
<i>Carica papaya</i>													+++
<i>Mangifera indica</i>													+++
<i>Musa x paradisiaca</i>													
<i>Eriobotrya japonica</i>													+++
<i>Morus alba</i>													
<i>Tamarindus indica</i>													
<i>Syzygium spp.</i>													+++
<i>Annona reticulata</i>													
<i>Psidium guajava</i>													+
<i>Punica granatum</i>													
<i>Casimiroa edulis</i>													
<i>Vangueria madagascariensis</i>													
<i>Citrus limon</i>													
<i>Citrus sinensis</i>													
<i>Vitex payos</i>													+++
<i>Persea americana</i>													
<i>Passiflora edulis</i>													+
<i>Pappea capensis</i>													
<i>Balanites aegyptiaca</i>													
<i>Carissa edulis</i>													
Available species	2	3	4	2	3	3	2	1	1	1	2	2	

➔ Provitamin A-rich fruits available year-round



Source: K. Kehlenbeck, unpublished data

Vitamin C supply from diverse fruit trees



Species name	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Vit C
<i>Lantana camara</i>													
<i>Carica papaya</i>													+
<i>Mangifera indica</i>													+
<i>Musa x paradisiaca</i>													
<i>Eriobotrya japonica</i>													
<i>Morus alba</i>													(+)
<i>Tamarindus indica</i>													
<i>Syzygium spp.</i>													
<i>Annona reticulata</i>													(+)
<i>Psidium guajava</i>													+++
<i>Punica granatum</i>													
<i>Casimiroa edulis</i>													(+)
<i>Vangueria madagascariensis</i>													
<i>Citrus limon</i>													+
<i>Citrus sinensis</i>													+
<i>Vitex payos</i>													
<i>Persea americana</i>													
<i>Passiflora edulis</i>													
<i>Pappea capensis</i>													
<i>Balanites aegyptiaca</i>													(+)
<i>Carissa edulis</i>													
Available species	2	3	5	4	4	4	2	1	2	1	1	2	

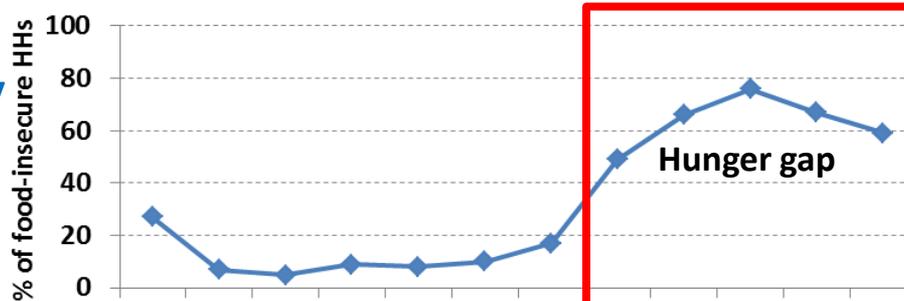
➔ Vitamin C-rich fruits available year-round



Source: K. Kehlenbeck, unpublished data

Fruit tree portfolio for vitamin supply

➔ (Pro)vitamin A and C supply possible year-round



➔ Cultivation of 8-13 fruit tree species on each farm

English name	Species name	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Vit C	Vit A
Tickberry	<i>Lantana camara</i>														
Pawpaw	<i>Carica papaya</i>													+	+++
Mango	<i>Mangifera indica</i>													+	+++
Banana	<i>Musa x paradisiaca</i>														
Loquat	<i>Eriobotrya japonica</i>														+++
Mulberry	<i>Morus alba</i>													(+)	
Tamarind	<i>Tamarindus indica</i>														
Waterberry	<i>Syzygium spp.</i>														+++
Custard apple	<i>Annona reticulata</i>													(+)	
Guava	<i>Psidium guajava</i>													+++	+
Pomegranate	<i>Punica granatum</i>														
White sapote	<i>Casimiroa edulis</i>													(+)	
Wild medlar	<i>Vangueria madagascariensis</i>														
Lemon	<i>Citrus limon</i>													+	
Orange	<i>Citrus sinensis</i>													+	
Chocolate berry	<i>Vitex payos</i>														+++
Avocado	<i>Persea americana</i>														
Passionfruit	<i>Passiflora edulis</i>														+
Jacket plum	<i>Pappea capensis</i>														
Desert date	<i>Balanites aegyptiaca</i>													(+)	
Bush plum	<i>Carissa edulis</i>														
	Available species	2	4	6	4	4	5	4	2	3	1	2	2		



Source:
K. Kehlenbeck,
unpublished
data

Case 2: Nutrient-sensitive processing

- Reducing post-harvest losses and extending shelf life of fruits
- Reducing the impact of seasonal food and nutrition insecurity
- Developing enterprise potential and livelihood diversification opportunities for income generation, particularly for women and the youth



Baobab yoghurt



Mango fruit leather

- Increase consumption of healthy fruit products
- Develop novel products and integrate farming communities into markets

- Focus on nutrient-maintaining and locally suitable technologies for processing of nutritious fruit products (cooperation with JKUAT University, Kenya)

Case 3: the BAOFOOD project

by decision of the
German Bundestag

“Enhancing local food security and nutrition through promoting the use of Baobab (*Adansonia digitata* L.) in rural communities in Eastern Africa”



The BAOFOOD project aims to promote market development, processing and local consumption of baobab to improve food security, nutrition and rural livelihoods

Duration 2016-19 (3 years); led by Rhine-Waal University in collaboration with research institutions, NGOs and industry in Germany, Kenya, Sudan, Malawi and the UK; study areas in Kenya, Sudan, Malawi



Thank you!