

Nutritious leafy vegetables for atolls

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Alarming NCD rates

- Pre 1940s: traditional lifestyle
 - Minimal diabetes, heart disease, etc
- Post 1940s: changes in diet, work, exercise
- Since 1960s: high incidence/prevalence of obesity, diabetes, heart disease
- Need for a substantial return to traditional/healthy diet (60%+) and more exercise
- Important roles for nutritious leafy vegetables and education (food system strategy)

Objective 2

Increase household and community production of local nutritious foods

Research:

- GxE studies of leaf minerals to identify most nutritious leafy food plants
 - Locations: South Tarawa, Funafuti and Outer Islands of Kiribati (Abemama, Tabiteuea North, Nonouti, Beru)
 - Babai/pulaka food garden concept
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- Education/training/extension:
 - Farmer field schools, community workshops, school talks (with IFAD), publicity via media
 - Production, nutrition, awareness, cooking, preservation

Nutritional value of leaves >> roots

Example: cassava

	Carotenoids			Minerals		Protein
	mg/kg dry weight					%
	<u>lutein</u>	<u>zeaxanthin</u>	<u>b-carot</u>	<u>Fe</u>	<u>Zn</u>	
Root	0	0	0	5	6	2
Leaf	450	50	350	40	100	23

Leaves valuable but under-researched and underused

Tough for plants

Atoll food crops must
tolerate drought, salt
& high soil pH (ie 9)

Hedge panax
(*Polyscias*): healthy



Cassava (*Manihot
esculenta*):
deficient in Fe, K, P, N



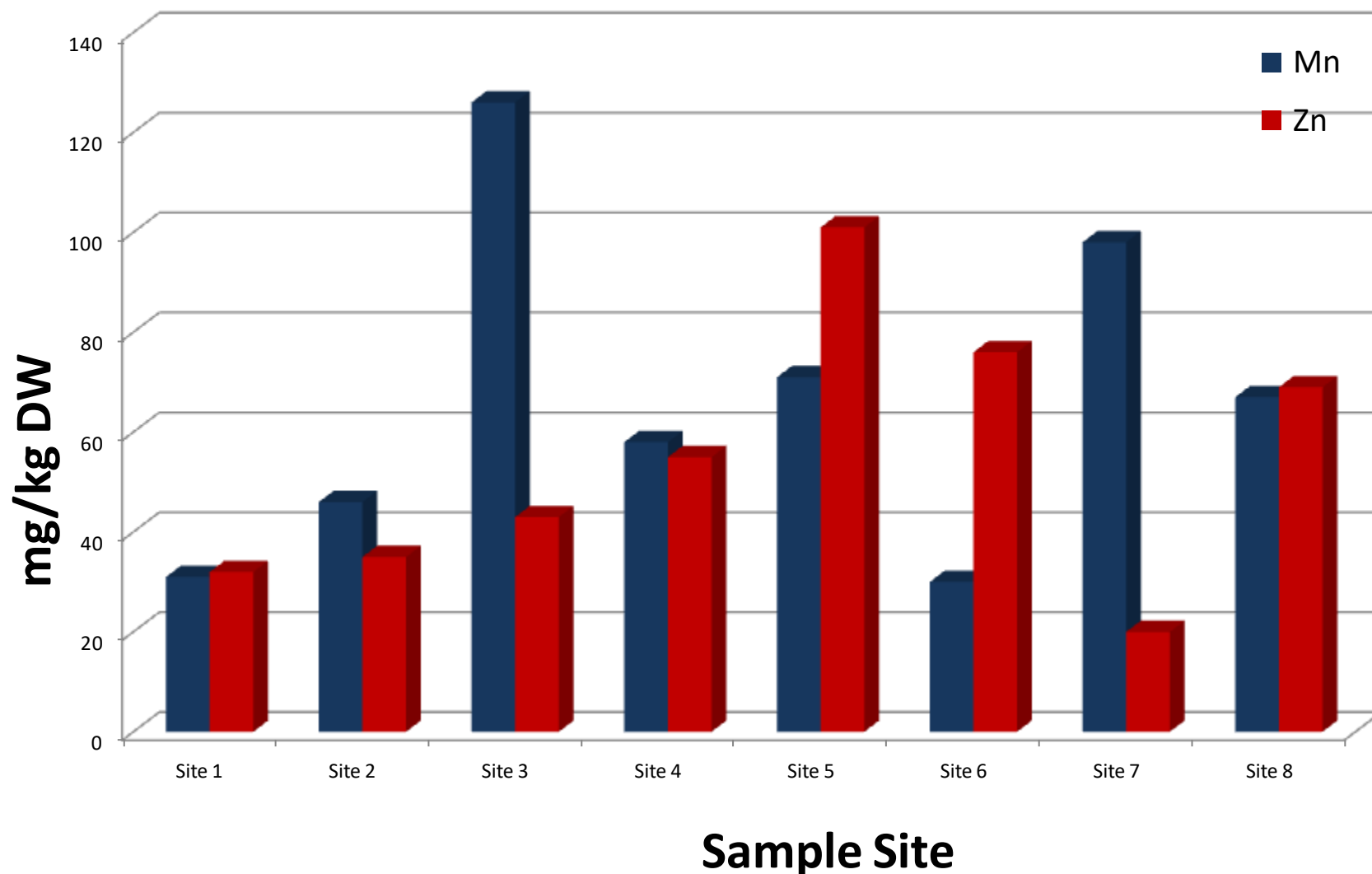
Pulaka pit, Funafuti, Tuvalu





Nutrients: Genotype X Environment

Abelmoschus manihot (aibika) Mn & Zn



Leaf nutrients: Genotype (species) effect

Species	Mineral nutrient				
	N	Mg	Fe	Zn	Se
	%	ppm	ppm	ppm	ppb
Hedge panax	2.6	6700	33	71	25
Chaya	5.1	6500	76	42	16
Beach cowpea	4.0	3600	67	46	35
Ofenga	3.0	17200	45	62	35
Drumstick	5.3	8000	52	41	510
Purslane	3.3	22000	70	103	33

Location: By Funafuti airstrip, Tuvalu

Best mineral accumulators

Iron: Purslane, beach pea, pumpkin, kangkong

Zinc: Purslane, cassava, pumpkin, hedge panax

Sulphur: Drumstick, chilli, sweetpotato

Magnesium: Purslane, ofenga

Calcium: Chilli, bele, ofenga, hedge panax

Selenium: Drumstick

Copper: Tree lettuce, pumpkin, chilli, ofenga

Potassium: Pumpkin, birdsnest fern, taro, kangkong

Nitrogen/protein: Pumpkin, Chaya, cassava, drumstick

Best all-rounders: Pumpkin, purslane, chilli

Tackling NCDs from the ground up: Nutritious leafy vegetables to improve nutrition security on Pacific atolls

Amaranth

Chaya

Drumstick

Hedge panax

Ofenga

Yellow beach pea

Kangkong

Pumpkin & choko

Bele

Chilli

Purslane

www.thewaite.org/helping-the-pacific-to-eat-its-greens/

Chaya (*Cnidoscolus aconitifolius*), high in protein, carotenoids, Fe, Ca



Drumstick (*Moringa oleifera*): high vit A, protein, Se, S, Ca



Purslane (*Portulaca*): high Mg, Zn, Fe, K



Ofenga (*Pseuderanthemum*): high Mg, Ca, lutein



Hedge panax (*Polyscias*): high Zn, Ca



Bele (*Abelmoschus manihot*): high Ca, protein, vit A



Kangkong (*Ipomoea aquatica*): high Fe, protein, lutein



Te mota (*Amaranthus*): high protein, Mg, Ca, Zn, K, carotenoids



***Asplenium*, “bird’s nest fern”, Tuvalu: high K, B**



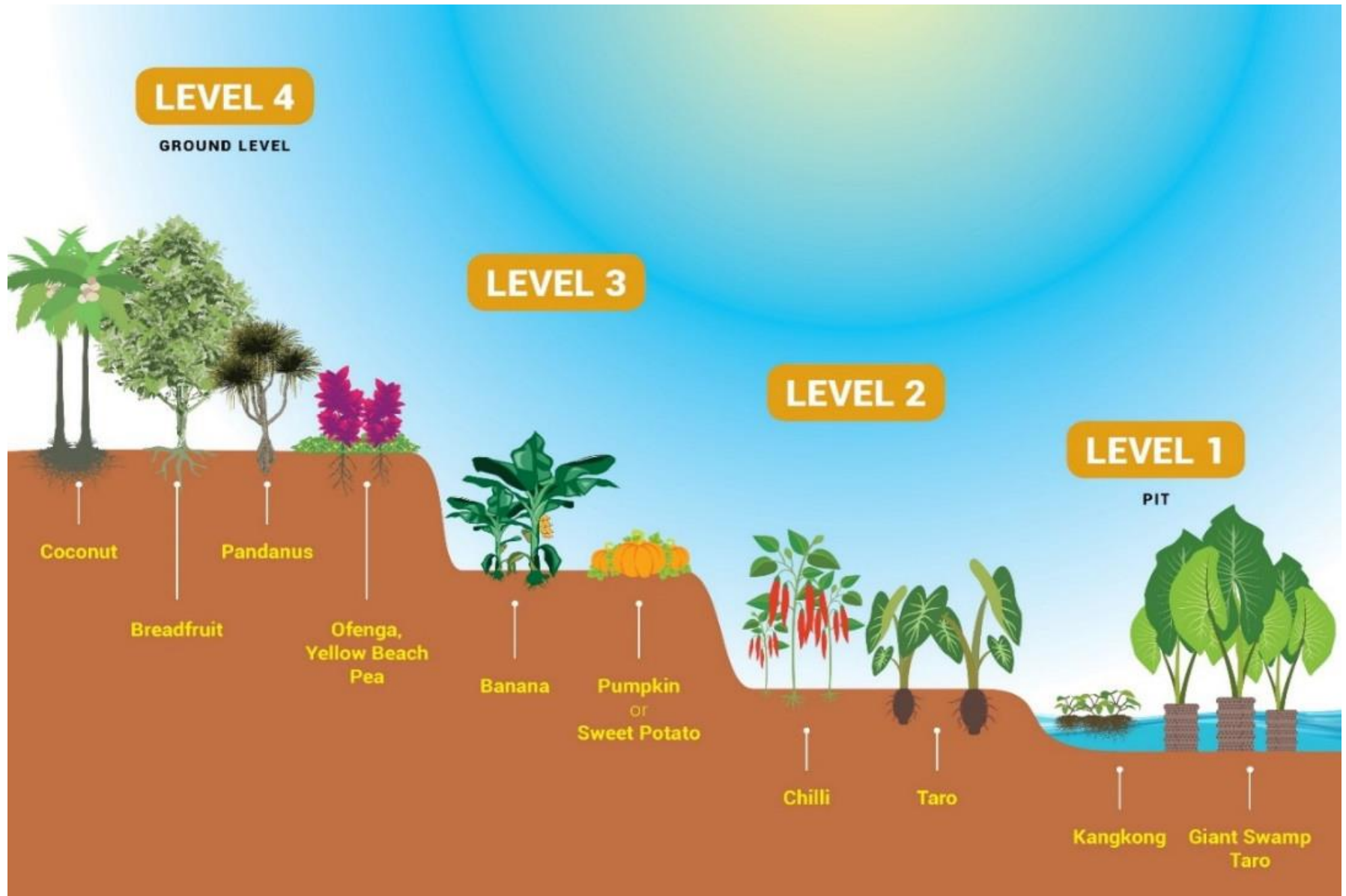
Yellow beach pea (*Vigna marina*): high protein, Fe, Zn



Yellow beach pea root with N-fixing nodules



Babai/pulaka food garden



Before: abandoned babai pit



During development



Babai/pulaka food garden



Awareness: Routan at KGV School, Tarawa 2018



AA Eera Tiira and principal at Abamakoro School, Nonouti 2019



Publications

- How food gardens based on traditional practice can improve health in the Pacific. *The Conversation* 24/5/2017
- Tackling NCDs from the ground up: Nutritious leafy vegetables to improve nutrition security on Pacific atolls. Series of 13 factsheets launched in June 2018, translated into Kiribati and Tuvalu languages
- Leafy green crops to improve diets on Pacific Islands. *Bulletin of the World Health Organization* 2018; 96: 595-596
- Natural plant biofortifiers could improve nutrition and reduce NCDs on atolls. *Plants* 2020; 9: 942-956
- This project is the source for 15 of the top 20 sites listed using a Google search of *Pacific atolls nutritious leafy vegetables*

Summary

- **Leafy vegetables for atolls**
 - Wide variety
 - Well adapted
 - Nutritious, taste good
 - Medicinal properties
- **Ongoing importance**
 - Reliable supply of planting material
 - Sustainable, conservation agriculture
 - Awareness activity:
 - agriculture/nutrition/health education; fact sheet promotion; develop more babai/pulaka food gardens



Carotenoids

Species	Carotenoid (mg/kg DW)		
	<u>b-carotene</u>	<u>a-carotene</u>	<u>lutein</u>
Drumstick	427	0	773
Aibika	356	38	1024
Sweetleaf	289	32	773
English cabbage	0	2	5

Mean levels for samples collected on Guadalcanal: top
3 compared with lowest

Drumstick: a Se & S accumulator

Comparison of levels of Se and S in leaves of *Moringa oleifera* and other food crops grown together

Location	Selenium (ppb DW)		Sulphur (ppm DW)	
	<u>Moringa</u>	<u>Others</u>	<u>Moringa</u>	<u>Others</u>
Adelaide	785	70	9300	2550
Torres Strait	970	86	8400	2140
Solomon Islands	2000	170	12300	3130
Samoa	540	28	12400	3460
Rwanda	455	40	8500	2070
Mean	950	79	10180	2670
-fold increase	12		3.8	

Influence of pH on nutrient availability

