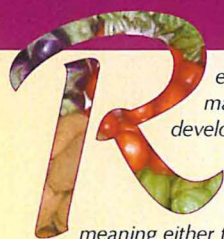


Leafy vegetables in the tropics: high nutritional and economic values as arguments to preserve their diversity and to invest in knowledge



Research and investment efforts are concentrated on a limited number of marketable species, including the most "sophisticated" vegetables from developed countries (F1 hybrids). The indigenous leafy vegetables remain, however, highly cropped and consumed in the tropics. Their natural diversity and the various sources of supply allow them to be present on the markets the all year round. They are bought fresh, regularly, meaning either they are cropped not too far from the market, or using efficient logistics. Leafy vegetables often lack of organization in their commodity chain, from the production to the marketing, and suffer from the competition with "modern" vegetables, revealing conflicts between ancient and new generations. The food transition habits of urban citizens, who consume more and more animal proteins and imported cereals, often carries diet deficiencies in vitamins, due to less fresh fruits and vegetables. Tropical leafy vegetables contain 10 to 100 fold the micro-nutrient content of lettuce, cabbage or leek. Such an argument favouring public health should be considered to restore economic and scientific interest in leafy vegetables.

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Amaranthus retroflexus L.
green (Ciba-Geigy, 1976)

The diversity in leafy vegetables in the tropics

The vegetables in Asia and Africa count about 884 and 1025 domesticated or wild species, respectively. Amongst the 275 vegetable species the most important in tropical Africa, 207 are consumed for their leaves, and 31 in addition are known and used for various other purposes, like root and tuber crops, or trees, from which leaves represent a substantial nutritional value (PROSEA, 1993; PROTA, 2004).

Nutritional value of tropical leafy vegetables

Traditional vegetables (or indigenous, in contrast to exotic vegetables in the temperate countries) are generally richer in minerals, vitamins and nutritional factors. Concentrations in iron, vitamins A and C (Table 1) are linked to health value, particularly in the countries hosting malaria and other severe immunity deficiencies.

The tropical leafy vegetables are most of the time strongly coloured, due to high concentrations in carotenoids that carry healthful anti-oxidative properties.

vegetables	Iron concentration (in µg/100 g FW)	Pro-Vit. A (in µg equivalent Retinol/100 g FW)	Concentration in Vit. C (in mg/100 g FW)
Lettuce	1,1-1,5	151-304	13-28
Cabbage	0,5-0,6	18	38-40
Pakchoy	1,1	186	35
Kangkong	3,1	793	49
Amaranth	8,7	953	66
Cabbage kanak	9,3	661	19
Nightshade	19,0	285	26
Taro (leaves)	2,7	744	90

Table 2. Concentration of β -carotene and lutein in dry leafy vegetables compared to their colour (mean \pm standard error, N=4)

Leafy vegetables	Dry matter content (in % FW)	Concentration (in µg/g DW) of β -carotène	Lutéine
Kangkong	7,8 \pm 0,2	1159 \pm 41	216 \pm 19
Roselle	10,1 \pm 0,6	1198 \pm 53	231 \pm 19
Amaranth dark green	9,6 \pm 0,2	1017 \pm 37	190 \pm 30
Amaranth green	8,8 \pm 0,2	920 \pm 22	172 \pm 14
Amaranth light green	8,5 \pm 0,6	462 \pm 21	69 \pm 7
Amaranth red	8,5 \pm 0,2	1445 \pm 54	287 \pm 18

Amongst these carotenoids, precursors of vitamin A (ex. β -carotene) and lutein, prevent from severe diseases like macular degenerating and cataract, various cancers and heart attack. The most colourful vegetables are advisable, and the darkest varieties compared to the lightest (Table 2).

The leafy vegetables are rarely single dish, but consumed as sauce or together with staple food. Such a combination has social and economic significances, and also nutritional ones: it often improves the bio-availability of the micronutrients contented in the vegetables, either through the combination of ingredients (presence of lipids especially), or due to the food preparation.

Characterizing the effect of food processing on the nutritional value of leafy vegetables

Characterizing the nutritional value of leafy vegetables is a huge task, already investigated (AVRDC in Taiwan, NRI in the UK, University of the Virgin Islands in USA). CIRAD decided to focus on the analytical protocols,

to standardize the methods (including sampling), to estimate the bio-availability of micronutrients and vitamins in leafy vegetables, and to evaluate the effect of food processing on their nutritional value: content and bio-availability of micronutrients (Table 3). The methods still need to

be addressed, due to undesired extraction micronutrient during the process and new combinations of chemical compounds.

	Before cooking		After cooking	
	b-carotene	Lutein	b-carotene	Lutein
Content (in mg/100 g DW)				
Kangkong	110 \pm 28	22 \pm 13	118 \pm 37	20 \pm 6
Amaranth green	57 \pm 18	14 \pm 7	70 \pm 5	16 \pm 1
Amaranth red	88 \pm 9	18 \pm 4	117 \pm 19	21 \pm 4
Bio-availability (in mg/100 g DW)				
Kangkong	0	0,30 \pm 0,05	0	0,10 \pm 0,07
Amaranth green	1,0 \pm 0,3	0,07 \pm 0,05	2,0 \pm 1,0	1,0 \pm 0,5
Amaranth red	2,0 \pm 0,3	1,60 \pm 0,30	2,0 \pm 0,5	2,0 \pm 0,6



Amaranthus lividus
L. red
(Ciba-Geigy, 1976)



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