

# Nutritional phenotyping and association between morphological and nutritional traits in vegetable amaranth (*Amaranthus spp.*) lines

Winnie Nyonje<sup>1</sup>, Mary Abukutsa-Onyango<sup>1</sup>, Ray-Yu Yang<sup>2,3</sup>, Anselimo Makokha<sup>1</sup>, Willis Owino<sup>1</sup>, Roland Schafleitner<sup>2\*</sup>

<sup>1</sup>Jomo Kenyatta University of Agriculture and Technology, Kenya

<sup>2</sup>World Vegetable Centre, Taiwan

<sup>3</sup>Food and Fertilizer Technology Center for the Asian and Pacific Region, Taiwan

\*Corresponding author: [roland.schafleitner@worldveg.org](mailto:roland.schafleitner@worldveg.org)

## Abstract

Amaranth (*Amaranthus spp.*) is an important leafy vegetable and grain crop which belongs to the *Amaranthaceae* family. It is a good source of nutrients and bioactive compounds, and is widely consumed in several parts of the world. However varieties of different *Amaranthus* species show great phenotypic variation and also may have different nutritional attributes. This study aimed to phenotypically characterize vegetable amaranth lines of five different species (*A. hypochondriacus*, *A. cruentus*, *A. tricolor*, *A. dubius* and *A. blitum*) by measuring morphological parameters and relating these data to the nutritional attributes of the leaves. Ten selected amaranth lines drawn from World Vegetable Center, Arusha and Taiwan were used in the study. The study involved the use of a high throughput phenotyping system to determine digital biomass, greenness, plant height and hue of the leaves using 3D scanning and correlating these data with the nutritional traits including carotenoids, flavonoids, vitamin C, minerals and oxalate contents of the various lines. The analysis of variance for both morphological traits and nutritional traits showed significant ( $P \leq 0.05$ ) difference for most traits recorded between the lines. Amaranth line 8 (*A. tricolor*) and line 10 (*A. dubius*) had highest content of most nutrients, while line 2 (*A. hypochondriacus*) and line 3 (*A. hypochondriacus*) had lowest nutrient content. Significant correlations were observed between greenness with oxalate and vitamin C contents; as well as between hues with carotenoids. We conclude that only a few morphological traits of amaranth are associated to their leaf nutrient contents.

**Keywords:** Phenotypic variations, 3D scanning, nutrients, bioactive compounds