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Nutrient composition of guava (*Psidium guajava* L.) fruits as influenced by soil nutrients

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1. Background and objective

Guava (*Psidium guajava* L.) fruit is appreciated both as a fresh fruit and an industrially processed product in the form of juices, jellies, and sweets. It is rich in sugars, minerals and vitamins, hence considered a `super fruit´ nutritionally. Fruit nutrient composition are to a larger extent a reflection of the soil mineral composition and geographic regions (1) and varies with climate (2), maturity, cultivar (3), and agricultural practices. The composition of fruits may therefore vary from region to region due to change of climatic conditions (4) and soil nutrients. Limited data exist on the mineral content of tropical fruits, especially underutilized ones such as guava in relation to these variables, hence limits their contribution to nutritional security.

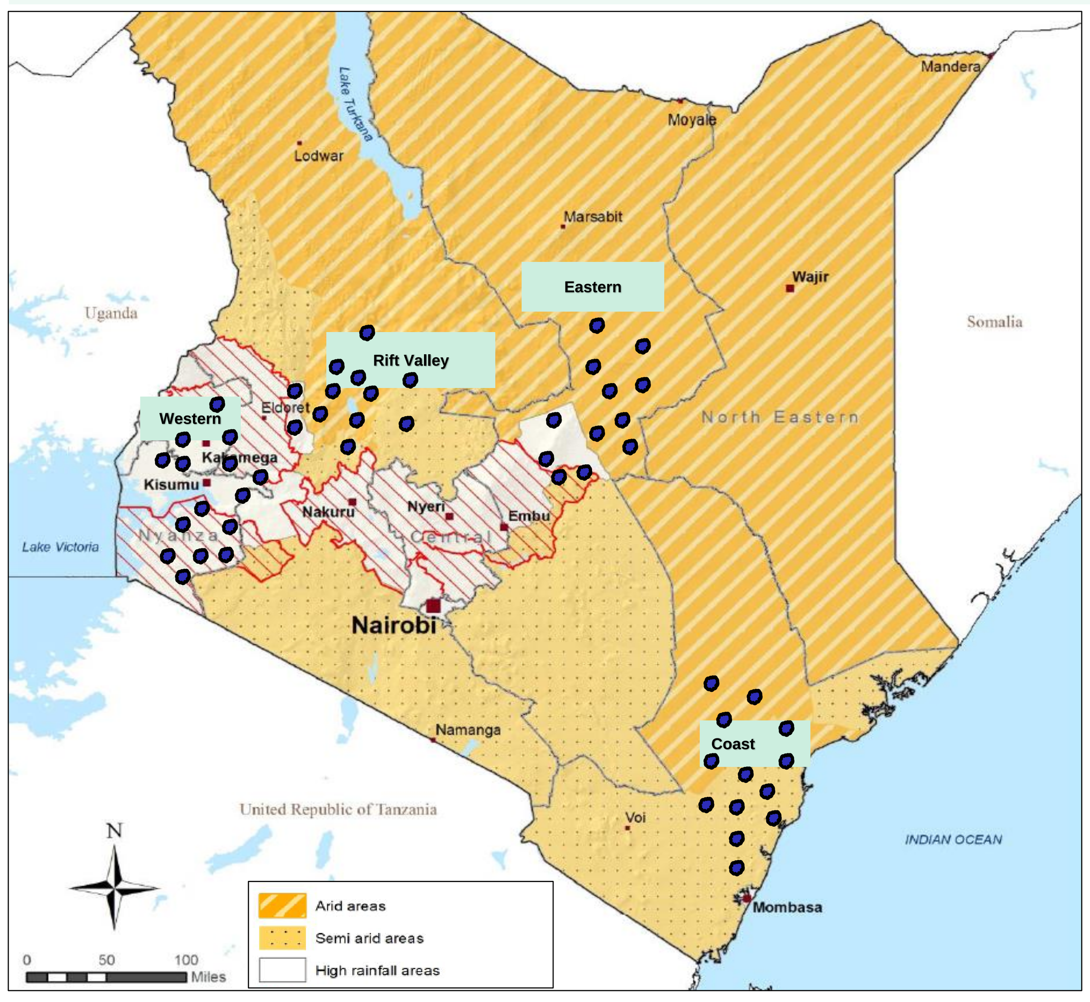
Objective: **To determine fruit composition diversity of the Kenyan guava germplasm.**

Hypothesis: Differences in the composition of guava fruits from different regions can be correlated with soil contents in these regions.

2. Methods

A. Fruit sampling and analysis

Four guava growing regions of Kenya were selected for fruit sampling.



- At least five to 20 healthy and undamaged ripe fruits were randomly picked from each tree for nutritional characterization.
- Nutritional analyses were performed on the edible portion of the fruit (skin + pulp).
- Nutritional content of fruits from 50 fruit trees were randomly selected for correlation with soils collected under their crowns.

Figure 1. Guava accessions sample collection locations (blue circles) in the four regions of Kenya (Coast, n = 36; Eastern, n =12; Rift Valley, n =19 and Western, n =61).

B. Soil sampling and analysis

- Soil was collected from two spots under the tree crown in a North and South direction from the main trunk to a depth of 30 cm.
- Soil was air-dried and sieved to 2 mm before mineral extraction.
- Extracted minerals were determined using inductively coupled plasma (ICP) atomic emissions spectroscopy.

3. Results and discussion

3. a) Results of fruit composition

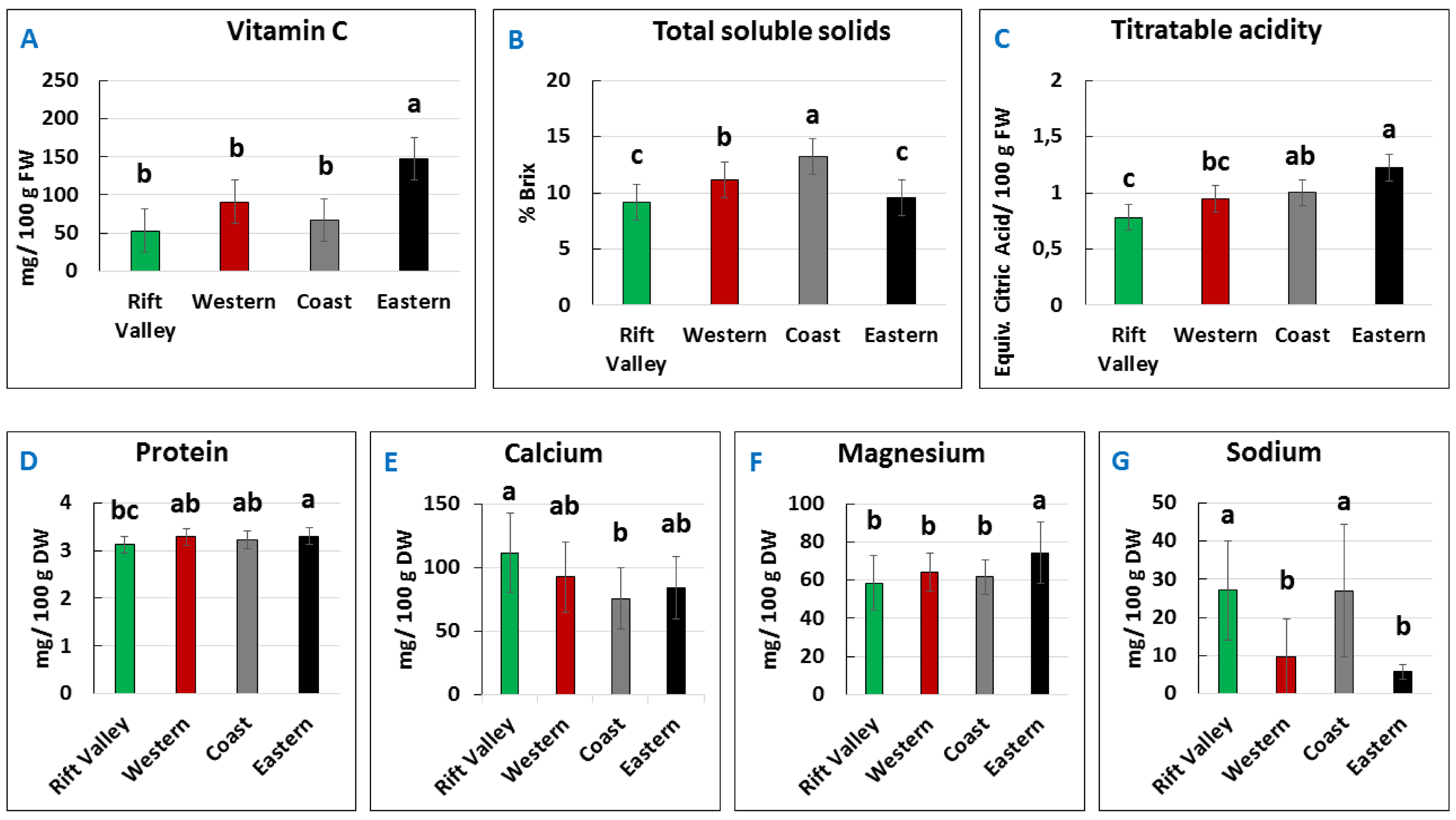


Figure 2: Composition of guava fruits **(A)** Vitamin C; **(B)** Total soluble solids (TSS); **(C)** Titratable acidity (TA); **(D)** Protein content; Mineral composition i.e. : **(E)** Calcium (Ca) **(F)** Magnesium (Mg) and **(G)** Sodium (Na) content. Bars show standard deviation from the mean and letters indicate significant differences at the 5% level by Tukey test.

There was a general variation in fruit composition traits across the regions:

- Higher vitamin C, TA, protein content values were recorded in the Eastern region followed by the Western region.
- Brix values were, however, highest at the Coast and followed by Western region.
- A similar trend of regional variation was observed with minerals Ca and Mg in which higher values were recorded in the Eastern region.
- Contrarily, Na accumulation in fruits was highest at the Coast and least in Eastern.

3. b) Results of soil mineral content and pH

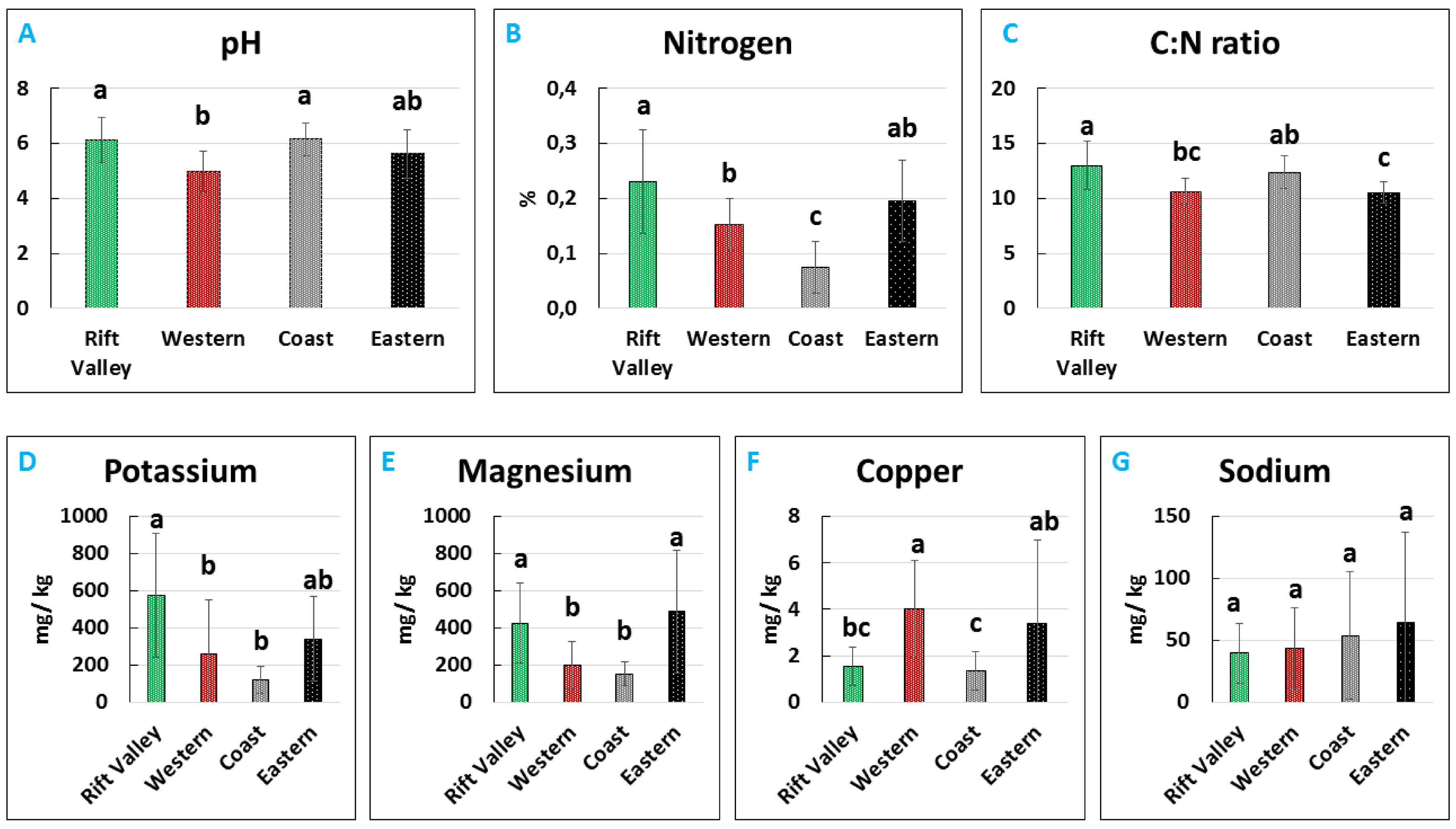


Figure 3: Soil mineral content and pH: **(A)** pH; **(B)** Nitrogen (N); **(C)** Carbon to Nitrogen ratio (C:N ratio)**; (D)** Potassium (K); **(E)** Magnesium (Mg); **(F)** Copper (Cu); and **(G)** Sodium (Na). Bars show standard deviation from the mean and letters indicate significant differences at the 5% level by Tukey test.

3. c) Correlation between soil and fruit variables

Table1. Correlation between soil and fruit traits

	Fruit traits					
Soil content	Vitamin C	TSS	Protein	Ca	Na	P
Cu	0.47**	-0.13	0.30*	-0.02	-0.38**	0.00
K	-0.17	-0.24	-0.17	0.38**	0.08	0.61**
Mg	0.15	-0.23	0.03	0.19	0.02	0.56**
N	0.04	-0.46**	-0.13	0.26	-0.05	0.55**
C	-0.03	-0.42**	-0.20	0.25	0.06	0.56**
C:N ratio	-0.30*	0.11	-0.30*	-0.01	0.49**	0.14

*Correlation is significant at p = 0.05 level.

**Correlation is significant at p = 0.01 level.

- Increasing soil Cu resulted in increased vitamin C (r = 0.47; p = 0.01) and protein (r = 0.30; p = 0.05) content of the fruits- Eastern and Western regions.
- Increasing soil C:N ratio resulted in reduction (r = -0.3; p = 0.05) in fruit vitamin C and protein - Rift Valley and Coast regions.
- High fruit Na in Rift Valley and Coast despite soil Na levels being the same across all regions. Soil pH seemed to influence.
- Positive correlation of soil K with fruit Ca observed (Rift Valley region).
- Fruit P levels increased with increasing soil N and soil Mg (p = 0.01).

Redundancy analysis (RDA) showed a linear relationship accounting for 40% constrained correlation between the soil and fruit traits (p = 0.001).

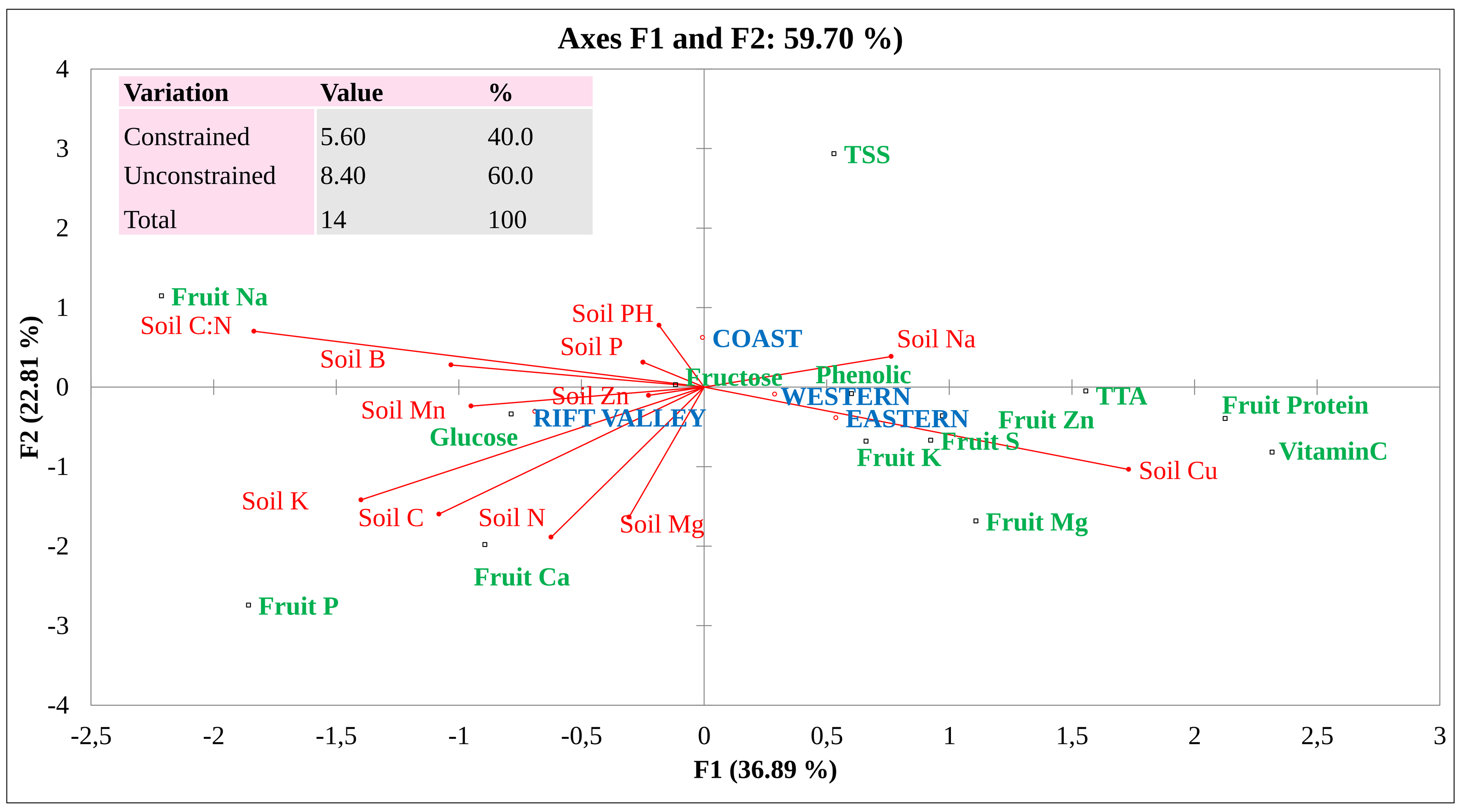


Figure 4. Triplot of RDA of the variation of guava fruit traits in relation to soil content in four region of Kenya. Blue colour= regions; Red colour= soil content; Green colour = Fruit traits.

4. Conclusions

- The studied soil traits accounted for about 40% of fruit traits- hence soil quality is important in guava fruit nutrition.
- Eastern and Western regions were synonymous with most fruit components (Figure 4).
- Soil Cu positively influenced fruit vitamin C and protein content.
- Soil N negatively influenced TSS.
- Further studies on relationship between soil Cu, soil pH, soil N and C:N ratio on fruit composition is recommended.

References

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