Journal of Horticulture and Forestry Vol. 2(2) pp. 012-016, February, 2010
Available online http://www.academicjournals.org/jhf
ISSN 2006-9782 ©2010 Academic Journals

Full Length Research Paper

Participatory characterization and evaluation of some African leafy vegetables in Lari, Kiambu West District, Central Kenya

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Accepted 30 November, 2009

Production and consumption of African leafy vegetables (ALVs) is generally low in Central Kenya, yet micronutrient and vitamin malnutrition in some parts is high particularly among young children and women in childbearing age. This work was conducted in Lari division, Kiambu West district and its objective was to participatorily characterize and evaluate selected ALVs with small-scale farmers. A total of 31 accessions of spiderplants (*Cleome gynandra*), amaranths (*Amaranthus* spp.) and African nightshades (*Solanum* spp.) were participatorily characterized by four farmer groups comprising over 80 members. The following traits were evaluated: Number of leaves per plant, leaf colour, branches/plant and organoleptic test. Most farmers preferred highly leafed and branched genotypes with dark green leaves. In organoleptic test, there was a wide variation among all accessions evaluated.

Key words: ALVs, Lari Division, participatory on-farm characterization.

INTRODUCTION

Production and consumption of ALVs is low in some parts of Central Kenya yet micronutrient malnutrition is high especially among resource poor families (Mwangi and Mumbi, 2006; Oniangó et al., 2005; Hongo, 2003). Small children and women in childbearing age are worst hit by Proteins, Calcium, Iron, vitamins A and C malnutrition yet these nutrients are richly found in ALVs (KENRIK, 2004). African leafy vegetables can provide vitamins and proteins higher than conventionally consumed exotic vegetables such as cabbage (KENRIK, 2004). African leafy vegetables such as amaranthus, nightshades, spider plants, pumpkin leaves and cassava leaves are easy to grow and can do well with minimal external inputs in these marginal areas with low rainfall and poor soils. They are more resilient to pests and diseases than exotic vegetables.

Small-scale farmers in Western Kenya produce ALVs and transport them overnight to Nairobi; almost 400 km away and still make profit. Some of the stakeholders that have been promoting production and commercialization of AVLs include Rural Outreach Programme (ROP) (Oniangó et al., 2005), Biodiversity International (formerly International Plant Genetic Resources Institute, IPGRI) (Maundu, 1997), Farm Concern International, Asian Vegetable Research and Development Center (AVRDC-World Vegetable Center, Regional Center for Africa), University of Nairobi and Maseno University among others (Mwangi and Mumbi, 2006). Public awareness campaigns have helped boost the popularity of these vegetables through radio programmes, newspapers, leaflets and trade fairs. These have assisted in highlighting the high nutritive value of ALVs (Mwangi and Mumbi, 2006; Oniangó et al., 2005).

The National Genebank of Kenya in her on-farm conservation activities has been promoting the production, consumption and marketing of ALVs in the Central Kenya region in collaboration with other stakeholders. The current work reported here is a continuation of these previous efforts and is focusing on small scale farmers in the drier parts of Lari division, Kiambu West district. The objective of the study was to participatorily characterize and evaluate selected African Leafy Vegetables with small-scale farmers in Lari Division, Kiambu West District

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Table 1. Scoring and ranking of *Amaranthus* accessions.

Accession No.	*Amaranthus* species	Organoleptic test			Leaf Number per plant			Branch number per plant			Leaf blade colour		
		Modal score	% Modal Frq	Rk	Modal score	% Modal Frq	Rk	Modal score	% Modal Frq	Rk	Modal score	% Modal Frq	Rk
034624	*A. dubius*	A	63.9	1	C	100	1	C	100	1	B	100	3
027299	*A. dubius*	A	60.7	1	C	100	1	C	100	1	D	100	1
-032045	*A. blitum*	B	59	2	A	100	3	A	100	3	C	100	2
045477	*A.* sp.	A	47.5	1	C	100	1	C	100	1	C	100	2
032001	*A. blitum*	A	57.4	1	A	100	3	A	100	3	C	100	2
045478	*A. lividus*	A	45.9	1	C	100	1	A	100	3	C	100	2
043257	*A. hybridus*	A	45.9	1	C	100	1	C	100	1	C	100	2
034673	*A.* sp.	B	63.9	2	C	100	1	C	100	1	B	100	3
032000	*A. blitum*	B	80.3	2	A	100	3	A	100	3	C	100	2
045467	*A. dubius*	B	67.2	2	C	100	1	C	100	1	D	100	1
045500	*A. graecizans*	B	60.7	2	C	100	1	B	100	2	D	100	1
032068	*A.* sp.	B	55.7	2	C	100	1	C	100	1	C	100	2
036671	*A. cruentus*	C	62.3	3	C	100	1	C	100	1	B	100	3

Rk = Rank: 1 = most preferred. Frq = Frequency
1) Leaf number per plant: A = few (0 ≤ 30 leaves/ plant); B = intermediate = (31 ≤ 60 leaves/ plant); C = many = (60 <).
2) Branch number per plant (primary and secondary) A= few (0≤5); B = intermediate = (6 ≤ 15); C = many (15 <).
3) Leaf blade colour: A = (reddish); B = (greenish red); C = (green); D = (dark green).
4) Organoleptic test: A= like most; B = like; C = dislike; D= dislike most.

with a view to promote their production, consumption and commercialization

MATERIALS AND METHODS

The project was started in January, 2006 at Kirenga location, Lari Division in Kiambu West district. Kirenga location is in Lower highland$_5$ and Upper midland$_4$ which is suitable for sunflower and maize production (Jaetzold and Schmidt, 1983). The low and erratic rainfall limits production of exotic vegetables and irrigation is rarely practiced. A mixed farming system is typical of this location although maize (*Zea mays*) remains the main staple crop. Other crops grown albeit at a lower scale include beans, potatoes and kales. Land ownership varies although generally it is less than 5 ha (Pers. Obsv.). Four farmer groups comprising not less than 80 members were involved. Farmer groups were identified with assistance from divisional agricultural extension officer. Most of these groups were involved in adult education and other community development activities besides farming. Each group had an existing administrative structure where they had a chairperson, secretary and treasurer. The existing group structures were used to avoid internal conflicts. This vegetable characterization work was carried out alongside other ongoing projects.

Thirty one vegetable accessions that had performed well in previous trials at KARI Muguga South station were selected. Seeds were planted on farmers' fields and participatory characterization was carried out using a mutually agreed characterization descriptor list. The descriptor list used was developed by the farmers, agricultural extension staff and Genebank of Kenya staff collaboratively. In each site, planting was done once during the long rains (April - May, 2006) and characterization work continued until December, 2006.

The following traits that in/directly influence vegetable yield quality and quantity were characterized:

1.) Leaves per plant. This was done at 50% terminal flowering. These were estimated as follows: A = few (0 ≤ 30 leaves/ plant); B = intermediate= (31 ≤ 60 leaves/ plant);
C = many = (60<).
2.) Number of primary and secondary branches per plant (counted at 50% terminal flowering). These were counted as follows: A= few (0 ≤ 5); B = intermediate = (6 ≤ 15); C = many (15 <).
3.) Leaf blade colour (based on Royal Horticultural Society Colour Chart, 2007).The colours were coded as shown: A = (reddish); B = (greenish red); C = (green); D = (dark green). By leaf blade colour I mean the colour of the upper leaf surface excluding the petiole.
4.) Organoleptic test. This was done at 50 % terminal flower ing. The leaves were plucked, steamed for 10 min and no

Table 2. Scoring and ranking of *Solanum* accessions.

Accession No.	*Solanum* species	Organoleptic test			Leaf No.			Branch No.			Leaf blade colour		
		Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk
045745	*S. villosum*	B	42.6	2	C	100	1	C	100	1	C	100	2
045758	*S. sp.*	A	47.5	1	C	100	1	C	100	1	C	100	2
029881	*S. villosum*	B	45.9	3	C	100	1	C	100	1	C	100	2
045767	*S. americanum*	B	60.7	2	C	100	1	C	100	1	D	100	1
045450	*S. scabrum*	B	60.7	2	C	100	1	C	100	1	C	100	2
028726	*S. villosum*	B	50.8	2	C	100	1	C	100	1	C	100	2
045743	*S. scabrum*	B	45.9	2	C	100	1	C	100	1	C	100	2
045757	*S. scabrum*	B	55.7	2	C	100	1	C	100	1	C	100	3
032230	*S. villosum*	B	54.1	2	C	100	1	C	100	1	C	100	2
043178	*S. Scabrum* (Foumbout)	D	86.9	4	C	100	1	B	100	2	D	100	1

Rk = Rank: 1 = most preferred. Frq = Frequency.
1) Leaf number per plant: A = few (0 ≤ 30 leaves/ plant); B =intermediate = (31≤60 leaves/ plant); C = many = (60 <).
2) Branch number per plant (primary and secondary) A= few (0 ≤ 5); B = intermediate = (6 ≤ 15); C = many (15 <).
3) Leaf blade colour: A = (reddish); B = (greenish red); C = (green); D= (dark green).
4) Organoleptic test: A= like most; B = like; C = dislike; D= dislike most.

Table 3. Rating and ranking of *Cleome gynandra* accessions.

Accession No.	*Cleome gynandra*	Organoleptic test			Leaf No.			Branch No.			Leaf blade colour		
		Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk	Mode	% Modal Frq	Rk
032048	*C. gynandra*	D	67.2	4	C	100	1	C	100	1	C	100	1
031991	*C. gynandra*	D	80.3	4	C	100	1	C	100	1	C	100	1
031932	*C. gynandra*	D	85.2	4	C	100	1	C	100	1	C	100	1
031866	*C. gynandra*	D	85.2	4	C	100	1	C	100	1	C	100	1
031955	*C. gynandra*	D	88.5	4	C	100	1	C	100	1	C	100	1
031990	*C. gynandra*	D	90.1	4	C	100	1	C	100	1	C	100	1
028563	*C gynandra*	D	95	4	C	100	1	C	100	1	C	100	1
031995	*C. gynandra*	D	100	4	C	100	1	C	100	1	C	100	1

Rk = Rank: 1 = most preferred. Frq = Frequency.
1) Leaf number per plant: A = few (0≤30 leaves/ plant); B =intermediate = (31≤60 leaves/ plant); C = many = (60<).
2) Branch number per plant (primary and secondary) A= few (0≤5); B = intermediate = (6≤15); C = many (15<).
3) Leaf blade colour: A = (reddish); B = (greenish red); C = (green); D= (dark green).
4) Organoleptic test: A= like most; B = like; C = dislike; D= dislike most.

Table 4. Organoleptic test score (%) for the vegetables.

Sum of responses	Score	Like	Dislike	Dislike most	Grand total
Species	**Like most %**	**%**	**%**	**%**	**%**
A. blitum	44.26	49.73	5.46	0.55	100.00
A. cruentus	0.00	11.48	63.93	24.59	100.00
A. dubius	54.10	36.07	8.74	1.09	100.00
A. graecizans	14.75	62.30	19.67	3.28	100.00
A. hybridus	45.90	42.62	9.84	1.64	100.00
A. lividus	47.54	39.34	11.48	1.64	100.00
A . sp.	27.32	55.19	16.39	1.09	100.00
C. gynandra	0.00	0.20	12.70	87.09	100.00
S. americanum	26.23	62.30	11.48	0.00	100.00
S. scabrum(Foumbout)	0.00	0.00	11.48	88.52	100.00
S. scabrum	27.32	54.64	16.94	1.09	100.00
S. sp.	47.54	27.87	18.03	6.56	100.00
S. villosum	28.69	52.87	18.03	0.41	100.00
Grand total	24.38	33.74	14.91	26.97	100.00

Table 5. Organoleptic test score (%) summary for the vegetables.

Sum of responses	Score	Like %	Dislike %	Dislike most %	Grand total %
Genus	**Like most %**				
Amaranthus	37.33	44.51	15.13	3.03	100.00
Cleome	0.00	0.20	12.70	87.09	100.00
Solanum	27.05	46.56	16.39	10.00	100.00
Grand total	24.38	33.74	14.91	26.97	100.00

no other ingredient was added. The scoring was as follows: A = like most; B = like; C = dislike; D = dislike most. Each of these traits was scored by a panel of 60 people.

RESULTS AND DISCUSSION

The results revealed that heavily branched genotypes with many leaves were highly ranked (Tables 1, 2 and 3). Most of the genotypes with many leaves were also highly branched (Tables 1, 2 and 3). All accessions except *Solanum scabrum* (Foumbout) and the three accessions of *Amaranthus blitum* had more than 60 leaves per plant and more than 15 primary and secondary branches per plant.

Majority of farmers seemed to prefer genotypes with dark green leaves, probably based on their experiences with other leafy vegetables such as spinach and kales where dark green leafed ones were preferred by customers. Table 1 shows the scoring of Amaranthus by farmers and Table 2 shows the scoring of *Solanums* while Table 3 shows the scoring of *Cleome gynandra*.

Table 4 shows the score in organoleptic test for all the three vegetable genera tested.

While farmers seemed to concur in their scores for number of leaves, number of branches and leaf colour, a lot of discrepancy was recorded for organoleptic test (Tables 1, 2, 3 and 4). Most of Amaranthus were either liked most or liked (Tables 4 and 5). *Amaranthus cruentus* was said to have the flavour of raw spinach and hence was disliked by most participants. Most of the *Solanums* were liked except *Solanum scabrum* (Foumbout) which was disliked by all the participants (Table 4) since it was exceedingly bitter. Most accessions of Cleome were disliked most with one accession being disliked by all the participants (Table 3). From Table 5, it is apparent that most participants liked Amaranthus and *Solanum* accessions and disliked *Cleome* accessions. This could partly be explained by the farmers' greater familiarity with *Amaranthus* and *Solanums* than *Cleome*. Besides, Cleome is bitter hence the scoring observed here.

In Western Kenya where ALVs are widely consumed, Cleome is boiled and then soaked in milk overnight to reduce bitterness (Pers. Obsv.). Mixing with other vegetables may be practiced to increase the nutrient bioavailability and palatability of these vegetables and hence increase their consumption.

Cooking has been shown to increase the availability of iron in some vegetables (Ray and Tsou, 2006). Mukolozi et al. (2004) found that in vitro bioavailability of ß-carotene from Cleome was 53% when cooked using oil as opposed to 8% when it was cooked without oil.

Conclusion

Highly branched genotypes with many leaves were the most preferred. Organoleptic test demonstrated the variant preference among farmers.

Recommendations

Nutrient density and other diversity indicators should be analyzed so as to get a full picture of nutritional and genetic diversity inherent in these ALV accessions. Farmers should be taught on proper cooking methods to reduce bitterness and to enhance bioavailability of some nutrients. Similar work should be extended to other needy areas

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