Participatory Varietal Selection and Agronomic Evaluation of African Eggplant and Roselle Varieties in Mali

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Abstract

African eggplant (Solanum aethiopicum L. and S. macrocarpon L.) is one of the most commonly consumed fruit vegetables in tropical Africa, in quantity and value probably the third after tomato and onion. Commercial production for supply to the cities is increasing. Roselle (Hibiscus sabdariffa L.) is another important vegetable crop in sub-Saharan Africa; its leaves, seed, and calyces are eaten. Roselle leaves and calyces are nutritious and rich in iron, β-carotene, and ascorbic acid. Although there is a market for African eggplant and Roselle, farmers have been slow to adopt new improved varieties due to use of traditional breeding method. To increase adoption rates of new varieties, we used a participatory varietal selection process to identify new varieties of both plants based on fruit yield, leaf, calyx traits, and consumers' preference. Fifteen lines and varieties of each species from several African countries were evaluated in Bamako, Mali during the 2008 hot rainy season. A randomized complete block design with three replications was used for the selection process. Twenty-two vegetable farmers and traders (or users) from Bamako rated the African eggplant and Roselle varieties based on visual characteristics (fruit color, fruit shape, number of fruits per plant, fruit size, number of secondary branches per plant, leaf size, leaf shape, leaf color, number of calyces per plant, calyx shape, and calyx color). Using a scale from 0 (least preferred) to 5 (most preferred), the varieties and the criteria were ranked, to identify the best variety and the most important criteria. In addition, agronomics data of African eggplant (number of fruits per plant, marketable yield, fruit weight,

fruits shape and fruit color) were collected. Agronomics data were also collected on Roselle calyces (number of calyces per plant, fresh calyces yield, dry calyces yield, dry matter and calyces color based on stem color) and leaves production (leaf length and width, economic yield, leaf shape and stem color). African eggplant line L10, varieties Soxna and Locale Gaya were highly rated for their visual appeal and have the potential to out-yield the local Malian variety. The fruit color and fruit shape, classified top two criteria through participatory selection criteria are important in the choice of users. For leafy entries of Roselle, leaf size was the most important trait. Samandah and line L28 were rated higher than the local check variety (Dah Rouge) for all traits. For calyx varieties of roselle, the number of calyces per plant was the most important trait. For leafy and calyx varieties, the agronomic evaluation show that yield is not a very important criterion in the choice of the users.

Keywords: Agronomic; calyx; criteria; fruit; leaf; Mali; preference; Senegal

Introduction

Sufficient levels of micronutrients and vitamins are essential for maintaining good health, especially for pregnant women and preschool children. Indigenous vegetables provide high levels of micronutrients, vitamins and fiber, and often are mainstays of diets in poor rural areas. Higher yielding, improved varieties could have a greater nutritional impact if they meet users' preferences for taste, color, shape, yield, nutritional, medicinal and economic values (AVRDC, 1998, Kamga et al., 2013, Njume et al., 2014 and Ray-Yu et al., 2013). African eggplant (Solanum aethiopicum L.) was domesticated from the wild species S. anguivi Lam. Both species are found throughout tropical Africa. The immature fruits of S. aethiopicum are used as a vegetable in stews, and sometimes eaten raw. The leaves and shoots are cooked; they are picked from the same plants that provide the fruit vegetable or from especially leafy cultivars. Fruits of bitter cultivars are used as medicine in many African countries. Small-scale growers account for at least 80% of the total production. Leaves of S. aethiopicum are especially important in southeastern Nigeria, Cameroon, and Uganda. It is a very popular leafy vegetable in Kampala markets. African eggplant cultivation for fruit and leaves is expanding in Tanzania because of its economic and nutritional value (Chadha and Mandinga, 2007). The leaves of the glabrous species (Solanum macrocarpon L.) are more nutritious than the fruit and are sometimes consumed in the same way as spinach in the southern part of Senegal (Seck, 1996 and Chippers, 2000). Roselle (Hibiscus sabdariffa L.), is another important vegetable crop in sub-Saharan Africa. Its leaves, seed, and calyces are eaten (Umerchuruba, 1997), and in many West

African countries the dried calyces are prepared into a refreshing drink (Dignan et al., 1994). Roselle leaves are nutritious and have been reported to contain protein, Iron, β-carotene equivalent, thiamine, riboflavin, niacin, and ascorbic acid (Babalola et al., 2000 and Qi et al., 2005). Roselle seeds are ground into meal or are roasted and boiled as a coffee substitute (Scott, 2003). The international market for dried Roselle calyces is more than US$120 million per year (Pasternack et al., 2004). Although there is a market for African eggplant and Roselle, farmers have been slow to adopt new improved varieties according to lack of use participatory variety selection method. In fact, there is a greater likelihood of farmers adopting a technology if they become involved early in project implementation (Rahman et al, 2015). To raise farmers' awareness and increase adoption rates of new varieties, the current research used a participatory varietal selection process (Getahun et al., 2016 and Ellsworth et al., 1992) to identify new varieties of both plants for the Sahelian region based on fruit yield, leaf, calyx traits, and users' preference. A similar study was conducted in Senegal on leafy roselle varieties (Diouf et al., 2007a). We would like to compare roselle preference varieties in Senegal and Mali on side and if relationship could be established between gronomic data and criteria users' preference.

Materials and Methods

Fifteen varieties of African eggplant from various African countries (Table 1) were evaluated at AVRDC's Samanko research station during the 2008 hot rainy season. Soil pH was between 4.5–6, the average rain was 807 mm, the temperature between 21–41°C and the relative humidity between 72–87%. Seed was sown on 7th July, and seedlings transplanted on 5th August. Before transplanting, basal fertilizer was applied, comprising 20 t/ha of compost and 250 kg/ha mineral fertilizer NPK (10-10-20). The experimental design was a randomized complete block design (RCBD). Each treatment was replicated three times. There were two rows per plot, each 4 m long with 70 cm between the rows. Plants were spaced 50 cm apart in the rows. The total number of plots was 45, including the check variety. Three side dressings of mineral fertilizer NPK (10-10-20) were applied: 200 kg/ha at 40, 60 and 80 days after planting (Beniest, 1987).

Before sowing the fifteen varieties of Roselle from Ghana, Mali and Senegal (Table 3), basal fertilizer was applied, comprising 10 t/ha of compost and 300 kg/ha mineral fertilizer NPK (10-10-20). The experimental design was a randomized complete block (RCBD). Each treatment was replicated three times. There were two rows per plot, each 4 m long, with 60 cm between the rows. Plants were spaced 40 cm apart in the rows. The total number of plots was 45, including the check variety. Two side dressings of mineral fertilizer NPK (10-10-20) were applied: 200 kg/ha at 40 and 60 days

after sowing (Beniest, 1987). Insects were controlled by applying deltametrine (10 ml / 10 L of water) and fungi were controlled with Metalaxyl (400 ml / ha).

At 65 days after planting African eggplant, at 54 days after sowing leafy varieties and 106 days after sowing calyx varieties of Roselle, 22 vegetable farmers, with great experience, who are also traders (21 women; 1 man) from Bamako, a nearby urban area, were invited to participate in selecting varieties. The participants walked through the plots and discussed the traits of different lines and varieties. Before starting the scoring process, participants and researchers agreed that the most important traits were fruit shape, fruit color, fruit size, and number of fruits per plant, number of secondary branches per plant, leaf size, leaf shape, leaf color, number of calyces_per plant, calyx shape, and calyx color. A plastic container was placed in front of each line or variety for all the three replications of the trial. Each participant was given a cup filled with white bean seeds. Using a scale from 0 (least preferred) to 5 (most preferred), each participant dropped beans in the containers placed by each plot and this process is repeated for each trait. The total score was calculated for each criterion. In addition, agronomics data of African eggplant (number of fruits per plant, marketable yield, fruit weight, fruits shape and fruit color) for the fifteen entries were compared. The number of fruits per plant and the marketable yield were calculated based on 6 harvests at 35, 47, 49, 56, 64 and 72 days after transplantation (dat). The fruit weight was calculated using a sample of 5 fruits at the second harvest (47 dat) and third harvest (49 dat). Fruits shape and color were evaluated at the third harvest.

Agronomics data were also collected on calyces and leaves production of Roselle. For leafy varieties of Roselle it concerned leaf length and leaf width, economic yield, leaf shape and stem color. The agronomics data of calyx varieties concern the number of calices per plant, fresh calices yield, dry calices yield, dry matter and calices color based on stem color.

Using a sample of two plants at 54 days after sowing (das) leaf length and width, number of secondary branches, the economic yield, leaf shape and stem color were calculated. The fifth leaf from top was used for each plant in leaf length and width evaluation.

The number of calyces per plant, yield of fresh and dry calyces and calyces color were evaluated at 120 das using a sample of two plants. To evaluate calyx dry matter, a sample of fresh calyces (20 g) was collected on the two plant sampled in each variety. A sample of fresh calyx was dried during one week at room temperature (24 °C).

The score of users' preference traits obtained during participatory selection process and agronomics data collected were entered in Excel file

and analyzed by STATISTIX. An Analysis of variance was performed followed by LSD All-Pairwise Comparisons test at 5%.

Results

1. Ranking varieties of African eggplant according to agronomic data and participants' preference criteria

The evaluation of six agronomic parameters showed that varieties UG-AE-8 and UG AE-3 have the highest fruit number per plant. Varieties L10 followed by Locale Mali had the highest marketable yield and average fruit weight. These two last varieties were respectively, light green and dark green fruit colour with both ribbed and lightly flattened fruit shape (Table 1).

The L10 was ranked the best variety during the participatory selection (PS) process. It was followed by the Soxna variety and Locale Mali. The three varieties less preferred by users were respectively, UG-AE-8 (13^{th}), UG-AE-3 (14^{th}) and UG-AE-13 (15^{th}) (Table 2).

The ranking of the four criteria of users' preferences showed that fruit color was the most important trait (Table 4). It was followed by fruit shape, number of fruits per plant and average fruit size. The L10 had the highest score regarding the 4 criteria and confirmed the position of best variety among the 15 evaluated (Table 4). The two best varieties (L10 and Soxna) identified during PS process had light green fruit color, ribbed and lightly flattened fruit shape (Table 2).

Table 1 : Origin and agronomic performance of the 15 African eggplant varieties from research station

Variety	Origine	FNPPL*	MY** (t/ha)	AFW*** (g)	Fruit color	Fruit shape
AB2	AVRDC-Tanzanie	04 c	8.380 ef	69.07 de	whitish	Smooth and elongated
RW-AE-1	Rwanda (AVRDC-Tanzanie)	06 c	8.39 ef	25.76 fg	Mixture Whitish with dark green	Smooth and round
Locale Mali	AVRDC-Mali	04 c	22.98 ab	145.51 ab	Dark green	Ribbed and lightly flattened
UG-AE-10	Uganda (AVRDC-Tanzanie)	05 c	4.80 f	21.19 fg	Light green	Smooth and lightly elongated
UG-AE-13	Uganda (AVRDC-Tanzanie)	20 bc	3.53 f	14.90 fg	Mixture whitish with green	Smooth and round

TZ SMN3-10	AVRDC-Tanzanie	09 bc	8.30 ef	20.43 fg	whitish	Smooth and elongated
Manyire Green	AVRDC-Tanzanie	03 c	4.94 f	44.70 ef	dark green	Lightly ribbed and flattened
UG-AE-3	Uganda (AVRDC-Tanzanie)	45 a	5.05 f	2.34 g	dark green	Smooth and round
UG-AE-20	Uganda (AVRDC-Tanzanie)	26 b	7.92 ef	25.59 fg	Mixture Whitish with dark green	Smooth and lightly elongated
UVPP	AVRDC-Tanzanie	03 c	13.24 de	94.86 cd	whitish	Smooth and round
N24	AVRDC-Tanzanie	08 bc	18.64 bc	42.19 ef	whitish	Smooth and lightly round
UG-AE-8		57 a	7.61 f	26.38 fg	Dark green	Smooth and round
SOXNA	ISRA-CDH Senegal	03 c	16.31 cd	127.21bc	Light green	Ribbed and lightly flattened
Locale Gaya	Niger	02 c	21.57 abc	171.03 a	Dark green	Smooth and round
L 10	ISRA-CDH Senegal	04 c	24.04 a	97.46 cd	Light green	Ribbed and lightly flattened
Grand Mean		13.3	11.7	61.9		
Standard Deviation		18.86	7.6	55.13		

FNPPL* : fruit number per plant; MY** : Marketable Yield; AFW*** : Average Fruit Weight

Values in the same column with same letter(s) are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability.

Table 2: Ranking fifteen African eggplant varieties based on users' criteria

Variety	NFPPL*	Fruit size	Fruit color	Fruit shape	Total score	Variety rank
L 10	102.00 a	106.00 a	92.33 a	104.33 a	404.7	1st
N24	86.67 ab	46.67 bcd	68.00 bc	51.00 de	252.3	5th
Locale Mali	80.33 abc	74.00 b	62.33 bcd	71.67 bc	288.3	3th
TZ MN3-10	75.00 bcd	32.33 cde	52.33 d	37.67 ef	197.3	7th

UVPP	70.33 bcd	60.00 bc	68.33 b	57.67 cd	256.3	4th
SOXNA	61.67 cd	55.67 bc	84.67 a	88.00 ab	290.0	2nd
Locale Gaya	58.00 d	61.00 bc	52.67 cd	61.67 cd	233.3	6th
AB2	30.67 e	20.67 det	49.67 d	29.33 fg	130.3	8th
RW-AE-1	21.00 ef	17.67def	22.00 e	23.00 fgh	83.7	9th
UG-AE-8	4.33 f	5.67 ef	12.00 e	12.33 hi	34.3	13th
UG-AE-10	2.33 f	3.67 ef	18.33 e	20.33 ghi	44.7	11th
UG-AE-3	2.33 f	1.00 f	11.00 e	6.67 hi	21.0	14th
UG-AE-13	2.00 f	0.00 f	11.00 e	6.00 i	19.0	15th
UG-AE-20	1.33 f	0.67 f	19.67 e	13.67 ghi	35.3	12th
Manyire Green	1.00 f	10.00 ef	21.67 e	17.33ghi	50.0	10th
Total score	599	495	646	600.7		
Criteria rank	3th	4th	1st	2nd		

NFPPL* : number of fruits per plant

Values in the same column with same letter(s) are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability.

Ranking leafy varieties of Roselle and identification of the most important traits

The assessment of agronomic parameters confirmed the preference of the participants for the red type varieties than green types (Table 3). Regarding the economic yield, the red types were less productive than green. In fact yield was not the most important criterion. The leaf length, leaf width and the number of secondary branches did not show a statistically significant difference (Table 4). These three parameters were not greatly important in the preference of the participants.

Participants preferred varieties with red leaves (Table 4). The variety Samandah was ranked the best followed by L28. The first five varieties were red types while the green types were ranked at the last position, confirming the preference of users for the red types. Among all the criteria, the best was leaf size, followed by the number of secondary branches, the leaf shape and finally the leaf color (Table 4). The two varieties ranked best (Samandah and L28) had the highest score for leaf size criterion (Table 4).

Table 3: Agronomic performance of the 15 leafy varieties of Roselle from research station

Variety	Origine	LL* (cm)	LW** (cm)	NSBR***	EY**** (kg/ha)	Leaf shape	Stem color
VIMTO	ISRA-CDH Senegal	10.57 ab	7.27 a	28.67 a	120.00 bcd	Light deep 2 lobes	Red

KOOR	ISRA-CDH Senegal	9.35 ab	6.05 ab	29.33 a	100.00 cd	Light deep 2 lobes	Red
Marché de Bazola	Mali	8.62 ab	5.13 ab	28.00 ab	162.23 abcd	Light deep 4 lobes	Mixture red and green
ILAFIA	Mali	8.28 b	5.22 ab	26.67 ab	189.17 ab	entire	green
L24	ISRA-CDH Senegal	8.70 ab	6.02 ab	23.00 b	179.73 ab	Light deep 4 lobes	Green
L22	ISRA-CDH Senegal	9.85 ab	6.20 ab	28.33 a	187.09 ab	Very deep 6 lobes	Green
L7	ISRA-CDH Senegal	9.27 ab	5.85 ab	28.00 ab	217.64 a	Light deep 2 lobes	Green
VERT CDH	ISRA-CDH Senegal	10.20 ab	6.02 ab	27.83 ab	168.61 abcd	Deep 2 lobes	Green
NOVORONGO	Ghana	8.32 b	5.18 ab	25.00 ab	215.14 a	Very deep 2 lobes	Green
MANDEKA	Mali	10.90 a	5.95 ab	29.17 a	174.73 abc	Light deep 2 lobes	Green
DAH BLANC	Mali	9.43 ab	5.95 ab	26.00 ab	132.64 bcd	Light deep 2 lobes	Mixture green and red
SAMANDAH	AVRDC Bamako	9.08 ab	5.42 ab	28.83 a	126.11 bcd	entire	Red
L 28	ISRA-CDH Senegal	9.83 ab	5.90 ab	28.83 a	134.86 bcd	Light deep 2 lobes	Red
VERT FATICK	ISRA-CDH Senegal	8.80 ab	5.05 ab	29.33 a	140.00 bcd	Very deep 4 lobes	Green
DAH ROUGE	Mali	8.08 b	4.60 b	27.33 ab	96.81 d	entire	Mixture red and green
Grand Mean		9.3	5.7	27.6	156.3		
Std deviation		1.5	1.3	3.1	53.2		

LL* : Leaf Length; LW** : Leaf Width; NSBR*** : number of secondary branches; EY**** : Economic Yield

Values in the same column with same letters are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability.

Table 4: Ranking fifteen varieties of Roselle for leaf and calyx production based on users' criteria

Variety	Leaf size	NSBR*	Leaf shape	Leaf color	Total score	Variety rank
VIMTO	86.33 abc	94.67 a	81.67 abcd	81.33 ab	257.67	4th
KOOR	86 abc	91.33 a	85 abc	78 ab	254.33	5th
SAMANDAH	100.33 a	89.67 a	101.33 a	100 a	291	1st
DAH BLANC	79.67 bc	89.33 a	63.33 de	59 bc	211.66	7th
L28	100.33 a	86.67 ab	94 ab	90 a	270.67	2nd
DAH ROUGE	90.33 abc	85.33 abc	88.33 abc	81.67 ab	255.33	3th
VERT CDH	78 bc	81.33 abcd	61 e	58 bc	200.33	8th
Marché de Bazola	45 d	67.67 bcde	30 f	27.67 def	125.34	11th
ILAFIA	75 c	65.33 cde	74 cde	42 cde	181.33	9th
L24	96 ab	64.67 de	79.33 bcde	93 a	237	6th
MANDEKA	40 d	56 ef	12.67 fg	9.67 f	78.34	13th
L7	76.33 bc	44 fg	76.33 bcde	54.67 bcd	175	10th
VERT FATICK	25.33 de	43 fg	18.33 fg	13 f	74.33	14th
NOVORONGO	38.67 de	33.67 gh	27.67 f	18.67 ef	80.01	12th
L22	8.67 e	19 h	3.33 g	2 f	24.33	15th
Total score criteria	1025.99	1011.67	896.32	808.68		
Criteria rank	1st	2nd	3th	4th		

NSBR* : number of secondary branches, Values in the same column with same letters are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability.

Ranking calyx varieties and identification of the most important traits

The assessment of agronomic parameters shows that the highest yielding varieties (fresh and dried calyx) were Samandah and L22 (Table 5). The two best ranked varieties during the participatory selection process had low yields. Although the number of calyces per plant was the first criterion, no correlation could be established with the yield of fresh and dried calyces.
Variety ranked first by the participants was green type (L24) followed by red (L28) (Table 6). This shows that the color criterion is not very important. The shape and color are respectively, ranked second and third and no statistically significant difference was observed between the two varieties. The criterion number of calyces per plant ranked first remains the most discriminating in ranking the 15 calyx varieties of Roselle (Table 6).

Table 5 : Agronomic performance of the 15 calyx varieties of Roselle from research station

Variety	NCPPL*	FCY** (t/ha)	DCY**** (t/ha)	Dry matter (%)	Calyx color
ILAFIA	209 a	5.08 cdef	0.43 cde	7.98 cde	Green
DAH ROUGE	189 a	7.48 abcd	1.08 ab	14.770 a	Red

Marché de Bazola	177 ab	1.89 f	0.21 e	10.46 bc	Green
NOVORONGO	146 abc	2.56 ef	0.27 de	10.76 bc	Green
MANDEKA	144 abcd	7.79 abcd	0.70 bcde	9.23 bcde	Green
SAMANDAH	129 abcde	10.43 a	1.51 a	14.42 a	Red
DAH BLANC	107 bcdef	2.85 ef	0.19 e	6.29 de	Green
VERT CDH	95 cdef	8.29 abc	0.79 bcd	9.58 bcd	Green
KOOR	89 cdef	6.35 bcde	0.37 cde	5.71 e	Red
L28	88 cdef	6.53 abcde	0.59 bcde	9.11 bcde	Red
L22	70 cdef	9.36 ab	0.99 ab	9.12 bcde	Green
L24	70 cdef	3.81 def	0.31 de	8.09 cde	Green
L7	64 def	7.02 abcd	0.89 bc	12.39 ab	Green
VIMTO	60 ef	5.51 bcdef	0.63 bcde	12.13 ab	Dark red
VERT FATICK	47 f	5.39 bcdef	0.45 cde	8.40 cde	Green
Grand Mean	112.06	6.02	0.63	9.89	
Standard deviation	63.54	3.12	0.45	3;37	

NCPPL* : number of calyces per plant; FCY** : fresh calyces yield; DCY*** : dry calyces yield

Values in the same column with same letters are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability

Table 6 : Ranking calyces variety of Roselle based on users' criteria

Variety	Number of calyces per plant	Calyces shape	Calyces color	Total score	Variety rank
L28	60 abc	92	77	229	2nd
L24	71 abc	91	71	233	1st
VIMTO	37 bc	52	51	140	8th
DAH ROUGE	45 abc	53	50	148	6th
Marché de Bazola	28 c	47	48	123	12th
NOVORONGO	27 c	49	45	121	13th
KOOR	37 bc	49	44	130	10th
ILAFIA	75 abc	55	42	172	3th
VERT CDH	43 abc	58	40	141	7th
L7	71 abc	31	37	139	9th
SAMANDAH	84 ab	37	37	158	4th
L22	59 abc	34	36	129	11th
VERT FATICK	46 abc	36	35	117	14th
DAH BLANC	94 a	30	25	149	5th
MANDEKA	50 abc	3	2	55	15th

Total score of criteria	827	714.12	638.1		
Criteria rank	1st	2nd	3th		

Values in the same column with same letters are not significantly different from each other according to LSD All-Pairwise Comparisons test at 5% probability.

Discussion

When conventional methods of breeding are used for African eggplant and Roselle, farmers have been slow to adopt new improved varieties. To increase adoption rates of new varieties, the researchers used a participatory varietal selection process to identify new varieties of both plants. In addition agronomics parameters were evaluated and their correlation with preference's criteria evaluated.

The process of ranking varieties of African eggplant according to agronomic data and participants' preference criteria show that the three varieties less preferred by users (UG-AE-8, UG-AE-3 and UG-AE-13) are produced in Uganda mainly for leaves consumption. In contrast, varieties L10, Soxna and Locale Mali, most preferred, are mainly grown in West Africa for fruit consumption. These results show that users' preference is highly related to locality and socio-economic aspects of people living in this area (Labrada, 2002).

Regarding the four criteria of users' preferences, fruit color and fruit shape are the two most important criteria in the choice of users during participatory selection process. These two criteria should be included as important trait during conventional breeding process.

Regarding leafy varieties of Roselle, among all the criteria, the best is leaf size, followed by the number of secondary branches, the leaf shape and finally the leaf color. The two varieties ranked best (Samandah and L28) have the highest score for leaf size criterion. The leaf size remains the most important trait (Diouf et al., 2007b). Malian participants preferred red type varieties, in contrast, Senegalese preferred the green types variety of Roselle (Diouf et al., 2006, Guèye and Diouf, 2006 and Van Rensburg et al., 2007), confirming that users' preference variation from one locality to another.

During the process of PS to rank calyx varieties and identify the most important traits, the yield is not a very important criterion. The criterion number of calyces per plant ranked first remains the most discriminating in ranking the 15 calyx varieties of Roselle. The calyx color is not very important in Mali, however the red calyx are more preferred in Senegal.

Conclusion

Variety L10 is ranked the best variety during PS process; followed by Soxna and Locale Mali. Among the four criteria of users' preferences, fruit color is the most important. It is followed by fruit shape, number of fruits per plant and average fruit weight. The L10 has the highest total score throughout the 4 criteria and confirms the position as best variety among the 15 evaluated. Evaluation of six agronomic parameters show that the color and shape of the fruit, classified top two criteria through participatory selection criteria are important in the choice of users. These parameters should be included as important traits during selection process of new varieties with high potential of adoption.

Participants were able to identify the criteria of preference during PS process and used it for ranking the 15 Roselle varieties (leaf and calices types). The two best varieties of Roselle-leaves are Samandah and L28 and for calyces variety L24 and 28. Agronomic yield is not always an important criterion in ranking varieties during PS process. Participatory Selection process is an efficient tool in ranking varieties by users and help to improve rate of adoption of new varieties. The best varieties (eggplant, leafy and calyx varieties) could be included in advanced yield trials or multilocation evaluation trials. This experiment should be conducted at farmers' level, with separation between farmers and traders, to confirm or challenge results of this research. In addition, a further study is recommended to evaluate the most promising varieties with respect to cooking time and organoleptic taste.

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