Understanding farmer preferred attributes of maize varieties in Eastern Kenya.

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I. Abstract

Maize is many things in Africa. It is one of the most important food crops which contributes about 20% of food calories. It is also grown for dual purpose to provide forage and cobs or grain for sale. In spite of its importance, however, maize production is affected by a number of a biotic factors such as drought and low soil fertility. Farmers in Sub Saharan Africa use different mechanisms to cope and adopt to climate change and variability. Such include growing drought tolerant maize varieties. The Drought Tolerant Maize for Africa (DTMA) project which is jointly implemented by Centro Internacional de MejoraMiento de Maiz Y Trigo (CIMMYT) and International Institute for Tropical Agriculture (IITA) with close collaboration of National Agricultural Research Systems has been implemented in sub-Saharan Africa since 2007. However, before the release of DTMA varieties there is need to identify the farmer preferences in prioritizing varietal selection. The report herein is a survey done to assess the criteria farmers use for selecting maize varieties to plant, how they compare and choose maize varieties planted on trial plots based on the selected trait, their preferred varieties and to identify any gender disparity in selecting maize varieties. Such findings are of economic importance in product development.

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II. Introduction

Agricultural productivity is highly influenced and vulnerable to changes in climate. Maize is one of the most important food crops in Africa which contributes about 20% of food calories (Shiferaw et. al. 2011). It is affected by a number of a biotic factors such as drought and low soil fertility. Farmers in Africa use different mechanisms to cope and adopt to climate change and variability. One of the mechanisms is growing drought tolerant maize varieties. The Drought Tolerant Maize for Africa (DTMA) project which is jointly implemented by (CIMMYT) and International Institute for Tropical Agriculture (IITA) with close collaboration of National Agricultural Research System has been implemented in sub-Saharan Africa since 2007. It is operating in 13 African countries – Angola, Malawi, Mozambique, Zambia, Zimbabwe, Ethiopia, Kenya, Tanzania, Uganda, Benin, Ghana, Mali and Nigeria. The project targets to increase maize yields by 20 to 30% through the provision of drought tolerant maize varieties benefiting 30-40 million people in the 13 countries that accounts for nearly 75% of the area on maize (Abate et al. 2013). Under DTMA project, as of 2013, about 149 drought tolerant maize varieties had been released and disseminated. This has been on-going in the project countries. However, before multiplication and release of DTMA varieties there is need to identify the farmer preferences in variety selection in order to inco-operate them in variety release systems. It is also important to capture if there exists a gender gap in prioritizing varietal selection. A survey was therefore done to assess, the criteria farmers set for selecting maize varieties to plant, how they compared and chose maize varieties planted on trial plots based on the selected trait, what varieties farmers preferred from the maize varieties planted on a trial plot and to identify any gender disparity in selection of maize varieties. Such findings could be deployed in product development by the breeders.

III. Materials and Methods

In order to understand the attitude of target farmers on different maize varieties, the farmer varietal and trait selection was made on researcher managed plots in Kenya during September 2014. The assessment was made at the harvest stage. Twenty varieties including three popular commercial checks:- DH04, PAN-M-419 and DUMA 43, and a local check KH 539E were planted at three sites using an alpha-lattice design of two row plots and three replicates during the long rains of March to September, 2014. The sites were Kaguru (latitude 0^0 5^1South, Longitude 37^0 39^1East, altitude, 1530M above Sea Level) in Meru county, Wambugu (latitude 0^0 26^1 South, Longitude 36^0 58^1East, altitude, 1798M above Sea Level) in Nyeri county and Embu (latitude 0^0 30^1 South, Longitude 37^0 27^1East, altitude, 1497M above Sea Level) in Embu County. The spacing was 25cm between plants on the row and 75cm between the rows of 5 metre length each. All the varieties were planted with DAP fertilizer (18:46:0) applied at the rate of 50kg/ha P_2O_5, at planting and later top dressed with CAN at knee high at the rate of 50kg/ha N. All other agronomic practices such as bird and monkey scaring including weed control were done as per appropriate recommendations. Below (Table 1) is the list of varieties planted and later used for the survey in 2014.

Initially, farmers were asked to discuss and jot down the use of maize in the study area. It was found that, in Kenya almost 90% of the maize product was used for food. The remaining percentage of the main product and the stover was used for commercial purposes such as animal feed, manure, fence, and fuel. The stover is also being used for mulching. Then male and female farmers were asked separately to choose and decide on five kinds of traits that they consider as a criteria while selecting a maize variety.

3 “I like cards” were distributed to each farmer to allow the farmer to select the best three varieties. A plastic bag was attached to each variety. Farmers were asked to visit each variety and to drop each I like cards in the plastic bag attached to the variety they liked most. The number of I like cards under each variety were counted to select 5 varieties with the highest number of cards for participatory varietal assessment. The selected varieties were CKH 140798, CKH 122044, CKH 122045, CKH 122047 and CKH 123806, which were all drought tolerant and hybrid.

-Evaluation of varietal/trait was made in three ways:- matrix method, pair wise selection and absolute selection. Under matrix method each farmer was assigned a number from 1 up to 10 which was used as an identification number for both male and female farmers separately. It was explained to farmers that they needed to give marks which ranged from 1 up to 5 to each variety based on the selected traits. Assigning 5 meant that the variety was excellent in the said trait and 1 that the variety was performing poorly. Each variety was assigned a letter A to /E and the letter written visibly and attached to each variety to serve as the name of the variety. This was to avoid bias during evaluation that could be associated with the name of the variety. After completing filling the matrix the farmers selected the maize variety on pair wise basis. Each variety was compared to each of the remaining variety and by counting the number of success history of the variety; the best variety by male and female farmers was identified. Lastly, both male and female farmers separately discussed and gave ranks unanimously for each maize variety planted on each trial plot.

Table 1:- List of all varieties planted across sites in 2014

S/N	Variety	S/N	Variety
1	CKH 141339	11	CKH 122046
2	CKH 141353	12	CKH 122047
3	CKH 141361	13	CKH 123805
4	CKH 140901	14	CKH 123806
5	CKH 140798	15	CML442/CML445/CKL05017
6	CKH 140925	16	CML444/CML489/CKL05019
7	CKH 140961	17	DH04-Commercial check
8	CKH 122021	18	DUMA 43-commercial check
9	CKH 122044	19	PAN-M-419-commercial check
10	CKH 122045	20	LOCAL CHECK (KH 539 E)

After explanation of the methods and carefully visiting the trial plots; both male and female farmers individually gave ranks from 1 up to 5 for each variety per each trait in each site. Farmers explained that a variety is considered high yielding if the size of the cob is large, if it has more seed rows and also if the variety has more number of cobs per plant. The farmers reported that they could distinguish if a variety was or not drought tolerant by looking at the stalks. The stalks of drought tolerant maize were green and strong while non-drought tolerant varieties had dried. The farmers informed us that early maturing varieties took between three and four months which made them easy to distinguish from the late maturing ones. Yield data was calculated as field weight of harvested ears adjusted to 12.5% moisture content, converted to tons per hectare. Statistical analysis was done using SAS (SAS 2012) to show differences in varieties in terms of yield.

IV. Results and Discussions

Table 2 shows the traits farmers preferred on a gender basis. There was no difference in their trait preference since yield per se was ranked first followed by drought or earliness in maturity whilst pests and diseases were a distant third. It was interesting to note that these traits were the best five traits that the farmers chose as key to their variety selection in ka guru village of Meru county in Kenya..Table 3 lists the type of verities and average ranking given with the corresponding traits in Kenya. From the selected five varieties, CKH 123806 and CKH 122047 performed well. CKH 123806 was excellent in good taste by both male and female farmers. It was also found to be very good in its ability to resist drought and pest / diseases by both genders. Its stalk strength and level of early maturity were also ranked as good. But its capacity to yield was lower relative to rank given to other traits. On the other hand, CKH 122047 had the highest grade for yield (relative score of 4.9) compared to other characteristics. It was also noted that CKH 140798 was rated the lowest for ability to resist drought especially by female farmers. Similarly, this variety had also the lowest grade in its capacity to resist disease and its taste.

Table 2:- Table 2. Trait preference by gender, in Kenya

Ka guru village, Site I	Female	Male
Preferred traits	High yield	High yield
	Early maturity	Drought tolerant
	Disease and pest resistance	Disease and pest resistance
	Good taste	Stalk strength
	Drought tolerant	Good taste

Source: Field survey - 2014

Table 3:- Trait/variety ranking at Ka guru village in Kenya

	Variety	Yield	Pest & Disease	Taste	DT	Stalk strength	Early maturity	Overall	Rank
Male	CKH	3.2	2.4	1.7	2.7	5		2.994	5
Female	140798	2.4	1	2.1	1		1.4	1.58	5
Male	CKH	2	3.2	3	2.8	4.2		3.04	4
Female	122044	1.5	2.2	1.7	3.8		2.9	2.42	4
Male	CKH	3	2.8	2.7	2.7	4.2		3.08	3
Female	122045	2.5	2.1	2	3		3.3	2.58	3
Male	CKH	4.5	3.9	1.4	3.5	4.4		3.54	2
Female	122047	4.9	4.8	3.5	3.4		3.4	4	2
Male	CKH	3.2	4.2	4.9	4.2	3.7		4.04	1
Female	123806	4.1	4.5	5	4.4		4.2	4.44	1

Source: Field survey – 2014

The pair wise as well as the absolute ranking on varietal assessment showed no differences among male and female farmers in both systems CKH 122047 was ranked first (Tables 4.0&5.0) while it was second in the matrix ranking (Table 3.0), CKH 123806 ranked 2nd, CKH 140798 ranked 3rd, CKH 122044 4th whereas CKH 122045 ranked 5th by both male and female farmers in both pair wise and absolute ranking. Incidentally, the statistical analysis showed that CKH 122047 was ranked 12th yield wise whilst CKH 123806 was 9th overall (Table 6.0)


Fig 1: – farmers on evaluation of maize varieties in Ka guru meru. – field survey 2014

Table 4: - Result of Absolute Ranking at Ka guru in Kenya

village	Site	Gender	Rank of a variety				
			First	Second	Third	Forth	Fifth
Ka guru, Kenya	I	Male	CKH 122047	CKH 123806	CKH 140798	CKH 122044	CKH 122045
	I	Female	CKH 122047	CKH 123806	CKH 140798	CKH 122044	CKH 122045

Source: Field survey - 2014

Table 5:-- Result of pair wise Ranking at Ka guru in Kenya.

village	Site	Gender	Rank of a variety				
			First	Second	Third	Forth	Fifth
Ka guru, Kenya	I	Male	CKH 122047	CKH 123806	CKH 140798	CKH 122044	CKH 122045
	I	Female	CKH 122047	CKH 123806	CKH 140798	CKH 122044	CKH 122045

Source: Field survey - 2014

Table 6:- On-farm farmers participatory variety selection

Parentage	Varieties selected by Scientist in order (ANOVA)	Grain yield (tones/ha)	Rank given by farmers
CK H140798	17	7.9	3
CKH 122044	13	7.8	4
CKH 122045	13	9.1	5
CKH 122047	12	7.5	1
CKH 123806	9	9.4	2

V. Conclusions

This study has been made to identify the preference of farmer on maize trait and varieties based on assessment of participatory variety and trait selection done at 3 trial plots in Kenya. Ten men and ten women farmers participated on the evaluation in each site to capture if there is gender difference on trait and variety selection. The result of the assessment shows that there might be a slight difference in prioritizing maize trait while selecting maize variety as in one location only female farmers mentioned to consider taste of maize while choosing variety to plant. In general, there is no major difference in setting criteria while choosing maize varieties among male and female farmers in Kenya. It was found that farmers considered grain yield, maturity time, ability to resist drought, disease and pest as the major traits whereas taste and stalk strength, as important criteria for choosing maize variety.

On the trial plots hybrid drought tolerant varieties were planted with some non-DT popular commercial varieties. The results showed that the DT varieties were performing well and preferred in almost all cases by both male and female farmers relative to non-DT commercial hybrid varieties. For example CZH 122047 was excellent in providing high yield, ability to tolerate dry spells and drought, ability to resist pest and disease, and early maturity. Also, CKH 122044 was excellent in good taste as shown by both male and female farmers. It was also very good in its ability to resist drought, pest and disease as shown by both genders. Its level of early maturity did also contribute to its good rank. In this exercise it was expected that the drought tolerant varieties should have a good capacity to resist drought and dry spells and be better than their contemporary commercial checks. Table 7 .0 showed that the top six varieties except KH 500-39E were all drought tolerant. These varieties ranged from 7.9 to 8.9 tonnes/ hectare compared to the checks which gave 6.6 (DUMA 43) and 7.2 (DH04). However it was also found that the performance of some DT varieties in yield

across sites was lower than the commercial checks. All in all, the DT varieties were providing acceptable harvest in situations where there exists good rainfall and under reduced rainfall than the popular commercial maize varieties. This was in agreement with Fisher and Snapp's observation (Fisher &Snapp 2014). Farmers also showed other preferences in addition to improved yield such as poundabilty, good husk cover and taste. The results were in agreement with Jeyaprakash et al,2004 who observed that PVs involving thirty rice genotypes some in advanced stages and others in released status paved the way for need based selection by the farmers and thereby helped promote quicker adoption of useful varieties in the farming community. In evaluating maize varieties across target environments Mwala et al, 2004 also came to the conclusion that varieties that possess important characteristics that conform to farmers' production and utilization expectations are adopted easily with enhanced uptake and use by the said farmers.Observations recorded by Mutinda et al, 2004 in their quest for improved drought tolerance and other traits in maize in Mt. Kenya region. Perhaps of relevance to this work would be that of Mahedran and his colleagues whose participatory rural appraisal results revealed that the awareness about high yielding varieties was as high as 93%. However, farmers preferred low yielding landraces to high yielding rice varieties for their tolerance to drought, low input cost, and and readily available seed materials.This work and the referred works agree with the remarks by professor Eskridge (Elbatan, 2003) that farmers choice of varieties is based on the chances that varieties selected will put , eventually, food on the table inspite of the circumstances.

V. Acknowledgements

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Entry	Pedigree	Across	Embu Ken	East Collage Ken	Kaguru Ken	Marima Ken	L.Kama Ken	Grain Yield			Anth	Days to
		GrainYield	GrainYield	GrainYield	GrainYield	GrainYield	GrainYield	GW	FW	Rank	Date	Silk
		t/ha	t/ha	t/ha	t/ha	t/ha	t/ha	t/ha	t/ha	Rank	d	d
15	CML442/CML445//CKL05017	7.1	5.5	8.3	11.9	8.2	1.5	4.85	7.0	5	71	71
8	CKH122021	6.3	7.0	7.1	8.5	6.9	2.0	4.46	6.1	6	67	69
16	CML444/CML489//CKL05019	6.8	7.8	6.7	10.6	7.9	1.0	4.46	6.9	7	73	73
13	CKH123805	6.3	7.9	6.4	11.3	4.6	1.5	3.04	6.4	7	70	71
2	CKH141353	6.6	7.3	8.6	9.8	6.9	0.5	3.68	6.6	7	72	72
3	CKH141361	6.0	7.3	7.4	9.2	4.8	1.3	3.07	6.0	7	72	73
14	CKH123806	5.8	6.7	6.3	9.4	5.5	1.1	3.29	5.8	9	69	70
20	KH500-39E	5.7	9.0	6.8	10.9	1.7	-	0.85	5.7	10	73	74
1	CKH141339	6.0	5.6	7.1	11.0	5.2	0.8	2.99	6.0	10	70	72
18	DUMA43	5.5	6.2	5.1	8.6	6.3	1.2	3.75	5.5	10	65	68
17	DH04	5.2	8.0	5.0	8.5	4.6	-	2.32	5.3	12	71	73
19	PANM-419	5.1	5.4	4.4	8.0	6.5	1.3	3.90	5.1	13	68	70
7	CKH140961	4.8	6.3	4.2	8.1	4.2	1.0	2.58	4.7	15	67	67
6	CKH140925	4.0	4.1	4.4	6.1	3.4	2.0	2.71	4.0	15	67	69
5	CKH140798	4.6	5.4	4.4	7.9	4.2	0.9	2.56	4.6	17	65	65
	Mean	**5.55**	**6.60**	**5.85**	**8.87**	**5.26**	**1.15**	**3.21**	**5.54**	**10**	**68.9**	**70.0**
	LSD (0.05)			**2.08**	**2.08**	**2.35**	**1.83**	**2.25**	**0.71**	**1.18**	**0.89**	**3**
	MSe	**0.78**	**0.90**	**1.14**	**0.69**	**1.05**	**0.10**	**0.58**	**0.83**	**0**	**3.0**	**2.9**
	CV		**14.34**	**18.23**	**9.39**	**19.47**	**28.24**					
	p		**0.043**	**0.024**	**0.001**	**0.004**	**0.007**					
	p		*	*	**	**	**					

Table 7.0