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Who Eats Yellow Maize? Some Preliminary Results of a Survey of Consumer Maize Meal Preferences in Maputo

By

MOA/MSU Research Team

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Who Eats Yellow Maize? Some Preliminary Results of a Survey of Consumer Maize Meal Preferences in Maputo

I. Background

The nature of consumer maize preferences is a complex and controversial issue with important policy implications throughout Eastern and Southern Africa. Until recently, thinking and policy on the issue was dominated by a conventional wisdom that held that yellow maize was fit only for animal, not human, consumption. This attitude has been a strong contributing factor to the types of maize production and marketing systems that have evolved in the region. With few exceptions, these systems have favored large scale, capital intensive production of refined white meals for mass consumption. Whole white meals have been less available. Yellow grain and meals were presumed to have very little or no effective demand for human consumption, and have typically been unavailable to consumers. Yellow "dent" varieties of maize are grown in several Southern African countries (though not in Mozambique), but until recently their marketing has been carefully controlled and the grain channeled exclusively to stockfeed. Such policies have imposed a high cost on consumers, especially those poor consumers who might choose a "less preferred" product were it available at a lower price.[1] Refined meals have typically been significantly more expensive than whole meals produced from the same grain.[2] The absence of yellow grain or meals has also raised the cost of food to consumers, since yellow maize in world markets is priced below white maize. The world yellow maize market is also far larger and more stable than the white maize market, making it a more reliable source of supply, especially during periods of drought in the Southern Africa region.

Mozambique was not an exception to this general rule until the mid 1980s. At this time, large amounts of yellow maize food aid began to arrive in the country, presenting urban consumers for the first time with the option of purchasing yellow, rather than white, maize.[3] Until the late 1980s, essentially all of the monetized yellow grain was channelled through large mills in Maputo and Beira and milled into a refined meal which was sold at controlled prices in ration shops (the *Novo Sistema de Abastecimento, NSA*). With the rapid development of informal markets following economic liberalization measures in the late 1980s, yellow maize began to leave the NSA. It was increasingly sold in *dumbanengues* (informal and initially illegal open markets) and often milled into whole meal in one of the increasing number of small, privately operated hammer mills. By early 1992, less than 10% of the yellow grain and meal consumed by Maputo residents was purchased in the NSA

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[1] For more detail on Zimbabwe, Kenya, and South Africa, see Jayne, et al. (1994); Jayne and Rubey (1993); Jayne and Rukuni (1993); Mukumbu and Jayne (1994); and Takavarasha, et al. (1994).

[2] Refined meals have some or all of the germ and pericarp removed from the grain prior to milling. Grain to meal conversion factors for refined meals range from 65% to 85%. Whole meals are produced from whole grain with no germ or pericarp removed, and give 98% to 99% conversion factors. See Weber, et al. for more detail on maize meal types in Maputo.

[3] Between 1987 and 1993, approximately half of all yellow maize food aid was monetized rather than distributed free.

(Sahn and Desai, 1993). Thus, since at least the early 1990s, consumers in Maputo, Beira, and outlying districts have been able to choose between a range of maize meal colors and levels of processing.[4] Since these products were sold in a competitive market setting, consumers were also faced with a range of prices for these goods.

This availability over a period of years of a wide range of maize products at competitively determined prices makes Mozambique unique in Southern and Eastern Africa. As such, it presents an outstanding opportunity to evaluate the strength of consumer preferences for differing color and processing characteristics of maize grains and meals, and the extent to which consumers will substitute between products as relative prices change.

The results of such analysis are of key importance for three important policy issues in Mozambique:

1. **What are the effects of yellow maize food aid shipments on incentives for the production and marketing of white maize?** If consumer preferences for white maize are so strong that they will pay large price premiums for it over yellow, then yellow maize food aid can be expected to have little effect on white maize production and marketing. This is not so if significant numbers of consumers will actively substitute between white and yellow maize as relative prices change. In this case, the quantity of yellow maize food aid entering the country, and the price placed on it, become of great importance as the country attempts to make the transition to self-sustaining growth.

2. **Should the Government of Mozambique encourage yellow maize availability, at market prices, even after the country reduces or eliminates its dependence on food aid?** Yellow maize is cheaper, more consistently available in world markets, and has a more stable price in world markets than white maize. In addition, evidence from Zimbabwe suggests that yellow maize attains higher yields than white maize under similar input regimes. These attributes imply substantial advantages to a country and its consumers if they will accept yellow maize as a partial substitute for white maize. If yellow maize becomes unavailable in Mozambican markets after food imports cease, which consumers will be most adversely affected? What can and should the Government of Mozambique do to ensure continued availability at market prices?

3. **What are the benefits to consumers (and which consumers capture them) of widespread availability in markets of whole white and yellow maize meals?** What would be the costs to consumers (and which consumers would bear them) if the Government of Mozambique were to constrain the activities of the small scale, informal milling and marketing sectors that produce these meals? Alternatively, who might benefit from efforts to stimulate investment in the small scale milling sector?

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[4] See MOA/MSU 1993 for information on the flow of yellow maize to outlying districts of the South and Center of Mozambique.

To help inform these issues, the MOA/MSU Food Security Project in Mozambique conducted a random sample survey of 400 households in eight *bairros* (neighborhoods) of Maputo. Bairros were selected non-randomly, but with the intention of being representative of relatively low income areas of urban Maputo and peripheries. Within each bairro a self-weighting sample of *quarteirões*[5] was selected, followed by a self-weighting sample of households within each quarteirão. The resulting sample is statistically valid for the group of eight bairros, and these bairros are believed to be representative of typical low income areas of the city of Maputo.

During April and May, 1994, the questionnaire was completed with the person in each household responsible for food purchases. At this time, white maize availability was increasing due to the recent harvest, while yellow maize availability was beginning to decline after a long period of great oversupply and very low prices. Thus, during the survey neither grain was in especially short or excessive supply, and this was also generally true for the year preceding the questionnaire (some questions made reference to "the past 12 months"). Households were included whether they typically consumed maize or not, allowing unbiased estimates for the entire population in selected bairros. The questionnaire included sections on family structure, supply sources of maize grain and meals, purchase behavior for maize grain, maize meals, and rice, two "price games" in which consumers were asked to make choices between products at differing prices, and a series of sections meant to quantify household income, including agricultural production and remittances.

This brief paper presents some preliminary results from this survey. The report consists primarily of tables and brief discussions of the implications of each. It is published at this time with the intention of making key policy relevant results available in a more timely fashion. All income figures are presented in terms of mean income per month per adult equivalent consumer in the household. These figures are subject to some revision, though such revisions are expected to be minor and should not affect conclusions. More detailed descriptions of the methodology employed, and more complete and in-depth analysis will be forthcoming in a DEA Working Paper.

II. Some Preliminary Results

A. Sources of Maize Supply and Grain Processing Practices

Tables 1 and 2 summarize results pertaining to sources of supply of maize grain and meals. As expected, nearly all consumers in these *bairros* consume maize regularly. Nearly all of those consuming purchase maize in city markets, and almost half have supply sources in addition to market purchases. A key and surprising result from the survey is the dominance of grain (as opposed to meal) purchases in consumer supply sources. Less than 3% of consumers cited meal purchases as their primary source of supply of maize during the 12

[5] A *quarteirão* is an administrative division below the level of *Bairro*; on *bairro* contains several *quarteirões*.

months preceding the survey. We emphasize here that this question pertains only to the households' **dominant** source of supply. Table 5 below will show that a substantial portion of consumers in Maputo purchase meal, though it is not the primary source of maize for most of them.

Table 1. Sources of maize

	Question	Frequency (% responding "yes"
A.	Do you regularly consume maize grain or meal?	98%
	Of those consuming ...	
B.	Do you regularly purchase maize grain or meal?	99%
C.	Do you consume maize produced on one of your own fields?	25%
D.	Do you receive maize produced on non-resident family member fields?	26%
E.	Do you receive maize grain from any other sources?	6%
F.	% with source of maize in addition to market purchases (those responding "yes" in C or D or E)	47%

Table 2. Principal sources of maize during past 12 months

Principal source	Freq.	%
Grain from own production	19	4.9
Grain from production on farm of non-resident family member	6	1.5
Grain purchases in Maputo	345	88.9
Meal purchases in Maputo	11	2.8
Other	7	1.9
TOTAL	388	100.00

Table 3 shows that white maize was the principal type of maize consumed for nearly three-quarters of the sample during the previous 12 months, and that the mean household income per adult equivalent consumer for this group was 23% higher than for those households who principally consumed yellow maize. White maize was relatively abundant during this period (May-June 1993 through April-May 1994) as a result of the good harvests of 1993 and 1994. Yellow maize was also very abundant, due to very large food aid arrivals beginning in late 1992 and continuing into 1993.

Table 3. Which type of maize (grain or meal) did your household principally consume over the past 12 months?

Dominant color	Freq.	%	Mean hh Income/AE
White	282	72.9	Mt 100,257
Yellow	85	22.0	Mt 81,341
Quantities were about equal	20	5.2	Mt 76,871
TOTAL	387	100.10	

Table 4 reveals several more interesting result from the survey. When obtaining grain (and recall that over 95% of the sampled households obtain their maize primarily in the form of grain) 86% typically hand pound the grain and consume it without ever taking it to a local hammer mill.[6] Only 3% typically send the grain to a local mill without any hand-pounding. As in the responses to Table 2, the figures in Table 4 underestimate the importance of hammer mills, since the question regarded only "typical" practices. It is likely that a greater proportion of the population makes some use of local mills. Nonetheless, the reasons for the apparently limited use of hammer mills by the relatively low income consumers included in this survey are not yet fully understood, and merit further data analysis and possibly focused interviews.

The second noteworthy result in Table 4 is that nearly one-quarter of the respondents indicated that, when pounding grain, they either preferred yellow (2.7%), or were indifferent (19.8%). This despite the fact that yellow maize from food aid is a dent variety, while white from local production is a flint variety. Informal feedback from consumers suggests that dent corn does not pound as well as flint corn; it is more difficult to remove the bran and germ from yellow dent corn without also losing some endosperm.

[6] This response includes several techniques, but was dominated by the response of "moer no alguidar". This is a technique which involves first pounding the grain to remove bran and germ, then soaking for one or two days, and finally mashing the wet grain in a shallow bowl (alguidar) with a wooden instrument. The result is a paste-like material used to prepare *chima*, the traditional maize dish consumed in most areas of the country. See Weber, et al., 1992, for more detail.

Table 4. Household grain processing practices

Question/Response	%
What do you typically do with grain prior to consumption?	
Hand pound then consume	86.0
Hand pound, then mill, then consume	10.9
Mill without pounding, then consume	3.0
Which type of grain do you prefer to pound?	
White	77.5
Yellow	2.7
Indifferent	19.8

B. Income and Purchase Behavior

One of the primary reasons for undertaking the Maputo Maize Preferences Survey was to explore the relationship between household income and purchase behavior. Key questions include whether the poorest consumers are more likely to consume yellow maize, especially whole yellow meal, and whether these same consumers would respond more sensitively than higher income consumers to changes in relative prices. Table 5 presents the proportion of households purchasing selected products during the past year, and the mean household incomes per adult equivalent consumer of those purchasing and those not purchasing these products. Key results are that fewer consumers purchased yellow grain and meals than purchased white grain and rice, and that those who did purchase yellow products have incomes substantially below those who never purchased them during the past year.

This issue is examined from a slightly different perspective in Table 6, where the percent of households purchasing each product is broken down by income quintile[7]. For the three yellow maize products, the percent of households purchasing holds steady through the first three or four quintiles, then decreases substantially in either the fourth or final quintile. This result shows that it is the highest income consumers that are least likely to consume yellow maize products. The results in Tables 5 and 6 suggest that yellow grain, and especially whole yellow meal, tend to be self-targeting products for poor consumers, in the sense that higher proportions of low income consumers choose of their own volition to consume these products. Results below will shed further light on this issue.

[7] Households in quintile number 1 are those 20% of households with the lowest incomes per resident adult equivalent consumer. Quintile 5 contains the 20% of households with the highest incomes per resident adult equivalent consumer.

Table 5. Mean household income per AE by purchasers and non-purchasers of selected products

Product	% purchasing in past year	Mean Monthly hh Income/AE	
		Purchasers	Non-purchasers
Yellow grain	65.3%	Mt 84,032	Mt 115,549
Whole yellow meal (FMACF)	34.3%	Mt 78,180	Mt 102,637
Refined yellow meal from CIM (FMASF/CIM)	12.3%	Mt 71,287	Mt 97,748
White grain	93.6%	Mt 96,608	Mt 62,210
Rice	81.4%	Mt 95,823	Mt 90,870

Table 6. Percent of households purchasing selected products, by income quintile

Product	Income Quintile				
	1 (22,627)	2 (41,300)	3 (62,056)	4 (96,239)	5 (252,950)
	---- % purchasing in past year ----				
Yellow grain	68.8	69.7	72.7	66.7	50.0
Whole yellow meal (FMACF)	40.3	36.8	40.8	28.2	23.0
Refined yellow meal from CIM (FMASF/CIM)	13.0	11.8	15.6	14.1	6.7
White grain	93.6	90.8	90.9	97.4	98.7
Rice	88.5	77.2	79.5	83.5	78.2

Poor consumers are also more likely to purchase in small units than are better off consumers (Table 7). Slightly more than one-quarter of surveyed households who purchased yellow grain typically did so in the small can (*caneca*) that is the standard unit of measure in Maputo informal markets. An identical percentage of white grain purchasers did so in *canecas.* In each case, mean incomes of those purchasing by *caneca* were substantially lower than those purchasing in larger units (20 liter cans or 50 kg bags).

Table 7. Mean income by typical unit of purchase, yellow and white grain

Product	Unit	% Purchasing in this unit (of those purchasing the product)	Mean monthly hh income/AE
Yellow grain (GMA)	Caneca (small can)	27%	Mt 68,158
	18 kg or more	73%	Mt 90,315
White grain (GMB)	Caneca (small can)	27%	Mt 84,352
	18 kg or more	73%	Mt 101,776

To better understand the dynamics of consumer choice when prices change, sampled consumers were presented with a price game. In this game they were first asked to choose between two alternative maize products at identical prices (equal to the mean of the actual market prices of the two products at the time of the survey). They were then asked how low the price of the less preferred product would have to fall before they would change their decision and purchase it. No actual transactions took place; consumers were simply asked to indicate what they would do in the given situations. Games were played between yellow and white grain, between yellow grain and whole yellow meal, between white grain and whole yellow meal, and between whole yellow meal and refined yellow meal from CIM. It is important to note that each of these products has been present in the market on a more or less continuous basis for the past several years. Thus, consumers could be expected to be familiar with each of these products. In each case, the consumer was allowed, if they wished, not to purchase either maize product, choosing instead more expensive rice or refined white meal from Swaziland. This type of game has been frequently used in consumer research. It is designed to determine the level of price premium that consumers are willing to pay for different colors of maize and different levels of processing of meals. When combined with income data, these games can indicate **who** (in terms of income) would most quickly change to the less preferred product as its price falls.

Tables 8 - 13 present results from two of these games: between white and yellow grain, and whole and refined yellow meals. The game between white and yellow grains (Tables 8-10) was designed to give an indication of consumers' pure preference for white color.[8] **At equal prices**, nearly all consumers indicate that they would purchase white grain. Very few opt out of grain altogether and choose to purchase rice or highly refined white meal from Swaziland.

[8] In fact, the white and yellow grains in Maputo markets differ in ways other than just color. The principal difference is that yellow maize is a dent variety and does not hand pound as well as the white flint varieties produced in Mozambique. Thus, it can be argued that this game overstates actual preferences for white color among consumers.

This result is not surprising, given historical preferences for white and the superior pounding attributes of the flinty white varieties as opposed to the dent yellow varieties supplied by food aid.

Table 8. At equal prices, do you prefer white grain (GMB) or yellow grain (GMA)?

Preferred product	Freq.	%
White grain (GMB)	372	95.6
Indifferent	1	0.3
Yellow grain (GMA)	7	1.8
Neither, would purchase rice	6	1.5
Neither, would purchase refined white meal from Swaziland (FMBSF/SZ)	3	0.8
TOTAL	389	100.00

The striking results are found in Tables 9 and 10. Table 9 shows that, with a price discount of only 14% on yellow grain (Mt 600 vs. Mt 700 for white grain), one-quarter of sampled households indicate that they would choose to consume yellow grain rather than white, **and these consumers on average have substantially lower incomes than all other consumers.** By the time yellow grain has been discounted 43% relative to white, more than 70% of sampled households have indicated that they would switch to yellow. Table 10 provides more detail on the level of discount which causes different consumers to switch to yellow grain. Two results stand out. First, lower income consumers are clearly more likely to switch to yellow at modest price discounts (34.7% of the poorest) than are higher income consumers (only 10.0% for the highest income consumers). Yet regardless of income, about three-quarters of all consumers will switch to yellow grain if it is discounted at least 43% below white; at these large price discounts, higher income consumers are just as likely as lower income consumers to switch to yellow maize.

These results are important for three reasons. First, they suggest that large volumes of yellow grain available at prices significantly below white grain prices (as occurred throughout 1993 due to excessive food aid supplies) can substantially reduce demand for white maize. This will have direct negative consequences for farmers, and will reduce the incentive for traders to invest in the marketing system for white maize. Each will bring negative consequences for Mozambique's economic development.

Second, on a more positive note, a 14% price differential is one that could most likely be maintained in an open market setting, given relative prices of white and yellow grains in world markets, and the apparently superior productivity of yellow grain in Southern African countries such as Zimbabwe, Zambia and South Africa. Thus, without food aid but with commercial imports of cheaper yellow maize, poor consumers would be benefited. Finally, the poorest consumers are those who would switch most quickly to yellow grain when its price falls relative to white. This suggests that poor consumers have the most to lose if

yellow maize becomes unavailable in the market, or if its price rises substantially. As food aid diminishes in Mozambique, serious attention must be given to ways in which the substantial market demand for yellow maize among low income consumers can be met. This could be accomplished through a fully liberalized import policy on food grains, through efficient domestic production of yellow grain, or through some combination of each. The GOM and donors should investigate the possibility of a research program to develop yellow flint varieties, possibly using material from Malawi.

Table 9. Percent switching from white grain to yellow grain with price discounts on yellow grain

% discount on yellow grain	% switching to yellow	Cumulative % switching	Mean monthly income/AE of those switching
14	25.1	25.1	Mt 58,427
29	14.4	39.5	Mt 100,289
43	31.3	70.8	Mt 108,387
>43	4.4	75.2	Mt 91,409
Would not switch	24.8	---	Mt 106,682

Table 10. Cumulative percent switching from white grain to yellow grain with price discounts on yellow grain, by income quintile

% discount on yellow grain	Income Quintile				
	1	2	3	4	5
	---- cumulative % switching to yellow grain ----				
14	34.7	37.8	21.1	20.5	10.0
29	45.3	58.1	31.0	35.6	27.1
43	69.3	77.0	67.6	74.0	65.7
>43	72.0	79.7	74.6	79.5	70.0
Would not switch	28.0	20.3	25.4	20.5	30.0

The game between whole and refined yellow meals (Tables 11-13) was designed to quantify consumer preferences for processing. It is important to note that these results may overstate consumer preferences for refined over whole meals, due to quality problems in the grain used to produce whole meals, and the difficulty of determining quality once the meal has been produced. The quality of yellow maize grain during much of 1993 and 1994 was often quite poor. This was a result of several factors, including the long period of storage within the country (most yellow grain was stored from late 1992 or very early 1993). When examining yellow grain, informed consumers could readily judge the quality of the grain and either negotiate a price discount or purchase better quality grain from another trader. Once milled, however, it is much more difficult to determine the quality of the grain that was used to

produce the meal. It is for this reason that researchers believe the reference period for this study implied a likely bias by consumers against whole yellow meal.

Table 11. At equal prices, do you prefer whole yellow meal (FMACF) or refined yellow meal produced domestically (FMASF/CIM)?

Preferred product	Freq.	%
Refined yellow meal (FMASF/CIM)	343	88.2
Indifferent	1	0.3
Whole yellow meal (FMACF)	3	0.8
Neither, would purchase rice	20	5.1
Neither, would purchase refined white meal from Swaziland (FMBSF/SZ)	22	5.6
TOTAL	389	100.00

Despite this, results are similar to those for white and yellow grains, showing a marked willingness of low income consumers to switch to whole meal at relatively modest price discounts. At equal prices, nearly 90% of consumers would purchase the more refined meal, while about 10% would buy more expensive rice or highly refined white meal from Swaziland. Less than 1% would choose the whole yellow meal. Yet if the price of whole meal is decreased by 20% (to Mt 400, vs. Mt 500 for refined meal), nearly 20% of sampled households would switch to it. Once again, these more price sensitive consumers have substantially lower incomes than all other consumers. Table 13 paints a picture similar to that for the white grain - yellow grain comparison. The lowest income consumers are substantially more likely to switch at modest price discounts, but by the time the price is discounted at least 60%, approximately 50% have indicated they would change, regardless of income.

Table 12. Percent switching from refined to whole meal with price discounts on whole meal

% discount on yellow grain	% switching to yellow	Cumulative % switching	Mean monthly income/AE of those switching
20	19.6	19.6	Mt 67,640
40	15.8	35.4	Mt 90,908
60	16.4	51.8	Mt 97,735
>60	2.9	54.7	Mt 80,343
Would not switch	45.3	---	Mt 103,173

Table 13. Percent switching from refined to whole yellow meal price discounts on whole meal, by income quintile

% discount on whole yellow meal	Income Quintile				
	1	2	3	4	5
	---- % purchasing in past year ----				
20	24.3	28.8	20.0	10.3	13.8
40	42.9	48.5	31.4	25.0	29.2
60	51.4	63.6	48.6	45.6	49.2
>60	55.7	65.1	50.0	50.0	52.3
Would not switch	44.3	34.8	50.0	50.0	47.7

Costs for milling maize grain into whole meal in local hammer mills are exceptionally low, hovering for two years around Mt 1,500 for a sack of 50 kilograms in Maputo. This cost is several times lower than the cost of producing a more refined meal in a large roller mill. Thus, relative milling costs indicate that a price discount of 20% on whole meal could readily be maintained in an open market. The important policy conclusion is that not only yellow maize availability, but the presence of a viable small scale milling sector to turn that maize into low cost whole meal, are both important for the welfare of poor urban consumers.

III. Tentative Conclusions

This study is based on preliminary results from a study of consumer maize meal preferences in low income *bairros* of the city of Maputo. Some figures are subject to revision, but these revisions are not expected to change substantive results. Food security project personnel will conduct more in-depth analysis to test statistically the strength of relationships identified in this report, and to estimate consumption parameters such as income elasticities of demand for different maize products.

Subject to these qualifications, the results reported here allow us to suggest some preliminary answers to the three policy questions posed at the beginning of this report.

1. **What are the effects of yellow maize food aid shipments on incentives for the production and marketing of white maize?** Results suggest that low income consumers are not willing to pay large price premiums for white maize grain and meals over yellow grain and meals. At price discounts potentially supportable in an open market setting, over a third of poor consumers, and a quarter of all consumers, will switch to yellow grain in favor of white grain. This suggests that large amounts of yellow grain food aid sold at prices well below world market levels can substantially reduce demand for white maize and thus reduce incentives for domestic production.

2. **Should the Government of Mozambique encourage yellow maize availability, at market prices, even after the country reduces or eliminates its dependence on food aid?** Results suggest that, to the extent the Government is concerned about the welfare of the poorest consumers, it should encourage the availability of yellow grain. This grain is more readily available than white grain on world markets, and can be procured at lower cost. If produced locally, evidence from other countries in Southern Africa such as Zimbabwe, Zambia, and South Africa suggests that it could be more productive and thus lower priced in markets. If available, this survey suggests that the lowest income consumers would be the primary consumers of this low cost grain, thus increasing their real purchasing power.

3. **What are the benefits to consumers (and which consumers capture them) of widespread availability in markets of whole white and yellow maize meals?** Results also suggest that the poorest consumers are the most likely to consume whole meals when these are discounted relative to refined meals. The discounts necessary to induce substantial shifts to whole meals are not substantial, being easily supported in a market setting on the basis of relative milling costs of large roller mills (producing refined meal) and small hammer mills (producing whole meal).

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