

# Maize quality requirements of producers of six traditional Ghanaian maize products

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## SUMMARY

Eight commercial producers of *abooloo*, *Fanti kenkey*, *fomfom*, *Ga kenkey*, *nsewhu* and *workple* from 18 towns of six southern regions of Ghana were interviewed on the quality of maize required by them for making their products. In decreasing order of importance, respondents chose general appearance, insect damage, moisture content, foreign matter, and mouldiness as the main quality indices they would like to be used as criteria for grading maize. The type of maize product influenced the choice of quality requirements for maize. Producers of *workple*, a wholemeal unfermented maize product, preferred maize of no mouldiness, almost no insect damage, and low moisture content. For *abooloo*, *Fanti* and *Ga kenkey* producers, maize of low moisture content, low insect damage, good general appearance and no mouldiness was equally important. Producers of *nsewhu* and *fomfom*, two dehulled fermented maize products, require maize which can easily be dilled. Most producers have problems using most of the newly released varieties of maize.

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## Introduction

Maize (*Zea mays* L.) is considered as the most popular staple food-grain in Ghana (Prempeh, 1971). This is because maize is a good source of carbohydrates. It is processed into several traditional products, the most popular being *kenkey* which is made from fermented wholemeal maize dough. There are two main types, the *Ga kenkey* (locally referred to as *komi*) and *Fanti kenkey* (*dokon*). Other types of maize products,

## RÉSUMÉ

JOHNSON, P-N. T. & HALM, M.: *Les besoins qualitatifs du maïs des producteurs de six produits du maïs traditionnel ghanéen*. Quatre-vingts producteurs commerciaux d'*Abolo*, de *Fanti kenkey*, de *Fomfom*, de *Ga kenkey*, de *Nsewhu* et de *Workple* de dix-huit villes de six régions du sud du Ghana étaient interviewés sur la qualité du maïs exigée par eux pour la préparation de leurs produits. Dans l'ordre décroissant en importance, les personnes interrogées choisissaient, l'apparence générale, le dégât d'insecte, le contenu d'humidité, la matière étrangère et l'état moisi en tant que les indices principaux de qualité qu'elles voudraient être employés comme les critères pour la classification de maïs. L'espèce de produit du maïs influençait le choix des besoins qualitatifs du maïs. Les producteurs de *Workple*, un produit-de-maïs complet non-fermenté préféraient le maïs de nulle moisissure presque un nul dégât d'insecte et un très faible contenu d'humidité. Pour les producteurs d'*Abolo*, de *Fanti* et *Ga kenkey*, le maïs de faible contenu d'humidité, le faible dégât d'insecte, le bon air général et la nulle moisissure étaient également pertinentes. Les producteurs de *Nsewhu* et de *Fomfom*, les deux produits de maïs fermentés décortiqués exigent le maïs qu'on peut facilement décortiquer. La plupart de producteurs ont des problèmes d'utilisation de beaucoup de variétés de maïs nouvellement mise en vente.

like *abooloo*, *fomfom*, and *nsewhu*, are made from dehulled and/or fermented maize. Another product used extensively in Ghana as a weaning food for babies is *koko*. This is a thin gruel made from fermented maize.

In addition to the extensive domestic use, appreciable amounts of maize are exported, especially to other West African countries. The maize industry can, therefore, be considered as one of the most vibrant agricultural commercial



activities in Ghana. However, one drawback of this industry is the lack of an official system for grading maize in Ghana. Bauwin & Ryan (1974) have pointed out that a well-established procedure for grading maize promotes the uniform application of official inspection systems for maize. An official grading system for maize will ensure that grains are priced according to the quality. The price differentials associated with the different classes of maize will also serve as incentives for farmers to improve upon the quality of maize they offer for sale.

Although there are no official grading systems, it is widely known that most farmers implement some form of grading standards before their grains are sold. Unfortunately, there is usually no uniformity in the standards from one farmer to the other (Ofosu, 1997). In general, methods for grading food-grains usually involve analysis of representative samples and the conversion of weights of carefully defined fractions of each sample (e.g. insect-damaged grains, broken grains, and foreign matter) into percentages of the original sample weight. Though Proctor (1978) explained that this method is used internationally to classify food-grains during trade, he further pointed out that the development of acceptable national grading standards for food-grains in any country is also dictated by the quality preferences of those who extensively use the grain.

In recognition of the latter consideration, a country-wide survey was conducted to ascertain from commercial producers of traditional maize products in Ghana what quality criteria they would prefer for developing a national grading standard for maize in Ghana. The survey was undertaken for a committee set up jointly by the Ministry of Food and Agriculture (MOFA) and the Ghana Standards Board to review proposals for the Ghana Draft Standards for maize. This study reports on the main findings of maize quality requirements for six traditional maize products: *aboloo*, *Fanti kenkey*, *fomfom*, *Ga kenkey*, *nsewhu*, and *workple*.

### Methodology

The survey was conducted with the help of a questionnaire which was administered through personal interviews and discussions. A total of 80 respondents was interviewed with the assistance of officers from the Extension as well as the Women in Agriculture Development (WIAD) divisions of the MOFA. The respondents were from the Ashanti, Brong-Ahafo, Central, Greater Accra, Volta, and Western Regions. Towns were selected by concentration of commercial producers of the six traditional maize products. In any one town, three prominent producers were randomly selected.

The first part of the questionnaire covered the biodata of the respondents, scales of operation, source and variety of maize used, informal method used by respondents for assessing maize quality during purchase, and the processing methods for six traditional maize products. Respondents were also asked to explain how long they stored maize and problems they encountered, and what practices they sometimes used to improve the quality of slightly damaged maize before processing.

In the second part of the questionnaire, respondents were asked to rank, in order of importance, the following parameters:

1. *The maize quality indices assessed during purchase.* General appearance, moisture content, absence of insects, absence of mouldiness, foreign matter, flour content, and variety and/or grain size.
2. *The main physical and functional properties essential for their respective maize products.* Swelling and pasting abilities, milling property, flour content, ease of dehulling, and colour of grain/flour.
3. *The desirable sensory quality characteristics of the maize products.* Texture, taste, aroma, mouth-feel, and colour.

These parameters were selected after the questionnaire had been pre-tested at two locations in Accra, where commercial processing of maize

is on a large scale. These were Osu Ajumako and Osu Amantra.

Respondents were then asked to list and rank, in order of importance, physical quality indices that they would like to be used in classifying maize grains in Ghana.

### Results and discussion

All the respondents were women processing, on the average, one to two 100-kg bags of maize in a week. Nearly 83 per cent of respondents have been processing maize commercially for more than 20 years in small cottage industries. Most of the respondents claimed that they were running mainly family businesses handed down from their mothers and grandparents.

Eighty-two per cent of respondents indicated that they bought their maize from the towns they were operating in, most of which were marketing centres. Some respondents moved out to look for better and less expensive sources of maize because of the high volume of production.

Sixty per cent of respondents said they bought and kept maize for subsequent use. These were usually kept in rooms, corridors, kitchens, and under sheds. Maize was usually stored for a short duration, mostly for a month. Only 15 per cent of the respondents claimed they experienced minor storage problems such as mouldiness, rodent attacks, and insect damage.

Table 1 shows the list of maize quality indices assessed by respondents. Respondents assessed general appearance, moisture content, insect damage, flour content, foreign matter, and mouldiness with well known informal techniques such as visual observation, biting, impact sound, and hand penetration (FAO, 1983). General appearance seems to be a composite quality index embracing colour, shape, size, and variety of the maize grains. Almost all respondents preferred the local traditional varieties of maize. The *Volta local*, a white flint maize grain with 83 per cent carbohydrate content (Andah & Muller, 1973), is one of the most preferred varieties of the respondents. Fig. 1 shows choice and ranking of

quality indices for grading maize by commercial producers of six maize products, *aboloo*, *Fante kenkey*, *fomfom*, *Ga kenkey*, *nsewhu*, and *workple*. The observations indicated that weights given to the five quality indices depended largely on the product and the processing techniques used. Fig. 2, 3 and 4 present flow diagrams for producing the six products.

The rankings of the producers of *aboloo* and *workple* were high and comparable for all five quality indices: moisture content, general appearance, absence of insect damage,

TABLE 1

*Quality Indices Assessed During Purchase by Producers of Traditional Ghanaian Maize Products*

| <i>Quality index assessed</i> | <i>% respondents</i> |
|-------------------------------|----------------------|
| General appearance            | 82.3                 |
| Moisture content              | 77.0                 |
| Insect damage                 | 72.9                 |
| Foreign matter                | 68.3                 |
| Mouldiness                    | 63.5                 |
| Variety/Size of grain         | 53.5                 |
| Flour content                 | 51.1                 |
| Adulterations/Admixtures      | 24.5                 |

mouldiness, and foreign matter. The high premium placed by producers of *aboloo* and *workple* on absence of foreign matter and insect infestation is because the maize grains are not thoroughly washed (Fig. 2) as in the preparation of the *kenkey* products (Fig. 3). For the *kenkey* products, the soaking process allows for the separation of insects and the collection of blemished grains and foreign matter. These refractions normally float on the surface of the washing water and, therefore, can be easily scooped away with a sieve. Sieves used were either small truncated raffia baskets, mosquito netting or square raffia-woven sieves about 500 mm × 500 mm. In addition, when the maize was not properly dried, some respondents claimed they were able to obtain the same quality product as from the dried maize, by reducing the steeping period and/or increasing the duration of

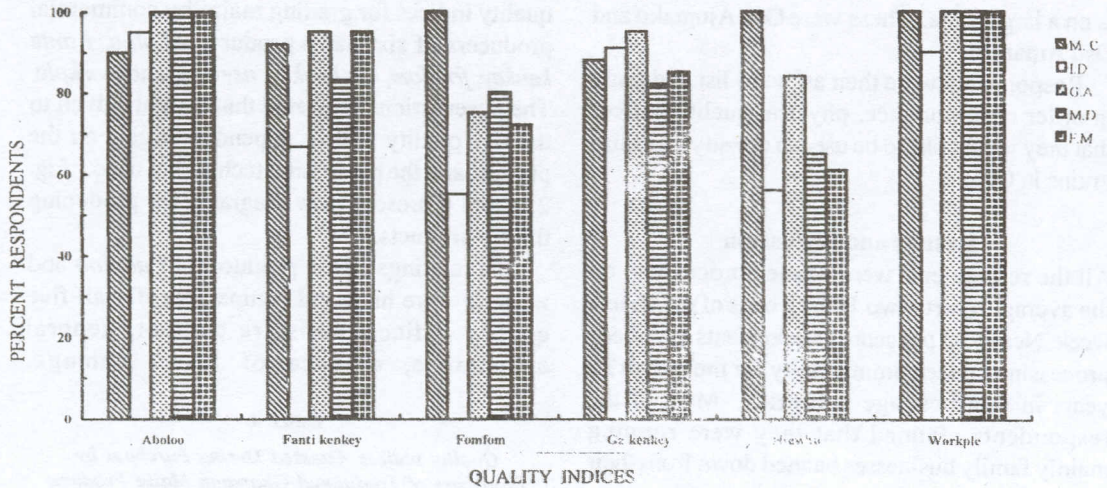


Fig. 1. Choice of quality indices for grading maize by commercial producers of six Ghanaian maize products.

(Legend: MC = Moisture content; ID = Insect damage; GA = General appearance; MA = Mouldiness; and FM = Foreign matter)

dough fermentation. The study also showed that the consistency of the fluffy texture of *aboloo* is affected if the maize grains are chaffy.

For *fomfom* and *nsewhu*, the most important quality index is the moisture content. Respondents of these maize products said that they required maize grains which had been properly dried and could be easily dehulled. The dehulled maize for *fomfom* and *nsewhu* must be whole. Clarke (1983) recommended that optimum moisture content for efficient dehulling of maize is the equilibrium moisture content of about 13 per cent (w. b.). This moisture content should correspond to the typical tropical ambient equilibrium relative humidity of 70 per cent (FAO, 1983). If the maize is dried further below this value, it becomes too brittle and breaks up into pieces during dehulling. The broken pieces would then be lost during winnowing. Insect damage and mouldiness, if not extensive, were eliminated during the winnowing process after dehulling (Fig. 4). For *aboloo*, however, the brittleness of the grain is not really considered important, since the maize grain is partially dehulled and then split into grits by sieving (Fig. 2) without incurring any losses.

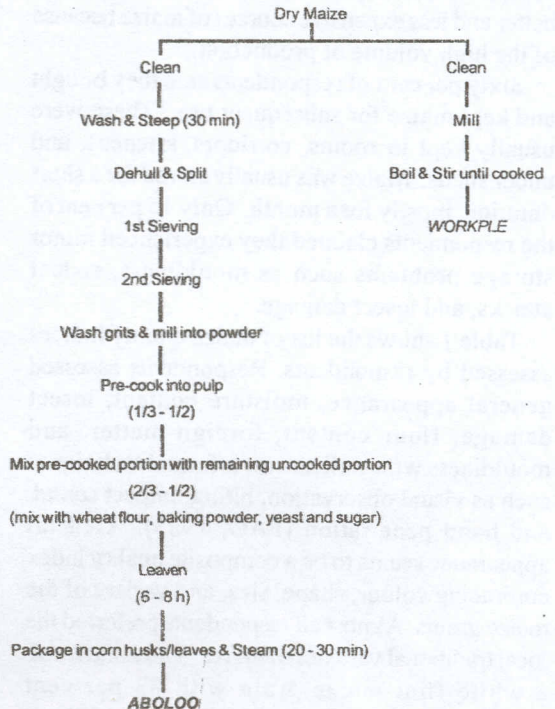


Fig. 2. Flow diagrams for the production of *aboloo* and *workple*.

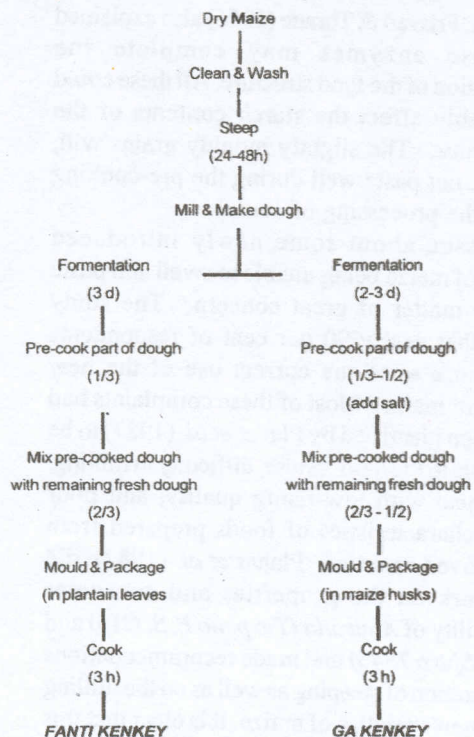


Fig. 3. Flow diagram for the production of *kenkey*.

Two types of *fomfom* were identified during the survey: one made from pinkish-red maize grains, and the other from white grains. *Fomfom* made from the pinkish-red grains was found to be a special preference of the *Nzema* people in the Western Region. The most important functional properties of maize identified by almost all respondents were its swelling and pasting properties (Table 2). The swelling of any food-grain depends on its flour content (Deobold, 1972), and this explains why respondents checked on flour content of maize grain during purchase.

Two subjective methods were used to assess flour content: (i) scooping a handful of grains and gently assessing the hand-weight, and (ii) biting through the grain to determine whether it was

floury.

Table 2 also indicates that the milling property of maize is equally important. Most respondents said they wanted maize that can be milled into smooth flour with relatively high amount of damaged starch granules which enhance the swelling and pasting characteristics of the flour (Sefa-Dedeh, 1989).

The average-ranked scores (AS) indicate that the texture of all six maize products is the most desirable sensory attribute (Table 3). The texture of most starchy foods is affected by the number of damaged starch granules (Penfield & Campbell, 1990). The high score for texture, therefore, corroborates the desire of producers to have maize with good milling property.

Taste, aroma, and mouth-feel are linked to the cleanliness of the maize as well as to the general hygiene during processing. Clean maize has negligible foreign matter, physical defects, and contaminants (Codex Alimentarius, 1994).

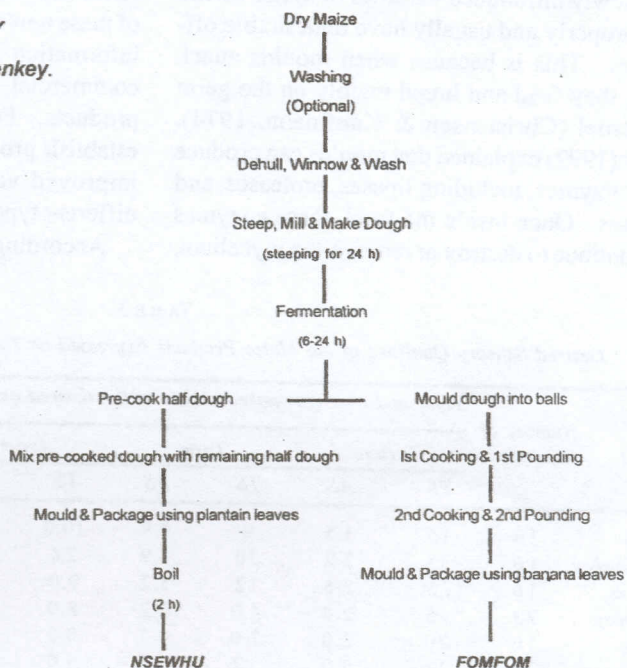


Fig. 4. Flow diagrams for the production of *nsewhu* and *fomfom*.

TABLE 2

Cumulative Scores of Important Physical and Functional Properties of Maize as Given by Producers of Six Traditional Ghanaian Maize Products

| Maize product       | Scores as percentages of total respondents of each maize product |                                |                   |                  |         |
|---------------------|--|--------------------------------|-------------------|------------------|---------|
|                     | Flour content  | Swelling and pasting abilities | Ease of dehulling | Milling property | *Colour |
| <i>Aboloo</i>       | 85.7   | 85.7                           | 57.4              | 18.8             | 82.5    |
| <i>Fanti kenkey</i> | 50.0   | 75.0                           | N/A               | 95.8             | 15.3    |
| <i>Fomfom</i>       | 62.5   | 87.5                           | 100               | 95.7             | 25.3    |
| <i>Ga kenkey</i>    | 87.0   | 87.0                           | N/A               | 98.4             | 78.5    |
| <i>Nsewhu</i>       | 70.0   | 100                            | 100               | 86.3             | 100     |
| <i>Workple</i>      | 63.6   | 81.8                           | N/A               | 80.1             | 36.4    |

N/A = Not applicable

\*All respondents, with the exception of some *fomfom* producers, wanted white/light yellowish-coloured maize. Some *fomfom* producers preferred pinkish red-coloured maize grains.

Respondents of *Ga kenkey* indicated that slightly discoloured and/ or mouldy maize and some newly introduced varieties of maize do not paste properly and usually have undesirable off-flavours. This is because when moulds attack grains, they feed and breed mainly on the germ and kernel (Christensen & Kaufmann, 1974). Bigelis (1992) explained that moulds can produce many enzymes, including lipases, proteases, and amylases. Once inside the food, these enzymes may continue to destroy or remove the mycelium.

Filttenborg, Frisvad & Thrane (1996) also explained that these enzymes may complete the disintegration of the food structure. All these could considerably affect the starch contents of the maize grains. The slightly mouldy grains will, therefore, not paste well during the pre-cooking stage of the processing of *kenkey*.

The issue about some newly introduced varieties of maize being unable to swell and paste well is a matter of great concern. The study showed that nearly 90 per cent of respondents were unsure as to the correct use of the new varieties of maize. Most of these complaints had earlier been identified by Plahar *et al.* (1987) to be attributable to the hard texture, difficulty in milling, chaffy meal with low-rising quality, and poor sensory characteristics of foods prepared from the improved varieties. Plahar *et al.* (1987) did some work on the properties and consumer acceptability of *Aburotia (Tuxpeno P.B. C16)* and *Dobidi (Ejura 7843)* and made recommendations on the duration of steeping as well as on the milling of these new varieties of maize. It is clear that this information is yet to be extended to most of the commercial producers of the traditional maize products. Further research is also required to establish properties of the other newly released improved varieties in their suitability for the different types of traditional maize products.

According to the Codex Alimentarius (1994),

TABLE 3

Desired Sensory Qualities of the Maize Products Expressed as Total and Average Ranking Scores

| Maize product       | Number of respondents | Total and average ranked scores of the desired quality characteristics of the maize products |     |       |     |       |     |            |     |        |     |
|---------------------|-----------------------|--|-----|-------|-----|-------|-----|------------|-----|--------|-----|
|                     |                       | Texture  |     | Taste |     | Aroma |     | Mouth-feel |     | Colour |     |
|                     |                       | TS   | AS  | TS    | AS  | TS    | AS  | TS         | AS  | TS     | AS  |
| <i>Aboloo</i>       | 10                    | 15   | 1.5 | 9     | 0.9 | 10.0  | 1.0 | 14.0       | 1.4 | 15     | 1.5 |
| <i>Fanti kenkey</i> | 16                    | 35   | 2.2 | 30    | 1.9 | 22    | 1.4 | 3.0        | 0.2 | 4.0    | 0.3 |
| <i>Fomfom</i>       | 10                    | 25   | 2.5 | 12    | 1.2 | 9.0   | 0.9 | 18         | 1.8 | 18     | 1.8 |
| <i>Ga kenkey</i>    | 23                    | 55   | 2.4 | 4.0   | 0.2 | 8.0   | 0.3 | 8.0        | 0.3 | 12     | 0.5 |
| <i>Nsewhu</i>       | 10                    | 20   | 2.0 | 7.0   | 0.7 | 8.0   | 0.8 | 7.0        | 0.7 | 28     | 2.8 |
| <i>Workple</i>      | 11                    | 24   | 2.2 | 12    | 1.1 | 9.0   | 0.8 | 18         | 1.6 | 18     | 1.6 |

Legend: TS = Total score from the best chosen characteristics, using the scale, 4 = first choice and 1 = last choice  
AS = Average score, i.e. total score divided by number of respondents for the maize product

representative samples of maize being analysed during grading must be whole, clean, free from impurities and insects, and should not have any abnormal or foreign odour. It is obvious from this study that most of the quality criteria producers of the six traditional maize products want for grading maize in Ghana agree with the specifications of the Codex Standards.

### Conclusion

The study has shown that commercial producers of *abolo*, *Fanti kenkey*, *fomfom*, *Ga kenkey*, *nsewhu*, and *workple* would like moisture content, level of insect damage, presence of foreign matter, and degree of general appearance to be used as the main quality indices to grade maize in Ghana. These quality indices agree with the general requirements of the Codex standards for maize.

Food research scientists also need to do more work on the appropriate methods of processing and using newly introduced varieties of maize. This will be of tremendous help to producers of traditional Ghanaian products.

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