

IDRC-Lib
57
34031

Proceedings of the
**International Symposium on
Sorghum Grain Quality**

**ICRISAT Center
Patancheru, India
28-31 October 1981**

04162

Sponsored by
**USAID Title XII Collaborative Research Support Program
on Sorghum and Pearl Millet
(INTSORMIL)**
**International Crops Research Institute for the Semi-Arid Tropics
(ICRISAT)**
**Indian Council of Agricultural Research
(ICAR)**

This report is presented as received by IDRC from project recipient(s). It has not been subjected to peer review or other review processes.

This work is used with the permission of Institute of Southeast Asian Studies.

© 1981, Institute of Southeast Asian Studies.

ARCHIV
VOGEL
no. 2

Consumer Acceptance of Sorghum and Sorghum Products

P. Pushpamma and Sally M. Vogel*

Summary

Consumer acceptance is one of the essential requirements for the successful adoption of any new cultivar of sorghum by farmers. In screening cultivars for better agronomic properties, grain characteristics that influence consumer acceptability need consideration. Though plant breeders are aware of the benefits to be derived from such screening, the lack of simple laboratory tests that use small samples of grain and are fast enough to screen large number of samples is a disincentive. To develop standard test procedures, it is necessary to identify grain characteristics influencing food quality attributes that have a major bearing on consumer acceptability of the grain. In addition to consumer and market surveys, utilization tests and consumer product tests can be used effectively to develop parameters to measure sorghum product quality attributes, which can be linked to physical or chemical grain characteristics. Acceptability of sorghum and sorghum products can be improved by introducing better and easy methods of processing and developing "high status" foods using refined sorghum flour or composite flour, in addition to breeding varieties with better food quality.

Success of any food grain or its product depends on acceptance by the consumer. Consumers' reactions are difficult to measure since acceptance and preference of food is conditioned by many complex factors—both attributes of the food and of the consumer.

Consumer preference refers to selection when presented with a choice and is frequently influenced by prejudices, religious principles, group conformance, status value, and snobbery in addition to the quality of food. Consumers exercise their preferences only when they are given an opportunity to select from a wide variety. Consumer preferences may indicate the optimum desirable characters, and the lowest level if rejected. However, in most of the grain characters there is a wide range between these two levels, which may be quite acceptable for the consumer.

Consumer acceptance is essentially weighed with consideration of cost along with traditional food processing and cooking procedures.

Acceptance of food varies with the standard of living and cultural background. It is conditioned by economic factors and deep-rooted religious restrictions.

Though both acceptance and preference are primarily economic concepts, acceptance is more conditioned by the purchasing power of the consumer. On the other hand, preference can be described as what they would like to have in theory. Acceptance is what they actually do under given circumstances. While preference for a food is more or less a permanent phenomenon, acceptance indicates only the reaction of the consumer at a given time under existing circumstances. What is acceptable today may not be acceptable next year, since acceptance may change either with increased purchasing power or the availability of other foods or vice versa.

Importance of Grain Quality in Crop Improvement Programs

In the process of achieving food production targets, agricultural scientists concentrate their efforts on developing high-yielding varieties. As a result of this, a number of varieties with wide

* Dean, Faculty of Home Science, Andhra Pradesh Agricultural University, Hyderabad, India; Program Officer, (Post Production Systems), International Development Research Centre, Edmonton, Canada.

the market. However, people prefer to grow not only those grains that produce good yield but also those that taste good. Therefore, in order to screen varieties for consumer acceptability, simple laboratory tests, which can be easily applied to a very large number of small samples of grain, are required. Cultivars that are selected in these laboratory tests can be studied further. When the program reaches the stage of advanced testing, only a limited number of promising varieties would undergo large-scale processing and utilization tests. By comparing the quality of the product made, with that of a currently popular local variety, a better evaluation can be made of the prospective acceptance. Subsequently in the final stages of the program, the selected lines can be evaluated in consumer product tests to determine their acceptance.

While there is a general awareness of the benefits to be derived from such a broad-based selection program, there is a need to develop standard test procedures. Research related to cultivar quality could help plot the cost/effect relationships between laboratory determinations of physical, biochemical, nutritional, and functional characters of the grains, the performance of these grains in utilization tests, and their consumer acceptability.

Factors Influencing Acceptance of Sorghum

Status Value of Sorghum and Sorghum Foods

Among consumer attributes, prestige of the food is one of the most important characteristics. Though food is a physiological requirement, people often select a particular food for social reasons. In general, sorghum is not considered as socially acceptable as wheat and rice. Even in the Third World countries, where sorghum is used for human food, it is considered a coarse grain. It is mainly consumed in the dryland areas which are backward in all respects. Sorghum and sorghum products occupy a low position in status value of foods, not only because they are available at a cheaper rate compared with other staples like rice and wheat, but also because of certain poor food quality attributes of the grain. The dark color, high fiber content, pronounced flavor, grittiness of the

flour, and difficulty to cook into soft products are some of the disadvantages in using sorghum for producing high-status foods like bread, biscuits, and pastries.

In addition to the poor palatability of sorghum foods, they are also low in digestibility compared with other cereals, especially varieties with high tannin content (Hulse, et al. 1980).

The third factor which is attributed to the low status of sorghum food is the poor nutritive image, which is held not only by consumers but also by a number of sorghum scientists. No doubt, the sorghum-eating population suffers more from nutritional disorders mainly because they consume very little non-cereal and other foods recommended in the dietary requirement, due to their low purchasing power. However, the adequacy of sorghum-based diets, when it is consumed in proper combination with other foods, has been tested in a longitudinal study with pre-school children by Pushpamma et al. (1979) and proved their ability to support desirable growth. The growth pattern of the children was even better than their counterparts, fed with rice based diets at home. Though not inferior to other cereals, since sorghum is more or less the single source for nutrients in a sorghum-eating population, the quantity and quality improvement of protein and other essential nutrients will be of great significance.

So the sorghum breeders, while evolving new varieties, are confronted with the dual problem of ensuring preferred grain characters for consumer acceptance and of upgrading the nutritive value to improve the status of sorghum and sorghum products.

Preferred Grain Quality Characters in Sorghum

Appearance probably has the greatest initial influence in acceptance of food since visual characteristics significantly control selection. However, once the food is prepared and tasted, visual characteristics become secondary to cryptic and palatability characters.

Quality characters which could influence the consumer acceptability of the product may be classified into three major groups:—

1. Physical characteristics of Grain: Color, size, pericarp thickness, texture of the endosperm etc.
2. Chemical characteristics: Quantity and

quality of carbohydrates, proteins, fiber, and other constituents.

3. Food quality characteristics:

(a) Culinary characteristics, i.e., easiness in dehulling, volume after soaking, texture of the flour, swelling capacity, rolling capacity or ability to spread, hydration characteristics, gel formation, etc.

(b) Palatability characteristics: color, flavor, texture of the product, taste, mouth feel, keeping quality, etc.

Because of their links with consumers, food scientists and home economists can be of great assistance in evaluating consumer acceptability of cultivars developed in crop improvement programs. This can be done in two stages:

STAGE I. By developing objective techniques for measuring the product quality.

STAGE II. By relating the desired product qualities to the grain characteristics which can be measured in the laboratory with small samples of grains.

Physical Characteristics

Consumer preference apparently is based on visible characteristics of the grain that have been associated with good or at least acceptable food quality over the years.

Sorghum consumers can be classified into three categories based on the source of procurement of grain: (a) producer/consumer (village), (b) consumer/open market (urban and semiurban) and (c) consumer/fair price shop.

Small and marginal farmers produce sorghum mainly for self consumption. This category is classified under producer/consumer. These groups of consumers exercise their choice while selecting the variety for cultivation.

Larger farmers, who produce grain for sale in the market, select the variety based on agronomic characters and also on market value. Since the market price is based on demand by the consumer, grain characters do play an important role.

The information on consumer preferred characters of grain can be ascertained through consumer and market surveys. Suitability of one of the methods or the combination of both depends on the type of consumer under consideration.

Producer consumer

Very few surveys are conducted among rural consumers of sorghum to ascertain the grain characters preferred by them. In an attempt made in Andhra Pradesh (Pushpamma and Chittemma Rao 1981) information was obtained on adoption of improved varieties, reasons for continuing local varieties for cultivation, and reasons for preferring local varieties for consumption. In spite of the introduction of improved varieties for different agronomic conditions, the level of adoption was very low. Large farmers with more than 25 acres of farm holding and with a better level of education were the ones who switched over to improved varieties (Table 1). The poor spread of improved varieties appears to be mainly due to a lack of information about the availability of the improved varieties. For those who are aware, the lack or delay in supply of seed followed by lack of resources, unfamiliar management practices, and insecurity in yields are the reasons given for not adopting the improved varieties.

A stronger preference for the local variety for consumption than for cultivation was expressed (Table 2). In this study, color was the major characteristic perceived and expressed by all consumers with either definite liking or disliking. Marked regional differences are observed for the color preference.

Size and shape of the grain also influenced the selection of a variety to some extent (Table 3).

Table 1. Percentage of cultivators with varying farm size and educational level cultivating local and improved varieties of sorghum in Andhra Pradesh (sample 2000 households).

	Varieties		
	Native	Improved	Both
Farm size			
Small	93	4	3
Medium	89	3	8
Large	70	12	18
Educational status of head of the household			
Illiterate	94	2	4
Primary	85	5	10
Secondary	75	11	14

Poor acceptance of improved varieties for consumption is also partly due to consumers' apprehension of their "contribution to poor health," though not specifically defined.

An overwhelming majority expressed their preference for the "taste" of the local variety. The taste was the first and most often mentioned characteristic. The reason given most often for

preferring a particular variety is: "it tastes good." It is possible that degree of liking and taste are synonymous in the minds of many consumers. But that would be difficult to measure because taste is a comprehensive word used for a complex factor derived from the interaction of several food and consumer attributes.

Information on other grain characters, such as size and shape of the grain and pericarp thickness, could be elucidated only after probing.

Culinary characters and preferences for sorghum product qualities, keeping quality of the products, and fodder quality all contribute to the overall acceptability of a variety.

In spite of all the efforts made through personal interview methods to collect information on preferred consumer characters, the survey was relatively unsuccessful because consumers prefer the local variety because they are used to consuming it. Since their experience is limited to the local cultivar, they do not appreciate even the subtle changes in grain characters that they consider might change the different cultivars and their suitability for sorghum products consumed in that

Table 2. Number of consumers preferring native and improved varieties of sorghum for cultivation and consumption.

Purpose	Native varieties	Improved varieties	Both
Cultivation	1365 (87) ^a	75 (5)	125 (8)
Consumption	1475 (94)	61 (4)	31 (2)

^a. Figures in parentheses are percentages.

Table 3. Specific preference for color, size, shape, pericarp thickness, and taste of sorghum (percentage of cultivators in different regions).

	Telangana region	Rayalaseema region	Coastal region	Overall
Color				
Yellow	42	29	70	46
White	49	62	10	42
Red	1	1	16	5
No preference	8	8	4	7
Size				
Bold	68	83	74	75
Medium	24	14	21	20
Small	5	1	1	2
No preference	2	2	4	3
Shape				
Round	99	100	97	99
Any other	1	0	3	1
Pericarp				
Thick	38	2	3	14
Thin	55	95	93	82
No preference	7	3	4	4
Taste				
Sweet	35	52	33	40
Sweet with astringency	55	42	61	52
Tasty	10	6	6	8

area. Their preference is not because of selection, but mainly because of their adaptation to a particular variety and a rigid requirement for the local cultivar.

For this reason, analysis of the most acceptable and the least acceptable samples of sorghum varieties from a sorghum-consuming population is essential for comparison of physico-chemical characters and food quality attributes in the acceptable range of sorghum varieties. It may be possible to develop criteria for measuring acceptance of sorghum as well as its use for a particular food product, if a good association can be obtained between the degree of acceptance and some of the physico-chemical characters of the grain.

Urban and Semiurban Consumers

This section of consumers, who purchase the grain in the open market, has a greater choice than any other category of consumers. The consumer is prepared to pay a premium for the quality. The range in price structures of the grain in the market is a reflection of consumer preferences. Unlike rice and wheat, sorghum is graded through subjective parameters, i.e., experiences of the consumer. The evident characters like color, size, endosperm type, and even place of production are some of the criteria applied in determining the price.

Attempts are often made to develop parameters for predicting the acceptability of the variety in a given area by using market survey information on the demand for different varieties of sorghum by the urban consumers. In the surveys conducted by the Economics Program of ICRISAT, the possibility of deriving a consumer preference index by an appropriate combination of grain characters, both evident and cryptic, was indicated (von Oppen 1975).

Consumers Receiving Sorghum as Wages and through Fair Price Shops

Acceptability of any variety or product of sorghum by this group of consumers is one more of availability rather than preferences. They accept varieties with a wide range of characters and are more flexible to adopt the grain available. However, they may reject varieties with grain characters falling short of minimum levels of acceptability. One such example is the recent

experience of the Food Corporation of India, which procured yellow sorghum varieties produced in one area and released them in a drought prone area, where consumers were used to white sorghum varieties. Consumers not only rejected the yellow sorghum but they even claimed that the grain was artificially colored and expressed the fear of health hazards. It is also a common experience that consumers under duress, i.e., during drought, floods, etc., may accept any type of grain but once the situation improves, they return to their normal pattern of selectivity.

Chemical Characteristics

The relationship between preferred product qualities and the chemical composition of the grain such as rice and wheat is well established. The influence of the nature and type of carbohydrates and proteins on the texture and the quality of the product such as bread, cookies, pastries, chapatias is well defined in some sorghum. To establish such relationships, basic information on the utilization of the grain and the preferred characteristics of the food product is essential.

Unlike rice and wheat, the form of utilization of sorghum varies widely from region to region and so the criteria used for measuring the quality of the product also varies. Though fairly reliable information regarding the forms of utilization of sorghum in different areas is available to sorghum workers (Vogel and Graham 1979), information on the food quality criteria used by the consumers for the different sorghum products is scanty. However, some progress has been made in linking the physico-chemical characters of the sorghum grain and their relationship to the quality of different sorghum products (Rooney et al 1970, Miller and Burns 1970, Viraktamath et al 1972, Rizley and Suter 1977, Khan et al 1980). The grain characters which showed definite relationship to the quality of the product were color, endosperm texture, and endosperm type.

Food Quality Characteristics

So far the standardized laboratory tests developed to determine various physical, bio-chemical, nutritional, and functional characters of sorghum have not been used successfully to predict consumer acceptance of the grain. Thus, in the final analyses of performance and food acceptability, cooking and processing trials must be done.

For testing the consumer acceptance of grain or its products, the most commonly used methods include in-home testing, in-location testing, and in-laboratory testing.

In-home Testing

The food sample is distributed among a selected number of families and the housewife is asked to use the grain or product and compare it with what they use normally at home.

IN-LOCATION TESTING. In this method, food samples are taken to a central location and distributed among the people. They are asked to give their opinion on the spot.

IN-LABORATORY TESTING. Either regular consumers of the particular grain/product or trained laboratory panel members compare and give a relative score. Though this method is faster and cheaper, it can be used only when (a) factors that influence the selection of grain/processed product/final product are known, and (b) the samples can be prepared using standardized recipes in the laboratory.

Limitations of the Laboratory Panel

Being a carefully selected small group of consumers, laboratory panel opinions and preferences may not be representative of the general population. As they are highly trained, they are hypercritical as compared with the general consumer. In addition, the influence of extraneous factors such as ease of processing and preparation, extraction rate, cooking time, shelf-life, and prestige is eliminated. In general, consumers may agree with the laboratory panel in direction, but not in magnitude.

Because of limitations in any single method described above, and the lack of information on important product characteristics and their weighted influence on consumer acceptance, utilization tests are recommended for testing the acceptability of sorghum grain and its products (Vogel and Graham 1979).

Utilization Tests

Three major steps involved in utilization tests are (a) investigating current practices to identify foods traditionally prepared at home, (b) standardizing the formula so that it can be exactly

reproduced in the laboratory, and (c) developing evaluation procedures and standards.

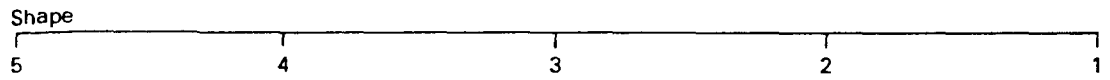
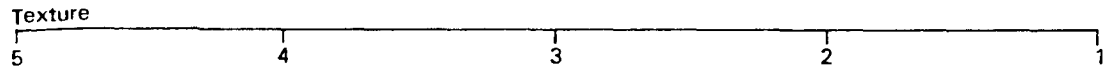
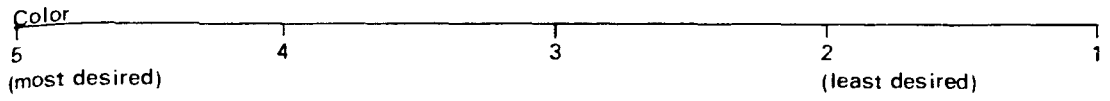
Once common foods of sorghum are identified and standardized formulae are evolved, the resulting products should be tested by consumers. The first step is establishing criteria of consumer acceptability that reflect consumer preferences. The final use of evaluation procedures is to assist in the selection of new sorghum varieties that are at least equal in acceptability to those in current use. This is done by serving the consumers the sorghum products of a new variety prepared by the standardized procedure and asking them to compare the sample with what they normally have at home. The first question will be about the overall quality of the product—whether it is better, equal to, or not as good compared with the one prepared with local grain. This is followed by securing information on criteria used by the consumer for comparison, i.e., external characters (color, texture, shape), internal characters (color, texture, consistency), eating characters (aroma, mouth feel, taste, after-taste), and finally which of these characters are most important in order of preference in accepting the product based on which the score sheet can be designed with weighted averages. Figure 1 shows a typical general score sheet for identifying important product characteristics and a score card for evaluating stiff porridge is given in Figure 2.

From the basic information collected, a more objective, consistent and consumer representative evaluation procedure can be developed. Often this can be used to identify physical characteristics of the product, including volume or yield; compressibility; fragility; flexibility; ability to hold shape; specific gravity (lightness); spreadability; rate of forming droplets; and pH of the batter. Once product standards are developed, the product may be compared with these standards and rated as good, average, or poor.

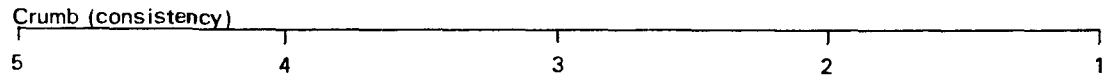
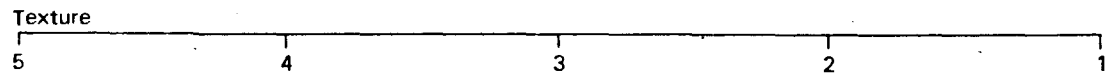
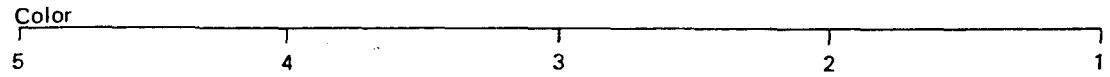
Consumer Acceptance of Sorghum Products

Food use of sorghum across the semi-arid tropics (SAT) and the wide variety of products traditionally consumed in these areas are well documented. Most of these products are prepared from dehulled whole or cracked grain or ground flour. Dehulling and grinding of sorghum is still done manually in each individual household. Traditional methods of

1. EXTERNAL CHARACTERISTICS



2. INTERNAL CHARACTERISTICS



3. EATING CHARACTERISTICS

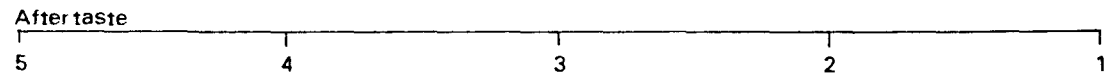
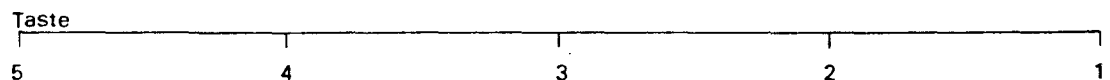
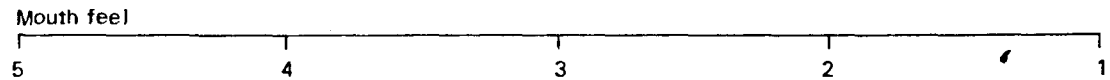
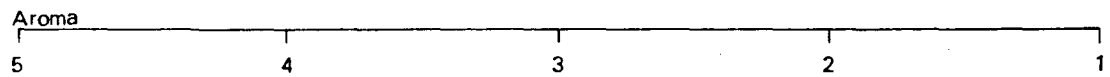


Figure 1. Typical 5-score sheet on which the most important product characteristics are listed. Preferred qualities are given a higher score (in this case 5); the least preferred qualities lower values (in this case 1). Ratio: 1 = 30%; 2 = 30%; 3 = 40%.

INTERNAL CHARACTERISTICS

COLOR		
light	neither light nor dark	too dark
SURFACE		
smooth, glossy	neither	dry, cracked
SHAPE – N/A		

2. INTERNAL CHARACTERISTICS

COLOR – N/A		
TEXTURE		
smooth or slightly granular	slightly too granular	lumpy or very granular
CONSISTENCY		
holds shape	flows slightly	too runny

3. EATING CHARACTERISTICS

AROMA		
characteristic of grain	no aroma or slightly off aroma	sour or off aroma
MOUTH FEEL		
smooth	slightly sticky	gluey, sticks to roof of mouth
TASTE		
bland, pleasant	slightly uncooked taste	raw starch taste
AFTERTASTE		
none	slight	bitter

Figure 2. A 3-score sheet designed to be used when evaluating a stiff porridge.

sorghum processing are more or less similar in all countries and are time consuming and labor intensive, thus deterring the utilization of sorghum as human food. Often in the areas where mechanical grinders are available there are no dehullers available, so whole sorghums are ground into flour. Whole grain flour has a high fiber content and products made from it have inferior texture, color, and digestibility. This is one of the reasons given for the low prestige value of sorghum products.

Methods of Improving Acceptability of Sorghum Products

Pearling

Advantages of pearling sorghum in improving the quality of the product and its acceptability are reported by several workers (Desikachar 1975, Badi and Hosenev 1976, Vogel and Graham 1979, Hulse et al 1980). Efforts to identify grain qualities suitable for pearling and milling have been made.

(Scheuring and Rooney 1977, Rooney et al 1970).

Mechanical Grinding after Dehulling

The advantage of introducing a dry mill designed specifically for sorghum and millets, that dehulls and grinds the grain into flour has been fairly well established in Botswana, Ghana, Nigeria, Senegal, and Sudan, through International Development Research Centre (IDRC) supported projects (Eastmen 1980). The acceptance of flour and the traditional products prepared with sorghum flour obtained after dehulling were researched by a specially designed consumer product test and by marketing studies in collaboration with the Prairie Regional Laboratory, Saskatoon, Canada. The consumer product test includes the testing of acceptability of flour for the preparation of common sorghum foods consumed in that area through in-home testing. Here the acceptability may not be based purely on the basis of product characteristics but on a combination of convenience and cost also. On the other hand, consumers may be willing to forego marginal differences in the quality if there are other compensating advantages. A typical example of a consumer product test used in testing the acceptability of milled flour for the preparation of *tuwo* is illustrated in Figure 3.

Use in Composite Flours

Several research studies have indicated the possibility of improving the acceptability of sorghum products by combining at various levels with wheat flour. Such composite flours can be used for producing high status foods like bread, biscuits, and other snacks (Hart et al. 1970, Narasimha et al. 1974, Haridas Rao and Shurpalekar 1976, Hulse et al. 1980). The possibility of feeding sorghum-based diets in schools and pre-school centers has been tested and results are very encouraging (Pushamma et al. 1981). However, both the children and parents accepted only when the sorghum was processed and converted into high status foods similar to those prepared with wheat and rice. Interesting enough, the quantity of sorghum product consumed estimated on the basis of plate waste in such feeding programs was found to vary depending on the sorghum varieties used, which suggests the possibility of using this

method for testing the acceptability of sorghum and sorghum products.

Refining and Processing

Use of refined and semirefined flours with pretreatment like malting, precooking, flaking, and puffing of sorghum grain or grits has been recommended for improving sorghum products and for diversified food uses (Desikachar 1975, Raghavendra Rao et al. 1976).

Marketing of Sorghum Foods

A limited number of sorghum and millet products are marketed on a commercial basis, and also some from home food processing units, which use only skill oriented recipes and methods. One such product is *tura*, a snack food often commercially prepared in ready-to-eat form. Similarly *ugi*, a thin porridge is marketed in street kiosks of major towns of Kenya. Sorghum products like flour, beer, germinated grain, bread, and snacks made at home are frequently sold at small daily or biweekly markets in sorghum-consuming areas. However in India, there is hardly any sorghum product available either in urban or rural markets.

In Sudan, efforts are being made to produce *kisra* commercially. For this purpose a pilot mill at the National Research Council (NRC) and the Food Research Centre (FRC) at Khartoum is installed to produce mechanically dehulled and ground flour. Light colored, finely ground, dry milled flour which is sold as "improved flour," costs only one-sixth of a high status food. The keeping quality of the flour is improved over traditionally milled procedures. In addition to *kisra*, breads, snacks, sweets, and pastries were prepared and served in the most prestigious hotels to expand the utilization of sorghum by upgrading the status of sorghum foods. Although the experimental data looked promising, to date sorghum utilization has not really been expanded since these efforts require considerable time to make a significant impact. These efforts should continue.

Food scientists and home economists can strengthen the efforts of sorghum breeders, by developing suitable processing technology and improving the food quality and prestige of sorghum products to satisfy the palate of sorghum-consuming populations.

SAMPLE QUESTIONNAIRE

Good afternoon. I am _____ of the _____

We are doing a study on *tuwo* and I wonder whether you would be willing to help us by answering a few questions and also by trying a flour in your home?

INSTALLATION QUESTIONNAIRE

1. May I have your name? _____

2. Do you do the cooking for the family?

YES NO IF THE RESPONSE TO QUESTION 2 IS NO, COLLECT INFORMATION FROM PERSON WHO DOES THE COOKING

3. Number in household eating from the same pot _____

4. About how many times a week do you eat *tuwo*?

- SEVEN OR MORE TIMES
FIVE TO SEVEN TIMES
THREE OR FOUR TIMES
ONCE OR TWICE A WEEK

NEVER END INTERVIEW AND RECORD AS NONPARTICIPANT

5. Do you usually buy *tuwo* or not?

YES NO GO TO QUESTION 8.

6. Which of the following is the prime reason for buying *tuwo*?

- IT SAVES BUYING MANY INGREDIENTS
IT IS TEDIOUS, UNINTERESTING TO MAKE
IT SAVES TIME AND EFFORT
I PREFER THE TUWO I BUY
OTHER (PLEASE SPECIFY) _____

7. About how much does it cost for enough *tuwo* to feed your family?

N _____ K GO TO QUESTION 9.

8. Which of the following is the prime reason you usually make *tuwo*?

- IT SAVES MONEY TO MAKE IT
MY FAMILY PREFERS THE TUWO I MAKE
BECAUSE I KNOW WHAT IS IN IT
WE LIKE IT HOT
I ENJOY MAKING IT
OTHER (PLEASE SPECIFY) _____

9. For *tuwo* made at home, how many level full milk tins of sorghum are prepared for the family per meal?

_____ TINS NEVER MAKE

Continued...

Figure 3. A typical questionnaire for use in testing the acceptability of milled flour for the preparation of tuwo.

Fig. 3. Continued.....

HERE IS A BAG OF SORGHUM FLOUR WHICH WE WOULD LIKE YOU TO TRY. WE WOULD LIKE YOU TO USE IT IN THE NORMAL WAY YOU PREPARE TUWO. WOULD YOU BE WILLING TO TRY THIS FLOUR?

YES

NO END INTERVIEW AND RECORD AS NONPARTICIPANT

CALL BACK QUESTIONNAIRE

10. Have you had a chance to make *tuwo* from the flour that was left?

YES

NO

IF THE ANSWER IS NO, THEN THE FOLLOWING TWO QUESTIONS APPLY:

(a) When might you expect to have tried the flour _____

(b) Would it be all right if I returned on _____

11. How did you find the flour to use? Would you say it was:

EASY TO USE

NEITHER EASY NOR DIFFICULT

DIFFICULT

12. What did you like most about the flour? _____

13. What did you like least about the flour?

(Note: Because open-ended questions should be asked before close-ended questions. Questions 12 & 13 should precede Question 11.)

14. How was the *tuwo* made from the flour in comparison to that you normally serve? Would you say it was:

A

OR

B

SUPERIOR
EQUAL TO
INFERIOR

MUCH BETTER THAN
A LITTLE BETTER THAN
ABOUT THE SAME AS
ALMOST AS GOOD AS
NOT NEARLY AS GOOD AS

15. Regardless of your overall comparison of the *tuwo* with what you usually serve, would you say that the _____ was
(insert colour, shape etc. in turn)

Continued...

Fig. 3. Continued.....

	Colour	Shape	Retention	Texture	Flavour	Aroma
MUCH BETTER THAN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A LITTLE BETTER THAN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ABOUT THE SAME AS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ALMOST AS GOOD AS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NOT NEARLY AS GOOD AS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Did you find the amount of water given in the instructions to be

TOO MUCH

JUST RIGHT

TOO LITTLE

17. Did you have enough *tuwo* for your family or would you say you had

TOO MUCH

JUST RIGHT

TOO LITTLE

18. Taking everything into consideration, how would you rate the *tuwo* from the flour? Which of the following statements would best indicate your feelings about this product?

EXCELLENT

EXTREMELY GOOD

VERY GOOD

QUITE GOOD

FAIRLY GOOD

FAIR

POOR

(Note: Because general information should be asked before specific information, Question 18 should follow Question 10.)

19. What do you consider to be a fair price for this flour in a bag the size you had?

N _____ K

20. Which of the following statements would best describe your likelihood of buying this flour if it were sold at N _____ K.

I WOULD DEFINITELY BUY

I WOULD VERY LIKELY BUY

I MIGHT OR MIGHT NOT BUY

I AM NOT LIKELY TO BUY

I DEFINITELY WOULD NOT BUY

21. Have you any other comments that might be helpful to us?

References

- BADI, S. M., and HOSENEY, R. C. 1976. Use of sorghum and pearl millet flour in cookies. *Cereal Chemistry* 53: 733-738.
- DESIKACHAR, H. S. R. 1975. Processing of maize, sorghum and millets for food uses. *Journal of Scientific and Industrial Research* 34: 231-237.
- EASTMEN, P. 1980. *End to pounding: A new mechanical flour milling system in use in Africa*. Ottawa, Ontario, Canada: IDRC. 64 pp.
- HARIDAS RAO, P., and SHURPALEKAR, S. R. 1976. Utilization of milo in bakery products. *Journal of Food Science and Technology* 13: 293-299.
- HART, H. R., GRAHAM, R. P., GEE, M., and MORGAN, A. I. 1970. Bread from sorghum and barley flours. *Journal of Food Science* 35: 661-665.
- HULSE, J. H., LAING, E. M., and PEARSON, O. E. 1980. *Sorghum and the millets: Their composition and nutritive value*. Ottawa, Canada: Academic Press. 997 pp.
- KHAN, M. N., ROONEY, L. W., ROSENOW, D. T., and MILLER, F. R. 1980. Sorghum with improved tortilla making characteristics. *Journal of Food Science* 45: 720-725.
- MILLER, O. H., and BURNS, E. E. 1970. Starch characteristics of selected grain sorghums as related to human foods. *Journal of Food Science* 35: 666-668.
- NARASIMHA, H. V., ANANTACHARI, T. K., GOPAL, M. S., and DESIKACHAR, H. S. R. 1974. Suitability of raw and steamed cereal grains for making deep fried preparations. *Journal of Food Science and Technology* 11: 76-78.
- PUSHPAMMA, P., and CHITTEMA RAO, K. 1981. Varietal preference, marketing, storage, processing and utilization of sorghum and millets in Andhra Pradesh. Hyderabad, Andhra Pradesh, India: College of Home Science. 81 pp.
- PUSHPAMMA, P., RATNAKUMARI, A., and GEERVANI, P. 1979. Nutritional quality of sorghum and legume based food mixture for infants and pre-school children. *Nutrition Reports International* 19: 643-648.
- PUSHPAMMA, P., GEERVANI, P., and RATNAKUMARI, K. 1981. (in press.) Acceptability of new varieties of sorghum by preschool children. *Research Journal of Andhra Pradesh Agricultural University*.
- RAGHAVENDRA RAO, S. N., VIRAKTAMATH, C. S., and DESIKACHAR, H. S. R. 1976. Relative cooking behaviour of semolina from maize, sorghum, wheat and rice. *Journal of Food Science and Technology* 13: 34-36.
- RIZLEY, N. F., and SUTER, D. A. 1977. Sorghum tortillas: Process and product attributes. *Journal of Food Science* 42: 1435-1438.
- ROONEY, L., GUSTAFSON, C. B., and SULLINS, R. D. 1970. Influence of brown and yellow-grain sorghum on attributes of products from white grain sorghum. *Cereal Science Today* 15: 206-207.
- ROONEY, L. W., JOHNSON, J. W., and ROSENOW, D. T. 1970. Sorghum quality improvement: Types for food. *Cereal Science Today* 15: 240-243.
- SCHOURING, J. F., and ROONEY, L. W. 1977. Preliminary studies on sorghum food quality in the sub-Sahel. *Sorghum Newsletter* 20: 116-117.
- VIRAKTAMATH, C. S., RAGHAVENDAR, G., and DESIKACHAR, H. S. R. 1972. Varietal differences in chemical composition. Physical properties and culinary qualities of some recently developed sorghum grains. *Journal of Food Science and Technology* 9: 73-76.
- VOGEL, S., and GRAHAM, M. 1979. Sorghum and millet food production and use. Report of Workshop held in Nairobi, Kenya. 4-7 July 1978. Ottawa, Ontario, Canada: IDRC. 64 pp.
- VON OPPEN, M. 1976. Consumer preferences for evident quality characters of sorghum. Paper presented at the Symposium on Production, Processing and Utilization of Maize, Sorghum and Millets, 27-29 December. Central Food Technological Research Institute, Mysore, India.