

TRADITIONAL BEERS PROCESSING IN TANZANIA : DEVELOPMENT
NEEDS

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CURRENT RESEARCH INTEREST : Improvement of Traditional
Alcoholic Beverages in Tanzania

SUMMARY

A general account of the status of the traditional alcoholic beverages in Tanzania is presented with special focus on sorghum beers. The traditional procedure used to prepare Mtama (sorghum) beer, a popular alcoholic beverage of Tanzania is described. Based on the personal experience of the author himself and on reports in the literature the problem areas requiring technological improvement on this beer are outlined. The case for immediate research needs, aimed at developing a commercially viable Mtama beer, is argued.

KEYWORDS : Mtama beer, sorghum beer, Tanzanian beverages
traditional alcoholic beverages

1.0 INTRODUCTION

There exists a prejudice that many of the traditional foods of developing countries are inferior in quality and not worthy of further development.

The traditional brewing industry of Tanzania representing a large number of alcoholic beverages falls in this category.

Although these fermentations are called beers, they are not really "beers" in the sense of the Western definition. These beers, like most other African beers, are characterized by being opaque liquids or semi-solids, with varying alcohol contents, and by containing high percentages of solids and microorganisms. They are acid-fermented beverages prepared mainly from cereals traditionally grown in Tanzania, notably sorghum, millet, and maize.

These beers are both a food item and beverage, and play an important role in the daily and tribal life of the Tanzanians. All over the country, beer-drinking-ceremonies are held at the schools of initiations for boys and girls, at weddings, funerals, and at communal activities such as farm and construction works. Beer drinks, too, are often held as a means of settling quarrels. In modern times, these beers have entered the commerce. Both in the villages and townships many people earn their living through selling beer and the local governments benefit from levies on beer sales.

The Western type beer produced in Tanzania cannot meet the demand of even the few popular consumers and is sold at a cut-throat price which the majority of the population cannot afford. Although the Tanzanian traditional beverages have been consumed for ages, there has not been any serious scientific investigation to establish their nature, and explore the possibility for further development. Apart from "Chibuku" beer, the only "industrialised" traditional beer (made using imported technology), the production of the remaining majority of these beers have not advanced beyond the cottage scale. The need to develop these traditional technologies on an industrial scale, especially the utilisation

of sorghum as a staple food commodity/beverage base, has been much emphasized by several workers (Hesseltine, 1979 ; Lukoo et. al., 1981 ; Kayumbo, 1985). The Tanzanian policy makers too have called upon local scientists into helping peasants improve their standards of living by developing the existing technologies, especially those requiring high-scale local inputs (Lukoo et. al., 1981 ; Kayumbo, 1985).

In view of these perspectives this paper presents :

- a. an account of the major traditional alcoholic beverages of Tanzania
- b. an outline of a laboratory-scale preparation, and analysis of "Mtama" beer, a popular traditional sorghum beverage, as a starting point for further activity in this field, and
- c. an identification of critical areas for technological developmental work in the near future.

Information in respect of the traditional brewing process discussed in this article has been gathered by interviewing experienced local brewers (both home-scale and commercial brewers) in Tanzania, and from the personal experience of the author himself.

2.0 THE MAJOR TRADITIONAL ALCOHOLIC BEVERAGES OF TANZANIA

The traditional alcoholic beverages of Tanzania are collectively referred to as "pombe za kienyeji" as opposed to "pombe za kizungu", the Western type beers. These traditional beers are called "Mapuya" in the Sukumaland, a typical rural area, where they are held in high esteem, while in the urbanised areas they are known as "Mataputapu" - a discreditable name implying "lower breed".

It is not possible to state precisely the exact number of these beverages in circulation at present. Depending on the ingredients, processing and final characteristics, several names are given to them in different tribal dialects. Also, with more than 120 Administrative Districts, one finds at least one typical beverage with its distinct flavour/ texture

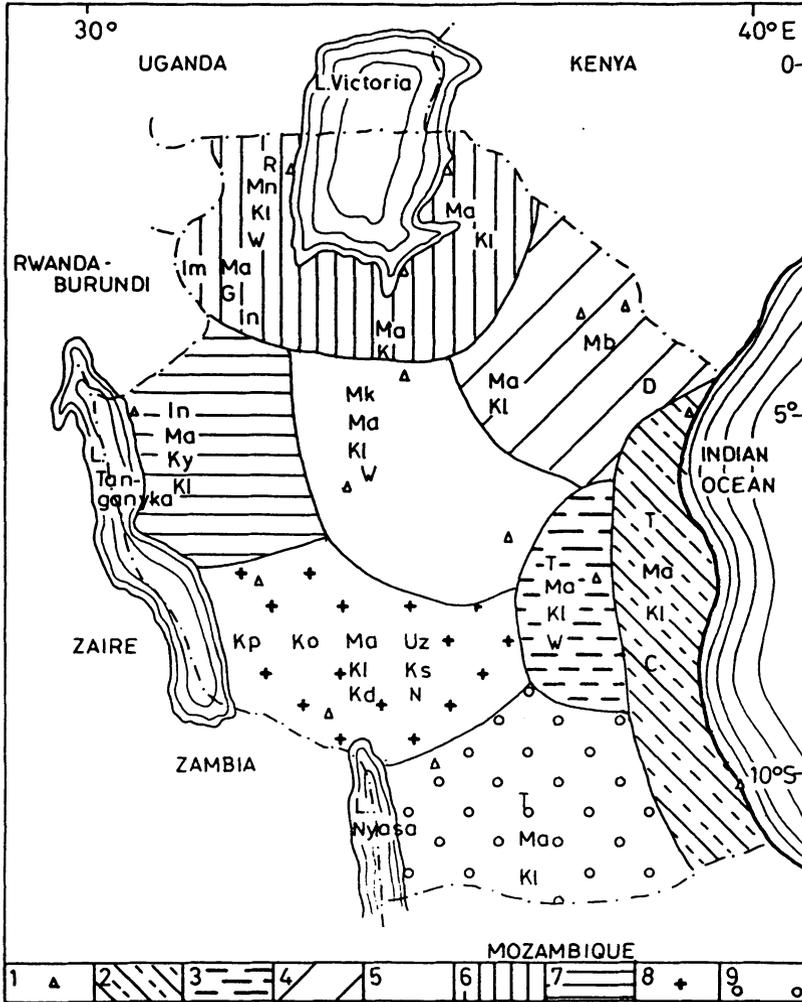


Fig. 1 : Geographical Distribution of the Major Traditional Alcoholic Beverages of Tanzania.

Geographical Zones (and relevant regions)

1. Urban Centres : The Capital and All Regional Administration Centres.
2. Coastal Belt : Tanga, Dar-es-Salaam, Pwani and Mtwara regions.
3. Sub-Coastal Zone : mainly Morogoro region.
4. Northern Zone : mainly Kilimanjaro and Arusha regions.
5. Central Zone : Dodoma, Singida and part of the Shinyanga and Tabora regions.
6. Lake Zone : Mara, Mwanza and Kagera regions.
7. Western Zone : Kigoma and the main parts of Tabora and Shinyanga regions.
8. Southern Zone : Ruvuma and Lindi regions.
9. South-Western Zone : Iringa, Rukwa and Mbeya regions.

Table 1. - The Major Traditional Alcoholic Beverages of Tanzania.

<u>Name</u>	<u>Symbol</u> ¹	<u>Beverage Base</u>
Mtama	Ma	Sorghum, maize bran
Indimasi	In	Sorghum
Kayoga	Ky	Sorghum
Impeke	Im	Sorghum
Kangala	Kl	Sorghum, maize bran, sugar
Mbege	Mb	Millet, banana juice
Mtukulu	Mk	Millet
Komoni	Ko	Maize, millet
Kimpumu	Kp	Millet
Chibuku	C	Sorghum
Kindi	Kd	Maize
Gwagwa	G	Banana juice, sorghum
Rubisi	R	Banana juice, sorghum
Ulaka	Uk	Cashew apple juice
Mnanasi	Mn	Pineapple juice
Dengeluwa	D	Sugar cane sap
Tembo	T	Coconut tree sap
Ulanzi	Uz	Bamboo sap
Wanzuki	W	Honey
Kabungusi	Ks	Tea, Coffee brews
Njimbo	N	Honey, Molasses

¹ Symbols refer to Figure 1.

attributes in every District. The most popular traditional alcoholic beverages of Tanzania are listed in Table 1, and their geographical distribution illustrated in Fig. 1.

It is apparent from Table 1, that most of these beverages are based on cereals, particularly sorghum. This is attributable to the extensive cultivation of this drought-resistant crop, practically under every existing climatic environment in Tanzania.

The distribution of other beverages in rural areas corresponds to the availability of the crop upon which the beverage is based. Thus, Rubisi or Gwagwa (banana wine) beverages are confined to the regions west of the Lake Victoria where banana is a staple. Similarly, Mbege and Kindi are popular in the northern and south-western Zones where banana and maize respectively are staples. Ulaka, a wine from cashew fruit juice fermentation is found exclusively on the Coastal Belt where cashew is an important crop. In Urban Centres, however, several beverages may be found depending on the raw material availability and relative demands imposed by the mixed tribal community.

3.0 THE PROCESSING OF TANZANIAN SORGHUM BEVERAGES

3.1 Some Aspects of Sorghum Cultivation

Sorghum is cultivated as the major crop in some regions of Tanzania, where it constitutes the staple diet in the form of a stiff porridge called "ugali". In most other areas it serves as a "buffer" crop in periods of drought which the major cereals (maize, rice) could not endure. Realising its potential, the Tanzanian government has instituted a promotional campaign for the cultivation of sorghum on a national scale, and particularly in the arid regions (Mosha et. al., 1977). (Extensive research is being conducted on the agronomic aspects of this crop at the various Experimental Stations in the country.)

The production trend of sorghum in Tanzania as published by FAO is presented in Table 2. However, Mosha and Lorri (1978) reported even higher production figures for sorghum - 318 (1974/75), 438 (75/76), and 517 (76/77) thousands of metric tons.

Table 2. Annual Production of Sorghum and Millet in Tanzania, 1973-1976 and 1980-1983 ('000 metric tons ; FAO, 1983)

	1973	1974	1975	1976 ¹	1980	1981	1982	1983 ²	1984 ²	1985 ²
Sorghum	248	128	180F	245	220F	220F	220F	793	492	724
Millet	171	63	120F	129	160F	140F	150F	206	267	300
Total	419	191	300	374	380	360	370	999	759	1024

¹ mean for 1974-1976 F = FAO estimate

² FAO, 1986

3.2 The Traditional Brewing Techniques

3.2.1 Post-harvest Handling Practices :

Sorghum is an annual crop requiring five to six months to mature ; however, certain cultivars (Serena and Lulu) have a shorter cycle. Several varieties are traditionally grown, with brown, white and mixed colour grain varieties being popular. These popular varieties exhibit both open and closed panicle structures. An example of a closed panicle structure grown in Tanzania is depicted in Figure 2. When the grain is fully ripened the panicles are harvested using kitchen knives. Traditionally, they are piled in heaps over the kitchen roof where they are left to dry all the year around by the kitchen smoke (Fig. 3). When they are sufficiently dry, the heaps are covered with dry grass for protection from rain. Alternatively, sorghum panicles may be stored in a "Kihenge", a structure specially constructed for this purpose (Fig.4).



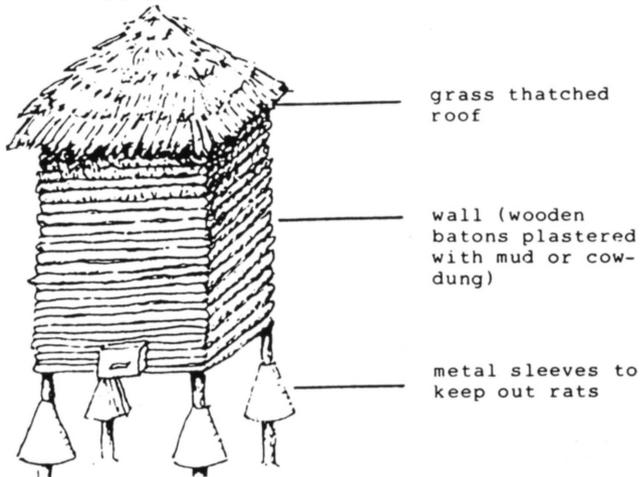
Traditional Beers Processing in Africa.

Figure 2 - Immature sorghum growing in the field (Courtesy Department of Crop Science, Sokoine University: of Agriculture, Morogoro, Tanzania).



Traditional Beers Processing in Tanzania.

Figure 3 - Traditional storage and threshing techniques ;
 X_1 : sorghum panicles piled on the roof of a
 grass thatched house (kitchen) ;
 X_2 : threshing dry sorghum panicles by beating
 on the floor with an oar-shaped wooden
 baton.



Traditional Beers Processing in Tanzania.

Figure 4 - Diagram of a typical Kihenge for Grain Storage
 (adapted from a village care Handbook, Werner
 1985)

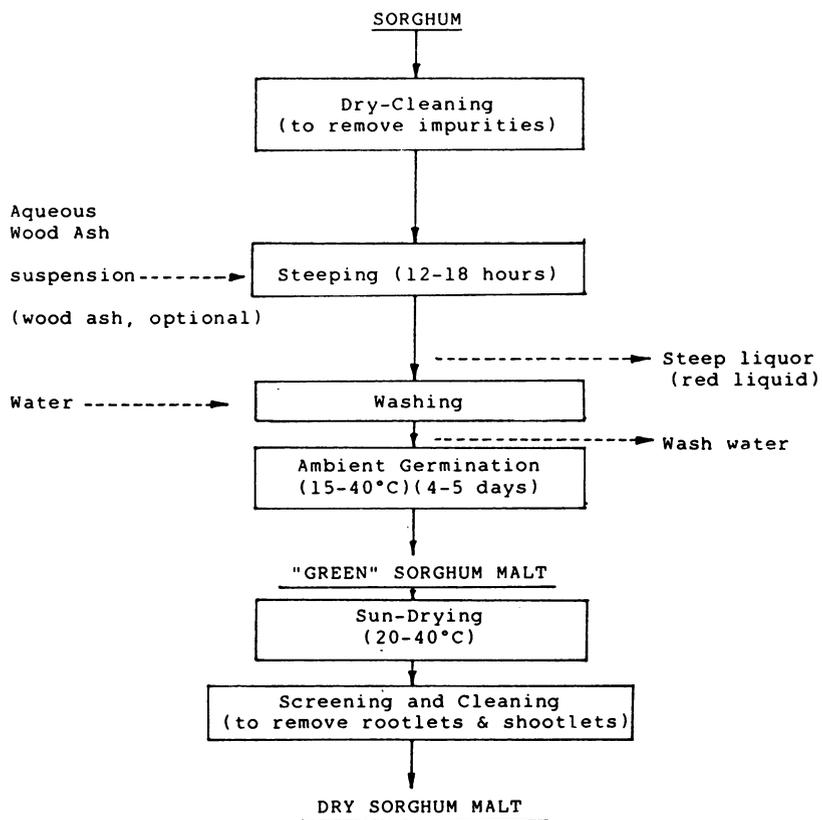


Fig. 5 : Malting of Sorghum

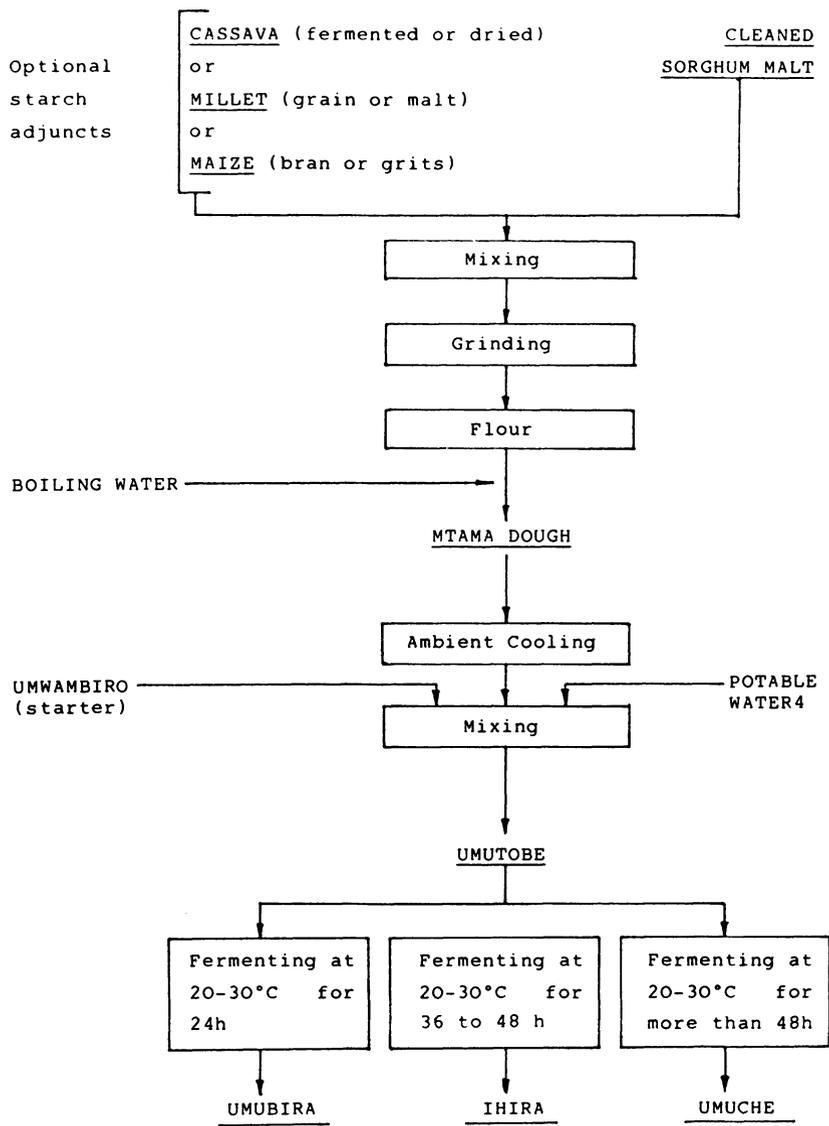


Fig. 6. Traditional Preparation of Mtama Beer

Occasionally sorghum panicles are also heaped on wooden platforms and covered with dry grass.

The dry sorghum panicles are threshed immediately before use by beating them on the floor with wooden batons (Fig.3). If small quantities are required the panicles are pounded in a wooden mortar and pestle.

3.2.2. Preparation of Sorghum Malt :

Results of our survey indicate that the red and mixed varieties of Sorghum bicolor, Moench are the most popular and preferred starting material for the traditional sorghum beers of Tanzania, particularly in the Lake, Central and Coastal zones.

The malting process outlined in Fig. 5 is common to all types of sorghum beverages. In the malting process for Mtama beer sorghum grains are soaked in water with or without wood ash, for one day before being germinated ; the steeped grains are washed, drained and spread on and covered with plant leaves or sisal sackings. A similar technique is used in Togo, Rwanda, Burundi and Uganda. Germination, which starts within 24h after steeping, is allowed to continue for a period of 4-6 days. The length of the radicle is used to judge the sufficiency of germination (Ntirubahamwe, 1985 ; Personal Comm.). Some brewers prefer the dark coloured sprouts that finally give good quality malts. The germination is usually complete after a period of four days. After germination the "green" malt is sun dried in thin layers (usually one or two days). The dry malt is then rubbed on the ground between feet or lightly pounded using a wooden mortar and pestle to remove rootlets and shootlets. The dry malt can be stored for a period of up to four weeks before further use.

3.2.3. Preparation of Mtama beer :

The preparation of Mtama beer from sorghum malt is presented in Fig. 6. Traditionally, milling is performed on a

grinding stone or by pounding using a mortar and pestle. Whenever starch adjuncts (maize, millet and more frequently fermented cassava) are incorporated, they are mixed together with the sorghum malt and coarsely ground into a flour.

The earthen pots used for brewing are usually heated with a probable intention to "sterilize" them (fig.7). The Mtama beer dough is prepared by adding boiling water to the flour mixture and working out into thick consistency. The dough is left to cool to room temperature and then diluted with water to form a suspension called Umutobe (the proportion of water determined from experience is usually 1:4). To activate fermentation some brewers add a starter called Umwambiro (dried powder obtained from an overfermented batch) to Umutobe. It is now left to ferment in earthen pots (fig.8) or metallic containers as required. Light fire may be made near to or around the fermentation containers to increase the temperature and speed up the process. Fermentation can be arrested at several stages depending on the alcohol strength required. Thus, three fermentation stages are distinguishable : at 24h, Umubira ; at 36h, Ihira and finally after 48h Umuche is obtained.

Stronger beers (Inturile) are produced by adding syrups (usually sucrose or honey) to the fermenting mixture after 24 or 36h, and continuing fermentation for a further period of 1-3 days. At any stage of the above fermentation the unfiltered beverage can be consumed straightaway. Traditionally, calabash scoops, grass straw (for sucking from the brewing pot) or glasses are used for serving the strained beer(fig.9). When home-brewed, the quantity is usually 10-100 litres (for special occasions or family consumption). As a cottage industry up to 600 litres could be produced in a batch.

3.3 The Laboratory-scale preparation of Mtama beer

Sorghums samples were procured from Kagera Region of

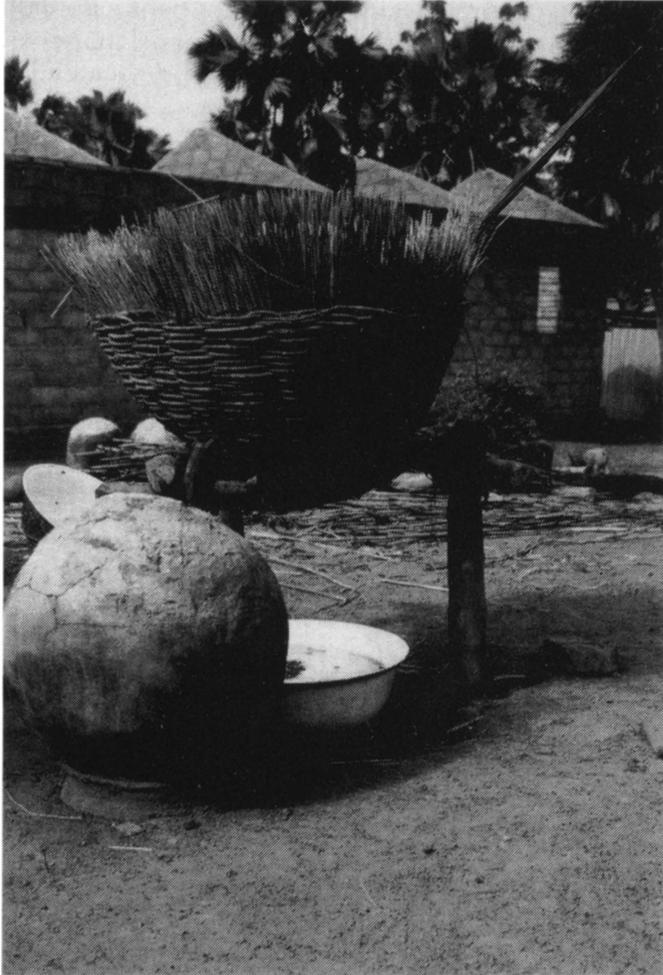


Traditional Beers Processing in Africa.

Figure 7 -Heating of pots for use in sorghum beer brewing.
(photo : P. Van Damme)



Figure 8 -Fermenting sorghum beer in earthen pots.
(photo : P. Van Damme)



Traditional Beers Processing in Africa.

Figure 9 -A specially woven sieve used for straining sorghum beer (made from flexible thin sticks and grass).
(photo : P. Van Damme)

Tanzania, and the Ghent Grain Terminal, Ghent, Belgium. The samples were cleaned, steeped in ash suspension, germinated under controlled conditions, and finally dry-milled (0.8mm mesh sieve) to produce the sorghum malts.

The procedure followed in preparing the beer was essentially the same as that used traditionally (section 3.2.3.) with few modifications. To activate fermentation pitching was performed using a traditional starter culture. Fermentation was carried out at a constant temperature of 30 C.

Mtama beer was chosen for laboratory work since it is the most representative of the different sorghum beers. Also, it is the most popular sorghum beverage with a broad country-wide distribution.

3.3.1. The analysis :

The analytical result of a typical sample (after straining) is presented in Table 3.

Table 3. Analytical Parameters of a Laboratory-scale Mtama Beer Sample (Ihira)

Parameter	Result	Reference
Total solids (% w/v)	1.75	Pearson (1970)
Specific gravity (pycnometer)	1.00	Pearson (1970)
Alcohol content (% w/v)	5.52	Pearson (1970)
Acidity (% w/v, as lactic and acetic acids)	0.45	Pearson (1970)
pH	3.8	Pearson (1970)

The sensory qualities (general appearance, flavour and mouthfeel) of the laboratory Mtama beer samples were similar to Indimasi or Mtama beer produced under traditional conditions (sensory evaluation conducted with 15 Tanzanian consumers). Fermentation at constant elevated temperature

resulted in reduced time for Ihira production. The analytical result, particularly the pH and specific gravity, compares very well with those reported for South African sorghum beers (Novellie, 1976). Also, reports on other sorghum-based African beers such as the Nigerian Burukutu (Faparus, 1970) and the Sudanese Merissa (Dirar, 1978) indicate a close resemblance to the Tanzanian sorghum beers in terms of the general processing procedure, product appearance and general textural characteristics. Overall, the beer offers a promising scope for further studies in this field.

4.0 TECHNOLOGICAL DEVELOPMENT OF SORGHUM BEVERAGES

It is apparent that the near-future technological development activity in this field should be centered around the following critical areas :

- a. Raw Material Quality Aspects
- b. Process Optimization and control
- c. Product Quality and Shelf-life Aspects
- d. Economic Aspects

This activity should be integrated in such a manner as to investigate, in totality, the commercial viability of producing an alcoholic sorghum beverage of uniform quality characteristics, in a typical mini-brewery in the rural Tanzanian environment.

4.1 Raw Material Quality Aspects

Traditionally the different varieties of sorghum are used indiscriminately depending on availability, without any reference to their brewing qualities. Thus, Novellie (1962 ; 1982) identified certain important brewing characteristics that require special attention ; unlike barley malt, the diastatic (enzyme)activity of sorghum malt is generally low, while the high nitrogen content of the malt does not cause any difficulty in brewing. The diastatic activity was found to vary among different varieties, and also influenced by the cultivating season, and level of maturity of the grain (Novellie, 1962b).

Daiber (1975) established that the varietal variations could be largely attributed to the tannin contents, the tannins having an inhibitory action on the enzyme system usually active during mashing for wort production. Unless treated, some high-tannin sorghum cultivars are totally unsuitable for commercial brewing. However, in traditional practice, the high-tannin varieties (the red and mixed ones) are the most popular for brewing sorghum beverages.

Possibilities for improving the quality of high-tannin sorghum exist.

The process of removal/inactivation of tannins in foods is generally referred to as detoxification since these principles, at high levels, have a deleterious effect on the metabolism of human and animal systems.

The chemical detoxification of high-tannin sorghums had been successfully accomplished in South Africa ; use of formaldehyde reduced the tannin content by 99%, thereby improving the brewing quality to a great extent. Traditionally, comparable brewing quality is achieved in rural areas, especially in Rwanda and Burundi, by steeping the grain in wood ash suspension. However, the argument put forward by the traditional society for steeping in the wood ash suspension is not detoxification but the development of appealing sensory quality (darkish malt, cream-coloured beer with absence of astringent taste) that results from such treatment. In their investigations on Tanzanian sorghum cultivars (Lulu, Mbangara and Serena) Muindi et al. (1981) reported a 57% reduction in tannin content on treatment of sorghum with a locally available carbonate mineral, Magadi soda (sodium sesquicarbonate, $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$).

4.2 Process Optimization and Control

A uniform quality raw material with definite quality characteristics is the pre-requisite for success in any commercial venture. The optimization of the processing conditions, and successful process control, would assure the

eventual manufacture of a uniform product with high quality. Many of the practices that are blindly followed in the traditional sorghum brewing procedure must be given up altogether if this be ever upgraded to a commercially viable industry. For instance, results from our laboratory studies indicate that the traditional mashing process results in the conversion of only 10% of the total available carbohydrates into reducing sugars. Some of the unconverted starch is slowly converted to fermentable sugars in the course of fermentation. However, a larger part of carbohydrates appear in the beer and in the waste after straining. The traditional fermentation is carried out by the natural (mixed) flora present in the environment and at ambient temperatures. In a study of the microbiology of sorghum beers Van der Walt (1956) identified over one hundred species of bacteria and several yeast strains in the ferment. This finding alone emphasizes the magnitude of the challenge encountered in this field.

4.3 Product Quality and Shelf-life Aspects

For successful marketing a consistently high quality product is essential. Lack of standardization of ingredients and absence of any form of process control, leading to very high day to day fluctuations in product quality, has been studied among the tribal (commercial) brewers of South Africa (Novellie, 1976). This lack of scientific basis may even lead to disastrous consequences ; for instance, levels of up to 4.6mg/litre of zearalenone, an estrogenic mycotoxin (Mirocha et. al., 1971 ; Sherwood and Peberdy, 1974), has been reported in a study of the traditional Zambian "Seven days" beer based on maize and sorghum (Lovelace and Nyathi, 1977). Also, the South African traditional beers were found to contain significantly high levels of fusel (high) alcohols (O'Donovan and Novellie, 1966). The effects of fusel oils on human metabolism are difficult to assess, but some authorities attribute certain undesirable effects of excessive consumption of alcoholic beverages to the fusel oil content (Stevens, 1960). The consumption of large amounts of sorghum beers has been associated with high iron (Fe)-

overload among Black population of Southern Africa (Derman et.al., 1980). This overload seems to be due to the enhanced iron absorption from the beer ; the mineral source being the brewing materials and the utensils used.

In addition to standardizing the product, urgent studies are required to investigate the shelf life of the product. The traditional beers are consumed straightaway, and at most would remain acceptable for a few days. Acrid taste development has been reported by Van der Walt due to *Acetobacter* activity in stored sorghum beers (storage time, 2 to 3 days). This off-flavour development is preceded by sedimentation of the suspended solids. The keeping quality might eventually turn out to be the limiting factor for the scale of industrial operations of a scientifically processed alcoholic sorghum beverage.

4.4 Economic Aspects

The benefits of this nutritionally significant (Aucamp et. al., 1961 ; Chevassus-Agnes et. al., 1976 ; Derman et. al., 1980) but traditionnally acceptable alcoholic sorghum beverage based on local raw materials could be reaped only if it is commercially produced to fall within the means of the peasants in the rural areas.

The economic aspects of this venture could not be discussed at length in this initial stage of scientific investigation ; only one significant observation could be made. Effort must be expended to identify inexpensive alternative local materials, wherever possible, to substitute for the processing aids/additives, in the brewing procedure of sorghum beverages.

In this context, the use of Magadi Soda for the detoxification of tannins should be investigated in preference to the expensive formaldehyde and conventional alkali materials. Also, the possibility of utilizing cane molasses, an underutilized by-product from the Tanzanian Sugar industry, in place of honey and refined sugar, for

enhancing the fermentation activity in the production of Inturile should be explored.

5.0 CONCLUSION

In spite of their immense socio-economic significance, the traditional alcoholic beverages of Tanzania, which differ intrinsically from the Western beers, have yet to be developed on sound technological basis for commercial exploitation. These alcoholic beverages are many and varied, nearly each district of the country having its own "brands" ; however, most of them are based on cereals, particularly sorghum.

The scientific investigation of Mtama beer, the most popular traditional sorghum beverage, seems to be a promising starting point for the technological development. An integrated approach should be pursued in this technological activity to explore the feasibility of producing an alcoholic sorghum beverage of uniform quality characteristics on a medium scale in the Tanzanian environment.

It remains a challenge for the scientific community of Tanzania to develop these traditional alcoholic beverages into successful commercially viable ventures.

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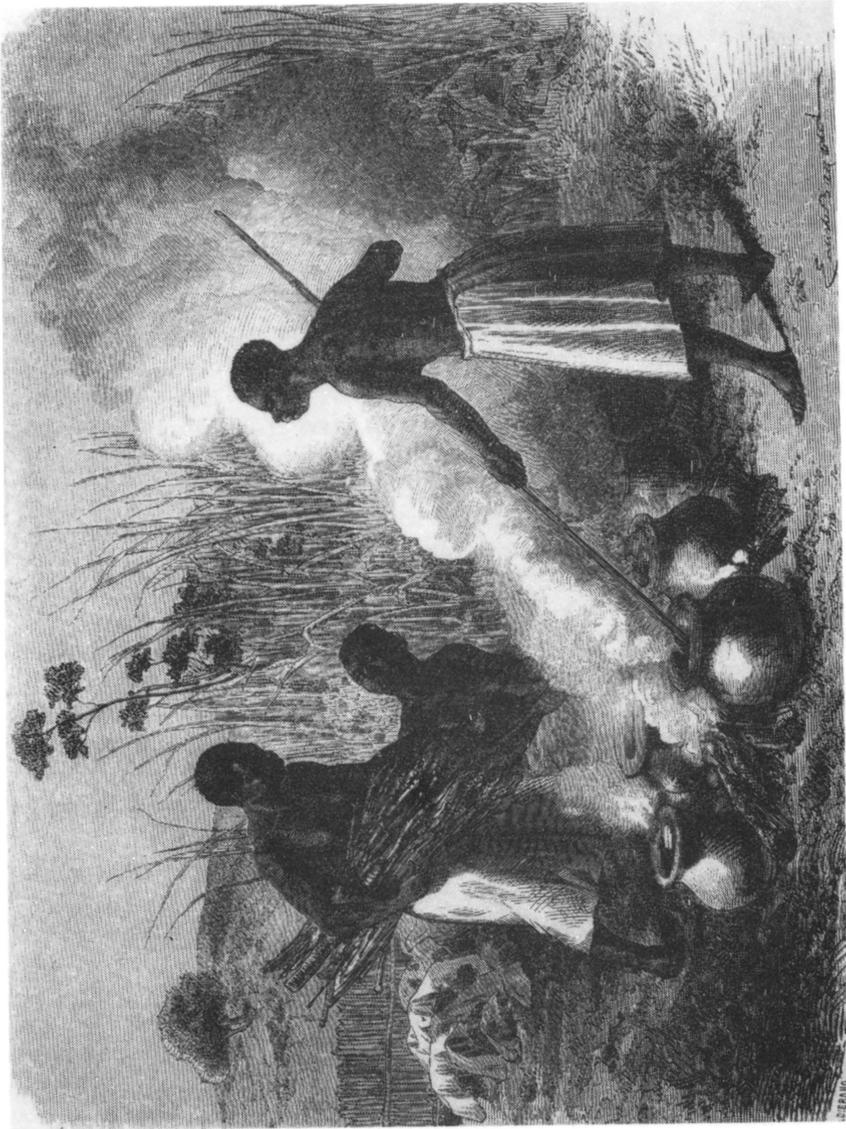
I am grateful to Mr. Paul Varodayan, my colleague at the University Department of Technology, Chemistry and - Microbiology of Foods, RUG-Faculty of Agricultural Sciences, Ghent, Belgium, for his constructive ideas in preparing the manuscript, and to the Service of Professor Dr. Ir. A. Huyghebaert for providing facilities for the laboratory work. Some illustrations were supplied by Ir. P. Van Damme of RUG-Tropische Plantenteelt en Economie ; he is highly acknowledged. For typing, I thank my wife Mrs. Jasmine Tiisekwa.

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Beer processing in Unyamwezi (Tanzania) circa 1850.

Engraving from :

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