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PROCESSING METHODS AND UTILIZATION OF SORGHUM  
AND MILLET IN GHANA



BY

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## INTRODUCTION Area and Yield Data for Cereals Crops

Sorghum and millet are two of the four major cereals cultivated in Ghana in terms of area and yield. The others being maize and rice. The average area cultivated yearly for millet is about 208,000 ha with an average yield of 0.7 t/ha while about 250,000 ha is cultivated to sorghum yearly with a similar average yield of 0.7 t/ha. The average total production annually is about 155,000 tonnes and 185,000 tonnes for millet and sorghum respectively. However, it has been projected that 2.0 t/ha and 2.5 t/ha yields are achievable in Ghana under better management conditions for millet and sorghum respectively.

The average per capita consumption of both millet and sorghum in Ghana is estimated to be about 17.3 kg/person/year for each crop. Sorghum and millets are generally cultivated in the Northern, Upper East and Upper West Regions of Ghana with smaller quantities being grown in the Volta and Brong Ahafo Regions.

Table 1. Average Area Planted to Cereals Crops ('000 ha)

Crop	Area('000 ha)	% Growth rate of area
Maize	530	6.7
Sorghum	250	3.0
Millet	208	0.3
Rice	72	0.8

**Table 2: Production and Yield Data for Cereal Crops**

<b>Crop</b>	<b>Total Production ('000 t)</b>	<b>Yield (t/ha)</b>	<b>Achievable Yield (t/ha)</b>
Maize	616	1.2	5.0
Sorghum	184	0.7	2.5
Millet	155	0.7	2.0
Rice	84	1.2	3.0

**Table 3: Per Capita Consumption for Cereal Crops**

<b>Crop</b>	<b>Consumption (kg/person/year)</b>
Maize	40.3
Rice	13.3
Sorghum	17.3
Millet	17.3

## SURVEY FINDINGS

A total of seventy six women were sampled from thirteen T/31 areas in the

**Table 4: Ranking of Regions by Output of Major Cereals**

Region	Maize	Rice	Sorghum	Millet
Northern	1	1	1	1
Brong Ahafo	2	2	4	5
Eastern	3	7	-	-
Ashanti	3	6	-	-
Central	5	9	-	-
Western	6	5	-	-
Volta	7	8	5	4
Upper West	8	3	3	3
Greater Accra	9	10	-	-
Upper East	10	4	2	2

## SURVEY FINDINGS

A total of seventy six women were sampled from thirteen (13) towns in the Northern, Upper East and Upper West Regions where sorghum and millet are mainly cultivated and predominantly consumed and interviewed on processing methods and utilization of sorghum and millet. While sorghum was used predominantly in brewing as well as for food purposes millet was found to be the traditional cereal staple in most of the areas surveyed. Below are excerpts from the survey findings.

## PERSONAL DATA OF INTERVIEWEES

Of the seventy six women interviewed, ten were from Bolgatanga, eight each came from Tamale and Wa with seven from Sawla and Walewale. (Table 5). Ninety (90%) per cent of the women were married while 10% were single.

Table 5 shows the age distribution of the women. In general the ages ranged between 16 and 73, however in between these extremes were considerable variations. The distribution shows that most of the women were aged between 20 and 49 years.

Effective processing and utilization of an agricultural produce to a large extent depends on one's knowledge and technical know-how's involved. Against this background the survey took into consideration the educational background of the interviewees. 38% percent of the women had no formal education while 40.8% had gone through primary education. It is however important to note here that some of them had very few years of this primary education either at the Islamic schools or Government established ones. Those that had attained higher levels of education were few. 14.5% having been through secondary education and 6.5% through post-secondary.

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The survey revealed that most of the women had other persons working with them. The highest number of persons working for one woman was 5 (in Walewale and Pong-Tamale).

Out of a total of 59 workers, 66% were found to be relatives while 30% were employees. 29% of the workers had some sort of education, mostly primary level with only one having gone through vocational training.

Bulk purchases of raw materials in quantities of between one bowl (2.5 kg) to twelve (12) bags [1 bag = 80 kg] were often made by the women. 92.5% of the women make these bulk purchases from markets within the towns, while the remaining 7.5% buy from nearby villages or towns. These were transported mostly between a kilometre and seven kilometres by 37.5% of the women.

**Table 5: Age Distribution of Respondents**

Town/ Location.	Age Class (Years)							Total	%
	10-19	20-29	30-39	40-49	50-59	60-69	70-79		
Walewale	1	1	2	1	2	-	-	7	9.2
Kpalwega	-	2	2	1	-	-	-	5	6.6
Bolgatanga	1	4	3	1	-	1	-	10	13.2
Bawku	1	-	1	2	1	-	1	6	7.8
Kpalugu	2	1	-	-	-	1	-	4	5.3
Wa	1	1	2	-	2	1	1	8	10.6
Nandom	-	-	1	2	1	1	-	5	6.6
Sawla	1	1	-	3	1	-	1	7	9.2
Pong- Tamale	-	2	-	-	1	-	-	3	3.9
Kongukwo	-	-	1	-	-	1	1	3	3.9
Babile	-	2	1	1	-	-	-	4	5.3
Tamale	1	-	3	2	1	-	1	8	10.6
Nyankpala	2	1	1	-	2	-	-	6	7.8
<b>Total</b>	<b>10</b>	<b>15</b>	<b>17</b>	<b>13</b>	<b>11</b>	<b>5</b>	<b>5</b>	<b>76</b>	<b>--</b>
<b>%</b>	<b>13.2</b>	<b>19.7</b>	<b>22.3</b>	<b>17.1</b>	<b>14.5</b>	<b>6.6</b>	<b>6.6</b>	<b>--</b>	<b>100.0</b>



**Table 6: Educational Background of Respondents.**

Town/Location	TYPE OF EDUCATION			
	Non-formal	Primary	Secondary	Post-Secondary
Walewale	4	3	-	-
Kpalwega	3	2	-	-
Bolgatanga	2	6	1	1
Bawku	2	3	1	-
Kpalugu	3	1	-	-
Wa	2	4	1	1
Nandom	1	3	1	-
Sawla	3	3	1	-
Pong-Tamale	1	1	1	-
Kongukwo	3	-	-	-
Babile	2	2	-	-
Tamale	1	1	4	2
Nyankpala	2	2	1	1
<b>Total</b>	<b>29</b>	<b>31</b>	<b>11</b>	<b>5</b>
<b>%</b>	<b>38.2</b>	<b>40.8</b>	<b>14.5</b>	<b>6.5</b>

The mode of transportation to processing sites was mostly by head carrying, and this constituted 50%. 26.5% of them used donkey carts and push trolleys with 23.5% using motorised vehicles. Obviously bigger quantities i.e. between 6 - 10 bags were transported by vehicles while quantities up to one bag were carried. These bulk purchases were processed over a period of time which could last up to a weeks or even months. Storage of the grains was mostly in jute sacks or polythene bags in rooms or corridors of their houses. 25% of the women did not store their material due to the fact that they processed everything at a sitting

The prices of the grains varied considerably from one town to another. Prices of millet was between ₵320.00 (\$0.16) per kilo in Sawla and ₵480.00 (\$0.22) per kilo in Nandom. However with the predominant price was ₵400.00 (\$0.18) per kilo. The price for bag of 80kg was between ₵40,000.00 (\$ 18.18) and ₵44,000.00 (\$20.00). Sorghum was found to be about 10 - 25% cheaper than millet in most places.

### Grading

No form of sorghum and millet grading takes place in Ghana. Rather, the commodities are sold upon classification according to the duration it takes to mature namely, early millet and late millet or colour i.e. red or white sorghum.

### Threshing and Cleaning

No machinery for threshing sorghum and millet are in use in Ghana. Threshing is entirely manual. This is done mainly by laying the panicles on the floor and beating with sticks. The grains so threshed are gathered, winnowed to remove straw and other plant materials and then bagged. Stones and other impurities, when they have to be removed, is done manually. No mechanical cleaners and destoners are in use in the country.

## Marketing TRADITIONAL METHODS OF PROCESSING

There is no formally organized marketing structure in Ghana. Marketing is done through local market women who buy from farmers, bag and resell in market to retailers. Retailing of sorghum and millet in the local market is done in bowls of 2.5 kg and in smaller quantities.

The end users buy in varying quantities i.e. from a few kilos to bags according to the intended use. Main wholesaling centres of sorghum and millet are the major towns in northern Ghana namely, Tamale, Bawku, Wa and Bolgatanga. Sorghum and millet bought in these towns are transported to market in southern Ghana in bags and sold to retailers.

Generally no figures are available on either the importation or exportation of sorghum and millet and it is therefore assumed that very little movement of the commodities across national borders takes place.

## Processing

Dehulling of sorghum and millet is generally not done as a result of the difficulty that it poses. The grains are usually grounded whole and sifted when necessary. The only available equipment which may be used for dehulling in Ghana is the Engelberg huller. This equipment is generally known to be inefficient in the dehulling of the grains.

The processing of sorghum and millet into flour is not done on commercial basis in Ghana. As a result, flours from these cereals cannot be purchased in the shops as in other countries. However some amounts of sorghum and millet are incorporated into various formulations particularly for infant feeding.

## LOCAL (TRADITIONAL) METHODS OF PROCESSING.

The processing methods for sorghum and millet vary from place to place and also with respect to the product one wants. There are a host of products derived from sorghum and millet .

### i. *BASI*

The millet first undergoes cleaning. Stones, straw and seeds of other plants and any other adulterated materials are removed. The clean millet grains are then milled whole. Water is sprinkled on the milled mass and sieved on a coarse mesh. Part of the sieved material is transferred into a pot with perforations at the bottom. The perforated pot is placed on another one containing water so that when boiled the vapour can be used in steaming the milled millet. Steaming is usually done 30 minutes to 1 hour and to ensure efficiency, the contact area between the pots is sealed. After steaming the basi is allowed to cool. The lumps within the mass are broken into smaller particles in a bowl by rubbing in between the palms or with a wooden ladle/broken calabash. The next step involves thorough drying of the material in the sun. After drying, the material is then mixed uniformly with ground pepper, salt and groundnut paste and sieved. Finally the product is sieved to remove chaff/bran. It is consumed either by soaking it with sugar and milk just like *gari* or taken with soap or stew.

### ii. *KOKO*

Except for that of Sawla all the other towns have about the same method of processing millet into *koko*. Basically the grains are first cleaned and washed followed by soaking in water for between 8-24 hours (mostly soaked overnight). After this the water is drained off and in some cases further cleaning by way of removing foreign particles is done. Next, spices including pepper and ginger are added to the millet and then milled. Water is then added to form flour from which

slurry is made. The slurry is sieved through cheese cloth and the filtrate kept overnight to develop sour taste. After this the supernatant is decanted and boiled. The remaining slurry is stirred, some fetched aside and the boiling water is added to the slurry and consistently stirred. More hot water or slurry may be added to give the required consistency. In Wa, fresh water instead of the supernatant is boiled and used. Moreover slurry is rather added to the hot water and more added to required consistency under controlled heat.

In Sawla however the slurry is add to the boiling water and stirred to boiling with the addition of more flour to created lumps in the *koko*.

In all the towns, good quality *koko* was cream or grey in colour, smooth (except Sawla where porridge of a thick consistency was preferred). All the towns for that matter preferred grey millet with large grain size. According to the women interviewed in most of the towns the grey millet is believed to have more starch.

Both late and early millet are suitable for *koko* but the late millet is mostly preferred because that has more starch and better taste than the early millet. It was also revealed that smaller grains with dark colour is preferred at Sawla due to the peculiar way their *koko* is.

In addition black grains were found not to ferment fast and the *Sisala* variety has off flavours. After sieving, the chaff is either sold to animal farmers or exchanged for firewood. Some problems the women faced were control of flies around processing areas and the *koko* becoming thin ( loosing consistency) after a few hours.

### iii *TUO-ZAFI (T.Z)*

Most towns except Sawla used millet for T-Z preparation. The grains when necessary are cleaned by winnowing or washing and removal of stones etc. followed by drying in the sun. The millet is milled and slurry made with water from the flour and left overnight to ferment. In certain places like Wa, Babile and Sawla water is rather boiled and flour sprinkled in to form the slurry. The sour supernatant (i.e. from slurry) is then used to prepare another slurry and then boiled. In some cases the sour water is rather boiled and either the residue or a freshly prepared slurry is added and stirred to avoid lumps forming in the porridge. Part of the boiling slurry is scooped aside and dry flour is sprinkled unto the rest and stirred. The slurry is added bit by bit till required consistency is arrived at. In Sawla, Kpalwega and Babile cassava flour/starch can be added to get desired consistency.

In Sawla however, the preparation is slightly different. After milling, the flour is sieved and made into dough to ferment overnight. Water is then boiled and some dough added with stirring to obtain slurry. More flour is added and stirred till well cooked.

Good quality T.Z is light in colour, and has a thick consistency. Most of the interviewees preferred late cream/grey millet since that gave a better product and could keep longer than early millet. In Sawla consumers preferred the use of white "cheese" sorghum for T.Z. It was also found out that the grains must be clean, insect free and light coloured in order to give good quality T.Z.

Millet was clearly the preferred traditional grain for T.Z.. The main problem faced is with loss of stickiness (consistency) when stored for any length of time.

#### iv. *MASA/KAKRO*

Milletts are also processed into cakes (*masa*). Grains are milled dry, dough made out of it and left overnight to ferment. Salt petre is not added. The dough is then fried with a little oil in indented frying pans. In places like Wa and Nandom, the processes are slightly complex. It involves a cleaning stage where stones and other foreign materials are removed and then washed. Sometimes grains are dehulled (pounded) in Wa. The grains are next soaked for 3-6 hours and then milled again into flour. Spices may be added at this stage. Part of the flour is used to prepare slurry with boiling water with vigorous stirring. The slurry is added to the rest of the flour, mixed and left overnight to ferment. Frying then takes place with little oil/shea-butter in indented frying pans and solution of salt petre and sugar is added, apparently to reduce acidity. Sometimes ripe plantain/banana is added to the dough.

For *kakro* (another form of cake), the process is similar. Grains are soaked for 8 hours, milled and part used to prepare slurry. More flour is added to make thick dough. The dough is covered and left overnight to ferment. After fermentation water and salt petre and added to required consistency. Banana may be added. This is followed by deep frying in oil.

Late millet is generally preferred because it expands. Early millet is also good when newly harvested but develops off flavours with time. It was also noticed that colour of grains is not so important whereas good fermentation is. Dehulled (pounded) grains also gives good physical appearance.

#### v *FULA/FURA*

Water is first sprinkled on the millet grains and pounded in mortars to dehull. After winnowing the grains are washed with water and soaked for 1-3 hours. The water is then drained and grains milled together with spices such as pepper and ginger. Removal of husks and coarser particles is next through sieving. The flour is then rolled into balls and cooked for about an hour. The balls are pounded again and rolled into smaller balls. Rice, maize or millet flour is used to coat the surfaces to improve the physical appearance, reduce stickiness and to prevent over-drying and cracking.

Late millet is preferred because early millet has more chaff and is difficult to process. In addition late millet tastes better and is easier to dehull. Those in Tamale and Nyankpala preferred black millet to any other variety. It was also found that taste changes with time. While some consumers prefer the *fula* fresh others liked it after a day or two. Besides these, the use of a grain polisher or already polished grains would improve the quality of the product.

#### vi. *MALT*

In all the towns where the survey was conducted the principal underlying process of brewing malt from sorghum is the same but the precise procedures from soaking to the sprouting stages differed slightly.

At Walewale, sorghum was soaked in water for 12 hours after which the grains are washed and put back in fresh water overnight. After draining, the grains are spread evenly on the floor and covered with leaves. Water is sprinkled on them every 12 hours and kept moist for 48 hours after the entangled sprouts are loosened.



At Kpalugu, the grains are soaked overnight, spread an inch thick on a clean floor and covered with jute sacks for 24 hours. Water is then sprinkled on the grains to keep them moist for 72 hours.

At Bolgatanga, grains are soaked overnight, water drained and kept in a basket for 12 hours. After this the grains are spread about half an inch ( $\frac{1}{2}$ " ) thick on a clean floor and sprinkled with water for 48 hours to enable sprouting to take place.

The last stages of the malting process are similar in all cases. The entangled sprout are loosened and either heaped up or put in baskets and covered with poly sacks for 48 hours. The grains are then dried in the sun for 1 to 2 days depending on the intensity of the sun. The dried grains are bagged and sold to *pito* brewers.

Although white sorghum was said to germinate better the red local variety was preferred in most areas due to its colour. However a mixture of white and red varieties is often used in brewing. Grains for malting must be insect free, have a high germination capacity and red in colour in order to obtain a good malt and resultant good taste of the *pito*.

#### *vii. PITO*

The brewing of *pito* involves three basic stages namely: malting, drying and fermentation. The malting and drying stages are covered above.

Fermentation stage begins with the milling of dried grains. The milled grains are then transferred into a container of water with a local tree bark extract or okro leaves extract and the particles allowed to settle. The supernatant is collected while the mash is boiled for about 3 hours with continuous stirring to obtain a thick paste. The boiled mash is powdered to the supernatant which was earlier collected and

more tree bark extract added. This is left overnight to cool and to develop sourness. The liquid is collected into another pot and more tree extract added to the residue to encourage further settling. The collected liquid is then boiled for between 3 to 12 hours pending on the intensity of the heat. The *pito* is then cooled and yeast added to ferment overnight.

In Bolgatanga no tree extract is added. In order to obtain good quality *pito*, the mash should drain well, the sugar content and resultant alcohol content must be high. In Nandom the cream and brown sorghum types are preferred. It is generally believed that the longer the malt is kept before brewing the better the *pito* quality. However, it is important to ensure that the moisture content of the malt is low so that it does not get mouldy in storage.