

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH



Food Research Institute

REPORT ON WORKSHOPS TO EVALUATE AND INTRODUCE A  
NEW PROCESSING TECHNOLOGY FOR MAKING SORGHUM  
MALT TO TRAINERS OF ARTISANAL SORGHUM PROCESSORS IN  
TAMALE AND ZEBILLA

A PROJECT REPORT SUBMITTED UNDER THE IFAD/ ICRISAT /FRI/ SORGHUM  
IMPROVEMENT PROJECT

BY

P. N. T. JOHNSON <sup>1</sup>, G. KOMLAGA <sup>1</sup>, I. D. K. ATOKPLE <sup>2</sup>, & P. M TOKU <sup>1</sup>

<sup>1</sup> FOOD RESEARCH INSTITUTE

<sup>2</sup> SAVANNA AGRICULTURAL RESEARCH INSTITUTE

## Summary

As part of the IFAD/ICRISAT/FRI/SARI Sorghum Development Project, a series of workshops were held between September and November, 2001, in Tamale and Zebilla to evaluate and demonstrate a simple technology developed by the CSIR-FRI to improve the production of malt from three new varieties of sorghum produced by the CSIR-SARI. The three varieties are *Kapaala*, *Kadaga* and *Mankaraga*. The workshop was also to establish the main desirable sensory quality attributes of *pito*, produced using the *Dagati* or *Frafra* methods. *Pito* is a local alcoholic beverage brewed from malted sorghum grains. Twenty-five participants who were mainly field officers of the Ministry of Food and Agriculture from the Women in Agriculture Directorate, officers of ACTIONAID, Ghana Bawku West and some artisanal sorghum processors attended the workshops. The technology introduced was the separation of small-sized grains from large-sized grains, malting them separately before mixing to be used for brewing *pito*. The technology was introduced through a participatory approach in which the participants malted the grains according to the new technology and compared it to the old method. Two of sorghum processors, one in Tamale and another Zebilla, were given samples and provided with money to use the new technology and all attested to the fact the method greatly improved quality of *pito*. The workshop clearly established the technology is very useful in helping to optimise the quality of malt for the brewing of *pito*. What remained to be done was to design appropriate local sieving machinery/equipment that can adequately separate the grains into small and large-sized grains. The workshop also revealed that there were clear differences in the sensory quality attributes of *pito* brewed from the different varieties. The methods used, whether the *Dagati* or the *Frafra* also significantly affected the sensory attributes.

## ACRONYMS

AAG – ACTIONAID Ghana

IFAD – International Fund for Agricultural Development

ICRISAT – International Crops Research Institute for the Semi-Arid Tropics

FRI – Food Research Institute

SARI – Sannan Agricultural Research Institute

WIAD – Women In Agricultural Development

PRA – Participatory Rural Appraisal

MoFA – Ministry of Food and Agriculture

SMBP- Sorghum Malt Brew Producers

## 1. INTRODUCTION

In September to November 2001, a series of workshops were held in Tamale and Zebilla for some field officers of Ministry of Food and Agriculture in the Tamale and Zebilla, and field officers of ACTIONAID, a non-governmental organisation based in Bawku West District, on an improved method for malting new varieties of sorghum developed by the Savanna Agricultural Research Institute of the CSIR. These officers have been assisting sorghum farmers and processors in the Northern and Upper East Regions. The three new varieties of sorghum that had been developed by CSIR-SARI were *Kadaga*, *Kapaala* and *Mankaraga*. These workshops were held under the IFAD/ICRISAT/FRI/SARI project, which was titled "Farmer participatory testing of technologies to increase sorghum production in Ghana". The main focal output for this project was to develop technologies that will increase the utilisation of sorghum.

At the beginning of the IFAD/ICRISAT/FRI/SARI project, a participatory rural appraisal (PRA) was carried out in the first year (Andah *et al.*, 1999). In that exercise, a number of factors were established as affecting the processing of newly developed sorghum varieties into malt and eventually into pito in the Tamale and Zebilla. The main problems were included germination capacities and energies and pre-processing factors. During this germination, the embryo of the grain secretes enzymes into the endosperm which breaks down the cell walls largely made up of  $\beta$ -glucan, and also breaks down the protein matrix within the endosperm to expose starch. During mashing, this starch is broken down by saccharifying enzymes into fermentable sugars. For example, it was established that most maltsters obtained their grains for malting from varied sources, usually containing a mixture of small-sized grains and large-sized grains. Additionally, the first year also established that there were differences in the way sorghum was processed into malt and/or pito, the traditional sorghum brew. Typically, there is the *Dagati* method that results in the malt for producing the *Dagati Pito* and the *Frafra* method that gives a slightly different type of pito. In terms of the brewing, the differences stem from the way the yeast is added. For processors in and around the Tamale municipality (in the Northern Ghana) and Wa (in the Upper-West of Ghana), where the *Dagati* pito is popular, the

added yeast foams on top of the drink and therefore there is no need to sieve the *pito* before drinking. Around the Zebilla (in the Upper East of Ghana), where the *Frafra* *pito* is popular, the yeast settles at the bottom of the fermenting pot and as a result the *pito* has to be sieved before sale

In the second year, three varieties sorghum developed by CSIR-SARI, *Kadaga*, *Kapaala* and *Mankaraga* were selected by processors as suitable for making good malts. Laboratory results showed that the smaller the grain size, the better the rate of water absorption and hence the better malting characteristics (Johnson *et al.*,2000). Again, it was demonstrated in the second year work that using slightly warmer water (at 37 °C) for the first 3-4 h of steeping significantly increases the rate of water absorption and hence the duration of steeping (Johnson *et al*, 2000). From these results, a number of pertinent questions came up for consideration.

There was the question of whether the different traditional methods of making the '*pito*' (*Dagati* and *Frafra*) significantly affect the selection of variety and quality attributes. Another question was what were the essential quality sensory attributes. Thirdly was the question on whether the processing steps for *pito* can be improved for these sensory attributes and to what extent can the significant laboratory results obtained in the second year be incorporated into the unit operations for *pito* brewing. Specifically, there was the question as to whether it is possible to optimise the processing of *pito* and thus improve the overall acceptability of *pito* not only through cleaning but also through separation of grains into small-sized and big-sized portions malt them separately before being used in the brewing of the *pito*. To do a comprehensive evaluation of these, it became necessary to conduct a series of participatory workshops involving field officers of the from the Women In Agricultural Development (WIAD) Directorates of the Ministry of Food and Agriculture (MoFA) Tamale Municipality and Zebilla District Directorate, ACTIONAID, a non-governmental organisation assisting sorghum farmers and processors in the Upper East as well as some artisanal sorghum processors to evaluate and transfer the technology developed. This is a composite report on the evaluation and transfer of the technology.

## **2 The Evaluation of Technology and Workshops to Transfer Technology**

### **2.1 Materials**

Three varieties of sorghum *Kadaga*, *Kapaala* and *Mankaraga* were used for the evaluation and demonstrations. These were produced by CSIR-SARI. They were first separated into small- and large-sized grain portions using sieves of mesh sizes 4 and 6 (Newark Wire Cloth Company, New York).

### **2.2 Methods**

#### **2.2.1 Production of Malt**

Two types of methods of producing malt were demonstrated. In method one, equal portions of the small-sized and large-sized grains were mixed and malted. In the second demonstration, the small-sized grains and the large-sized grains were malted separately. In either case, approximately 50 kg lots of small-sized and large-sized grains of the three sorghum varieties were obtained and given to four sorghum maltsters in Tamale and Zebilla to produce the malt. Fig 1 gives the scheme for the production of the malt.

#### **2.2.2 Brewing of Pito**

Three sets of experiments/demonstrations of producing pito (Fig. 2) were carried out.

In the first method, two *Dagati* sorghum processors each brewed two pito portions separately from malt made from the small-sized and the big-sized grains. The other two *Frafra* sorghum processors also produced two *pito* portions.

In the second experiment method, malt was prepared in the laboratory intermediate fermentation and given to the processors to brew into pito.

The third method involved the comparing the sensorial attributes of the two types of pito after mixing malt from the small –sized and big-sized grain malts

### 2.2.3 Training of Sensory Panel

Methods outlined in the ASTM Method E 1083 –889(1991) were used to train and select panelist from among volunteers from the Savanna Agricultural Research Institute, the Ministry of Food and agriculture and the Regional Administration in Tamale. Two groups of panelists were trained for the two types of pito the *Frafra* and *Dagati pito*. On day 1 of training, the panelists were instructed on the use of the graphic scale methodology (Appendix 1). The line scales were anchored with terms *none* and *very strong* for recording sensory perception of the various attributes such as aroma , taste, mouthfeel etc. whilst agreeing with the panelist on what they perceive as the most important sensory attribute of pito. Panelists received a set of free pito samples with very slight variations in alcoholic contents and other perceptible sensory attributes like aroma, taste and mouthfeel. This set of pito was used in the training. During the training the panelists were instructed to concentrate carefully on the perceptions of the various sensorial attributes and to memorise their levels before scoring on the line. They washed their palate at intervals with cream crackers biscuits and water. Panelists scored and at the end of the training session, the correct ratings were thoroughly discussed.

In the course of the training, it became obvious that a number of terms had to be incorporated. In the case of taste, some panelists said there usually combined two attributes in judging what they perceived as good taste. So we had on the line scale combinations like bitter-sweet, sweet–sour etc. For freshness, *Dagati pito* consumers looked out for the foam formation whilst for strong pito, the *Frafra pito* consumers looked for what they call “wavy lines” on the surface of the drink.

In all two sets of ten panelists were trained for the exercise, one set for the *Dagati* and other set for the *Frafra*

#### **2.2.4 The sensory evaluation sessions**

Four sensory evaluation sessions were organized between the months of August to October, 2001 at the CSIR-SARI Canteen. Each session was for a particular investigation. The evaluations were held on Saturdays when the panelists were free from their official duties. During each session panelists for each type of pito evaluated three replicate samples at interval of about 2 h. They also filled out comments on the particular choice.

#### **2.2.5 The follow –up Workshops**

Two workshops were organized in October 2001 during which the results of the work on improvements to the production of malt and therefore pito were introduced for twenty Sorghum Malt Brew Producers (SMBPs). These workshop were held at the premises of our main SMBPs collaborator,, Madam Jacintha Sanziri. One workshop was orgained in Zebilla, on November 2001 with the help of ACTIONAID Bawku West District Coordinator,



FIG. 1 SCHEME FOR THE PRODUCTION OF MALT FROM SORGHUM GRAINS

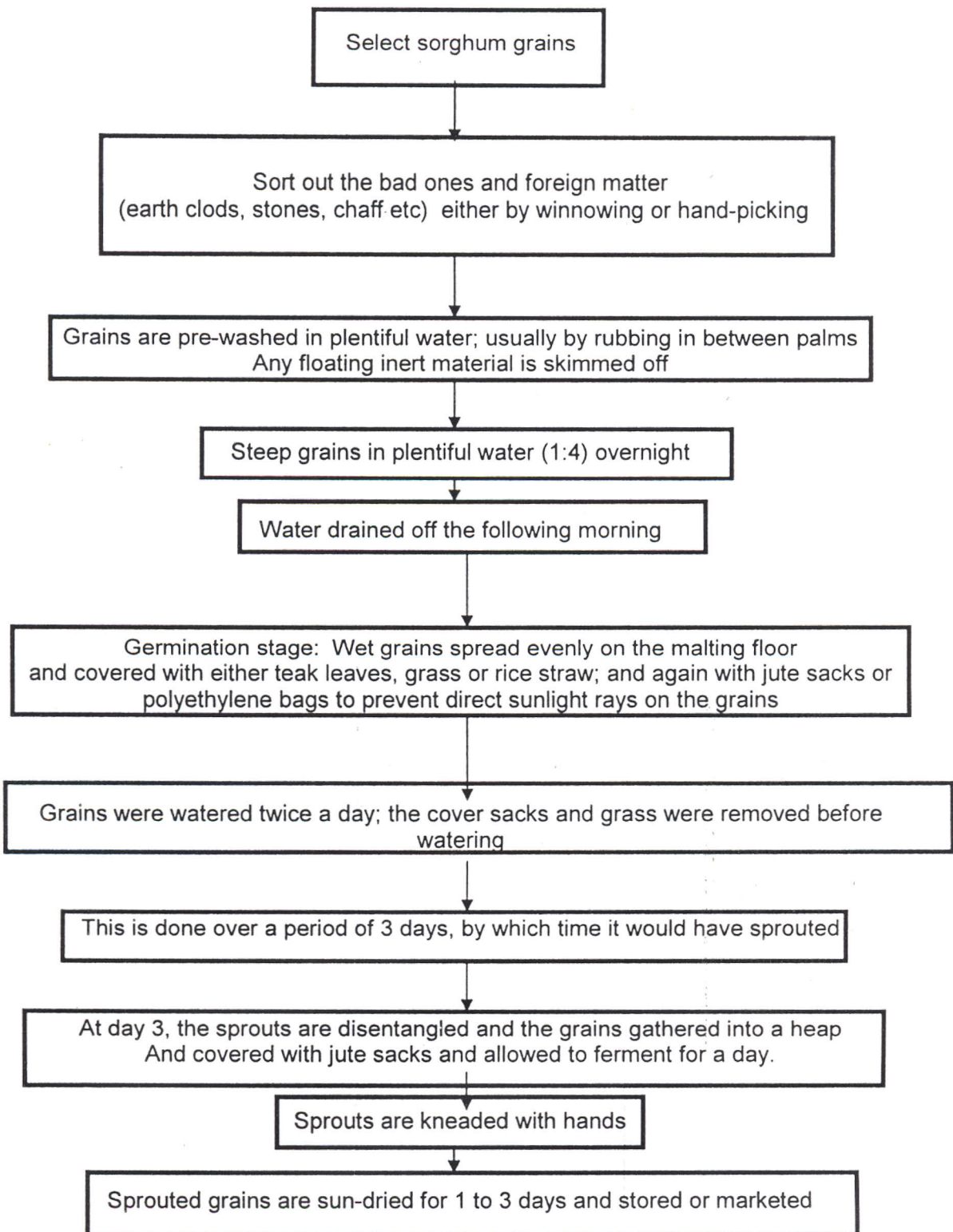
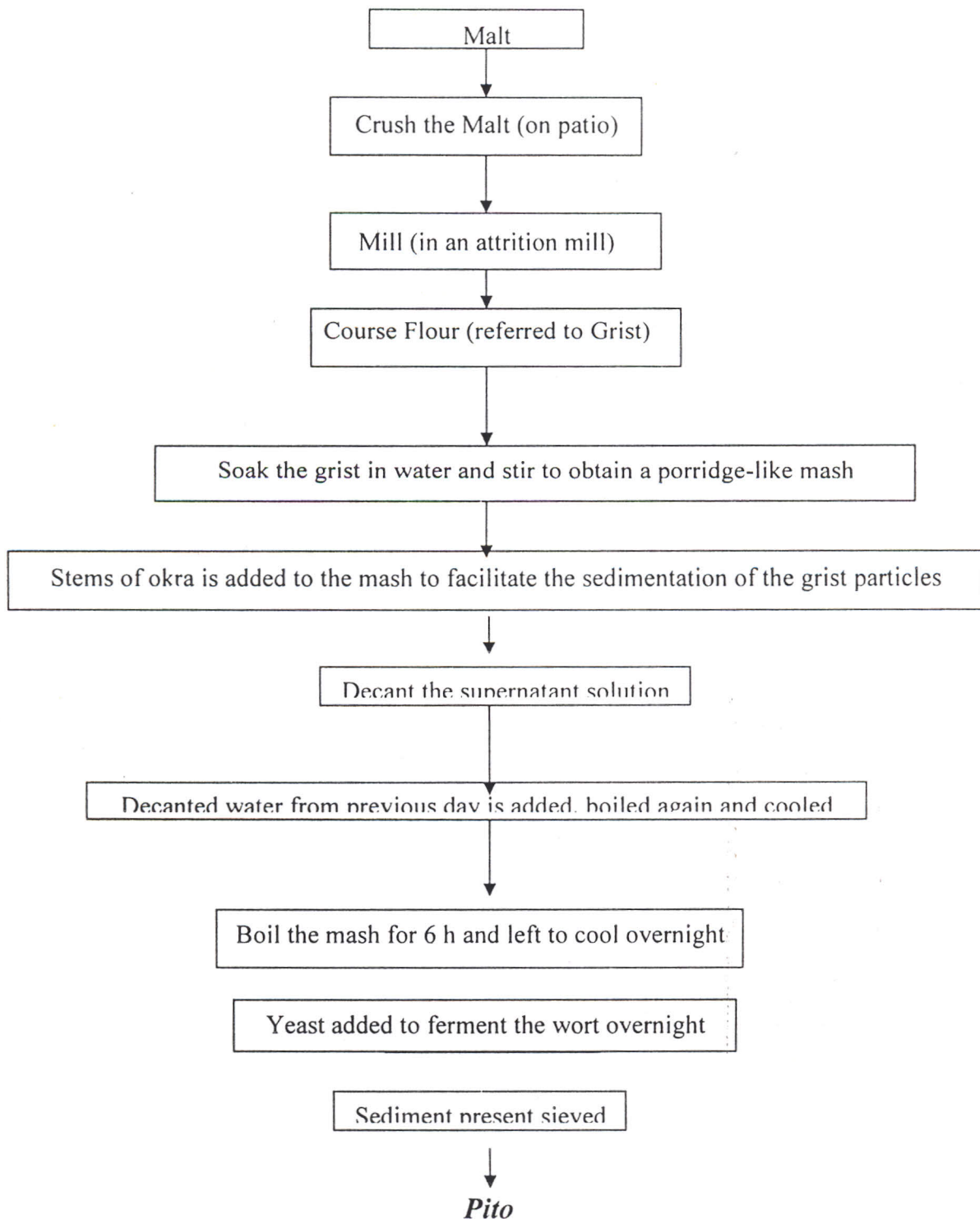


FIG. 2 SCHEME FOR THE PRODUCTION OF LOCAL GHANAIAN SORGHUM BREW, *PITO*



### 3. Results of the Evaluation of the Technology

Fig. 3 to 5 summarise the results of the sets of sensory evaluation carried. As shown, the study showed that both methods of producing pito prefer the use of the sorghum variety *Kadaga* followed by *Mankaraga*. The Figs also shows the malt of small-sized grains produces a much more acceptable pito than the large.

**Fig. 3 Comparison of some sensory attributes of Frafra 'pito' from three varieties of sorghum (var. *Kadaga*, *Kapaala* and *Mankaraga*)**

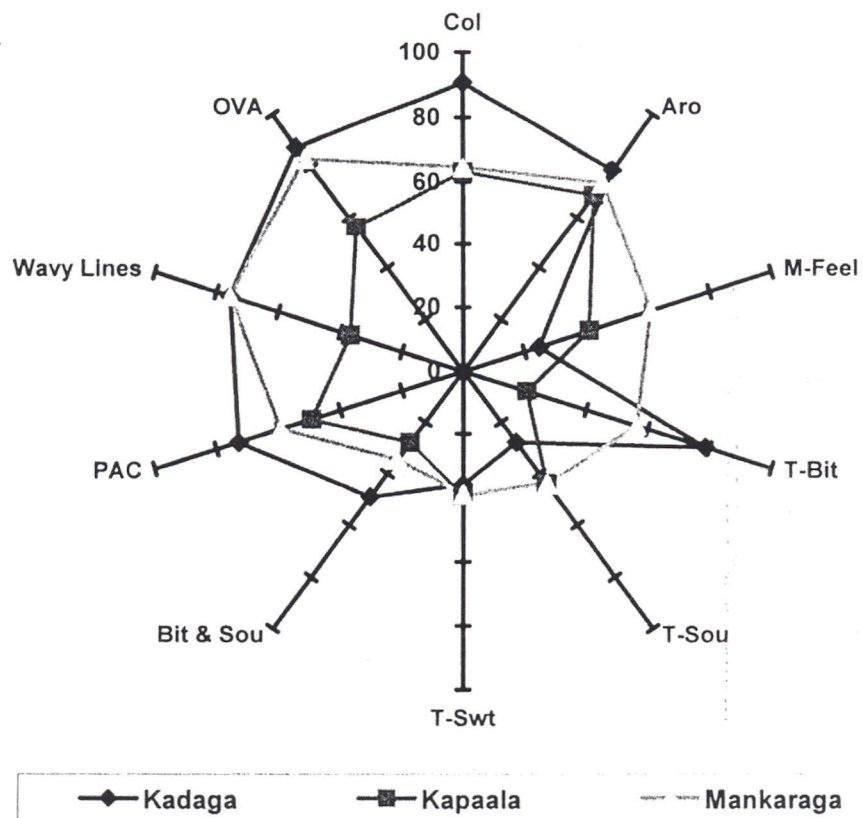
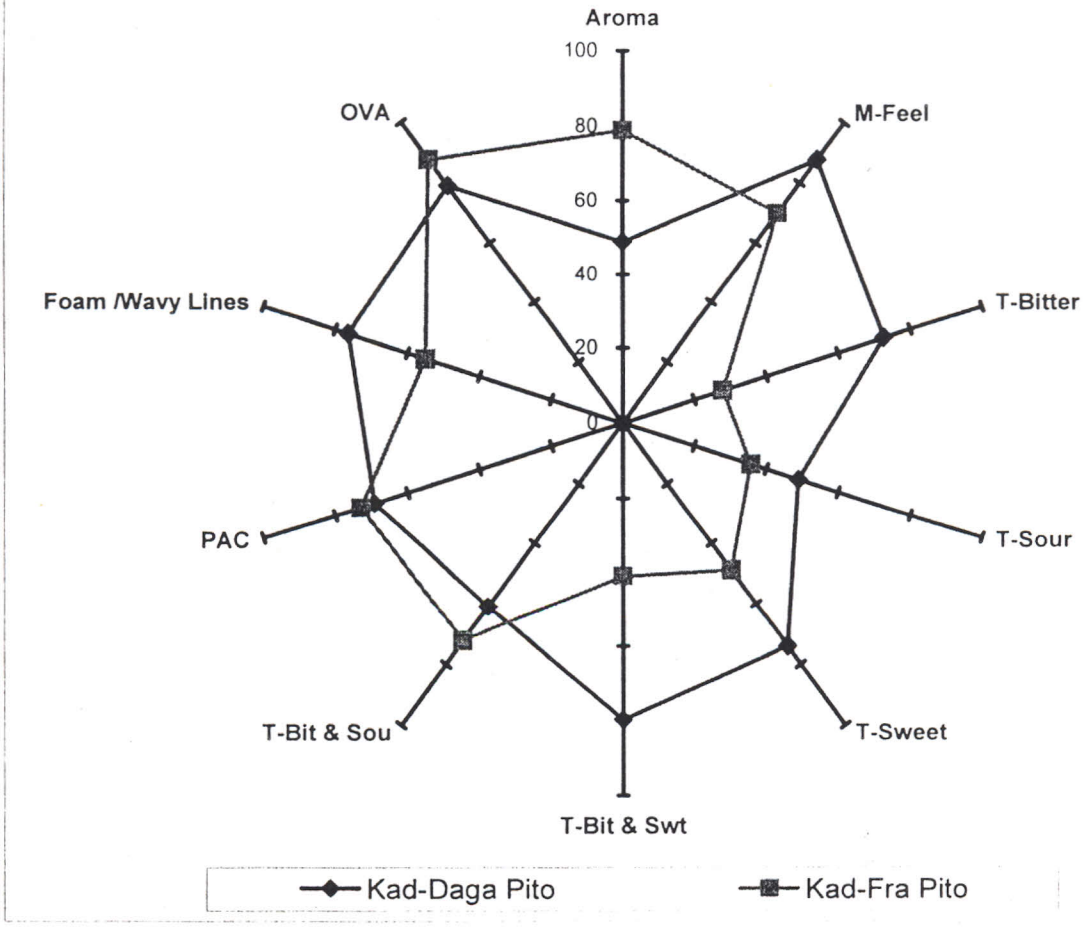


Fig. 4 Comparison of some sensory attributes of Dagati and Frafra pito made from sorghum (var. Kadaga)



**LEGEND:**

**Variety , Type of Pito & Size of Sorghum Grain**

**Kad-Daga**= Kadaga Dagati Pito; **Kad- Fra**= Kadaga Frafra Pito

**Kad-small**= Kadaga small-sized grain; **Man-small**= Manakaraga small-sized

**Kad-large**= Kadaga large-sized grain; **Man-large**= Manakaraga large sized grain

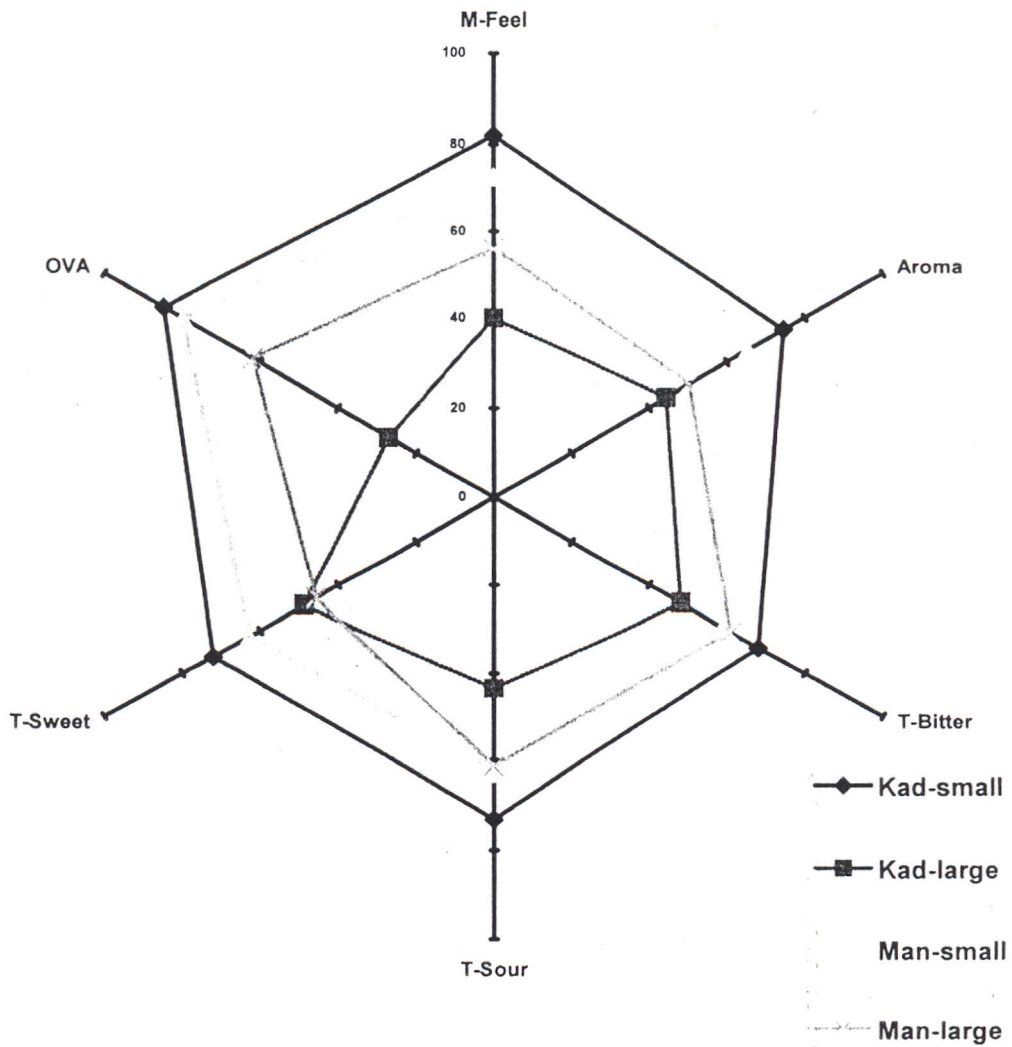
**Sensory Attributes:**

**OVA**= Overall acceptability; **Col**= Colour ; **Aro**= Aroma; **Bit & Sou**= Bitter & Sweet

**PAC**= Perceived Alcoholic Content; **M-Feel** = Mouth Feel; **T-Swt**= Sweet Taste Only

**T-Sou**= Sour Taste Only; **T-Bit**= Bitter Taste Only

Fig. 5 Effect of grain size on some sensory parameters of 'pito' brewed from two sorghum varieties (var. *Kadaga* and *Mankaraga*)



## Conclusions

These series of workshop established that the technology introduced of separating sorghum grains into small-sized grains from large-sized grains, malting them separately before mixing to be used improves the efficiency of the brewing of the sorghum brew, *pito*. The workshop also revealed that a number of sensory factors affect the type and acceptability of *pito* being produced. This has a lot of bearing on the industrial production of the brew.

## References

Andah, A.A., Manful, J.T., Atokple, I.D.K., Clottey, V.A., Addo-Kwafo, A., Quaye, W., Gyasi, O.K. (1999) Participatory rural appraisal (PRA) report on sorghum production, processing, utilisation and marketing systems in selected areas of Northern Ghana. Food Research Institute Report.

Johnson, P.-N.T., Komlaga, G. Atokple, I.D.K, Toku, P. Sanziri, J.G. Koyir, G. (2000) effects of variety, grain size and methods of processing on the quality of *pito*, a traditional Ghanaian sorghum beverage. In: Second Year Progress Ghana Report to IFAD/ICRISAT Sorghum Development Project, ICRISAT, Bamako, Mali.

IFAD/ICRISAT/FRI/SARI/ARI/MoFA SORGHUM PROJECT

SENSORY EVALUATION OF PITO BREWED FROM THREE SORGHUM VARIETIES

SAMPLE =

NAME =

DATE=

Colour



Aroma



Mouth-feel-



Bitterness

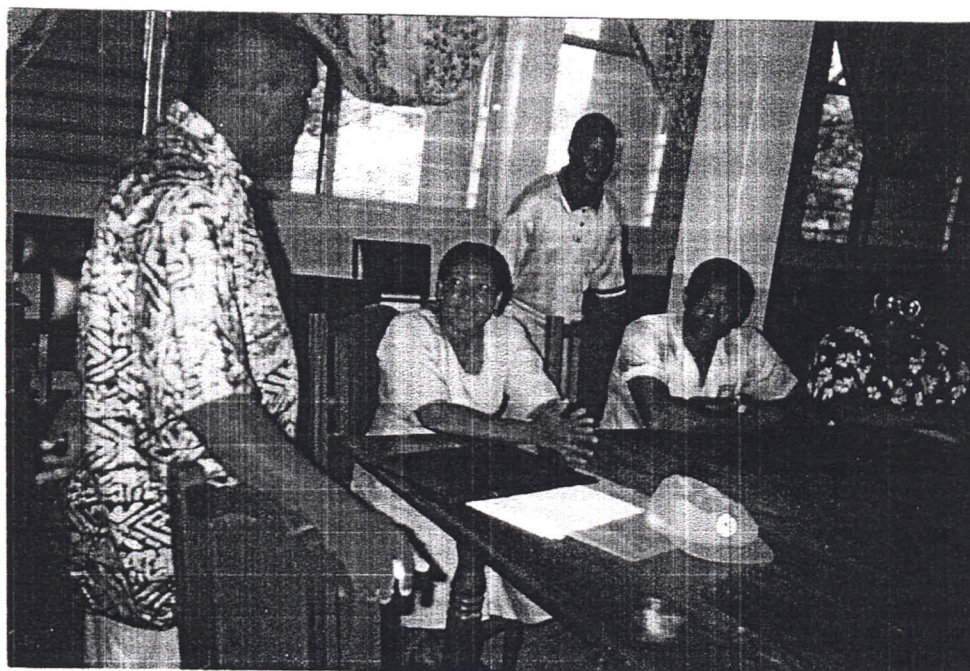


Sourness



Fig 6 to 9 pictorial of sessions to during the training of participants on methods used for sensory evaluation and the main sensory evaluation period

**Fig. 6**



**Fig. 7**

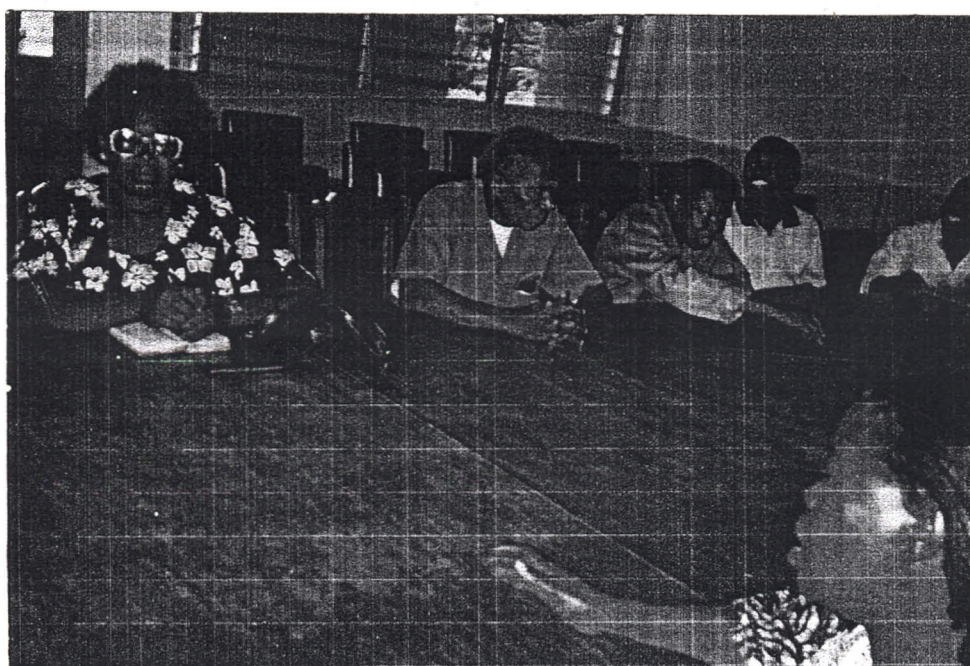




Fig. 8



Fig. 9



Fig. 10

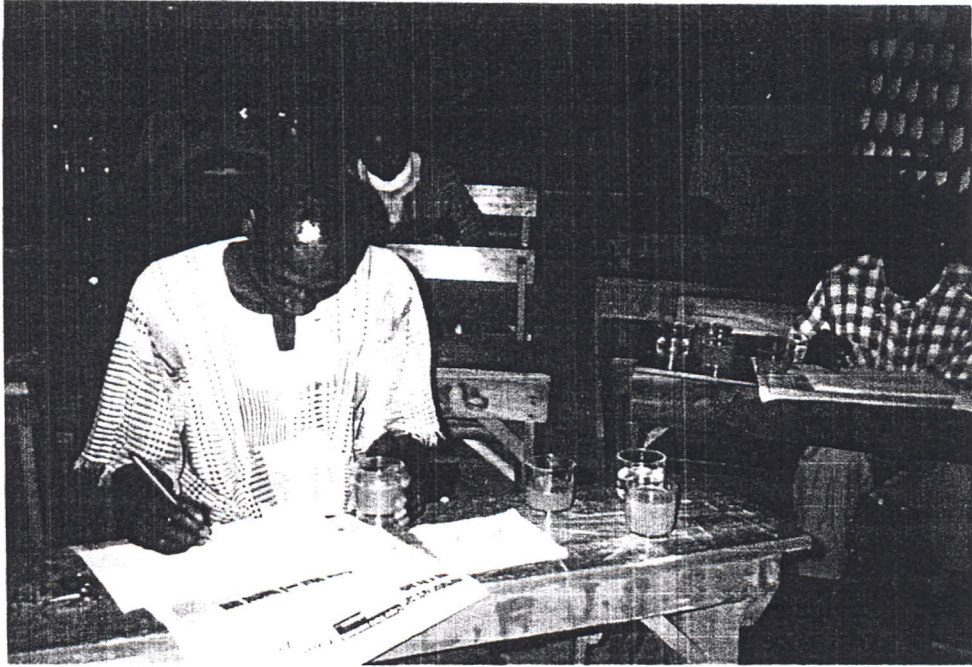


Fig. 11

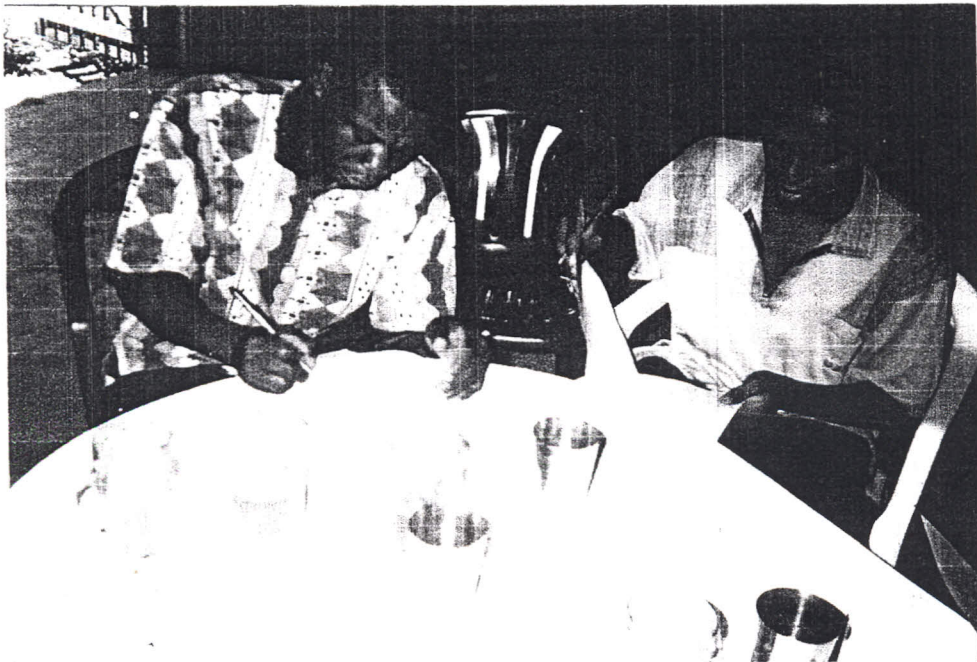


Fig. 12 to 22 show various stages of the preparation of the malt and pito.

Fig.12

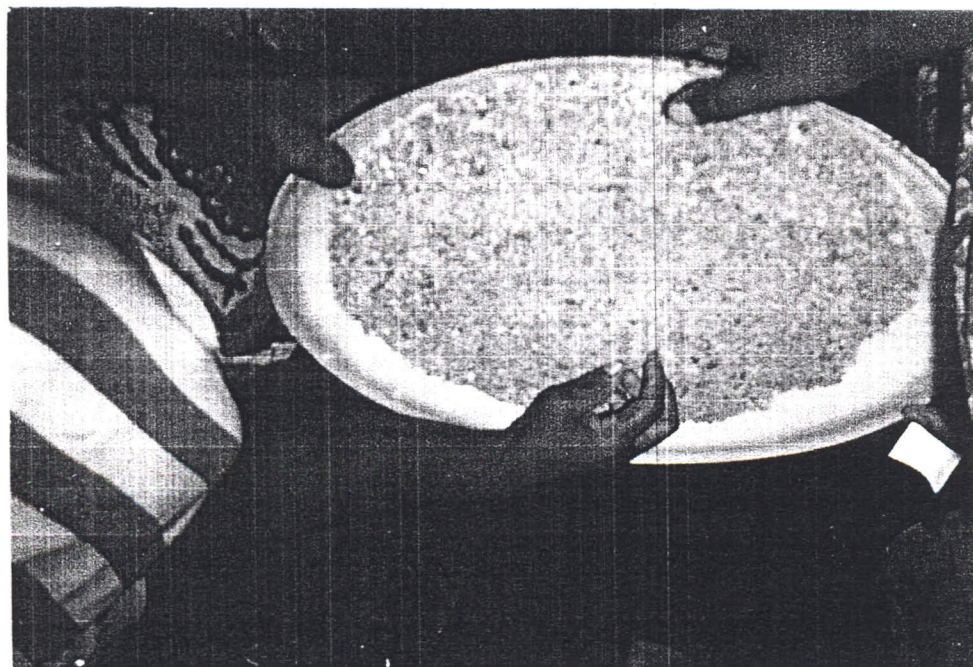


Fig. 13

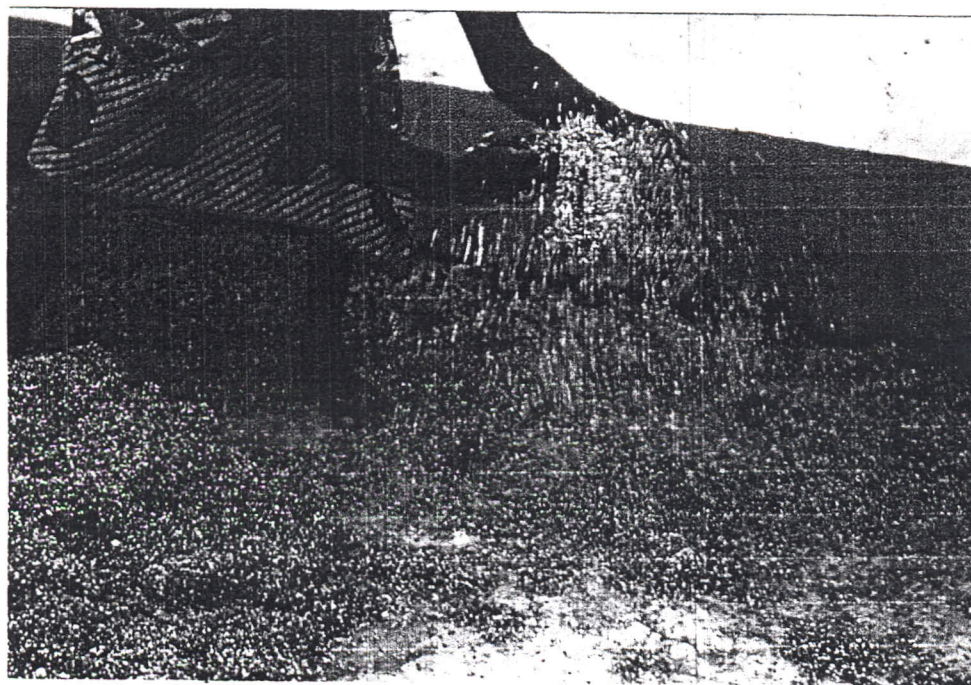


Fig.14

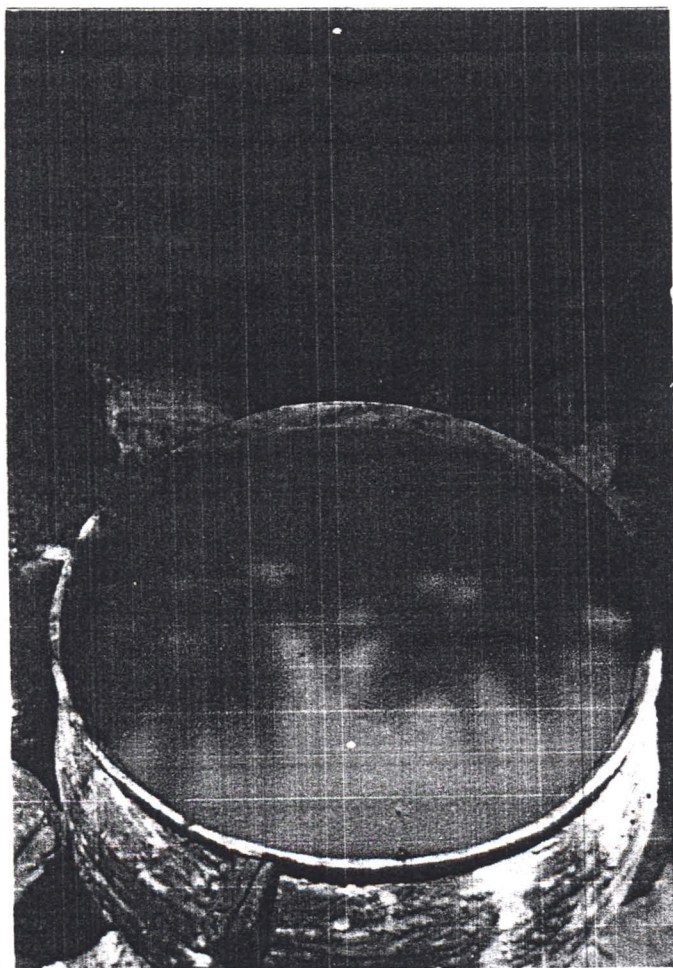


Fig. 15

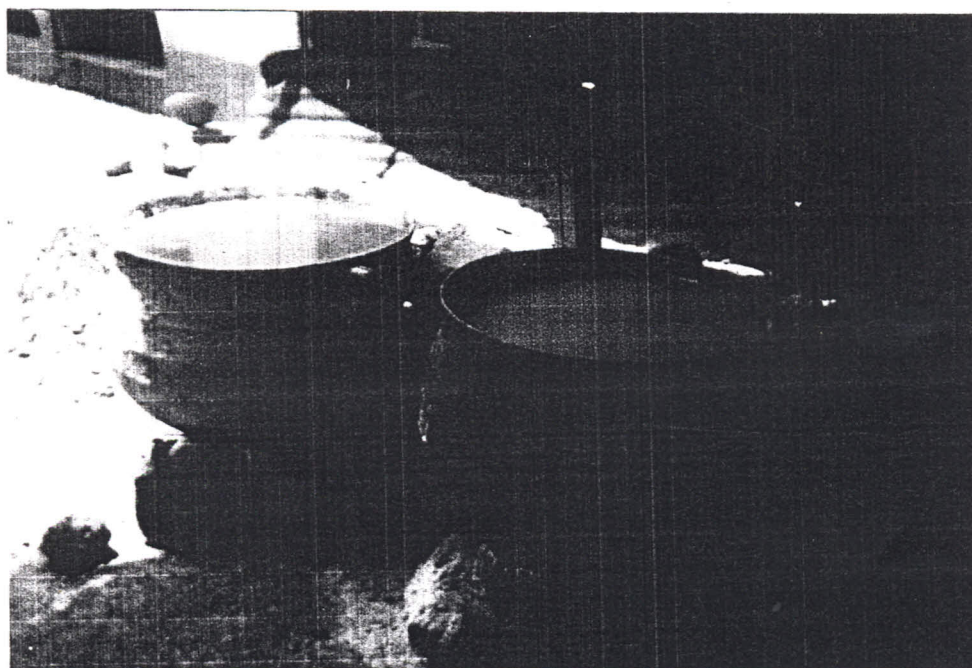


Fig. 16

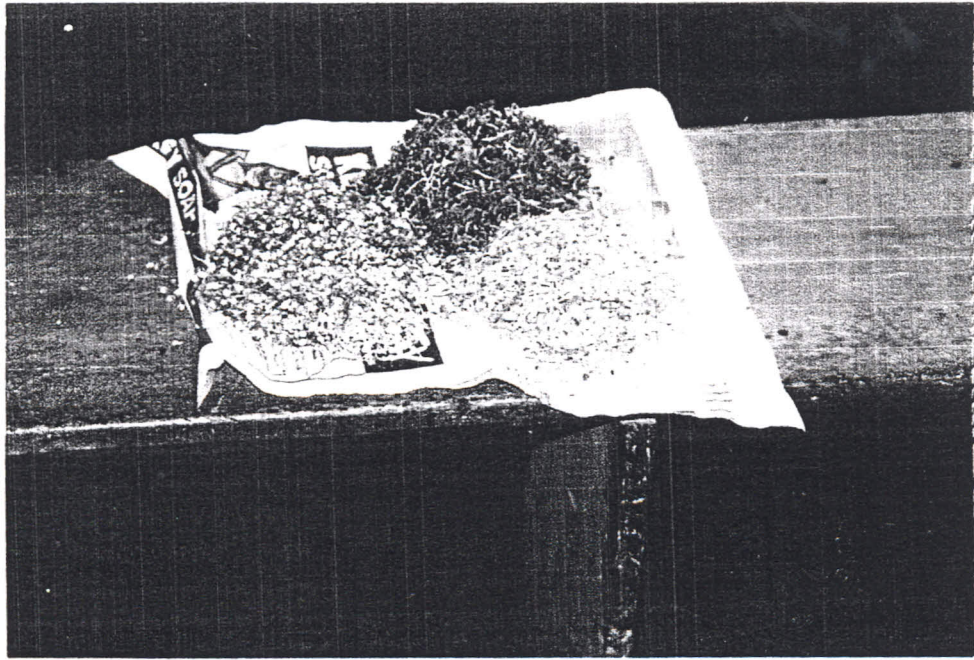
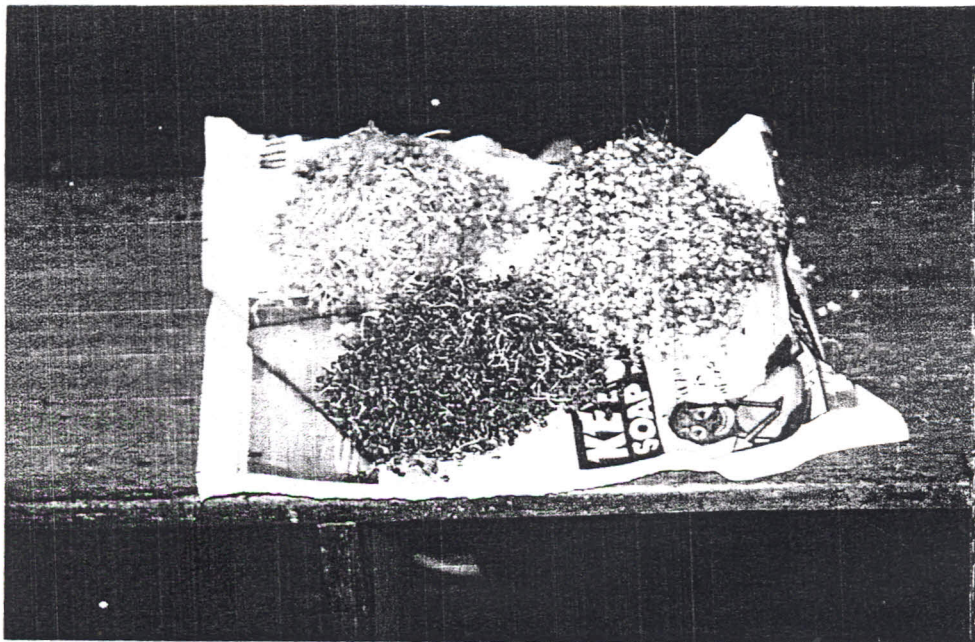


Fig. 17



**GERMINATED SORGHUM GRAINS**

Fig. 18



Fig. 19



Fig. 20

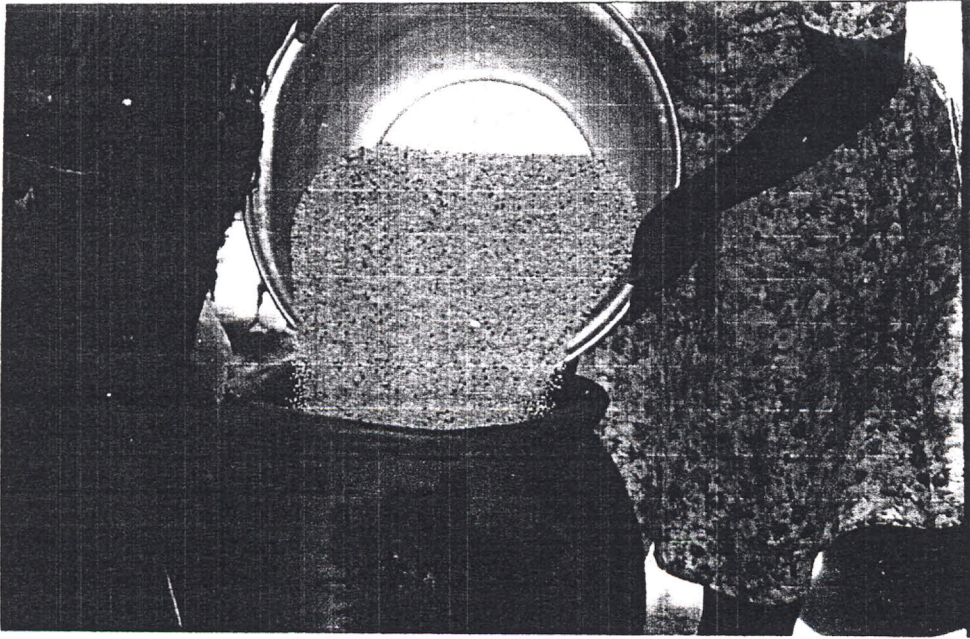
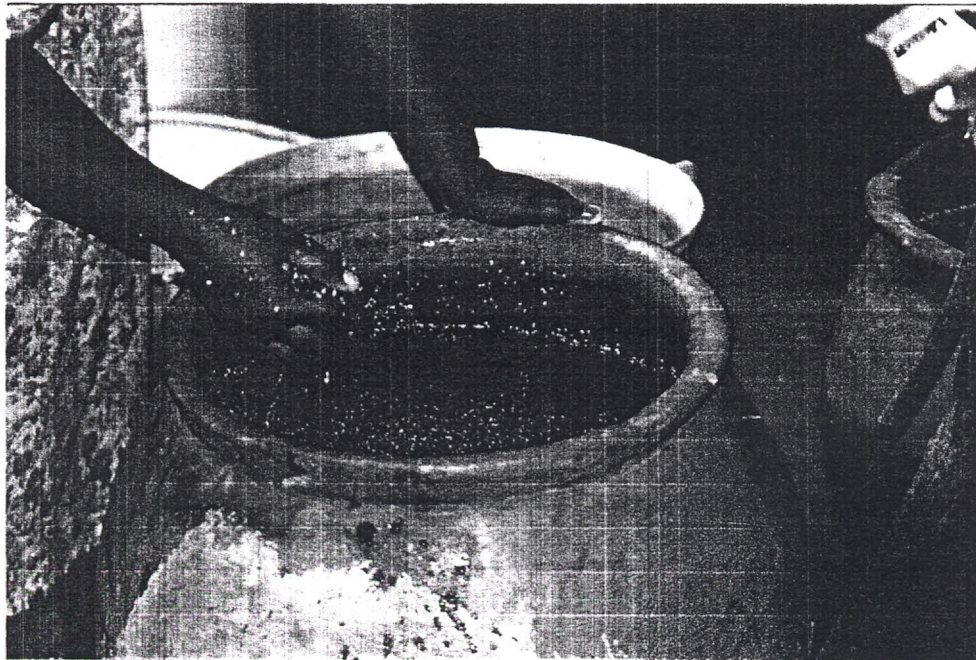


Fig. 21



**PREPARING THE MALT FOR BREWING OF PITO**

Fig. 22



Fig. 23





Fig. 24 and 25 show the discussion period in syndicate groups after the evaluation

Fig. 24.

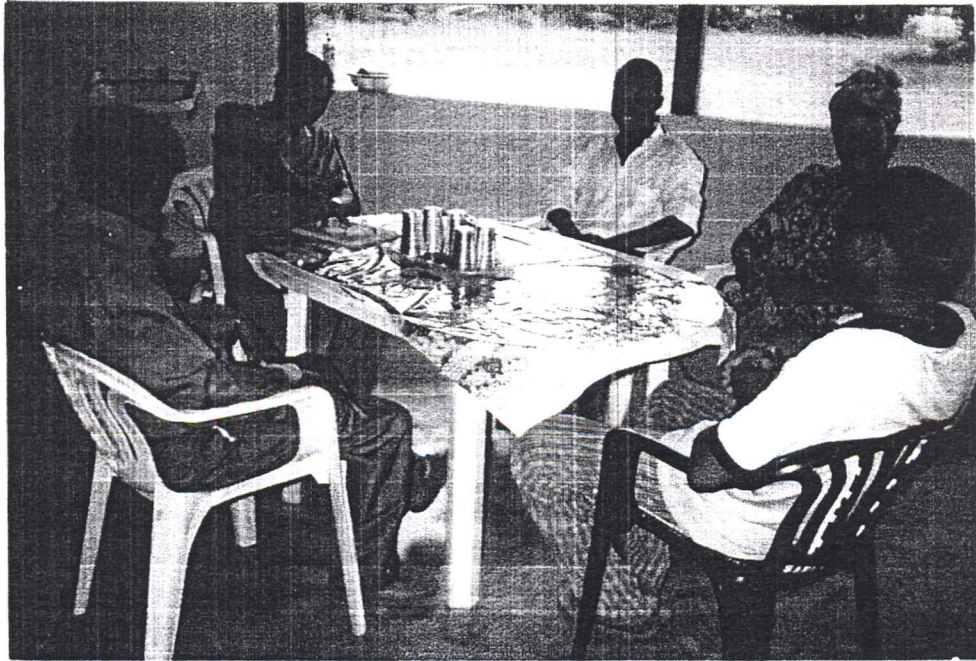


Fig. 25

