

MRS MARGARET CHUOYE

FOOD RESEARCH INSTITUTE
(COUNCIL FOR SCIENTIFIC & INDUSTRIAL RESEARCH)

ANNUAL REPORT
1974-1975

P. O. BOX M.20, ACCRA.

FOOD RESEARCH INSTITUTE

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JULY 1974 - JUNE 1975

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8. Mr. J.E.M. Bartels (Member) - Officer-in-Charge, Food Research Institute, Accra.

Mr. J.E. Musey, Administrative Officer, Food Research
(Secretary) Institute, Accra.

SENIOR STAFF LIST
JULY 1974 - JUNE 1975

| | |
|-------------------------------------------------------------------------------------------------------|----------------------------|
| Mr. J.E.M. Bartels, B.Sc., M.Sc.(Agric. Econ.) | - Officer-in-Charge |
| A. <u>PROCESSING AND ENGINEERING</u> | |
| Mr. B.L. Lartey, B.Sc.(Agric. Eng.), Post-Grad. Dip. Food Tech., A.I.F.S.T., M.R.S.H., M.Gh. I.E.- | Senior Research Officer |
| ¹ Mr. St. J.A. Clottey, B.Sc., M.Sc., Dip.Vet.Sc. | - Research Officer |
| Mr. J. Dei-Tutu, B.Sc.(Agric.), Dip.Food Sc., M.Sc. | - " " |
| Mr. J.K.B.A. Ata, B.Sc., M.Sc. | - " " |
| Mrs. A. Andah, B.Sc., M.Phil., A.I.F.S.T. | - " " |
| Mrs. Lydia A. Bonsu, B.Sc., M.Sc. | - " " |
| Mrs. G. Nerquaye-Tetteh, B.Sc. | - " " |
| Mr. J.A. Dakwa, City & Guilds | - Snr. Tech. Officer Gd.I |
| Mr. J.K. Magbo, City & Guilds (Final) | - Snr.Tech.Officer Gd.II |
| Mr. A.K.G. Amoah, City & Guilds (Final) | - " " " " |
| B. <u>CHEMISTRY, MICROBIOLOGY & NUTRITION BIOCHEMISTRY</u> | |
| Mr. K.K. Eyeson, B.Sc. (London), Dip. Nutrition, Dip. Food Quality Control, M.R.S.H., A.I.F.S.T. | - Snr. Research Officer |
| Mrs. J.M. Kordylas, B.Sc., M.Sc. | - " " " |
| Dr. M. Caurie, B.Sc.(Agric.), M.Sc., Ph.D. | - Research Officer |
| Miss Mary Halm, B.Sc., M.Sc. | - " " |
| Miss C. de Graft Johnson, B.Sc. | - Asst. Research Officer |
| Mrs. Shashi P. Sharma, B.Sc., M.Sc. | - " " " |
| Miss Joyce C. Baidoo, B.Sc., M.Sc. | - " " " |
| Mr. Ebenezer Asibey-Berko, B.Sc. | - " " " |
| Mrs. Juliana Larmie, B.Sc., M.Sc. | - " " " |
| ² Mr. George B. Quartey, B.Sc. | - Research Assistant |
| Mr. J. Tete-Marmon, A.I.M.L.T. | - Snr.Tech.Officer Gd.I |
| Mrs. C.M. Korsah, H.N.C. | - Snr.Tech.Officer Gd.I |
| ³ Mr. J.B. Bortey, S.I.M.A. Cert. | - Snr. Tech.Officer Gd.II |

¹On secondment to the Environmental Protection Council for a period of one year with effect from 1st October, 1974.

²Resigned his appointment on 31st August, 1974.

³Died through motor accident while on duty on 10th July, 1974.

C. CONSUMPTION SURVEYS, ECONOMICS AND MARKETING

| | | |
|-------------------------------------------------------------------------------------------|---|-----------------------|
| Mrs. F.E. Dovlo, B.Sc., Cert. Food Sc. & Applied Nutrition, Cert. Food Consumption Survey | - | Snr. Research Officer |
| Mr. P.A. Kuranchie, B.Sc.(Hons. Agric.Econ.), M.Sc. (Agric. Econ.) | - | Research Officer |
| Mr. A.W. de Graft-Johnson, Gen. Agric. Cert. | - | Snr. Tech. Officer II |
| Mrs. M. Randolph, School Cert., Gen.Agric.Cert., Food Science & Applied Nutrition Cert. | - | Snr.Tech.Officer II |
| Mr. S. Nyarko, GCE, RSA, Dip. Journalism | - | Snr.Tech.Officer II |

D. ADMINISTRATION, ACCOUNTS & LIBRARY

| | | |
|-------------------------------------------------|---|-----------------------------|
| Mr. J.E. Musey, B.Sc.(Econ.) | - | Administrative Officer |
| Mr. A.G. Gbeckor-Kove, B.Sc.(Admin.) | - | Snr.Accounting Asst. |
| ⁴ Mr. A. Kwa-Eshun, A.C.I.S.(London) | - | Snr.Accounting Asst. |
| Mrs. Margaret Oddoye, A.L.A. (London) | - | Principal Library Assistant |

⁴On temporary relieving duties from the Head Office with effect from 1st May, 1975.

A. INTRODUCTION

1. ORGANISATION

1.1 The Institute's programme of work continued to maintain the broad objectives of carrying out coordinated applied research in the storage, processing, preservation, marketing and consumption of the main foods in the country in order to encourage and support the development of domestic food industries. In this endeavour due consideration was given to the primary standards of wholesomeness, safety and better nutrition.

1.2 This year, greater effect was given to the plan to give the broad activities of the Institute, namely, research, control laboratory services, and industrial consultancy and advisory services - their identity, at the same time maintaining the desirable relationships that would foster mutual support and cooperation.

1.3 The processing of the routine control laboratory services was delegated to the laboratory operatives to ensure quicker response to the day to day needs of established industries while research paid more attention to issues of exploratory nature. In this regard a close association was maintained between the latter and industrial consultancy services to draw in custom and create better opportunities for identifying relevant problems.

1.4 The progress of establishing closer links with the appropriate food industries however remained slow owing to the absence of facility and personnel for public relations. This deficiency will be corrected in the ensuing year. In the meantime, a committee was appointed to prepare the ground and initiate some action in matters which this defect was obviously deleterious.

1.5 This inevitable expansion in the scope of the Institute's activities will aggravate the severe restrictions in accommodation which existing lines of activities have faced. The Institute's stores had already spilled over into the outhouse and the garage of the Director's bungalow. The research staff had barely sufficient standing room in their laboratories, and office accommodation remained grossly inadequate. It appears this situation will persist until the Pilot Plant is completed.

2. BUILDING PROGRAMME

2.1 The Pilot Plant. This building has been under construction for so long a time that an occasional reminder on its purpose is necessary to give the right picture of its importance to the Institute.

2.2 This is a building which will accommodate a range of equipment and the necessary facilities for exploring further the laboratory scale research results on precommercial pilot scale. This would involve much higher levels of bulk purchases and storage of agricultural raw materials and batch processing with a sizeable output of finished products that will provide the facility for market and consumer testing. It is only when these activities have been thoroughly investigated and their costs clearly determined that prospective entrepreneurs can be sufficiently stimulated to consider the advisability of investment.

2.3 It is this attribute of the Pilot Plant which provides the indispensable link between available research results and adoption on a commercial scale. It is this obvious that in the absence of this crucial facility, the Institute will be hard put to it to go beyond the laboratory results which are accumulating but lack the comprehension that commercial feasibility demands.

2.4 The construction of the building for this plant began in February 1969 and at the end of this reporting year there was only a glimmer of hope that there would be sufficient progress during the ensuing year to allow part-occupation. By September 13, 1974 work on the project stood as follows:-

- (i) Main Building:- 90% completed; window frames fixed but without louvres.
- (ii) Electrical Installations: - almost completed leaving the fitting tubes and the connection of the high tension cable from the sub-station to the building.
- (iii) Mechanical Works, Gas and Plumbing:- 90% completed.
- (iv) Laboratory Furniture:- about 90% completed but quality of work questionable.
- (v) Cold Rooms:- needed reinforcement and the floors to be screeded.
- (vi) Plant for Cold Room:- construction of the roof top house to take the A/C plant for the cold rooms had reached the lintel height.

- (vii) Construction of Transformer Room:- little progress.
- (viii) External works:- roads, drains etc. 75% completed.
- (ix) Car Ports:- 80% completed.
- (x) Septic Tank and Soakaway:- about 80% completed.

2.5 By every indication the work was fairly advanced and the supervising consultants were convinced that with normal effort the structure and the basic fittings would be completed in a very short space of time. But this assessment, as in the past, continued to be a hope more than a reality, since in practice, the main contractor's performance had not justified confidence in any projection.

2.6 Stores and Workshop Buildings: In the hope that the Pilot plant might be completed for occupation in the following year, serious consideration was given to the design of stores and a workshop to support operations in the pilot plant. The Architectural and Engineering Services Corporation was engaged to prepare the designs and the plans.

3. INDUSTRIAL CONSULTANCY AND TECHNICAL ASSISTANCE
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3.1 Under this function fall the various requests and enquiries from government agencies, private establishments and individuals seeking information for application or for exploratory purposes.

GOVERNMENT

3.2 Bread From Composite Flour. In the previous year mention was made of the government's interest in the part substitution of wheat flour with corn meal, flour or starch to reduce the complete reliance on the limited imports of wheat.

3.3 As a follow up of this interest the Ministry of Agriculture submitted for examination samples 'cassava-bread' and 'cassava biscuits' produced by the Tropical Products Institute, London. The composition of the samples were as follows:

| | | | | |
|-------------------------|---|---------|---|-----|
| (i) 'Cassava bread' | - | Wheat | - | 70% |
| | | Cassava | - | 28% |
| | | Soya | - | 2% |
| (ii) 'Cassava biscuits' | | Wheat | - | 50% |
| | | Cassava | - | 40% |
| | | Soya | - | 5% |

3.4 The 'cassava bread' contained 8% more cassava constituent than a similar product produced by the Food Research Institute. The former product also had a higher specific volume. Since the manufacturing details were not known it was speculated that chemical improvers or more sophisticated equipment might have been used to achieve a higher cassava component, and at the same time, a higher specific volume. It was anyway obvious that the Tropical Products Institute was ahead of this Institute in this line of research and it was necessary to establish the necessary links to learn about this experience.

3.5 Handling and Processing of Surplus Ginger In an appeal by the government to the farmers to produce more ginger for export, the farmers responded by growing the local ginger which is inferior as an export item. Consequently a surplus stock of ginger accumulated without any favourable outlet. This Institute was drawn in by the Ministry of Economic Planning to provide technical advice on how best to handle the stocks. The discussions subsequently culminated in

a joint visit with the State Distilleries Corporation to Holland to look for a suitable extractor equipment for essential oils. A report was submitted to government for consideration.

3.6 Aflatoxin in Stored Maize. The Grains Development Board which has the responsibility for purchasing the farmers' crop of maize for storage faced the problem of establishing fresh maize standards that would be comprehensible and acceptable to the farmers. This had been motivated by a very bad experience of stocks of maize of mixed quality that had to be purchased by the Corporation. A series of meetings were held in the Ministry of Agriculture to formulate these standards.

3.7. Besides the question of deterioration of the maize during storage, there was a strong suspicion of the growth of aflatoxin producing microorganism which would make the maize unfit for even livestock consumption. Samples of the stored maize were examined for the incidence of aflatoxin, but no significant levels were detected.

3.8 The Institute, since this occasion, realized that certain storage problems should be anticipated while the government is pursuing large storage schemes. Consequently discussions began on the prospect of setting a monitoring arrangement for aflatoxin in stored products. The facilities would involve some capital expenditure which is hard to come by, therefore, a thorough research design is being formulated to support any appeal for funds.

3.9 Requests involving the same subject came from the Ministry of Health and the Tema Food Complex Corporation. Other minor consultations came from the Tema Food Complex Corporation on the use of sun-dried and smoked-dry anchovies as a source of fish meal in the formulation of animal feed. The State Distilleries Corporation enquired about the use of vanillin in the development of flavours for alcoholic drinks. The Cotton Development Board requested the analysis of two varieties of cotton seeds - Allen 333 and BJA 592 for their respective oil content.

PRIVATE

3.10 Requests from private establishments and individuals showed an increase over the previous year's, but in general they remained small in scale and limited in scope. For most of them the enquiries had arisen out of curiosity and the wish to explore possibilities of commercial gain. With the establishment of an information unit it will be possible to provide a routine arrangement for the screening of these requests to handle them appropriately on their merits.

3.11 It is however important to mention that there were enquiries on the manufacture of soap from oil and rotten cocoa beans; the export prospects for shea nuts, its availability and the technique for using the fat for the manufacture of margarine.

3.12 The Volta Aluminium Company requested for data on the caloric and nutritional values of 26 local food items to serve as a basis for the formulation of a menu for the Company's workers.

3.13 The proprietor of Yeho Food Products was put through a 3 months orientation and practical assistance in the reformulation of mayonnaise to the final stage of consumer acceptance.

3.14 The Ghana Tourist Board was provided with a list of popular Ghanaian dishes to form part of the Tourist Guide.

3.15 An enquiry worth mentioning separately because it has prompted a systematic exploration and promises to qualify for their support, is the prospect of using local clays as a decolorising agent in the oil industry in place of imported Fuller's earth. A further report is submitted under Research.

4. CONTROL LABORATORY SERVICES

4.1 Table 4.1 below presents a breakdown of the routine services rendered by the laboratories in the Institute. Compared to the previous year the total number of establishments that availed themselves of our services increased by 3. There was a marked drop in the number of samples from commercial sources compared with the number from the non-profit making agencies. The sharp increase in the non-profit sector was accounted for mainly by the Ghana Standards Board Laboratory, which was the only servicing agency recorded, and the government research institutions.

TABLE 4.1

CONTROL LABORATORY SERVICES BY SOURCE, SAMPLES, ITEMS
AND TYPE OF REQUEST

| Sector | No. of Est. | Total | | | Chemical | Micro-biological | Combination & Others |
|--------------------------------------------------|-------------|------------|------------|-----------|-----------|------------------|----------------------|
| | | Samples | | Items | | | |
| | | 1974/75 | 1973/74 | 1974/75 | | | |
| <u>COMMERCIAL</u> | | | | | | | |
| 1 Government | 6 | 36 | 7 | 6 | 3 | 1 | 3 |
| 2 Private (Established) | 12 | 48 | 31 | 17 | 4 | 24 | 3 |
| 3 Pioneer Enterprises | 3 | 7 | 3 | 3 | - | - | 3 |
| Sub-Total | 21 | 91 | 41 | 26 | 7 | 25 | 9 |
| <u>RESEARCH, NON-PROFIT AGENCIES, INDIVIDUAL</u> | | | | | | | |
| 4 Research Agencies | 3 | 18 | 55 | 4 | 18 | - | 37 |
| 5 Servicing Agencies | 1 | 47 | 103 | 21 | - | 103 | - |
| 6 Individuals | 2 | 3 | 2 | 2 | - | 3 | - |
| Sub-Total | 6 | 68 | 160 | 27 | 18 | 106 | 37 |
| GRAND TOTAL | 27 | 159 | 201 | 53 | 25 | 131 | 46 |

4.2 Mention should be made of the Department of Horticulture, University of Science and Technology which relied on our chemical tests for the development of selected citrus varieties. The Crop Research Institute at Ohawu continued with its cassava breeding programme to improve yield and processing characteristics. Our laboratories conducted the tests for starch and hydrogen cyanide contents.

4.3 The preponderance of microbiological tests is very evident although compared with the previous combination of tests increased considerably. This indicates the need to strengthen the facilities for microbiological examinations.

5. TECHNICAL COOPERATION

Oil Palm Research Institute, Kade.

5.1 The Oil Palm Research Institute generated interest in the food potential of the serendipity berry apart from the sweet principle which is the only constituent that has so far attracted attention. The present investigation is concentrating on the fat content which is expected to be high from the initial crude tests.

Tropical Products Institute, London

5.2 The Tropical Products Institute, London freely offered to supply pure samples of catechins to assist research work in the identification of catechins of shea kernel (*Butyrospermum parkii*). Ampoules of epigallocatechin gallate, epigallocatechin and epicatechin gallate were received.

5.3 Miss P.J. Sutcliffe who visited this Institute to conduct a joint research programme at this Institute submitted her report.

Acknowledgement

5.4 The Institute expresses its gratitude to the Tropical Products Research Institute, for the kind assistance offered during the year.

5.5 Our thanks also go to the Distilleries Division of GIHOC which has placed at our disposal its equipment for filtration, pasteurisation and bottling in our wine project.

Public Relations

5.6 The Institute was able to produce 3 issues of the FRI Newsletter. These issues concentrated on the operations of the scientific divisions in the Institute. To foster relations with industry a reply slip entitled "Communication with Industry" was inserted to give readers the facility to write to the Institute on food subjects of their own choice. The response even though small was not discouraging.

5.7 The Institute participated in the following exhibitions:-

- (i) National Agricultural Fair, October 25 to November 1, 1974 at the Labadi Trade Fair Site.
- (ii) Exhibition of made-in-Ghana goods - "Ghana's manufacturing achievements." January 10 to January 18, 1975.

6. TRAINING

FRI Staff

6.1 Mr. Caurie, Research Officer, registered with the University of Rhode Island in September 1972 for a course leading to Ph.D. He successfully completed the course in June 1975. The topic for his thesis is - Improvement in the Technology of and Subsequent Stability of Hot Smoked Fish in West Africa.

6.2 Mr. J.K.B.A. Ata, Research Officer, registered with the Food Science and Nutrition Department of the University of Ghana in October 1972 as a non-resident student for a course leading to Ph.D. He submitted his thesis.

EXTERNAL

6.3 Crop Research Institute - A Technical Assistant from this Institute was attached to the Chemistry, Microbiology and Nutrition Division for training in laboratory techniques.

6.4 State Fishing Corporation - The Quality Control and Marketing Research Officer was given a 3 week orientation in the quality control of frozen fish.

B. SUMMARY OF RESEARCH PROJECTS

7. CHEMISTRY, MICROBIOLOGY AND NUTRITION

7.1 Project: Chemical Methods for Monitoring the Quality of Local Fresh-water Fish

Team: K.K. Eyeson, L. Bonsu.

7.2 The Nile Perch storage experiment was carried out for 31 days. During storage re-icing was done wherever it was found necessary. Samples were drawn at definite intervals for analysis.

7.3 Chemical determinations carried out included total volatile bases (TVB), and trimethylamine (TMA) by Conway - Diffusion method; pH Hypoxanthine extracts were also prepared for future work.

7.4 For temperate marine fish a TVB level of 30mg N/100g is considered as the usual limit of acceptability (Farber, 1965). In the experiment values obtained were much lower (2.8 -6.6)mg. N/100g, and erratic. The TMA values, for all practical purposes must be considered as negligible. TVB and TMA are regarded as metabolites of bacterial action, so the relatively lower values may be due to the slower growth of bacteria in ice-stored fresh-water fish.

7.5 The pH values remained fairly constant between 6.4 and 7.1. These values are well within the usual post-rigor pH values. The spoiled marine fish is usually reported to reach pH values as high as 7.5-8.0 (Reay G.A. and Shewan, T.M. Advances Fd.Res. 1949 Vol.11 p.343).

7.6 From the results it may be concluded that TVB, TMA and pH values are of little value for assessing the quality of fresh water fish during ice-storage.

7.7 Project: Vitamin A Levels in Cases of Onchocerciasis (River Blindness)

7.8 Team J.M. Kordylas (FRI), Chinery (Ghana Medical School)
The various biochemical analyses have been completed on the samples collected from the forest areas. The second batch of samples has been received from Northern Ghana. The specimens have been preserved till a spectrophotometer becomes available.

7.9 Project: Vegetable Protein Mixtures for Weaning Foods

Team: J.M. Kordylas (Leader), E. Asibey-Berko

7.10 An assessment of the extent of the nutrition problem was necessary. This would also act as a guide in the formulation of the vegetable protein mixtures. Consequently children from two different socio-economic backgrounds were chosen for the project. The study was divided

into two parts, the first dealt with basic information on home background, food habits and the level of knowledge about nutrition.

7.11 The children were weighed and measured, and were dosed with 1mg of thiamine and 1mg of riboflavin in pineapple juice during the second phase of the project. Urine samples were collected during the subsequent 4 hours and analysed for nitrogen, creatinin, vitamin C, riboflavin and thiamine.

7.12 Preliminary results. Group 1 children attended private Preparatory schools while Group 2 children attended government Public Schools.

92.7% from Group 1 lived with both parents while only 53.9% from Group 2 enjoyed this family life. 80% from Group 1 sat at table to eat with their parents compared with 21.3% from Group 2.

91.8% of the children in Group 1 ate from their own plates compared with 48.2% from Group 2.

61.8% of the children in Group 1 associated food with health while 44.9% of the Group 2 thought the same.

7.13 Project: The Effect of High Intake of Carotenoids in Palm Oil on the Thyroid Function of Ghanaians

Team: J.M. Kordylas, E. Asibey-Berko

7.14 The method for the analysis of Protein-Bound Iodine in serum has been established. Plans have been made to investigate PBI levels in "normal" Ghanaians to serve as a baseline for the project. Blood samples will be collected from the Korle-Bu Hospital Blood Bank.

7.15 Project: Kotobabi Nutrition Rehabilitation

Team: J.M. Kordylas (Leader), J.C. Baidoo

7.16 Collection of further background information on mothers, and children brought to the Kotobabi Clinic with protein-calorie malnutrition continued. The work on the calculation of nutrient composition of diets given to the children during rehabilitation was completed. Anthropometric data on these children were also collected. The next step will be the measurement of the vitamin status of children at the time of admission and just before discharge, to be able to assess the effect of protein-calorie malnutrition on vitamin status and the effect of rehabilitation on same.

8. PROCESSING AND ENGINEERING

PROCESS DEVELOPMENT

(i) CEREALS

8.1 Project: Identification of Carboxylic Acids Produced In Corn Dough

Leader: A. Andah

8.2 It was mentioned in the previous year's report that a liquid extractor had been procured to achieve a finer extraction of the acids. This extractor was constructed according to AOAC specifications. Acids in water extracts of fermented corn dough were extracted with di-ethyl ether. The efficiency of the extractor was checked with standard pure acids and found to be 83%.

8.3 Acids extracted from fermented corn-dough were chromatographed on paper. The results showed that lactic acid and acetic acid were present in the dough. The ratio of volatile acids to non-volatile acids was also found to be 3:100.

8.4 This led to the conclusion that lactic acid which is non-volatile is the main acid produced in the fermentation of corn dough. It is further concluded that the spontaneous fermentation of corn dough is caused mainly by lactic acid bacteria. The presence of other types of micro-organisms is a possibility since fermentation is uncontrolled. This agrees with published work done on the identification of micro-organisms in corn dough which showed the predominance of Lactobacilli being responsible for the production of lactic acid.

8.5 Project: The Stability and Nutrient Content of Whole Maize Meal and Degermed Meal

Leader: A. Andah

8.6 This project was concluded during the reporting year. The two types of maize meal were dried to a moisture level of 8.0% (to forestall mould growth), placed in airtight containers and stored at room temperature (27°C) for 3 months.

8.7 The fat acidity value of the whole meal was more than double its original value (from 34.72mg KOH/100g to 78.76mg KOH/100g) after two weeks storage; at this stage taste panel results on cooked samples showed the development of off-flavour and bitterness. After 12 weeks storage, the Fat Acidity value of the whole meal was 246.43mg KOH/100g. On the other hand, the initial Fat Acidity value of the

degermed, 12.11mg KOH/100g increased to only 36.28mg KOH/100g after 12 weeks storage and no odours were detected when cooked samples were tasted.

8.8 The results showed that development of off flavours and after-taste due to fat rancidity was much faster in the whole maize meal than was found in the degermed maize meal. Analysis for nutrient content showed that thiamine, riboflavin, iron and phosphorus were significantly reduced by degermination while the protein content was only slightly reduced.

8.9 A report has been submitted on this project.

FERMENTATION

8.10 Project: The Production of Wines from Local Fruits

Leader: C. de Graft Johnson

This project made use of wine yeasts for fermentation for the first time in the laboratory. The wine yeasts were adapted in sterile fruit before they were added to the bulk juice. The resultant wine showed marked increase in the alcohol level than those previously obtained whilst using Baker's Yeasts; the taste and flavour improved.

8.11 Further experiments were carried out using the wine yeasts on pineapples and grapes. Before fermentation, all the samples had a pH of 2.5 to 3.9. Most of the wines were maturing at the time of reporting.

8.12 Project: Derivation of Table Vinegar from Exuded Sap of Trees

Leader M. Halm

8.13 This project aims at producing table vinegar from palm wine and 'adoka', initially through the slow (Natural) process of fermentation and acetification, and subsequently to use the 'seeding' technique to produce the vinegar.

8.14 Work done in the previous year with palm wine was not successful. Derived alcohol levels were obtained but acetification was extremely slow in all samples of fermenting palm wine used. Yeast flora in the fermenting musts were isolated and attempts were made at identification.

8.15 In the current year four samples of adoka were left to ferment after the addition of sugar. Seven morphological types of yeasts were

isolated and pure cultures were maintained on slopes. Identification of the 21 isolates of yeasts from palm wine and adoka were in progress.

8.16 The adoka samples followed the same pattern of results as obtained for the palm wine. However, one sample formed a thick film of microorganisms and after a period of 8 months attained an acidity of 6.7%. The fourth sample was stored at the end of the alcoholic fermentation at an alcohol level of 12.0% to be used as vinegar stock subsequently.

8.17 With the difficulty encountered in the natural process, two freeze dried samples were ordered for this work - Acetobacter pasteurianus subsp. pasteurianus NC1B 7215 and Acetobacter aceti NC1B 8621; these are being reactivated. After reactivation these will have to be adapted to palm wine and the adoka samples and used to inoculate the vinegar stocks prepared from the raw materials.

FATS AND OILS

8.18 Project: The Study of the Shea Kernel in Relation to the Traditional Manufacture of Shea Fat

Leader: J.K.B.A. Ata

8.19 The project was concluded the previous year and reviewed the current year for submission as part fulfilment of the conditions for the award of a Ph.D degree. The thesis was submitted to the Food Science and Nutrition Department, University of Ghana, Legon.

8.20 Project: Examination and Development of Local Clay Types as Bleaching Agent

Leader: J.K.B.A. Ata

8.21 Preliminary results have shown effective bleaching effect of selected clay types. Future development will direct attention to methods of activation used in industry and their adaptation to improve the bleaching efficiency, and also to determine the optimum parameters for producing an efficient decolouring agent. It is hoped that the finished product will compete favourably with imported Fuller's earth.

FISH PRESERVATION

8.22 Project: The Keeping Quality of Local Catch of Fish During Iced Storage

Team: L.A. Bonsu, K.K. Eyeson

8.23 This project was initially limited to marine fish but later extended to fresh water fish at the request of the Volta Lake Research Project. It was decided to compare the shelf life of the fresh water fish in pure ice and in a mixture of salt and ice.

8.24 Fresh water fish, the Nile Perch (*Lates niloticus*), was iced in pure flake ice at 0°C and flake ice mixed with about 9% crude solar salt at -15°C. The fish were stored in insulated containers at room temperature for 33 days and the ice and ice/salt were replenished as necessary.

8.25 The fish which were iced with all ice developed unpleasant odour in the flesh after 26 days in ice. However the fish was acceptable to a trained taste panel after the fish had been cooked in 1% brine. The unpleasant odour of the raw fish increased in intensity after storage for 31 days, and the fish was not acceptable since even cooking could not remove the odour.

8.26 The fish stored in a mixture of ice and 9% salt had acceptable odour in the flesh after being kept in the mixture for 33 days. However, the texture became tough and fibrous after cooking. This was caused partly by slow freezing of the flesh at the ice/salt temperature of -15°C and also by the salt which induced denaturation of the fish muscle protein in the raw state.

8.27 Further experiments to produce acceptable product after maximum possible storage continued.

8.28 Project:

8.28 Project: Determination of Optimum Parameters for Salting Trigger Fish (*Balistes* spp.)

Leader: M.G. Nerquaye-Tetteh

This project had got to a stage where the following objectives were in view:

- (i) to reduce the processing time;
- (ii) to determine the concentration of the various brines before and after brining to find the amount of salt that was used up during the 12 hours brining process; since it is the traditional method to re-use the brine;
- (iii) to determine the microbial load on the skin and in the muscle of trigger fish during 12 hours brining.

8.29 After 12 hours of brining the following concentrations were obtained:

| NaCl Solution | % NaCl in Fresh brine | % NaCl after 12 hours |
|-----------------|-----------------------|-----------------------|
| 100% Saturation | 24.8 | 21.4 |
| 80% " | 22.6 | 16.2 |
| 60% " | 17.6 | 13.8 |
| 40% " | 13.6 | 10.2 |
| Dry Salt | 2.07kg | 1.025 kg |

8.30 The most predominant organisms in the brine as well as the fish were found to be catalase positive gram positive cocci. These are mostly halophiles which withstand salt. This shows that the presence of salt removes the non-salt resistant organisms, thus lowering the microbial load. After some time there are only salt resistant organisms making the fermentation much more specific.

FRUITS AND VEGETABLES

8.31 Project: Effect of Blanching, Dehydration and Storage on B-Carotene and Vitamin C Content of Cocoyam Leaves (Xanthosoma sp.)

Leader: J. Dei-Tutu

8.32 In the previous years the effect of blanching and dehydration on Vitamin C of the leaves was determined. It was shown that the Vitamin C level of cocoyam leaves ranged between 29.7-51.4mg/100 g. Blanching reduced this level to 6.1-6.6%, while on dehydration to a moisture content of 4-5% the level only slightly fell to 4.1-5.4%. These results have shown very drastic destruction of Vitamin C during blanching of cocoyam leaves.

8.33 The last stage of the work was done on the B-carotene content of the leaves. It was observed that pigment extraction from the completely dried leaves was rather difficult. It was therefore necessary to reconstitute the leaves in water and allow it to become soft, before the pigment could all be extracted satisfactorily.

8.34 Levels of B-carotene were as follows:-

| <u>Treatment</u> | <u>Concentration of Carotenoid (mg/g)</u> |
|-------------------------------|-------------------------------------------|
| Fresh | 384 |
| Blanched | 340 |
| Dehydrated (new) | 297 |
| Dehydrated (3 months storage) | 174 |

Processing and storage resulted in the loss of B-carotene. Changes were also observed in the nature of the carotenoids as significant variations were noted in the spectral curves of the extracts. Generally, it was observed that while there was a decrease in the peaks at longer wavelengths, peaks at the lower end of the spectrum increased in intensity as a result of processing and storage.

8.35 It is strongly suspected that apart from the loss of carotenoids as a result of oxidation there also occurred cis-trans isomerisation resulting in shifting of absorption maxima towards the shorter end of the spectrum.

PACKAGING - CANNING

8.36 Project: Ration Packs for the Armed Forces - Jollof Rice
Leader: J. Dei-Tutu

The pieces of meat were usually placed in the centre of the can and covered with rice. Because of heat penetration considerations it was decided to mince the meat instead of leaving it in chunks. The first trial using minced meat resulted in a product with a rather pale colour. But when the minced meat was steamed before it was used in the gravy in which the rice was cooked the bright red colour was restored to the jollof.

8.37 The other variation in style was the addition of beans - cowpeas - to the jollof. This was also successful and storage trials followed.

8.38 Project: The Properties of Traditional Food Packaging Materials

Leader: B.L. Lartey

8.39 There are 3 main types of leaves in use -

- (i) plantain leaves (*Musa paradisiaca*)
- (ii) *Thespesia populnea* leaves
- (iii) *Marantocloa* spp. leaves

These materials are generally opaque and have thicknesses varying from 4 to 17 mils. Unlike artificial packaging material like polythene films whose tensile strength are above 1,000 lb/in² (70.3kg/cm²), the tensile strength of the traditional packaging materials range between 0.25 lb/in² and 15 lb/in² (1.76 x 10⁻² kg/cm²). Some of these

materials have a central vein which breaks causing pin-holing. Most of the materials exude different pigments when dipped in alkali and acid media, and later boiled in water. The materials withstand the various heat treatment associated with heat processing without disintegration.

8.40 Project: Survey of Cassava Processing Units in Ghana

Leader: B. L. Lartey

The primary objective is to undertake the organisation of cassava processing units with a view to improving raw material supply/procurement, the processing of the roots and the distribution and marketing of the processed products. This survey showed that there were 47 cassava processing units in Volta Region; 26 in the Eastern Region; 15 in the Greater Accra Region, 34 in the Central Region and 50 in the Western Region.

8.41 With respect to raw materials, the survey showed that these units receive raw cassava roots mostly from individuals who may be farmers - from areas located about 2 to 12 miles away. These units are able to process about 5 tons a day. Water for these units are obtained from dug-out wells, pipe-borne and from rivers.

8.42 Direct electrical power from the mains, a generating plant or a diesel engine are the power sources for operation. Operators for the units machines vary from 2 to 3 people, use being made of casual labour when large quantities of crops are to be handled.

8.43 The main machine in the units (unlike the factory in Kpong, in the Greater Accra Region) is the grater with a capacity of about 1 tonne an hour. These machines are mostly either the Lister or Petters diesel engine, and cost between ₵80.00 to ₵120.00. The total cost of machinery in such units vary from ₵500 to ₵1,500.00.

8.44 The end-products of these units are gari, tapioca, dough and starch and these are marketed through individuals or distributed to certain institutions in or outside the specific regions.

PRODUCT DEVELOPMENT

8.45 Project: Nutrient Enrichment of Kokonte Flour

Leader: B. L. Lartey

Two methods were used:

- (i) Involved the mixing of grated cassava with ground cowpeas soaked in water at room temperature (27°C) for 8 hours. The mixture was allowed to ferment for 36-48 hours and then dried at 70°C for 8 hours and ground into a flour. The following proportions of cowpea/grated cassava were produced: 1:1, 1:2 and 1:3. There was a progressive change in colour of the mixture during fermentation: this became pronounced after drying and grinding. The mixture had a beany flavour and on cooking developed an objectionable colour. Proximate analysis gave the following results:

| | | |
|----------|---|-------------|
| Moisture | - | 5.6 - 7.4% |
| Fat | - | 0.7 - 1.0% |
| Protein | - | 7.7 - 10.3% |
| Ash | - | 3.0 - 3.1% |

- (ii) Laboratory prepared kokonte was mixed with cowpea flour in the proportions as in the previous method with the following proximate composition:

| | | |
|----------|---|-------------|
| Moisture | - | 6.1 - 6.31% |
| Fat | - | 0.8 - 0.9% |
| Protein | - | 8.3 - 12.0% |
| Ash | - | 2.7 - 2.9% |

9. CONSUMPTION AND MARKETING

CONSUMPTION

9.1 Project: Consumer Preference for Cowpea Types and Household Utilization

Leader: F.E. Dovlo.

In this project, consumer preference for the varieties of cowpeas available in Ghana (13 identified) based on grain size and colour were studied. Further, qualities such as quick cooking, swelling capacity and taste of these varieties were assessed.

This project is nearing completion and a report will be submitted in the next annual report.

MARKETING

9.2 Project: The Relative Economic Position of Cowpea in the Programmes of Farmers in the Navrongo-Bawku & Denu-Abor Areas of Ghana

Leader: P.A. Kuranchie

Objectives:

- (i) To assess the competitive position of Cowpea in Farmers' crop production programmes
- (ii) To identify the bottlenecks in Cowpea production.
- (iii) To assess farmers' motivation (if any) for increased production of the crop
and
- (iv) To evolve an optimum enterprise mix (including cowpea if possible) which would enable farmers maximise their returns subject to their resource constraints.

9.3 Synopsis of Report

The report provides an exposition of the nature of competition between the various farm enterprises for farmers' resources and defines the competitive position of cowpeas vis a vis other enterprises in the two areas of Ghana. It highlights the dominant farming systems and identifies the major bottlenecks to increased cowpea production in the two areas. Finally it evolves the optimum enterprises mix which would enable farmers in both areas maximize their returns subject to their resource constraints.

10 OTHER RESEARCH ACTIVITIES

10.1 To Determine the Quantity of Crude Solar Salt Required to Super-chill Flake Ice

The super chilled flake ice would be used to preserve fresh fish. Freshly made flake ice was mixed with crude solar salt to give concentrations ranging from 5% to 90% salt. This mixture was kept in a vacuum flask and the temperature monitored with a thermocouple. The results was enough to cause super-chilling of the ice.

10.2 Results:-

| | | | | | | | | | | | | |
|--------|---|---|----|----|----|----|----|----|----|----|----|----|
| % Salt | 0 | 5 | 10 | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|--------|---|---|----|----|----|----|----|----|----|----|----|----|

| | | | | | | | | | | | | |
|-----------------------------------|---|----|----|----|----|----|----|----|----|----|---|---|
| Final temp. of mixture (minus °C) | 3 | 16 | 21 | 22 | 24 | 24 | 25 | 24 | 25 | 23 | 7 | 1 |
|-----------------------------------|---|----|----|----|----|----|----|----|----|----|---|---|

(L.A. Bonsu)

CONFERENCES, SEMINARS, STUDY TOURS ETC.

1. Dei-Tutu, J. - Ghana Government - UNIDO conference
Implementation and Utilization of Industrial Research Services. January 27-31, 1975. Accra.
2. Dei-Tutu, J. The 12 Session of the Codex Committee on processed fruits and vegetables. May 19-23, 1975. Washington D.C., U.S.A.
3. Kordylas, J.M. - Twelfth Session of the Codex Committee on Food Labelling; Ottawa, Canada. 26-30 May, 1975.
4. Bartels, J.E.M. - West African Conference on the environment and Development; University of Ghana, Legon, 1-7 September, 1974.
5. ----- Training Session on the Rural Environment in Forest Areas and Wooded Savannah zones (IDEP-UP). Ghana and Togo. 14th July to 2nd August, 1974.
6. Oddoye, M. - Agricultural Librarians Conference; Ibadan, Nigeria. 23-27 January, 1975.
7. Eyeson, K.K. - 10th Session of the Codex Alimentarius Commission; Rome, Italy. 1-11 July 1974.
8. Lartey, B.L. - Ghana Government/UNIDO Consultation on Industrial Research; Accra. 27-31 January 1975.
9. ----- - CSIR/USAID Workshop on Remote Sensing Technology; Accra; 8-10 April 1975.
10. ----- - Ghana Government/UN-ECA Workshop on Training of Trainers in Programmes designed to improve the quality of Rural life; Axim, Western Region, Ghana. 5-23 May, 1975.
11. Kuranchie, P.A. - IDRC Conference on Cowpea Network; Dakar, Senegal. 16-21 June 1975.
Paper presented: Cowpea Production and Marketing in Ghana

PUBLICATIONS

1. Abutiata, W.S. & Eyeson, K.K. - The response of pineapple (*Ananas comosus* L.) Merr. var. smooth cayenne to nitrogen, phosphorus and potassium in the forest zone of Ghana. Ghana Jul. agric. Sci. 6, 155-159 (1973)
2. Eyeson, K. K., & E.K. Ankrah. Composition of foods commonly used in Ghana (1975). Published by the CSIR on behalf of the Food Research Institute.
3. Bonsu, L.A. & Dei-Tutu, J. Problems in achieving good quality in food industry. The Home Scientist Vol.3, Nos.3 & 4, July-Dec., 1974.
4. Okraku-Offei, G. Trials in the production of fish crackers. Jul.agric.Sc. 7. 1974, pp 139-142.
5. Ata, J.K.B.A. & Sackey Veronica. The decrease in total tocopherol of shea fat with autoxidation. The Ghana Journal of Agric. Sci. 7, 223-225, 1974.

REPORTS

APPENDIX IIb

1. Andah, A.; Kuranchie, P.A.; Bartels, J.E.M. Corn bread manufacture.
2. ----- - The stability and nutrient content of whole maize meal and degermed meal.
3. Ata, J.K.B.A. The manufacture of mayonnaise - advisory notes to industry.
4. Nerquaye-Tetteh, G. & Tete-Marmion, J. Production of kippers from horse mackerel.
5. Lartey, B.L. The production of bancorn - a maize product.
6. ----- Research in Ghana's food industries.

7. Lartey, B.L. Some methods for the domestic preservation of fruits and vegetables and the storage of some grain legumes, tubers, fruits and vegetables.
8. Dovlo, F.E. Preliminary study of consumer preferences for cowpea varieties in the Volta Region of Ghana.
9. Kuranchie, P.A. Maize production and marketing in the Gonoa Area of the Central Region of Ghana.
10. ----- - Cowpea production and marketing in Ghana.

EXTERNAL COMMITTEESK.K. Eyeson

Ghana National Codex Committee

A. Andah

Ghana Standards Board (GSB), Food Standards Committee - Working Party on Cereals and Cereal Products.

J.K.B.A. Ata

- (i) Member, Advisory Board, Vegetable Oil Mills Division, GIHOC.
- (ii) GSB, Food Standards Committee, Working Party for Fats and Oils.
- (iii) Ghana National Codex Committee.

L.A. Bonsu

G.S.B., Food Standards Committee - Working Party for Fish and Fish Products.

G. Nerquaye-Tetteh.

G.S.B., Food Standards Committee, Working Party for Fish and Fish Products.

J.M. Kordylas

- (i) Ghana National Codex Committee.
- (ii) Editorial Board - Ghana Journal of Science.
- (iii) National Council on Social Welfare.
- (iv) National Nutrition Programme Committee
- (v) GSB, Food Standards Committee - Working Party on Milk and Milk Products.

J. Dei-Tutu

G.S.B., Food Standards Committee - Working Party on Processed Fruits and Vegetables.

G.S.B., Food Standards Committee - Working Party on Roots & Tubers.

B.L. Lartey

G.S.B., Food Standards Committee - Working Party on Roots & Tubers

F.E. Dovlo.

National Advisory Council on Curriculum for pre-university education.

VISITORS TO THE INSTITUTE

JULY 1974 - JUNE 1975

1. A. Stabile-Wolcan, M.D. - WHO Consultant in Nutrition
2. M. Bohdal, M.D. - WHO Secretary, Joint FAO/WHO/
OAU Food and Nutrition
Commission for Africa, Accra.
3. Robert K.A. Gardiner - Executive Secretary,
UN Economic Commission
for Africa, Addis Ababa,
Ethiopia.
4. A.A. Laryea - Ghana Permanent Representative
to the F.A.O., Rome, Italy.
5. Bola O.A. Osifo - University of Ibadan, Nigeria.
6. Prof. G.C. Esh - University of Science & Techn.
Kurasi.
7. Prof. V. Jasmic - Faculty of Agric., Beograd,
Yugoslavia.
8. Cecil C. Shrock - Christian Association, U.S.A.
9. Prof. A. Stewart Truswell - Queen Eliz. Coll, University of
London.
10. Onni F. Rauha - Turku, Finland (on FAO Mission
on Technology Transfer)
11. H.A. Parpia - F.A.O., Rome, Italy.
12. Prof. J. Hawthorn - Department of Food Science &
Nutrition, University of
Strathalyde, Glasgow.
13. C.S. Hakansson - UNESCO, Paris, France.
14. S. Griggs - Cleveland, Ohio, U.S.A.
15. Christine Boidot - Agricultural Planning Associa-
tion, Oxfordshire.