

GRAIN CROP AND PRODUCTS

- NPA 855 Ofuyah, T.I. and Ibaremo, S.O. (1999] Aspects Of Egg Dispersion On Cowpea Seeds By The Seed Beetle, *Calosobruchus maculatus* (Fabricius) (Coleoptera: Bruschildae).
Bioscience Research Communications. Vol.11. No.3. Pp. 245-249.

The seed beetle *Callosobruchus maculatus* (F.) is a very serious pest of stored cowpea seeds in Nigeria. The effects of seed population and alignment of storage container on egg distribution among cowpea seeds by a Nigerian strain of the beetle were investigated in the laboratory. The coefficients of variation and dispersion used to measure egg dispersion among available seeds generally increased in seed population. There was no significant difference ($P > 0.05$) in the number of eggs laid by females of the *C. maculatus* strain on the different seed populations. There was significant difference ($P < 0.05$) in the number of eggs laid by the beetle on cowpea seeds in the upper and lower halves of test tubes placed either horizontally or diagonally in storage. The number of eggs counted in the two halves in tubes placed vertically were not significantly different ($P > 0.05$). The implications of these findings are discussed.

- NPA 856 Ogbo, A.I. (1999). Effect Of Different Fruits On the Sensory And Nutritive Quality Of Breakfast Cereal From Maize And Soyabean Flour Blends.
Proceeding Of 23rd Annual NIFST Conference. Pp. 79-81.

There was significant difference in flavour between the control [without fruit] and products containing fruits indicating that the inclusion of these fruits improved the flavour intensities of the breakfast cereals .

- NPA 857 Ogbonna, A.C. and Obasi, C.N. (1995). A Qualitative Assessment Of Some Nigeria Larger Beer Brands.
Nigerian Food Journal Vol.13. Pp. 49-53.

Several brands of the Nigerian lager beers were analysed for alcohol content, carbon dioxide [Co₂], diacetyl contents, bitterness units; original gravity [OG], specific gravity[SG] real extract, Ph, foam head retention, colour haze potential, flavour and air content. Results show that more than 50% of these beer samples conformed with both the local and international standards. Samples [X6, X7, and X10] recorded some deviations.

- NPA 858 Ogunnubi, Olufunmilayo Iyabode. (1987). Evaluation Of Maize Flour For The Manufacture Of Confectionery Products.
Submitted In The Degree Of Bachelor Of Science (Honour) In Food Science And Technology. O.A.U. Pp. 1-59.

Quality parameters of a commercial maize flour and its use as composite flour in the production of four confectionery products were evaluated. Values obtained for flour acidity, gluten and damaged starch contents for the maize flour were 5.4 units, 0 and 33.3% respectively while corresponding values for wheat flour were 2.9 units, 11.89 and 3.3% respectively. Amylograph data indicated that maize flour had peak viscosity, setback and index of gelatinization values of 273, 315 and 360 B.U. respectively while wheat flour recorded corresponding values of 383, -50 and -20 B.U. Taste panel evaluation showed that optimum substitution of wheat flour by maize flour for the following confectionery products were: cake, 40%; cookies, 80%; doughnut, 40%; and chinchin, 40%. It was apparent from the results obtained that none of the four confectionery products prepared from 100% maize flour was acceptable.

- NPA 859 Oguntunde, A.O. (1989). Traditional Convenience Foods From Major Nigerian Cereal Grains.
Nigerian Food Journal. Vol.7. Pp. 58-67.

The paper describes known traditional convenience foods produced from maize but which can be made, in most cases, from the other two major cereals i.e., sorghum and millet. The most common production techniques involve dry or wet milling with unit operations such as sieving and fermentation being optional. Flow charts are used to illustrate these processes and the localized native names of the various food products are provided.

- NPA 860 Oigiangbe, N.O. and Onigbinde, A.O. (1996). The Association Between Some Physico-Chemical Characteristics And Susceptibility Of Cowpea(*Vigna unguiculata*) (L).
Journal Of Stored Products Research. Vol.32. Pp.7-11.

The association between some physical characteristics and the tannin content of cowpea (*V. unguiculata*), and the susceptibility of the beans to bruchid (*C. maculatus*) infestation was investigated. The physical characteristics were the coat colour and texture, seed height, length and

width, and the thickness of the seed coat. The dimensional parameters show significant ($P < 0.05$) correlation with the number of eggs laid with the seed height accounting for about 7% of the variance. The same parameter accounted for 77% of the variance in the number of F_1 progeny. The tannic acid content, however, becomes increasingly significant with the growth of the larvae to adulthood. The tannic acid content accounted for 14.3 and 39.9% of the variance in the number of F_1 progeny and percentage adult emergence, respectively.

- NPA 861 Ojih, S.A. and Iwe, E.A. (1999). The Effect Of Cissus Stem (*Cissus Araloides*) Gum And Flour On The Textural Properties Of Akara Baked From Bambara Nut (Voandzeir Subterranea). **Proceedings Of 23rd Annual NIFST Conference**. Pp. 199-200.

From the result it can be seen that Bambara nut contain appreciable quantity of food component which makes it acceptable as a quality legume . As obtained from the texts on the textural properties , there was a degree of difference in three sets of baked Akara . This difference was shown in terms of compression and weight .

- NPA 862 Ojo, D.K., Ellis, R.H. and Ajala, M.O. (2001). Effect Of Time Of Harvest On Seed Germination And Capacity For Seeding Emergence In Tropical Soyabean Tenotypes. **Moor Journal Of Agricultural Research**. Vol.2. No.1.pp8-14.

Effect of time of harvest on germination and seedling emergence capacity of seeds of six genotypes of tropical soybean (*Glycine max* (L). Merr) from four harvesting dates in Mokwa, Zaria and Jos, Nigeria was studied under rainfed conditions in 1996. Percentage losses in seed germination and seedling emergence for each harvest date, compared to matured seed were used to determine the quality, the best site and the best time to harvest soybean seeds. Mean squares from analysis of variance (ANOVA) showed highly significant differences among genotypes, location as well as harvest within locations. Highly positive relationship between harvesting time and germination as well as harvesting time and seedling emergence was observed for all six genotypes. Soybean seeds harvested 10d before or after harvest maturity in Zaria and Jos did not show any substantial loss in quality. However, there was a significant reduction in quality of seeds harvested in Mokwa at the same period. The study suggested that production site and weather conditions at harvest actually determined the harvest and subsequent maintenance of seeds of tropical soybean cultivars.

- NPA 863 Ojukwu, M.C. and Okoye, W.I. (1982). Comparative Study Of Cold-Shocks And Dry Pepper Treatments For the Disinfestation Of Cowpea. **NSPRI Technical Report**. No.3. Pp. 41-51.

Some portions of winnowed cowpea were weighed into 6 kg lots and sealed in polyethelene bags. Sealed samples were subjected to cold treatments (-10 to -15°C) for 48 hours and 96 hours respectively. Other portions were mixed with dry pepper. The samples were stored for 9 months. No live insects were found in the cold-shock treated samples during the 9 month storage. The treatment did not have adverse effect of germinability also. Dry pepper at the dosage applied (ground pepper of 205 gm per 6 kilogram of cowpea) was not effective. Insects survived and quality was adversely affected.

The cold-shock treatment is therefore effective for pre-storage treatment of cowpeas, both for consumption and seed

- NPA 864 Okagbue, R.N. (1986). Fungal Deterioration Of Dried Barley Malt In International Trade. **International Biodeterioration**. Vol.22. No.2. Pp. 111-112.

All the malt samples supplied by Nigerian Breweries Ltd were contaminated by fungi. The two species *Aspergillus fumigatus* and *A. versicolor* were the only ones found in relatively high frequencies. However, *A. versicolor* was probably located superficially on the grain. The results supplement the findings of other workers and suggest that measures should be taken to control these species.

- NPA 865 Okaka, J.C. and Iseh, M.I. (1990). Development And Quality Evaluation Of Cowpea Wheat Biscuits. **Nigerian Food Journal**. Vol.8. Pp. 56-63.

Compsite flour biscuits were made from cowpea-wheat flour blends containing 50 percent or more of cowpea flour and various levels of sugar. An expert taste panel indicated that composite biscuits containing high level of sugar (>59 percent on flour basis) in biscuit formula were nutty while those with lower levels of sugar were beany. Biscuit strength improved with the level of sugar in the recipe

- NPA 866 Okechukwu, P.E. and Rao, M.A. (1995). Thermal Transition And Gel Rheology Of Mixtures Of Cowpea Starch And Protein. **Nigerian Food Journal**. Vol.13. Pp.71-82.

Heating of 10% solids suspensions containing mixtures of cowpea starch and protein isolate over 20-150°C at 5°C/min. produced a single endothermic peak in the Differential Scanning Calorimeter. As the protein/starch ratio (R) increased, the transition temperatures (initiation, T_o ; peak, T_p ; and concluding, T_c) shifted to higher temperatures and approached T_o , T_p , and T_c for the cowpea protein isolate. From rheological measurements on gels made from suspensions of cowpea 'starch held at 85°C for 15 minutes and aged for 1 hr at 25°C, G' showed a power law increase with concentration (C) according to the relationship $G' \propto C^{3.7}$. Addition of the protein isolate to raise gel solids to 10% increased gel strength for $R > 2/8$. The increase in gel strength is attributed to the enhanced rate of gel strength development on aging. Time sweep rheological evaluation of gels produced by heating 10% solids suspension of protein/starch mixtures showed that G' increased with aging time at 20°C and attained plateau levels that decreased with R

NPA 867

Okelana, F.A. and Osuji, F.N.C. (1985). Influence Of Relative Humidity At 30°C On The Oviposition Development And Mortality Of *Sitophilus zeamais* Motsch. (Coleoptera: Curulionidae). In Maize Kernels. **Journal Of Stored Product Product Research. Vol.21.No1.** Pp. 13-19.

Eight cultivars of maize comprising five improved (high-yielding) cultivars (FARZ-23,-25,-27,-34 and TZY) and three local (low-yielding) cultivars (LW1,LW2 and LY) were conditioned to moisture contents in equilibrium with relative humidities of 30, 50, 70 and 90% at 30±2°C and subsequently infested with *Sitophilus zeamais* Motsch.

The numbers of eggs laid, rate of development, mortality, length, width and weight of the weevils were determined at each relative humidity.

Relative humidities of 30 and 50% were detrimental to survival, oviposition and development of the weevils, and weevil damage to the kernels judged by the number of weevils that emerged, was greatest at 70% r.h. At 90% r.h., the largest numbers of eggs were laid on all maize cultivars but the growth of bacteria and fungi effectively prevented the growth of the weevils.

Kernels of all cultivars conditioned to 50 and 70% r.h. supported heavier, larger, more active and darker weevil emergents than those at 90% r.h. However, oviposition was lowest at 30% r.h. and there was no noticeable kernel damage in any cultivar at this humidity., of the humidities studied, 70% was optimal in terms of oviposition, fecundity and kernel damage for all maize cultivars.

NPA 868

Okoh, P.N. (1989). Some Compositional Changes In Malted Sorghum (Sorghum Vulgare) Grain And The Value In Broiler Chicken Diet. **Journal Of Science Food Agriculture.Vol. 49 No. 3 Pp. 271-281.**

Grains of two sorghum [sorghum vulgare L] varieties were germinated at room temperature for 2, 4 and 6 days. Germination resulted in an increase in protein content due to dry matter loss; this rose with increasing time of germination. The absolute amount of tannin was unchanged until the fourth day of germination but decreased markedly by the sixth days. Fractionation of the grain protein of one varieties showed that there was a large increase in the albumin-globulin fraction [rich in lysine] and a decrease in the kafirin and cross-linked kafirin fraction [low in lysine] as a result of germination. Although these changes resulted in a more than 30% increase in lysine content on the fourth and sixth days of germination, a substantial loss in dry matter occurred when germination was continued up to 6 days. When 14-day-old Hubbard chicks were fed a diet containing about 59% malted sorghum supplemented with lysine, they showed better [P < 0.05] weight gain and efficiency of feed conversion than those on malted sorghum without lysine supplementation. However, malting reduced the amount of lysine needed to supplement the diet from 0.25% for unmalted sorghum to 0.18% for malted sorghum.

NPA 869

Okoli, E.C. and Ogunsua, A.O. (1987). Effects Of Malting Temperature, Bromate And Ammonia Treatment On Liquefaction Power, Diastatic Activity And Malting Loss Of Some, Nigerian Sorghum Malts. **Nigerian Food Journal. Vol.5. Pp. 57-65.**

Effects of malting temperature, bromate and ammonia treatments of liquefaction power, diastatic activity and malting loss of four Nigerian Sorghum malts derived from two newly developed Nigerian Sorghum varieties L.243 and SK 5912 and two local (wild) varieties LR and LW were tested in this study. All the varieties germinated optimally at 30°C. During germination at 30°C, L 243 showed very high diastatic activity peak of 106 Kdu/g dry malt weight (or 40L/100g original grain dry weight) while diastatic activity peaks of 90.8, 86.8 and 84.0 KDU/g dry malt weight were obtained for SK 5912, LR and LW respectively. During germination at the optimum temperature, L243 developed the highest liquefaction power peak of 500 Perten liquefaction number of 134 SKB Units. SK 5912, LR and LW gave Perten liquefaction power peaks of 463 (105 SKB), 146 (34SKB) and 82 (15SKB) respectively. Malting loss was found to increase in all varieties with the temperature of malting. At the temperature of optimum amylase activity, malting losses were 35.6%, 15%, 23.9% and 33.0% for LR, SK 5912 L 243 and LW respectively.

Bromate treatment had no significant effect on malting loss, liquefaction power and diastatic activity. Treatment with 0.3% ammonia reduced malting loss significantly and also reduced liquefaction power and diastatic activity.

- NPA 870 Okoli, E.C., Linus, O. Ezenweke and Anthony Aladeedu (1987). Improvement By Oxidising Agents Of The Baking Performance Of Pure And Compositea Flours From Nigeria Grown Wheats (Leex And Inia66). **Journal Of Science Food And Agriculture. Vol.41. No.1.** Pp. 69-80.

The feasibility of improving the bread -baking performance of two varieties of Nigerian- grown wheat [Lee X and Inia 66] in pure and composite flour, using the oxidising agents potassium bromate and ascorbic acid was studied. Composite flour was prepared by mixing pre-cooked bambara bean [*Voandzeia subterranean*] flour at levels between 0 and 50% with each of commercial [control], Lee X and Inia 66 wheat flour. Physical and sensory evaluations showed that the performance of straight Lee X and Inia 66 flour was inferior to that of the commercial flour. The commercial flour showed better tolerance to blending with bambara flour, producing acceptable loaves at up to 20% substitution with bean flour.; Lee X and Inia 66 could not tolerate blending beyond 15% and 5% levels, respectively. Physical properties and baking performance of the Lee X and Inia 66 flours were improved by treatment with various level of the oxidising agents $KBrO_3$ ascorbic acid and $KBrO_3$ / ascorbic acid combinations. Lee X flour was more responsive to the treatments than Inia 66. Concentrations of 25 mg kg⁻¹ $KBrO_3$ and 80 mg kg⁻¹ ascorbic acid singly were found to improved Lee X flours adequately, but a combination of the two agents at a level of 25 /60 mg kg⁻¹ $KBrO_3$ ascorbic acid was optimal. When treated with the optimal level of improver combination, Lee X flour performed as well as the commercial flour; and treated Lee X composite flours containing up to 30% pre-cooked bambara flour were found to produce loaves not significantly different from 100% commercial wheat bread [$P < 0.05$].

- NPA 871 Okoli, E.C. (1998). Chemical Pasting And Organoleptic Qualities Of Ogi From Malted Sorghum. **Nigerian Food Journal. Vol.16.** Pp. 20-28.

The chemical composition and amylograph pasting characteristics of ogi powder made from dry and wet milled ungerminated and germinated sorghum [3days@30⁰ + 1⁰C) after steeping the grain for 18hrs (30⁰ + 2⁰C). the sensory evaluation ogi porridge "Akamu" and ogi paste "Agidi" from these powders were investigated. Malted and unmalted products produced by dry milling retained higher level of protein. (10.08 –

11.30% protein content) than those produced by wet milling (7.28 – 8.87% protein content). Ash content for dry-milled products were also higher (0.71 - .48%) than their wet-milled counterparts (0.53 – 0.67%) ($P < 0.05$). titratable acidity (TA) was higher in wet-milled products, with the malted wet-milled soured product having significantly ($P < 0.05$) higher TA value than other samples. Hot and cold paste viscosities for wet milled germinated and ungerminated products were not significantly different (390 – 405 BU) ($P > 0.05$), but the germinated soured products had significantly higher index of gelatinization value (140 BU) than other wet milled products. Ogi made by the dry mill process generally had lower hot paste viscosities (420 – 480BU) than wet-milled products (540 – 640BU). Product made from germinated grain by the dry mill process had significantly inferior hot and cold paste viscosities and index of gelatinization value than the ungerminated product (420, 330 and 50BU Vs 480, 410 and 105BU respectively). Ogi powders made from germinated and ungerminated grain by the dry and wet mill processes yielded porridge with acceptable sensory qualities. Whereas ogi powder made from germinated grain by wet-mill/souring procedure yielded acceptable Agidi, the product from the dry-mill process was unacceptable due to significantly inferior rigidity ($P < 0.05$).

NPA 872

Okon, E.V. (1988). Effect Of Mash Constitution On Sugar Production In Malting Sorghums. **Nigerian Food Journal. Vol.6.** Pp. 49-60.

Three different varieties of sorghum malt were mashed using various mash composition namely total malt mashing at 2.5,5,10 and 20% w/w malt/water concentration; soluble starch-adjunct mashing at 5,10 and 20% w/w soluble starch/malt solution concentrations; and unmalted grain-adjunct mashing at 7.5, 15 and 30% w/w sorghum/malt solution concentrations. The yield of sugar was directly proportional to the diastatic power as well as the concentration of the malt variety. The variation in sugar production was more pronounced when mashing with malt of a higher diastatic power and at high malt concentrations than at low malt concentrations. However this was not proportional to the differences in the diastatic powers of the malt. Thus, there was a concentration effect favouring sugar production whatever the ratio of malt enzyme to substrate. Also; the yield of sugar from sorghum adjunct was less than that obtained from soluble starch adjunct no matter their concentrations in the mash. However, the efficiency of sugar production decreased as the ratio of malt/adjunct increased. It was higher at relatively lower concentrations of adjunct. It appears, therefore, that the use of adjunct in mashing with sorghum malt offers a means of controlling sugar production

- NPA 873 Okonkwo, E.U. and Ewete.F.K (1998). Comparative Evaluation Of *Demettia Tripetala* Seed Powder, Pirimiphos-Methyl And Aluminium Phosphide Table Against *Sitophilus zeamais* Moschulsky (Coleoptera: Curculionidae) And Their Biochemical And Organoleptic Effects On Stored Maize.
Nigerian Food Journal. Vol.16. Pp. 29-40

Comparative studies under simulated domestic storage conditions were carried out on the effect of *Dennettia tripetala* Baker f. and two recommended synthetic insecticides, pirimiphos-methyl and aluminium phosphide, on insect mortality, grain damage and their biochemical and organoleptic characteristics of the treated maize grains. *D. tripetala* powders mixed with maize grains, at 3g per 25g were effective as pirimiphos-methyl (10 ppm) and aluminium phosphide in achieving 89.3% adult mortality of *Sitophilus zeamais* Motsch, in 24h, and were most effective ($P < 0.05$) than pirimiphos-methyl and aluminium phosphide in achieving 60.9% weevil mortality of adult weevils recorded for the two synthetic insecticide. *D. tripetala* powders mixed with maize grains at 200g per 5kg reduced seed damage from an initial 0.28% to 4.7% compared to 7.7 and 8.4% in maize grains treated with pirimiphos-methyl and aluminium phosphide at 10 ppm and 3 g per 5kg respectively, and 66.7% in untreated control. 12 months after treatment. Changes in the level of crude protein, oil and starch contents were negatively correlated [$r = -0.368$; -0.498 ; -0.772] with emergence of *S. zeamais* and insect damage [$r = -0.341$; -0.481 ; -0.772], while sugar, moisture and free fatty acid contents were positively correlated [$r = 0.626$; 0.284 ; 0.666] with emergence of *S. zeamais* and insect damage [$r = 0.750$; 0.334 ; 0.714] on the grains. Pap prepared from fermented treatment maize grains 12 months after treatment had good flavour, sourness and was organoleptically acceptable and no off-flavour was detected. At an effective application rate of 200g powder of *D. tripetala* it cost ₦4.30 [\$0.86] to disinfect 5kg of maize grains.

- NPA 874 Okonkwo, E. U. and Okoye, W.I. (1999). Comparative Evaluation Of Two Seed Powders And Two Synthetic Pyrethroid Insecticides Against Insect Infestation On Stored Sorghum And Millet Under Simulated Trader Condition.
Proceedings Of 23rd Annual NIFST Conference. Pp. 67-69.

It may be concluded from the present study that *D. tripetala* and *P. guineense* powders were as effective as the two synthetic pyrethroid insecticides.

- NPA 875 Okonkwo, E.U. (2000). Testing Of Attapulgite Based Clay Dust As Protectants Against *Sitophilus zeamais* (Mots) On Stored Maize In Nigeria.
Bulletin Of Grain Technology. Vol.33. Pp. 3-10.

Attapulgite Based Clay Dust (inert substance) was tested as a protectant of maize grain when mixed at 5g and 10g/kg (w/w) caused 100% mortality of adult *S. zeamais* within 48h of exposure for 4 months, and 0% mortality recorded for control.

An essentially similar result was obtained with ABCD mixed at 0.75g and 1.00g per 0.25kg, 0.50kg and 1kg maize that caused 78.75, 85, 100 and 78.75, 90, 100% mortality of adult *S. zeamais* within 48h after exposure respectively.

ABCD protected maize grains for up to 6 and 3 months at 5g and 10g/Kg and 0.75g and 1.00g respectively in storage from damage by *S. zeamais* and by checking the adult population. Germination was also not affected in maize grains treated with ABCD. The insect damage to the lower dosages of the treated grain was below 9%. However, the grains treated with ABCD at 5g and 10kg/kg were highly tainted and messy

- NPA 876 Okonkwo, E.U. and Ewete, F.K. (2002). Comparative Evaluation Of *Dennettia Tripetala*. Seed Power, Pirimiphos-Methyl And Aluminium Phosphide Tablet Against *Callosobruchus maculatus* Fabricius (Coleopten:Bruchidae) And Their Organoleptic Effects On Stored Cowpeas In Nigeria.
Nigerian Food Journal Vol.1. No. Pp. 48-53.

Comparative studies under simulated domestic storage conditions were carried out on the effect of *Dennettia tripetala* Baker f. and two recommended synthetic insecticides, pirimiphos-methyl and aluminium phosphide, on insect mortality, grain damage and their biochemical and organoleptic characteristics of the treated maize grains. *D. tripetala* powders mixed with maize grains, at 3g per 25g were effective as pirimiphos-methyl (10ppm) and aluminium phosphide in achieving 89.3% adult mortality of *Sitophilus zeamais* Motsch, in 24h and were most effective ($P < 0.05$) than pirimiphos-methyl and aluminium phosphide in achieving 60.9% weevil mortality in 7 days, 4 months after treatment compared to 46.4 and 0.64% mortality of adult weevils recorded for the two synthetic insecticide. *D. tripetala* powders mixed with maize grains at 200g per 5kg reduced seed damaged from an initial 0.28% to 4.7% compared to 7.7 and 8.4% in maize grains treated with pirimiphos-methyl and aluminium phosphide at 10 ppm and 3g per 5kg respectively, and 66.7% in untreated control, 12 months after treatment. Changes in the level of crude protein, oil and starch contents were negatively correlated (

$r = -0.368$; -0.498 ; -0.772) with emergence of *S. zeamias* and insect damage ($r = -0.431$; -0.481 ; -0.772), while sugar, moisture and free fatty acid contents were positively correlated ($r = 0.626$; 0.284 ; 0.666) with emergence of *S. zeamais* and insect damage ($r = 0.750$; 0.334 ; 0.714) on the grains. Pap prepared from fermented treated maize grains 12 months after treatment had good flavour, sourness and was organoleptically acceptable and no off-flavour was detected. At an effective application rate of 200g powder of *D. tripetala* it cost N4.30 (\$0.86) to disinfest 5kg of maize grains.

- NPA 877 Okorie, P.E. and Salissou, O.M. (2000). Influence Of Storage On Growth And Biomass Production Of Vetiver Grass (*Vetiveria Zizaniodes* L.Nash) Slips. **Nigeria Agricultural Journal. Vol.31.** Pp. 89-96.

The use of vetiver grass (*Vetiveria zizanioides* L. Nash) for environmental amelioration, especially soil erosion control in Nigeria is very recent. Few attempts to utilize it on a number of eroded areas in S.E. Nigeria gave encouraging results but relevant local data on the cultural techniques for its establishment are lacking. Investigations were therefore carried out at Micheal Okpara University of Agriculture, Umudike, Nigeria to determine the effects of storage on its survival, growth and biomass production. A total of 240 slips were prepared and differently stored for 1,2, and 3 weeks under shade and sunlight respectively, before planting in the field. Survival counts were taken at 3 and 5 weeks, heights of tillers were measured at the 7th week and total biomass production was determined 11 weeks after planting. The results showed that storage of vetiver slips beyond two weeks significantly affected its growth and biomass production. To avoid wastage of slips, the crop should be planted soon after preparation but certainly not beyond two weeks to ensure good growth and successful establishment

- NPA 878 Okoruwa, A.E., Adenekan, G.I. and James, A.O. (1998). Novel Use Of African Star Apple (*Chrysophyllum Albidum* G. Don.) Extracted Juice As Coaquant For Tofy (Soycheese) Making. **Proceedings Of 22nd Annual NIFST Conference.** Pp. 11-13.

The results of proximate compositional analysis showed that nutrient density of tofu made with African star apple fruit extract is similar to that of ogi liquor -and calcium sulphate- coagulated tofu. In fact, the protein and fat in the fruit extract tofu [13.4% and 5.1% respectively] were higher than the traditional calcium sulphate tofu [11.0% and 4.5% respectively] [Table 1]. In terms of taste, there was no difference

between the tofu made with African star apple fruit extract, calcium sulphate and ogi liquor. However, for other sensory quality attributes such as colour, aroma and texture, the tofu made with other coagulants were preferred to that from African star apple fruit extract. However, Tofu made with star apple juice extract was generally acceptable to consumers.

NPA 879 Okwuraiwe, P.E. (1977). Grain Legume In Traditional Diets.

Tropical Grain Legume Bulletin No.8 Pp. 52.

Legume as green vegetables are readily accepted and are likely to become increasingly important in local diets. Young leaves of cowpea are high in protein but have relatively low sulphur; nitrogen ratio and mineral content are high in proteins and minerals. More widespread use of legumes as green vegetables would go a long way in correcting the nutritional imbalance of traditional diets.

NPA 880 Okoye, W.I. and Okobi, A.O. (1984). Physical And Chemical Parameters Of Some Less Known Nigeria Oil Seeds.

NSPRI Technical Report. No.14. Pp. 101-109.

The seed characteristics and chemical composition of 9 less known Nigerian oilseeds were investigated. The mean oil contents ranged from 12-70% while the mean crude protein content ranged between 8-28%. Data obtained for the Iodine values, saponification values, acid values and other chemical parameters compared well with other edible oils obtained from groundnuts, coconut, oil palm, Rubber seeds, and melonseed. All the oils are from pale yellow to golden yellow in colour and, except *Irvingia gabonensis* which solidifies at room temperature, others are liquids. Gas chromatographic analysis showed a vast range of various fatty acids common with edible oils.

NPA 881 Okonkwo, E.U. and Okoye, W.I. (1992). The Control Of *Callosobruchus maculatus* (F.) In Stored Cowpea With Dried Ground *Ricinus Communis* (L.) Leaves In Nigeria.

Tropical Pest Management. Vol.38 No3 Pp. 237-238.

One to five grams of dry ground castor leaves. *Ricinus communis*, mixed with 300 g cowpea seeds, achieved mortality up to 100% in 7 days. After 48 h only 20% mortality was recorded with 5 g. The grains were protected from damage for more than 3 months. However, little energy was involved in collecting, drying and grinding sufficient quantities of leaves required for the experiment.

- NPA 882 Okoye, W.I., Okobi, A.O. and Okonkwo, Ego. U. (1999). Extraction And Characterization Of Oils From Nine Lesser Known, Nigeria. **Proceedings Of 23rd Annual NIFST Conference.** Pp. 231-233.

The result indicated that the 9 lesser know Nigerian oil seeds compare to other oils already existing as edible vegetable oils.

- NPA 883 Okoye, W.I. and Okonkwo, Ego. U. (1999). Physicochemical Quality Parameters, Fatty Acid Composition And Essentials Oil Yield Of Six Indigeneous Species. **Proceedings Of 23rd Annual NIFST Conference.** Pp. 285-288.

The result shows the botanical, local and common names of the spices. Table 1 further shows the essential oil yield, physicochemical composition and fatty acid composition of the spices. Results shows that *P. guineense* has the highest yield of [3.5%] followed by *M.myristica* [3.2%]; *X. oethioca* [3.0%] and *D. tripetala* [2.3%] Annual³

- NPA 884 Okunade, S. O.; Williams, J. O.; and Ibrahim, M. H. (2002). Comparative Efficacy Of Twelve Botanicals And Two Synthetic Insecticides Against The Lesser Grain Borer, *Rhyzopertha dominica* Fabricius (Coleoptera: Bostrichidae) On Stored Sorghum **Nigeria Journal Of Entomology** Vol.19 Pp22-30

The results show that there was significant difference ($P < 0.05$) in adult mortality between the treatments after seven weeks of storage. While the two synthetic insecticides resulted in 100% adult, mortality, there was no significant difference between them and *Ocimum americanum* which gave mean mortality of 93.25% not significantly different ($P \geq 0.05$) in mean percentage adult insect mortality with 75.76%, 71.16% and 70.52% respectively. *D. platycarpa* followed with adult mortality of 60.96%; *P. filicoidae* (bark of stem) and *P. glaucum* recorded 50.70% and 44.60% respectively. The poor performance of the latter is traceable to the smaller quantity of the botanical admixture. *S. senegalensis*, *M. hispida* and *E. major* gave mean percentage mortalities of 42.53%, 42.48% and 40.01% respectively, while *A. hypogaea* mortalities of 42.53%, 42.48% and 40.01% respectively, while *A. hypogaea* with mean percentage mortality of 30.46% was not significantly different from the control with a mortality of 19.86

- NPA 885 Olaoye, I.O. (2000). Fracture Resistance Of A Castor Nut To Mechanical Damage. **Proceedings Of The First International Conference And Millennium General Meeting Of The Nigeria Institution Of Agricultural**

Engineers (A Division Of The Nigerian Society Of Engineers. Vol.22. Pp. 44-47.

The development of processing procedure and equipment for biological material requires in depth knowledge and utilisation of the established characteristics of the plant materials. The bio yield point in a force deformation curve and the ability of the materials to resist penetration through hardness test were studied. These information on the mechanical property is essential in the design of equipment and system for processing castor nut. Three varieties of castor nuts at different moisture contents were quasi- statistically loaded in three principal axes of the nut. The effects of moisture content, variety, and loading position on the hardness and the force needed to rupture the seed coat were investigated using the analysis of variance. Force required to rupture seed coat indicated a significant effect with increase in moisture content. The loading position and variety of the nut indicated significant effect of the hardness value of the nut. Maximum hardness value are recorded when the nut is loaded along its intermediate axis. The average compressive force required to cause castor nut to rupture decreases as moisture content of the nut increase from 4 to 6 percent [wet basis].

NPA 886 Olaoye, J.O. and Oni, K.C. (2001). Some Physical And Mechanical Properties Of Selected Grain Crops. **Proceedings Of The International Conference And Annual General Meeting Of The Nigerian Agricultural Engineers. Institution Of Vol.23. Pp. 315-329.**

Grain crop losses begin in the field with the standing plants, as soon as they have ripened, then continue during threshing, drying and storage. Threshing whether done manually or mechanically inevitably leads to some of the grain splitting and breaking. Adequate care is therefore necessary in ensuring that the processes or instruments used cause as little damage as possible. Some physical characteristics of selected grain crops (millet, sorghum and Rice) were studied. The relationships that exist between crop varieties, grain size and the compressive force on the grain crops were evaluated. The results of the evaluation showed that the average threshing moisture content for Millet, Sorghum and Rice are 10.2, 17.4 and 13.3% wet basis, respectively. At these values of the moisture content the average force at rupture for all the varieties of each grain crop are 7.53N for millet, 57.83N for sorghum and 166.56N for rice. The corresponding average force at yield are 10.40N, 10.81N and 98.98N for millet, sorghum and rice, respectively. The results obtained can be used to establish optimum threshing conditions for the grain crops.

- NPA 887 Oje Olukayode (1988). Design And Construction Of A Simple Rice Parboiling Hardware For Use In Nigeria.
AMA Agricultural Mechanization In Asia, Africa And Latin America. Vol.19. No.1. Pp. 61-63.

Parboiling of rice - a hydrothermal process – is a treatment given to raw paddy in Africa. It enhances the quality of rice during milling.

An appropriate technology equipment was designed and constructed for rice parboiling in Nigeria. Results show that the machine reduced the time of parboiling from 48 h to 4.5 h and was found to improve the quality of milled rice significantly.

- NPA 888 Oni K.C. and Ali M.A. (1986). Factors Influencing Threshability Of Maize In Nigeria.
AMA Agricultural Mechanization In Asia Africa And Latin America. Vol.17. No.4. Pp. 39-44.

Overall shelling efficiency is the percentage of total collected whole grains . It indicates the quality of shelling , taken into consideration the kernel damage and the loss of grains . It is influenced by such single factors as speed and ear size , two factor interactions of speed and variety , and feed rate and ear size .The three factor interaction of speed , feed rate and ear size also showed significant contributions at 5% alpha level .

- NPA 889 Olalusi , A . P . Bolaji , O . T . and Adebayo , S . S . [2009] Some Engineering Of Tiger Nut
Proceedings Of 3rd International Conference Of WASAE and 9th International Conference Of NIAE pp244--248

The result showed that small , medium and large tiger nut had mean sphericity value of $0.73 \pm 0.17\%$, $0.86 \pm 0.17\%$ and $0.95 \pm 0.21\%$ respectively The angle of repose for randomly sample Tiger nuts increase with increase in size while coefficients of friction were for wood was higher in all the sizes compared with stainless steel . The cracking forces and bulk densities were also determined for the randomly selected grades of Tiger nuts .

- NPA 890 Ologhobo, Anthony, (1986). Composition And Food Potentials Of Dry And Germinated Legume Seeds And Their Sprouts.
Nigerian Food Journal. Vol.4 No 1 Pp. 34-44.

Chemical composition and energy values of dry seeds, germinated seeds and sprouts of limabean (*Phaseolus lunatus*), cowpea (*Vigna unguiculata*) and soyabean (*Glycine max*) were determined. With the exception of soyabean seeds, crude protein levels were remarkably similar in all legume seeds and they fell within a relatively narrow range of 24.3-27.5% dry weight. The protein content of germinated seeds and sprouts ranged between 20.5-33% and 1-94.2% dry weight respectively. All sprouts were poor sources of oil. Linoleic acid was the predominant fatty acid in the dry seeds, germinated seeds and sprouts, while in the germinated soyabean seeds and sprouts, linoleic acid was the poorest just as stearic acid was most limiting in the dry seeds. Potassium was the most abundant mineral element and values obtained were 466 – 1060mg/100g for germinated seeds and 188 – 416 mg/100g for sprouts. Manganese ranged between 12.7 and 22.5 mg/100g in the dry seeds, 6.6 and 19.0 mg/100g in the germinated seeds and between 6.0 and 12.8 mg/100g in the sprouts. With the exception of this mineral, values obtained for all other minerals were much lower in the germinated seeds and sprouts than in the dry seeds. Lower energy values ranging between 113 – 166 kcal/100g and 26-42 kcal/100g were also observed for the germinated seeds and sprouts respectively. The nutrient/energy ratio was however, quite high, especially the linoleic/energy ratio, and this suggests that germinated legumes or even sprouts, could be of value as significant sources of nutrients in the diet

NPA 891 Ologhobo Anthony and Babatunde, L. (1987). Energy Values In Differently Processed Cowpeas. **Nigerian Food Journal. Vol.5.** Pp. 18-23.

The energy values of three improved cowpea varieties grown in Nigeria were determined for the weanling rat. All rats fed raw and processed cowpea diets gained weight but rats fed soaked and germinated cowpeas gained less weight than rats fed the raw, autoclaved or cooked meals. Feed conversion efficiency ranged between 1.50 and 2.66, being significantly ($P < 0.05$) highest in the cooked and autoclaved varieties. Digestible energy [DE] was highest in soaked Adzuki (4.69 Kcal/g) and lowest in raw Ife Brown (3.50 Kcal/g) while metabolizable energy (ME) values ranged between 3.27 kcal/g for raw Ife Brown and 4.45 Kcal/g for cooked Farv-13. Regression of DE against trypsin inhibitor activity gave a negative quadratic relationship and combined effects indicated tannin and phytin as significant ($P < 0.05$) estimates for digestible energy. Trypsin inhibitor accounted for 34.36% of the variability in ME ($r = -0.59$) phytin accounted for 3.40% ($r = -0.53$) and tannin accounted for 16.87% ($r = -0.11$).

- NPA 892 Olowoniyan, F.O. and Osho, S.M. (1995). Acceptability Of Different Coagulation Agents For Soycheese Proceesing In Kaduna State, Nigeria; **Postharvest Technology And Commodity Marketing. A Proceedings Of Postharvest Conference In Accra, Ghana.** Pp. 169-171.

Cheese is an important and versatile source of protein which has been used by most cultures down the centuries. Traditionally, cheese is obtained in Nigeria by coagulating cow's milk with a coagulating agent such as bombon leaf juice (*Calopris pocere*). However, cow's milk is expensive and cannot be stored and therefore this study investigated the acceptability of cheese made from soybean milk. The milk was coagulated with three types of coagulant and subjected to sensory evaluation. The results showed no significant difference in the level of acceptance of soymilk coagulated with lemon juice or Epsom salk, but soymilk coagulated with (alum) was considered of lower quality. All products compared favorably in appearance and texture.

- NPA 893 Oluka, S.I. And Bardey, I.A. (2000). The Thermal Properties Of Pigeon Pea (*Cajanus Cajan*). **Journal Of Agricultural Engineering And Technology. Vol.8.** Pp. 37-43.

The thermal properties of pigeon pea *Cajanus cajan* such as thermal conductivity, specific heat capacity, thermal diffusivity and latent heat at different time intervals and temperatures were studied. The studies were carried out at the moisture levels of 11.76% (w.b.) 32.34% (w.b.). The specimens were prepared in two forms of whole seed and powdered flour. Analysis of the results revealed that the thermal conductivity of pigeon pea increases with an increase in the temperature difference between the specimen and the ambient air. At the same temperature, the thermal conductivity of pigeon pea remains constant irrespective of the form or shape in which the specimen exists.

For a pigeon pea seed, at the moisture content of 11.76% (w.b), 100% degree of tenderness was achieved with a heat of 57.80 joules, temperature difference of 34°C and period of 60 minutes. Also for the pigeon pea flour at the moisture content 32.34% (w.b), 100% degree of tenderness was achieved with a heat of 48.05 joules, temperature difference of 31°C and a heating period of 20 minutes.

As the temperature difference increased from 23°C to 48°C the specific heat capacity increased from 1.17jg⁻¹k⁻¹ to 2.361.17jg⁻¹k⁻¹.

The thermal diffusivity of the pigeon was found to be 1.53m²S⁻¹°C⁻¹ while the latent heat of the seeds and flours were 2.88jg⁻¹ and 10.67jg⁻¹ respectively at the moisture contents of 11.76% (w.b) for the seed and 32.34% (w.b) for the flour.

NPA 894 Oluka, S.I. And Bardey, I.A. (2001). The Thermal Properties Of Pigeon Pea (*Cajanus Cajan*) As Related To Its Processing And Utilization. **Proceedings Of The International Conference And Annual General Meeting. Of The Nigerian Institution Of Agricultural Engineers. Vol.23.** Pp. 297-304.

The thermal properties of pigeon pea *Cajanus Cajan* such as thermal conductivity, specific heat capacity, thermal diffusivity and latent heat at different time intervals and temperatures were studied. The studies were carried out at the moisture levels of 11.76% [w,b] and 32.34% [w.b]. The specimens were prepared in two forms of whole seed and powdered flour.

Analysis of the results revealed that the thermal conductivity of pigeon pea increases with an increase in the temperature difference between the specimen and the ambient air. At the same temperature, the thermal conductivity of pigeon pea remains constant irrespective of the form or shape in which the specimen exists.

For a pigeon pea seed, at the moisture content of 11.76% degree of tenderness was achieved with a heat of 57.80 joules, temperature difference of 34°C and period of 69 minutes. Also for the pigeon pea flour at the moisture content 32.34% [w. b] 100% degree of tenderness was achieved with a heat of 48.05 joules, temperature difference of 31 °C and a heating period of 20 minutes.

As the temperature difference increased from 23 °C to 48 °C the specific heat capacity increased from 1.17 Jg⁻¹k⁻¹ to 2.361.17 Jg⁻¹k⁻¹.

The thermal diffusivity of the pigeon was found to be 1.53 m² S⁻¹ °C⁻¹ while the latent heat of the seeds and flours were 3.88 Jg⁻¹ and 10.67 Jg⁻¹ respectively at the moisture contents of 11.76% [w.b] for the seed and 32,34% [w.b] for the flour.

NPA 895 Oluka, S.I. (2001). The Effects Of Angles Of Inclination And Loading Capacities Of Solar Dryer-Bed On The Drying Characteristics Of Rice Grains. **Proceedings Of The International Conference And Annual General Meeting Of The Nigerian Institution Of Agricultural Engineers. Vol.23.** Pp. 443-447.

A locally constructed solar dryer was used to investigate the effects of angles of inclination and loading capacities of solar dryer-bed on the drying characteristics of rice grains.

The rice grains of faro-11 (056) variety were placed on the dryer-bed trays and covered with ultra-violet light resistant plastic sheets. The moisture behaviours of the grains were monitored at the angles of inclination of 10°, 15°, 20°, 25° and 30° at varying time intervals.

The moisture characteristics of the grains at the different loading capacities of 12.5kg/m² were monitored. Analysis of the result indicated that the optimum drying rate occurred at the angle of 20° to the base. For angles of inclination less or more than 20°, the drying rates were very slow. It was found that as the loading capacity increased, the drying rate decreased. The critical loading capacity of the rice grains were found to be 31.0kg/m².

- NPA 896 Oluwatola, O.I., Moreck, J.H., Akingbala, J.O. and Kling, J.G. (1995). Effect Of Husk Removal And Length Of Storage On The Texture And Physical Quality Of Green Field Maize. **Postharvest Technology And Commodity Marketing**. Pp. 208-215.

This study examined the effect of storage time and husk removal on textural quality characteristics and physical quality parameters of three selected field maize varieties, namely POP 40-SR(QPM), EV8443-SR(dent), and TZESR-W (flint) grown on IITA, Nigeria. Results showed that kernel weight decreased with storage time and husk removal exacerbated weight loss. There was no significant changes in kernel density but volume decreased with the removal of husks during storage. Kernel length and breadth increased in 1 or 2 days after harvest but decreased on further storage. Kernel thickness, however, decreased progressively over the storage period. There was no detectable effect of husk removal on kernel dimensions. Kernel hardness increased with length of storage. Kernels stored in husks were more tender than those with husks removed and the hardness values correlated significantly with moisture in TZESR-W and EV 8443-SR (0.86, P<0.05; -0.89, P<0.01, respectively). Initially, pericarp thickness increased slightly with length of storage. The implication of moisture content of kernels on the observed trends is discussed. The importance of the results on breeding selection and preservation methods is highlighted

- NPA 897 Oloyo, R.A. (1999). Some Aspects Of Nutritive Quality Of Some Maize Based Traditional Convenience Foods. **Proceedings Of 23rd Annual NIFST Conference**. Pp. 61-64.

Proximate analysis of the foods samples was carried out, and total energy values were estimated by multiplying protein, fat and carbohydrate by 4, 9, and 4 respectively. Statistical analysis of results was done in accordance with the procedures of Steel and Torrie³.

NPA 898 Omoti, U. and Okiy, D.A. (1987). Characteristics And Composition Of The Pulp Oil And Cake Of The African Pear-Dacryodes Edulis (G.Don.) H.J. Lam

Jouraal Of Sceince Food Agriculture. Vol.38 No. 1 Pp. 67-73

The pulp of the African pear, Dacryodes edulis was investigated for its nutritional quality and oil characteristics. The crude protein, fat, fabre and carbohydrate contents were 29.9, 31.9, 17.9 and 13.5%, respectively. The pulp was found to contain significant levels of Ca, Mg, K and P. The fatty acid profiles showed a saturated fatty acid content of 50.85% and an unsaturated fatty acid content of 49.14%. The predominant fatty acids were palmic and oleic acids. The saponification value and iodine value were 201.4 and 59.6. The amino acid profiles showed high contents of the essential amino acids lysine, leucine and threomine.

NPA 899 Omueti, O. (2000). Development, Nutritional Quality And Organoleptic Characteristics Of A Protein Snack From Maize And Tofu: Maize Tofu Sausage.

Moor Journal Of Agricultural Research. Pp. 106-114.

A protein snack named Maize-Tofu sausage was developed from a blend of variously processed maize flour and Tofu (Soya cheese). Protein content of the Maize- Tofu sausage was increased above the protein content of the variously processed maize-flour. The values ranged between 15-23% protein. The in vitro protein digestibility results showed that all the various types of Maize – tofu sausage were digestible when compared with Bovine serum albumin and casein. In all the parameters tested for organoleptic attributes all types of Maize – Tofu sausage except the dry Masa – Tofu sausage were accepted by panelists. In this work high protein snack had been successfully developed from cheap sources of protein.

NPA 900 Akhueemonkhan , I . A .and Adepoju ,P , A . [1999] Production and Evaluatrion Of Gin From Cassava Processing Wast

Proceeding Of 23rd Annual NFST Confrence Pp 25-27 .

Results obtained compared favourably with a commercial sample obtained from the market and used as a standard . The hydrogen cyanide content was 0 .0032 ppm in the final product , while the ethanol was 42 .96% compared to 43 .23% in reference sample , and ester was 6g /100L ethanol as compared 4g/100 in reference sample . Methanol and ethyl carbamate were not detected . Overall the gin produced falls within the standard required by NAFDAC .

- NPA 901 Onuorah, S.I. (1987). Incidence Of Enterotoxin Production Amongst Strains Of *Staphylococcus aureus* Isolated From Local Cereal Drink (Kunun Zaki). **Nigeran Journal Of Microbiology**. Pp. 110-115.

The incidence of enterotoxin production in *Staphylococcus aureus* strains isolated from kunun zaki and utensils used in its preparation was determined by the double gel (microslide) diffusion technique. Twenty (8.1%) of the 246 staphylococcal isolates were enterotoxigenic, produced SEE while only two elaborating staphylococcal enterotoxins A (SEA), B(SEB), C(SEC) or D(SED). No strain produced SEE while only two elaborated multiple enterotoxins, types BD, SEB production was most prominent with 10 (4.1%) strains being producers and it accounted for 50% of all enterotoxins produced by the isolates. There was no significant difference ($P > 0.05$, X^2) between the incidence of enterotoxin production amongst strains of *S. aureus* isolated from the points of preparation and sale outlets. Isolates that produced coagulase, thermonuclease and alpha hemolysin displayed the highest incidence of enterotoxigenicity. Two known enterotoxigenic strains of *S. aureus* when inoculated into kunun zaki failed to elaborate enterotoxins after 24 hrs at 37°C with a pH change from 4.0 to 2.9.

The risk of staphylococcal intoxication associated with kunun zaki consumption appears minimal.

- NPA 902 Onyelucheya, N.E. and Omeire, G.C. (1999). Effect Of Hydrolysis Of Soy Milk Protein With Papain. **Proceedings Of 23rd Annual NIFST Conference**. Pp.193-195.

It was observed from the result of the experiments [Table 1] that NaHCO₃ used as a blanching agent, increased the pH of the blanched samples. At a pH 6.8 and lower concentrations of papain [5% of 0.05%], high emulsion stability of the soymilk [sprouted and unsprouted] was observed. Hence pH and papain concentration affect the action of papain on soymilk. It was also observed that papain played a dual role on soymilk. It acts as a high emulsion-stabilizing enzyme at lower concentrations [5% of 0.05%], but at concentrations higher than this, it acted as a milk-clotting enzyme. It was also observed that papain imparted a bitter taste to the soymilk. If further work is to be continued with papain or any other proteolytic enzyme on soymilk, it would require further hydrolysis of soymilk with amino peptidase in order to clarify the debittering mechanism of the major bitter peptide from trypsin hydrolysates produced by papain hydrolysis.

- NPA 903 Onyuchi, J.N. (1978). A Survey Of The Rural Farmers Storage Practices In The Bendel State (1) Maize Storage.
NSPRI Technical Report. No.4 . Pp.45-49.

Storage structures and practices adopted by the rural farmers in relation to the storage of Maize in the Bendel State were examined.

Two main harvests of maize are handled in the state. One is harvested between late July and September.

Considerable losses were encountered in storage, estimated variously at between 10% to 20% of total annual production. Losses were principally from microbial, insect and rodent activities. Storage period is usually over a period of about seven months.

Storage structures ranged from local adaptations of the crib storage concept to improvised versions of the usual store house system. Storage structures were uniform for each clan unit. Maize was usually stored with the sheath on. Infestation control strategy emphasised in the main the use of heat (natural and artificial) as a pest repellent in addition to its drying effect. Insecticidal treatment was rarely found and was limited to the use of "gamalun 20" as a spraying dust

- NPA 904 Opadokun, J.S, Kasaure and Qureshi, A.H. (1972). Oil Contents Of 1971-72 Northern Nigeria Groundnut Crops.
NSPRI Technical Report. No.4. Pp. 39-42.

As a result of routine out-turn analyses of groundnut kernels sold to oil millers in the Northern States extensive records of oil content of the groundnut crop have been compiled. In the 1971-72 season 371 samples were analysed giving an average oil content of 48.67 per cent. The highest oil content was 51.11 per cent and the lowest 46.57 per cent.

- NPA 905 Opadokun, J.S. (1975). The Relative Proportions Of Aflatoxin B₁ and B₂ In Groundnuts.
NSPRI Technical Report. No.3. Pp. 27-30

The relative proportions of aflatoxins B₁ and B₂ in naturally contaminated groundnuts and groundnut dake have been determined. Aflatoxin B₁ concentration is found to be approximately four times the concentration of aflatoxin B₂.

- NPA 906 Opadokun, J.S. Ikeorah, J.N. and Afolabi, E. (1976). The Aflatoxin Of Locally Consumed Food Staffs Part 3: Maize.
NSPRI Technical Report. No.12. Pp. 105-108.

Moisture and aflatoxin contents of 39 samples of maize from Kano markets have been determined. The average moisture content was 9.94 per cent varying between 6.56 per cent and 18.93 per cent. The average aflatoxin content of the 13 samples which had aflatoxin was 106 ppb. 8 samples had aflatoxin contents above 30 ppb., the maximum recommended level of aflatoxin in food meant for human consumption. It appears that maize could be a significant source of aflatoxin in human and animal diet in Nigeria

- NPA 907 Opadokun, J.S. (1976). The Aflatoxin Contents Of Locally Consumed Food Staffs Part 11 Sorghum.
NSPRI Technical Report. No.11. Pp. 101-104.

Moisture and aflatoxin contents of 89 samples of sorghum from Kano markets have been determined. No sample had moisture content above the 'safe' moisture content level of 13.5 per cent of sorghum. Only one sample had detectable aflatoxin (22ppb); the others had non-detectable aflatoxin contents (less than 5 ppb), The negligible aflatoxin in the samples examined suggest there is little danger of aflatoxin poisoning from consumption of sorghum in kano.

- NPA 908 Opadokun, J.S. and Ikeorah, J.N. (1978). The Aflatoxin Contents Of Locally Consumed Food Staffs Part V1: Rice.
NSPRI Technical Report. No.12. Pp. 101-105.

Moisture and aflatoxin contents of 68 samples of rice (locally produced and imported samples) from Kano markets have been determined. The average moisture content is 9.92% below the 'safe' moisture content for the storage of rice. None of the 68 samples contained detectable aflatoxin

- NPA 909 Opadokun, J.S. and Afolabi, E. (1978). The Aflatoxin Contents Of Locally Consumed Food Staffs Part V11 Cowpea.
NSPRI Technical Report. No.13. Pp. 107-109.

Moisture and aflatoxin contents of 33 samples of cowpea collected from Kano market were examined. The mean moisture content was 7.69%. Only one sample had detectable aflatoxin B1 and this was very low at 6.7 ppb.

- NPA 910 Opadokun, J.S. and Ikeorah, J.N. (1983). Moisture And Aflatoxin Contents Of Market Grain Samples In Kano And Plateau States Of Nigeria.
NSPRI Technical Report. No.3. Pp. 35-41.

Nine hundred and twenty five samples of various grains comprising 195 samples of cowpeas, 145 samples of maize, 195 samples of millet, 195 samples of rice and 195 samples of sorghum taking during the 1980/81 and 1981/82 crop seasons from Kano and Plateau States of Nigeria were assayed for moisture and aflatoxin contents. 7 samples of maize had moisture contents higher than the 'safe' moisture content of 13% for maize. 30 samples of maize (20%) had detectable aflatoxin B₁, 20 of them (14%) having aflatoxin B₁ content higher than 330 ug. Kg⁻¹. Aflatoxin B₁ was not detected in any of the other grains. Present findings which confirm an earlier one make it imperative to take preventive action to minimize the incidence of aflatoxin in maize

- NPA 920 Opadokun, J.S., Williams, J.O. and Ikeorah, J.N. (1984). Biochemical Changes In Insecticides Treated Maize Stored In Ventilated Maize Cribs.
NSPRI Technical Report. No.3. Pp. 39-45.

Eight chemical quality parameters of yellow maize on the cob treated with Deltamethrin (K - othrine) and pirimiphos methyl (Actellic) were monitored over a period of nine months during storage in ventilated maize cribs. The maize samples, which had high initial moisture contents, dried out to below 'safe' moisture content levels within one month of storage but started picking up moisture again from the eight month. The non-reducing sugar content increased during storage while the B-carotene content decreased at the end of the storage period. Ash, Crude fat and crude protein remained unchanged during storage. Aflatoxing B₁ present at the initial stage remained unchanged during storage.

- NPA 921 Opadokun, J.S. (1984). Keeping Quality Of Vegetable Oils Stored In Different Containers.
NSPRI Technical Report. No.14. Pp. 117-123.

Palm oil and four other vegetable oils were stored in metallic, plastic and glass containers and their qualities monitored monthly for one year. The factory - produced palm oil with a high initial quality kept better in all containers that the locally produced palm oil with an initial inferior quality. The other vegetable oils did not show any marked increase in acidity during storage, but the peroxide values increased greatly and the

oils were all organoleptically unacceptable at the end of nine months of storage. Oils in containers that were not opened until the trials were terminated had a better overall quality than those which were opened for sampling during storage.

- NPA 922 Opadokun, J.S. and Sowumi, O. (1985). Chemical Quality Of Maize And Sorghum Stored In Nitrogen In Metal Silos For Four Years. **NSPRI Technical Report**. Pp. 67-68.

Grains purchased in March 1981 and stored in 40-ton metal silos under nitrogen were sample after 12, 36, and 50 months and analysed. The silos were evacuated after 50 months and the grains were sold off.

- NPA 923 Opara, C.C. and Paiko, Y.B. (1993). Influence Of Pretreatment Of Cane-Sugar Molasses On Balance Of Cations And Anions Needed In Fermentation. **Nigerian Food Journal**. Vol.11. Pp. 25-32.

The effects of pretreatment of Nigerian sugar –cane molasses on some inorganic ions and few anions required for fermentation processes were investigated. The pretreatment employed include adjusting the pH of the diluted molasses to 4.5, keeping at 60°C for 36 hours, autoclaving at 121°C for 15 minutes and one hour respectively and the addition of 2% tricalcium phosphate. Metal ions known to promote or inhibit fermentation and anions (phosphate, iodide and chloride) were assayed. The results showed that the sample obtained by adjusting the pH to 4.5 and autoclaving at 121°C for 15 minutes had the cations and anions in the optimal concentration for both bacterial and fungal growth. In most of the samples, however, except for Cu⁺⁺ and K⁺, the metal ion concentrations were below the inhibitory levels for both cell growth and anaerobic fermentation. Further studies should be conducted to find means of reducing the levels of Cu⁺⁺ and K⁺.

- NPA 924 Oparaeke, A.M. and Dike, M.C. (1996). Comparison Of Garlic And Lemon Grass Products In The Control Of *Callosobruchus maculatus* (F) (Coleoptera Bruchidae) In Stored Cowpea Grains. **Nigerian Journal Of Entomology**. Vol.13. Pp. 73-80.

Powders of garlic (*Allium sativum* L.) bulb and lemon grass (*Cymbopogon citratus* Staph) stem were compared for their effectiveness against *Callosobruchus maculatus* F. on cowpea stored for three months. Garlic bulb powder at 2.5g, 5.0g and 10.0g per 100g cowpea grains gave

18.33%, 23.33%, 45.0% adult weevil mortality respectively in 24 hours; 50.0%, 56.66%, 75.0% adult weevil mortality respectively in 48 hours; while lemon grass stem powder of the same dosage caused 26.65%, 33.33%; 35.0% weevil mortality respectively in 24 hours and 56.65%, 66.66%, 68.33% mortality respectively in 48 hours. Garlic bulb and lemon grass stem powders significantly ($P < 0.01$) reduced the oviposition and progeny emergence in all the treatment levels, compare with the control. However, lemon grass stem powders performed better than garlic bulb powder in F_2 and F_3 progenies control and had better protection of cowpea grains. Seed viability and quality were unaffected by the treatments.

NPA 925 Oresanya, O. Moji and Ebuehi, O.A.T. (1999). Extraction And Characterization Of Guma Melon (*Colocynthis Citrusllus L.*) Seed Oil. **Proceedings Of 23rd Annual NIFST Conference**. Pp. 238-240.

The Results of the study showed that the extracted Guna melon oil was $54.7 \pm 0.82\%$ of the kernel and $43.3 \pm 0.60\%$ of the unshelled seed by weight. The moisture, free fatty acid content, iodine value, sponification value and unsaponifiable matter content were $0.13 \pm 0.04\%$, $0.65 \pm 0.10\%$, 109.0 ± 1.50 , 213 ± 4.85 and $1.05 \pm 0.006\%$ respectively.

NPA 926 Osho, S.M. and Dashiell, K. (1995). Expanding Soyabeans Production, Processing And Utilization In African. **PostHarvest Commodity And Marketing. Proceeding of a Postharvest Conference Accra- Ghana** Pp. 151-156.

This paper describes methods of soybean incorporation into traditional African foods, the response of evaluators to fortified products, options for household use of soybean, and industrial potential. At present Africa is heading towards a food crisis: populations are rising and per capita incomes are falling in many countries; both of these factors raise the price of the higher protein foods such as meat, milk, and cheese, placing them beyond the financial reach of many people. Soybean contains up to 40% protein and the incorporation of soybean into traditional foods offers a simple but effective solution to improving the nutritional status of diets in Africa, particularly for the poorest people.

- NPA 927 Ossai, G.E.A. and Malomo, O. (1988). Nutritional And Sensory Evaluation Of A New Cereal-Legume Wearing Food. **Nigerian Food Journal.Vol.6.** Pp. 23-35.

Nutritional evaluation showed no significant differences in wieght gains, Biological Value (BV) and Net Protein Utilization (NPU) between with different cowpea – corn flour diets and the commercial baby foods, despite the large cost disparity (Commercial baby food is approximately thrice the cost of the developed food). Diet A possessed the best nutritive quality as shown by the higher values for weight gain, BV, or NPU of the rats placed on it. Sensory evaluation results indicated that the developed product was mjacceptable to a taste panel. There existed no significant difference between the developed infant product and the more expensive imported commercial foos. This 30:70 cowpea/corn flour blend (Diet A) could be an acceptable formula for infants and growing children in a developing country like Nigeria.

- NPA 928 Osundaunsi, O.F. and Akinola A.O.A. (1999). Effect Of Banana Extract Addition To Soya Milk On Chemical And Sensory Properties Of Tofu. **Proceedings Of 23rd Annual NIFST Conference.** Pp. 28-30.

Increase in percentage of added banana extract increased the acceptabilityof Tofu . Flavourant was not detectable at lower levels while curd was unstable at 50% level of addition .

- NPA 929 Otegbayo, B.O. and Sobande, F.O. (2000). Effects Of Soya Substitution On Physico Chemical Qualities Of Extruded Plantian Snack. **Tropical Oil Seeds Journal. Vol.5.** Pp. 69-78.

The physico-chemical and sensory qualities of extruded plantain snacks fortified with full fat and defatted soy flour were investigated. Snack production involved extrusion of soy-plantain flour blends (1:1 and 1:2) in a single screw extruder of die diameter 8cm operated at standard processing conditions (barred temp 150°C. Screw speed 250 rpm). Analytical data showed that soy fortification had profound effect on expansion ratio, swelling capacity and water absorption index of the extrudates, while extrudates from fullfat soy flour caused further reduction in these physical properties. Sensory evaluation indicated that all the soy fortified plantain extrudates were acceptable to consumers though there was preference for extrudate from defatted soy-plantain blend in terms of volume, crispiness and flavour.

Although the preferred snack has a low fat content, it contained high carbohydrate, ash and protein, which suggest a good potential snack for meeting the protein and energy requirement of pre-school children

- NPA 930 Otolowo, T.D. and Oguntunde, A.O. (2000). Production And Evaluation Of Foam Mat Dried Cowpea Flour For Making Akara. **Nigerian Food Journal. Vol.18.** Pp. 32-41.

Cowpea (*Vigna unguiculata*) was processed into flour using foam-mat drying technique which involves whipping of the cowpea paste to produce foam, drying the foam in thin layers in a forced-drought oven at 70°C and milling into flour. The foam stabilising agents monoglycerol palmitate (MPG) and non-distilled mono- and di-glycerides (MPG) concentration levels of 3%, 40% and 5% (w/w) were added to the cowpea pastes before whipping for 5.75 and 10 minutes. The foam density (before foam drying) and drying time of the cowpea foams were determined. MPG at 40% concentration level (w/w) in cowpea paste whipped for 7.5 and 10 minutes produced the best quality foam-mat dried cowpea flours acceptable for akara making. Foam density, drying time of the foam, foamability and foam stability of the foam-mat-dried cowpea flours were found to be process parameters' dependent. Also the process parameters, frying characteristics and the quality attributes of akara were found to be dependent on one another.

- NPA 931 Oyeniran, J.O. (1970). Microbiological Studies On Maize Used As Poultry And Livestock Feed At Two Research Farms In Ibadan, Western State, Nigeria. **NSPRI Technical Report. No.6.** Pp. 47-56.

Twenty samples of white and yellow maize used as poultry and livestock feed were obtained monthly between September 1969 and June 1970 from the Moor Plantation and University of Ibadan farms. The samples were analysed for their moisture, mould and aflatoxin contents. The moisture contents of many samples were above the maximum level for safe storage (about 13%). There was a similarity between the trends of moisture content and mouldiness of the maize samples. Aflatoxin contents were mostly in the high level of above 1,000 micrograms per kilogram. Twenty mould species were isolated of which only six: *Aspergillus flavus*, *Aspergillus tamarii*, *Absidia corymbifera*, *Penicillium citrinum*, *Mucor pusillus* and *Aspergillus niger* predominated, in that order.

- NPA 932) Oyeniran, J.O. (1971). Microbiological Examination Of Maize From Various Sources Soon After Harvest.
NSPRI Technical Report. No.3. Pp. 27-32.

An account of studies of moisture, mould and aflatoxin contents of maize samples obtained from various sources soon after harvest is given. Discoloured and insect damaged grains were also estimated and their relationship to factors connected with microbiological deterioration is discussed.

Maize left on the cob was less infected by storage moulds than shelled maize even at high moisture levels and it is recommended that maize be left on the cob until it is needed for use or is sufficiently dry to prevent mould development, unless facilities exist for immediate artificial drying.

- NPA 933 Oyeniran, J.O. (1971). A Preliminary Report On The Mycoflora Of Market Rice In Ibadan.
NSPRI Technical Report. No.4. Pp. 33-38.

Rice is an important cereal foodcrop in Nigeria, second only to maize in southern Nigeria. The extent of post-harvest deterioration of this crop in Nigeria has never been determined, yet moisture content studies on market samples do indicate that deterioration is quite possible. This paper reports a preliminary investigation on the mycoflora of some market samples of rice whose moisture contents were found to exceed the safe level (13%) for storage.

Mouldiness as expressed in number of mould colonies per gram of rice was fairly low compared with results of earlier studies on livestock feed maize. Fourteen mould species were isolated from the six rice samples examined. Many of these moulds have previously been found on stored maize and cocoa in southern Nigeria. Three of the moulds isolated: *Mucor rouxii*, *Aspergillus clavatus* and *Penicillium chrysogenum* were recorded for the first time on stored products in Nigeria.

Though *Aspergillus flavus* was present, aflatoxin was not detected in any of the samples analysed.

- NPA934 Oyeniran, J.O. (1973). A Comparison Between The Direct And Dilution Planting Methods Of Isolating Moulds From Grains.
NSPRI Technical Report. No.5. Pp. 39-46.

Two methods of isolating moulds from grains, the direct-plating method and the dilution-plating method, were used to analyse seven samples of maize and six samples of rice for the purpose of comparing these methods.

The results showed that only about half of the mould species infecting the grains were isolated by both methods together. Other species especially the less abundant ones were isolated only by one or the other of the two methods. The frequency of the mould species as estimated by the two methods differed very widely in some cases but seemed to agree in one or two instances. In general it appeared that no one single method is enough to exhaustively isolate moulds from grains. A combined use of various methods, media and temperatures of incubation might be needed to achieve this goal

NPA 935 Oyeniran, J.O. (1972). Effect Of The Relative Humidity Of Storage On The Moisture Content And Internal Mouldness Of Groundnuts. **NSPRI Technical Report. No.6.** Pp. 49-58.

Two experiments to determine the effect of the relative humidity of storage on the moisture content and internal mouldiness of groundnuts are described. In the first, shelled and unshelled groundnuts were exposed to the atmosphere of a laboratory room and that of the laboratory verandah for three months, July to September 1972. The rate of moisture absorption, measured by weight changes in the samples was determined weekly, while the moisture content and internal mouldiness of the groundnuts were analysed monthly. It was found that enough moisture absorption took place in the groundnut samples placed on the verandah, to cause internal mould development in the kernels. This was pronounced in the shelled samples, resulting in an internal mouldiness of 22.8 per cent at the end of storage.

In the second experiment, shelled groundnuts were stored in seven desiccators maintained at relative humidity of about 65%, 71%, 75%, 81%, 90% and 98% using saturated solutions of various salts. Weight changes were measured weekly for one month when the groundnuts reached equilibrium with the atmospheres in the various desiccators. Moisture content and internal mould analyses were carried out at the end of the one-month storage.

These two experiments full demonstrate the ability of both shelled and unshelled groundnuts to absorb moisture when they are exposed to the atmosphere of comparatively high humidity and how this moisture absorption does lead to internal infection by storage moulds.

NPA 936 Oyeniran, J.O. (1973). The Deterioration Of Maize During Storage At Variuos Moisture Contents. **NSPRI Technical Report. No.7.** Pp. 55-60.

Samples of yellow maize at initial moisture contents of 23.1 per cent, 16.6 per cent and 13.0 per cent were stored in loosely screwed kilner jars for

two months. The moisture content, aflatoxin content and mouldiness of the samples were determined at the start and at monthly intervals. It was found that the sample at 23.1 per cent moisture content increased in moisture, aflatoxin and mould contents. By the end of the first month, mould counts had increased from 10^5 to 10^7 colonies per gram. The samples at lower moisture contents kept fairly safe during storage, showing only slight increases in the factors of deterioration measured.

NPA 937 Oyeniran, J.O. (1978). Pre-Storage Infection Of Maize Cobs By Moulds. **NSPRI Technical Report. No.7.** Pp. 65-73.

Studies were carried out on the occurrence and importance of pre-storage mould infection of maize cobs and grains. Infection was influenced by maize disease fungi, wetting of the cobs after maturity and insect damage. Eight mould species were isolated from the maize samples, including storage moulds like *Aspergillus flavus*, *Aspergillus niger*, *Syncephalastrum racemosum* and *penicillium citrinum*.

The significance of this pre-storage infection is discussed in relation to subsequent storage of maize. It is recommended that such cobs should not be included in storage consignments in order to reduce the chances of mould deterioration of the grains.

NPA 938 Oyeniran, J.O. and Shejbal, Kuku, F.O. (1979). Microbiological Studies On Maize Stored In Sealed Mini-Silos Filled With Nitrogen. **NSPRI Technical Report. No.1.** Pp. 27-34.

Yellow maize grains of 12.7% moisture content was stored in 2 metal silos each of about 0.65m³ capacity. The oxygen in the interstitial atmosphere in the metal silos was replaced with nitrogen gas which was maintained in the silos for a period of 10 weeks. A quantity of the maize was stored in unsealed metal drums to serve as controls. Samples of the maize stored were drawn at the start and after 4 and 10 weeks storage for moisture content and microbiological analysis. The moisture content of the maize at the start was 12.7%, having been reduced by artificial drying from the level of 20% at which it was obtained from source of supply. This moisture content level was maintained at about 13% in the sealed silos but rose very steadily to 17.2% in the unsealed controls. Moldiness of the maize as determined by dilution planting analysis was 9.9×10^5 colonies per gram of maize in the initial samples. While this mouldiness increased substantially to an average of 2.5×10^7 in the controls, maize in the mini-silos maintained about the same level of mouldiness as the initial sample. Seven mould species were isolated from the maize out of which

three were most prominent in the initial as well as in many of the samples taken during the experimental storage . These were *Aspergillus flavus* Link, *Fusarium moniliforme* Sheld . and *Aspergillus niger* v . Tieghem .

- NPA 939 Oyolu, C. (1977). A Quantitative And Qualitative Study Of Seed Types In Egusi (*Colocynthis-Citrullus* L.). **Tropical Science**. Pp. 55-62.

Five seed types of egusi (*Colocynthis citrullus* L.) were studied to determine their extraction rates and the chemical composition of kernels. These had an average of 53 per cent oil and 5.75 per cent oil total nitrogen. They were fairly rich in carbohydrates (soluble sugars plus starch) and in phosphorus, potassium and magnesium. All the chemical components taken together did not appear to vary significantly between the five seed types. The main difference between the seed types was in the rate of kernel extraction from the seed; this was largely determined by seed coat thickness and texture. The kernel is considered to be an important dietary item, because of its protein. The increased production and use of egusi seed is advocated, and one of the five seed types is recommended for commercial production..

- NPA 940 Ozumba, A.U., Olatunji, O.O. and Odunfa, S.A. (1999). Quality Assessment Of Some Soya Enriched Mixes For Cookies And Waffle Production. **Proceedings Of 23rd Annual NIFST Conference**. Pp. 214-216.

Sensory evaluation results showed preference for sample containing 5 and 10% soybean flour , while at 15% samples were unacceptable in texture and aroma . It was also indicated that 5% soy enrichment was best for cookies while 10% enrichment was ideal for the waffle production . The samples were found to be quite acceptable to the tasters .

- NPA 941 Onolemhemhen, P.O., Bossey, E. and Okaka, V.B.(1999). Assessment Of Soybean Oil And Fenosan D For The Control Of *Callosobruchus maculatus* Fab
Niger Agricultural Journal. Pp. 41-48.

Effects of Soybean oil and Fenosan D used as surface protectants against *Callosobruchus maculatus* F. infestation were studied.

Admixture of soybean at the rates of 1,5 and 10 ml kg⁻¹ of cowpea seeds, effectively controlled adult *C. maculatus* infestation. At 5-10ml kg⁻¹, 100% mortality was recorded 3-4 days after treatment but it took 6 days after treatment, with 1 ml kg⁻¹ Soybean oil also impaired oviposition by female *C. maculatus* and significantly affected offspring emergence. Only 1.7% to 8.3% of the eggs deposited in 10ml kg⁻¹ treatment seeds emerged as adult weevils, as against 12.6% for 5ml kg⁻¹ and 54.23% for 1ml kg⁻¹. About 100% of the eggs deposited in the control emerged as adult weevils. Albino rats fed on seeds treated with soybean oil, externally showed no signs of ill health and all their organs examined at the end of the experiment showed no abrasions or damage. The rats showed appreciable gain in body weight.

Fernasan D. at the rates applied recorded 100% kill within 24h and effectively impaired oviposition and adult weevil emergency.

- NPA 942 Patrick, N. Okoh. (1998). Cereal Grains.
Nutritional Quality Of Plant Foods. Pp. 32-52.

The problem of malnutrition can be solved through efficient and effective food crop utilisation. although cereals are utilized in a variety of ways in Nigeria, information on the effect of processing practices on nutritional composition is scanty.

- NPA 943 Petters, H.I. (1999). Antimicrobial Property Of Two Varieties Of *Sorghum bicolor* Extracts On Pathogenic Microorganism.
Proceedings Of 23rd Annual NIFST Conference. Pp. 55-57.

The crude extracts from two varieties of sorghum bicolor had an inhibitory effect on four pathogenic bacteria and a yeast isolate. The extracts from the rootlets of a 5-day germinated grain showed more inhibitory effect on organisms than the other portions. This antimicrobial effect if properly made use of can be advantageous in preservation of food and in manufacture of drugs.

- NPA 944 Philippa, C. Ojmelukwe (1999). Protection Of Stored Grains Against Insect Pests Using Phytochemicals 1: Insecticidal Effects Of 1,8-Cineole, Eugenol And Dill. *Proceedings Of 23rd Annual NIFST Conference.* Pp. 43-44.

Eugenol was the most effective phytochemical 10 microlitre / ml Eugenol was able to cause 100% mortality of *C. chinensis* within 24h, Higher

dosage levels were required to achieve 100% mortality of other insects , 1 , 8-Cineol and linalool also showed insecticidal and repellent properties against test insects but they were not as effective as eugenol. Eugenol also protected stored grains for longer periods than 1 , 8- cineol and linalool .

- NPA 945 Popoola,T.O.S. and Akueshi, C.O. (1986). Microorganisms Associated With The Fermentation Of Soyabean For The Production Of Soyabean "Daddawa" (A Condiment
Nigerian Food Journal Vol. 1,2,and3 Pp194-196.

Soyabean seeds were fermented for the production of 'Daddawa'' [a condiment] using traditional methods to isolate and identify microorganisms involved in the fermentation. Three bacterial species belonging to the genera of *Bacillus*, and staphylococcus were found associated with the fermentation of soyabean seeds for daddawa production. In the microbial succession observed, a species of *Bacillus* was found to be present throughout the fermentation period while the staphylococcus sp. occurred only the last three days of fermentation. A laboratory method of soyabean daddawa production which simulated the traditional method of production. Butried out with glasswaters, under aseptic conditions and acceptable to the industries is herein described and discussed.

- NPA 946 Prevett, P.F. and Asham, F. (1991). Tackling Storage Problems.
Nigerian Agricultural Today. Vol.2. No.1.Pp12-

Recommendation was made in respect of getting solutions to storage problems .

- NPA 947 Qureshi, A.H. and Riley, J. (1967). Studies On The Fumigation Of Bagged Groundnuts With "Phostoxin" In Railway Waggons.
NSPRI Technical Report. No.10. Pp. 99-103.

The fact that detector tubes reading down to 0.1 ppm , revealed no trace of phosphine when wagons were opened in Apapa suggests that in spite of the sealing attempted there was still some ventilation which would be accentuated by the movement of the train .

NPA 948

Qureshi, A.H. and Opadokun, J.S. (1972). A Rapid Method For The Determination Of Oil Contents Of Groundnuts And Its Comparison With The Soxhlet Extraction Method
NSPRI Technical Report. No.3. Pp. 31-38.

A comparison of the soxhlet method of oil extraction with a more rapid method involving the use of a high speed blender with n-hexane as the solvent suggests that the more rapid method produces the same result as the soxhlet method, but only if great care is used and allowance for evaporation of solvent is made

NPA 949

Sanni, L.O. and Akinlua, O. (1996). Chemical, Physical, Physicochemical And Sensory Qualities Of Soy Lafun.
Nigerian Food Journal. Vol.14. Pp. 30-36.

The chemical physicochemical and sensory qualities of lafun blended with full far soy flour at 80:20 ratio were studied. Storage studies of soy lafun was also carried out. Soy lafun was very rich in protein, fat, crude fibre, ash and water binding capacity while the amylose content, and amylograph pasting viscosity of lafun were higher. The specific heat capacity, angle of repose and bulk density of soy lafun were 1.63 KJ/Kg^ok, 44.80°, 0.39 g/dm³ respectively. There were no significant differences in the sensory qualities of lafun and soy lafun (P<0.05.] There were no appreciable increases in the pH of soy lafun during storage.

NPA 950

Sanni L.O. and Oyewole, O.B. (2000). The Effects Of Controlled And Uncontrolled Solar Drying Temperatures Heat Fluxes Proximate Composition And Functional Properties Of Soybean.
Tropical Oil Seed Journal. Vol.5. Pp. 62-68.

The effects of controlled and uncontrolled solar drying on the drying temperatures, heat fluxes, proximate composition and functional properties of soybean were investigated. Maximum temperatures, relative humidity, and solar heat fluxes were 63°C, 62%, 718Wm⁻² and 36°C, 78%, and 510Wm⁻² for controlled and uncontrolled solar drying respectively. Moisture contents of controlled solar-dried samples reached minimal level faster (180.0 to 7.0% m.c. dry basis) than uncontrolled solar-dried samples (180.0 to 11.0% m.c. dry basis). Drying methods, did not appreciably change the proximate composition and bulk density (0.66 ± 0.12g/cm³) of soybean, but samples dried under the

controlled system recorded higher gelation capacity ($16.0 \pm 0.1\%$), water and oil absorption capacity ($3.98 \pm 0\%$ and $1.74 \pm 0.3\%$ respectively) compared with sun-dried samples ($3.00 \pm 0.1\%$ and $1.58 \pm 1.58 \pm 0.3\%$ respectively).

NPA 951

Solomon, B.O. (1987). Microbial Conversion Of Hydrolysed Maize And Sorghum Dusts To High Protein Food. **Nigerian Food Journal. Vol.5.** Pp. 1-11.

In this work, microbial utilization of maize and sorghum dusts was investigated. The starch in the grain dust samples of the hydrolysis products were fermented in shake flasks. Microbial growth and protein yields were measured and compared with literature values as well as with maximum theoretical values. Average growth yields of 0.50 and 0.49 g cells/g glucose were obtained for filtered glucose from maize and sorghum dusts respectively. For unfiltered substrates, cell yields of 0.43 and 0.45 g cells/g glucose were obtained for maize and sorghum dusts respectively. The values for the filtered substrates resulted in protein-enriched products with 31% and 20% protein for maize and sorghum dusts respectively. This type of microbial action may be useful for protein-enrichment of gari and cassava.

NPA 952

Simmons, E.A. and Riley, J. (1967). An Assessment Of Various Packaging Materials For Packing Cowpeas (*Vigna Unguiculata*). **NSPRI Technical Report. No.14.** Pp. 123-125.

It shows that the simple polythene pack is quite satisfactory for the storage of cowpeas so long as it is in a clean environment and the cowpeas are totally Disinfested . If the pack rests on infested food little or no protection will be offered and in such cases a heavier laminated pack incorporating paper would be better . The latter type of pack would however be uneconomic for beans but could be used for processes foods of higher value .

NPA 953

Sowumi, O. (1978). Effects Of Butylated Hydroxytoluene On The Growth And Aflatoxin Production By *Aspergillus flavus* (Link Ex FR). Grown On Maize. **NSPRI Technical Report. No.1.** Pp.81-85 .

The effects of butylated-hydroxy-toluene BHT (a common additive of commercial food products) on the growth and aflatoxin production by *A. flavus* growing on moist maize were studied. The growth of *A. flavus* was depressed by the addition of BHT. The growth (expressed as mycelial dry weight) was proportional to the concentration of BHT used and it fell from 2.38g for the control (using no antioxidant) to 1.66g at an antioxidant level of 200mg/g. Under the conditions of the experiment, aflatoxin B1 was more abundantly produced than aflatoxin B2 and its production was more effectively depressed by the addition of BHT. Percentage decrease in aflatoxin production ranged from 10.34% at BHT level of 50mg/g to 36.2% at BHT level of 200mg/g. The results indicate that BHT has the properties of depressing the growth of and suppressing aflatoxin production, by *A. flavus*.

NPA 954

Sowumi, O. (1978). Phosphine Residues On Cowpeas Fumigated With Phostoxin Tablets.
NSPRI Technical Report. No.8. Pp. 75-79.

Fumigation of cowpea was carried out in polythene-lined hessian sacks with phostoxin at the rate of 1, 2, 3 and 4 tablets per bag. A control with no treatment was also run at a parallel. In all treatments, data show that residue levels were well below tolerance limits of 0.1 ppm established for crops such as maize and in the 1 and 2 tablets per bag, residue values were below tolerance limits established for flour. The necessity of running a control experiment during phosphine residue analysis is discussed.

NPA 955

Sowumi, O., Shejbal, J., Akinnusi, O.A. and Oyeniran, J.O. (1979). Biochemical Composition Of Cowpea (*Vigna-Unguiculata*, L.) Stored Under Nitrogen In Metal Mini Silos In Nigeria.
NSPRI Technical Report. No.4. Pp. 49-55.

Biochemical analyses were carried out on cowpea [Ife brown variety] stored under nitrogen in airtight metal silos and cowpea stored in non-airtight 44-gallon metal drums. The proximate constituents. Various sugar contents as well as the quantity of oil expressed from the samples indicated that the crops stored very well under nitrogen for the three month period. In the control sample stored in air, there was an

increase of about 37% of the initial moisture content as well as other food component changes which indicated biodeterioration. The technological advantages of nitrogen during the storage of cowpea in airtight metal containers when pesticides and other protective measures are not used appear established.

NPA 956

Sowumi, O. and Chukwudebe, A. (1979). The Use Of Organic Acid In The Preservation Of High Moisture Maize. **NSPRI Technical Report**. No.2. Pp. 35-44.

Yellow maize, conditioned to 30% moisture content was treated with organic acids and stored for two weeks. The acids were: Acetic, Propionic and Butyric acids, applied singly and in combinations. A control, also at the same moisture level but with no acid treatment, was parallelly set up, Biochemical and Nutritive characteristics of the maize were analyzed before and after storage.

Acid treatment did not significantly affect the proximate composition of the maize, neither did it significantly alter the free fatty acidity of the oil expressed from the maize. Acid treatment, especially at the over 1 per cent levels increased the concentrations of free (amino) acids with lysine increasing from 0.115g/16gN to 0.23g/16gN; alanine from 0.1g/16gN to 0.22g/N methionine from 0.002g/16gN to 0.098g/16gN. In addition, the application of organic acids caused significant increases in the total reducing sugars and maltose contents. Assessment of protein quality by feeding trails revealed that rats fed on organic acid treated maize showed a slight decrease in feed intake but there was no significant difference in body weight gain. The rats also showed no significant differences ($P > 0.05$) in Apparent and True digestibility values.

The significance and possible explanations to the biochemical and nutritional alterations in acid-treated maize are discussed

NPA 957

Sowumi, Ekundayo, Olabode (1981). Bio-Chemical And Nutritional Changes In Maize (*Zea-Mays*, Linn.) And Cowpea. (*Vigna Unguiculata* (L.) Walp) During Storage.

Submitted To The Department Of Animal Science, Faculty Of Agriculture And Forestry In Partial Fulfilment Of The Requirements For The Degree Of Doctor Of Philosophy Of University Of Ibadan. Pp. 1-412.

Biochemical and nutritional studies were carried out to assess the effects of length and method of storage as well as insecticide

treatment on maize (Western Yellow variety) and also on the effect of storage length and insecticide treatment on cowpea (Ife browh) stored in polythene-lined jutebags. The crib and polythene-lined jutebags were the storage structures used for maize and pirimiphos – methyl was the insecticide employed.

Phostoxin and pirimiphos-methyl were the insecticides used in preserving cowpeas. In both cases, storage spanned twelve calendar months. Maize and cowpea samples, drawn monthly for the first eight months and bi-monthly thereafter till the end of storage, were analysed for levels of insect infestation, percentage kernel damage and germinability as well as weight-to-volume ratio.

Became more severe as storage period lengthened. Aflatoxin level of 1,000 ppb was encountered at the end of the 12 –month storage in maize stored in crib, while in cowpea stored without any insecticide treatment, aflatoxin level of 1,650 ppb was detected after five months in storage.

There was no incidence of aflatoxin contamination in maize stored in polythene-lined jutebags and in cowpea stored in same container with phostoxin and pirimiphos-methyl.

NPA 958

Sowumi, O. (1981). Effect Of Maturity On The Nutritive Value Of Yellow Maize.

NSPRI Technical Report. No.5. Pp. 57-62.

Thirty maize ears were sampled at regular, two-weekly, intervals until full matured. The initial moisture content was used as the index of maturity for each sample consignment.

Proximate and vitamin analyses as well as nutritional evaluation by feeding trials were carried out. Ether extract and crude fibre increased as maturation progressed while moisture content decreased. Although crude carotene increased with improved maturation, riboflavin and niacin decreased.

Feeding trials showed a gradual increase in PER, NPR, PRE and NPU values as maturation progressed. Apparent and True digestibilities also increased with maturation. Mature maize kernel is considered more nutritive than immature kernels

NPA 959

Sowumi, O. (1982). The Degradation Of Pirimiphos Methyl Applied To Stored Yellow Maize In Southern Nigeria.

NSPRI Technical Report. No.1. Pp. 27-31.

Maize (Western Yellow variety FARZ 7) was stored outdoor in the crib and indoor in polythene-lined jutebags treated with pirimiphos-methyl insecticide at 20ppm and 10 ppm dosages respectively in the two storage structures. Samples were drawn monthly throughout the period of storage and analysed for insecticide residue. The results indicated a gradual degradation of pirimiphos-methyl, as storage period lengthened, which was more dramatic in crib storage than in polythene-lined jutebags. The insecticide had degraded by about 70% of the initial in the cribs at the end of the 5th month of storage and had barely reached half-life in maize stored in jutebags at the end of twelve storage.

NPA 960

Sowumi-, O., Fetuga, B.L. and Agboola, S.D. (1982). Changes In Some Chemical Quality Factors Of Oil Of Stored Cowpea Treated With Insecticides.

NSPRI Technical Report. No.4. Pp. 53-62.

The protective effects of two insecticides (Pirimiphos-methyl dust and Phostoxin tablet) on the lipid constituents of cowpea stored in polythene-lined jutebags and placed on raised platforms were assessed in comparison to a non-treatment control. The parameters measured included: free fatty acidity (f.f.a) peroxide value (PV); anisidine value (AV); "totox" value (TV) and the individual fatty acid components. These were determined on oil from samples drawn monthly for the first 8 months and bimonthly afterwards till the end of the 12-month of storage. FFA, PV, AV and TV increased in the oils of the non-treated cowpeas. These increases were more pronounced as the storage period lengthened. Palmitic (23%); oleic (28.5%) and linolenic (20%) acids were the prederant fatty acids in cowpea. Palmmitic and stearic acids decreased, while oleic acid increased significantly ($P < 0.001$) with deterioration in the cowpea samples

NPA 961

Sowumi, O.E. and Akinnusi, O.A. (1983). Studies On The Use Of Neem Kernel In The Control Of Stored Cowpea Beetle (*Callosobruchus maculatus*).

Tropical Grain Legume Bulletin.No 27 Pp. 28-30.

An extension of the basic finding from this work in traditional storage practice to the wider community, should be made where insecticides are used in household, village crop storage holdings and smallstores and where basic, simple and adequate storage technology is required.

NPA 962

Sopade, P.A. and Legrys, G.A. (1991). .An Investigation Into The Effect Of Extrusion Cooking On The Properties Of Maize Starch Extrudate.

Nigerian Food Journal.Vol.9. Pp. 49-67.

A pilot-scale APV Baker MPF 50 twin-screw extruder was used to investigate the effect of extrusion-cooking on maize starch. The study revealed that the powdery feed changed into a dough-like material before being melted prior to extrusion at the die. The important variables on the extruder response and the characteristics of the extrudate were barrel temperature, feed moisture content and screw speed. An increase in temperature decrease the pressure . The transverse expansion , which reduced with an increase in moisture content, was enhanced by the pressure . An increase in the temperature increase the longitudinal expansion starch gelatinisation was complete all the conditions studies.

NPA 963

Storing Your Produce, Maize (1982).

NSPRI Advisory Booklet. No.1.

The following were highlighted ; family level storage , storage at village level , medium to large scale storage in bags and silo storage .

NPA 964

Suberu, H.A. (2001). Nutrient Composition Of Soybeans Fermented With A Mixed Culture Of *Bacillus Subtilis* And *B.Licheniformis*.

Nigerian Journal Of Botany. Vol.14. Pp. 25-34.

Quantitative changes in the nutrient composition during the fermentation of soyabeans by a mixed culture of *Bacillus subtilis* and *B. Licheniformis*, for the production of a condiment, were investigated. Significant amount at $P > 0.05$, of total soluble protein (356mg/g), free amino acids (354mg/g), organic acid (3.5 molar acidity), and ammonia (1.18milli mol/ml) were developed with fermentation compared to the unfermented soyabeans. Total sugars decreased progressively from 43.3mg/g at 0h to 24.3mg/g at 72th of the fermentation, and the lipids decreased from 117.3mg/g at 0h to 71mg/g at 0h to 24.3mg/g at 0h to 71mg/g after 30h. A record level of ash content, 47.8mg/g at 0h decreased to 38.05mg/g after 30h fermentation. Increase in the reducing sugar content was not significant. The condiment obtained seems

to be of higher nutritive quality, especially at 20 to 30 of fermentation than the unfermented soyabeans

NPA 965

Tehinse, J. F. and Ogundiwin, J. O. (1978). A Study Of Some Quality Characteristics Of Okika - A Traditional Alcoholic Beverage From Guinea Corn. (NIFST). **Proceedings Of 2nd Annual Conference. Vol.2.** Pp. 61-70.

A wort infusion which was obtained from a malted sorghum (*Sorghum guineense*) was inoculated with cultures of *Saccharomyces cererisiac* (baker's yeast), *S.carlsbergensis* (brewer's yeast) and cultured palm wine tub respectively. The inoculated samples, which were incubated at 50°C, 20°C and 30°C, were compared for their duration of fermentation, residual reducing sugar, developed acidity, colour changes, alcohol content and flavour scores.

The apparent duration of fermentation varied with temperature ranging from about 20hr at 30°C to about 14 days at 5°C. The residual reducing sugar was highest at the lowest temperature for all samples. Increase in the lactic acid, alcohol content and intensity of discoloration was highest at 30°C.

The analysis of variance of the taste panel scores showed significant difference between temperatures at 95% level. The fermented products at 20°C appeared most preferable.

NPA.966

Talabi, A.E. (1996). Grains Reserve Strategies. **Proceedings Symposium On Irradiation For National Development Sheda Science & Technology Complex.**Pp. 90-96.

This paper discusses the eminent position of food as an economic and nutritional commodity and the need for its year round ready availability inspite of the seasonality of its production. Food security and its international political dimensions are examined. The National Grain Reserve Scheme vis-à-vis policy implementation strategies, constraints and future perspectives are analysed.

The paper concludes that it is desirable for Nigeria to maintain an adequate Food Reserve Stock, irrespective of the prevailing level of self-sufficiency, in order to provide food security for its citizens and maintain its leading role in the West African sub-region.

NPA 967

Turaki, J.M. and Buahin, G.K.A. (1999). Studies On Oviposition And development Of Cowpea Bruchid, *Callosobruchus maculatus* (F) On Different Varieties Of Cowpea *Vigna Unguiculata*(L) Walp.
Bioscience Research Communications. Vol.11. No.3. Pp. 227-233.

Laboratory studies on oviposition and rate development of *Callosobruchus maculatus* were used as bases to screen ten high yielding cowpea varieties for pest resistance. Ambient condition in the laboratory were 34 ± 0.15 °C and 25 ± 0.18 % Relative Humidity [RH]. There was a significant [$p < 0.01$] difference in attractiveness of rough- and smooth- seeded varieties for oviposition by the weevil. Fewer eggs laid on varieties IT-88D-867-11, 88D-643-1 and IT-90k-59-2. These varieties recorded averages of 1.2 ± 0.15 , 1.4 ± 0.16 and 1.5 ± 0.15 eggs / seed accounting for 70.7%, 65.9% and 63.4% reduction in oviposition, respectively, when compared with variety 91X-91-11 which recorded the highest mean number of eggs / seed of 4.1 ± 0.18 . Varieties 91x-91, 1190x-284-2 and IAR 48 [SAMPEA 7] were significantly more susceptible [$P < 0.05$]. The ten varieties also differed their suitability for development of *C. maculatus*. Susceptibility index [1.7 ± 0.7] for the most resistant variety. IT-88D-867-11 was more than two times lower than the susceptibility index [4.0 ± 0.17] of the most susceptible variety, 90x-284-2. Similarly, more than 2-fold difference was obtained in terms of percent adult emergence from IT-88D-867-11 when compared with 90x-284-2 from which values of 15.7 ± 1.26 and 35 ± 1.26 were obtained respectively. Length of development was significantly [$P < 0.05$] shorter in IT-90k-59-2 [33.5 ± 1.06] than in IT-88D-867-11 [38.7 ± 1.06].

NPA 968

Uvah, I. I. Ogunbile, A. O. And Ahmed B. (1991). Efficacy Of Some Insecticides For Control Of Storage Insects Of Cowpea, Maize And Sorghum Under The Farmer's Storage Conditions.
Appropriate Agricultural Technologies For Resource Poor Farmers. Pp. 101-108.

On-station proven storage chemicals, chlorpyrifos-methyl and fenitrothion dust formulations, were compared with the traditional storage chemicals, lindane, aluminium phosphide and pirimiphos-methyl dusts, against insect pests of maize, sorghum and cowpea grain under farmer's storage conditions during 1987 and 1989. The results indicated that fenitrothion (sumithion 1.5% dust) was

most effective for control of storage insect pests of maize and sorghum but not cowpea grain. Chlorpyrifos-methyl, lindane and pirimiphos-methyl were less effective in this regard. Although aluminium phosphide gave greatest reduction of infestations of *C. maculatus* on cowpea, such control could not be sustained under the traditional farmer's storage system in jute bags. Further investigations including economic analysis are continuing against maize and sorghum storage insects during 1990

NPA 969

Ubani, O.N., William, J.O., Opadokun, J.S., Ikeorah, J.N. and Akano, O.A. (1985). Storage Of Melon Seeds In Various Containers.
NSPRI Technical Report. No.7.Pp. 55-58

Unshelled melon seeds were fumigated and stored in five different types of containers (air tight metal drum air tight plastic bucket, clay pot, polythene-lined jute bag and jute bag) for 10 months. From physical observations, chemical, microbiological and entomological analyses, the clay pot and jute bag proved to be inadequate for storage of melon seeds over a long period

NPA 970

Ubani, O.N. and Okoye, W.I. (1999). Effect Of Pesticide-Treated Maize Based Diet On The Performance And Physiopathology Of Wistar Albino Rats.
Proceedings Of 23rd Annual NIFST Conference. Pp. 50-51.

The result showed there was no evidence that either pirimiphos methyl or its metabolites accumulated in the liver, kidney or fat of rats following daily dosing with insecticide for 4 days. The observations in the present study suggest possible toxic effects on the animals following ingestion of the pesticide over a longer period.

NPA 971

Udensi, A.E., Onwuka, G.I. and Eze, A.I. (1999). Effect Of Blanching And Drying Temperature On The Functional Properties Of Bambara Groundnut (*Voandzeia Subterranea*).
Proceedings Of 23rd Annual NIFST Conference. Pp. 191-192.

The result showed that soluble solids and fat absorption capacity increased with increase in blanching time and drying temperature. Foam capacity decreased with blanching time and drying temperature as shown in Table 1. There was no marked difference in water absorption, capacity emulsion

capacity , viscosity at the various blanching times and drying temperatures .

NPA 972

Udensi, E.A. and Okaka, J.C. (1999). Effect Of Processing On The Wettability Of Cowpea Flour.
Proceedings Of 23rd Annual NIFST Conference. Pp. 196-198.

The study shows that blanching for 6 minutes or more and milling to a particle size of 425nm will produce cowpea flour with high wettability .

NPA 973

Udensi, E.A. and Okaka, J.C. (2000). Predicting The Effect Of Blanching Drying Temperature And Particles Size Profile On The Dispersibility Of Cowpea Flour.
Nigerina Food Journal. Vol.18. Pp. 25-31.

The effect of blanching, drying temperature and particle size profile on the dispersibility properties of cowpea flour was studied. Cowpea flour was processed by blanching for 0, 3, 6, and 9 mins. and drying at 60, 80, and 110oC, then milled and separated on sieves at 425, 180, 150 and 75nm before studying in model systems. Regression analysis was used to fit data generated in the study to first order relationship to circumvent the problem of non-linearity of primary data. Blanching and particle size were found to affect the disperibility properties followed apparent first order kinetics and the rate constants correlated highly. Results obtained after first order mathematical modelling showed high correlation (0.83-0.99) in nearly all cases between the independent and response variables, suggesting that mathematical manipulation of experimental responses may enhance the predictive potential of the data on the effect of processing conditions on the dispersibility of a particular variety of cowpea.

NPA 974

Umechuruba, C.I. and Nwanchukwu, O. Eunice (2002). Long-term Survival And Pathogenicity Of Seed-Borne Fungi On Soyabeans Stored At 5°C.
Tropical Science. Vol.42. Pp. 42-45

Eleven soyabean cultivars were tested for fungi before and after storage at 5°C for 10 years. Six storage fungi, *Aspergillus flavus*, a member of the *A. glaucus* group, *A. niger*, *A. terreus*, *Penicillium oxalicum* and *Rhizopus stolonifer*, and five field fungi,

Chaetomium globosum, *Collectrobtichum dematium* var. *truncatum*, *Fusarium ooxysporum*, *Macrophomina phaseolina* and *Phomopsis sojae*, were found. In 2000, all except the *A. glaucus* sp. were recovered. The field fungi were pathogenic. The germination rate was increased after storage in nine of the 11 cultivars

NPA 975 Umoh, V.J., Yusuf, Z.I. and Ahmed, A.A. (1995). Antibigrams Of *Bacillus cereus* Isolates From Flour, Commonly Used In Stiff-Poridge Preparation. **Nigerian Food Journal**. Vol.13. Pp. 31-39

Three hundred [300] flour sample were assayed for *B. cereus*, 295 [98.3%] were conterminated and 250 isolates were obtained. The isolate were confirmed as *B. mycoides* based on their reaction to biochemical tests. Thirty-three toxigenic, 39 non-toxigenic and 113 other strains not tested for toxigenicity were subjected to antimicrobial sensitivity tests. only 2[6.1%] and 17 [11.2%] of the toxigenic and other strains respectively were resistant to erythromycin, 2[6.1%] and 17[11.2%] to chloramphenicol, 4[12.1%] and 19[12.5%] to streptomycin. Over 80% of all the isolates tested were resistant to ampicillin, penicillin, cloxacillin and cotrimoxazole. The implication in the treatment of *Bacillus* infection is emphasized.

NPA 976 Williams, J.O., Adesuyi, S.A. and Falomo, D.A. (1978). Comparative Effectiveness Of Different Doses Of Damfin Aand Permethrin Insecticides For Protecting Maize Stored In Ventilated Cribs From Infestation. **NSPRI Technical Report. No.5**. Pp. 51-55.

The efficiency of dusts formulation of Damfin and Permethrin at 5, 10 and 20 ppm dosages for controlling insect infestation of maize on the cob stored in cribs was investigated. From samples analysed monthly for insect damage seed viability and weight loss, it was found that 10 ppm Permethrin was suitable for protecting maize in storage for 6 months. Damfin at the highest dosage of 20 ppm was found unsuitable.

NPA 977

Williams, J.O. (1979). Effect Of Treating Maize With Black Pepper, (*Piper Nigrum*. L.) On The Maize Weevil (*Sitophilus Zea Mals* Mot).

NSPRI Technical Report. No.3. Pp. 45-48.

Ground components of Black pepper, *Piper nigrum* L. when used to surface treat a variety of maize susceptible to maize weevil, were found to be toxic to some extent to the Nigeria strain of maize weevil, *Sitophilus zeamais* (L). More F1 progeny were however, also recorded from the maize. The pepper components seemed to stimulate gravid female insects to lay more eggs before death. Even at the highest dosage of 500mg. of ground pepper per 10gms of maize, no significant insecticidal activity was recorded, for the immature stages of *Sitophilus zeamais*

NPA 978

Williams, J.O. and Mills, R.B. (1980). Influence Of Mechanical Damage And Repeated Infestation Of Sorghum On Its Resistance To *Sitophilus oryzae*(L).(Coleoptera:Curulionidae).

Journal Of Stored Product Research. Pp. 51-53.

Abrading the pericarp rendered resistant sorghum cultivars as susceptible as abraded susceptible cultivars to attack by *Sitophilus oryzae* (L.) A previous exposure of sorghum cultivars to *S. oryzae* broke down pericarp resistance factor(s). Damage to sorghum kernels during harvesting and handling could therefore destroy resistance to rice weevil attack.

NPA 979

Williams, J.O., Mbata, G.N. and Adesuyi, S.A. (1981). A Comparison Of Two Formulations Of Phosphine For The Fumigation Of Maize In Hermetic Conditions.

NSPRI Technical Report. No.2. Pp. 41-46.

The efficacy of two tablet formulations of Aluminium phosphate (“Celphos” and Phostoxin”) was tested and compared against some insect pests of maize of 13.5 m.c. stored hermetically. From the trials it was established that a dosage of 6.6 mg/l of the two formulations was found satisfactory for disinfestation of maize against *Sitophilus zeamais*, *Tribolium castaneum* and *Trogoderma Trogoderma granarium* within 24 hours while for exposure period of 12 hrs, 10.5 mg/l was required to give 100% mortality of *Sitophilus zeamais*, *Rhi-opertha dominica* and *Plodia interpunctella*. Insects treated with fumigants laid eggs while dying. Most of these eggs gave rise to viable progenies that were able to re-infest the maize.

The activity of 'Celphos' and 'Phostoxin' in disinfesting maize was equal. They could be used interchangeably

NPA 980

Williams, J.O., Odeyemi, O.O. and Akinnusi, O.A. (1982).
Studies On Insect Pest Of Cocoa Beans And Groundnut Stored
Stored In 4-Tons Metal Silos Filled With Nitrogen.
NSPRI Technical Report. No.14. Pp. 131-135.

Cocoa beans and groundnuts of initial moisture contents of 5.5% and 8.4% respectively were stored in metal silos of 4-ton capacity. The air in the interstitial spaces of the stored commodity was replaced with nitrogen gas. The commodities were stored for about 12 months. Some quantity (500gm) of cocoa and groundnuts were stored in 1-litre size kilner jars and –put in the entomology rearing room as control. From the samples drawn (1st month, 6th month and 12th month) the moisture content of both commodities rose above safe storage level (7%) at the top of the silo while the middle and bottom samples maintained fairly stable moisture throughout the 12-month storage period. This however resulted in discoloration of the commodities at the top of the silos. No live insect was found after the first month of storage in nitrogen while the different insect species developed and multiplied in the control sample stored in air. This report also gives the checklist of insect species sieved from the commodities and their relative abundance

NPA 981

Williams, J.O., Odeyemi, O.O, and Mbata, G.N (1982). Survey Of
Insect Problems Of Stored Cowpeas And Groundnuts From Kwara,
Niger, Oyo and Ondo States Of Nigeria.
NSPRI Technical Report. No.6. Pp. 69-76.

The survey reveals that insect damage to cowpea and groundnut was higher during the rainy season than the dry season, when the moisture content of the commodities were between 12% to 13% and 8% respectively. The survey also showed that insect pests of cowpeas were abundant throughout the year. The type, however, varied from season to season. Moisture reduction in these commodities might be very important in decreasing insect number and consequently discouraging insect damage of the commodities.

NPA 982

Williams, J.O. and Akinnusi, (1983). A Protection Package Flour
From Insect Infestation.
NSPRI Technical Report. No.5. Pp. 49-51

Yam flour packaged in polyethylene bag was protected from insect infestation when it was stored in Actellic (Pirimiphos methyl) – treated brown paper bag. Woven polyethylene and untreated brown paper bags did not protect yam flour from infestation during the 14 week storage period. The species of insects that infested the flour within the bags were *Tribolium castaneum* and *Lasioderma serricornis*.

NPA 983

Williams, J.O. and Onasile, A.O. (1984). Field Trials With Deltamethrin Dust For The Control Of Insect Infestation On Stored Maize In Nigeria.
NSPRI Technical Report. No.4. Pp. 47-54.

Deltamethrin dust was effective in controlling insect pest damage during a field trial using maize on cob stored in crib in Southern Nigeria. The viability of the treated seeds was not affected: A treatment level of 2.5 ppm Deltamethrin gave comparable protection as 10 ppm pirimiphos methyl from insect damage over a storage period of 9 months.

NPA 984

Yahaya, A. and Agina, S.E. (1996). Laboratory Production Of A Nigerian Local Beverage (TSIMI) Using *Saccharomyces cerevisiae*.
Bioscience Research Communications. Vol.8. No.4.Pp. 279-282.

The suitability of using *Saccharomyces cerevisiae* culture as a source of improving the alcoholic content of a Nigerian local beverage (“Tsimi”) was investigated under laboratory-controlled condition. The product was made from flavouring spices and fermented for 4 days at 27-30°C. The specific gravity was within the range of 1.0610 and 1.0670 with distilled alcoholic content of 14.0% (v/v). The pH dropped from 4.20 to 3.12. Seven fungal species were isolated from the spices. These include *Aspergillus spp.*, *Rhizopus stolonifer*, *Penicillium nigricans*, *Neurospora sitophila* and *Saccharomyces cerevisiae*. The volume of carbon dioxide released was proportional to the viable cells of *Saccharomyces cerevisiae*. None of the panel of tasters complained of any discomfort. “Tsimi” is comparatively as good as other alcoholic beverages such as “Burukutu” and “Pito

NPA 985

Yere, K.A. (2001). Strategic Grains Reserve Programme Of The Federal Ministry Of Agriculture And Rural Development. **Nigerian Agricultural Engineer.A Journal Of Engineering And Technology For Food, Agriculture And Environment.** Pp. 16-17.

The paper highlights the objective of the strategic grains reserve [SGR], some technical management problems associated with the use of metallic silos of SGR and the achievement of by the SGR departments .

TREE CROP AND PRODUCTS.

NPA 986

Abu, D. James (1999). Production, Chemical And Sensory Evaluation Of Wine From Log Plum (Spondias Mombin) Fruit. **Proceedings Of 23rd Annual Conference (NIFST)** . Pp. 22-25.

A comparison result of Spondias mombin wine with a commercial wine [New York apple] showed no significant differences in colour , flavour , mouthfeel and overall acceptability although higher mean scores were observed with respect to colour , flavour and mouthfeel in the commercial sample.

NPA 987

Adesuyi, S.A. and Cornes, M.A. (1968). Moisture Content Survey Of Palm Kernels At The Time Of Grading In The Western State Of Nigeria. **NSPRI Technical Report. No.6.** Pp. 53-57.

The moisture content of palm kernels in storage is very important in view of the deleterious effects which can be caused by high levels of moisture (Cornelius 1966). A survey on quality of palm kernels was being conducted at Apapa and Port Harcourt (Riley and Simmons 1967) and it was felt that a survey of the moisture content of kernels at the time of grading would provide some useful background information to this work. Also with the discovery of mouldy kernels infected with aflatoxin (Cornes and Riley unpublished) it was considered necessary to evaluate the level of success of Produce Inspectors in detecting kernels above the permitted moisture content of 9 per cent (Anon 1946) in order to ensure that the incidence of mouldy kernels be kept to a minimum. The survey was initiated in August 1964 and concluded in October 1968.

NPA 988

Adesuyi, S.A. and Oyeniran, J.O. (1974). A Report On The Effect Of Using A Supported Aluminium Foil As A Ceiling Material In A Store On The Keeping Quality Of Palm Kernels. **NSPRI Technical Report. No.5.** Pp.51-56.

A supported aluminium foil was tested in a warehouse containing palm kernels to see if its insulating effect when applied to the ceiling would lower the temperature . A control

warehouse of similar size and commodity was included. No significant difference in temperature was noted between the insulated warehouse and the control, nor was the humidity or quality of the palm kernels affected, though there was a larger weight loss in the insulated warehouse.

NPA 989

Agboola, D.A. and Etejere, E.O. (1991). Effect Of Relative Humidity During Seed Storage On Longevity Of Seeds Of Six Forest Tree Species.

Nigerian Journal Of Botany. Vol.4. Pp. 23-32.

The effect of varying relative humidity conditions during storage on the viability and germination of seeds of six tropical forest tree species of economic importance in Nigeria was investigated using fresh to two – year seed crop. The tree (Engl. Diels), *Tectoma grandis* (Linn.), *Gmelina arborea* (Roxb.), *Ceiba pentandra* (Linn.) Gaertn. and *Leucaena leucocephala* (Lam.)-de wit. Ten relative humidity (RH) regimes ranging from 4 – 100% obtained by using water and saturated solutions of various chemicals in closed desiccators at 28-30°C were investigated. Seeds were sundried for three weeks before storage. Sundrying reduced the moisture content of *G. arborea* and *C. pen tandra* seeds by about 45% and 17% respectively but did not alter the initial moisture content of seeds of the other four species significantly. RH of 47 – 62% favoured longevity of seeds of *T. gran dis*, *G. arborea* and *L. leucocephala*. RH of 52 – 62% favoured those of *C. pen tandra*, *T. superba* and *T. ivorensis*. RH of 90 – 100 and 4 – 22% did not favour the longevity of the seeds as complete loss of viability occurred in 9 – 15 months in *T. ivorensis* and *G. arborea*, 9 – 12 months in *T. superba*, 12 – 15 months in *C. pen tandra*, 15 – 18 months in *T. grandis* and 21 – 24 months in *L. leucocephala*.

NPA 990

Airede, C.E. (1999). Reduction Of Post-Harvest Losses In The Oil Palm Industry.

Proceedings Of The 23rd Annual NIFST Conference. Pp. 245-249.

Physical and mechanical methods involve the prevention of mechanical damage of fruits, nuts, kernels and subsequent invasion by fungi, by careful harvesting, transportation, depericarping, handling, picking and packaging. Entry of insects and rodents can be prevented by use of insect proof

doors and windows and by use of rodent traps . Invasion of fungi can also be prevented by prompt and adequate drying of produce and low temperature storage at $22 \pm 2^{\circ}\text{C}$.Seeds should be stored at a moisture content of 17% while kernels should be stored at 8 . 9% moisture , subsequent moisture intake after storage should be avoided by preventing leakage off roofs and tearing of bags .

NPA 991

Akano, D.A. (1978). A Survey Of Fungi Deterioration In Stored Cashewnuts.

NSPRI Technical Report. No.3. Pp. 35-43.

A total of twenty-one mould species were isolated from mouldy kernels of stored cashewnuts. Nine were *Aspergillus and penicillia* four were members of the phycomycetes.

Mould damage in the kernels was mostly due to soil fungi notably *A. flavus, penicillium sp.* and *Rhizophus sp.* occurring with 68.3 percent.

NPA 992

Aniyi , S .O . [2004] Perfomance Evaluattion Of A Manually Operated Decoating Machine For Cooked Locust Bean Seed .

Journal Of Agricultural Engineering And Technology Vol . 12 . Pp26-32 .

The recovery of seeds from locust bean in the preparation of fermented food condiment in the home for domestic use or be food vendors has remained a ridiculous and messy operation till now . A decoating machine was designed for peeling and separating the chaff from cooked bean . The machine consists of an anger with decreasing pitch and the separation of the chaff was effected by floating in a mechanically agitated water tank . The machine was tested using 12 ,18 ,and 24 hours cooking time preparation to machine feed and anger speeds of 80 ,100 and 120 rpm . Results showed that performance efficiencies increase with increasing cooking time and auger speed . Decoating and cleaning efficiencies of over 80% and 50% respectively were obtained . The experimental macine had a throughput of 3 . 8 kg / hr.

NPA 993

Antai, S.P. (1986). Studies Of The Ability Of Two Streptomyces Strains To Degrade Locust-Bean Testa Lignocellulose

Nigerian Journal Of Biotechnology. Vol.2. Pp. 31-35.

Lignocellulose prepared from the tough fibrous testa of African locust-bean seeds was subjected to decomposition by two *Streptomyces* strains. Lignocellulose weight loss, lignin loss and carbohydrates loss were used to monitor their abilities in decomposing this type of lignocellulose. These organisms were grown on 1% [w / v] yeast extract dampened lignocellulose and incubated at 37°C for up to 10 weeks. Results obtained from the periodic harvest of both inoculated and uninoculated lignocellulose showed that the microbes were capable of decomposing this lignocellulose. *S. viridosporus* T7A decompose both the lignin and the carbohydrate component of the lignocellulose more efficiently than *S. setonii* 75vi2.

NPA 994

Anthony, O. Oboh, Aworh, C. and Ogugua. (1987). The Use Of Nigeria Clays On Vegetable Oil Refining In Quality Of Palm Oil Leached With Acid-Activated. Nigeria Clays. **Nigerian Food Journal. Vol.5.** Pp. 52-56.

The effects of bleaching with selected acid-activated Nigerian clays on colour removal and some quality characteristics of palm oil were investigated. Relative to commercial fuller's earth, acid-activated clays from Ewekoro and Shagamu in Southern Nigeria produced comparable colour reduction when used to bleach crude palm oil by conventional bleaching and physical refining. The Nigerian clays effectively removed carotenes, phosphorus and trace metals, and produced oils comparable with that bleached with fuller's earth in free fatty acids, iodine, peroxide and anisidine values.

NPA 995

Ayodele, J.I. and Okpapi, S. (2000). Fatty Acid Composition Of *Sterculia Setigera* Seed Oil. **Nigerian Food Journal. Vol.18.** Pp. 66-69.

Identification of kukkuki methyl ester components on a gc/ms has established the presence of seven fatty acids by comparing their retention times with those of authenticated standards by their equivalent chain lengths and on screening the seed oil for its components it was established that it has some industrially interesting fatty acids.

NPA 996

Atanda, O.O., Oniwe, J.A. Adeyeye, Oshunyeye, P.O. and Dawodu, T.O. (1995). The Quality Of Nigerian Cocoa Beans. **Nigerian Journal Of Botany**. Vol.8. Pp 11-16.

The cocoa industry is one of the backbones of the Nigerian economy and ranks first in her agricultural export trade. For this cocoa to be acceptable in world market, it is imperative to produce high quality cocoa beans from well precessed and clean cocoa. The indiscriminate sourcing of raw cocoa beans by private entrepreneurs for processing and export led to the assessment of the quality of the beans based on percentage mouldiness, Slatey, Other Defects (O/D), Moisture content, Free Fatty Acid (FFA) and weight of 300 beans (g). Studies carried out on these criteria, showed that majority of the cocoa beans were of the low crop type (L.C) and 87.98% of the 34.325 bags of raw cocoa beans examined were accepted as grade II, while 2.02% were completely rejected.

NPA 997

Ayeni, F.O. and Onyinke. (1973). Studies On The Funmigation Of Cocoa. **NSPRI Technical Report. No.1**. Pp. 23-25.

Riley and Simmons (1967) recommended a dosage of 400lb of methyl Bromide for the fumigation of cocoa in a subsection of the specially designed Ikeja cocoa stores owned by the Western Nigerian Marketing Board. Each subsection is about 9,226 cubic meter with a capacity of about 2,400 tons.

The dosage recommended is still being used despite the fact that the stores need maintenance and the seals on the doors which made them airtight have deteriorated.

Investigation in six different subsections was therefore carried out to find out if the recommended dosage is still effective and a survey of the abundance and significance of the insects found on the cocoa beans at Ikeja was made.

Results from sieving and suction trapping revealed that the recommended dosage is still effective although not as efficient as when the stores were new.

NPA 998

Asoegwu, S. N. and K. G. Obi-Mgbam (2003). The Effect Of Parboiling Time And Moisture Content On The Shellability Of African Breadfruit (*Treculia Africana*) Seed **Proceeding Of The 4th International Conference Meeting Of The Nigerian Institution Of Agricultural Engineers**. Vol.25. Pp. 219-228.

Freshly processed African breadfruit (*Treculia africana*) seeds were sun dried for 8 days and then rewetted to different seed moisture contents (8.1, 10.2, & 13.5%). Some of the seeds were then parboiled in a pressure cooker for 5,8,10,13 & 15 minutes at temperatures of 70-100°C and pressure of about 55 kpa. The seeds were shelled traditionally and mechanically in order to determine the shellability and breakage and how these parameters are affected by parboiling time and seed moisture content. It was observed that the moisture content of the fresh unparboiled seeds decreased linearly with increase in days of sun drying from 20.39% to 5.83; and that the seeds were difficult to shell with shellability not more than 51%. Also, shellability increased with increase in seed moisture content from 38 – 43% at 8.1% moisture content to 46 – 51% at 13.5% moisture content. With parboiling, the time taken and moisture content affected both shellability and breakage of the African breadfruit (ukwa) seeds. The highest shellability of 63.8 – 72.0% was recorded for parboiling time range of 8 – 10 minutes and 10.1 – 13.5% moisture content range. The lowest breakage percentage, which lies between 2.5 – 3.9% was obtained at 8 – 10 minutes parboiling time range for all seed moisture contents tested.

NPA 999

Agidzi, D. Balami, A. A. And R. M. Exemikose (2003).
Development and Performance. Evaluation Of A Shea-butter
Extractor.

**Proceedings Of The Fourth International Conference and 25th
Annual General Meeting Of The Nigerian Institution Of
Agricultural Engineers Vol 25 . pp251 -257 .**

A Shea-butter extractor was designed, constructed and evaluated. The raw materials used for testing the developed extractor were milled shea-nut. Three different quantities of the milled shea-nut, weighing 3kg, 5kg and 9kg respectively was fed into the machine at one hour interval and gradually mixed with 4, 6 and 9 litres of water. Mixing was achieved by the agitation of the impeller, through the rotation of the horizontal handle shaft. As the shaft was rotated, power was transmitted through the gear and pinion transmission system, and through the vertical shaft, thereby rotating the impeller attached to the end of the vertical shaft, located at the bottom of the tank. The mixing and heating process takes place simultaneously for a time interval of 45 minutes for each sample. The purified butter was then collected through the outlet tap. The percentage of oil extraction and the efficiency of the machine were found to be 16.8% and 82.4% respectively.

NPA 1000

Anne L. Samuel, Victor J. Temple and Ladeji O. (1997). Chemical And Nutrition Evaluation Of The Seed Kernel Of *Balanites aegyptiaca*. **Nigerian Journal Of Biotech. Vol.8. No.1.** Pp. 57-71.

The seed kernel of *Balanites Aegyptiaca* has been evaluated chemically and nutritionally. The crude protein, crude fat and total carbohydrate content of the seed kernel were 35.26, 48.82G and 12.56g per 100g dry weight respectively. The caloric value was 630.66cal per 100g dry weight. The seed is a rich source of potassium, calcium and iron. Amino acid analysis of the seed showed high levels of leucine, Isoleucine, threonine, cycteine, phenylalanine and Iysine. Methionine seemed to be the limiting amino acid with a chemical score of 34.10%. The protein efficiency ration (PER) and net protein ratio (NPR) for the boiled seed kernel (0.18 and 1.09 respectively) were significantly higher ($P < 0.05$) than the values for unboiled seed kernel (0.61 and 0.40 respectively). The seed kernel may be a good source of protein in livestock feeds.

NPA 1001

Aniyi, .S. O. [2004] Performance Evaluation Of A Mannually Operated Decoating Machine For Cooked Locust Bean Seed **Journal Of Agricultural Engineering And Technology. Vol 12** Pp 26-32.

The recovery of seeds from locust bean in the preparation of fermented food condiment in the home for domestic use or by food vendors has remained a ridiculous and messy operation till now. A decoating machine was designed for peeling and separating the chaff from cooked beans. The machine consists of an auger with decreasing pitch and the separation of the chaff was affected by floating in a mechanically agitated water tank. The machine was tested using 12, 18, and 24 hours cooking time preparation to machine feed and auger speeds of 80, 100 and 120 rpm. Results showed that performance efficiencies increase with increasing cooking time and auger speed. Decoating and cleaning efficiencies of over 80% and 50% respectively were obtained. The experimental machine had a throughput of 3.8 kg/hr.

NPA 1002

Badifu, G. I. O. and M. C. O. Abah (1998). Physicochemical Properties And Storage Stability Of Oils From Sesame Seeds And Sheanut Kernels.

Nigerian Journal Of Science And Technology. Vol.1. No.1. Pp. 116-123.

Oils extracted from the kernels of sesame seed (Sesamium indicum L.) And sheanut (Butyrospermum Paradoxum Gaertn.f.) were evaluated for fatty acid composition and storage stability. The predominant fatty acids in sesame oil were oleic (36.4%) and linoleic (46.1%). The total saturates and unsaturates were 17.5 and 82.5, respectively. In shea fat, stearic (47.5%) and oleic (41.8%) were the major fatty acids. The levels of saturation and unsaturation were 51.7 and 48.3, respectively. Sesame oil was found stable under refrigeration condition ($6 \pm 1^\circ\text{C}$) but the stability was relatively low under ambient conditions ($33 \pm 1^\circ\text{C}$). Prerefrigeration of crude sesame oil for about two months prior to storage under ambient conditions ($33 \pm 1^\circ\text{C}$) enhanced its rate of peroxidation. Analysis of data indicated that shea fat has great potentials which merit further investigation.

NPA 1003

Badmus, G.A., Adeyemi, N.A., Mohammed, A. Usifoh, C.O., Ayinde, B.A. and Ukoh, G.C. (2000). Oil Palm And Coconut Shells Pyrolysate Extraction And Its Antimicrobial
Conference And Millennium General Meeting Of The Nigerian Institution Of Agricultural Engineers (A Division Of The Nigerian Society Of Engineers. Vol.22. Pp. 62-65.

The pyrolysates were used to challenge overnight cultures of clinically and standard type micro-organisms such as *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Salmonella typhimurium*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* (27857), *Escherichia coli* (NCTC 10418), *Staphylococcus aureus*, *Escherichia coli* and *Bacillus subtilis*. The pyrolysates showed antimicrobial properties even at very low inhibitory concentrations, hence the minimum bactericidal concentrations of the pyrolysates were determined

NPA 1004

Broadbent, J.A. (1967). The Importance Of Different Moulds In Causing Internal Mouldiness Of Nigeria Cocoa.
NSPRI Technical Report. No.5. Pp. 53-57.

Table 1 contains general information on the three samples of mouldy beans and Table 2 lists the mould species isolated , with details of their occurrence in the beans of each sample .

NPA 1005

Broadbent, J.A. and Oyeniran, J.O. (1967). The Penetration Of Cocoa Beans By Filamentous Moulds During Fermentation And Drying.
NSPRI Annual Report. No.6. Pp. 59-65.

Clearly , the quality of Nigerian cocoa would be much improved by preventing mould growth on the beans during fermentation.

NPA 1006

Broadbent, J.A. and Oyeniran, J.O. (1970). Internal Mouldness Of Nigeria Cocoa Caused By *Botrydiplodia Theobromae* Pat.
NSPRI Technical Report.No.3. Pp. 29-33.

Experiments on the effect both of fermentation and of temperature alone on the viability of *B. theobromae* mycelium are described. It appears that the mould often may not survive fermentation, probably because of the high temperatures reached during this process. This finding, when considered with the results of earlier work, strongly suggests that pre-harvest infection is the most important single cause of internal mouldiness in Nigerian cocoa.

NPA 1007

Catherine, E. Airede and Esuruoso, O.F. (1986). Seed-Borne Fungi Of The Oil- Palm (*Elaeis Guineensis* Jacq) In Nigeria.
Nigerian Journal Of Plant Protection. Vol.10. Pp. 43-49.

Absidia corymbifera, *Aspergillus flavus*, *A. fumigatus*, *A. niger*, *A. terreus*, *Apiospora montagnei*, *Botrydiplodia theobromae*, *Cephalosporium* sp., *Chaetomium* sp., *Colletorichum capsici*, *Curvularia geniculata*, *Drechslera hawaiiensis*, *Fusarium eguisei*, *F. oxysporum*, *F. solani*, *Geotrichum candidum*, *Phoma leveillei*, *Rhizopus oryzae*, *Stemphylium* sp., *Syncephalastrum racemosum*, *Trichoderma harzianum* and *Trichothecium roseum*, were isolated from seeds of oil palm

(*Elaeis guineensis* Jacq) in Nigeria. Many of these fungi are new records for seed-borne fungi in the oil palm. The relationship between some of these seed-borne fungi and disease development in the oil palm is discussed

NPA 1008

Catherine, E. Airede and Oladele, F. Esurunosu. (1987).
Deterioration Of Shelled Oil Palm Kernels Caused By Seedborne Fungi.
Journal Of The Science Of Food And Agriculture. Vol.40.
No.4. Pp. 293-304.

Autoclaved oil palm kernels were inoculated with spores of seedborne isolates of either *Aspergillus flavus*, *A. niger*, *Penicillium chrysogenum*, *P. janthinellum*, *Paecilomyces varioti*, *Syncephalastrum racemosum* or *Fusarium oxysporum*. At 0, 2, 4 and 8 weeks after inoculation, determinations were made of the moisture content, oil, free fatty acids (FFA), sugars and protein nitrogen. The principal biochemical changes induced by these fungi were increases in moisture content and FFA, decreases in total oil and total sugars and a degradation of protein nitrogen. *Aspergillus flavus* caused the greatest changes, and *P. varioti* caused the least changes under the moisture conditions of this experiment. The main type of deterioration was hydrolytic rancidity of the oil, resulting in a dark reddish-orange-coloured oil and a discoloration of the kernel meal.

NPA 1009

Chima Cartney Igwe and Mansour Moudachirou (2000).
Quantitative Analysis Of The Organic Acid Components Of Oil Palmwine By Simple Esterification And Gas Chromatography-Mass Spectrometry (G.C-M.S.).
Nigerian Food Journal. Vol.18. Pp. 63-65.

The organic acid components of fresh natural oil palmwine of Nigerian origin obtained by simple esterification into butyl esters were investigated by means of a gas chromatography-mass spectrometry (gc-ms). Four organic acids were identified and quantified. These were namely; acetic, lactic, levulinic and succinic acids

NPA 1010

Cornes, M.A. (1967). Studies Of Physical Conditions (In The Rainy Seasons) In An Air House Containing 160 Tons Of Bagged Cocoa Beans.
NSPRI Technical Report. No.3. Pp.39-44.

Satisfactory storage of well dried cocoa can be conducted in an inflated airhouse for short periods during the rainy season. Long term storage under these conditions would result in an uptake of moisture to a level above the regulation level of seven per cent but below the critical level for mould growth under the conditions of the current experiment. Wetter conditions can be envisaged however and long term storage in the inflated airhouse can not be recommended for the rainy season. During the rainy season condensations to store in the deflated airhouse at this time of year.

NPA 1011

Daramola, M.A. and Taylor Ajibola (1975). A New Species Of Kola Weevil From Nigeria, *Sophrorhinus Gbanjaensis* (Sp.Nov) Coleoptera: Curculionidae).

Journal Of Natural History. Vol.9. Pp. 397-402.

A new species of *Sophrorhinus* recorded on kola [*Cola nitida*] in Nigeria is described and named *S. gbannjaensis*. The description of the new species is based on details of external morphology and structure of the aedeagus which were found to be sufficiently different from other validly identified species of *Sophrorhinus*. *S. divareti* Hoffmann is also established as a synonym of *S. quadricristatus* Faust.

NPA 1012

Daramola, M.A. and Ivbijan (1975). The Ecology And Distribution Of Kola Weevils In Nigeria.

Nigerian Journal Of Plant Protection. Pp. 5-9. Vol.1. No.1.

The distribution of the kola weevils, *Sophrorhinus quadricristatus*, *Sophrorhinus sp.* and *Balanogastriis kolae* in the kola belt of Western Nigeria was determined. *B. kolae* and *Sophrorhinus sp.* were found in all the kola growing area while the kola belt.

Correlation analysis showed significant positive correlations between percentages *Ceratitidis colae* (a fruit fly) holes in kola pods and weevil infestation of kola nuts and, also, the numbers of exit holes made by *C. colae* larvae on kola pods and the numbers of weevil larvae found in nuts from the same pods

NPA1013

Daramola, M.A. (1976). Weevil Infestation Of Kolanuts In The Field And Marketing In Western Nigeria.

Nigerian Journal Of Entomology. Vol.2. Pp.21-27.

The patterns and levels of weevil infestation of kola nuts offered for sale in three major kola markets. Ile-Ife, Ogunmakin and Mamu, in Western Nigeria were investigated. The populations of the weevils in market and field samples of kola nuts were also assessed. Infestation of nuts was generally high (41-52 percent) during the off-season of kola. (June – August or September) when the field population of the weevils was very low. Both the market and field samples of kola nuts gave two peaks of weevil population: a smaller peak in April-May and a main peak in November – January. The two population peaks are related to the light and main harvest season of kola in Southern Nigeria.

NPA 1014

Daramola, M.A. (1976). The Reaction Of The Kola Weevil *Sophrorhinus Gbanjaensis* To Moisture **Entomology And Exp. Appl.** Vol.20. Pp. 248-260.

The reactions of the kola weevil, *Sophrorhinus gbanjaensis* to moisture in a simple and a two-way gradient (centre low, high at ends) and a humidity choice chamber and its survival at the different relative humidities of 10, 30, 60, 80 and 95% R.H. were investigated. Both the male and female insects showed preference for the dry air (10 & 30% RH) in the humidity gradient irrespective of its position along the gradient. The insects also detected and reacted to humidity differences of 20 & 30% R.H. when offered a choice of 40 – 60%: 0 – 30%: 60 – 200%; 10 – 60% and 50 – 100% relative humidities. The indices of reaction (IR) increased with increase in the differences between the pairs of humidities offered with a peak at 60 – 100% and 50 – 100% RH for males and females respectively. The insects survived for an average of 21.1 ± 1.3 days and 5.4 ± 0.2 days at 95% and 10% RH respectively. A highly significant negative correlation ($r = -0.926$) was obtained between the mortality rates of the insects and the various relative humidities.

NPA 1015

Daramola, M.A. (1976). Effect Of Harvesting Regime On Weevil Infestation Of Kolanuts In Southern Nigeria. **Nigerian Journal Of Plant Protection.** Vol.2. Pp. 78-83.

The effect of harvesting regime on the level of weevil, *Balanogastriis kolae* and *Sophrorhinus spp.*, infestation of kola nuts in Southern Nigeria was studied. Infestation ranged from 13.3% at beginning of nut maturity to 85.4% 20days later. The increase in

the percentage infestation of nuts and numbers of weevil larvae in infested nuts and percentage of dehisced pods was statistically significant as from ten days after maturity.

Weevil infestation of the kola pods was first observed during the 12th week after fruitset.

NPA 1016

Daramola, M.A. and Ivbijaro, M.F. (1977). Fight Activity Of The Adult Kola Weevil (*Balanogastri* *Kolae*) Coleoptera: Curculionidae) In Relation To Infestation.

Journal Of Entomology Exp & Appl. Vol.22. Pp. 203-207.

Investigations on the flight activity of adult *Balanogastri kolae* (Desbr.) in relation to infestation of kola nuts in the field were conducted using light, suction and impaction traps. Adult weevils were not attracted to light, and catches in suction traps at three heights up to 1.8 m were negligible and only made at 10.00 and 11.00 h (GMT + 1h). Catches on impaction traps showed a decrease with increase in the height of the traps up to 2.2m. Low weevil catches with increase in the height of the impaction traps compared to the significantly high weevil infestation on the ground litter and at the upper parts (3m) of the canopy, is attributable to the large numbers of dehisced pods unharvested in the canopy and those that have subsequently dropped onto the litter.

Prompt harvesting of mature pods before dehiscence, and removal of overripe, dehisced and dropped pods from the debris will minimize the incidence of weevil infestation in the field.

NPA 1017

Damola, M.A. (1978). Host Range And Distribution Of The Kola Weevils In Nigeria.

Nigeria Journal Plant Protection. Vol.4. Pp. 9-13.

The host range and distribution of the Kola Weevils, *Sophrorhinus gbanjaensis*, *S. quadricristatus*, *S. duvernoyi* and *Balanogastri kolae* were investigated throughout the kola-knowing areas in Nigeria. Four out of the ten wild members of the *Sterculiaceae* sampled were attacked by one or more species of the weevils. The species are: *Cola gigantea*, *C. verticillata*, *C. lataritia* and *Cola sp.* (*Ochicha kola*; *Igbo*). *B. kolae* has the widest host range followed by *S. gbanjaensis* and *S. quadricristatus* with three and two wild hosts respectively. *S. duvernoyi* which was recorded for the first time in Nigeria during this study was found only on the 'Ochicha' kola.

Some of the wild Cola spp. are alternative hosts of the weevils especially during the off seasons of the cultivated species. *S. gbanjaensis* and *B. kolae* were found all over the areas of kola cultivation while the distribution of *S. quadricristatus* and *S. duvernoyi* was restricted to some regions of the kola belt. Weather factors especially rainfall and host plants appear to be some of the main factors influencing the distribution of the weevils.

NPA 1018

Daramola, M.A. (1978). The Biology And Ecology Of The Kola Weevil, *Sophrorhinus gbanjaensis* D&T (Coleoptera: Curculionidae).

Journal Of Nat.Hist. Vol.12. pp. 661-680.

Field experimental on the time and sequence of infestation of kola nuts by the kola weevils showed that *S gbanjaensis* larvae were first observed 12 weeks after fruit-set when the nuts were already filled with solid materials. Few larvae of *B . kolae* were found in the field until 16 weeks after fruit-set when many of the pods had been damaged by other insect pest. Results of laboratory and field studies showed that the ability of *B . kolae* to infest kola nuts through undamaged husks is highly limited and is unlikely to be of economic importance.

NPA 1019

Daramola, A.M. (1979). The Mating Behaviour And Effects Of Mating On The Fecundity Of The Kola Weevil *Sophrorhinus Gbanjaensis* D&T(Coleoptera:Curculionidae).

Nigerian Journal Of Natural Science. Vol.1. Pp.41-48.

The mating behaviour and effects of mating on fecundity of the kola weevil, *Sophrorhinus gbanjaensis* Daramola & Taylor were studied. Male and female weevils became sexually receptive six and four days respectively after emergence. Male weevils did not display any detectable courtship behaviour prior to mounting. Copular periods of 5-10 minutes with a maximum and mean of 15 and 8.7 minutes, respectively, were observed. Mating has a stimulating effect on oviposition and fertility in *S. gbanjaensis* as determined by number of eggs laid and larvae produced. Significantly higher numbers of eggs and larvae were recorded for females paired for 84, 42 and 21 days when compared with those paired for one, seven and fourteen days and unmated females, respectively. Mating at intervals also increased the number of eggs laid and larvae produced over a given period in *S. gbanjaensis*.

NPA 1020

Ajibola, M. Daramola, (1980). Gamma Radiation Sensitivities Of The Kola Weevil, *Sophrorhinus*.

Journal Nuclear Agriculture Biology. Pp. 36-38. Vol.9. No.2.

Studies on the sensitivity of the kola weevil, *Sophrorhinus gbanjaensis* D. & T. to gamma irradiation showed that 15 to 20 Krad were effective for the control of the immature forms. Papal and larval mortalities which increased with dosage were 100 per cent 15 days post treatment. The percentage of irradiated pupae that metamorphosed into adults decreased with dosage which the percentage of deformed adults increased with the dose. The females were more sensitive to gamma radiation than the males, Males irradiated at 5 Krad produced viable sperms while females irradiated at 5 Krad and paired with untreated males failed to lay eggs. Both males and females were completely sterilized at 10 Krad.

NPA 1021

Daramola, M.A. (1981). The Biology Of The Kola Weevil *Balanogastriis Kolae* On *Cola Acuminata* And *Cola Verticillata*. **Insect Science Application.** Vol.2. No.4. Pp. 201-204

Studies on aspects of the biology of the kola weevil *Balanogastriis kolae* on *Cola acuminata* and *C. verticillata* were made in the laboratory at temperatures of 28-30°C. Mated females of *B. kolae* oviposited a significantly higher number of eggs (238) in *C. acuminata* than in *C. verticillata* (205) when confined separately with the nuts. But when the weevil was offered the choice of three *Cola* species as oviposition media, significantly more eggs were oviposited in both *C. nitida* and *C. verticillata* than in *C. acuminata*. However, there was no significant difference between the number of eggs oviposited in *C. Verticillata* and *C. Nitida*.

The average total incubation, larval and pupal developmental periods of *B. kolae* in both *C. nitida* and *C. verticillata* were 6, 16.2 and 61 days respectively. The average total developmental period in *C. acuminata* was 28.8 days, and 26.5 days in *C. verticillata*. Although the total developmental periods overlap, there was a significant of *B. kolae* in the wild species, *C. verticillata*, coupled with its wide distribution show that it may be

ecologically important in the survival of the weevils, especially when the cultivated Cola species are not available in the field

NPA 1022

Daramola, M.A. (1983). Studies On The Control Of Kolanuts Weevils (*Balanogastriis Kolae* And *Sophrorhinus* SPP: Coleoptera: Curculionidae) During Storage In South Western State Nigeria. **Tropical Stored Products Information**. Vol.46. Pp. 11-15.

A survey was conducted on the measures employed by farmers and retailers to control kola nut weevils in storage in the main kola producing areas of south western Nigeria. The effectiveness of a chemical insecticide was also investigated. About 96% of the people interviewed used chemicals, either solely or in combination with the sorting out of infested nuts prior to storage. Seventy – seven per cent of those that employed chemicals used Gamma, BHC, 10% used common Alum Potash while 13% could not name the chemicals used. The most common method of application was the soaking of infested nuts in various solutions of the chemicals used and the amount of chemical used depended on a visual estimate of the level of infestation. The insecticide tested gave effective weevil control but the residues in treated nuts and the insecticidal properties of the Alum Potash used by some farmers need to be further investigated.

NPA 1023

Daramola, A.M. (1983). Studies On The Reactions Of The Large Kola Weevil, *Sophrorhinus quadricristatus* Faust To Moisture And Temperature. **Nigerian Journal Of Entomology**. Vol. 4. Pp. 106-117.

The reactions of the large kola weevil, *Sophrorhinus quadrimium*s to moisture in a humidity choice chamber and temperature in a linear temperature gradient were studied. Both the male and female insects showed a hygronegative response in all the pairs of humidities offered. The insects perceived and reacted to humidity differences of 20% R.H. at the lower (10-30% R.H. and upper (60-80% R.H.) portions of the humidity scale. Dehydrated and starved insects showed a hypropositive response and the intensity of reaction increased with the period of treatment. *S. quadricristatus* showed a preferred temperature range of 27°C – 31.5°C. This range falls within the temperature ranges the insects are usually exposed to in the field and storage

NPA 1024

Denenus, E.O. and Eze, J.N. (1983). The Quality Of Locally Processed Palm Oil A Comparison Of Processing Methods. **Nigerian Food Journal. Vol.1.** Pp. 123-127.

Five traditional methods of processing palm fruits were evaluated with respect to the quality of the final product (palm oil). The methods investigated, although prevalent in Anambra State, are also practised elsewhere in Nigeria. The qualities of the palm oils were examined with respect to free fatty acid (F.F.A.) content, moisture content and impurities. Furthermore, the five traditionally processed palm oils were also compared with two mechanically-processed palm oil.

One mechanically processed and two traditionally-processed oils had relatively low F.F.A., content (3 to 5 per cent) moisture content (0.09 to 1.70 per cent) and impurities in the range 0.46 to 2.26 per cent. One locally and one mechanically processed oil samples were characterised by high F.F.A (greater than 18 per cent),, the 3.0 per cent) making them poor quality oils. The qualities of the other oils were intermediate in value.

NPA 1025

Doye, R, Abigor, Fred, I.O.P. Andy, R. Opkum and Anthony, U, Osagie. (1985).
Partial Purification And Some Properties Of The Lipase Present In Oil Palm (*Elaeis guineensis*) Mesocarp.
Journal Of Science Food Agriculture. Vol.36. No.7. Pp.599-607.

The fatty layer obtained by centrifuging a homogenate of oil palm fruit mesocarp contains an active lipase. The lipase which was partially purified using a combination of ammonium sulphate fractionation, ion exchange and gel filtration chromatography, indicated an optimum activity at pH 4.5 and a temperature of 30°C. The enzyme exhibited good activity towards its natural substrate, palm oil as well as glycerol trioleate and glycerol tripalmitate. It also showed a linear reaction rate for the first 20 min of incubation. Sodium cyanide, resorcinol, cholesterol, lecithin and glycylglycine strongly inhibited its activity while phenol, L-cysteine and EDTA enhanced its activity. It is suggested that the lipase is associated with the membrane of the oil droplets.

NPA 1026

Faborode, M. O. (2000). A Reappraisal Of Recent Research Advances Into Cocoa Flavour Characteristics. **Journal Of Agric. Engineering And Technology. Vol.8.** Pp.1-15.

A review is made of the significant advances in research into the origin of cocoa flavour characteristics. Cocoa flavour is presented as the totality of quality perceptions of raw cocoa including aroma, astringency, bitterness, acidity and other off-flavours. It was shown that the major flavour notes in cocoa derive from the inherent genetic attributes of the cocoa seed as conditioned by basic biochemical transformation processes during fermentation. Specifically, the precursors of normal cocoa flavour note, the hydrophilic oligopeptides and hydrophobic free amino acids, are products of post-mortem digestion while phenolic compounds are important to astringency and early developing bitter taste. The volatile flavour compounds are generated on roasting of cocoa seeds, while the intermediate flavour compounds, Amadori products, are synthesized during drying. Off flavours mainly result from defects in fermentation and use of ineffective drying regimes. Indeed, without proper drying, a well fermented cocoa is not likely to achieve its maximum flavour potential. The need for more fundamental research into cocoa of comparable and indeed better flavour than sun-dried cocoa was identified.

NPA 1027

Felicia O. Kuku. (1978). Mouldiness In Nigerian Palm Kernels Resulting From The Mechanisation Of The Palm Oil Industry (NIFST). **Proceedings Of The 2nd Annual Conference. Vol.2.** Pp. 71-77.

A survey of the quality of pre-storage and stored palm-kernels from local palm-oil processing sites and government oil mills (where palm-oil extraction was mechanised) in Nigeria was carried out. Internal mould infection was widespread in the kernels after palm-oil extraction when these were left, wet and unshelled in heaps prior to cracking. The quality of palm-oil from the government mills was very good with very low free fatty acid content. However, the incidence of internal mouldiness in the palm-kernel samples from government oil mills was higher, since the amount of palm-fruits processed was greater resulting in greater quantity of palm-kernel accumulation. Thirty-seven mould species were isolated, eighteen of them for the first time from Nigerian palm-kernels. The deleterious effects of the moulds on the palm-kernels are discussed and the factors which

facilitate deterioration are highlighted. Recommendations are also made on how improvements can be affected.

NPA 1028

Glami, S.Y., Akusu, M.O., Barbar, L.T. and Nwachukwu, O.C. (1998). Chemical And Functional Properties Of Some Edible Plant Seeds Used As Soup Condiments In Nigeria. **Proceedings Of 22nd NIFST Annual Conference**. Vol.1. Pp.44-46.

The relative low levels of phytic acid [192.4-199.0mg per 100g] in the raw samples of *B. eurycoma* and *D. microcarpum*, compared to the levels [280.7-330.4 mg per 100 g] reported in the literature for commonly consumed Nigeria legumes, seem to suggest an overall better nutritional quality of these food sources.

NPA 1029

Ibikunle, B.O. and Quarcoot, A. (1972). Kola Processing And Storage In Nigeria... **CRIN Farmers Field Day .Pp . 43-44**

Kolanuts meant for these two purposes must fulfil certain conditions. Those meant for future germination must be processed and stored in a way that subsequent germination is unimpaired while those preserved for future chewing must be kept in a way that they remain fresh and attractive as well as palatable.

NPA 1030

Igbeka, J.C. (1987). Viscoelastic Behaviour of Kolanut (Cola SPP) In Axial Compression. **Journal of Food Agriculture Vol.5**. Pp. 23-26.

The viscoelastic behaviour of three species of kolanut was investigated by analysing experimental force-deformation data. An empirical equation for determining the toughness was applied to the force-deformation data. Also experimental stress relaxation data were analysed. Other viscoelastic properties found were modulus of deformability, hysteresis loss and degree of elasticity. It was found that all the three species of cola could be represented by three Maxwell elements in parallel. The half relaxation (geometric mean relaxation) time ranged from 3.08 to 10.90 seconds. From the analysis of other properties, it was concluded that *C. acuminata* exhibited the highest elasticity and springiness.

On the basis of toughness, it was concluded that *C. nitida* will be most preferred for chewing.

NPA 1032

Ijabo, O.J., Satirehin, A.A. and Iwe, M.O. (2000). The Effect Of Heat Treatments Of The Cooking Time Of Locust Bean. **Nigerian Food Journal**. Vol.18. Pp. 49-56.

Research was carried out to determine the effects of two heat treatments on the cooking time of locust bean (*parkia clapperionianna*) compared with that of the traditional method of boiling. The heat treatment methods were:-

- i) Roasting as a pre-cooking treatment and
- ii) Pressure cooking of locust bean at a pressure of 1.4kgf/cm² and a temperature of 125°C. Effect of time on roasting was investigated.

Also, the effects of the treatments on the quality and level of acceptability of the processed bean seeds by fermentation into, "Okpehe", were examined by subjective sensory evaluation.

Optimum time for roasting was found to be five minutes. Roasting as a pre-cooking treatment for locust bean reduced the cooking time from 10 hours to 0.91 hours (55 minutes) and was also able to reduce the foul smell of the product considerably. Pressure cooking of locust bean at a pressure of 1.4kgf/cm² and a temperature of 125°C gave an optimum cooking time of 45 minutes. The economic heating of *Parkia clappertoniama* seeds for dehulling is to roast the bean seeds for five minutes in a pan followed by boiling in water for 55 minutes.

NPA 1033

Iwunze, M.O. And Celline Iwuoha (1986). Activity Of A Simple Palm Wine Extract In Sucrose Fermentation. **Nigerian Journal Of Biotechnology**. Vol.2. Pp9-12

The active fermenting substance in local palm wine was extracted using rotor evaporator to remove the aqueous constituent leaving a very highly viscous yellow material. The fermenting activity of the yellow extract was tested by subjecting it to different concentrations of sucrose solution and measuring the rate of evolution of carbon dioxide. Further test was performed by varying the extract concentration at constant sucrose concentration. In both tests it was observed that the extract did in fact ferment the sucrose. Its pH effect on the rate of fermentation was also investigated. It was observed that the activity was optimum at a pH of 6.9. The extract was observed to behave as a regulatory

enzyme. The pH of optimum activity was observed to correlate with the optimum pH of d-amylase.

NPA 1034

Jegede, M.O. (1974). A Survey And Comparison Of Free Fatty Acid And Moisture Contents Of Locally And Mechanically Produced Palm Oil In Lagos And Some Part Of Western States Of Nigeria.

NSPRI Technical Report. No.8. Pp.69-71.

A comparison between local and mill production of Palm Oil showed that the locally produced oil had higher moisture content and a higher ffa. On receipt, the oil purchased in local markets had an ffa between 15.2 and 10.4%. After two months storage increases of from 1 to 2% ffa took place in the local samples. The moisture content was from 0.423 to 0.707%. The comparable figures for mill oil were ffa between 2.6 and 3.7%. This increased to 6.3 and 5.9% respectively after two months storage. On receipt moisture content was 0.27-0.40%.

NPA 1035

Kogbe, J.O.S., Bamtefa, O.T., Bada, O.O. Folorunsho, I.O., Akanbi, A.S. and

Sanuth, J.A.B. (1998). Comparaative Studies Of Traditional And Improved Cultural/Conventional Methods Of Kolanut Processing.

Farming Systems Research And Extension Technology Generation And Dissemination. Pp. 61-63.

No significant difference was observed in the replicates and the treatments when the number of nuts lost to insect infestation was considered alone under the two treatments . similar result was obtained for number of nuts lost due to deterioration and spoilage among the two treatments . Pooling total loss in the two treatments due to insect infestation , deterioration and spoilage was also found not to be significantly different .

NPA 1036

Kuku, F.O. (1969). A Preliminary Study Of Mould Deterioration Of Nigeria Palm Kernels.

NSPRI Technical Report. No.4. Pp. 31-37.

Commercial palm kernels from the Mid-Western State have been examined during the last yearfor internal mouldiness and the

responsible moulds have been isolated and identified. The moisture, free fatty acid and oil contents of each sample have also been determined. Eighteen mould species were isolated from the kernels of which nine were aspergilli and four were penicillins. Members of the *Aspergillus glaucus* group, especially *A. chevalieri*, were isolated most frequently followed by *A. flavus*. There was no obvious correlation between the incidence of internally mouldy kernels in the samples and any other factor measured.

NPA 1037

Kuku, F.O. (1970). Deterioration Of Palm Kernels During Storage At Various Relative Humidities.
NSPRI Technical Report. No.4. Pp. 35-38.

Fresh palm kernels were stored for two months at relative humidities (R.H.) between 65% and 98%. The kernels kept at R.H. of 75% and above became mouldy. The composition of the kernel mycoflora was determined by the relative humidity of storage.

NPA 1038

Kuku, F.O. (1972). Mould Deterioration Of Palm-Kernels Of Western State Origin.
NSPRI Technical Report. No.7. Pp. 59-64.

Samples of palm produce from the Western State have been analysed to determine when they first become mouldy. The results confirm that palm kernels harvested at the correct time become mouldy only after palm oil extraction, even though kernels from overripe fruits picked up from under the trees may be internally mouldy.

NPA 1039

Kuku, O. Felicia (1972). Some Mould Induced Changes In Palm Kernels.
NSPRI Technical Report. No.9. Pp. 69-72.

Five mould species namely *Aspergillus chevalieri*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Pacciloyces varioti* and *Penicillium steckii* were grown on autoclaved shelled palm kernels and the changes caused by the individual moulds in the moisture, oil and free fatty acid contents of the kernels were determined, two, four and eight weeks after inoculation. The mould species generally caused a decrease in the oil content and an increase in the moisture and free fatty acid contents of the palm kernels. *Aspergillus flavus*, however, caused the greatest changes in all the factors measured.

- NPA 1040 Kuku, F.O. (1972). Moisture Absorption In Palm-Kernels In Relation To Mouldness.
NSPRI Technical Report. No.10. Pp. 73-77.
- Fairly dry palm kernels with initial moisture content of 4.7% were exposed to the atmosphere and their rate of moisture absorption was followed for a period of about 2 months.
A relationship was established between the changes in moisture contents of the kernels and the relative humidity of the atmosphere. The mycoflora of the kernels was also affected by the changes in relative humidity of the atmosphere
- NPA 1041 Kuku, O. Felicia (1972). A Study Of Relationship Between Mouldiness, Insect Infestation, Breakage, Oil Content And FFA Contents Of Some Samples Of Nigerian Palm-Kernels.
NSPRI Technical Report. No.8. Pp. 65-68.
- Laboratory analyses have been carried out on whole, broken, insect damaged, mouldy plus discoloured and non-mouldy palm kernels to detect the effect of each factor on the keeping quality of the palm kernels.
The mouldy discoloured samples had the highest average FFA content of 1.3 percent, followed by broken with 1.07 per cent, the non-broken and insect damage were intermediate with 0.95% and 0.96% respectively, while the non-mouldy had the lowest FFA of 0.78%. There was, however, no direct relationship between the factors measured and the five groupings of the kernels
- NPA 1042 Kuku, O. Felicia. (1973). The Effect Of High Temperature On The Activities Of Individual Mould Species On Palm Kernels.
NSPRI Annual Report. Pp.43-47
- Changes in palm kernels caused by five species of mould were investigated at high temperatures (30°C, 39°C and 45°C) *Aspergillus chevalieri*, *A. flavus*, *A. fumigatus*, *Paecilomyces variot* and *Penicillium steckii* were inoculated into sterile palm kernels and, after eight weeks of storage caused increases in the free fatty acid content and decreases in the oil content of the kernels when incubated at 30°C and 39°C.

Only *A. fumigatus* and *P. varioti* (both being thermophilic moulds) grew at 45°C during the first two weeks of storage. During the subsequent weeks, the kernels at 45°C became so dry that they were exuding oil vigorously and there was no further mould growth. A general decrease observed in the moisture content of the kernels was due to the continuous

drying effect of the high temperatures of storage. The biochemical activity of the moulds was affected by temperature of storage and more important, the resultant loss of moisture. The maximum biodeteriorative activities of the moulds were found at their optimum temperature of growth.

NPA 1043

Kuku, F.O. and Broadbent, J.A. (1973). Studies On Mould Deterioration Of Mid Western Nigerian Palm-Fruits And Prestorage Palm-Kernels At Various Stages Of Processing. **NSPRI Technical Report. No 6.** Pp. 49-53.

Microbiological investigations have been carried out on twenty-four samples of Mid-western Palm Produce (consisting of palm fruits, unshelled and shelled palm kernels obtained from local processors, the Ewohinmi Pioneer Oil Mill and Produce Stores) to determine when they first become internally mouldy.

The palm fruits from the local processors had superficial infection by *Aspergillus niger* and *A. flavus*. However, these two mould species did not penetrate the kernels

Of the thirty-seven mould species isolated from internally mouldy palm kernels, eight were aspergilli, three were penicillia and ten were phycomycetes with percentages occurrence of 23.8, 5.08 and 26.7 respectively.

About 25 per cent of the moulds isolated were soil fungi resulting from careless treatment after palm oil extraction, when the palm kernels were left in heaps on bare soil to dry

The results indicate that internal mouldiness becomes wide-spread only after palm oil extraction.

NPA 1044

Kuku, O. Felicia (1974). The Effect Of Moulds On The Bleachability Of Nigeria Palm-Kernels. **NSPRI Technical Report. No.6.** Pp. 57-62.

The deteriorative effect of lipolytic moulds on the bleachability of palm kernel oil was investigated.

Aspergillus flavus turned the oil deep green, but this colour was easily bleached. On the other hand, the yellowish brown colour

imparted to the oil by *A. chevalieri* was difficult to remove. The effect of *A. fumigatus*, *Paecilomyces varioti* and *Penicillium steckii* on the colour of palm kernel oil was not pronounced. Generally, the bleachability of the mould infected palm kernel oil decreased with the increases in length of storage and free fatty acid contents of the palm kernel oil.

NPA 1045

Kuku, O. Felicia. (1974). Studies On The Fungi Deterioration Of Nigerian Palm Kernels.

Disertation Submitted To The Faculty Of Agriculture In Partial Fulfilment Of The Requirements For The Degree Of Master Of Science University Of Ibadan. 1974.Pp1-87

The origin of mould infection, frequency of mould occurrence and the biodeteriorative effects of moulds on Nigerian palmkernels has been studied. The external factors which favour mould growth in palmkernels were also investigated.

A preliminary survey of mould occurrence in commercial palmkernels of Mid-Western State origin was carried out. *Aspergillus* and *Penicillia* were the commonest mould species isolated from the palmkernels samples in this state.

This preliminary study was followed by a more detailed investigation of mould occurrence in palmfruit and palmkernel samples at different stages of processing. These samples of palmproduce were obtained from local palm oil processing sites and Government Pioneer Oil Mills in the MidWestern and Western States. The percentage mouldiness, free fatty acid and oil contents of the samples were determined. An ecological trend was observed in the moulds isolated from the two states. The high moisture – demanding moulds (such as *A. flavus* Link) were frequently isolated from the humid MidWestern state while the xerophytic moulds (e.g. *A. glaucus* group) were predominant in the relatively dry Western State. Analysis of palmproduce from the two states indicates that palmkernels first become mouldy after palmoil extraction, when the kernels are left in heaps to dry on the bare ground prior to cracking.

NPA 1046

Kuku, O. Felicia (1974). Study Of The Fungal Deterioration Of Oil Palm Produce From The Three Eastern State Of Nigeria.

NSPRI Technical Report. No.7. Pp. 63-68

Oil palm produce collected from local processors, pioneer oil mills and commercial stores in the three Eastern States were analysed for their percentage mould, moisture, free fatty acid and oil contents.

The results show that mould infection first becomes widespread in palm kernels after palm oil extraction. The high moisture demanding moulds dominated the mould species isolated, *Rhizopus arrhizus* was, however, the dominant individual mould species occurring in about 28 per cent of the kernels examined.

The percentage moisture content of the samples ranged from 6.2 to 9.2 while their average free fatty acid and oil contents were 5.4 per cent and 52.4 per cent respectively.

The pre-occupation with palm oil extraction at the Pioneer Oil Mills, to the neglect of palm kernels, usually resulted in the mould deterioration of this produce.

NPA 1047

Kuku, O. Felicia (1975). The Analysis Of Oils From Mould Infected Palm Kernels By Gas Liquid Chromatographic Method. **NSPRI Technical Report. No.5.** Pp. 35-38.

Autoclaved palmkernels were infected with five lipolytic moulds, previously obtained from mouldy palm-kernels Kuku (1976) namely *Aspergillus chevaieri*, *A. flavus*, *A. fumigatus*, *Paecilomyces varioti* and *Penicillium steckii* and stored for six weeks at room temperature (24°C)

Gas – liquid chromatography analyses were carried out on the oils obtained from the mould infected palm kernels. The results of the two-weekly analyses on the percentage occurrence of the various free fatty acids (resulting from the lipolytic activity of the moulds in the oils) indicated that lauric acid is the principal fatty acid in palmkernel oil, the other acids obtained being – capric, caprylic, myristic, palmitic, stearic, oleic and linoleic.

The lipolytic moulds caused a substantial increase in the percentage occurrence of lauric acid after two weeks of inoculation., In subsequent weeks the levels of the fatty acids fluctuated with time and the acids appear to be complementary in the frequency of their occurrence.

NPA 1048

Kuku, O. Felicia and Umeh, E.O. (1976). The Effects Of Five Lipolytic Mould Species On The Protein Content Of Palm Kernels. **NSPRI Technical Report. No.7.** Pp. 75-77.

Flasked, sterilised palm kernels with initial protein content of about 3 percent were infected with five lipolytic mould species namely *Aspergillus chevalieri*, *A. flavus*, *A. fumigatus*, *Penicillium steckii* and *Paecilomyces varioti*. The samples were stored for six

weeks at room temperature (about 25°C). At 2 weekly intervals, the protein contents of the defatted meals were determined.

All the five mould species caused decreases in the percentage of protein in the infected samples. The effects of *A. chevalieri* and *A. flavus*, which decreased the protein level of the kernels to less than 0.5 percent at the end of six weeks of storage, were more pronounced than those of other species.

NPA 1049

Kuku, Felicia O. (1979). Some Quality Aspects Of Nigerian Palm-Kernels From Apapa Port.

NSPRI Technical Report. No.2. Pp. 125-131.

Samples of palmkernels from the export consignments at Apapa port in Lagos were obtained periodically over three years (1977 – 1979). Their moisture, oil and free fatty acid contents, as well as their level of internal mouldiness were determined. Generally, the mean of the moisture content of the palm-kernel samples remained below 9 percent (the level acceptable at grading). Internal mouldiness as high as 25 percent was recorded in some samples. The mean of the oil contents of the samples was around the 49 percent limit acceptable for commercial purposes.

Twenty-one mould species were isolated from the samples of which five: *Aspergillus awamori*; *Cladosporium* sp.; *Curvularia* sp.; *Penicillium digitatum* and *Penicillium chrysogenum* were isolated for the first time from Nigerian palmkernels.

NPA 1050

Lale, N.E.S. and Okunade, S.O. (2000). Effect Of Weevil

Infestation On The Caffeine Content Of Stored Kolanuts

(*Colanitia* Schott Vent Et Endl.) In Maiduguri, Nigeria.

Journal Of Plant Disease And Protection. Vol.107. No.1. Pp. 88-92.

An assessment of the effect of weevil infestation on the caffeine content of red and white cultivars of kolanut, *Colanitia* [Vent] . Schott et Endl . , was carried out in Maiduguri, northeastern Nigeria . Caffeine content was determined by a modification of the methylene chloride-water system method . Results showed significant decreases in the amount of caffeine with increasing level of infestation , being 8 . 0 g/kg for uninfested kolanut , 6 . 5 g/kg for the mildly

infested , 6.7 g/kg for the moderately infested , and 4.8 g/kg for the heavily infested . There was no significant difference between the caffeine content of the red and white kolanut cultivars at the two lower levels of infestation . Caffeine content was , however , significantly reduced in kolanuts that were heavily infested with weevils , especially in the red cultivar . Mean reductions in caffeine content ranged from 8.8 to 62.6% in the red cultivar and from 18.8 to 25% in the white cultivar .

NPA 1051

Mejule, F.O. and Onyuike, P. (1976). The Fumigation Of Large Stacks Of Cocoa In An Airtight Store Using Detia Gas. Ex-B'R'. **NSPRI Annual Report. No.4.** Pp. 57-60

Space fumigation of a 9,226 cubic meter cocoa store was conducted with phosphine gas applied at the rate of 0.8 gm phosphine per cubic meter. The store held two stacks of bagged cocoa beans each of approximately 1,250 tons.

The phosphine gas was released from 660 bags of Detia Gas Ex B. 'R'. Two-thirds of these bags were placed on top of the two stacks and a third hung on the sides.

The levels of insect infestation before and after the fumigation were assessed by means of a sieve (Donall sieve) and stick trap (ate strands).

A very good kill of insects was obtained after a 72 hours fumigation period.

NPA 1052

Mejule, F.O., Nwangwa and Wood, G.A.R. (1976). The Effect Of Polythene Liners On Moisture Movement In Containerised Cocoa During Shipment. **NSPRI Technical Report. No.3.** Pp. 61-67.

Four trial shipments of bagged cocoa in containers from Nigeria to the United Kingdom were made between 1975 and 1976. The trials were designed to investigate the use of polythene liners in hessian bags and also the use of polypropylene bags as means to overcome the hazard to quality which arise from condensation in the containers.

In each trial about 60 tons of cocoa were shipped in four containers. The beans were bagged in polythene line bags, in uplined bags in polypropylene bags.

Before shipment the cocoa beans were fumigated with phosphine gas at the rate of three grams per ton. In order to determine any

change in the moisture content, samples of cocoa beans were taken in Nigeria before shipment and duplicate samples sent to the United Kingdom.

There was little or no condensation in containers in which polythene lined bags were used, whereas there was considerable condensation where unlined hessian or polypropylene bags were used. There was however a slight increase in moisture content of the cocoa beans on arrival at the United Kingdom with the exception of the first trial.

NPA 1053

Mejule, F.O. (1978). The Fumigation Of Large Stacks Of Cocoa Using A Powder Formulation Of Aluminium Phosphide D.ET.L.GAS EX-B'R'.
NSPRI Technical Report. No.1. Pp. 23-27.

Two stacks each of 1,327 tons of cocoa beans were fumigated with phosphine gas in a partially air-tight cocoa store. Approximately 7.26kg of the gas was released from the powder formulation of Aluminium phosphide which were held in crepe paper bags. Insect mortality was determined by means of a sieve and the use of stick traps (ate strands). A 99.6% mortality was achieved after 6 days.

NPA 1054

Mejule, F.O. (1979). The Insect Pests Of Cocoa And Their Control In Nigeria.
NSPRI Technical Report. No.11. Pp. 117-123.

This paper reviews the insect pests of cocoa and their control in Nigeria. Most of the insects which affect the quality of stored cocoa are members of the orders Coleoptera and Lepidoptera. Some of the coleopteran pests are *Lasioderma serricornis* (F), *Ahasuverus advena* (Waltl.) *Tribolium castneum* (Herbst), *Carpophilus dimidiatus*, *Orzaepphilus mercator* (Fauv), *Cryptolestes ferrugineus* Steph.) are important lepidopteran pests. Other insects which are associated with stored cocoa are hymenopteran parasites like *Bracon hebetor* Say, *Holopyris hawaiiensis* (Ashm.) and some hemipteran predators e.g. *Piexostethus arer* (reut) and *Xylocoris* sp. Most of these insects are however secondary pests.

The methods of control of insect infestation of cocoa in Nigeria are mainly based on chemicals. Fumigation with Hydrogen phosphide or Methyl Bromide is the usual practice at the ports of shipment and in stores.

