

R2080 (S)

**REPORT ON A VISIT TO CAMEROON TO
EXAMINE THE OPPORTUNITIES FOR
FURTHER ADAPTIVE RESEARCH INTO
DRIED MEAT**

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Abbreviations

ADI	Acceptable Daily Intake
BE	British Embassy
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
EC	European Community
ELISA	Enzyme Linked Immuno Sorbant Assay
FAO	Food and Agricultural Organisation of the United Nations
FCFA	Currency of Francophone West Africa
FFA	Free Fatty Acid
GLC	Gas Liquid Chromatography
GOC	Government of Cameroon
HPLC	High Performance Liquid Chromatography
HQ	Headquarters
IEMVT	Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux
IMF	International Monetary Fund
IRZV	Institut de Recherches Zootechniques et Vétérinaires
NRI	Natural resources Institute
ODA	Overseas Development Administration
TCO	Technical Cooperation Officers
WB	World Bank
WWF	World Wildlife fund for Nature

Terms of reference

1 Improvements of the production technologies of dried meat was carried out by NRI staff under several strategic research projects in the Livestock Programme between 1985 and 1992. The results of this research were adapted for use in Ghana and Nigeria between 1991 and 1993. In Nigeria, an element of product marketing was included. In continuation of the NRRD policy of adaptation and application of research results on a regional basis, a visit to Cameroon was undertaken with the following terms of reference:

To examine the opportunities for the adaptation of research findings of improved technologies for drying meat, adopting existing recommendations for Kilishi and/or transfer of other production methods and technologies as appropriate, in Cameroon

Should the opportunities for continued research into dried meat be found, to devise a programme of adaptive research which will be address the Cameroonian production and marketing systems and which could be of continuing regional interest

2 D Silverside of the Livestock Section, NRI, undertook the terms of reference between 26 October and 7 November 1993 funded under ARI project F0016.

Acknowledgements

3 I thank the staff of the Institut de Recherches Zootechniques et Vétérinaires in Yaounde, Mankon, Bambui, Maroua and Wakwa, the University of Ngaoundere and the British Embassy in Douala and Yaounde, the Delegates of Livestock of Maroua and Ngaoundere, the producers of dried meat and all other persons met during the course of the visit for their advice, help and hospitality. Their contributions to the proposals put together in this report were essential and are very much appreciated.

Summary

4 A visit to Cameroon was made to identify prospects for continuing an Adaptive Research project which started in Nigeria and which concerned the production of dried meat in the arid northern regions for sale in the more humid south.

5 Many similarities in dried meat production between Nigeria and Cameroon were found. In both countries there is a surplus of meat in the north and a deficiency in the south. Livestock and meat move from north to south. Kilishi and other dried meats are produced in the north of both countries. In Cameroon however, Kilishi is also made in the south, although to a different specification, to meet the difference in climate. The market demand for dried and smoked meat in the south appears to be significant inasmuch as it could be observed in many markets.

6 Although Kilishi is produced in a variety of ways in Cameroon, (and these are different also from production methods in Nigeria), common problems exist. These include the difficulty and tediousness of cutting the meat, hygienic preparation and processing of the meat and its marinade, and an active marketing system.

7 Smoke-dried bush meat is consumed in large quantities throughout Cameroon. The practice is widely condemned and commercialisation is illegal. Smoke-dried beef is prepared in the north and taken south by visiting friends and relatives to their hosts. No formal trade in the commodity exists and no commercial producer could be identified. Opportunities exist therefore, to increase meat availability in the south through the provision of smoke dried beef. It is hoped that the trade in bush meat can be displaced.

8 Facilities for conducting research at the Institut de Recherches Zootechniques et Vétérinaire and at the University of Ngaoundere are excellent and, despite a difficult situation regarding the payment of local staff salaries, co-operation with researchers is assured.

9 Language difficulties are minimal as all researchers are bi-lingual. Research conducted in Cameroon opens opportunities for continued extension in both Anglophone and Francophone countries in West Africa.

Recommendations

10 It is recommended that a research project with dried meat in Cameroon will progress the ARI project significantly and an outline programme is suggested in Appendix 2.

11 The project funds should be administered directly by the researcher during a two month in-country project. Housing on the IRZV site should be provided at a nominal rent. Para 68 refers

Introduction

12 In 1987, the FAO held an international consultation of experts to determine the future direction of meat science and technology for African scientists. *Inter alia*, the consultation advised that more work on meat drying was required. NRI, through its previous *noms de plume* has wide experience in drying meat and agreed to continue with this work.

13 To start the project anew, work on Kilishi, a meat product comprising a thin sheet of sun-dried meat coated with a layer of groundnut paste with other condiments, was discussed with Dr Igene of the University of Maiduguri in Northern Nigeria. Regrettably, work had to be curtailed with the outbreak of the Gulf war. In its stead, work on solar dried meat was conducted at the Food Research Institute in Accra, Ghana. The work had FAO co-funding. The concept was to dry meat in the humid tropics, a practice on which data were limited. Opportunities for marketing the novel product in Ghana appeared to be limited so it was thought better to identify a location which had an operating system which could be modified rather than started afresh.

14 Cessation of hostilities in the Gulf led to continuation of the work in Nigeria. A mission to identify a suitable product for further development was undertaken in late 1992. In early 1993, Messrs Jones and Kleih of the NRI visited Nigeria to characterise two meat products, Kundi and Kilishi and study their markets so that a marketing strategy could be developed.

15 Further work on Kundi in Nigeria was not advised as control of production was seen to be almost impossible without committed intervention by the Nigerian authorities. Secondly, the product was considered to be of such poor quality that attempts to market it further would have been unethical. Nevertheless, the production technology was considered both simple and transferable into the right situation. The product was potentially acceptable by the appropriate consumer.

16 Further work with Kilishi was advised and several improvements to its preparation and marketing were recommended. These included the use of a machine to cut the meat into the fine sheet necessary for rapid drying, improvements to the microbiological quality of the groundnut and spicy additions, some form of packaging and a business plan to expand the market for the product. The recommendations were accepted by the manager of the Livestock Production Programme and plans to continue the work were made. Regrettably, the political situation in Nigeria developed to the point where ODA recommended cessation of new initiatives and a new location for the work was sought.

17 Reference to the map shows that Cameroon has a common border with Nigeria and a similar source of livestock around Lake Chad to the arid north for the manufacture of dried meat products. Further research showed that there were cultural similarities between the peoples of Northern Nigeria and Cameroon and that "dried meat" was considered as part of the diet. There are large markets to the south of the country, in the humid zones, indicating that the possibilities for expanded markets exist. It was decided to investigate the opportunities for further work in Cameroon.

Background

18 In brief, Cameroon lies between 2°11'N and 9°16'E. It is shaped as a triangle and situated between Nigeria to the west, Chad and Central African Republic to the east and the Congo, Gabon and Equatorial Guinea to the south. The apex is situated on Lake Chad. It has a population of 12 million, with over 200 vernacular languages. It is described however, as bilingual, both French and English. The Anglophones are situated in the Southwest Region, occupying approximately 20% of the land area, and the Francophones the rest of the country. The agro-ecological zones range from semi arid desert in the north to dense equatorial forest in the south. Annual rainfall ranges from 500mm in the north through 1200mm at Ngaoundere in Adamaoua province to over 5000mm in the southwest which falls in two seasons. Cameroon is blessed effectively with self-sufficiency in food production to include a wide variety of fruits, vegetables, staples, fish and meat. It has cocoa, coffee and cotton in quantities suitable for export. Cameroon also has oil reserves, adequate road and communication systems and first impressions therefore indicate considerable potential for further development.

19 Cameroon is in financial crisis. The government is bankrupt and has not paid its "civil servants" for periods of up to 18 months. Only the militia, top civil servants and ministers are said to have been paid. One payment, thought to be either one month or all back pay, was paid, however, before the end of 1993. As approximately 20% of the population is said to be part of the civil service, the spending power of the population is very much reduced. Cameroon is therefore deep in recession, consumption is restricted to necessities. Hotels, roads and passenger seats on commercial aircraft are almost empty. Rubbish lines the streets, potholes remain unrepaired and traffic lights do not function. Services however, remain intact. Airlines operate, telephones function and there is water and relatively reliable electricity.

20 As support staff have not been paid for 18 months, aid work is said to be difficult and donors, including ODA, allow contracts to expire. Expert TC staff are posted elsewhere. Towards the end of 1993, there was a reluctance to welcome Cameroon into bilateral agreements; as an example the Cameroon was refused membership into the Commonwealth perhaps based on its record of human rights. France has traditionally given great assistance to Cameroon but looks like withdrawing support after a final squaring of accounts in December 1993. Whether this actually happens is another matter. France is most reluctant to allow the FCFA to float from its parity of 50:1 with the French Franc*; There are several "FCFA" countries with currencies linked to the French Franc which have more stable economies than Cameroon.

21 The World Bank and the IMF were to visit in November 1993. It was rumoured that they will call for a cut in research staff, (an unpopular move according to researchers who have persuaded the government that as Cameroon is an agricultural country, research is essential), cuts in the numbers of civil servants (who are in a significant minority and thus have a voice) and the military (unpopular with government). The WB & IMF will almost certainly insist on a move towards further free enterprise initiatives and revision of the current human rights situation.

Nevertheless, the parity changed to 100:1 in early 1994

22 It is astonishing that the Camerounais accept their situation so philosophically. They openly blame themselves for the situation and fully realise that times will get very much harder before long and any relief will be hard to come by. These hard times will come about if the Government accepts the WB/IMF conditions (to which most believe it will) or even harder times if the GOC does not accept the conditions. Civil unrest, however, does not feature in the discussions which most Camerounais initiate within minutes of first meeting.

23 The Cameroonian says his way of life has changed. Fortunately food is plentiful and the population will go neither hungry nor cold. Urban dwellers however, find life becoming increasingly difficult and this is when the extended family comes to their assistance most effectively. The man in the street is a realist and has done the best possible for himself and his family. The private economy is very active. Unpaid staff of the research centres are a little reluctant to work but nevertheless report for duty. The boredom of home and modified administrative arrangements allow the research centres to remain open. In exchange for staff understanding, a little research is conducted particularly where the resources required for the work programme are minimal.

24 It was against this background that this report was written. It addresses the potential for conducting research rather than looking at the difficulties of the current financial crisis. It could be argued that there is little point in starting new research work while little is presently underway and staff are demotivated. It could also be argued that the time is ripe to undertake work when there is clearly considerable spare research capacity and some cash incentive would be most welcome. The latter view is taken especially as the project is set up as a package and designed to produce results which could be applied in other countries within the region.

Livestock production in Cameroon

25 National herd - Number of head (source FAO, 1992)

Cattle	4,730,000
Sheep	3,560,000
Goats	3,560,000
Pigs	1,380,000
Poultry	19,000,000

26 Offtake - Number of head slaughtered (source FAO, 1992)

Cattle	520,000
Sheep	1,260,000
Goats	1,300,000
Pigs	560,000
Poultry	182,000mt

Livestock marketing and movements within Cameroon

27 Approximately 50% of all livestock including wild life, is produced in the North and Extreme North provinces (see map). Livestock in the northern provinces is traded, slaughtered and consumed on an east-west axis as there is an east-west fence at Mbe near the 8th parallel, erected to prevent southern movement of stock. Some stock and bush meat is said to be "smuggled" south past Ngaoundere but the terrain is said to be difficult. The fence was set up to prevent animal diseases from the north spreading into Ngaoundere which was said to be disease-free. Whether this status still holds could not be established but the fence is considered by those to the north to be an unreasonable restriction on trade. Cattle from Ngaoundere and south are taken to slaughter by road to the southern markets where there are organised abattoirs in the large towns and cities. Smallstock is to be found throughout the country while pigs and poultry tend to be found in greater numbers in the south.

28 There is a wide variety of wildlife throughout the country, much of which finds its way onto the tables of the population. Primates, deer, birds, rodents (especially the "cutting grass") snakes, tortoise, etc. are to be found in markets and along the roadside. Trade in wildlife as a food source is now actively discouraged by Government and commercialisation of trade in these products is illegal.

29 Although it was said that there had been a relatively recent study of livestock marketing in Cameroon, no details were offered and it must be assumed that it lies in an unoccupied office. Anecdotal evidence indicated that cattle are freely traded across the borders to the north, being sold where the currency is the strongest. Effectively this means that stock is traded between Nigeria and Cameroon. Since the borders are effectively open in this region, it is doubtful if numbers and prices are reliable. To collect prices in the livestock markets themselves was beyond the scope of this short mission.

30 Livestock to the south of Ngaoundere travel by road or are trekked to the southern markets, mainly Yaounde and Douala. Prices of cattle were not available but they were said to increase significantly as animals pass south. As an indication, the price of smallstock was said to be about FCFA 4,700 in the North and FCFA 30,000 in the South.

Meat marketing and consumption in Cameroon

31 No study of the structure of the meat market has been conducted in Cameroon. Dr Tambi of IRZV, however, conducted a household survey in 1992 to reveal the consequences of imposition of an import tax on meat in 1988. This weighty tome was studied briefly and Dr Tambi promised to send a revised version direct to NRI. Essentially, it explains that the EC had been dumping meat in the Cameroonian market at such a level that it was jeopardising domestic production and consumption. An import tax of 14% was applied in 1988 which reduced imports significantly, to about 25% of their record level. It is thought that expatriates and hotels are now the only importers. Meat was shown to be price elastic and the imposition of the tax had the desired effect of stimulating domestic production. Dried meat was mentioned in one brief paragraph. It indicated that between 0.08 and 2.6% of household income was spent on the purchase of smoked bush meat, depending on the region under survey. No differentiation was

made between the various forms of bush meat or whether it included all dried meats including Kilishi, Suya and other conventional cooked meats.

32 As with livestock, meat prices increase with distance from the north. Fresh beef in the north costs FCFA 4-500/kg but FCFA 1200 in the south. Fresh meat is not transported commercially as there is no infrastructure to prepare chilled or frozen meat and journey times are considerable and expensive. Having observed this however, considerable quantities of fresh meat are carried south as accompanied baggage on internal flights. Smoked beef is not traded commercially but prepared by northern families to take as gifts to southern friends and relatives. There is no need to use smoked beef in the north as there is always plenty of fresh meat.

33 This pattern is not repeated with bush meat, *Viande Bucannée*. Various estimates of consumption range between a few percentage points of total meat consumption in some areas to over 75% in some towns. Forest Pygmies in the south are said to eat nothing else. The Government of Cameroon actively discourages the hunting and trade in bush meat through its own organisations and those such as the WWF and Centre d'Etude de l'Environnement et Développement au Cameroun. The wildlife parks, a substantial environment protection scheme and tourist attraction, have rangers who try to prevent hunting and trade. The trade continues however. Smoked products find their way onto trains south. At one time, rangers stopped the trains but the hunters threw the meat from the windows to avoid prosecution. Near Yaounde, trains were stopped often by operation of the emergency cord so that the meat could be offloaded to accomplices rather than face police at the final destination. The railway authorities became so annoyed at the habit that they now slow the trains to walking pace to assist the delivery!

34 The smoke-dried bush meat market holds a lowly place at the kerbside in Yaounde, next to the railway station. Smoked monkey, chimpanzee, deer, snake, tortoise etc are on offer along with live monkeys and birds. Observing sales is distressing and the vendors unwilling to discuss their trade; but there are many customers and it is difficult to see how the trade can be stopped. Prices increase as the meat travelled south. A smoked antelope cost FCFA 6-7000 in the North, FCFA 2000 for a leg in the south. The prices of smoked bush meat are said to be uncompetitive with other fresh and smoked meats but there is an active trade as it is considered a delicacy.

Kilishi production

35 The big market demand for smoked fish, particularly from the dam at Lake Chad, towns such as Kribi and Limbe and other little coastal villages, ensures also a taste for dried and smoked meat. A visit to Bricketerie market, Yaounde ("the Northern peoples market") showed many smoked and dried animal products including the item of initial interest, Kilishi. Although difficult to quantify, Kilishi is clearly made and sold in large quantities. It differs from the Nigerian product to take account of local tastes and climate. It is said not to be produced elsewhere in Yaounde.

36 Each producer makes his own speciality product. The meat is prepared at the butcher's stall or close by. Smaller producers cut, prepare and sell the product simultaneously, larger producers employ staff or seek help from family members. Most

equipment is of rudimentary nature except the domestic refrigerator, used only during inclement weather.

37 The following describes the basic method of manufacture: Individual large muscles of hind and forequarter beef are cut longitudinally along the fibres to divide the muscle into two but leaving a 2mm join between the two halves. One half is rested on a table while the other is cut to roll out the muscle into a thin sheet. The uncut muscle is held in the hand and the cuts made downwards thereby exposing the hand to risk. Once completed, the other side is cut and rolled out. Each joint takes about one hour to prepare and about 10kg can be made each day. The holes in the meat are derived from cutting damage and are considered undesirable. The high quality of the meat makes removal of unwanted material unnecessary. The sheets are laid out and placed on a solid wooden board to dry in the sun. After drying for one day, the product is soaked overnight in spices and exposed to the sun for a further day before a 10 minute roast over a smoky fire. The whole process takes over two days in Yaounde, which is in the humid zone, if the sun shines. If not, the meat is confined to a refrigerator, a procedure which the producers do not like.

38 Groundnuts are not predominant in the spicy marinade used in Bricketerie market so the Kilishi bears a red colour of pepper rather than the yellow appearance of the Nigerian product in Maiduguri. Because the Kilishi is made in a humid zone, the product is rubbery and rather unlike the crisp material found in Maiduguri. Four producers were interviewed and all would like a machine to prepare the meat, indicating the difficulties and dangers of preparation of the thin slices. However, considering the quantities available and the number of buyers, it is difficult to assess the impact of a streamlined production system on the market. In the recession, however, no products were selling (it was also the end of the month and the product was possibly lined up for the turn of the month when those with a salary were paid).

39 In Maroua (Extreme North) where there is said to be only one producer, Kilishi is prepared combining the techniques of Maiduguri and Yaounde. Good quality beef is cut longitudinally within 2mm of the board as in Yaounde and then placed in a washing bowl to assist preparation into the familiar sheet as in Nigeria. The butcher takes about an hour to cut one piece and can prepare 15kg in eight hours. Drying takes place on rush matting to allow air under the product. Initial drying takes about 5-6 hours and marinading in the groundnut spices takes place for at least 5 minutes, although large quantities are allowed to pile before the product is placed in the sun again. The butcher said he would be very interested in a machine to cut the beef. He said he had never tried to sell the product in the south. The product looks and tastes different from that of Yaounde being crisp rather than rubbery and yellow/brown with the predominance of the groundnut sauce.

40 Yet further variations in production methods were observed in Ngaoundere (Adamaoua). One producer cuts the large muscles into smaller pieces (500g?) before preparation into the characteristic thin slices. No attempt is made to dry the meat until the end of the day when it is placed on rattan mats and placed on very high racks in a smokehouse. A low fire is lit and the meat dried over night at a temperature only slightly elevated from ambient. This has the effect of keeping the flies away from the

drying product. Unfortunately, the meat is not covered while awaiting and after cutting thus negating the good effect of the fire. Kilishi is also made from tripes.

41 Between three producers in Ngaoundere, approximately four cattle are used in Kilishi production each week. It was not easy to establish what this really meant as only the high quality meat is used and the rest sold as fresh beef. Much trimming goes into retail sale. One producer said he uses only *faux filet* and cut eight/day - yet he was using sirloin! Among these producers it was observed that all the family is involved in Kilishi production. Children fetch and carry, the men cut and manage the main product and the women fry the groundnuts, dry, grind and mix the spices etc.

42 One producer uses eight ingredients in the marinade; groundnuts, chilli pepper, cloves, black pepper, dry ginger, adroc pepper, (this has the same leaves as ginger) Kiene (black acho pepper) and the bark of a tree. The mixture and ratios were to "experience" and no weights were available. Presumably each Kilishi maker has his own recipe and unique product. There are two main flavours, "pimente" and "non-pimente". The taste of the pimente is excellent although somewhat spicy. The meat expands in the mouth and the fibrous nature is apparent but not unpleasant. The product lasts long in the mouth.

43 No producer appears to promote his product actively away from the place of production. All producers said that buyers came from the south and carry the meat back with them. All said that it is appreciated by ministers and ambassadors etc and the product finds its way into France and Saudi Arabia. (NB import regulations!)

44 There are other meat products in the markets. The most frequently seen are the two types of Suya. The most predominant is the kebab type consisting of meat chunks strung together on a stick interspersed with onions and other vegetables. The meat is roasted over a smoky fire and garnished with an oily marinade of spices. The other, flat type of Suya is cut into thin slices with a knife and roasted for some time by a fire. The product is again garnished with spices and cut into pieces immediately before eating. Both looked very appetising, contrasting with the Nigerian version.

Research Capability

Institute des Recherches Zootechniques et Vétérinaires (IRZV)

45 This institute has the remit to undertake research into all classes of livestock. It has programmes on nutrition, management, veterinary sciences, genetics, socio-economics and processing & transformation. Regrettably, all programmes have more or less stopped as a consequence of non-payment of salaries to support and scientific staff who were pre-occupied with their own affairs. Naturally, programmes will be re-cast once there is a return to normality when assurances were given that the *post-harvest* activities will be developed further. Although the Institute employs a meat technologist he was said to have "returned to his ministry" as a consequence of changed circumstances within the civil service.

46 The IRZV has its administrative headquarters in Yaounde and nine Centres of Research, two near Bamenda, (Northwestern Province), at Mankon and Bambui and others at Ngaoundere (Adamaoua Province), Maroua, (Extreme North Province),

Garoua, (North Province), Limbe, (Southwestern Province), Kounden, and a satellite station at Yagoua, (Extreme North Province). Four were visited.

IRZV at Mankon and Bambui, Bamenda

47 These two Centres are situated 4 ½ hours drive from Yaounde (an easier road than the nearer Douala). The two Centres are discussed together as they are but 30km apart and under the same manager. They were visited at the end of the rains and the road between them was ungraded. It took 30 minutes, double the dry season journey.

48 The Centres have facilities for the production of all classes of livestock including poultry, rabbits, pigs, sheep, goats, cattle and horses. The Centre owns over 140 ha of land and a number of large production sheds too widely spread to have inspected in the short time available. To the non-specialist eye, however, the poultry houses appeared adequate for feeding trials. Other facilities included an animal feed mill and hatchery, although day-old chicks are imported, and an experimental abattoir for pigs, poultry, rabbit and smallstock.

49 At Mankon, other facilities include laboratories for Chemistry, Biochemistry, Mineral analyses, Histology, Nitrogen (Kjeldahl), grinding room for animal feeds preparation, Pathology, Chromatography and a Distillation room for water. Equipment is in good supply (there is a stores room) and major items of equipment include amino acid analyser, HPLC and GLC

50 At Bambui, there is a dairy unit complete with dairy technology and microbiology laboratories.

51 Both sites have low cost staff housing, suitable for expatriate staff. The main HQ for the International Potato Centre was situated at Bambui and from the lightening inspection made, Dr Panigrahi could adequately perform his poultry feeding trials at Bamenda.

52 The meat technologist, when last active, had produced smoked chicken and poultry which reputedly sold well. The meat was smoked over a drum.

53 Several types of *post harvest* projects were discussed with staff of the Centre:

Continuation of the Kilishi project which originated in Nigeria: Microbiology and proximate analyses of Kilishi can be conducted satisfactorily. Work with the cutting machine and ingredient improvement could proceed. Product packaging studies will present difficulties and equipment will need to be imported. Marketing studies could be carried out with assistance from Dr Tambi who is well set to conduct the work. Any visitor would need to bring chemicals and consumables, there is a system for tax free import if there is a contract document to show the authorities. To overcome sample preparation difficulties, a stomacher (with bags) and grinder would need to be imported.

Suya: The microbiology of Suya needs some examination since it is practice to reheat the previous day's unsold product. It is thought to cause problems and the IRZV wishes to advise Government.

Smoke dried beef: Game meat is smoke dried. It has exceptional storage properties and is well preserved in the humid zones. A project to smoke-dry beef in the same way as game and market it at all levels from roadside to supermarket would/could address the game issue and, at the same time, the problems which will, eventually, be caused by a reduction in electricity supply to the rural areas as financial hardships continue.

Salted/smoked product: As the smoked beef above but a variation to address other tastes.

Improvement to "Cutting Grass", the well known grasscutter found in other West African countries. Although a wild animal, "cutting grass" is produced for market in some rural areas. The meat is sometimes smoke dried but processed poorly. Improvements would reduce wastage and improve nutrition.

ADI of smoke products: Concern was expressed about the amount of smoke which was ingested as a result from consumption of smoked products. Some products are stored in a smoky environment as a means of preservation and some estimation of Acceptable Daily Intake and nutritional changes would be useful advice to government. No work on traditional methods of smoking has been conducted.

54 Discussed also was the system of NRI staff working at the Centre. Although it was suggested that Cameroonian staff could be deployed at their existing salaries, this would be subject to approval by the Director at Yaounde. During visits to other Centres later, the issue was discussed at length. The staff will eventually be paid their salaries in full by the GOC and it is inappropriate that the staff should receive double salaries. Also, other donors may wish to deploy Centre staff and precedences would be dangerous. The issue of staff payments were discussed with Dr Tanya at Wakwa when an accord was reached which might apply throughout the IRZV organisation. It is proposed that NRI pays additional allowances and expenses incurred as a consequence of the work programme and some overheads to the Centre and HQ. NRI staff would need to bring all consumables and some equipment. Staff housing could be provided for FCFA 20,000/month. If any apparatus (eg smoker/dryer) needed to be made, NRI would need to pay. IRZV would provide vehicles, with driver, to carry staff between the two sites if the use of Landrovers in the BE Yaounde from ex TCOs were not available. NRI would need to purchase fuel. NB Hotel facilities at Bamenda are excellent and currently relatively cheap but they are lonely and therefore unwelcoming.

IRZV, Wakwa, Ngaoundere

55 Wakwa is situated about 10km north east of Ngaoundere along a rough road. Wakwa is the main Centre for the other Centres of Garoua, Maroua and Yagoua. Garoua is said to be well up and running as is the satellite station at Yagoua. Maroua Centre comprised only one officer, Dr Njiforti Hansen.

56 Wakwa Centre has a total of 68 staff comprising 18 researchers, not all of whom were on station, 10 technicians who assist the researchers, leaving the remaining 40 as administrators, and support staff including herdsman etc. Temporary labour (to cut grass etc) is hired as appropriate.

57 Wakwa undertakes four kinds of research:

Veterinary research, especially into epizootic diseases such as Rinderpest, Foot and Mouth Disease Trypanosomiasis and Bluetongue

Range management, particularly pasture management with *Stylosanthes* and *Brachiaria*

Beef cattle production, particularly nutrition and crossbreeding

Dairy production, again, nutrition and crossbreeding

58 The FAO has funded a research project to test the trypanotolerance of two local breeds called Namchi and Kapsiki. Twenty of each of these breeds are herded with twenty (known trypanotolerant) N'Dama and twenty (known trypanosensitive) Gudali in two herds of forty. One herd is male the other female. They had been allowed to adjust to the climate and pasture of mixed *Brachiaria* and local grasses for five months. They were to be infected with a million parasites each in December 1993. All animals are cleared of known infections through weekly dipping and treatment with regular helminthocides etc. Every two weeks, the cattle will be bled for measurement of Packed Cell Volume, Parasitaemia and differential cell counts.

59 The Centre has an STD3 project associated with the University of Liverpool, the University of Strathclyde and the University of Hohenheim in Germany. The concept is to examine the possibility of producing a vaccine for *Onchocerca*, which causes river blindness. It seems that human *Onchocerca volvulus* produces some immuno reaction in cattle and it is planned to investigate this further to determine if the opposite reaction occurs.

60 Pasture management research comprises the use of various grasses but not grass/legume mixes. Results indicated that the system was not successful and research has been discontinued. The EC had funded an inventory of browses available in Cameroon which has now been drawn up. Samples were sent to IEMVT at Maisons Alfort for characterisation. Standard analyses eg protein, fibre etc are to be carried out, but not Tannin content. Four fodder banks have been successfully established.

61 US Brahms are used in research on beef production but stock management has to be very good for the animals to thrive. IRZV believed that the breed will not do well with the farming system in Cameroon so work will be discontinued.

62 Dairy research concentrates on increasing milk yields from 3 to 15 litres/day through the use of F2 local/Holstein crosses. The present herd is not stabilised and there is dependence on importation of Holstein semen. Analysis, however, shows the system to be cost effective. The Centre has a small economics unit.

63 The WB funded, designed and built an experimental abattoir at the Centre. The design is not good. There are plans to dissect carcasses to determine meat yield following a breeding programme.

64 The Centre extends its research findings in a number of ways. Results go through the Ministry of Livestock and the Ministry of Agriculture. There is a Demonstration Unit of the Ministry of Livestock, open at all times to farmers. IRZV undertakes its own initiatives at extension. Field days are held each year, there are nation-wide radio programmes, results are published in journals and the Centre publishes farmers' bulletins. One TV programme has been made. Farmers sometimes approached IRZV for advice.

65 The Centre has a number of well appointed laboratories for microbiology, pathology, histology, surgery etc and stores for equipment, glassware and chemicals. A virology unit has been started but funding for completion and research has been withheld. Major items of equipment include freezing microtome, photomicrography, microscopes, rotary evaporators, electrophoresis apparatus, ELISA, ovens, moisture ovens all manner of balances, autoclaves, lamina flow cabinets, several different centrifuges including an ultracentrifuge, whirlmixers, shakers, Waring blenders, icemaker, Balsch and Lomb spectrophotometers 601 (scanning?) and 21 (Absorbance?), flame photometer, chloride analyser etc.

66 The Centre has much to offer for collaborative research with NRI and NRI staff would be made most welcome. During the visit, the Kjeldahl apparatus was still in its box and not all the parts could be identified. Verification of the full system or identification of the missing parts with a view to replacement would be needed before work could commence on nitrogen determination in Wakwa. No apparatus for fat was present and there was no muffle furnace for ash determination. These could be brought in from Bamenda. Dishes for ash and moisture would need to be provided. In the microbiology laboratory a stomacher would need to be provided for any meat work to be carried out. It would be necessary to provide media, boric acid, Kjeltabs and some simple glassware to leave behind on conclusion of a programme. Electricity supplies are to UK specification but French plugs were in evidence. The UK square pin can be converted locally.

ACTION: Should the project be approved, Mr Jones to verify with IRZV, Wakwa, that the Kjeldahl apparatus is in a fully operational condition before arrival.

67 Discussions took place with senior staff at the Centre about the nature of the projects to be carried out. The projects discussed earlier at Bamenda were thought to be most appropriate both for the programme of the Centre at Wakwa and to suit the NRD Livestock Programme.

68 The Director offered to let a campus house to a visitor for FCFA 50,000/month plus utilities. He would make available a vehicle and use of all his facilities including the virology module of the incomplete virology unit with the lamina flow cabinet for microbiological studies. Technicians could be used but may not receive a second salary. A payment/inducement Allowance of FCFA 30,000/month was seen as reasonable for each member of staff used. Additionally overhead costs will be required. A flat rate of FCFA 50,000/month was seen as reasonable. To simplify administration it was agreed that the project funds could be directly administered by the visiting researcher.

University of Ngaoundere

69 This is a new university of about 12 years. It has several faculties of which food technology is strong and unique in the region. Students arrive from all over Francophone Africa to complete courses.

70 The facilities and equipment are very impressive. There are numerous laboratories to cover all aspects of food research including pilot plant for baking, brewing, dairy, meat, fruit and vegetable processing. Meat equipment includes a chiller/oven/dryer/smoker, bowl cutters, mincers, stuffers, brine injectors, packaging machinery etc. The laboratories are well equipped with general and specialist apparatus, for chemistry, biochemistry, nutrition, home economics etc. There is an engineering workshop for training food engineers, and able to make specialised equipment. The University also has a socio-economics department.

71 The Director, who has clear links with CIRAD, welcomed collaboration but had no research funds himself. NRI would need to employ technicians (FCFA 100-150,000/month) and some overheads (I suggest here that FCFA 40,000/month would be appropriate). The director also said that 3 billion FF had been invested in a food drying project 200km north of Ngaoundere and that we could visit.

72 Work on smoke ingredients and nutritive value of the smoked products was discussed with the professor of Food Science at the University. He asked that the project should be carried out by laboratory technicians at full salary cost over two months (FCFA 100,000 - 150,000/month or approx £1250). Although the University has a different administration from the IRZV, and different conditions could therefore apply, it was believed that all staff engaged on this project should receive similar benefits. As a consequence, allowances of FCFA 30,000/month/technician and a flat rate of overheads of FCFA 40,000/month would seem appropriate. The overheads are reduced as the University of Ngaoundere would not need to seek customs clearance for consumables shipped from UK.

Business interest

73 Contact was made with several businessmen to gauge the measure of interest for collaboration and potential funding in any project which may arise. All Kilishi producers seemed very amenable to assistance with their trade from the Centre and the project. Before commitment however, traders asked about the benefits they would gain from their cooperation. Most wanted to know about market research, capacities, weights to be traded, expected investment and returns on investment etc but it was explained that development was at an early stage and NRI would need to take the lead for the time being. The businessmen were offered the research findings in exchange for their labour and the Centre and NRI would gain knowledge of the process. As expected, interest was expressed but enthusiasm for the project may take a little longer to achieve. The project should be further advanced before the businessman will put his hand in his pocket.

74 There were several rumours that some entrepreneurs in the north were already smoking beef and transporting it to southern markets. Several attempts were made to

meet these people but their contacts were not very forthcoming about the nature of the business or prepared to make introductions.

Local Official Administration arrangements

75 In Maroua, a written proposal should be prepared by the Cameroonian partner and submitted to the Chef de Service Provencale de Production des Animaux for approval. Such an approval will be a formality, mainly so that records of animals used may be recorded.

76 In Ngaoundere, base of the IRZV Wakwa and University, contact with the Delegate of Livestock was positively helpful and he asked to be kept informed of progress of the project. This is advised.

ACTION: Should the project be approved, Mr Jones to copy correspondence to the Delegate of Livestock in Wakwa during preparation of the project and keep him informed of progress during the assignment

77 Contact with the Delegate in Bamenda should be made before work is conducted at Bambui/Makon.

ACTION: Dr Panigrahi to note that contact should be made with the Delegate in Bamenda before work is conducted at Bambui/Makon

Conclusions

78 It is concluded that there is considerable production and consumption of dried meat in Cameroon and that processes and markets can be improved.

79 A process to improve the preparation of Kilishi should be undertaken through the use of a cutting machine, drying cabinets and, perhaps packaging. A monitor of procedures and ingredients would assist product development as suggested for the original programme in Nigeria.

80 A process to develop smoke-dried beef should also be undertaken. This meat should be aimed at a market in the major towns and cities to the south. It is hoped to address not only the provision of increased meat supply to the south but also the issue of smoke-dried bush meat. Attempts will be made to identify a marker in smoke constituents to measure the degree of smoking so that guidance regarding an acceptable daily intake may be considered.

81 Product development and monitoring should take place at the IRZV in Wakwa, Ngaoundere under the guidance of Dr V Tanya. Collaboration with Dr C Mbofung at the University of Ngaoundere, particularly with some of the more specialised analyses and engineering inputs, will be necessary. It was hoped that these inputs would complement an existing trade route. This will not be possible. Instead, arrangements should be made to employ existing dried meat producers at the IRZV campus and hope to extend technical findings directly. An input of two man-months by an NRI scientist

and four man-months by laboratory technicians at IRZV. A total of two man-months technical input by the University of Ngaoundere has been budgeted.

82 Marketing studies should be undertaken in collaboration with IRZV also at Wakwa, Ngaoundere under the guidance of Mr David Pingpoh, an Agricultural economist. Three enumerators will be required, one each in Ngaoundere, Yaounde and Douala. It has been established that dried meat producers are not market oriented and that distributors from the south visit to buy and return to the southern markets. It is against this background that it is expected that expanded markets will result and advice from the marketing economists is sought.

83 A project document is appended to this report.

Appendix 1

Persons met

Mr D Pearce	British Consul, Douala
Mr C Hamilton	Chargé d'Affaires, British Embassy, Yaounde
Mrs Amanda Pau	British Embassy, Yaounde
Mr Peter O'Rourke	British Embassy, Yaounde
Mrs S Gartland	British Embassy, Yaounde
Prof Jacob L Ngu	Dept of Nephrology, Faculty of Medicine, University of Yaounde
Benedicta Ngu	Demographer
Daphne Fohtung	Market Surveyor
Sacchi J	IBL Field Surveyor
Dr J Banser	Director, Institut de Recherches Zootechniques et Vétérinaires (IRZV)
Dr CS Wanzie	Head of Research Services IRZV
Dr Rubi Fomunyam	Head of Centre of Research IRZV, Bamenda
Dr Tambi	Agricultural Economist, IRZV, Bamenda
Dr Pone	Researcher (poultry), IRZV, Bamenda
Mrs Pamela Kamga	Microbiologist, IRZV, Bambui
Dr Ndi	Veterinarian, IRZV, Bambui
Dr Njiforti Hanson	Wildlife Ecologist, Centre d'Etude de l'Environnement et du Developpement au Cameroun, Maroua
Mr Tarla Francis Nchembi	Range (livestock) Ecologist CEEDC
Mr Kouahole Etienne	Wildlife Ecologist CEEDC Maroua
Dr J Michael S Allen	Project Leader, IUCN, Maroua
Manager	CGD Supermarket, Maroua
Kilishi Producers in Yaounde and Maroua	
Mr Mana Toukour	Director, Societe Industrielle de Transformation de Fruits, Maroua
Mr Francis E Obale	Agricultural Engineer, Institute of Agricultural Research, Maroua
Mr Dili Passole Baba	Chef de Service Provencale de Production Animale, Maroua
Mr Ousman	Joint Chef de Service Provencale de Production Animale, Maroua
Dr V Tanya	Chief of Centre, IRZV, Wakwa, PO Box 65, Ngaoundere
Dr Yonkeu	Deputy Chief of Centre, IRZV, Ngaoundere
Dr Ekue	Head of Veterinary laboratory, IRZV, Ngaoundere
Dr Achukwi	STD3 researcher on Onchocerca
Mr David Pingpoh	Agricultural economist, IRZV, Ngaoundere
Dr Oumarou Dawa	Delegate for Livestock for Adamaoua Province
Alhadji Aoudou Mekilishi	Kilishi producer
Mohamed Hamisou	Kilishi producer
Alhadji Aoudou Babangida	Kilishi producer
Prof Carl MF Mbofung	Dept of Food Science and Nutrition, Ensai, PO Box 455, University of Ngaoundere
Prof P Rochegude	Director, Ensai, U of Ngaoundere Fax (237) 25 25 73
Dr Agatha Tanya	Head of Nutrition, University of Ngaoundere

Appendix 2 Draft Programme of work

Development and Marketing of Dried Meat

Upon completion of formalities, this document may constitute a form of general agreement between the NRI and the Institut de Recherches Zootechniques et Vétérinaires, Wakwa, Ngaoundere, Cameroun

Objectives

- 1 To improve on the production and marketing systems of dried meat products manufactured in the North of Cameroon and sold in the South. The programme, which relates mainly to Kilishi and smoke-dried beef, aims to increase availability of meat in the south and perhaps displace bush meat.
- 2 To determine the smoke content of smoke-dried meat products

Project location

Based at the Institut de Recherches Zootechniques et Vétérinaires, Wakwa, Ngaoundere and the University of Ngaoundere, Cameroon

Project partners

Dr V Tanya,	IRZV with two laboratory technicians (TBI*)
Mr D Pingpoh	IRZV with three enumerators (TBI)
Prof C Mbofung	U of NG with one laboratory technician (TBI)
Mr M Jones,	NRI, Meat technologist
Mr U Kleih,	NRI, Marketing economist
Mr D Silverside,	NRI

Project timing

1 October to 30 November 1994:

Meat technologist:	2 months
Marketing economist:	1 month

Background

There is market demand and a shortage of dried meat in the south of Cameroon. Producers of dried meat in north Cameroon do not market their product aggressively in the south. Manufacture of the product requires their full attention. Buyers visit the north to buy and return south with a product.

The products are not manufactured under hygienic conditions. It is believed that these products will be more marketable if their shelf life is increased and the product has an improved image.

* To be identified

Method of operation

At the project concept stage, it was the intention to identify and cooperate with existing entrepreneurs with a view to modification of the system of production and improve the image of the product. It has been found impossible to identify such a person or organisation. The alternative therefore is to produce improved dried meat at a research Institute and introduce the technology to existing producers through an extension system. The concept is that the Institute will use a local meat producer in the development of the products and demonstrate the technology to others. Contacts have thus been made to encourage the producers to cooperate with the Institute through the Delegate of the Province of Adamaoua.

Alongside product development, studies will be undertaken in Ngaoundere, Douala and Yaounde to determine the nature of the market for the product and to interest wholesalers and other agents in expanding their activities.

It is proposed to undertake a collaborative project between the IRZV and NRI. Two members of NRI will be based at the Institute at Wakwa. The meat technologist will collaborate with Dr V Tanya and two laboratory technicians of IRZV and Prof Mbufong and two laboratory technicians at the University of Ngaoundere. The Marketing Economist will work with Mr D Pingoh and three market enumerators of the IRZV.

The programme of work will be as follows:

Kilishi:

Technology studies

- 1 Test the meat cutting machine, currently under development at NRI, if available
- 2 Make and test an hygienic dryer using a variety of production techniques
- 3 Introduce a simple packaging method which will extend its shelf life, protect the product from manufacture to retail and enhance the product's image
- 4 Determine nutritional quality of products manufactured under different conditions given in 2 above

Marketing/Economic studies

- 5 Establish the market potential for Kilishi in the south
- 6 Establish the interest of actual and potential buyers from the south who might be interested in purchasing more meat from the production area
- 7 Determine the implications of Kilishi production on production of other types of meat and its by-products

Viande fumée:

Technology studies

- 1 Develop and test an efficient and practical drying and smoking system for beef
- 2 Introduce simple packaging methods which will give adequate shelf life and enhance the image of the product
- 3 Determine the degree of smoking under different production systems

Marketing/Economic studies

- 4 Establish the market potential for viande fumée in the south
- 5 Establish the interest of suitable producers in Ngaoundere
- 6 Determine the implications of smoke-dried meat manufacture on production of other types of meat and its by-products

Technological analyses to be performed at IRZV:

- 1 Moisture/Ash/ A_w /Protein N_2 , Lipid, pH, weight changes in meat and meat additives during and after production
- 2 Bacteriological status of meat and its additives at appropriate stages of production; to include TVC, moulds, *S aureus* and a faecal marker.

Technological analyses to be performed at the University of Ngaoundere:

- 1 Nutrition parameters of Kilishi produced under different conditions at IRZV eg digestibility of proteins, nutrient availability (amino acids and minerals), lipid changes (eg FFA) vitamins (B group and fat solubles)
- 2 Toxicological studies, particularly aflatoxins and free radicals (not through the use of expensive kits)
- 3 Smoke constituent label(s) content of smoked meats produced at IRZV

To be provided by NRI:

• Equipment, chemicals* and miscellaneous consumables (incl freight to Garoua) to a value of	£6000
• Allowances for 2 technicians at IRZV at FCFA 30,000 each per month for two months	£150
• Allowances for two university technicians at FCFA 30,000 each per month for two months	£150
• Allowances for 2 IRZV market enumerators in Yaounde and Ngaoundere at FCFA 30,000 each for one month + their expenses to FCFA 50,000 each (assumed that enumerators live in these towns)	£200
• Allowances of FCFA 30,000 and expenses for 1 market enumerator in Douala at FCFA 100,000 (assumed that there is no enumerator based in Douala)	£150
• Supervision of enumerators by IRZV researcher FCFA 200,000	£250
• Rent for house at FCFA 100,000/month for 2 months	£250
• Overheads for use of IRZV laboratory at Wakwa and Yaounde, freight clearance, telephone, electricity, water etc (FCFA 200,000)	£250
• Overheads for use of University laboratory, telephone, electricity, water etc FCFA 80,000	£100
• Meat samples to a value of	£500
Total	£8000

To be provided by IRZV:

- Laboratory with operational utilities, freight clearance, miscellaneous consumables and services, to conduct the analyses outlined above
- Housing for visiting workers
- Two laboratory technicians
- Three market enumerators
- Transport, if British Embassy is unable to help

To be provided by The University of Ngaoundere:

- Laboratory with operational utilities, miscellaneous consumables and services, to conduct the analyses outlined above
- Two laboratory technicians

List attached

Chemicals and equipment to be provided and shipped by NRI:

1	Moisture dishes	20	500.00
2	Desiccator cabinet	1	261.00
3	Acid washed sand		12.40
4	Celite filter aid		9.00
5	Filter paper		11.70
6	Beakers, 250 ml		6.90
7	Conical flasks, 250 ml		8.46
8	Beakers, 600 ml		10.20
9	Separating funnels		64.56
10	Anhydrous sodium sulphite		4.49
11	Sodium hydroxide 0.1N		19.20
12	Phenolphthalein		7.40
13	Stomacher		1200.00
14	Stomacher bags		35.00
15	Basins, vitreosil	30	603.00
16	Watch glasses		105.60
17	pH meter and buffers		100.00
18	Bunsen burner		10.00
19	Silica gel		44.82
20	Volumetric flasks		52.74
21	Polythene bags		10.00
22	Pipettes		30.00
23	Pipette filler		10.00
24	Petri-dishes		189.20
25	Pipettes, sterile		296.40
26	Pipette fillers and adapters		20.56
27	Pyrogloves		20.00
28	Disposable gloves		10.00
29	Max/min thermometers		16.00
30	DRBC media		132.16
31	DRBC supplement		39.04
32	DG18 media		129.60
33	DG18 supplement		39.04
34	VRBA media		76.20
35	PCA media		115.68
36	BP media		228.76
37	Egg yolk tellurite emulsion		49.00
38	McCartney bottles		51.25
39	Bottle for media		38.08
40	Miscellaneous consumables (gloves, tissues etc)		0.00
	Total		4567.44
	Air freight at 15%		685.12
	Grand total from UK		£5252.56

All acids and solvents to be provided locally but funded by NRI.

These to include:

1	Sulphuric acid	55.80
2	Hydrochloric acid	60.40
3	Petroleum spirit (60-80°)	91.40
4	Chloroform	78.48
5	Methanol	38.52
6	Methylated spirit	32.04
	Total	356.64
	Freight charges	53.5
	Grand total	410.14

Total costs of UK supplies, say	5500
Total cost of Cameroon supplies, say	£500

Grand total of chemicals and equipment £6000

Other requirements:

Assumed present in Cameroon if not, they may be taken from and returned to UK

- 1 A_w meter
- 2 Meat knives
- 3 Lab coats
- 4 Analytical balance
- 5 Distilled water supply
- 6 Homogeniser
- 7 Suction pump (electric)
- 8 Drying oven (103°C)
- 9 Muffle furnace (500°C)
- 10 Incubators (x3 @ 30°C, 35°C and 50°C)
- 11 Temperature controlled waterbath
- 12 Plate counter (with backlight)
- 13 Lamina flow cabinet
- 14 Stapler
- 15 Packaging?
- 16 Microwave oven
- 17 Hotplate
- 18 Autoclave
- 19 NRI developed cutting machine?

Summary of Costs

One staff member 2mm x 5750	11500
One staff member 1mm x 7250	7250
Food supplements	750
Unaccompanied/XS baggage Allowance	250
Return air ticket x 2	3000
Subsistence 30 days at £60	1800
Fuel costs	200
Housing utilities	<u>100</u>
Total	24850
Consumables, equipment and other Local expenditure	8000
Grand total for NRI	£32,850

