

**A Review of the Storage and
Marketing Systems of Major
Food Grains in Northern Ghana**

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GLOSSARY OF ACRONYMS USED IN THE TEXT

ADB	Agricultural Development Bank
BHC	Bank for Housing and Construction
DA	District Assembly
FLS	Front Line Staff (extension workers)
GFDC	Ghana Food Distribution Corporation
GPRTU	The Ghana Private Road Transporters' Union
MoFA	Ministry of Food and Agriculture
PPMED	Policy, Planning, Monitoring and Evaluation Department, MoFA
PHO	Post Harvest Officer of MoFA
TAAP	Tamale Archdiocese Agricultural Project

Currency conversions

When the study was undertaken, between November and December 1995, the exchange rate was: £1 = 2,300 cedis; \$1 = 1,500 cedis

SUMMARY: CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

In northern Ghana, the main durable food crops cultivated are maize, sorghum, millet, rice and pulses, particularly cowpea and to a lesser extent bambara groundnut. The prolonged single rainy season allows two crops of maize and millet to be produced each year but most crops are only harvested once. There is therefore a need to store crops for long periods on the farm to ensure food security for the family. Nevertheless, farmers produce surpluses of some food crops in order to meet debts accrued during agricultural operations, educating children, meeting medical expenses and so on.

This study was conducted to determine the constraints to maintaining good quality grain in store on the farm and to marketing produce surplus to food needs. Two regions were visited, Northern Region, where maize is the main cereal staple, and Upper East, where maize is replaced by millet and sorghum. Farmers and traders were interviewed in groups or individually in both villages and markets.

CONCLUSIONS

Storage

- a) The main cereal staples are stored for as long as possible on the farm for home consumption. Storage can extend for seven months or more, certainly until early maize or millet are ready to be harvested. However, unpredictable rainfall and low yields produced as a result of low soil fertility and use of unimproved, low yielding varieties, means that families may not harvest sufficient to meet all the requirements for home consumption. Women often have to supplement the staple food supply, generally the responsibility of men, by selling cash crops such as vegetables, rice and groundnuts.
- b) Pulses may also be stored for seven months or more, particularly those lots kept for seed. However, the level of insect infestation in store usually necessitates cowpea, in particular, and bambara being sold early.
- c) The condition of grain in store is affected by both insect and rodent pests. Both these groups cause significant losses. The level of loss sustained could not be quantified but farmers believe it is worth taking action to remedy the causes. Pulses are most heavily damaged, perhaps 20% by weight of cowpeas are lost on average but often the entire crop is destroyed in storage. Bambara losses may also exceed 20% but also important is the reduced seed germination which cannot be appreciated until the seed is sown. Maize is susceptible to Larger Grain Borer which is gradually extending its range across northern Ghana. This pest will result in maize losses becoming of the same magnitude as those incurred by cowpea. Some male growers believe the damage to small grain cereals is also significant, eg 10-20% loss in seven months. However, experience from similar climates in other parts of Africa would point to this not being

the case; many producers in northern Ghana said they suffered no damage to sorghum and millet during storage.

d) In general, farmers do not use any remedial measures to counteract these storage problems. A few farmers use ashes and plants as protectants against insects but these are relatively ineffective, at least in the way they are applied. Very few farmers are able to afford modern protective chemicals; these chemicals are not available outside the major towns. Phosphine is used as a rodenticide and as an insecticide. Its use is both dangerous to those applying the tablets (and their families) and ineffective.

e) Food crops in Northern Region, particularly cereals, are kept in traditional storage baskets, the *kambon* and *kunchun*, which are woven from grass matting or sorghum stalks. These structures are not very durable and they require building materials, e.g. wood poles for the platforms, which are a steadily diminishing resource in northern Ghana. Cash crops, including pulses, are stored in jute or polypropylene sacks.

f) In Upper East, all grain crops are stored in mud silos. These structures do not require wood for construction but they do require some degree of skill to build. They are very durable, some lasting 20 years or more and they require little maintenance. The silo, when covered with a lid, provides an effective barrier against both insect and rodent attack. However, they are prone to being damaged or even destroyed by termites, a particularly prevalent problem in the far north of Ghana. Silos, and the grain they contain, may also suffer rain damage if not covered by thatch or a mud-plastered lid.

g) Most of the post-harvest technical problems relate to storage issues. Transportation from the fields, which might be many kilometres distant, was a problem identified by many because of the difficulty in obtaining or affording transportation to the house, or because traders would not buy and collect the produce direct from the field.

h) Processing issues were not studied in detail so information was obtained on an *ad hoc* basis. Some producers decried the lack of maize and groundnut shellers but this was not a major issue for most people. Milling facilities were adequate in most villages. However, problems in processing bambara groundnuts were mentioned occasionally; they take too long to cook and require too much water.

i) Many traders store cereals and pulses for up to seven months. They utilise whatever structures they own or are able to hire. These stores are usually totally inadequate for the purpose, being simply large enclosures. The structures are flimsily built, poorly maintained and infrequently cleaned. Good storage management is very difficult to practise and pest control operations difficult to adapt to maintain effectiveness. Insect damage can be heavy and only seems to be contained by the very liberal use of insecticide and fumigant. Pest control operations are conducted by both government and commercial organisations without due consideration being given to efficiency, health hazards and cost. No attempts are made to tailor the treatment to fit the storage facility or to modify the store to optimise control options. If grain pests are controlled and insect and rodent damage limited it is because of excessive overdosing of chemicals and by increasing the turnover of the grain.

Marketing

- a) The research demonstrates a high degree of entrepreneurial activity in the villages of northern Ghana. This links into the well-integrated marketing system through an extensive network of local markets which in turn feed into the district, regional and national marketing systems. Many agents operate at the exchange points at all levels, indicating that barriers to entry are low.
- b) The resulting high degree of competition means that marketing margins do not appear to be high, especially at the lower levels. However a more systematic study of marketing margins would be required to confirm this impression.
- c) No evidence was found to suggest that relationships between producers and traders are characterised by mistrust or exploitation. Rather the evidence suggests that producers see traders as providers of a service for which a fee (e.g. the traders' "measure") is legitimate payment.
- d) Institutional arrangements between producers and traders vary considerably. At the village level trading involves a variety of informal financial arrangements which are difficult to characterise as the modalities of any given arrangement are determined largely by the relationship between the trader and the producer. Credit might flow in either direction. Even at higher levels in the marketing system, there is no uniformity of trading arrangements: some wholesalers use agents, others use regular suppliers whilst others use both or neither. Similarly a farmer may go direct to a wholesaler in a market or sell through a middleman, or use the services of an agent to whom he pays a commission.
- e) Women predominate at the lower levels of the marketing system and are as equally represented as men at the higher levels. Women's prominence in marketing is probably linked to different gender roles at the household level where men are primarily responsible for the production of basic staples for the entire compound whilst each wife is only required to produce "stew" for the husband and her own children. Thus whilst the husband is primarily concerned with subsistence production, his wives require cash to buy condiments, linking them much more directly into the cash economy.
- f) This gender division has an impact on the commodities traded by the household. The husband's production of basic grains is primarily for household consumption and in deficit areas there is evidence that the marketing of such crops is socially unacceptable. In less marginal areas which support a wider range of productive activities men market maize, groundnut, cowpea and yam. Women, where they have access to their own land, produce a similar range of crops to their husbands although groundnuts, beans and rice seem to predominate, all of which are primarily cash crops. In some areas soybean is popular among the women as a cash crop.
- g) Processing activities are a widely practised form of income generation for women and in the most arid areas, where there is little surplus agricultural production, they may represent the only means available to women to raise cash income.

h) The commercial benefits of interseasonal storage are widely understood by villagers and traders alike and those who have the capacity to hold stocks over time do so, especially groundnuts, rice, cowpeas and maize. Interseasonal price changes are most marked for these commodities: over the last five seasons, the July price for maize has risen an average of 85% over the low post-harvest price (October); for groundnuts, the price rise averages 89% (from October to June) and for cowpeas the August price has risen 64% over the low November price.

i) High storage losses represent one major constraint to increased interseasonal storage both on farm and in warehouse storage in the markets. Cowpeas particularly appear to present producers and traders alike with severe problems. Though some producers practise traditional storage protection methods, understanding of chemical treatments appears to be poor at the farm and market levels and access to the required inputs very limited.

j) On-farm storage for sale appears more common among women than men, especially the storage of groundnuts and paddy. Women appear not to store in the traditional structures, which are used by the men for storing grains for consumption, but in jute sacks in compound houses.

k) Another major constraint to increased interseasonal storage is finance. At the village level, the only evidence of formal sector lending was through donor projects and, even higher up the marketing chain, few traders had access to bank financing. In these circumstances traders appear to rely on family, friends or another business enterprise to finance storage. In the absence of this the little capital they have available is required for trading itself.

l) More generally limited access to finance appears to be constraining the growth of trading enterprises at all levels as traders cannot invest in expanding their operations or improving facilities.

m) Local taxes appear to be widely enforced and collected by the District Assemblies. Although rates varied in different districts, a tax of 300-400 cedis per bag seems to be common, representing 1-2% on a bag valued at 20,000 cedis. No trader complained about the tax. Equally the commission charged by the GPRTU and its monopoly position in the provision of transport services appeared to go unchallenged among traders. One explanation for this could be that traders feel they are receiving a good service from the District Assemblies and GPRTU, but sufficient evidence was not collected to confirm or reject such a hypothesis.

n) There is no evidence of the use of standardised weights and measures in the markets. The introduction of such a system would add transparency and efficiency to the existing system and would reduce the opportunities for exploitation. However no evidence was collected of a demand for change. The present system may represent an adaptation to the particular circumstances of market exchange which has broad support.

m) The role of the government in maize marketing has changed markedly in recent years. The marketing board, the Ghana Food Distribution Corporation, no longer

intervenes in the market to purchase grain from producers or agents. Now its role is restricted to acting as managers of grain on behalf of banks who provide inventory credit to producers. GFDC holds commodities in its own warehouses and provides management services to ensure the stocks are kept in good condition whilst in store.

RECOMMENDATIONS FOR FURTHER RESEARCH

On-farm storage

There are two areas which need to be addressed:

- provision of durable, cost-effective stores for long-term (six months plus) storage of cereals and pulses;
- development of low-cost methods of protecting grain against insect and rodent damage.

Farmers require a store which is more durable than the *kambon* but which is relatively cheap. The store should be pest resistant so that rodents, in particular, are excluded from the stored commodity. Such a structure can be found in the mud silo which is used by some ethnic groups in the north. However, the silo has its own problems which must be addressed, including its vulnerability to termite and rain damage, and possible implications of fungal contamination from the structure to the produce.

Women frequently store in sacks and earthen pots. Their problems are similar to those of men who use traditional structures but the solutions must be adapted. Low-cost methods must be developed to enable grain to be stored in such a way that its quality can be maintained. This may require the application of non-synthetic protectants such as those derived from plants, and methods for the optimal use of these will need to be produced. Some farmers may wish to purchase and use modern chemicals to reduce insect damage and ensure the highest quality is maintained; efficient methods of treatment should be developed to enable this to be achieved with minimal expenditure of cash but ensuring maximum safety.

Cowpeas and bambara groundnuts are highly susceptible to damage by storage insect pests. Methods to reduce infestation must be regarded as a priority to enable these commodities to be safely stored, so as to ensure the protein intake of the farm family. Two approaches should be taken. Firstly, short to medium-term solutions must be designed for the farmer which can be implemented relatively simple and cheaply. Such solutions may include developing cheap hermetic storage structures or the application of thermal disinfestation techniques. Secondly, in the longer term, pulse-breeding programmes must be adapted to incorporate insect resistance. Although resistant varieties have been developed by legume breeders, the varieties do not seem to be widely cultivated, probably because the resultant grain does not meet cooking and organoleptic needs. The only long-term sustainable way to reduce insect infestation is to develop varieties which are both resistant and acceptable to the consumer.

Cereals do not pose the same problems as pulses. However, research should be conducted to address the problems of drying (and possible fungal contamination) and

insect damage which occur in early-harvested maize and millet. Furthermore, it is likely that LGB will become increasingly important throughout northern Ghana and storage practices will need to be adapted to counter the problems which are likely to occur.

People storing grain in the homestead must be given the opportunity to enhance quality and reduce losses with as little change to normal practices as is necessary. Therefore they should be in a position to select what changes they want to employ and the amount of money they wish to expend to make improvements. A raft of options must be developed, the application of which is not necessarily mutually exclusive. These options will include store management practices, store types and protectants, and the choice will depend on the type of commodity, its end use, its value and the predicted storage period.

Trader-level storage

It became clear during the study that there is a very low level of understanding of good storage practice among traders. Although high-quality produce fetches premium prices, particularly for pulses, many traders were resigned to dealing in grain which was badly damaged by insects. Grain bought in good condition can be maintained at the same quality in store if appropriate pest storage management practices are put into place. Although some traders employ government and private pest control operators to treat their commodities this is usually not efficiently done nor cost-effective. Therefore, effective strategies for improving stock and store management and pest control should be developed for the small to medium scale trading enterprises.

Marketing margins

The evidence collected during the research suggests that marketing margins are not abnormally high anywhere in the marketing system. However given the central importance of competition in the characterisation of any marketing system, and the direct link between the level of marketing margins and the degree of competition, it is important to test this impression against the results of a more systematic study. It is proposed that such a study should focus on regional markets, particularly the market in Tamale which is the most important regional market in the north.

Finance

Finance is a central issue in relation to storage and marketing. Further development of methods to improve the financing of storage and trade at both the farm and market levels is required.

At the producer level, donor initiatives involving inventory credit and group lending were reviewed during the course of this research (5.2.1). Assuming prevailing interest rates and commodity prices are favourable, producers have much to gain from an inventory credit system but the IFAD experience of inventory credit with smallholders suggests that more effort is needed to develop a sustainable approach, given the high degree of subsidy involved at present. The group-lending schemes promoted by TAAP

should also be more closely evaluated to establish the degree to which such schemes can eventually become sustainably integrated into the formal financial system.

At the market level, inventory credit offers the best approach as it has the potential to simultaneously improve a trader's access to finance and elevate standards of storage management at this level. However a number of variables, most significantly prevailing interest rates and commodity price movements, will have a decisive influence on the viability of inventory credit. A more systematic study is therefore needed to assess the feasibility of inventory credit under varying assumptions about these variables.

Further research should also be carried out on the cost effectiveness of the commercial banks adopting the procedures pioneered by the Citi Savings and Loans Company to attract business among the trading community. If it could be demonstrated to the banks that the benefits of more "trader-friendly" banking would outweigh the costs, then they might show more interest in providing services to the sector.

Weights and measures

Despite the fact that observations and theoretical considerations suggest that the present system is not very efficient, and is certainly not transparent, change should be introduced with caution. As a first step, research should attempt to get a better understanding of how the present measuring system operates and is viewed by those who use it. Without an understanding of who gains and loses from the existing system, it will be impossible to predict how traders will react to any efforts to introduce a new one.

Other issues

Information systems for traders and communal storage operators

The government does not direct any extension effort towards traders. Thus commodity traders do not receive any advice or technical information on storage issues other than from private pesticide wholesalers, retailers and applicators, who have a vested interest in promoting their services and products. Similarly, farmer groups becoming involved in communal storage to obtain credit will also lack the ability to judge the effectiveness of the inventory manager, particularly when storage is on a small scale in the village. This manager, likely to be a MoFA FLS may not possess sufficient expertise to be able to address all the issues which are likely to occur, unless more extensive training is provided. A system needs to be established, therefore, whereby traders and those involved in communal storage can obtain impartial advice, training and assistance on these issues.

The GPRTU

Despite the fact that the GPRTU appears to be inflating marketing costs through its monopoly control over transport rates and the 10% commission, further research to improve transport arrangements is likely to become politically very sensitive. It is therefore unlikely to be an area for further research through the ODA funded programme.

CHAPTER 1. INTRODUCTION

1.1 Background and objectives

Grain legumes contribute a major part of the protein and energy requirements of many subsistence farmers and the non-farming community in semi-arid areas of West Africa. In these regions, pulses are rapidly attacked by bruchid beetle pests after harvest which affect both nutritional value and quality of produce sold to traders. Good quality legumes are known to command premium prices when sold in major cities closer to the coast. Apart from cowpeas, little is known about the post-harvest commodity systems for the major legumes, including bambara groundnuts, soyabeans and groundnuts, in semi-arid areas.

The commodity systems for the major cereal crops (maize, sorghum and millet) produced in the semi-arid areas are similarly under-studied, and exploratory work is needed to identify where stocks are held in the marketing chain and to identify researchable constraints. Issues such as whether improved varieties are grown and stored, the source of seeds available, susceptibility to insects, losses suffered and market access and pricing structures need to be examined.

A study was commissioned by the Crop Post Harvest Programme of the ODA Natural Resources Research Department to strategically review commodity systems for major cereals and legumes in the semi-arid areas of West Africa, to identify appropriate storage management and marketing strategies and to define technical research requirements. The study was to include:

- farmer perception of production and post-harvest systems;
- a description of commodity systems for cereals and legumes, including: the source of seed; input supply; and credit availability;
- identification of research needs relating to: legume quality; household food security; farmer access to markets; and seed sourcing and maintenance of quality.

The first study, the subject of this report, was conducted in Ghana.

1.2 Team composition

The team was composed of a storage management specialist (team leader), Dr Peter Golob; an agricultural economist, Ms Rachel Stringfellow; and a consultant market economist, Dr E.O. Asante of the Ghana Institute of Management and Public Administration. The team was assisted in Northern Region by Ministry of Agriculture (MoFA) Post-Harvest Officers (PHO), Mr Harry Gbetroh and Mr Adam Dauda and by Ms Fauzia Fuseini of the Tamale Archdiocese Agricultural Project (TAAP). In Bawku West, Action Aid kindly assisted by providing accommodation and two field assistants, Mr Adam Kolibili and Mr Peter Sani. The MoFA PHO, Mr James Atayagiri, assisted in Bolgatanga.

Typically, in each village Dr Golob and Dr Asante together interviewed groups of men and Ms Stringfellow the women. Ms Stringfellow was ably assisted in Northern

Region by Miss Fuseini and, in Upper East, by female front line staff of the MoFA Department of Extension. The same teams interviewed individual farmers and traders, except in Tamale market where the teams split up into three groups.

1.3 Outline of Study

The study was conducted in Northern and Upper East regions of northern Ghana (Figure 1). In Upper East, surveys were conducted in two areas: in Bawku West district, which is in the extreme north-east of the country; and around Bolgatanga/Navrongo districts in the central and western part of the region. Ethnic conflict prevented visits to much of the eastern area of Northern Region and the surveys were restricted to villages located within a radius of 80 km from Tamale.

In each region, surveys were conducted in villages with groups and with individual farmers. Men and women were interviewed in separate groups. The size of the groups ranged from 14-37 (median 18) for men and 3-19 (median 10) for women. Five groups of women were interviewed in both regions; five and six groups of men were interviewed in Northern and Upper East regions respectively. Twenty one farmers were interviewed individually.

Sixty-one traders were interviewed both in markets, when they were either buying or selling, and in villages. Thirteen markets were visited: in rural areas; in small towns such as Bawku; in main trading centres such as Tamale; in major urban areas in Accra; and in the main distribution centre in Techiman.

CHAPTER 2. OVERVIEW

2.1 National production and consumption patterns

There is a great diversity of the starch staple supply in Ghana with yam, cassava, cocoyam and plantain being major foodstuffs in addition to the cereals - maize, sorghum, millet and rice. Legumes, including groundnuts and a variety of different pulses are other important basic staples.

2.1.1 Cereals

The principal grain production belt extends across the Ashanti, Brong-Ahafo and Northern regions. Maize is the major cereal and is grown as a staple and a cash crop in all regions. Brong-Ahafo and Northern regions account for more than 45% of cereal production although they have only 19% of population. As a result there is surplus production and large inter-regional transfers.

In the south there are two maize crop seasons every year, eliminating the need for year-long storage. In the north, the marginal savannah climate limits the range of staples that are available in addition to restricting production to one season annually. Sorghum and millet are the principal subsistence crops in the Northern and Upper regions, accounting for 95% of national production. These areas face considerably greater food insecurity than those in the south.

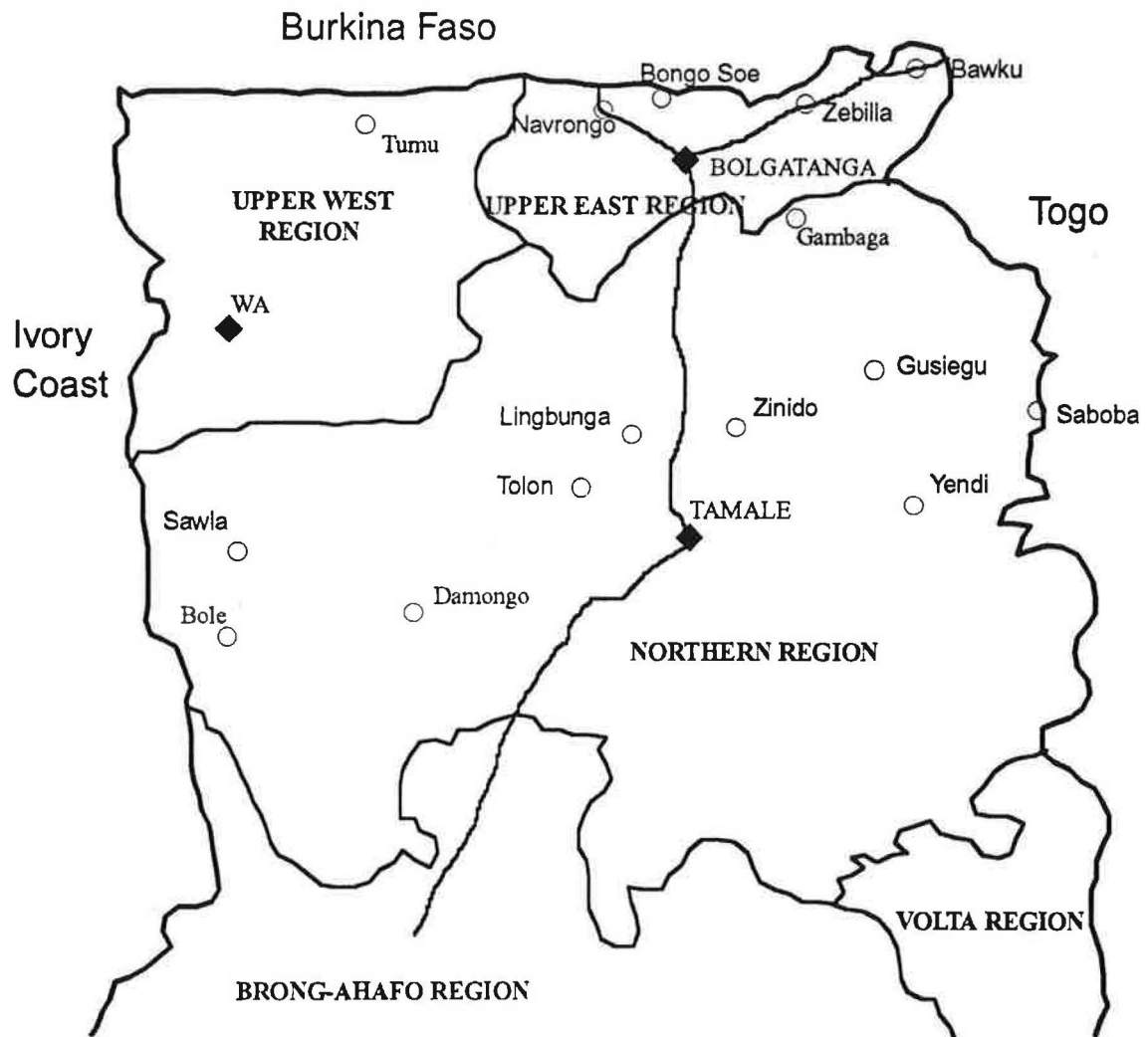
National cereal production has been increasing for the past 10 years as a result of an expansion in cultivated area, mainly in existing production zones but also in more marginal northern areas, and yield increases through effective promotion of high-yielding varieties.

It is estimated that marketable surpluses are 50% of maize production, 60% for rice and 20-25% for sorghum and millet (FAO 1989). Up to 90% of the marketable surplus is handled by the traditional marketing system.

The major areas of consumption of marketed cereals are in the Forest (Kumasi) and Coastal Savannah (Accra) agro-ecological zones, whereas production is in the Guinea savannah and Transitional zones. On a regional basis, demand estimates show that grains are of greatest importance in Northern Region which consumes 275,000 t or 18% of national demand. Regional demand estimates show maize to be the most important cereal in all regions except Upper East and Upper West where millet and sorghum are more significant.

Estimates of inter-regional transfers show that six of Ghana's ten regions are not food self-sufficient hence inter-regional transfers are estimated at 240,000 t of cereals (50% of which is maize). The principal surplus production regions are Northern and Brong-Ahafo and the deficit regions are Greater Accra, Eastern, Volta and Ashanti.

Figure 1. Northern Ghana



2.1.2 Legumes

The most important grain legumes in Ghana are cowpeas, bambara groundnuts and increasingly, soyabean. Pigeon peas are produced on a much smaller scale and sold at local markets in small quantities. Lima beans, grown in very small quantities, are intended for home use only. Other grain legumes, reportedly cultivated in Ghana, are the geocarpa bean, the winged bean and the sword bean. Legumes, grown primarily for their oil content, include groundnut and soybean. In recent years soybean has been promoted extensively by government due to its high protein content.

Legumes are grown throughout Ghana but the intensity of production and importance varies from one region to another. Production is largely concentrated in the Northern, Upper East and Upper West regions.

In 1993, the FAO estimated that the total area planted with groundnuts was 130,000 ha, producing a yield of 100,000 t. For 1989, the Policy, Planning, Monitoring and Evaluation Department (PPMED) estimated that approximately 28% of groundnuts produced came from the Upper East, 16% from the Upper West, 45% from the Northern region and the remaining 11% from other areas. Most groundnuts are cultivated by smallholder farmers cultivating less than 4 ha of land and they are commonly inter-cropped with other food crops, including maize, sorghum and millet. They are an important food crop but are also widely traded as kernels or in processed form (principally as oil although groundnut paste and snack foods are common in local markets).

In northern Ghana, cowpeas form a major part of the diet and the majority of farmers cultivate the crop on a subsistence basis although there is trade in surplus production. Most farmers cultivate between 0.4 and 2 ha which is often intercropped with cereals.

2.2 National production figures

Table 1: National Production estimates of maize, sorghum, millet, groundnuts and cowpea, 1984-1994

'000 MT

	84	85	86	87	88	89	90	91	92	93	94
maize	574	395	559	598	600	715	553	932	731	961	940
sorghum	176	185	128	206	178	215	136	241	259	328	324
millet	139	120	110	173	192	180	75	112	133	198	168
groundnut	167	140	189	191	230	200	113	n/a	n/a	n/a	n/a
cowpea	14	11	20	18	15	19	n/a	n/a	n/a	n/a	n/a

Production figures for other legumes, including bambara, have not been collated. These legumes are only of importance in the north; they are not cultivated on a significant scale in the southern parts of Ghana.

2.3 Regional distribution of production

The regional distribution of production of the commodities for the years 1987-1990 is given in Figures 2-6.

The data illustrates the sharp regional differentiation between the higher rainfall areas of southern and central Ghana and the more arid areas of the north where maize production is of much less significance than the smaller grains. There is also a marked regional distribution of groundnuts and pulses with production concentrated in the north of the country.

**Figure 2: Regional distribution of maize production, 1987-1990
(figures in MT)**

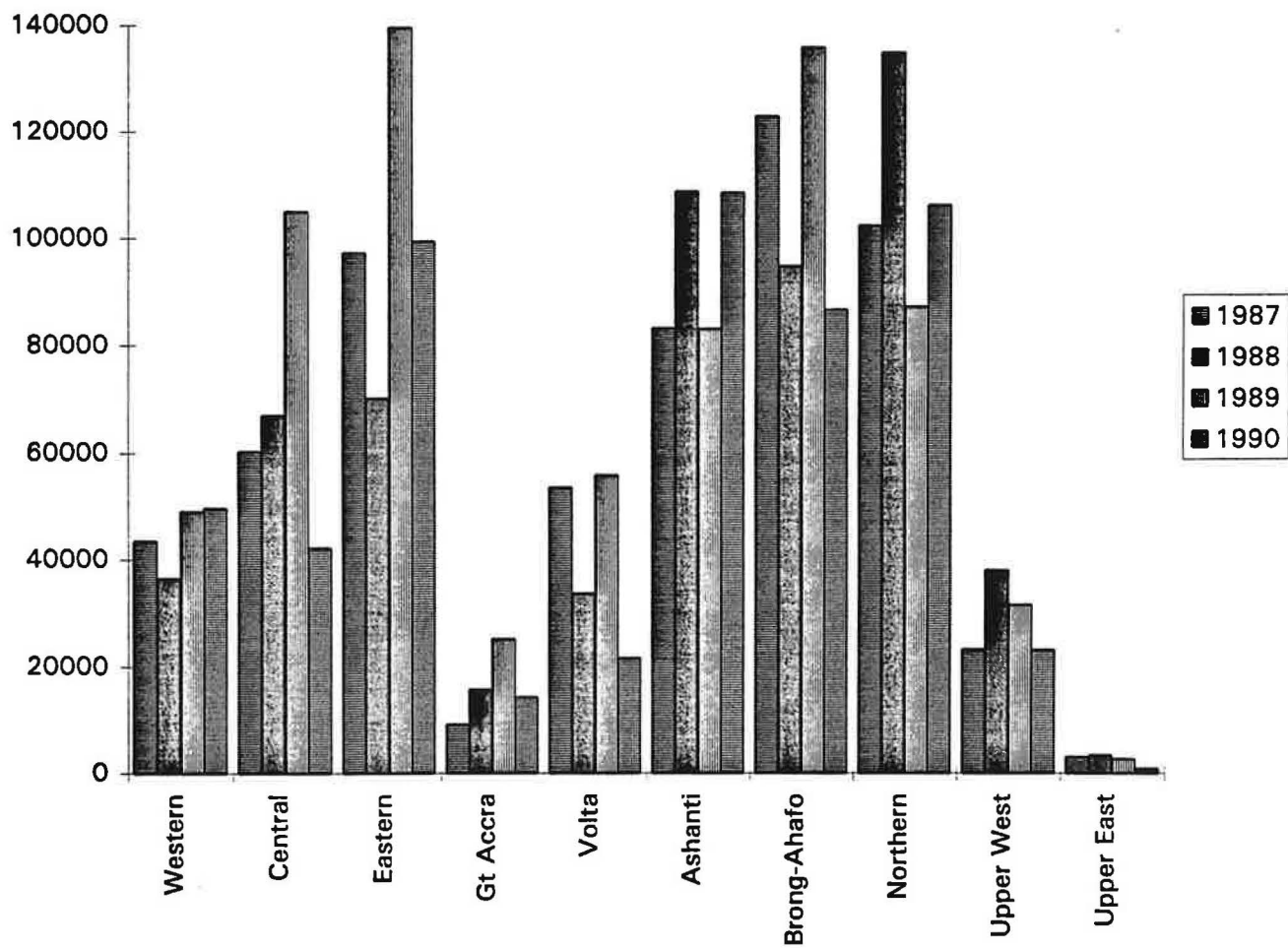
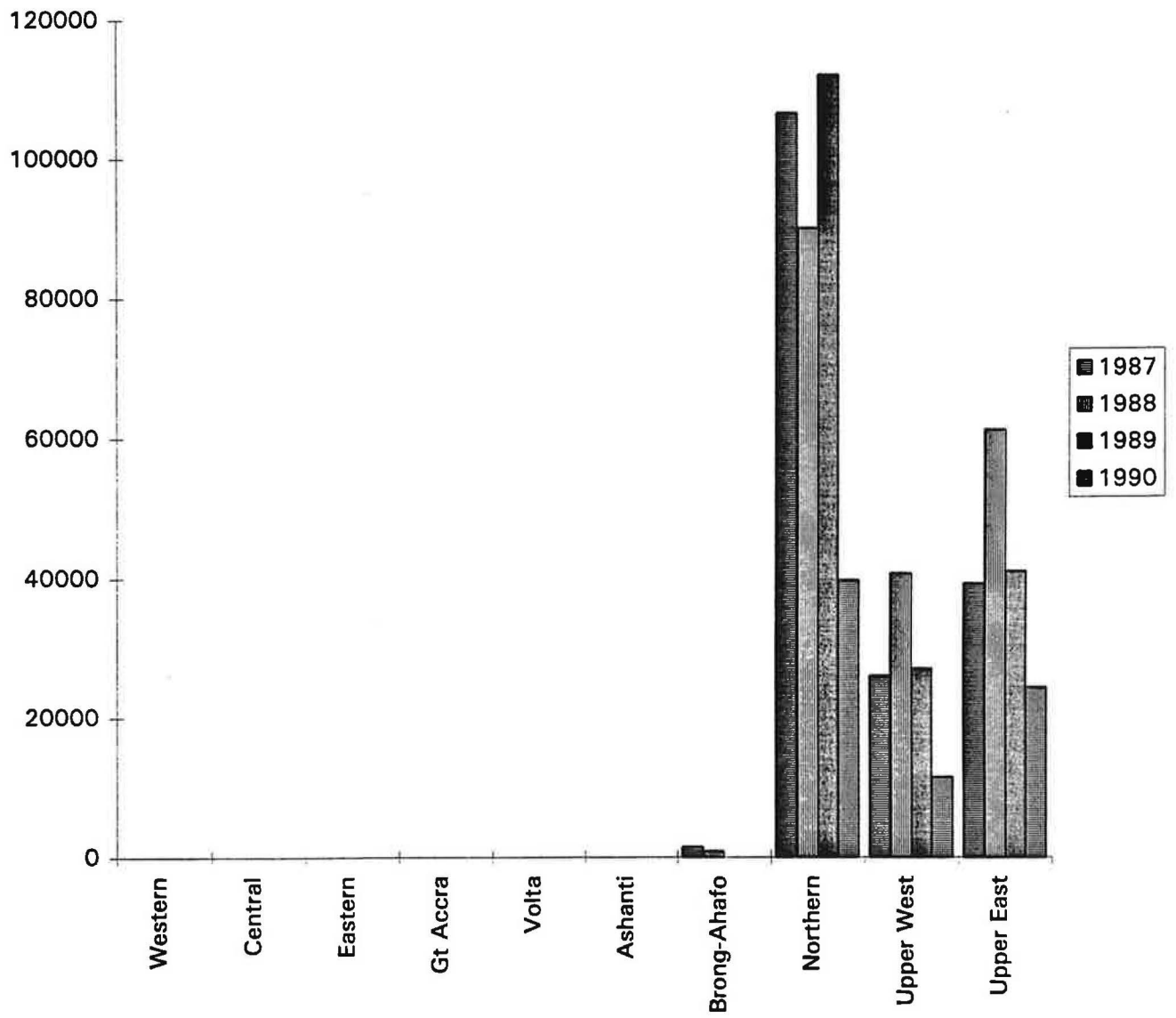
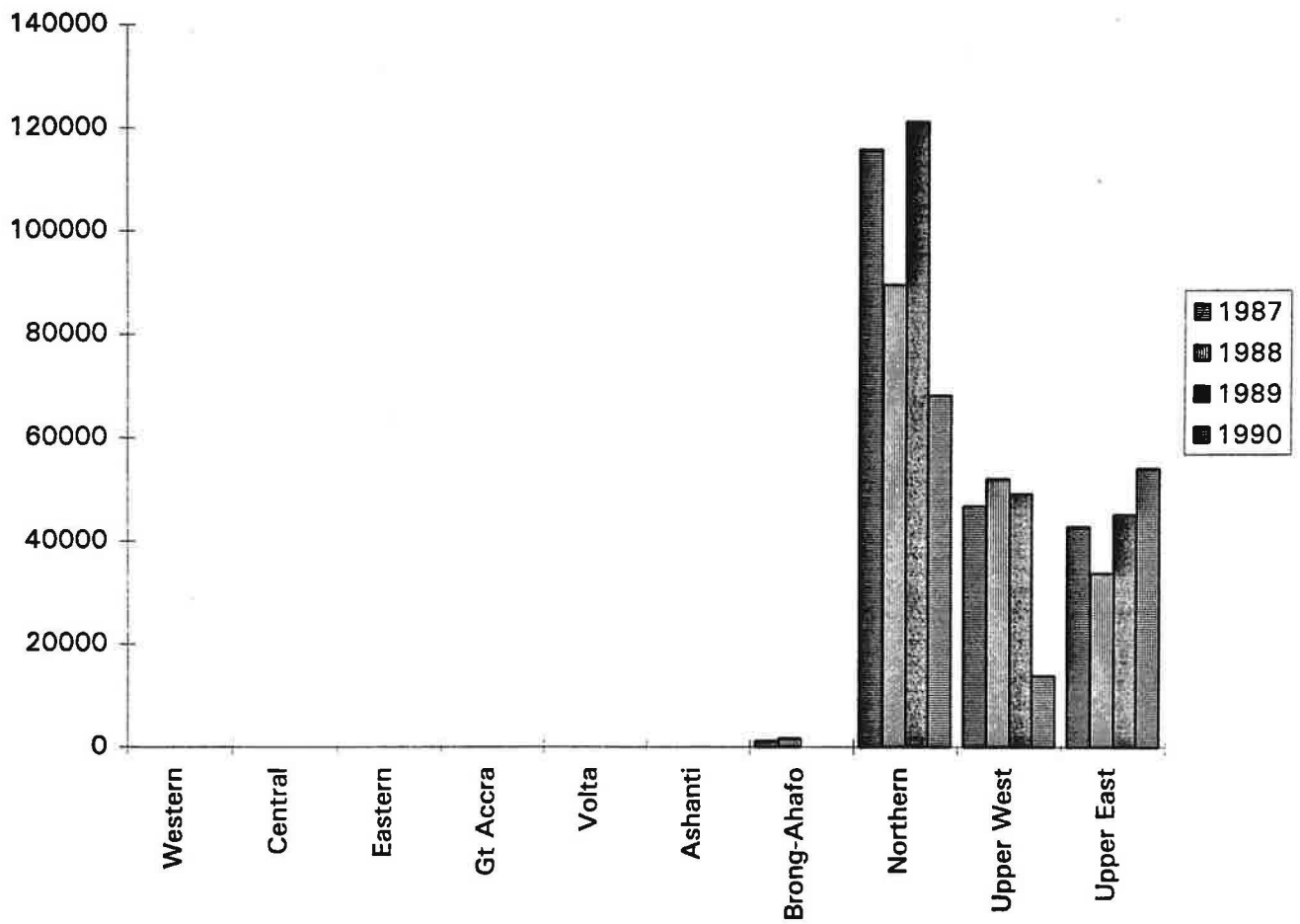


Figure 3: Regional distribution of millet production, 1987-1990
(figures in MT)



**Figure 4: Regional distribution of sorghum production, 1987-1990
(figures in MT)**



**Figure 5: Regional distribution of groundnut production, 1987-1989
(figures in MT)**

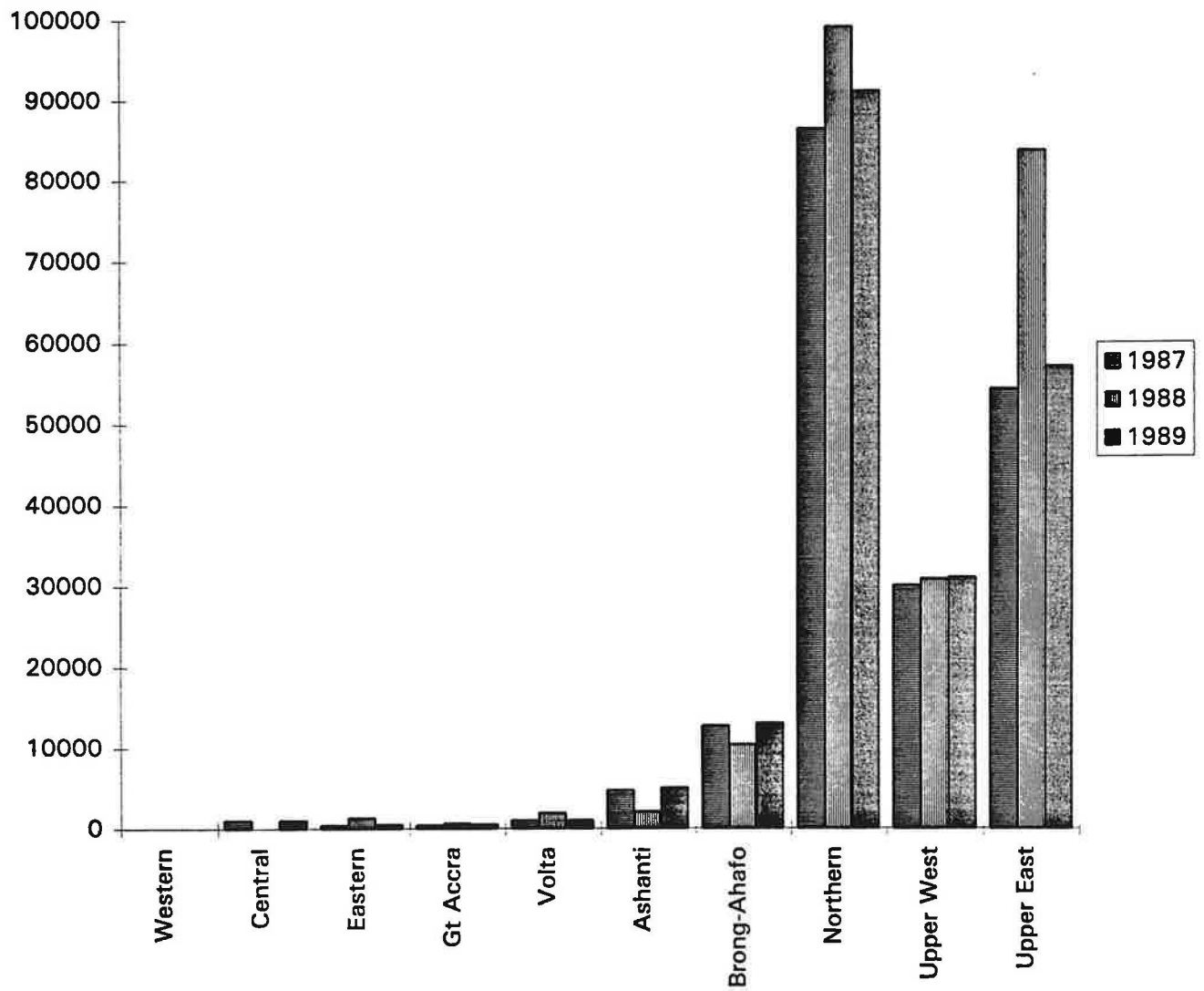
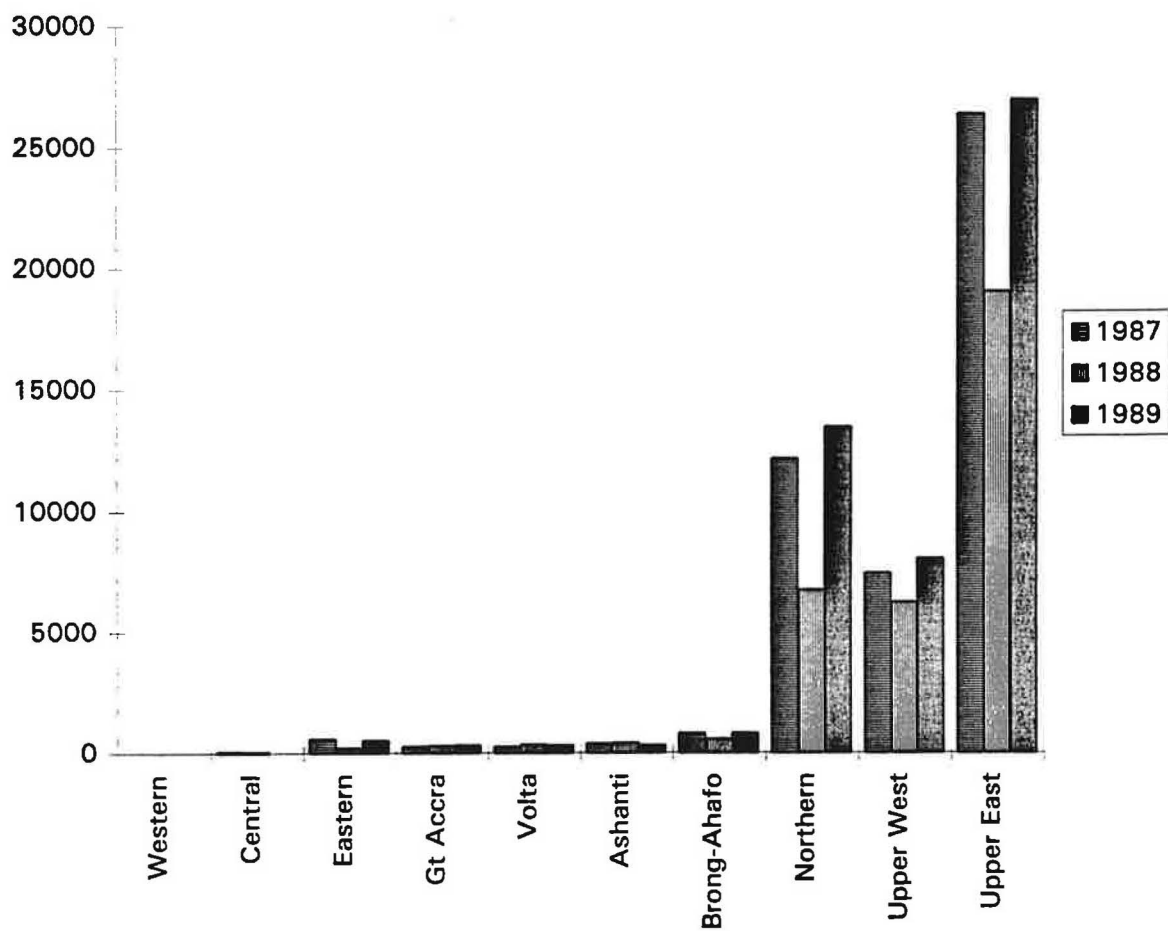


Figure 6: Regional distribution of cowpea production, 1987-1989, (figures in MT)



CHAPTER 3. PRODUCTION SYSTEMS IN NORTHERN GHANA

3.1 Climate

Northern Ghana is semi-arid. Climatically, the year can be divided into a dry season which lasts 5-6 months and a rainy season which lasts 6-7 months. The length of the rainy season increases slightly from north to south but annual precipitation varies considerably from year to year and there are no real differences across the area. The 21 year average for several towns is shown below:

Location	Mean precipitation (mm)	Standard deviation (mm)
Tamale	1025	209
Bawku	960	181
Navrongo	1032	175
Zuarungu	948	155
Wa	1006	163
Tumu	1065	176

From Ruge-Metzger and Diehl (1993)

The rainfall pattern is also unpredictable. The onset of the rains can commence as early as the beginning of March or as late as the end of June, though the bulk of the rain falls between mid-June and mid-September. Short dry spells often occur during July and these can lead to crop failures especially when they coincide with sensitive periods during plant development, such as tasseling of maize (Benneh, 1973).

3.2 Cropping patterns

Farming systems in northern Ghana have been well described by Ruge-Metzger and Diehl (1993). In brief, the main food crops cultivated are maize, rice, sorghum, millet, cowpeas, groundnuts, soya bean, bambara groundnuts, yam and cassava. Furthest north, in Upper East Region, maize production diminishes or ceases, particularly towards the eastern border with Togo, and sorghum and millet play an increasingly important part in food security.

In the southern half of the area maize forms both a food staple and a cash crop. Groundnut and yam are the other major food cash crops in the area, though soya is also becoming important; soya is being increasingly cultivated, particularly by women, and is being incorporated into the local diet as an alternative to cowpeas. Non-food cash crops include shea nut, which is processed for its fat content, cotton and tobacco. Neither sorghum nor main crop millet are traded to any extent but early-harvested millet is. Throughout the area, groundnuts, cowpeas and bambara are important cash crops; in Bawku West onions are an important cash crop.

In general, men cultivate the food staples whereas women cultivate for sale. Women do not own land but rely on their husbands setting aside an area which they can cultivate. Women produce vegetables, pepper, kenaf, groundnuts and some cereals

and pulses for market. Cash so obtained is used either to purchase household items and clothing or food to supplement that provided by their husbands.

The extended period of rains allows more than one crop of several of the commodities to be cultivated each year from the same plot of land. In Northern Region, early plantings of local varieties of maize (yellow), cowpeas and the Chinese variety of groundnut occur in April and these are harvested in July and August, whilst it is still raining. The main crops of all cereals, groundnuts, cowpeas and soya are sown in May and June and harvested from October onwards, after the rains have ended. Bambara tend to be cultivated and harvested after main crop cowpeas; harvesting of cowpea is in October and November and bambara in November and December. Sorghum is the last crop harvested, usually in December.

In Upper East, early millet replaces early maize in the cropping calendar but it is harvested when all other crops are ready for sowing, in May or June. Most of the main crop cereals mature in three months but white sorghum matures in six months and is harvested after other crops. Bambara is harvested in October, about the same time as cowpeas, late millet and maize.

Most of the farming consists of mixed cropping and it is therefore difficult to estimate yields from individual farms. Groundnuts are mixed with bambara or cowpea and the latter two are also mixed. Yam and cassava are grown together as are maize and cowpea, and sorghum and groundnut. Farmers rarely cultivate pure stands.

3.3 Production constraints

The main constraint to production in the north is the gradual decline in soil fertility which has been occurring over past decades (D. Warner, personal communication). This decline is associated with a shortening of fallow periods and an abandonment of shifting cultivation. Farmers are aware of the changes that have taken place and of the nutrient requirements of cereals, particularly maize. However, the most commonly recurring complaint expressed during the study was that inputs, particularly fertiliser, are too expensive to use. Many farmers have ready access to inputs, especially those living close to towns, but cannot afford to buy them. Compounding the problem is the lack of credit available to farmers in rural areas to finance agricultural pursuits. However, some inputs are simply unobtainable, for example there was no indication that fertiliser was on sale at any of the rural markets visited during the study.

One consequence of the decline in soil fertility has been the switch away from cereal production and an increase in production of cassava.

The cost of hiring agricultural implements, particularly tractors was also a problem, although more commonly farmers complained that tractors were simply unavailable. Farmers, in *Kuglogu village* near Tamale, said they have to travel to Brong-Ahafo, more than 100 km, if they needed to hire a tractor.

Crop cultivation in many villages is a series of communal activities. When a farmer requires labour to plough, sow and weed his land he obtains assistance from among the village population, providing food for his helpers. When others require assistance he,

in turn, will labour for them. Women, however, are usually unable to acquire assistance in this manner and they have to hire labour to cultivate their plots. Furthermore, they must wait until the main food plots have been cultivated before labour becomes free to assist them. Thus cash costs incurred by women are greater than by men although women are able to sell their crops whereas men cannot, as they produce food for family consumption and only sell if they have a surplus.

In most areas, pre-harvest pest problems were frequently mentioned as major constraints to production. In Upper East, *Striga* invasion of sorghum and millet has been, and remains, a constant concern. Insect pests, including stalkborers and earworms, and birds also cause important problems on small cereal grain crops, especially rice. Cattle, monkeys and squirrels destroy the standing crop. The most important pests in both field and store in the more northern areas, especially in Upper East, are termites.

The lack of drought resistant varieties, together with unpredictable rainfall patterns and poor quality soil often leads to reduced yields if not to crop failure.

CHAPTER 4. STORAGE SYSTEMS

4.1 Storage Structures

Traditional storage structures in use in Ghana have been described by Nyanteng (1972). In Northern Region there are three basic types of structure used for storage of cereals and pulses although there are many variants of these. Names of structures vary depending on the ethnic group using them or even the geographical location of the village. Gudrups *et al.* (1996) provides a listing of names of the structures found throughout the north. The most common store type is a cylindrical basket of matting woven from dried grass ('zana' matting). This structure, known as a 'kambon' or 'pupuri' throughout much of northern Ghana ('kpachala' elsewhere in Ghana), is located outside the house. It is usually raised above the ground on a small wooden platform and is occasionally topped by a thatched roof, particularly during the rain season. The structure is frequently used for storage of unthreshed cereals, including maize cobs, and heads of sorghum and late-harvested millet. Frequently, the kambon is the sole storage structure possessed by the farm for cereals and it is often above 4m in diameter. The large size of the structure, as well as the weight of the commodity stored, prevents the kambon platform from being more than 0.5m above ground level. This height is not sufficient to prevent rodent ingress though it does prevent penetration by water rising by capillary action from the ground. Smaller structures are raised higher but, because they are never fitted with rodent guards, the produce still remains susceptible to rodent attack. The flimsy nature of the grass matting necessitates it being replaced annually or every two years.

For storage of shelled maize farmers in Northern Region use an inverted conical basket, 'the kunchun'. Traditionally, it is constructed from woven sorghum stalks but farmers are substituting zana matting in areas where sorghum cultivation is in decline. Use of grass matting inherently weakens the structure and is not an option farmers would choose to adopt. The basket is much smaller than the kambon and it is usually raised on a wooden platform above the ground to a height of 1.5m or more. The entire structure, except for the poles supporting the platform, is completely covered by an extensive thatched roof, which hides the basket from view. Usually the basket is plastered with mud and cow dung on its outer or inner surface. The extent of the thatch together with the mud plastering inhibits rodent entry and the damage caused is less than occurs to produce stored in the kambon. The kunchun is more robust than the kambon and, if properly maintained, will last for about four or five years.

In Upper East and Upper West Regions, structures built entirely from soil are used for storing cereals and pulses. These mud silos, can be of varying sizes and shapes (for more detailed descriptions see Gudrups *et al.*, 1996 and Brice and Golob, 1996). Very large mud structures are found inside houses in an area between Sawla in the south west of Northern Region and Wa in Upper West. These stores, which may hold many tonnes of grain, are accessed near their apex which often projects through the flat roof of the dwelling. Very small, cigar-shaped, portable silos, with capacities of less than 100 kg, are also found inside dwellings in Upper West. Other very large silos,

spherical in shape, are found in the extreme eastern area of Northern Region, around Saboba district, which is along the border with Togo. These structures, located outside the house, may hold as much as 2-3 t of grain. They usually have a double wall, the outer one protecting the integrity of the store from damage by heavy rainfall. Similar but smaller spherical mud silos, with a capacity of up to 500 kg, are common in Upper East but these are not as robust, having only a single skin wall. When well maintained mud silos in Saboba district can last for 20-30 years and in Upper East, where the silos are less well made, they can last up to 10 years, but, because of damage by both rain and termites, they usually last only 2-3 years.

Small quantities of produce and, especially, seed are often stored in gourds which may be sealed with cow dung. Larger quantities of grain, particularly groundnuts and bambara, are frequently stored in jute or woven polypropylene sacks. At times, jute sacks are difficult to obtain as they are imported. Polypropylene sacks are manufactured locally and of a comparable price, though not as resilient. Bagged products are usually stored inside the house though it is not uncommon to see them kept in the kambon.

4.2 Storage practice

Families prefer to keep their stored produce in or near their house, inside the home compound, where it can be guarded and is easily accessible. However, in many areas of the north cultivated fields are located long distances from the homestead because of the demand for land as a result of the increasing population and the declining fertility of soils cultivated close to the home compound (cf Wright and Tyler, 1994). Farmers find it difficult to transport the harvested produce to the house. They may then store part of the crop at the homestead and also where the cultivated plots are situated. In *Kuglogu village*, in the Tolon/Kumbugu district of Northern Region, where farms may be as far as 50 km from the house, sorghum and millet are threshed in the field and stored there in a kambon or in sacks; where the fields are closer to the house the produce is stored on the head in the same type of structure. To transport produce stored at the fields farmers sell commodity kept at home to raise funds to hire vehicles. In this village traders sometimes travel to the fields to buy. However, in many other villages, farmers are forced to transport their produce to the house because of poor security at the fields. This often presents difficulties because transport is either expensive or simply not available. For example, in *Bongo Soe* near Bolgatanga, one farmer, whose fields are 15 km from the village centre, is forced to organise groups of women to carry head loads to his house or, if he has sufficient cash, pays 7000 cedis per trip for an ox cart.

Cereals which are reserved almost exclusively for home consumption, for example sorghum and late millet in Upper East, are stored on the head and only threshed immediately before being processed into food. In Upper East, heads are stored in mud silos though produce owned by women, generally smaller quantities, is kept in sacks inside the home. These cereals will be stored, after threshing, in sacks (or in the kunchun) if they are to be sold, a more common practice in Northern Region. Early millet, which is cultivated both for food and sale, is commonly threshed before storage in sacks or gourds. In *Winkojo village* near Bolgatanga, early millet is dried on

platforms because it is harvested during the rains and would go mouldy if put directly into the silo; it is then stored unthreshed in the silo during the dry season.

Maize is mainly stored, after shelling, in the kunchun, kambon or in sacks. One farmer in *Galiwei village*, near Tamale, stored maize on the cob in a kambon and only shelled immediately before consumption or sale.

Cowpeas are frequently stored in the pod though many farmers do shell before storage. Pods may be stored in the kambon, in sacks or simply heaped in a store room.

Bambara groundnuts are almost always stored in-shell because the spherical cortex is relatively difficult to remove - 3-4 people can only decorticate one bag of bambara kernels in a day - but the presence of the cortex does not impede handling in the way a long, narrow cowpea pod does. The shell also provides some protection against insect infestation although insect damage does still occur (see below). However, in-shell storage does prevent inspection of the kernels and farmers are unable to detect insect infestation thus they are often unaware, until too late, of the damage and reduced germination of seed that results.

Groundnuts are stored in-shell in sacks until required for sale when they are then decorticated by hand.

4.3 Storage period

Storage duration depends upon the financial position of the family, on the type of crop and on the quantity harvested. Farmers would like to retain produce in order to sell seven or more months later, during the lean season when prices are at a peak.

However, many families need to raise funds to pay off debts and are forced into selling some of their crop immediately after harvest. Other farmers require cash to pay for expenses incurred during cultivation and so sell produce, about five or six months after harvest, to finance ploughing and the employment of labour for sowing and weeding before these operations begin. Families who rely heavily on sorghum and millet for food and sell none, particularly those living in Upper East, try to retain food in store for as long as possible, that is until the following harvest, a period of one year. Most often such farmers simply do not produce sufficient grain to meet family requirements beyond three to five months and then they are forced to sell their labour to be able to buy extra food. A few farmers, however, do keep small grain cereals for very long periods. For example, in *Gusiegu village* in Northern Region, sorghum may be stored on the head for as long as three years, as a stand-by crop to hedge against poor maize harvests which are not infrequent. This sorghum sustained few problems other than occasional termite damage.

Farmers who produce early-harvested varieties store them each year only until the main crop is harvested, some 3-5 months later. The late-harvested crop may be stored for seven months or more.

Because the storage period depends so much on personal circumstances of the farm family it is not possible to describe the average period any of the crops is stored. However, a few generalisations can be made. Pulses tend to be more difficult to store well and maintain in good quality than cereals and so these are traded first. Most

farmers sell groundnuts first; this crop is grown particularly as a cash crop and usually only a small proportion is consumed on the farm. However, women in *Kimbisi village*, Bolgatanga, use groundnuts to supplement the food produced by their husbands which is often insufficient to last all the year round. Cowpeas are sold next because they are very susceptible to insect pests. Farmers are more reluctant to sell cowpeas than groundnuts because they form part of the staple diet and those in *Gusiegu* did say that they were forced to sell early because of the insect problems, not because of the need for cash. Bambara beans may be sold at the same time as cowpea but generally they are retained until much later in the storage season. Thus many producers sell bambara late in the year by which time the beans are of poor quality and may fetch low prices. Despite these generalisations some producers keep groundnuts and cowpea for many months to take advantage of increasing prices. One farmer, in *Kuglogu village*, sells bambara groundnuts last and may keep them in store for a year and more.

4.4 Post-harvest problems

Most of the problems and constraints listed by the interviewees, whether in groups or individually, related to storage issues rather than to threshing, winnowing or milling aspects. However, two groups were very concerned about the lack of transportation available to carry the produce from the farm to homestead and, that when available, it was very expensive. Most families felt that threshing was not a constraint because, for the small grained cereal crops, it is undertaken intermittently, as grain is required for consumption. Although threshing is carried out by hand by the family members and is labour intensive, average family sizes are large enough to ensure that threshing does not take too long. In *Zinido village*, near Tamale, and in *Koglogu village* men complained about the lack of maize shellers because shelling by hand was slow. These same producers also wanted groundnut shellers. Only in *Galiwei village*, located about 10 km from Zinido, did producers complain about the lack of local milling facilities. Some men thought the dust and frass created during threshing operations caused respiratory problems.

Drying can be an issue when early maize and millet are harvested before the rains have terminated. However, because rainfall is intermittent grain does not usually become mouldy if it is kept well ventilated by being stored in the open.

Every group interviewed in Northern Region was particularly concerned with problems caused by rodents and storage insects ('weevils'). In Upper East, these concerns were supplemented by those caused by termites which could destroy not only the stored crop but also the store itself; termites were also a constraint in Northern Region but not to the same extent.

The main rodent pest was described as being a 'black, German mouse' (*Salifu Suleimane, Galiwei village*) and is most likely to be a common house mouse, either the multimammate mouse, *Mastomys sp.* or the spiny mouse, *Acomys sp.* (G. Key, personal communication). Damage by rodents occurred in all grain, irrespective of whether this was stored threshed or unthreshed or of the structure in which it was kept. However, the problems were less severe where farmers stored grain in mud silos or small pots if the openings were well sealed between filling and each grain removal.

In many villages in Upper East, farmers do not cover the silo with a lid, except sometimes during the rainy season, and so they allow easy access by rodents. Rodents damage not only the grain but also the fabric of the structure itself, particularly the grass matting of the kambon.

Insects pests of stored grain in Ghana have been documented by Forsyth (1966). In the semi-arid areas of the north, the main pests of importance are of cosmopolitan distribution. Weevils, *Sitophilus oryzae* and *S. zeamais*, and the Lesser Grain Borer, *Rhyzopertha dominica*, are the main beetle pests of stored cereals. Only one farmer, *Mr Mbabod Ayalgi* of *Saka village* in Bawku West district, complained of problems caused by moths and these were in stored paddy.

Pulses are particularly susceptible to insect attack and all farmers who grew cowpeas complained of their inability to store this crop, whether shelled or in pods, for any length of time because the grain quickly becomes heavily infested. Cowpeas, which were seen in villages during the survey, were mostly recently harvested and were either free of visible infestation or only lightly damaged. More heavily damaged cowpeas were seen in markets when the crop had been harvested a month or more previously. One particular farmer/trader, *Mr Alhaji Malkole Isa* from *Gusiagu village*, showed the team his store of cowpeas in pod, approximately the equivalent of 10 bags of threshed cowpeas, which had been harvested one month previously. When this farmer opened his store a cloud of adult bruchid beetles flew out and the ceiling of the store was found to be covered with a black layer of adults.

Damage to unshelled bambara, which was often heavy though generally not as extensive as in cowpea, caused concern because the farmers were often unaware of the infestation being present. This was particularly a problem with bambara retained for seed, as the insect would develop inside the bean and would not be visible even when it was shelled and sown; the infestation became apparent when the seed failed to germinate.

Maize is susceptible to insect damage but the crop grown early, which matures and is harvested before the rains have ended, is particularly at risk. Early-harvested maize has a relatively high moisture content when it is harvested and is difficult to dry. The high moisture content facilitates insect development but is not high enough to induce mould growth; although none of the farmers complained of mould problems it is possible that fungal toxin contamination may occur. Although early maize is susceptible to insect damage it is only stored until the main crop is harvested, a matter of three months or so, and generally the losses incurred are relatively light. Nevertheless, a sample of maize seen in *Tampion village* near Tamale was heavily damaged by weevils, with perhaps 50% of the grain being holed after two months storage.

In the last five years, farmers living along the border with Togo have experienced problems with stored maize due to infestation by the Larger Grain Borer (LGB), *Prostephanus truncatus*. This pest, an exotic insect from the Americas, can cause five times the damage of infestations involving indigenous insect pests. Due to ethnic conflict, it was not possible to visit areas where LGB has become established. However, recent reports emanating from Saboba district in Northern Region indicate

that farmers are particularly concerned with the damage this pest is causing to maize (Stephenson Suleimani, TAAP, personal communication). There is no doubt that as the pest gradually becomes established in central and western areas of the north it will become the most important problem to be overcome if maize storage is to be continued on the farm.

Few farmers complained specifically of insect damage in small grain cereals. However, two farmers in Northern Region spoke of sorghum suffering from insect problems. Insect infestation of millet only occurred in Upper East when early maturing varieties were stored, and although farmers in *Templigo* and *Agaogo villages* said damage could be severe, insects on this commodity were not observed during the survey. Sorghum and millet were particularly prone to damage by mice and, in Upper East, by termites.

In both regions, farmers regarded their storage structures as being unsatisfactory. Throughout Upper East this was because the mud silos could not withstand termites damage; the nature of the structure itself made it difficult to detect the presence of termite early enough to allow remedial action to be taken. Often termites entered the silo through the base and, when the external surface resting on rocks on the ground was enclosed by mud plaster, as was frequently the case, it was not possible to detect the infestation before the termites entered the store.

When the opening of the silo is not covered by a lid stored cereals often become water damaged during the rainy season. In extreme conditions, heavy rainfall may damage the mud silo structure itself. Regular maintenance by replastering is required to ensure the silo remains in good condition and durable.

The lack of durability of the kambon used throughout Northern Region is a source of inconvenience for many farmers. Grass matting has to be replaced every year and the wooden platform every two or three years. Many farmers expressed the desire to have a cheap, durable alternative such as a mud silo. Even the kunchun, which may last for five years or more, is becoming more difficult to construct because the declining production of sorghum, in some areas, limits the availability of stalks with which to weave the basket. Sorghum is being replaced by grass matting as a result, and so the structure of the kunchun is becoming not much more hardy than the kambon.

Farmers would like to use jute or hessian sacks for convenience; the produce can then be stored inside the house where it is secure and quickly available for sale when needed. However, sacks are in short supply and those available are therefore expensive. Slightly cheaper woven polypropylene sacks are more readily available but they are less durable and must be replaced every season.

4.5 Storage losses

It was not possible to measure damage and loss directly during the survey because most commodities had only been in store for a month or so and damage levels were therefore low. Nevertheless, information was obtained on farmers' perceptions of losses incurred during the previous storage season. Estimates on damage in pulses

were obtained during previous visits in 1995 and these are described below. These actual values reflect the perceptions of farmers quite well. Published literature contains little information regarding post-harvest losses in the semi-arid areas of northern Ghana.

Table 3. Damage in pulses collected from different markets in northern Ghana, 1995

	Month collected	Market	Damage % (insect holed)
Cowpea	May	Tamale	15
Cowpea	May	Tamale	17
Cowpea	May	Tamale	38
Cowpea	July	Bolgatanga	54
Cowpea	July	Bolgatanga	67
Cowpea	July	Gambaga	94
Cowpea	July	Yendi	84
Bambara	May	Tamale	24
Bambara	May	Tamale	23
Bambara	May	Tamale	20
Bambara	May	Tamale	14
Bambara	May	Tamale	18
Bambara	May	Tamale	32
Bambara	July	Gambaga	100
Bambara	July	Yendi	100

The extent of weight loss of commodities is related to the period of storage. If maize is left untreated it can lose up to 20% by weight in about seven months. Many families who store maize experience 5-20% loss, and this does not really diminish if the crop is treated with a traditional method of protection. However, if a modern synthetic chemical is applied to maize the loss is reduced substantially so that, for example, women in *Zinido village* claimed they lost nothing after treating grain, irrespective of the storage period.

Damage to sorghum is generally slight though several farmers claimed to lose about 10% in store, mostly as a result of infestation by mice; some farmers in *Koglogu* and *Linbunga villages* said they lost up to 20% of their sorghum. Millet losses are even lower, though *Katayre Sekan* in *Nangalikinia village*, Navrongo district, lost 40% of the early crop, mostly as a result of insect damage. Other farmers in Upper East also claimed to lose significant amounts of early millet even though the storage period was relatively short; late millet which is harvested once the rains have ended is not subject to the same degree of infestation or, therefore, weight loss. Nyanteng (1972) quotes losses of 20-30% and 15-20% for sorghum in Northern and the Upper Regions respectively and 5-20% and 10-20% as the corresponding levels for millet. The methods of estimating these losses are not described but it is unlikely that they take into account the declining quantities of food in store as the season progresses due to food removals for consumption, sale gifts and so on. If these are taken into account, it is unlikely that losses will be very much different to those found under similar climatic conditions in southern Africa. There, in Malawi, Golob (1981) found losses in sorghum due to insect attack on 80 farms did not exceed 3% when stored for 2-10 months.

Cowpeas exhibit insect damage rapidly after harvest and losses can be substantial in a short period of time. If cowpeas are retained in store for many months the entire crop can be rendered unfit for human consumption. People in *Yogibania village* in Navrongo district try to store cowpea for six months to obtain high market prices but they may have lost 50% of the commodity in this period; men in *Saka village*, Bawku West and in *Linbunga village*, Tamale have lost all their grain during storage.

Loss of stored bambara can also exceed 50% but this crop is usually not damaged as quickly as cowpea or to the same extent. Partly, this is because *Callosobruchus maculatus*, the major pest of both these pulses, is able to become established earlier on cowpea as this crop is harvested one or more months before bambara. Katayre Sekan reduces the loss to bambara by grinding the beans to produce flour, however he still only reduces a loss of 60% down to 40%. Damage to bambara is so extensive that farmers in *Gbanjong village* in Tolon/Kumbungu district only keep beans for seed and, in particularly bad years, they have to purchase seed from the market in order to cultivate a new crop.

Women experience the same level of loss, in general, as men though in some areas, especially in Upper East where women do not have access to mud and have to use sacks, their losses may be greater.

Groundnuts are mostly used as a cash crop and in some villages, such as *Zinido* near Tamale, farmers do not retain any for food. They are sold relatively quickly after harvest and so post-harvest losses are low. However, women in *Bongo Soe* and *Kimbiisi villages*, near Bolgatanga, retain groundnuts in shell to sell later in the season and they estimate about 15% loss occurs. The damage is caused by both mice and moths. Although they keep cats to control the mice they do not use any method to control the moths. Moth damage becomes particularly noticeable when broken or physically damaged pods have not been removed from the bulk during sorting.

4.6 Methods of protection

Throughout the areas of northern Ghana where the survey was conducted farmers, in general, did not take any precautions to prevent pest damage during storage, other than to place the commodity in the sun. In some villages, such as *Zinido*, *Galiwei* and *Gusiegu* in Northern Region, farmers were unaware of any traditional method of protecting stored crops against insect infestation. In other villages, including most of those visited in Upper East, less than 5% interviewed were aware of traditional practices but did not necessarily apply the methods themselves, though they knew of others in the village who did. These methods were not used because they were thought to be ineffective - in *Saka village*, Bawku West, villagers believed too much protectant was needed to be effective and so was impractical to use - particularly when compared with the effects of using modern chemical protectants of which they had heard but not experienced. Modern chemicals approved for use as grain protectants, such as Actellic (pirimiphos-methyl) dust are either unavailable, especially away from the main towns, or too expensive; few farmers were aware of the names of these chemicals. However, three farmers in *Bongo Soe* and another in *Saka village* bought Actellic from traders in the market and used it to treat shelled bambara, cowpeas and early-harvested millet, which were then stored in sacks.

Of all the commodities stored, pulses were most commonly treated with a protectant. This was usually with ash obtained from the cooking fire, or with powdered chilli pepper, although farmers in *Lingbunga village* said use of the latter is declining because of the increase in value of chilli as a commodity. *Alhasan Bugle, of Wantugu village*, stores cowpeas in gourds and uses, as protectants, both wood ash and the residue ('kpambirigu') produced during the boiling of shea nuts for butter production; *Kuglogu* villagers use about 5 g of this precipitate for every 3 kg of shelled cowpea. *Danaa Al Hassan*, a woman farmer also in *Wantugu village*, treats her cowpea with oil left over after making ground nut 'kulikuli' biscuits. Wood ashes were used on maize, millet and sorghum, particularly for treating small quantities kept for seed.

Plant protectants are used by some people in Upper East. The most common was 'kimkim', a labiate weed occurring throughout the north. Produce is either mixed with dried, powdered leaves and stems or is steamed with a water-based infusion of the plant; sometimes the infusion is poured over the commodity which is then left to dry. Kimkim is most commonly used to protect bambara but it is also used for cowpea and early millet. One old male farmer in *Bongo Soe* claimed to use an infusion of the plant mixed together with powdered rabbit bones!

Neem, which grows commonly throughout northern Ghana, is also used as a protectant but only by a very few farmers. Dried leaves are mixed with grain but the treatment is not felt to be particularly effective. Most farmers are unaware of the potential insecticidal properties of neem, and those that were did not utilise the seed kernels which contain most of the active components and are, therefore, the most effective part of the plant. Other plants found in northern Ghana and which are purported to have value as grain protectants include *Phytis sauveolens*, *Cassia tora* and 'lodel' (S. Suleiman, TAPP, personal communication).

Phosphine was found being sold and used for fumigation throughout the survey area, even in villages remote from the main towns. In two of the local village markets, *Tampion* and *Kpatinga*, itinerant traders were seen selling individual tablets of aluminium phosphide. Farmers said they used tablets to treat grain stored in sacks. *Ziblim Wumbei* obtains tablets from *Guseigu* market and uses them to treat produce kept in a room inside his house; he uses one tablet for every two bags of commodity and removes the tablets after 10 days. He claims he has never smelled the gas during the treatment period. Other men in *Saka village*, Bawku West and in *Yogibania village*, Navrongo simply put 2-3 tablets into each jute bag of commodity and either store the bags in the house or outside in the sun. Some people believed the treatments were effective, others thought they were not. Clearly, the use of phosphine gas as a grain protectant by farmers is not uncommon but the manner in which it is used is extremely hazardous to the health of villagers, is biologically ineffective and therefore uneconomic, a conclusion which supports observations made by Golob (1994). Traders also use aluminium phosphide to disinfest commodity in store and they too encounter problems (see 4.8 below). Several farmers used tablets as rodenticides, rather than as insecticides, because they believe 'only animals with blood' would succumb to the effect and so 'insects would not be affected'.

4.7 Seed types and varieties

Traditional seed-saving practices in northern Ghana have been comprehensively reviewed by Wright and Tyler (1994). Information gleaned during this study confirmed their observations and conclusions. In essence, farmers mostly retain their own seed from year to year, preferring to produce low yields rather than to risk crop failure in periods of uncertain rainfall. Farmers appreciate high yielding varieties and they have used them but the requirement for fertiliser and the uncertain rainfall makes their use difficult to justify. In *Bongo Soe*, improved sorghum seed was provided by the NGO, Global 200, but after two years of cultivation the crop was destroyed by drought and the seed has not since been available.

Producers use their own seed. If there is a crop failure then they will either borrow seed from their family or from within the village but if all farmers have suffered in an area, they purchase new seed from the local market. Market seed is not designated as seed but is simply purchased from any grain on sale. This does mean that there is a continual interjection of new breeding material into locally produced lines.

Cereal seed is selected either immediately before harvest, for sorghum and millet, or just after harvest for maize. This seed is stored unthreshed usually, but not always, separate from food grain. The heads or cobs may be tied together and suspended from the eaves of the home or they might be placed on top of the food grain in a kambon. Only early-harvested millet is stored threshed.

Pulses are not selected until late in the storage season, i.e. when they are required for sowing. Bambara and cowpea may be stored shelled or unshelled. Seed is protected during storage by the same methods used to protect food grain (4.6). Small quantities of legumes or millet seed may be kept in a gourd or earthen-ware pot and sealed with cow dung.

Farmers try to use the best means available for protecting seed. This often means employing insecticides designed for other purposes. For example, it is not uncommon for chemicals meant for treating the cocoa plant to be used as seed treatments; in *Agatuse village*, farmers treat millet with propoxur. When they can afford to, those farmers who are aware of Actellic, purchase this chemical to treat seed. This chemical is a specific storage protectant but is rarely available away from the main towns.

4.8 Communal storage

In certain villages in Northern Region, including for example *Zinido village* near Tamale, groups of farmers have bulked maize together and placed it into a store in order to obtain credit (see 5.2.1). In Zinido, each farmer is limited to keeping 10 bags of maize and the total in the store is about 150 bags (15 members). The store is simply a mud-plastered room, constructed for the group at no charge, and the village Ministry of Food and Agriculture Front Line Staff (FLS: extension worker) bears the responsibility for overseeing the grain and maintaining its quality. Although the FLS is trained to use insecticides, he/she would be unable to implement corrective measures, such as fumigation, if any serious problem occurred during storage because of the poor

quality of the store itself. The store is too small to permit the use of fumigation under gas-proof sheets, and the mud wall is too permeable to gas to allow effective whole-store fumigation. Other inventory credit schemes, such as those operated by the Ghana Food Distribution Corporation, utilise large-scale warehouses where store management can be more efficiently practised and so do not suffer the same drawbacks. It remains to be seen how important this potential problem area becomes.

4.7.1 *Action Aid seed stores and grain banks*

In Bawku West district, Upper East Region, Action Aid have introduced seed and grain banks stores in several villages. Each seed store is circular in cross section and has a corrugated metal roof. They are constructed from concrete blocks, rendered with smooth concrete painted white, and have a ceiling of plasterboard below the eaves. The eaves space is ventilated through adjustable openings in the walls. These openings are covered by wire mesh to exclude rodents and birds.

One seed store, near *Agaogo village*, was inspected. Since the store was constructed the double doors had become warped so that there were wide gaps between the walls and the doors (there were no frames), between the doors themselves and between the base of the doors and the floor. All these gaps will allow entry by rodents and should be covered with chicken wire to exclude them. At the time of inspection there was no seed in the store but cement had been procured to repair the structure in preparation for the new storage season. It is clear that care is taken over the maintenance of the structure. The ventilation was obviously effective as the inside of the building was quite cool even when ambient temperatures were reaching a maximum just after noon (this was in distinct contrast to the temperature generated in the grain bank store (see below)). One unusual feature was the large size of the wooden pallets used for dunnage. These were very long in relation to the circumference of the store and would be rather awkward to manoeuvre and position to optimise storage capacity, particularly if some seed is already present. The circular design of the store was adopted to enhance ventilation in an area where there is no consistent prevailing wind direction. However, this shape does mean that there is less usable space than would occur if the cross section was square or oblong. This may not be a problem at present but if the number of groups using each store increases, thereby increasing the total quantity needed to be stored, then space will become a limiting factor affecting expansion.

Farmers store their own seed, sorghum, millet or groundnuts, in the store and they collect the seed when it is required for planting. They use the stores because they know the seed will be kept in good condition as long as good quality grain is submitted to begin with. The onus to store good seed, especially that which is well dried, is upon the farmers themselves. It was claimed that no insect problems were experienced but it was not possible to assess this at this time of the year. However, AA staff who live in or near the villages to advise and train the store committees said they do not use insecticide to control storage pests. However, it is possible that when unusually heavy or sustained rainfall occurs insect pests may multiply rapidly and cause significant damage in store. As a contingency, should this situation occur, store committees should learn the techniques of insecticide application.

One grain bank was examined at *Teshie* where was possible to draw some conclusions regarding both the store design and management. The store was constructed of the same material as the seed store but was oblong in cross section and incorporated an office area, in one corner, which was accessed internally. The store had no ceiling and, despite having a single row of vents stretching the length of both long wall just below the eaves, the interior of the store was very hot even at dusk. It is quite likely that the ventilators are insufficient and may well not be effective during the rainy season. It may be necessary to increase the ventilation by creating air gaps in all four walls at about a metre above the ground. None of the ventilators was covered by wire mesh so that entry by birds and rodents could occur. These openings should be so covered. There was little grain in store at the time of the visit. There were about 10 bags of millet grain in a small stack on a pallet; other bags of unthreshed millet were lying in a heap near the entrance of the store. There was a considerable quantity of millet seed on the floor around the base of the small stack. Quite clearly very little effort had been expended to ensure the store was kept clean and tidy. If this is not done when only small quantities are in store, when very little is required to maintain a reasonable level of hygiene, it is less likely to happen when the store is filled. Dirty stores facilitate both insect and fungal problems. Another indicator of inadequate management was the presence of weeds growing around the walls outside the store. These must be cleared to eliminate other pest harbourages, including those for rodents.

4.8 Trader storage

Most of the larger scale traders operating out of the major marketing towns of Tamale and Bawku store produce for many months. All of the cereal and pulse grains are stored by traders from immediately after harvest until the lean period in May/June, up to 6-7 months but sometimes even longer.

Produce is stored in sacks in store rooms which are located either in or near the market. None of these stores is large, the maximum capacity is about 2000 bags (200 t), but larger traders maintain several stores. Several stores owned by traders in *Tamale* market were inspected. *Abdul Aziz* has two stores one of which has a capacity of 500 bags and the other 1500 bags. The larger of the two had walls of wooden planking and a concrete floor. There were large gaps between the planks, around the frame of the wooden door and between the walls and the corrugated iron roof. He stores maize, cowpeas, groundnuts, sorghum and millet in the store for up to eight months and employs the MoFA Seed Inspection Unit in Tamale to fumigate every two months, at a cost of 60,000 cedis for 400 bags (about 1 US\$/t). As it is impossible to cover the stock with fumigation sheeting, whole store fumigation is employed; the nature of the construction of the store ensures that the building is far from gas-tight and so fumigations must fail. The second store has both concrete walls and floor and although whole store fumigation would be more successful than that carried out in the first store, the badly broken floor, with many patches of soil being exposed, and the ventilated apex of the metal roof would also guarantee gas loss and, therefore, treatment failures. However, with better stock management and repair of the floor fumigations could be carried out successfully under gas-proof sheets.

Two other stores, owned by *Mr Yakubu Baba A. Jamil*, visited in *Tamale* market were in similar, if not worse, condition. Neither the management, which resulted in a

rather haphazard arrangement of bags, nor the fabric of the buildings, corrugated and wooden sheeting, would have permitted adequate fumigation. The owner did not fumigate nor did he treat with a contact insecticide even though he does experience some loss. However, he also hires a much larger concrete store, capacity 500 t, which he uses to store cowpeas procured on behalf of the World Food Programme. The Seed Inspection Unit cleans and fumigates groundnuts which he buys for commercial export to India.

Although trader stores in other markets were not inspected closely, it was obvious that their condition was too poor to enable long term, effective storage, including adequate management of stock and pest control operations. Fourteen of the 21 traders interviewed who store for periods above three months fumigate their produce. Many undertake the treatments themselves but some contract the MoFA or private companies to carry out the fumigations. It is clear from the physical conditions of the stores and from descriptions of the methods of application (usually one tablet per bag of grain: 3-5 times the recommended dosage) that fumigations are uneconomic, ineffective and dangerous. There is definitely a need to remedy this situation.

Several of the traders used contact insecticides to protect their grain. *Malam Fale*, a buying agent for his employer who is based in Accra, stores cowpeas for 4-6 months. He experiences insect problems and tries to overcome them by applying Actellic dust every three months to the contents; he also sprays bags regularly with insecticide and fumigates with phosphine. Despite these treatments he still experiences high losses and has to winnow and rebag regularly. *Addisa Adam*, who also trades in Tamale, believes she loses 10-15% of her cowpeas which she stores up to three months, despite applying insecticide and fumigation. Another woman trader, *Rabi Mohammed* from *Gusiegu*, loses 10% of her stored cowpea, sorghum and millet despite employing a commercial pest control operator to treat her commodities. Much of the insecticide is applied simply as a spray to the bag surfaces, a practice known to be of only limited efficacy (McFarlane, 1989). Furthermore, it is quite likely that treatments are not applied correctly or that inappropriate chemicals are used. For example, *Yacubu Abdul Jamil* uses sevin dust, a compound with only limited effectiveness against storage pests and, *Ayishetu Mumuni* from *Gusiegu*, uses one packet of Actellic (500 g) to treat 10 bags of maize or cowpeas, half the required dosage; she loses 10% of her cowpeas in 7-8 months storage.

However, when undertaken correctly the application of Actellic can provide significant protection to stored pulses and cereals. *Mary Grace Kanaba* in *Navrongo* market has the MoFA to treat her maize with Actellic. She stores it for three months before sale without loss.

Inspection of cowpeas on sale in any of the major markets in Ghana shows clearly that pulses sustain significant insect infestation during storage with a consequent loss in weight and quality. It is clear that treatments applied by traders to counteract the problem are not efficient as the damage generally increases in store. There is a need to introduce good, effective store management practices which will enable traders to maintain stored commodities in good condition for extended periods.

CHAPTER 5. THE MARKETING SYSTEM

5.1 The marketing chain

5.1.1 *Village level activity*

All the villages visited showed evidence of considerable entrepreneurial activity. Traders appeared to be resident in all the villages, providing producers with immediate linkages to outside markets. Both men and women were involved in trade although the opinion was given in some villages that more women were involved as their lesser responsibility for household food security (men are required to provide the entire compound's supply of basic grains) allowed them to spend more time on income earning activities, which in turn provided them with the capital required for trading. Traders were also identified as wealthier members of the village as they owned cattle or were in receipt of a government salary. On the other hand, what appeared to be a common practice among producers of supplying village traders on credit, suggested that barriers to entry for new traders may be very low: a new trader does not have to accumulate large amounts of working capital to begin trading.

In addition to resident traders, producers had the option of selling to the itinerant traders who travel to the villages from local market centres or even from regional centres. These traders were sometimes agents for a larger trader, in which case they were generally paid on a commission basis, or they were operating independently. Some producers had regular buyers and the relationship may be sufficiently established to allow credit arrangements to operate. The evidence suggested that these operated in either direction: farmers supplied on credit and traders advanced loans, particularly at planting time, in return for payment after harvest (in cash or kind). Modalities varied and it would seem unwise to generalise beyond saying that the overall impression gained was that the interaction of producers and traders was perceived to be mutually beneficial rather than exploitative.

Producers also had the option of taking their production to market themselves. By doing this they received a better price in return for meeting the time and transport costs of marketing themselves.

Markets in the two regions visited operate at local, district and regional level. In Northern Region there are over a hundred markets, held either every 6 days or every 3 days and in the Upper East there are 36 markets held every 3 days (Asuming-Brempong et al., 1991). This extensive network of markets, which is characteristic of the whole of Ghana, means that 94% of villages are within 10 km of a market and 54% villagers sell at a market.

The competing operations of village traders, itinerant traders and market traders suggests that producers have a variety of options when they want to dispose of surplus production. Trading itself generates additional income for many villagers, especially women. However evidence collected indicates that entrepreneurial activity is not

simply confined to trade. Processing and storage of commodities were found to be important income generating activities. The benefits of storing for sale in the lean season were widely understood and there was plenty of evidence that wealthier villagers store in this way. By contrast, processing activities were undertaken by even the poorest women, especially during the lean season, when the small margin that can be obtained by adding value to a commodity through her own labour may be a woman's only source of income. Processed commodities are carried by the women to the nearest market for retailing.

During the course of the interviews a commodity marketing sequence emerged. Groundnuts, as well as paddy in the Upper East, appeared to be the foremost cash crop. In Northern Region maize, cowpeas and yams were also traded and finally, if there was surplus, or in order to raise money for purchasing other commodities or seeds at planting time, sorghum and millet. A discernible difference however appeared to exist between the degree of marketing activity in the villages visited in the Northern Region and those in the Upper East. Especially around Bawku, where the soils are very poor and the rains are short and unreliable, producers are far more likely to face a deficit in basic grains than have any to sell. Producers in these villages stressed that they would only sell sorghum and millet in an emergency and in one village opinion was so strongly against such sales that the women said their husbands would beat them if they found them selling! Given the limited opportunity for marketing their own production, producers, and especially women, relied much more on processing activities (sorghum malting, pito brewing (in non-Muslim areas), shea butter processing, parboiling and milling rice) to generate small amounts of cash.

Below, by way of illustration, short accounts of trading activities from a selection of the villages visited during the research are given.

Northern Region

In *Kuglogu Village*, none of the women farm because they have no access to land. As an alternative, and given the fact that women are traditionally required to be economically independent of their husbands, women in the village trade, often in family groups (a mother and her daughters). Trade is mostly in maize, groundnuts, rice and shea nuts and they buy from farmers in their village and surrounding villages. They buy throughout year, paying sometimes after sale and sometimes making a half payment at purchase. If the seller agrees to give credit, the price is agreed in advance plus some interest. The young women trade with neighbouring villages, whilst the older ones send their stocks for sale in Tamale market. One trader may send up to 10 bags of each commodity each week.

The older women also store for between 3-6 months, financing the storage with their own savings, and selling in the lean season when prices rise. One woman had 20 bags of each of the four commodities in store. The women also process shea butter, parboil paddy for resale and crack and process groundnuts.

In *Galiwei village*, among a group of 12 women interviewed, four were trading as well as farming. They trade throughout the year, travelling once a week to Tamale with 2-4 bags each of maize, groundnuts and sorghum. They pay the producers after returning. Traders from Tamale also come to the village. Two farmers interviewed said that they had regular buyers from Tamale who advanced them credit which could be repaid in cash or kind.

In *Gusiegu*, some producers sold at the local market, others to traders who came to the house although the price paid was lower. The smaller farmers tended to sell for cash, whilst the larger farmers and farmer/traders were more likely to sell on credit. Some traders provided financial assistance to be repaid at harvest although a repayment price is not set in advance and repayment can be in kind in various forms: the quantities repaid would be agreed upon discussion between parties.

Rabi Mohammed is a trader in *Gushiegu*, buying cowpea, groundnut, millet and sorghum. She buys from the villages and also goes to local markets to buy. She helps her suppliers with loans and pays cash for her purchases. She buys up to 10 bags of each crop each week during the season, turning over half her purchases and storing the rest, although she would prefer to store more if she had the capacity to do so. She stores up to 100 bags each of cowpea, millet and sorghum. She sells at *Gusiegu* market to traders from *Tamale* and has regular buyers who give her credit. *Ayishetu Mumuni* buys cowpeas, maize and millet in *Gusiegu* to store. Last year she stored 30 bags maize, 60 cowpeas and 20 millet. She said that it was not common to find traders storing, only those with the money could do so. She finances herself from her other business - a bar - which she owns.

In *Gomonayili village*, *Labaran Bubakari* grows maize, sorghum, yam, groundnuts, cassava, rice and millet. He consumes all the sorghum, maize and cassava which lasts until the next harvest. Groundnuts are sold at planting time in order to pay for tractor services. He sells at *Gusiegu* market to a trader from *Tamale* who gives him an advance which he pays back the following week when he brings his crop to market. He has never asked the trader for pre-finance but gets this from male traders in the village. He stores the millet for 6-7 months and then sells it to buy maize. Rice is stored as paddy and processed by hand when required for consumption. If he has a surplus, he will sell half.

Upper East

In *Agaogo Village*, *Bawku West District*, the soils are very poor (full of rock), there is a very short rainy period and therefore yields are low. Conditions are too arid for maize and sorghum and millet are more important. Crops are only sold in emergencies - for example, to finance funerals or to buy a sacrificial animal after harvest. Production is primarily for own consumption and is stored though output is often only sufficient to feed the compound until the next planting season. Women generate cash income by processing sorghum into malt for *pito* (a local beer) for which they buy sorghum rather than using their own supplies.

In *Saka village*, *Bawku West District*, a number of village women interviewed supplement their farming activities with trade. *Sheitu Mohammed* from *Kpalib village*, comes to *Saka* to buy paddy. She buys one or two bags for cash, takes this home to parboil and then sends to the mill. The milled rice she sells at *Bawku* market. *Mbama Abugri* sells shea butter at *Saka* market every market day. She also farms rice, groundnuts and soybeans. She keeps back some of the rice for seed and sells the rest - one and half bags this year. She produced one bag of groundnuts which she consumed, saving some for seed. The soybeans failed this year and she produced only one bowl of sorghum. Given that her own food supplies do not last long, she has to rely on shea butter revenues which allow her to buy millet.

In *Bongo Soe village*, *Navrongo District*, members of *Akemdoo Women's Group* grow rice, groundnuts, cowpea, bambara beans, small quantities of pigeon pea and very small amounts of millet and sorghum (husbands' crops). Only groundnuts and rice are sold. The groundnuts are sold at harvest to buy cloth, some is kept for seed and the rest is stored for consumption or for processing into *kulikuli* for sale. They have regular buyers who pay cash but do not give credit. Traders in the village also buy and store from 20-

100 bags of unshelled groundnuts until the lean season. Some of these traders are cattle owners and they often sell cattle to buy and store groundnuts; some are government workers with salaries. Paddy is sold at harvest and some is stored for consumption. The women also buy paddy to parboil, mill (manually) and resell.

In *Laabiisi village*, *Atia Abagana* (a contact farmer for the extension officer) grows early millet, sorghum, late millet, rice, groundnuts, bambara and cowpea. He never sells sorghum or millet but stores the paddy until planting time to raise money for land preparation. He gives a bag of paddy to his wife to parboil and mill, sending the processed rice to a trader who cooks and sells the rice and then pays him back. He did this last year with 5 bags of paddy, buying at 16000 per bag, storing for 5 months and selling at 27000 for each bag of processed paddy. Groundnuts are mainly for family consumption though he sells some at planting to get cash for land preparation. Last year he bought at harvest for storage and sold in lean season. February bought for 10000 and sold in June for 14500. He also keeps livestock and cultivates vegetables in the dry season.

5.1.2 *Local markets*

As discussed above, large numbers of local markets provide a regular trading opportunity for villagers. Most walk to the market, carrying what they are to sell on their heads - grains, vegetables or processed commodities. Many of the markets are completely outdoors, offering no storage facilities and only rudimentary stalls for the traders. Much trade is done in the open, perhaps under a tree to provide shade, and produce is set out on the ground. The markets have a retailing and a wholesale function and traders come from district and regional market centres both to sell retail items (cloth, cosmetics, kitchen wares) and to buy commodities in bulk. In non Muslim areas, *pito* is widely sold and consumed in the *pito* bars around the market. The markets are held from late morning until dusk and appear to serve an important social function as well as an economic one. In the Upper East, each market is held every three days.

The major characteristic of these markets is the large number of petty traders who may travel considerable distances to buy only a few bags each. They then load these into waiting lorries and carry them back to the district or regional centres where they live. Middlemen also operate in these markets, buying from producers and selling on to outside traders. As will be examined in more detail later, in the face of what amounts to intense competition, margins do not appear to be very high, although this may be compensated for to some degree by the measuring system which is in widespread use (see 5.3)

Below a selection of the markets visited and traders interviewed are presented.

Northern Region

Kumbungo market is mainly a retail market although groups of traders also buy from farmers and itinerant traders. Two women interviewed work together, one buying small quantities from villages, the other buying from her and bulking up stock to send to Techiman. She sends about 3 bags a week. Another trader, a teacher from Tamale, buys from intermediate traders who buy from the villages. They buy at 1400 per bowl of groundnuts and she pays them 1500 per bowl. She sends what she buys to Kumasi where she has a regular buyer and where she hopes to get 1900-2000 per bowl. The

accepted practise of using a shorter measure to retail than to purchase from the producer (an extra handful is added to the standard bowl measure, approximately equal to an extra bowl for every 10 purchased, see 4.3 below) further adds to her margins.

At Kpatinga market a bus from Tamale had brought some 50 traders to the market, including 20 or so buying grains. Many may only buy a few bags, which they load onto waiting trucks or, if there is little to buy, they may not buy at all. In this case they may leave money with agents to buy for them when supplies improve. Kpatinga to Tamale is about 53 miles and the transport charge per bag of maize is 1000c. Loading costs are a further 200 cedis and taxes to the District Assembly are 200 cedis.

Upper East

Templigo market is a small local market to which village women bring small quantities (one head load) for sale. Local traders buy from these women and either sell on to bigger traders from Bawku, or purchase for processing and resale. **Anali Ayariga** farms (groundnut, millet, paddy) and trades. She sells rice balls in the market for which she buys milled rice, preferring to store her own paddy until the lean season when she cooks and sells. She consumes all her own groundnuts and millet. She also brews pito for sale. **Akambila Akpakire** from Komarka village comes to the market every 3 days to buy groundnuts which he also purchases direct from producers. He has some regular customers and always buys on credit, selling the same day to traders from Bawku. He is selling unshelled groundnuts for 17000 per bag, making about 3000 per sack. He has a regular buyer in Bawku who finances him sometimes but he does not lend to his suppliers. He buys up to 10 bags a week. **Hawa Sule** buys groundnuts at the market (about 5 bags) which she sells to the *kulikuli* producers in Bawku after shelling at a mechanical sheller in Bawku.

5.1.3 District markets

These markets also have a dual function but the wholesaling function is more obvious and larger traders operate from these markets. There are limited storage facilities. At the time of our visit to the Upper East, the flow of some commodities (sorghum, millet, maize, cowpeas) appeared to be as significant into the districts from outside the region or even the country (indicating a deficit in food supplies) as it was out of the district in other commodities (groundnuts).

At Bawku there was much evidence of trade with Burkina Faso and Togo, (the town is only a few miles from the border). Despite the strong CFA relative to the cedi, traders are still going over the border to buy cowpeas (because they are of a better quality) and red sorghum (when it is out of season). Some of the traders interviewed had quite large operations, employing many agents and buying 50 -100 bags of different commodities each market day (twice a week) during the harvesting period. These bigger traders invested in long term storage for which some received assistance on pest control from the Ministry. Smaller traders interviewed (trading between 5 and 20 bags a week) said that limited access to finance constrained their ability to store. Indications that Bawku is a deficit area were provided by the fact that several traders were involved in bringing grains (maize, millet, sorghum, beans) from outside the area for local sale.

Tahim Nambe buys groundnuts, millet, maize and shea. He buys 20-30 bags a week in bowls or in bags. Often the small quantities he buys are from small farmers who urgently need cash. He sometimes advances cash to his suppliers, who are traders buying in the surrounding villages, agreeing the purchase price in advance. He sells to traders who come during the harvest period to Bawku from Kumasi and Accra every two weeks. He only stores if the price falls from one week to the next in order to avoid a

trading loss, but not to take advantage of interseasonal price variation because of limited access to finance.

Sheitu Issifu buys maize from Techiman when stocks are low in Bawku. At present she is paying 22000 for a maxi bag in Techiman, transport is a further 5000 to Bawku (including taxes) and she sells for 28000. She goes to Techiman twice a month and buys 15 bags each time. Her own transport cost is 14000 for the round trip. She has regular buyers in Bawku and when she sells on credit, she charges a higher price.

Lizeta Seidu buys 10-15 bags of cowpeas from Cinkaasu market, Togo, every Thursday and Sunday. She has regular suppliers there who sometimes finance her and give her commission. Presently, all her costs are equal to 46000 per bag and she is selling at 48000 to buyers from the south (Accra, Kumasi etc.). She trades in this way all the year round and knows lots of other women doing the same. She has stored in past but got badly into debt when she was not paid for some cowpeas because her buyer could not sell them due to insect damage. She knows she can make money if she uses insecticide, but she believes that the chemical she needs is not available now in Ghana but is available in Burkina.

Navrongo Market is mainly a retail market. Some traders source from outside the district (especially maize from Techiman; cowpeas from Burkina). Their principal customers are local consumers, including institutional customers, food processors and food bar owners. Buyers do come from the south to buy groundnuts. Many traders appeared to be operating on a very small scale, selling only a few bowls of produce a day, purchased from farmers in surrounding villages. However some larger traders were storing groundnuts long term.

Yagade Nakanase bought 20 bowls of maize from local farmers at 600 per bowl and is selling at 700. She pays 50 cedis per day to the district assembly. She also buys from wholesalers in the market. She makes malt (for pito) and sells it in the market.

Sylvia buys 10-20 bags per week directly from farmers in the market, some of whom are regular suppliers. She also buys to store when groundnuts begin to get scarce, tying up all her spare cash in this way. Last year she bought 40 bags at 49000 and sold at 77000 after 7 months. Her losses were low because before storage she removed damaged kernels and dried the nuts well. She keeps down rodent damage with cats. She sells to local institutions and to buyers from Bolgatanga and Northern Region who pay cash but they do not loan her money and she does not give loans herself. She does get financial assistance from ADB which is facilitated by her primary occupation as a civil servant with a regular salary.

At *Zebilla market* most traders were buying small quantities. Some were bulking up and reselling in the same market, others were buying one or two bags for processing and resale. Some were storing - but only small quantities of one to fifteen bags.

Adabogo Azubire is a member of a loose association of 20 male traders who buy rice, groundnuts, cowpeas, millet, early millet, beans and shea nuts. He buys 3-4 bags per market day and sells to traders from the south. He can store for 2 months or longer and within his group each member stores an average of 10-15 bags each in houses around the market. He doesn't have storage problems with groundnuts and paddy, but losses can be high for storing cowpeas which also pose a marketing risk: if an unexpected supply of cowpeas come from Burkina, prices collapse. However if this doesn't happen, he can make a 50% profit in two months.

5.1.4 Regional markets

Northern Region

Aboabo Market, Tamale is a permanent market site at which a market is held every six days. It covers a large area in the centre of Tamale and is the largest market in the north of Ghana. No official register of traders appears to exist as traders are not required to register or hold licences but the traders interviewed at the market during the course of our research indicated that there were well over 100 wholesale traders buying food grains (groundnuts, maize, cowpeas, rice, sorghum, millet). The scale of operations amongst those interviewed ranged from those purchasing several hundred bags a week at the peak purchasing period to under 50 bags a week.

Traders buy directly from the local and district markets in the region (e.g. Kumbungu, Savalugu, Tolon, Yendi, Bimbilla, Salaga) through agents, who receive a commission, or from regular suppliers in these markets. Credit flows in both directions: some traders interviewed in Tamale were supplied on credit, others advance credit to their suppliers. Traders also buy from suppliers in Tamale who go out themselves to buy in the villages or at local markets. The traders sell on to buyers from the south, principally Kumasi, Techiman and Accra. Traders are aware of the benefits to be gained from long term storage and many of those interviewed were storing groundnuts, cowpeas and maize for up to 6 months, some with assistance from the Ministry. However the quantities stored relative to quantities purchased do not appear to be high, reflecting a commonly voiced view among traders that their ability to store is constrained by their limited access to finance. They prefer to keep turning over what little capital they do have rather than tying it up in storage. In addition traders were concerned about storage losses which they perceived to be high, even after treatment. Warehousing facilities in the market did not appear conducive to effective storage management and traders generally were poorly informed about the effective use of chemicals and fumigants.

Short accounts of the operations of two traders interviewed in Tamale are given below.

Abdullah Aziz Salifu buys cowpeas, groundnuts, millet, sorghum and maize. He buys 300-400 bags of each commodity per week and employs 8 agents who buy in the local villages at pre-fixed prices. Each agent buys a different commodity. His buyers are in Accra. He stores 1000-1200 bags for 6-7 months, partly in the market but also in stores at the lorry park. He has some assistance from extension officers from the Ministry with storage management. Presently maize is selling at 20,000 a bag but he expects the price will rise to 30-35,000. Sorghum is 35,000 and should reach 40,000. With cowpeas price is linked to quality: good quality cowpeas might fetch 36,000 but poor quality would only fetch 30,000. Generally good quality cowpeas (i.e. no damage) are very rare. He does not have assistance from the bank to finance his operations but has four business partners, some of whom have provided capital for the business.

Addisa Adam buys 500 bags each week of rice, cowpeas, groundnuts, soya, maize, sorghum, millet and bambara. She has 20 agents buying from Tolon, Kumbungu, Savulugu, Yendi and Salaga whom she finances and pays a commission based on 50% of her profit. If she makes a loss, she doesn't pay her agents who accept this as they trust her. She sells to 10 buyers in Accra, sending a lorry load there every 2 weeks which

costs her 2800-3000 per bag. She also sells to traders from Techiman. She also stores maize and cowpeas for up to 3 months, though not groundnuts. She does have storage problems despite treating the grains and believes she may lose between 10-15% of the cowpeas. She finances her own operations although she sometimes gets credit from others traders in the market when she is short of cash. She does not give loans herself. She did have a savings account at the Commercial Bank but she withdrew this when they refused to provide her with a loan.

Upper East

At *Bolgatanga market* many traders buy in grains from outside the region (millet from Tamale from January to June; maize from Tamale and Techiman; sorghum and millet from Gusiegu and Lanbusi; bambara, cowpeas and groundnuts from Tamale) and retail them in the market .

Fati Loko deals in sorghum, late millet and maize. She buys sorghum and late millet from Gusiegu and Lanbusi markets in Northern Region. She travels regularly, buying up to 15 bags of all the grains together. She buys maize from Techiman which is brought by a regular supplier each week on credit. At the other markets she has no regular suppliers and buys with cash. Her customers are retailers and consumers, some of whom buy up to 5 bags. She does advance some credit to her customers. After Christmas she buys for storage until June although the amount she stores depends on her capital availability - last year she stored 40 bags and she claims she had no storage problems as she cleaned and dried the commodities before storage. Her returns were good: she bought millet and sorghum at 20000, and sold at 30000; maize she bought at 16000 and sold at 30000. At the moment she is buying for immediate sale: sorghum is 26000 to buy, selling at 28000; she is buying millet 26000, selling at 28400 and maize at 24000, selling at 25000. She used a loan from her husband to start the business and has never been to the bank to ask for a loan although she does have a deposit account at the Commercial Bank. She rents a store in the market from the District Assembly which costs 5500/month. She also pays a District Assembly levy of 300 per bag when it is unloaded and 200 per bag when she sends it out of the market. There is a retail tax of 100/basin.

Sawadatu Moro deals in bambara, cowpeas, groundnuts, and *gari*. She is supplied by Mamprussi and Dagomba women from Tamale who buy direct from farmers. They give her credit for about a week. She buys about 100 bags *gari* per month, 20-40 bags bambara, 35 bags cowpea and 40 bags groundnuts. Occasionally in the lean season supplies run out. She sells in bulk, up to 5 bags a time, and in bowls. Her regular customers are retailers and food processors. She doesn't store because she can't afford to tie up her capital.

5.1.5 *The markets at Techiman and Accra*

The market at *Techiman* takes place on Wednesday, Thursday and Friday. Buyers from the south come to buy wholesale from northern traders, some of whom come from as far as Burkina, Togo and Cote D'Ivoire. Turnover is rapid and there is little evidence of long term storage in the market. Prices fluctuate during the market day in response to information on supply and demand. There are bulk storing facilities in Techiman at the GFDC silos. Some 1000 MT have already been rented out to 20 private traders and farmers this season (1995/96).

In Accra the Kaneshie, Agbogbloshi and Timber markets were visited.

Kaneshie is primarily a retail market. There was much evidence of maize, groundnuts and beans for sale, but little sorghum and millet. Much of the market is covered but at the back an open area near the market's storage facilities (which provide traders with overnight storage of commodities rather than serving any long term warehousing function) is the main maize retailing section. The women sell from bags which they purchase either from wholesalers delivering to the market or from maize producing areas directly to which they travel. The operations of these traders are illustrated with a few examples.

Naomi Labi sells 5 bags of maize each week which she is supplied on credit. She pays interest. She buys from different suppliers and at the moment she is paying 30000 for a maxi bag. This contains the equivalent of 50 "American" tins, which is the retail measure used in the market, and she sells one tin for 650, obtaining 32500 for the bag. On each bag her gross profit is 2500, a gross margin of 8%.

Fatty is one of the few traders selling sorghum and millet (among other commodities) in the market. She travels to the North to buy supplies twice a year purchasing 5-6 bags which she sells over the following months. She stores the grain in the warehouse at Kaneshie at a fee of 200 cedis per month.

Agbogbloshi market is also a retail market although there was more evidence of wholesaling as well. Different commodities were concentrated in different areas of the market. The maize retailers were grouped together in a circle around the bags they were retailing, in a similar way to the traders at Kaneshie. The retailers said they bought from a wholesaler who travels to Sunyani for his supplies. They were currently buying on credit at 30,000 cedis per maxi bag and selling at 650 cedis per American tin (the same prices quoted at Kaneshie on the same day).

The *Timber Market* is a wholesale market for groundnuts and cowpeas (it is also a wood and hardware market, hence its name). Many of the traders are northerners. Turnover was reported to be quite fast and although some traders store long term, they do so in Tamale rather than in Accra. Considerable concern was expressed by the traders about the long term storage of cowpeas.

5.1.6 *Export markets*

Official data is not kept on the export of food grains. One trader in Tamale did know of an exporter in Accra who exported groundnuts last season. He was interviewed in Accra.

Mr Gulati, who owns Indgha Agro Enterprise Ltd., exported 12.5 tonnes of groundnuts to the UK in 1994 which he purchased on the open market. He believes he is the only groundnut exporter in Ghana. Quality problems last year (aflatoxin) led him to work on a contract farming basis this year which he believed would give him more control over quality. He provided seed, ploughing services and extension (through 14 field staff) to 2400 farmers in the North, financed through an ADB loan. He used his existing network of contract farmers for cotton to locate farmers. Farmers were contacted through groups and each farmer planted 0.5 ha.

He anticipated a yield of some 8-10 bags but only got 0.5 to 2.5 bags per farmer and as a result many of the farmers are in debt. He also believes that the apparent poor performance of farmers was in part due to the diversion of production to other buyers, something the farmer is able to do much more easily than with seed cotton where alternative markets are harder to find. As a result of these problems he has had to meet his orders this year by purchasing on the open market. This has been expensive as prices this year have not gone down after harvest as a result of low production. The price is now around 55-56000 cedis - he bought seed for his farmers this year at 55000 (lean season price).

Generally he says the groundnut market is characterised by large numbers of small traders who turn over their stocks rapidly rather than store. He knows of no traders in Tamale who store more than 50 -100 bags of groundnuts as the finance to do this is not available. Adequate storage facilities are also a constraint.

He is considering exporting cowpeas next year as he believes the returns would be better than for groundnuts and he might try sending some samples abroad to see if there is any interest among buyers. He is also thinking of maize exports.

5.2 Finance

5.2.1 *The financing of village level activities and itinerant traders*

As indicated in the examples presented, village level trading involves a web of informal financial arrangements. These are difficult to characterise as the modalities of any given arrangement are determined largely by the relationship between the trader and the producer. The frequency with which producers entrust their produce to traders for payment after sale suggests that problems of moral hazard are not common. It also illustrates the lack of liquidity in the system: traders do not always have the working capital to pay cash. This limits their operational capacity to the extent to which they are known to and trusted by their suppliers.

The evidence collected provides examples of credit flows in the other direction, from trader to producer, especially at planting time when farmers may have exhausted their stores and require cash for purchasing seed and land preparation. However the cases given do not indicate any uniformity in the modalities of such arrangements. The terms of the repayment may be fixed in advance (for example the farmer will agree to sell at harvest to the trader at a predetermined price) or they may be negotiated after harvest. Repayment may be in cash or kind. Interest may or may not be charged. In one example traders were giving loans to farmers against the harvested crop (groundnuts which had been harvested but not shelled).

The only evidence of formal sector lending at the village level was through donor supported programmes. The IFAD smallholder development programmes have been operating for several years in Northern Region and in the Upper East. A number of NGOs also have lending programmes.

In Northern Region a group of farmers at *Zinido village* were in receipt of inventory loans for maize held in a specially built village store (funded by IFAD) and managed (at no cost to the farmers) by the local extension officer. Group members expressed satisfaction with the arrangement but within the village the scheme was only benefiting fifteen out of several hundred farmers. The two banks involved in the programme, the Bank for Housing and Construction (BHC) and the Agricultural Development Bank (ADB) in Tamale who have 24 and 5 such inventory groups respectively, reported a high repayment rate (over 95%), far higher than for any other lending programme under IFAD. However the high degree of subsidy involved (storage and supervision costs are met by IFAD and interest rates charged are below market rates) limits its potential as a widely replicable pilot project.

In Upper East, the IFAD programme, through the ADB, has started in the last year to make loans to farmers for trading activities. Originally lending was for crop production under rain fed conditions but very poor recovery rates led IFAD to switch loan support to irrigated production systems and food marketing projects. A loan is made to a group of farmers which is then shared out among the individuals for investment in their own enterprises. The group is jointly liable and the bank deducts 10% of the value of the loan and puts it in a security deposit. The type of trading projects being funded recently are those supplying finance to groups of small traders to

allow them to buy from villages and bulk up the commodities for onward sale. They also finance groups to parboil paddy, and to buy and resell fish.

The Tamale Archdiocese Agricultural Programme (TAAP) also uses groups for lending programmes. A loan is made to a group and this is divided among its members to finance their individual enterprises. Trading, processing and storing activities predominate. The group agrees an interest rate and repayments are made by all members each month to the group's savings account held in the parish credit union where it earns interest. When the loan is due, it is repaid from this account. TAAP provides training in basic book keeping to the groups. It also stresses the savings component of the approach and requires groups to save for at least six months before they qualify for a loan. TAAP began the programme in 1994 and has 17 groups receiving loans. Four groups which were set up during the pilot phase of the programme are still operating independently five years on and one group has opened an account with the Bank for Housing and Construction in Tamale.

5.2.2 *Access to finance among market traders*

The examples provided above of the operations of market traders suggest that it is only a few of the largest traders in the regional centres who have access to formal sector finance. Even amongst traders turning over several hundred bags a week there were many who did not have bank finance, although some had deposit accounts at the banks.

The impression gained of very limited formal sector lending to traders was confirmed by a survey of bank managers in Tamale and Bolgatanga. In Tamale the manager at Barclays said that his branch was no longer financing agricultural producers or traders. In Bolgatanga the branch manager at the Commercial Bank expressed his view that traders preferred to hold their own money rather than put it in the bank where access to it would be limited. He conceded however that banking hours were not convenient for traders, as banks close before the end of trading and market days sometimes fall on Saturday or Sunday when the bank is closed. He also admitted that many traders still recalled the time in the early 1980s when Government had seized deposits held in the banks. He said that his bank did try and encourage the traders to open deposit accounts at the bank but with little success. He had no loans to traders in agricultural commodities.

At the Co-operative Bank in Bolgatanga the branch manager said he had no customers receiving loans who were traders although a few traders had deposit accounts at the bank. Anyone wanting a loan is required to provide adequate security, preferably real estate to the loan value, and to prepare company accounts and to provide details of the company's cash flow. He did not think that market traders would be able to meet these conditions.

The only bank which did appear to have a number of trader clients was the Agricultural Development Bank in Tamale.

High rates of interest for the commercial sector may also contribute to the lack of formal sector financing. Following guidelines set by the Bank of Ghana, the

commercial banks fix varying interest rates for different sectors of the economy. Rates are highest for loans for trade and commerce. For example at the Commercial Bank in November rates were as follows: for agricultural production, 30%; manufacturing, 43%; mining, 44%; and general trading, 48%. A similar hierarchy of rates was in operation at ADB: for crop production, 40-45%; for processing and manufacture, 46-50%; and for marketing and trade, 48-52%.

In the absence of formal sector financing the capacity of traders to extend their activities is limited, unless they can borrow money from family, friends or another business enterprise. In these circumstances traders interviewed expressed a preference for rapidly turning over their limited capital rather than tying it up in stores. Thus limited access to finance was one of the main reasons given by traders for not carrying out more interseasonal storage.

One private sector initiative which has targeted traders and has attracted considerable donor interest is the Citi Savings and Loans Co. This was incorporated in July 1992 and has the specific objective to meet the demand for financial services among the micro and small scale entrepreneurial sector, particularly market traders. Although its activities to date have been concentrated in Accra, its success in reaching this sector is an important indication of the potential that exists for improving the access of small traders to the formal financial sector. The company emphasises deposit mobilisation, to build up a trader's own capital base, as much as loan services and it has adjusted its operational procedures to attract custom from market traders (for example its branches are sited within the biggest markets in Accra, it has longer opening hours as well as safe deposits for customers to use out of banking hours and it employs savings collectors to go round the market and collect daily deposits, very much along the lines of the traditional *susu* collectors). From August 1993 to May 1995 7,705 savings accounts were opened with the company and in May 1995 511,368,000 cedis (about US\$500,000) was outstanding in loans. The company's main constraint is its ability to raise capital for lending. For this reason it has attempted to attract donor funds for on lending.

5.3 Weights and measures

There is no evidence of the use of standardised weights and scales in Ghanaian markets. Although cocoa and shea nuts have long been purchased by weight by the COCOBOD, all other market transactions are done on the basis of standard measures. At the retail level these are metal bowls or tins, and at the wholesale level, bags are used. Especially at the retail level, the measure may vary according to the commodity and geographical location. For example, a different bowl size was in use for the purchase of unshelled and shelled groundnuts in the North. The standard bowl used for many other commodities in the North did not appear to be in use in the markets in Accra where the "American" tin is used.

As neither thin metal containers nor jute bags are rigid materials, volumes contained within them show considerable variation. The common practise of sewing an extra piece of cotton onto one end of a bag (the "maxi bag") introduces more variability into the system.

The widely accepted use of "bush" weights (bags filled in excess of the standard 40 bowls) and the extra handful added by traders to the bowl measure when they purchase from producers suggest that the lack of transparency in the system works in favour of the traders. However in a number of the villages visited in the North, where the relationship between traders and producers was one of trust and the bowl price given by the trader in the village was the same as that prevailing in the market into which she was to sell, the trader's "commission" (i.e. the handful added to each bowl purchased) appeared to be accepted as a legitimate fee.

There is no doubt that the introduction of a system of weights and measures would add transparency and efficiency to the existing marketing system and would reduce the opportunities for unscrupulous traders to exploit their suppliers. At the same time it should not be assumed that the present system is always exploitative. Arrangements between traders and producers may sometimes represent an adaptation to the particular circumstances of market exchange which is mutually beneficial.

5.4 Transport

5.4.1 The road network

The access of villages to the market places greatly depends on road conditions and transportation facilities. In general, the network of roads which can be used throughout the rainy season is comparatively wide. Major tarred roads link Navrongo, Bolgatanga and Bawku, though the road between Tamale and Bolgatanga, which was tarred, deteriorated dramatically in the last decade and is presently undergoing major reconstruction.

Other important north-south connections which are gravelled include Bawku, Nakpanduri, Gushiegu, Yendi, Bimbilla; and Tamale, Salaga, Yuri-ferry, Ejura (the old Tamale-Kumasi road). Western and eastern parts of the north are linked through roads leading from Wa to Navrongo and Bolgatanga; Walewale-Gambaga to Nakpanduri; Tamale-Karaga to Gushiegu; Tamale-Yendi; Daboya-Tamale; Sawla, Damongo, Yapei to Tamale; and Salaga to Bimbilla.

Transportation services are provided by state owned buses and private lorries and passenger vehicles. Daily services are only available between the regional and district capitals. Most villages located along feeder roads can only be reached on market days. The standard truck takes about 120 bags although smaller vehicles serve the smaller, local markets. Traders travel separately in trucks or buses, which often appear dangerously overloaded. Distances travelled may be considerable.

Throughout the North bicycles are a widely used form of transport for moving passengers and produce between the farm and the compound and the compound and the feeder roads or markets. Many villagers, especially the women, walk to the market carrying head loads. Head loading may also be used to bring produce from the farms to the compounds. In the Upper East, donkey carts are quite common.

5.4.2 *Transport costs*

As discussed below, rates are set by the Ghana Private Road Transporters' Union (GPRTU). For freight, charges are made on a per bag basis. There are no fixed mileage rates as the condition of the road is a key determinant of cost. Examples of rates per bag in November/December 1995 given during the course of interviews with producers and traders are as follows:

Northern Region:	<i>Cedis</i>
Kumpungu - Techiman:	2000
Tamale - Accra:	2800
Tamale - Cape Coast:	3300
Kpatinga - Tamale:	1000

Upper East

Templigo village - Bawku:	700
Saka village - Bawku:	1000
Bawku - Accra:	5000
Bawku - Kumasi:	4000
Bawku - Techiman:	3500
Navrongo - Techiman:	3500
Bolgatanga - Tamale:	1300

Rates have been increasing rapidly over the last 12 months. The GPRTU in Bawku quoted the following rates for Bawku-Accra and Bawku-Kumasi for 1993-1995:

1995 per bag to	Accra, 5000;	Kumasi, 4000
1994	Accra, 4000;	Kumasi, 3000
1993	Accra, 2500;	Kumasi, 2000

Thus over the 2 year period, rates have increased by 100%.

5.5.3 *The Ghana Private Road Transporters' Union (GPRTU)*

The GPRTU is a private voluntary organisation with membership open to drivers, owners, owner-drivers, porters and station guards. It is divided into regional, autonomous branches. The Union offers its members legal and welfare assistance and representation through the union. However the Union's influence extends beyond representing its members as its branches are responsible for setting the fares and haulage rates to be charged by its members in each locality. Within the markets, where the offices of the branch unions are located, officials arrange transport for traders and in the bigger markets the union will have several branches, each providing haulage services to different areas of the country. A number of union officials interviewed expressed their belief that the union plays an important role in protecting users of transport services from unscrupulous operators as all its members are registered and, should any problems arise, they can be traced. The union also works closely with the district assemblies, collecting exit fees on their behalf.

The Union takes a 10% commission on the transport charges of all vehicles leaving the market. For example the union commission on a load of 120 bags travelling from Tamale to Accra at a rate of 2800 per bag would be 33600 cedis. According to the Union, this money is used to fund its operations and to provide welfare services to members including sickness pay, grants for funeral expenses and legal costs.

In practise the operations of the union suggest that it is a closed shop. During the course of the research there was no evidence of the operations of the GPRTU's only rival, the Private Transport Owners' Association. One official interviewed said non-union drivers would not be able to use the market loading area. Given the GPRTU's control over price setting, its monopoly position raises questions about the efficiency of transport pricing in Ghana. In addition the Union's 10% commission operates like a tax on all journeys.

One indication of the inefficiencies created by this system is the widespread practise of paying for freight on a rate per bag basis, regardless of the size of load. A large operator, or even a group of smaller traders, should be able to realise scale economies by hiring a vehicle at a lower rate than that which would be charged for individual bags. However, the union does not encourage its members to hire out vehicles in this way.

5.6 Taxation

At all the markets visited traders were charged a variety of taxes by the local District Assembly (DA). The rates are set by the DA and were found to vary across the regions. All bags of goods "landed" in the market are subject to the flat rate "landing tax", usually between 300 - 500 cedis per bag. On leaving the market, as it is loaded into waiting lorries, each bag is charged an "exit tax" of about the same amount. Traders entering the market with head loads are charged a head load tax (this was fixed at 100 cedis in two of the markets visited) and a retail tax per bowl sold is levied on foodstuffs sold. The District Assembly appoints revenue collectors to go round the market and collect taxes due.

Given that the tax is a flat rate tax, the burden falls more heavily on lower value commodities. As an example, at the end of November a bag of maize was trading in Tamale for 20,000. Exit tax from the market was 300 cedis and landing tax in Accra, a further 300. Thus the tax adds 3% to the cost of the commodity.

The district assemblies charges a vehicle tax on all vehicles entering and leaving the district. Depending on the size of the vehicle, this ranged from 500 - 3000 cedis. Charges are also made for the hiring of warehousing facilities in the markets

5.7 Marketing margins

The information presented here on marketing margins is drawn from random interviews in the villages and markets and should serve as an indication of the margins received by traders, rather than precise estimates based on a systematic survey. In addition the absence of any standardised weighing and measuring system makes the calculation of exact margins very difficult. Given the large number of operators at all

levels in the system one would expect that the competition would drive margins down. This hypothesis appears to be confirmed by the information collected. As might be expected, margins are higher for processed commodities (although time costs are not included in the traders' estimates of their costs) and for trade between distant markets, despite higher transportation costs.

5.7.1 *Village and itinerant traders*

In many of the villages visited, the selling price given by producers and traders was the same, that is a trader might say she was buying groundnuts at 700 cedis a bowl and selling them in the local market at the same price. This apparent zero return was not disputed by the producers, many of whom were present as the trader was interviewed. The explanation lies in the measure used. As discussed above, it is accepted practice for a trader to add an extra handful of produce to the bowl measure when she is purchasing from farmers. When the commodity is retailed, the measure used does not include the extra handful. If the commodity is sold on to another trader, its value is calculated on the basis of it containing a certain number of retail not purchase bowls, usually 40. According to one group of traders, the effect of this is to reduce the real number of purchased bowls in a 40 bowl bag as follows:

35 bowls groundnuts purchased = 40 bowls retailed.

37 bowls cowpeas, millet, sorghum and soya purchased = 40 bowls retailed

In the case of groundnuts, this produces a gross margin of 14% for each bag of groundnuts traded. For the other commodities, the gross margin is 8%.

To arrive at a more accurate figure of a trader's margins, transport and any other costs should be deducted. An indication of the turnover should also be provided.

It is more difficult to arrive at an estimate for returns to storage in the village as these are influenced by a number of determinants. Most important is the ability of the trader to time purchasing and sales to maximise any interseasonal price increase. Storage losses should be included in the costs as should the opportunity costs of storage and any direct storage costs (jute bags, maintenance or construction of storage facilities, treatment costs). Among villagers interviewed, the storage of groundnuts (unshelled) and paddy were the most common and this is likely to be linked to the relative ease with which they can be stored, minimising losses. One farmer interviewed in Labiisi village in the Upper East bought groundnuts (unshelled) for 10000 cedis in February this year, selling them in June for 14500. This gives a gross margin of 45% after four months storage.

5.7.2 *Petty traders at the local markets*

Petty traders in the markets include those buying and selling directly and those retailing processed commodities.

At *Kumbungu* market a trader was buying groundnuts from itinerant traders at 1500 per bowl, 100 cedis more than they had paid the producers in the village. She hopes to buy about 5 bags in this way every two weeks and she sends these down to Kumasi at

a cost per bag of 4000 cedis (transport plus other costs - taxes, unloading etc.). In Kumasi she hopes to get 1900-2000 per retail bowl. Her total costs per bag are therefore the raw material price (1500 x 35 bowls) plus other costs (4000), that is 56500. Her gross return is 78000 (40 x 1950) which gives a margin of 38%.

Women from *Agaogo village* in Bawku West District, process sorghum purchased at the local market into malt and carry it back to the market for sale to the pito brewers. Two large basins of sorghum purchased at a cost of 6000 cedis produced malt that could be sold for 7200. The margin is 20% for three days work.

Akambila Akpakire, a groundnut trader at *Templigo* market, makes about 3000 cedis per sack of groundnuts purchased from producers in the market when he sells on the same day to buyers from Bawku. He buys up to 10 bags a week. His margin is about 20%.

Azara Iddi travels to Burkina twice a week to purchase red sorghum. She buys 30-40 bags per visit, at a total cost of 26000. She retails at Zebilla market at 600 cedis per bowl, and retails 45 bowls per bag. Her margin on each bag is only 4%, but with a relatively high turnover (up to 80 bags per week), she derives a reasonable income.

5.7.3 Wholesalers in the district and regional markets

In *Tamale Fuseini Nabila* buys up to 30 bags of mixed commodities per week during the harvest period. He is buying maize at 22000. Costs to take this to Accra are 4000 (transport at 2800, loading 500, tax 300 and storage 400) and he hopes to sell at 35000 per bag. This gives a margin per bag of 35%. *Iddi Tiah* buys up to 50 bags cowpeas a week. The current price is 36000 per bag and he hopes to sell in Accra for 42000. Marketing costs to Accra are 4000c.

In Upper East, at *Bolgatanga*, *Ayime Aloligo* buys 10 bags of millet from Tamale every 2-3 weeks at 18000 per bag. His costs are a further 2000 and he sells for 28000, a margin of 40%. *Hamidu Mahama* buys maize in Tamale at 20000, brings it to Bolgatanga at a further cost of 3000 and sells for 25000, a margin of 9%. *Fati Loko* gave buying and selling prices as follows: sorghum 26000 to buy, 28000 to sell; millet 26000, selling at 28400; maize 24000 to buy, selling at 25000.

In *Bawku* market, *Alhadji Karim Addulih* trades and stores commodities for 2-3 months during which time he expects the price of sorghum to increase from 20000 to 22000; the price of millet to move from 22000 to 24000 and the price of cowpeas from 30000 to 36000. *Sheitu Issifu* buys maize from Techiman at 22000, transports it to Bawku for total costs of 5000 and sells for 28000. She does this once a month when maize is in short supply and buys 15 bags each time. Her margin per bag is only 1000 per bag (or 4%). *Lizeta Seidu* buys 30 bags cowpeas from Togo each week at 46000 and sells to buyers from Accra and Kumasi for 48000, a margin of 2000 (4%) per bag.

In *Navrongo* *Abubakari Harman* buys and transports about 30 bags of maize from Techiman each month at a total cost of 27600 per bag. He is selling at 32000, a margin of 16%. *Sylvia* trades and stores groundnuts. Last year she stored for 7 months with only small losses. She bought at 49000 per bag and sold at 77000, a

margin of 57%, although storage costs are not included. *Mary Grace Kanaba* buys maize in Techiman for 22000; her costs bring this up to 29200 and she sells at 32000, a margin of 10%.

CHAPTER 6. PRICES

6.1 Wholesale prices for maize, sorghum, millet, groundnut and cowpea, Northern Region, 1990-1995

The PPMED collects weekly price information from the market in Tamale and this was used to calculate monthly prices (see Figures 6-10). All prices given are nominal wholesale prices. Prices of bambara, a crop of importance in the north, are not collected on a routine basis as are prices for cowpea.

The difficulty of obtaining reliable estimates of the rate of inflation adjusted for rural consumers made the calculation of real wholesale prices impossible in the short time available. However work cited in Runge-Metzger and Diehl's study of farm household systems in Northern Ghana (Runge-Metzger and Diehl, 1993) finds that most crop prices declined in real terms between 1978 and 1992.

The relative value of output prices to input prices is another indication of the real value of farm incomes. Data from the PPMED in Tamale indicates that fertiliser prices have increased annually relative to maize prices since 1983: in 1983 less than 0.2 kg of maize was necessary to buy 1 kg of fertiliser at the official price. In 1992 farmers had to spend 6 times more maize than before. This is a result of the government policy to deregulate the formerly state dominated fertiliser market and remove subsidies. In 1983 the subsidy was as high as 80% of the real fertiliser price.

6.2 Interseasonal price variation indexes for 1990-1995

The data was used to calculate the interseasonal price variation indexes for the different commodities, shown in Figures 7-11. The month which recorded the lowest price was taken as the base month (the month chosen varied for the different commodities as the harvesting period varies) in order to indicate the relative magnitude of interseasonal price change for different years.

Seasonal price variation is a key determinant influencing the decision to store. The data indicates that of the five commodities, seasonal price variation is most marked for maize and groundnuts. Over the last five seasons, the July price for maize has risen an average of 85% over the low post-harvest price (October); for groundnuts, the price rise averages 89% (from October to June).

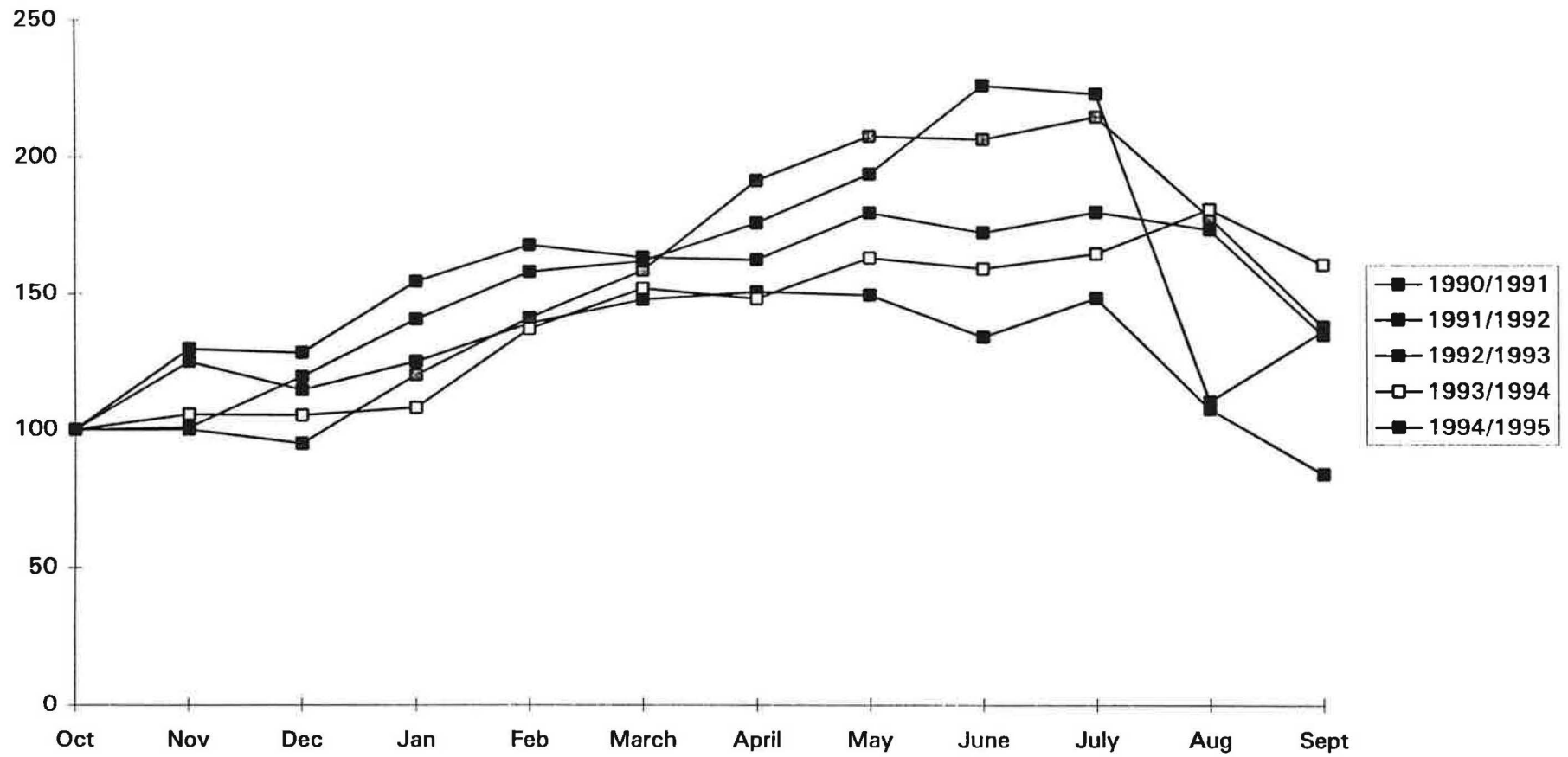
The cowpea data does not produce such a clear pattern of price peaks and troughs. Over the last five seasons the August price has risen on average 64% over the low November price. Variation about the August mean is more marked, from a low of 124 above the trough price to a high of 206. Variation about the mean for maize is from a low of 147 to a high of 221 and for groundnut the variation is from 163 to 221.

Seasonal price variation for sorghum and millet is less pronounced. The harvest is later than for the other commodities and the price is usually at its lowest in January and highest for sorghum in October and for millet in November. Over the last five seasons

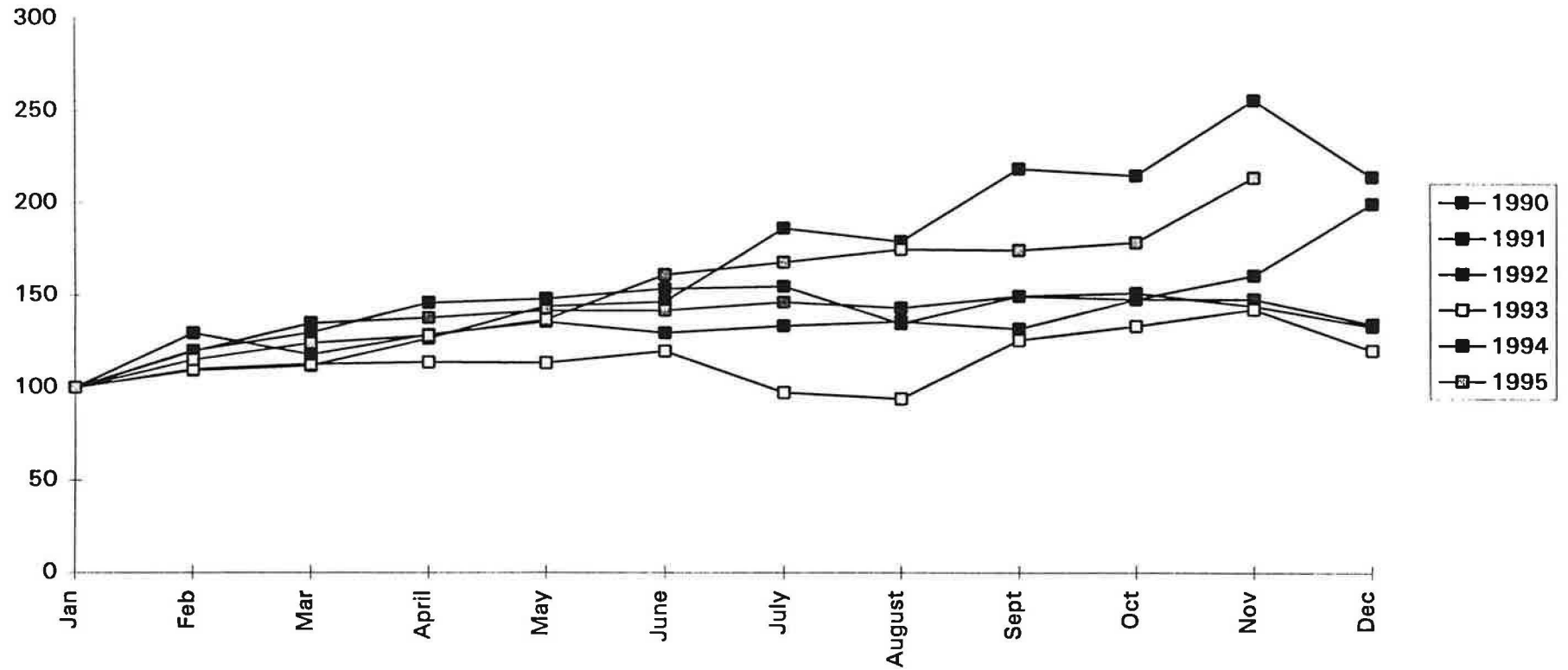
the October price has been 57% above the January post harvest price for sorghum and for millet the November peak price has been 60% above the January price.

These findings confirm the impression gained from interviewing traders that there is most commercial interest in storing groundnuts, maize and cowpeas, although cowpeas do present traders with considerable storage problems and losses are perceived to be high.

**Figure 7: Monthly wholesale maize prices relative to October, Northern Region, Ghana
1990/1991 - 1994/1995 seasons
(October = 100)**



**Figure 8: Monthly wholesale millet prices relative to January, Northern Region, Ghana 1990-95
(January = 100)**



**Figure 9: Monthly wholesale sorghum prices relative to January for 1990-1995, Northern Region, Ghana
(January = 100)**

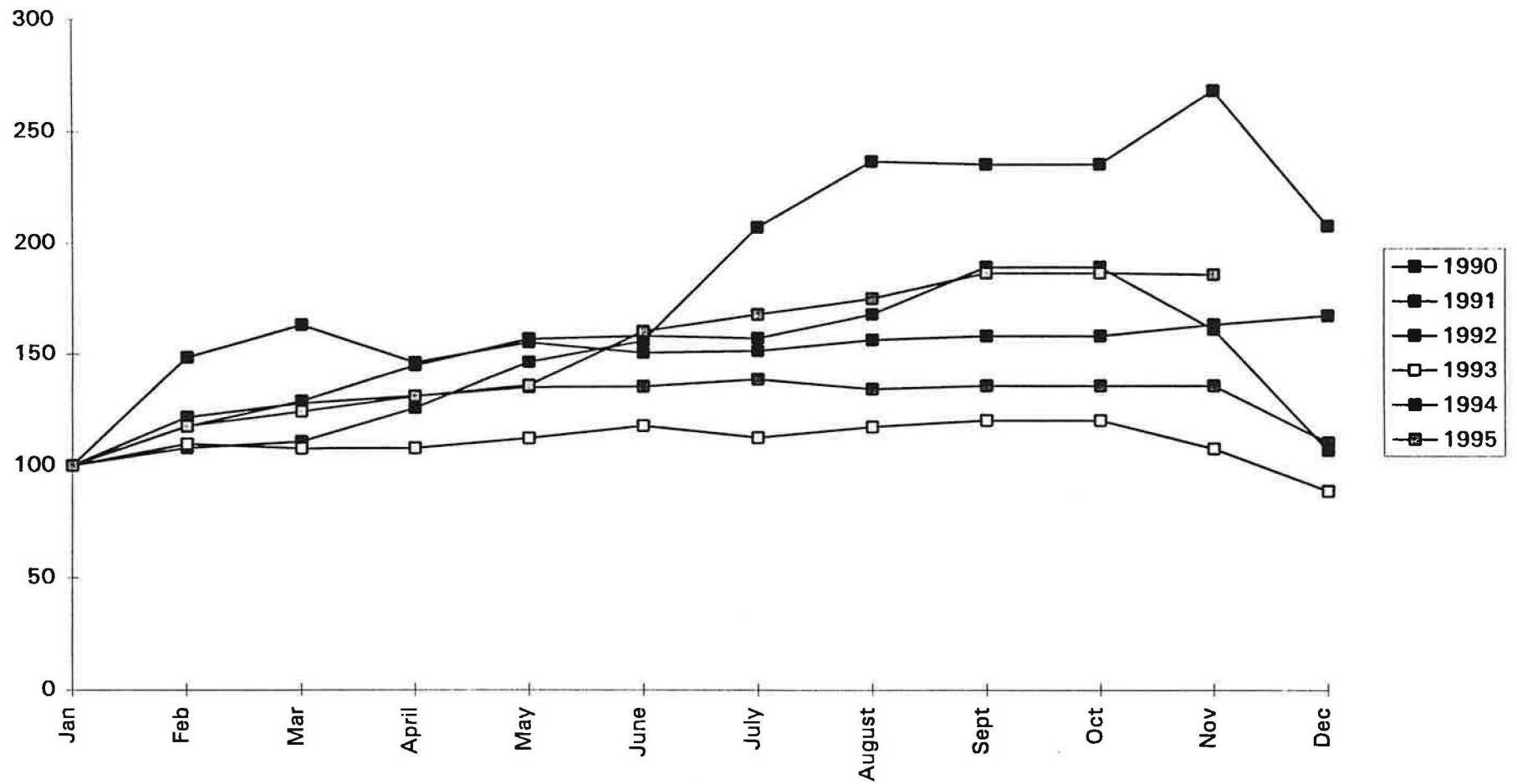


Figure 10: Monthly wholesale groundnut prices relative to October for 1990/91 to 1994/95 seasons, Northern Region, Ghana (October = 100)

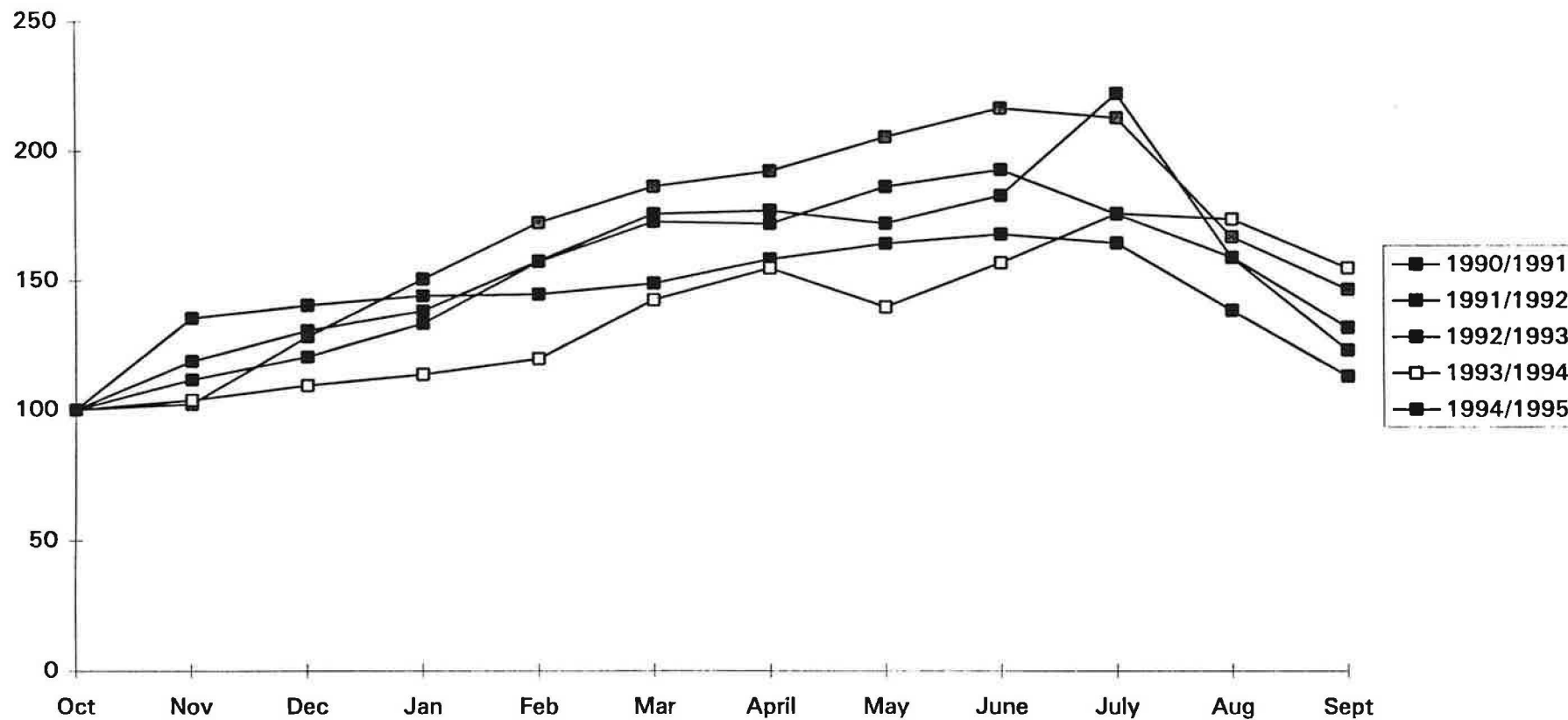
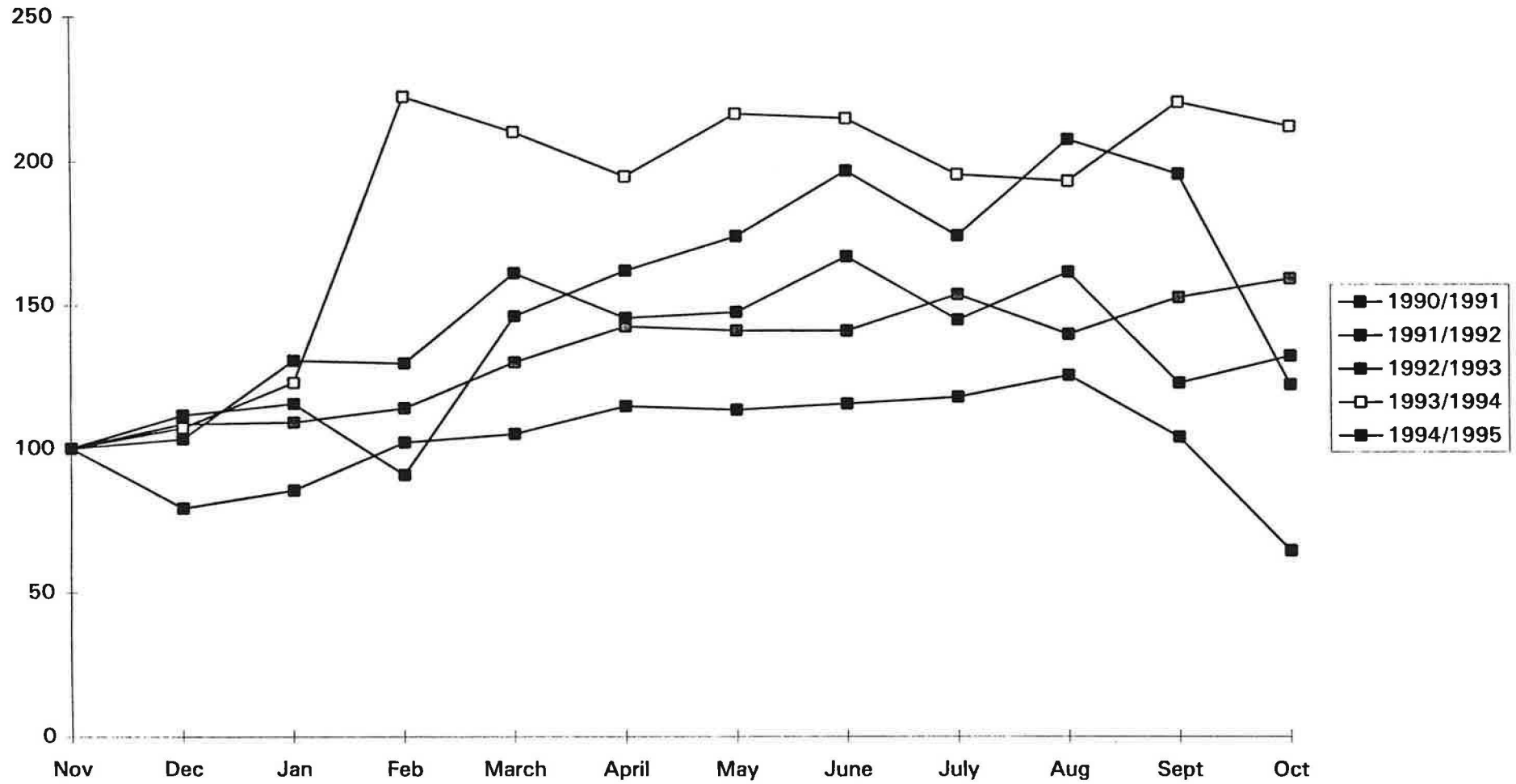


Figure 11: Monthly wholesale cowpea prices relative to November for 1990/91 to 1994/95 seasons, Northern Region, Ghana (November = 100)



References

- Asuming-Brempong et al. (1993) *Agricultural Marketing Development in Ghana: Strategies and Projects*, Technical Report prepared for the Ministry of Agriculture and World Bank, Accra, Ghana
- Benneh, G. (1973) Water requirements and limitations imposed on agricultural development in northern Ghana. In Ofori, I.M. ed. *Factors affecting agricultural growth in west Africa. Proc. Int. Conf., ISSER, Univ. Legon, Ghana, April 1971*, 71-81.
- Golob, P (1981) A practical appraisal of on-farm storage losses and loss assessment methods in Malawi. 1. The Shire Valley Agricultural Development Area. *Tropical Stored Products Information* 40, 5-13
- Golob, P. (1994) Phosphine, a fumigant for small-scale use in northern Ghana. *unpublished report*, 5pp
- McFarlane, J.A. (1989) Guidelines for pest management research to reduce stored food losses caused by insects and mites. *Overseas Development and Natural Resources Institute Bulletin No. 22*, xviii+62 pp.
- Nyanteng, V.K. (1972) The storage of foodstuffs in Ghana. Technical Publication Series, No.18, Institute of Statistical, Social and Economic research, University of Ghana, Legon. 99pp.
- Runge-Metzger, A. and Diehl, L. (1993) *Farm Household Systems in Northern Ghana Nyankpala Agricultural Research Report No.191*, viii+249 pp
- Wright, M. and Tyler, P. (1994) Traditional seed-saving practices in northern Ghana and central Malawi. *Natural Resource Institute Report No. R2102 (s)* ii+55 pp

Appendix 1

List of Villages and Markets Visited

Northern Region

Tamale district

Tamale market

Tampion market
Tampion village
Nadigu village
Zinido village
Galiwei village

Tolon/Kumbugu district

Koglogu village
Gganjong village
Kumbungu market
Lingbunga village
Wantugu village

Gusiegu district

Gusiegu village
Gomonayili village
Kpatinga market

Upper East Region

Bawku West district

Agaogo village
Templigo village
Agatuse village
Saka village
Zebilla market
Bawku market
Teshie village

Navrongo district

Navrongo market
Bongo Soe market
Bongo Soe village
Yogibania village
Nangalikinia village

Bolgatanga district

Bolgatanga market
Kambiisi village
Winkojo village
Laabiisi village
Naliregu market

Other Markets Visited

Techiman market
Kaneshie market, Accra
Agbogbloshi market, Accra
Timber market, Accra