University of Reading,
Department of
Agricultural Economics & Management

AGRICULTURE IN SOUTH EAST GHANA

Volume I. Summary Report

D. S. Thornton

Development Study No. 12

June 1973

Price 50p

AGRICULTURE IN SOUTH-EAST GHANA

VOLUME I SUMMARY REPORT

By

D.S. Thornton

Second Report of the Reading/Legon Joint Research Project in Village Development, South-East Ghana.

AGRICULTURE IN SOUTH-EAST GHANA

Volume I Summary Report

Volume II Special Studies

FOREWORD

The two reports which follow bring together the results of a number of studies that have been going on since 1969, directed towards the investigation of agriculture in South-east Ghana and the appraisal of possibilities for change.

The aims of the overall programme were initially as follows:-

(a) the elaboration of a programme of development in agriculture which would include suggestions about production patterns, capital investment, changes in economic and social institutions, designed to raise the level of living of the local people by a path acceptable to them; and at the same time (b) the establishment of a technique of survey, planning, programme formulation and subsequent liaison that would effectively co-ordinate existing agencies and their programmes with the local extension services, resulting in fruitful local action - a sequence which might subsequently be applicable in other areas.

The first Report arising from this programme, entitled 'Policies and Institutions in Ghanaian Agriculture' by H. Mettrick, which appeared in June 1971 as Development Study No.9 in this series, sought to provide a broad analysis of agricultural policies and conditions in Ghana as a whole and South-east Ghana in particular.

An Interim Report covering a part of the field investigation was prepared in June 1972. Its main purpose was to provide justification for the setting up of a Research and Development programme in the region, an objective which has not yet been achieved.

The two reports presented here seek to give first a short comprehensive account of the Reading-Legon Joint Project, and second, results of five of the special studies carried out by two of the team's members.

In Appendix I of Volume I will be found a list of all those who contributed to the work of the programme, and in Appendix II a list of papers already produced. It will be realised that the study has been very much a joint effort by the two Universities and that there has been a substantial educational 'spin-off' arising from its mode of organisation.

The Research Project has not fully achieved its original objectives. This arises in part from the under-estimation at the planning stage of the complexity of the pattern of farming within the region and the inadequacy of the scale of the budget to cope with its full examination, and in part from the inadequacy of the technical information available which is required for more fully developed programme formulation. It is to be hoped however that this work and the reports resulting will contribute to the setting in motion of a fuller-scale process of survey, planning, research-and-development and programme formulation as the basis for regional development.

The bulk of the financing of the programme has been from the United Kingdom Overseas Development Administration, though other contributions have been made by the Ghana Ministry of Agriculture and Shell International.

D.S. Thornton, Project Leader,
Department of Agricultural
Economics and Management,
University of Reading.

June, 1973.

ACKNOWLEDGEMENTS

Assistance has been received in both Ghana and the United Kingdom from a large number of persons. In particular the help is gratefully acknowledged of:

1. Mr. Clement Tagoe, then Co-ordinator, Ministry of Agriculture.
2. The Agricultural Officer, Volta Region and members of his staff, (in particular, Mr. Heyford, then Crop Production Officer).
3. Mr. Martin Upton, Department of Agricultural Economics and Management, University of Reading.
4. All those farmers and others who willingly gave information.

CURRENCY

1 New Cedi N¢	=	100 np.
£1 Sterling	=	2·45 N¢

SUMMARY WITH RECOMMENDATIONS

INTRODUCTION

The programme of work began with a study of the production environment, which included an investigation of farming activities (Chapter 1.), and limited investigations of the marketing framework within which producers operate (Chapter 2.). An array of possible improvements, ranging from the infra-structure to production methods was then considered (Chapter 3.); certain aspects of the institutions in the Region and the possibilities of change were also examined (Chapter 4.). Finally attention was given to the general requirements of the planning process and in particular to two specific elements in it - namely the need for a Research-and-Development Unit and the potential of Linear Programming as a tool in planning (Chapter 5.).

1. THE PRODUCTION ENVIRONMENT

1.1 GENERAL

South-east Ghana may be described as a triangular area of some 2,000 square miles, flat or gently undulating, falling from 300 feet in the north to sea level in the south. It is administered in the three Districts of Ho, Tongu and North Anlo[1] and is covered by the three Agricultural Districts administered from Ho, Sogakope and Denu. Natural drainage is by many streams, most of them only seasonal, which flow toward the Volta river. Climate is characterised by even temperatures and a bimodal rainfall with Major and minor rainy seasons which, in the North, last from March to June and September to December. This rainfall, which may be as high as 55" is unreliable in total and even more so in its timing within the seasons. Soils are related to the underlying metamorphosed and Tertiary rocks. Vegetation, much influenced by humans and animals, changes from forest on the north-west fringing hills and in valley flood plains, to grassland in the south.

The Agricultural Census 1970 and our own reconnaissance emphasised first the mainly subsistence nature of agriculture on household holdings of three to four acres, with few livestock but a great variety of crops, dominated by maize, cassava, groundnuts and oil palms; and second a population mainly concentrated into villages of 200-350 people with interspersed scattered hamlets (often of newcomers). The villages on the whole are badly served with roads, drinking water, utilities and health services but relatively well served with schools and shops.

1. South Anlo and Ada are not included.

The more intensive survey that followed was concentrated in two groups of four villages some twenty miles south-west and south-east of Ho. Within each group two villages were on a hard road and two at least two miles into the bush. The purpose of the intensive study was two-fold: on the one hand to build up a picture of resource availability and utilisation, and on the other to assemble information about possibilities for development. In pursuit of the second purpose, other parts of the region were also used in investigation.

1.2 HUMAN RESOURCES

The people are organised into households, mainly under male heads. In the 1970 census there were 5·8 persons per household,[1] with sometimes more than one family per house. There were on average 1·1 wives per male head of household. Households tended to be rather larger in Western villages; the number of unmarried males living alone was rather high in the Eastern villages.

The natural rate of increase of the 2,000 population in the households studied in 1970/71 was estimated at 2·8%, but amongst the families recorded, it was overshadowed by an 11·7% net exodus from the villages. This must be considered against a background, in the three Districts making up the bulk of South-east Ghana, of population net increase between 1960 and 1970 of 2·5, 1·5 and 2·2% per annum respectively.

Education levels are improving rapidly all over Ghana and South-east Ghana is no exception. Nevertheless some 40% of adult males and 60% of adult females in these villages have had no education and only 4% of the men and 1% of the women have reached secondary school level. Clearly illiteracy will continue to be a barrier to the spread of knowledge and new ideas for some years to come.

1.3 LAND RESOURCES

Land in the Northern part of South-east Ghana is still seemingly plentiful in that the overall proportion cultivated in any one season is not high. Appearances may be deceptive however; in a system of cultivation which depends on the natural regeneration of fertility, the overall proportion of cultivated land cannot safely rise over 10-15%. The proximity of villages and the level of village populations is now such that this is exceeded in the environs of some villages. In addition local people are themselves disturbed at the rapid inroads being made into tree growth by the expanding charcoal industry.

---

1. Further investigation revealed some families with satellites nearby, making average household size 6·8.

The situation is not improved by the natural infertility of most of the soils of these villages. These are predominantly Pallid Sands, which may suffer alternately from drought and impeded drainage. Some villages have stretches of more fertile riverain land.

1.4 INFRASTRUCTURE

The periphery of the region is traced over much of its length by good roads. The centre is on the whole poorly served, with tracks which are impassable in the wet season.

The water supplies available leave much to be desired. General lack of underground water precludes the widespread use of wells, and streams are seasonal. Supplementary supplies of poor quality are available to a few villages from dugouts and dams. But shortage and poor quality of drinking water constitute severe constraints almost everywhere. Shortage results not only in a level of consumption lower than desired but also in time-consuming head portage, and cash costs in those seasons when it is imported by lorry. The poor quality results in stomach ailments which, besides causing serious discomfort, reduce work efficiency. Moreover, water shortage, by limiting settlement sites probably reduces the area cultivated.

1.5 SOCIAL STRUCTURE AND OCCUPATIONS

Households are grouped in clans, and the distribution of land and much of the informal social organisation is on the basis of the clan. The government of the village is therefore such that the village headman is balanced by elders who are clan leaders. Social structure is further complicated by the mixed religions and by identifiable age-sex groups. Activities may be centred on any one of a number of organisations - the churches, the schools, the village elders, special interest groups and, in some villages, on Village Development committees which were set up during the Nkrumah regime.

The occupations of the people are dominated by farming, but crafts (among the men) and trading (among the women) form an appreciable proportion especially in the roadside villages. Very many men and women have subsidiary occupations which provide sources of cash income; while trading and craftwork are common in the Eastern villages, charcoal burning, hunting and fishing are notable activities in the West. Moreover, in measuring the availability of people for work in the village, it was found that, apart from illness which varies with sex and village from 1 to 5%, many adult men and women spend substantial time away in work and family visiting.

1.6 HOUSEHOLD AND FARM STRUCTURE

Within the household, men and women frequently have a degree of autonomy; both cultivate land and have agreed responsibilities in the provision of food and cash.

Land is, in general, at the disposal of the clan heads. All natives have usufruct rights, some regarding themselves as inheriting their land from their parents. Newcomers may acquire land upon some kind of payment to the clan chief, but may in some villages be denied access to the best land.

Villagers' capital is largely in their houses which are of a fairly simple kind. The walls are constructed mostly of swish or sun-dried bricks; roofs are thatched or metalled in about equal proportions. Metalled roofs are generally provided, though not very efficiently, with gutters and drains for water catchment.

In addition, farm tools and simple equipment, the largest pieces of which are bicycles, average some N¢ 34 per household in value.

Livestock are unevenly dispersed. Only the inhabitants of the two westernmost villages studied owned cattle. These represent considerable wealth to a few households. Elsewhere the value of small livestock per household was valued at N¢ 33·5.

With these resources the local people pursue a system of farming which is unsophisticated in techniques and chiefly subsistence-orientated. The number of 'farms' or plots per household is on average about 3·5 and the acres being cultivated in the three seasons Major 70, minor 70 and Major 71 were 3·3, 2·9 and 3·7 respectively. Calculations suggested land is cultivated more or less continuously for some six seasons before returning to bush, though the effort expended on it in its final season may be limited to the harvesting of a 'stored' cassava crop.

1.7 FARMING PATTERNS

On householders' farms of the villages surveyed, some twenty crops were grown in all. Maize and cassava dominated, the former particularly in the East, the latter in the West but with quite marked variation between villages. Mixed cropping on any one farm was common. Thus the plots of maize and cassava average 0·54 and 0·51 acres respectively while those of groundnuts, yams, cocoyam, etc. were smaller. The oil palm is an important crop in the area but trees are scattered through cultivated plots and regenerating bush and receive little attention.

There is virtually no investment in land improvement beyond the initial clearing.

1.8 RESOURCE UTILISATION

The labour available for farm work consists of family members and hired-labour of which the former is predominant. Commercial labour carries out a variety of tasks in village maintenance and construction. The pattern of farm work is influenced considerably by rainfall both in the general and day-to-day regimes. Land clearing must take place to a minor extent before each season but the major clearing, commonly done by hired labour, occurs early in the year. Clearing is not complete and the pattern of planting is disturbed by ant hills, oil palms and other standing trees.

Planting, occasionally fertilising, weeding and harvesting are the main field operations of which weeding in maize and cassava is the most labour-consuming operation. Women, besides tending their own crops assist on the householder's farms in planting, in weeding (especially of groundnuts) and in harvesting when the children often also help.

Records of a small sample of 27 families, the heads of all but two of which were first and foremost farmers, showed that adult men spent, on the average, 24 out of 84 daylight hours (28%) per week in farming tasks while women spent 17 hours (20%). Broadly productive work (including also house-work, marketing, charcoal burning, hunting, fishing and other agricultural and non-agricultural work) accounted for 42% and 56% of the time of men and women respectively, while leisure accounted for another 26% and 19%. Even in the busiest week in September, time devoted to farm work did not exceed 42%, 30% and 15% of the time available of men, women, and children respectively.

Hired labour, hitherto supplied by migrants from Togo, but in recent years increasingly from the ranks of local school leavers, goes to supplement the local labour force, particularly at clearing and weeding. Contract labour probably supplies some 20% of the labour required for maize and 10% for groundnuts.

Capital expenditure in 1970/71 averaged only N¢ 17 per household including tools and equipment, guns, bicycles, and house building and repairs. (In addition there were a few large items of investment in the range N¢ 150-500, indicating the presence of a small number of individuals capable of initiating business activities, such as maize milling, wine distilling, clothes making, etc.). In one smaple of householders N¢ 22 per householder

were expended on working capital but owing to the substantially greater cash income (N₵ 122) and its spread through the year, no serious borrowing problem arose at the levels of activity and technology ruling.

2. THE MARKET ENVIRONMENT

2.1 GENERAL

Most of the crops produced locally are also locally processed, at least in part. A large proportion of family time is spent in preparing a variety of cassava products (involving grating, drying, fermenting and frying), in processing palm fruit for oil, tapping palms for wine and spirit, and the storage and processing of maize and groundnuts. In addition much time is taken in cooking two or three complex meals a day incorporating these ingredients and a variety of vegetables, as well as bought-in foods such as fish and tinned milk. The milling of maize is the only post-harvest process which is entirely in specialist hands in Ewe villages.

Marketing of local products[1] is extremely diverse, ranging from inter-household exchange, through local markets often occurring once in five days, to town markets and even to Accra. The amounts of commodities both sold and bought are generally very small, headloading to local markets being predominant; all-purpose 'mammie' trucks are used for more distant journeys.

2.2 HOUSEHOLD SALES

Both wholesale and retail markets are relevant to the villagers. Both sets of prices fluctuate widely, due to perishability and poor storage facilities for most of the products. Climatic variation intensifies year-to-year gluts and shortages.

2.3 HOUSEHOLD PURCHASES

The small scale of trade, high transport costs and the variation in associated services, such as credit provision, result in a great diversity in prices of which relatively high prices at the village shop level is frequently a feature.

2.4 MARKET PROSPECTS

All the signs are that the pressure of population increase and (hopefully) rising levels of living will cause the prospects for farmers in South-east Ghana, who are mainly food producers, to improve over time. The price of cassava export products also is likely to remain strong and could well exert an influence on local agriculture.

1. The marketing of cotton and tobacco, (little grown in the villages intensively surveyed) is exceptional, being handled entirely by marketing boards at fixed prices.

3. THE POSSIBILITIES FOR IMPROVEMENT

3.1 GENERAL

A variety of innovations have been considered, many of them small. Consideration has been given to infrastructure as well as to production and processing but the list is by no means exhaustive. (Also in due course it will be necessary to give thought to non-agricultural activities as well as other agricultural ones).

The general principles guiding selection have been that

1. it is mainly local resources, of capital as well as labour and land, which will be available,
2. there is a paramount need to conserve natural resources, which, in the conditions of South-east Ghana, are all too easily over-exploited,
3. It will be necessary to accommodate in the future at least as many people as in the past,
4. development will have to start from small beginnings, giving time for the growth of sound knowledge and of confidence, for accumulation of capital and for the adjustment of aspirations,
5. some innovations may only be possible if successful forms of co-operation between individuals are devised.

An approach to development through 'improvement' rather than 'transformation' has therefore been adopted. No obvious lines or methods justifying massive injection of capital or technology from outside suggested themselves. Moreover, in the past, many large scale units such as settlement schemes, state farms, and local special concentrations (notably in cattle ranching and tobacco) have been unsuccessful.

3.2 INFRASTRUCTURE

Limited road improvements, both metalled and gravelled have recently occurred in South-east Ghana but many villages are still isolated. Transport to and from these villages is still infrequent and expensive. Roads built by the Public Works Department are however costly and on present information represent an annual cost of at least N₵ 1,600 per mile. At current rates of usage more of these roads cannot be justified. There seems to be considerable scope however for self-help improvements, using locally organised community labour, supplemented by skilled advice and modest quantities of materials by the Rural Development Department.

There is immediate need for increasing the quantity and quality of conveniently placed drinking water for the population. A programme of constructing dams and dugouts by the Ministry of Agriculture has had a positive effect on the cattle population, but is seldom effective in supplying good drinking water to villagers. An alternative may be to develop the practice of small-scale water catchment from either roofs or protected ground. The first of these is already sometimes practised but supplies are inadequate. Capital costs of such construction are high; nevertheless, if the labour saved in water-carrying can be put to productive use returns to investment can be substantial, especially for constructions designed for the utilisation of seasonal gluts. Careful investigation of alternative, improved and cheaper methods is required.

3.3 LAND PRODUCTIVITY

In general, it has already been observed, the soils of South-east Ghana are poor and the Pallid Sands particularly so. Limited areas of riverain soils may be of higher fertility. On the other hand the pressure to increase output to support an increasing population at better levels of living will increase. Shifting (or rotational) cultivation can probably support population densities up to about 50 per square mile at subsistence level.

Consideration should therefore be given to how a transition to more intensive forms of land utilisation can be made. The first possibility, where land is still plentiful, lies in improving rotational cultivation itself; this might be possible by organising villagers into clan groups, in such a way that time can be saved in transporting materials to, and products away from, the land; the time saved could then be used for rather larger-scale more intensive agricultural enterprise. Some precedents already exist for this approach in the area as well as elsewhere in Africa, but unevenness in land quality and complexity of local tenure may make for difficulties in some villages. Prior successful co-operation in simpler innovations discussed below might facilitate the process.

Some of the time saved might usefully be given to the second possibility - namely, improved fertility maintenance with the use of vegetable and animal waste (together with mineral fertilizers where these are economic). Moisture retention as well as conservation of nutrients would be an important objective here.

But a third stage is also visualised where the rotation of crops and possibly a combination of crop and animal practices would also serve to

formulation can impinge on the activities anterior to them and (3) to take into account, where distinguishable, of the various classes within regional society and the ways in which they interact.

The conclusion was reached that effective regional planning, which will necessarily have to be built up bit-by-bit, is an important requirement for development in South-east Ghana.

Control would be in the hands of the Regional Agricultural Officer, assisted by an Advisory Committee on which interested Government Departments, public agencies and the University of Ghana would be represented.

5.2 FARM PRODUCTION PLANNING

Farm planning is a necessary part both of the provision of material for extension and of programme formulation at regional level. An exploratory study was made using as a basis a model representative of households in Kpomkpo. This model was used to test various combinations of six innovations.

The value of the exercise was four-fold. First it drew attention to the crucial operational characteristics of the household situation in a South-east Ghana village; second, it put in sharper perspective the prospects of various innovations in the Kpomkpo situation already studied; third, it underlined some of the crucial principles of agricultural development at near-subsistence levels which have hitherto been neglected by technical researchers (especially by illustrating the close inter-relatedness of things); and fourth, it indicated the kinds and quality of Survey data required.

5.3 SOME GENERAL SUGGESTIONS ON REGIONAL PLANNING

Finally, the study provides an appropriate occasion to consider the nature of some aspects of the regional planning problem, which can be visualised in terms of four broad types of activity - survey, planning exercises, research-and-development, and programme formulation.

The nature of the task is conditioned by the nature of the Region for which the institution is set up, and by the broad lines of the national government's policy and its general political standpoint (where there is considerable freedom of individual decision-making, planning must be in large measure predictive, in that policies and general conditions will dictate the ways in which people act and planners will be concerned to estimate the likely effects of changes).

The planning literature, and intuitive impressions arising from the work reported above lead to the view that regional planning in a predominantly rural setting needs (1) to be couched in terms of comprehensive social development with agricultural development as a central but not separate theme, (2) to be a closely-knit operation as far as its constituent parts are concerned, so that the results of planning exercises, R. and D. and programme

educative role to play. Flexibility in attitude to the size and functions of groups will be essential.

5. PLANNING FOR AGRICULTURAL DEVELOPMENT IN SOUTH-EAST GHANA

5.1 RESEARCH AND DEVELOPMENT

Enough has been said to indicate that, while the natural fertility of South-east Ghana is low, there are probably many ways in which agricultural production can be improved; moreover, present market conditions, and those expected in the future, are such that increases in local production can result in increases in income and in levels of living. But development will only proceed smoothly if the Government's programme is based on a sound understanding of the technical possibilities, and if there is an efficient flow of information about these possibilities both to planners and policy makers and to individual decision makers in farming and related activities. Much depends on effective action at regional level.

Although some innovations can be confidently promoted immediately, there is a wide range of possibilities that must be tested locally if specification is to be reliable. Furthermore not only single innovations but whole systems require assessment, in both their economic and social aspects, if the long-term transition from present to radically improved agriculture is to be effected. What is required therefore is a Research and Development Unit at the regional level, operated at sites in South-east Ghana which have been selected for their ecological representativeness.[1] The objectives of the Unit would be:

1. to investigate promising innovations singly and within systems,
2. to investigate various kinds of organisation designed to promote new technology, such as group action of villagers for maize storage, palm-oil extraction, etc., and government and commercial services,
3. to work so closely with the local people and with public agencies that information about needs and opportunities is continually reaching the Unit and the Unit's findings are speedily available to all interested parties.

The staff of such a Unit would include besides a leader, agriculturists specialising in crops and livestock, an agricultural economist for planning and evaluation, two extensionists (one male and one female), plus the occasional services of an agricultural engineer and a market analyst.

1. Three such sites, representative of the three main soil types, Pallid Sands, Black Earths and Red Ochrosol should be established in sequence.

2. that there is a marked degree of individuality among Ewe people and signs of a liking for private enterprise but, at the same time, an ability to co-operate together for some purposes where mutual benefit is clear,

3. that the relatively new gap between old and young sharpened by educational differences, is reflected in contrasting values and aspirations, and is likely to be an important factor in institutional development.

The fashioning and implementation of a development programme will therefore require careful investigation in detail, lengthy discussions with individuals and groups, and progress will be by trial and error.

With one major exception, which will be discussed in Section 5, the full range of services required by the local communities already exists in embryo. They will have to be expanded and integrated however if progress is to be measurable. Most, but not all, of these will be provided by the Ministry of Agriculture.

The pivotal service will be Extension. Around this, agencies must be grouped. Adequate supplies of improved seeds and plants, and appropriate fertilizers and other farm materials, suitably packed, must be available. Tools, equipment and machines must be on hand for purchase or hire.

Credit services will have to be expanded as capital investment rises but expansion presents a major difficulty. While maize loan policy might work well given stronger extension services, medium/long term funds will be required for such things as processing machinery, storage buildings, breeding cattle, water catchment installations and transport. The potential borrowers may be individuals or groups. Ways of ensuring wise spending and prompt repayment must be found. It may be that the links already existing between agricultural and non-agricultural interests will be of crucial importance in increasing the flow of credit.

Marketing channels will remain diverse and diffused through Southern Ghana. With the exception of cotton and tobacco, it is likely that small-scale private enterprise in marketing will grow as production grows. Good information and assistance towards smooth operation are probably the main ways in which government can assist here.

Services which facilitate group action, such as the Department of Co-operatives and the Rural Development Department have a primarily

The first task must be to increase the usefulness of the stationary engines already installed. Moreover, if economic uses could be found there are probably individuals within the local community (or syndicates of family members) who could afford to invest in more of these.

Traction power is more difficult because the scope for small hand-guided machines is probably limited and four-wheeled tractors represent a much more substantial investment. Yet it is with the latter that, when human power is stretched to its limit, expansion can probably best be achieved.

Tractor work is prejudiced by small scattered 'farms' and lack of year-round employment. Investigation of the operations of tractors at Akatsi suggests that 1,000 hours of ploughing and cultivating will cost N¢ 9·76 per hour. In order to break-even, a public or private contractor must be able to plough and harrow 400 acres in a season if he is to set N¢ 10 as a combined contract charge.[1] These calculations imply a high degree of efficient organisation by tractor operators. Similarly, for those who would clear and continuously farm with tractor power, a 100 acre unit must produce a persistent annual yield of more than 1,300 lb. of maize per acre, or 880 lb. of maize and 450 lb. of groundnuts in order to break-even after paying management. Under the conditions of South-east Ghana, these targets are not likely to be very easy to achieve.

4. PEOPLE, INSTITUTIONS AND SERVICES

A programme incorporating a selection of the possible innovations suggested in the foregoing paragraphs would inevitably result in changing human relationships in the area, as well as changing roles for the private and public services supporting the local communities.

The directions in which local people should be encouraged to move will depend both on individual personalities and characteristics of the social structure. The indications from this study are:

1. that, while strong and flexible in some respects, the traditional hierarchy may not contain those who will produce leadership in rapidly changing conditions,

---

1. It should be noted that government charges are currently N¢ 6 and the hours of operation of their tractors is probably lower than 1,000 hours per annum. It may of course be that if government was to raise the charge, a low price elasticity of demand would reduce income and inflate the concealed subsidy element still further. Also, it should be emphasised that there may be cases where a tractor owner, already assured of covering his fixed costs, can afford to take on more business at rates nearer to variable costs.

capital-intensive and initially risky and would not come high in the list of priorities for early introduction. There are enough examples in West Africa however to make intensive pig production worth investigating.

Ghana already has recognisably distant traditional and 'modern' poultry production, the latter financed by urban entrepreneurs in accessible villages. There is considerable scope for improving traditional methods so as to increase protein supplies to local markets. Assistance with animal health is already available from the Health Division for those who seek it. Radical improvements are needed in feeding and watering, using materials locally available. Feeding for both eggs and meat would appear to be profitable given freedom from epidemic diseases which is a major risk at the present time.

Apart from the yield of hunting and fishing, firewood and charcoal are the other main products of the natural environment. While very little firewood is traded, charcoal is a major source of income in those villages where its production is still permitted.

Charcoal is made by all members of the family, as a spare time occupation that can be fitted in at any time and is assured of a cash return. Net return per hour to family members compares closely with contract work rates.

The most talked-of innovation is the introduction of the power saw. While increasing the cash cost of production sharply, its use reduces the physical effort involved in production. With more saws in use, competition might be expected to force down the level of charge. Expansion of charcoal burning, which would almost certainly follow, raises questions about the rate at which fertility would be undermined, however. This is already a preoccupation among those responsible for land. There would seem to be a strong case for a positive approach to vegetation management, which would include the planting and protection of fast growing species so as to maintain fertility and stabilise soil as well as to provide firewood, timber and charcoal supplies in the future.

3.6 POWER DEVELOPMENT

The possibilities for land development described above imply the application of increased power, and mechanisation.[1] The local people themselves are certainly anxious to mechanise.

---

1. Lack of experience with animal draught, together with tse-tse fly, rule out ox-cultivation except in the less wooded south.

other hand, tended to be rather poorer for tobacco when compared with maize (the seasonal labour pattern of which is similar). There seems to be little case for expanding tobacco growing at the expense of, or in place of, maize and cassava as long as the markets for these food crops persist. Further investigation of certian aspects of agronomy, and exploration of the possibilities of replacing air-cured with higher value flue-cured tobacco, seem justified however.

Bearing in mind the highly unreliable rains of South-east Ghana it is surprising that the potentialities of sorghum have not been explored, for stockfeed and beer-making.

Numerous plans and some practical attempts have been made to improve and expand cattle production in South-east Ghana. The beneficial effects of expanded water supplies, measures to eradicate rinderpest and pleuro-pneumonia, and the provision of a small number of improved breeding stock, resulted in some natural increase during the 1960's, but more ambitious schemes involving heavy investment have had little impact.

Considerable further improvement is believed possible with an enlarged health and breeding programme. The effects of this could be extended further by a positive policy which would more closely control the relationship between water, grazing and animals, though heavy investment in fencing should be kept to a minimum. Other possibilities such as the supplementary feeding of wheat bran and other by-products need systematic investigation. Better feeding could conceivably be linked with a better organised movement to market.

Almost all rural households have some small livestock. There are considerable opportunities for improved management in the case of goats, pigs and chicken. Goat meat is preferred, and a series of inexpensive changes in husbandry which improve health, breeding regularity and the rate of growth need careful working out.

The future of pig production would seem to lie in radical innovation, with an exotic breed together with economical but comprehensive environmental control and intensive feeding, albeit centred on local feeds. Cassava and the by-products of the extraction of palm and groundnut oil suggest themselves as worth serious consideration. Such innovation is

3.5 OTHER ENTERPRISES

Cowpeas, already grown in small quantities in South-east Ghana, can provide an important alternative source of vegetable protein in local diets. Unfortunately however, yields are currently very low and variable. Trials at Kpong have shown that major improvements can be achieved with insecticide sprays. Spraying, together with new varieties with a more concentrated ripening period, and the introduction of improved storage methods (already mentioned in the case of maize) could be expected to make cowpeas a much more popular crop.

As an import-substitute, cotton growing in South-east Ghana could make an important contribution to the economy. Climatic conditions are not however very suitable. The two possibilities are:

1. the growing of rainland cotton on limited areas of suitable soil in the north of the region, and
2. the irrigation of cotton on the heavy soils on the west side.

Rainland cotton is currently being encouraged in some areas of the Volta Region by the Cotton Development Board. The most productive trial in 1970/71 took place at Abuadi in a favoured location some eight miles south of Ho. But even the 688 lb. per acre yield achieved here gave a return to labour which was hardly competitive with maize, at present prices, although the Board provided free materials and services. Expansion of rainland cotton will depend on careful choice of growing sites, examination of crop combinations including cotton, and improvement in husbandry (including early planting, weeding, spraying and thorough clean-up after harvest).

Irrigated cotton - which has been successful in experiments at near-by Kpong - will be limited in South-east Ghana by the supply of irrigation water, particularly if the plan to water 6,000 acres of sugar from the Alabo (just outside South-east Ghana proper) goes ahead.

Air-cured tobacco is produced at Akatsi under the guidance of the Ghana Tobacco Company but attempts to extend it to the Kpetoe area failed. The G.T.C. has established 6-700 acres of tobacco grown by small farmers under their direct guidance. Returns per acre of N¢ 78 and N¢ 106 were estimated from two samples of growers in 1970; these compared with N¢ 30 per acre for maize and N¢ 120-125 per acre for maize/cassava. Where maize and tobacco can be grown in two consecutive seasons, returns per acre are probably not dissimilar from maize/cassava. Returns to labour, on the

There is considerable scope for the expansion of cassava production. This would be facilitated by the spread of mechanised grating which is already practised in a few centres, based on local fabrication. The market outlets for cassava products may include export possibilities; improved technology in production and handling could secure substantial benefits in foreign exchange.

There is again a range of possible improvements in groundnuts, in both agronomy and post-harvest handling, which need local inquiry. New varieties are available but have not yet appeared in South-east Ghana; no fertilizing trials have been made, the economic value of spraying needs investigation.

A moderate increase in scale of production would require the introduction of improved stripping and shelling processes which currently make exhorbitant demands on hand labour. Such an increase in scale of production might be sufficient to make large-scale oil extraction viable at the currently disused Denu plant.

Two possible lines of development must be considered for oil palm;

(a) improvement of the traditional system, and

(b) radical change to a plantation regime.

The present system which is characterised by little modification of the natural distribution and generation of palms, yields not only small quantities of palm oil and palm kernel but also palm fronds, palm wine and distilled spirit (the last two entail the premature destruction of the tree at 10-12 years old). Only limited improvements can be achieved in the agronomy of the traditional system of husbandry. Attempts are now being made to supply improved nursery seedlings in South-east Ghana. There is also scope for encouraging greater care in planting and subsequent husbandry in orderly plantations, inter-cropped in the early years.

Radically increased income from oil palm requires a change in objectives as well as practices, with an emphasis in future on palm oil. Provided the market could absorb increased supplies, comparative costs suggest that, in those villages where oil palms already make a substantial contribution, there may be scope for the introduction of small presses, but that this innovation would encounter initial difficulties: namely inadequate supply of fresh fruit, fruit of low oil-content from unimproved trees, assembling and managing the capital investment, and marketing the product.

increase soil productivity. Intensive annual crop rotation would require little innovation; the combination of crops and animals requires developmental research.

At the same time as these improvements are being pursued there is the fourth possibility - intensification of use of the riverain land with the aid of small-scale irrigation. Small patches of irrigable land are scattered along a number of seasonal streams. Preliminary calculations suggest that small dams and diesel pumps (some perhaps semi-mobile) might be economically justified in a climate where there is likely to be a rainfall deficiency in each of three four-month growing seasons. Distribution pipes would be a necessity in view of the irregular terrain. Marketing of crops - the most likely to be profitable are high-yielding perishable vegetables - may be a constraint to rapid expansion.

3.4 MAJOR CROPS

Improvements likely to be most easily introduced and most effective are those concerned with the production and processing of the four already dominant food crops - maize, cassava, groundnuts and oil palm.

Maize is the only food crop which has received some attention from improvers in the Volta Region but the focus of activity has been on the better soils north of Ho. There are good prospects for improved hybrids of a quality in line with market demand, and there is evidence that moderate levels of fertilizer might be economic.[1] These innovations, together with improved agronomic practices need local testing and demonstration. It will be important to assess performance in the mixed cropping and rotational context of South-east Ghana as well as under those conditions (single stands, large fields and continuous cultivation) which may be more common in a few years' time.

Of equal importance are the possibilities of improvement in drying and storage, which have already been tested elsewhere in Ghana. These, developed on a household or village group scale, could make a substantial and immediate contribution to output by the elimination of waste, which the local people acknowledge as substantial.

The agronomy of cassava almost certainly affords wide scope for improvement; studies in Ghana are now under way. It is first important to identify and establish the performance characteristics, with fertilizer, of local varieties and to assess their potential value in the various uses to which cassava is put.

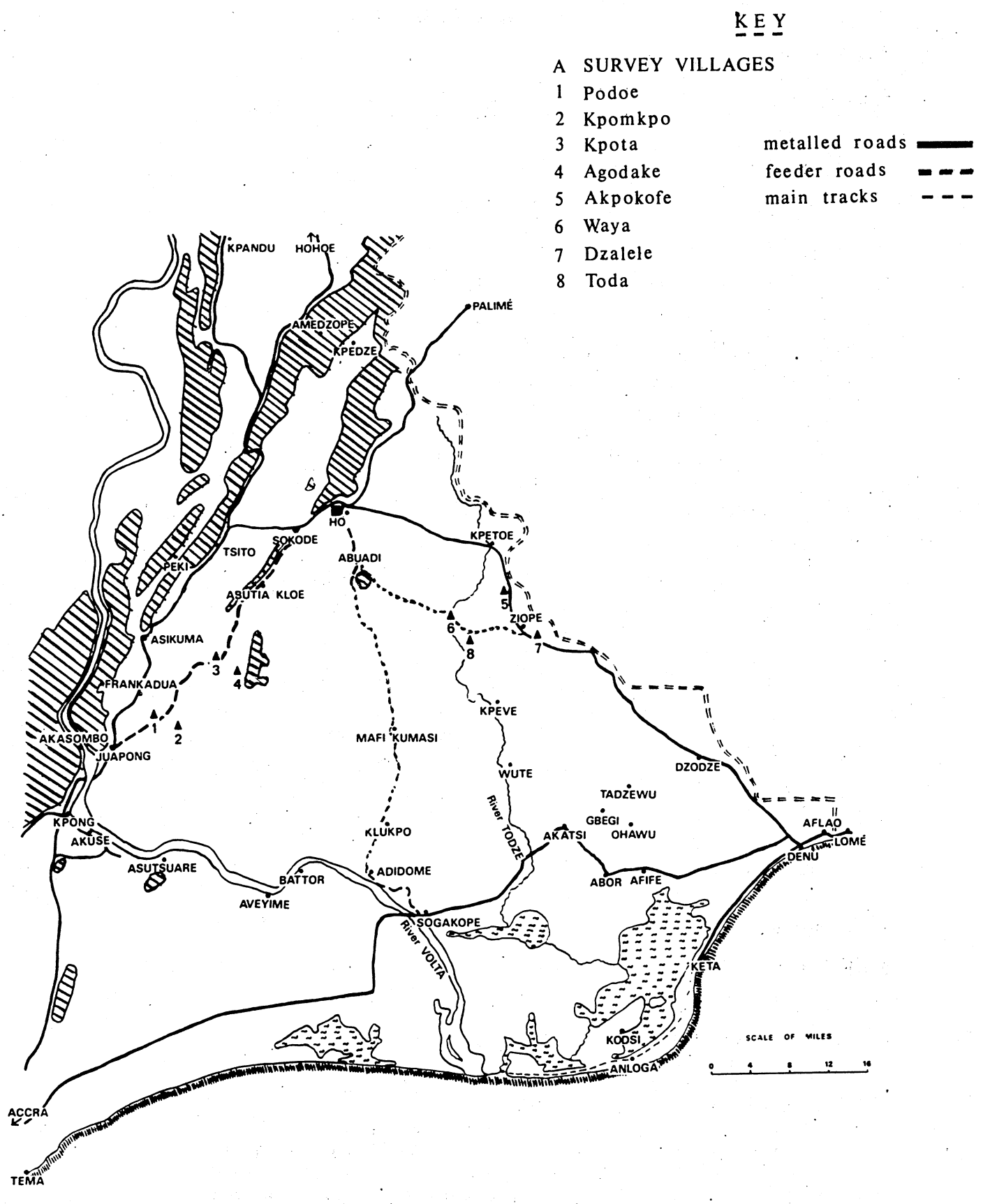
1. At fertilizer prices ruling in summer 1971.

CONTENTS

(Continued)

Map 1

South East Ghana



CHAPTER 1 THE PRODUCTION ENVIRONMENT

1.1. INTRODUCTION

The Background to Development in South-east Ghana was briefly discussed in Chapter 4 of the 1971 Report (Mettrick 1971).[1] The purpose of this Chapter is to set out in more detail a description of the human resources, physical resources, infrastructure and current production activities, as a preliminary to an assessment of production possibilities.

1.1.1. METHOD OF INVESTIGATION

The information used is largely derived from a preliminary reconnaissance, carried out early in 1970, and a study of eight villages July 1970 - June 1971 (see Map 1). A more intensive study of one of these, Kpomkpo, during May 1970 - October 1971 is also referred to (Parker 1973).

A sample of villages from the region was selected for the reconnaissance. Owing to transport limitation, attention was confined to villages north of a line Kpong-Dzodze and reasonably accessible to headquarters at Ho. Thirty villages were visited in January - March 1970.

Eight villages were then selected for more intensive study. Four of these - Podoe, Kpomkpo, Kpota and Agodake - lie south-west of Ho some 20-25 miles, and four others - Akpokofe, Waya, Dzalele and Toda lie about the same distance away to the south-east. They were chosen with the objectives of comparing two areas of contrasting physical environment, and contrasting four of the villages - Podoe, Kpota, Akpokofe and Dzalele - situated on all-weather roads ('roadside'), with the others situated at least two miles away from a road ('bush').

Within the villages a variety of information was collected from three samples of households, one of 40 per village (the 'large sample') drawn at random from the 1970 village census; one of 20 households per village (the 'small sample') drawn at random from the large sample,[2] and of three households per village (the 'special sample') drawn at random from the small sample.

---

1. References are listed at the end of each chapter.
2. Data collection for this sample was incomplete in villages No.s 3 and 4 and these villages were omitted from the analysis.

The large sample, visited at the beginning and end of the survey year (July 1970 - June 1971) provided general information about the population, farming practice and leadership. The small sample provided more detailed information throughout the year about farming practice, while the special sample was used to provide daily work records.

In addition, opinions were tested in these eight villages by serving questionnaires to groups selected in relation to their interest in particular products. (AA's 1-6.)

In the village of Kpomkpo, a variety of methods of investigation was again used, but for detailed socio-economic study, a sample of 37 individuals was randomly drawn from the village population of 420.

For a special investigation of cassava growing the village of Mafi Kumasi, some 25 miles south of Ho, was studied.

It must be emphasised therefore that, due to shortage of resources, our background studies were inadequate in the southern part of South-east Ghana. This inadequacy is mitigated by two other recent studies (Atsu-Ahedor 1961, Lawson 1972). Material from the Agricultural census was also made available to us of which extracts are given in Appendix III. Moreover, in the second phase of the work, reported in Chapter 3, enquiries were pursued in areas further south in relation to tobacco and oil palm, and to livestock.

1.1.2. RECONNAISSANCE

The reconnaissance of the northern part of South-east Ghana, carried out early in 1970 showed:-

(1) A population living mostly in settled villages but with small hamlets scattered between, the latter peopled by recent immigrants from the South and Togo; all Ewe.

(2) Population fairly concentrated within the village with little garden cultivation, though sometimes coconut and oil palms.

(3) Location of villages particularly in relation to reliable water supplies, giving an uneven village distribution, but an overall impression that land is apparently plentiful and seldom a matter for contention

(4) Road access and communications (post and telephone) mostly poor.

(5) Electricity and petrol supplies seldom available.

(6) Villages fairly well supplied with shops, primary schools and churches; poorly provided with health facilities and agricultural extension workers.

(7) Soils predominantly pallid sands, with some marshy land and areas liable to flood.

(8) Out of a very long list of crops, maize cassava and groundnuts the most widely grown and also reckoned by the informants to have generally good prospects for further development; Coconut and oil palm locally important; small livestock common everywhere.

(9) Plenty of firewood but timber more limited.

(10) The constraints to development in the fore-front of informants' minds - mechanised power, credit, drinking water.

1.2. HUMAN RESOURCES

The beginning of the study of eight villages coincided with a nationwide population census in May 1970. This formed the background for an analysis of human resources; it was also possible to make comparisons with earlier censuses. Table 1.1 illustrates that individual villages were markedly different in their rates of growth but that in general the Western villages have been growing faster than the Eastern. Growth during the sixties in the four 'bush' villages investigated was relatively small. These trends fit with the general impression obtained of South-east Ghana as a whole that the growing population is finding accommodation by utilising increasingly the country in the north-west of this triangle, wherever there is drinking water, while, at the same time there is a tendency to gravitate towards the more accessible and better serviced villages.

Further analysis on the basis of the 40 household sample showed other details of demographic structure. (Table 1.2) Small household size in Eastern roadside villages was linked in one case to a relatively high proportion with female household heads and in the other to a large number of unmarried males living alone.

Adult females (i.e. over 15 years old) outnumbered adult males in seven out of eight villages.

The data testify to the important effects of seasonal and long-term migration especially in the Eastern area, including two-way movement over the Togo border. Taking the large sample as a whole, migration radically modified the rate of population growth during the survey year 1970-71.

Table 1.1

Census of Population 1948, 1960, 1970 in Villages of the Intensive Survey

	Podoe	Kpomkpo	Kpota	Agodake	Akpokofe	Waya	Dzalele	Toda	West	East	Roadside	Bush	Total
1948 Population[1]	357	318	184	139	196	694	644	206	998	1740	1381	1357	2378
1960 Population	479	369	197	228	434	695	421	533	1237	2083	1531	1825	3356
1960 Houses	61	52	43	34	58	115	64	72	190	309	226	273	499
1960 Pop^{n}/house	7·9	7·1	4·6	6·7	7·5	6·0	6·6	7·4	6·7	6·7	6·8	6·7	6·7
1970 Population	762	421	396	189	373	915	348	496	1768	2132	1879	2021	3900
1970 Houses	82	65	44	8	76	102	60	88	219	326	262	283	545
1970 Pop^{n}/house	9·3	6·5	9·0	6·8	4·9	9·0	5·8	5·6	8·1	6·5	7·2	7·1	7·2
1970 Households	138	72	58	31	85	122	69	102	299	378	350	327	677
Population Change[2]													
1948	74·5	86·2	93·4	61·0	45·2	99·9	153·0	38·7	78·4	83·5	90·2	74·4	70·9
1960	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
1970	159·1	114·1	201·0	82·9	85·9	131·7	82·7	93·1	138·9	102·4	122·7	110·7	116·2

1. It is widely believed that the 1948 census tended to underestimate the population.

2. These may be compared with the 1960-1970 population changes shown by Districts in Appendix IX.

Table 1.2

Population, June 1970 ('Large' sample)

	West	East	Roadside	Bush	Total
Persons per household[1]	6·47	5·85	5·73	6·6	6·16
Adult males (%)	24·3	26·6	25·8	25·0	25·4
Adult females (%)	27·2	32·0	30·1	29·1	29·6
Children (%)	48·5	41·4	44·1	45·9	45·0
Average number of wives per male household head[2]	1·1	1·0	1·1	1·0	1·1
Close family as % of household	94·5	84·0	89·7	88·7	89·2
Population less than 12 months resident (%)	10·5	17·3	12·8	15·0	13·9

1. Increasing familiarity with the villages suggested the concept of household usedin the Census may underestimate the degree to which people are naturally organised into family groups.

In particular, second wives and their offspring, old people and servants, who live in the same house or nearby, are sometimes treated as independent whereas they are only partially so. A revised count for 1970 gave household sizes as follows, but no significant changes in any other results.

	West	East	Roadside	Bush	Total
Persons per household	7·37	6·18	6·50	7·06	6·78
Average no. of wives per male head	1·17	1·01	1·12	1·06	1·09

2. The total number of households with 2, 3, 4, and 5 wives were only 45, 12, 1, and 1 respectively out of a total of 308.

Analysis of the departures showed 359 out of 402 were members of families continuing in the villages while 43 comprised whole households moving away (Table 1.3). Of the 359:

128 went off to work or seek work elsewhere, notably from the Eastern villages,

169 were 'domestic' moves, including wives going to join absent husbands, divorces, and children and others going to live with relatives outside the household,

53 were sent off to school (balanced by an equal number who had returned since 1970), and

9 were away for miscellaneous reasons.

Education levels vary widely between villages; adult males who have not attended any school, average 39% and vary from 4% to 58%. and females average 60%, varying from 35% to 82%. At the other end of the scale only 4% of adult males and 1% of females in the sample who are currently resident have received any secondary education.

Map 2

South East Ghana - Geology and Soils

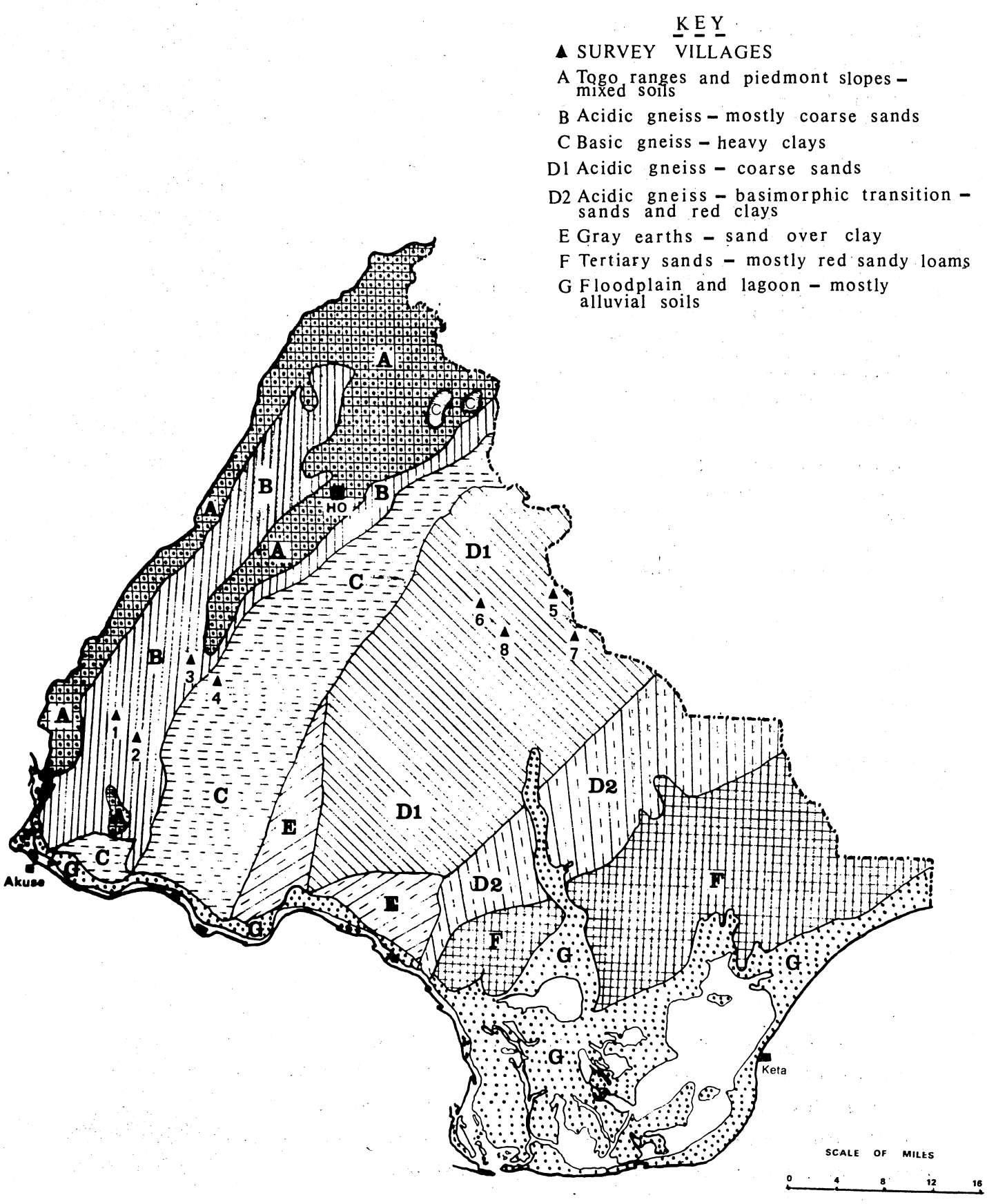


Table 1.3

Change in Household Population, June 1970 - June 1971

	Number of Households 292[1]		
Total Population June 1970	1,999		
plus births	86		
plus arrivals	110		
less deaths		29	
less departures		402	
Total Population June 1971			1,764
Number of births per 1,000 people			43
Number of deaths per 1,000 people			14·5
Net increase per 1,000 people			28·5
Net change 235 (-11·7%)			

1. Full information was not available for 16 households of the sample.

1.3. PHYSICAL RESOURCES

Under a cover of savannah vegetation which changes from predominantly forest in the North and North-west to predominant grass in the South and South-east there are marked contrasts in basic geology and soils. (See Map 2.)

In the villages intensively studied there were contrasts between Eastern and Western villages. Physically the Eastern villages are the more uniform. Their soils are wholly pallid sands. Generally the soils consist of 1-2 feet of yellow-brown medium or coarse sand overlying yellow mottled gravelly loam or clay, which in turn overlies weathered Gneiss at a depth of about 3 feet. There is marked variation from deep sands on the high ground to heavier textures similar to Grey Earths in the valley bottoms. There is commonly a perched water-table and lateral movement of water. Water storage depends on the presence, depth and effectiveness of a clay layer. Soils are commonly subject to both drought and water-logging: they are low in organic matter, responses to nitrogenous and phosphatic fertilisers are good but overall yields are low. Akpokope and Dzalele are situated on mid-slope sites in gentle undulating topography distant from streams but with the possibility

Table 1.4

Monthly Rainfall (inches)

	Annual Total	(a) Major Season						
		March	April	May	June	July	Sub Total	%
Ho	55·93	5·46	5·71	6·97	7·20	4·34	29·68	54
Akuse	44·01	4·14	5·02	6·41	7·09	2·57	24·23	57
Keta	32·69	2·36	3·89	6·54	6·80	2·43	22·02	67
		May	June	July	Aug.	Sept.		
Tamale	42·63	4·67	5·66	5·69	7·70	8·78	33·50	79

	(b) Minor season						
	Aug.	Sept.	Oct.	Nov.	Dec.	Sub Total	%
Ho	3·27	5·88	7·53	3·13	1·95	21·66	39
Akuse	1·54	3·77	5·15	4·02	1·58	16·06	36
Keta	0·68	1·83	4·18	1·73	0·59	9·01	27
	Oct.	Nov.	Dec.	Jan.	Feb.		
Tamale	3·76	0·56	0·15	0·09	0·29	4·85	11

Table 1.5

Percentage Distribution of Total Annual Rainfall Frequency

Rainfall (")	10-20	20-30	30-40	40-50	50-60	60+
Ho	-	-	5	22	41	32
Akuse	-	2	37	40	19	2
Keta	11	33	33	18	5	-
Tamale	-	2	37	44	15	2

Source: Walter, N.W. (1959).

(realised in Dzalele) of local dam construction. Waya and Toda are near, though safe from the flooding of, the river Todze; there is therefore a considerable area of low-lying wet land of heavier texture.

The Western villages have rather more varied topography and more varied soils. While sands are dominant, soils related to the Togo piedmont are available in Kpota and Podoe, while the black earths approach close to Kpomkpo and Agodake. There are also marked variations in the soils related to local streams such as the Alabo which flows through Podoe and Kpomkpo.

There is a dearth of local rainfall data though the records of three sites on the edges of the region are indicative. (Tables 1.4 and 1.5). The main characteristics of rainfall incidence are:

(a) broadly, two rainy seasons which decrease in length and intensity southward,

(b) everywhere a low reliability, which deteriorates southward both in quantity and timing. (The impact is dramatically shown in Parker's data, Appendix IV).

The amount of rainfall and its variations have marked influence on water supplies for human drinking (and therefore on population distribution and village location) and for cattle drinking, and also on soil moisture for crops.

Generally, the water requirements of growing crops will be closely related to the open-water evaporation rate. Tamale (in Northern Ghana) has four months (June-September) when rainfall exceeds evaporation, and crops with a growth requirement of 120-150 days can be grown in the single season. Ho has a major season with four months when rainfall exceeds evaporation; there is a definite minor season at Ho but it has only two months when rainfall exceeds evaporation. Akuse, with a higher annual rainfall than Tamale has only two months (May-June) when rainfall exceeds evaporation in the major season. Thus a 90 day growing season would be the maximum, allowing for crops to mature by utilising moisture reserves. Keta has a major season not dissimilar on average from Akuse. In both Akuse and Keta the minor season rains do not exceed evaporation in any month. Crop failure and low yields are therefore to be expected.

The reliability of the major season can be assessed from Table 1.6. If it may be assumed that a crop needs about 5" of moisture per month, then, in the Ho area planting in late March would appear to be possible but low reliability in April is a factor adversely affecting

Table 1.6

Rainfall Reliability

(a) Major Season

	% of years with rainfall less than 5"							
	March	April	May	June	Sept.	Oct.	Nov.	Dec.
Ho	49	66	16	22	36	19	87	97
Akuse	66	55	34	21	66	56	77	100
Keta	91	70	30	39	89	66	66	100

(b) Minor Season

	June	July	Aug.	Sept.	Oct.
Tamale	40	43	27	10	52

Source: Walter op. cit.

early crop growth. In one out of three years rainfall in May is adequate at Akuse. Supplementary watering could apparently be expected to increase yields in the major season at both Akuse and Keta, and ensure an early start to plant growth even at Ho.

In the minor season: at Ho there is less than optimal rainfall in one year out of three during September, which makes the minor season hazardous as well as short. At Akuse and Keta the situation is even worse.[1]

1.4. INFRASTRUCTURE

1.4.1. ROADS

The road system of South-east Ghana is shown in Map 1. Of the villages studied, Akopkofe and Dzalele lie on the Ho-Denu road, close to the Togo border. This was recently completely metalled throughout its length. Podoe and Kpota lie on an all all-weather feeder road, also recently constructed, with an average of 12-15 commercial vehicles a day. Waya and Toda, and Kpomkpo and Agodake are only accessible by tracks which, though improved and maintained by village self-help, are

1. If irrigation water can be applied where rainfall is deficient, there is of course always the risk of heavy rainfall immediately after irrigating, thus making good drainage systems a necessity.

difficult in wet weather. The building of a pylon line through Podoe and Kpomkpo may be expected to improve access to the latter. The construction of a feeder road through Waya and Toda from the north-east has been discussed.

1.4.2. WATER SUPPLIES

Human drinking water supplies are poorly developed. In the Northern part of the Region, absence of a water-table precludes the widespread development of wells. Kpota has a borehole where the machinery has for long been unserviceable, Podoe's borehole is pumped by a highly labour-consuming mechanism. Waya, Toda, Akpokofe, Kpomkpo (and Podoe in part) rely on nearby streams which are seasonal in quantity and poor in quality; Akpokofe and Agodake people may have to walk five miles for water in the dry seasons. Dzalele has a nearby reservoir and Kpomkpo a dugout, and there are plans to build a dam at Akpokofe. Catchment tanks conserving roof run-off are not uncommon and water is sold by local people as well as by carriers in some villages for up to 5np per 4 gallon can.

Drinking water for animals is equally scarce. A reservoir for cattle drinking is available on the north-west fringe of Waya lands, which is used by a large-scale cattle owner from nearby Abuadi.

No water is used for irrigation in these villages at the present time; suggestions for limited development are made in Chapter 3.

1.4.3. EDUCATION AND HEALTH

In all of the villages investigated primary schools are to be found. In addition Podoe, Kpota, Waya and Dzalele have middle schools. There are no secondary schools in any of these villages. As already indicated, therefore, there are a number of teenagers leaving the villages to attend private and public schools in the towns (mostly within the Volta Region).

It is not yet clear how the new policy towards the structure of public school education (see Mettrick, p. 90) will affect the pattern of schooling in this part of rural Ghana. It is likely that shortage and poor quality of teachers will persist for some years. Equipment in public schools also leaves much to be desired. Basic accommodation is commonly the product of village communal labour and local contributions.

Only Waya and Podoe have a health centre, with a resident medical assistant. There are however other dispensaries nearby, at Kpetoe and Abutia Kloe/Agove. It is policy that such health posts should serve an area ten miles in radius. In addition, community health nurses (mainly concerned with baby care) are attached to these posts and may visit some other villages on specified days.

1.5. SOCIAL STRUCTURE AND OCCUPATIONS

The social structure of the Ewe is typified by clans and patrilineal inheritance.[1] Though the degree of autonomy varies from village to village, the clan is a basically important unit, new villages having been set up by clan units in the first place. The village chief is chosen by the elders of the chief clan. (The Linguist who communicates the Chief's decisions to the people will be from a different clan in a multi-clan village.) The paramount and divisional chiefs are chosen according to traditional rules or by the other chiefs. Women are not (as for instance in Ashanti) central to the process of inheritance but have a high degree of independence. Their leader in the village is the Queen Mother who will belong to the same clan as the Chief.

The villages surveyed were Pagan or Christian in religion, in varying proportions. Two sets of beliefs exist side-by-side (and probably to some extent combined within individuals) and justify two sets of customs. On the Pagan side, there are several kinds of traditional religious priests. A fetish priest may represent the village or one clan. The sorcerer-herbalist may be chiefly concerned in the practice of traditional medicine but this is rarely completely separated from superstitions or super-natural explanations.

In the Christian sector the head teacher is frequently also the church leader. In Congregational communities the leaders may be male or female. The pastor, catechist and head teacher may be active in guiding the traditional leaders in their decisions and, in relation to the Christian element, may have considerable influence.

In addition to these two religious structures, others may occur as follows:

(a) Youth groups

(b) Drum and dance groups

---

1. For sociology of the Ewe, see Barbara E. Ward (1949).

(c) Women's groups (which regulate female activity in the village, including communal work, and may have the power to arraign and fine a man who has wronged or abused a local woman)

(d) Communal work organisation, commonly organised under the Village Development Committee (an obligatory institution under the Nkrumah regime), with a literate secretary and a chairman who may rival the chief for power.

There is also the position of Chief Farmer, a traditional position which before February 1966 was a political post; National, Regional and District Chief Farmers were employees paid by the Government. At present, the importance of the Chief Farmer varies from village to village.

Thus the social structure is complex and undergoing rapid change. Nevertheless the chief and his elders are still people of considerable importance. The chief, though he does not have powers as a magistrate, in practice deals with a variety of minor cases. The police are called by the chief for more serious matters, especially where death or serious injury is involved.

The District Councils do not have elected representatives from individual villages. The structure of these is described by Mettrick;[1] the impression gained is of increasing direct dealings between village leaders and the departments of regional government and a relatively declining role for District Councils.

The pattern of work in the village is punctuated by a great variety of social events. Easter is by far the most important time of celebration during the year. It is a predictable four-day holiday and has become prominent since the 1950's when opportunities for employment outside the village increased and it became the time of family reunion. Independence and other national days have little significance in the village as days of celebration, but certain regular events associated with the schools, are such occasions.

The cycle of life is not particularly marked by customary rites, except death. 'Outdooring' of a new-born child takes place about a week after birth when gifts are brought for mother and child and there are drinks for all. There are no puberty rites. Marriage is accompanied by two (or more) ceremonial discussions; the first is the proposal by the bridegroom's parents or relatives, the second is for receiving of answer when, if the bride agrees to marry, gifts will be given, including twelve

1. Mettrick (op cit) p. 36.

bottles of drink, a ring for the bride and cloth and money for clothes for the bride. The bride may leave home at any time after this. Normally men marry women younger than themselves; marriage is tending to take place earlier. Polygamy is not universal and is practised by the more prosperous men[1] with traditional attitudes. The choice of marriage partners is made by the bride and bridegroom; partners can be chosen within or outside the village; the wife will move to her husband's village. Many teenage girls become pregnant before marriage; in this case the man may admit responsibility and may compensate the girl's family or marry the girl. The child belongs to the father provided he supports it; even where he does not support it he may still influence decisions relating to the child. A man can divorce his wife after discussions with her parents or relatives; if the latter disagree, then the husband may obtain a divorce by ruling of the chief, for NȻ 10. A wife can divorce a husband by deserting him. Family relationships thus tend to be somewhat flexible, though not particularly unstable because divorce is not very common.

The education of children is, in principle, the father's responsibility though in practice the wife often contributes to the cost. The completion of apprenticeship to master craftsman is marked by payment of cash, gifts of drink, the slaughter of animals and libations.

Death is followed by burial a day later. Funeral rites are performed five, six or seven days after burial and may be commemorated many times thereafter in the case of respected or important people. The cost is borne by the family but sums of money are also received from the village and from others farther afield. The village contributes towards coffin, drumming and drinks; the family, in addition, entertains guests who may stay (at least in the case of close relatives) for one or two weeks. The minimum cash cost is about NC 50. Work days are also lost, which may be a serious matter at certain seasons. For non-relatives, the pressure of work may determine the time sacrificed.

In the eight villages studied, a high proportion of adult males and females had both major and minor occupations. The main occupations, divided into nine groups, (Table 1.7) showed variation between villages. Adult males are concerned predominantly with farming but crafts are notable in the East and Roadside villages. Adult females are concerned even more exclusively with farming but a sizeable proportion, especially in the Eastern and Roadside villages, are engaged in trading.

1. At least where more than two wives are kept.

Table 1.7

Major Occupations (% Distribution)

	No. in sample	Farming	Crafts	School	Official	Professional	Unskilled	Traders	Agric. Subs.	Unoccupied	No record
(a) Male Adults		percentage									
West	210	63	9	13	3	4	2	0	1	4	0
East	284	59	12	12	2	6	1	0	1	5	0
Roadside	230	61	14	11	3	3	2	0	2	3	0
Bush	264	60	8	13	2	8	2	1	1	6	0
Total	494	61	11	12	2	5	2	0	1	5	0
(b) Female Adults											
West	242	75	4	5	0	1	1	2	3	8	0
East	345	64	3	9	0	2	0	11	1	11	0
Roadside	269	71	5	5	0	1	0	8	3	6	0
Bush	318	66	2	9	0	2	1	6	1	13	0
Total	587	69	3	7	0	2	0	7	2	10	0

The chief minor occupations of men are crafts and agricultural subsidiary tasks - like corn milling, charcoal burning, hunting, fishing, food and wine processing, etc.; trading and agricultural subsidiary jobs are most common among the minor occupations of women.

But the picture of occupations is only complete if work and trading visits further afield are included. Time spent working away, in Accra, in other parts of Ghana and outside the country (including service in the armed forces) was more than twice as great amongst the household members of Eastern (rather than Western) and Roadside (rather than Bush) villages; a predominant occupation was cocoa cultivation either as workers in Ashanti or as independent cultivators in the middle Volta Region. The same villages were equally prominent in distant trading activities.

1.6. HOUSEHOLD AND FARM STRUCTURE

1.6.1. HUSBANDS AND WIVES

It is common to fine both husbands and wives engaged in cultivation, sometimes working together on the same 'farms', sometimes independently. This varies between villages, predominantly Christian villages like Waya showing a higher tendency for husbands and wives to work together. The distinction is a difficult one to draw however; the cultivator may be independent in his/her farming yet consult other family members, in order, for instance, to ensure satisfactory food supply.

The part played by women is seen in the crops that they grow and the use to which their produce (or the cash derived from it) is put. Overall analysis of cropping activity shows a strong concentration on food crops, especially cassava, and a relatively strong concentration on beans, tomatoes, okra, pepper and egg plant; a higher proportion of the wives grow these crops than their husbands in most villages. In addition groundnuts (grown both for food and cash) are predominantly a woman's crop in seven out of eight villages.

The organisation of the household is further complicated by the transfer as gifts, of produce between the household and other relatives. (This is almost always in the form of food but is occasionally seed). The proportion of households who had received gifts of food from relatives during 1969-70 varied from 4 to 35% as between the eight villages. Those who reported giving away food varied from 0 to 77% in the villages surveyed. In this case it may be simply as a gift or in return for assistance given in cultivation or harvesting. There appears to be no specified arrangement for this sharing; the farmer gives as much as he wishes or as much as the person needs.[1]

In all villages studied the responsibilities of the heads toward the household were stated as providing money, food and clothing, money carrying the strongest emphasis. In most cases responsibilities were said to include paying for health in the form of medical supplies, education, especially school fees, paying the levy for both man and wife, and providing shelter.

The responsibilities of wives were frequently given as service activities (cooking, housekeeping, washing, looking after children, fetching water and firewood, and helping on the farm). Providing food,

1. C.S. Belshaw (1965) has lucidly described the complex interchange of goods and services in pre-monetised economies as 'prestations'.

money and clothing were usually mentioned, sometimes specifically meat and bought fish. Buying utensils and her own requirements, as well as contributions to health and education, were also mentioned as the wife's responsibility.[1]

1.6.2. SIZE OF FARMS

Questioning in May-June 1970 among 308 householders in the eight villages showed that 286 householders had cultivated land in the Major season 1969 and that the estimated acreage cropped averaged 2·43 (1·99 in Eastern and 3·05 in Western villages), the largest acreage per village varying between 3·0 (Podoe) and 20·0 (in Kpota). Estimated acres cleared for 1969 Minor season averaged 1·42 (249 households) and for 1970 Major season averaged 1·68 (268 households).

Closer scrutiny of 120 households,[2] all cultivating during the 1970 Major season showed:

(i) the degree to which relatives' farms (almost entirely wives') contribute (Table 1.8). It will be noted that the number of relatives' farms average 1·29 per household and add 0·69 acres (their average size being smaller than householders' farms).

(ii) the wide distribution of farms, averaging more than one mile distant from the homestead, inversely related to

(iii) the average years under cultivation

(iv) the high proportion of farms accessible, at least in part, only by footpath.

Table 1.8

Location of Farms

	No. of house-holds	Av. no. of farms		Av. acres		Acres per farm	
		Head	Head and relatives	Head	Head and relatives	Head	Head and relatives
Podoe & Kpomkpo	41	2·34	3·54	2·91	3·86	1·24	1·09
Akpokofe & Dzalele	39	1·79	3·26	2·03	2·57	1·13	0·79
Waya & Toda	40	2·43	3·63	2·78	3·34	1·14	0·92
Total	120	2·19	3·48	2·58	3·27	1·18	0·94

continued

cont'd

	Av. distance from homestead (miles)	Av. years under cultivation	Access to farms (%)	
			by footpath	by road
	1·29	1·94	74·1	25·9
	0·95	2·95	92·1	7·9
	1·17	1·38	78·3	21·7
	1·17	2·01	80·2	19·8

1. A more detailed appraisal of husband-wife relationships is given by Parker (1973), Chapter 2.

2. 20 per village in six villages (omitting Kpota and Agodake).

1.6.3. LAND TENURE

The distinctive characteristics of Ewe land tenure are that clan interests are dominant and that the political chief seldom has say in land allocation. Clan heads therefore have ultimate say on cultivation and the planting of perennial crops. However, individual rights have in some cases become regarded as ownership, and sales, pledging and a form of renting by individuals all occur. Inheritance of usufruct or of owned land is patrilineal. In the villages studied, autonomy rests with the clans in six out of eight villages. Kpota and Agodake, of relatively recent origin occupy land generally regarded as at the disposal of clans of a village some ten miles distant, who may take payment for trees removed for charcoal but apparently derive no other income. 'Strangers'[1] may acquire land from clan heads (payment is commonly in 'drinks') or from individuals (by payment sometimes of a nominal rent unrelated to acres).[2]

In some villages a distinction is made between 'forest' and 'savannah' land, the former occurring on the better soils, particularly in the valley bottoms. In these cases the 'forest' is reserved for the original settlers, and 'strangers' may not acquire it.

Thus while there is still land in the village which is unallocated there is local scarcity of forest land and of land around village centres, and the notion of cash payment for rights to land is coming in.

1.6.4. LAND AVAILABILITY

The amount of land available for cultivation is difficult to estimate because (a) the limit of village lands is in every case indeterminate on at least one side and (b) recent immigrants in small hamlets occupy semi-permanently some of the village lands. The tendency for villagers to migrate elsewhere for work, together with one recent report of conflict between villages over land, might indicate a land 'shortage'. It is of course necessary to distinguish between insufficiency of land on the one hand to support life and on the other to provide a living equal to alternative employment elsewhere. While people seeking subsistence ('strangers') still seem to arrive in the area from time to time there is also apparently dissatisfaction among villagers with the level of living local resources provide.

1. These are commonly Ewe from the south where population density is high and vested interests have sometimes 'cornered' land.
2. Analysis of 308 'farms' in six villages (not including Kpota and Agodake) showed only 33 to be rented, while 58 were claimed as owned, 70 held in trust from father or mother and 136 held directly from the clan or chief.

The need (for water and for various social reasons) to congregate in nucleated communities results necessarily in uneven utilisation of the land resource, quite apart from the constraint of variations in land potential. Thus Table 1.9 shows an estimate, based on the 20 household sample, of the degree to which cultivation intensity varies with distance from the homesteads.

Table 1.9

Cultivation Intensity in Relation to Distance from Village Centre

(Cultivated land as % of total land area)

	Miles from centre					
	0 - 0·5	0·6 - 1·0	1·1 - 1·5	1·6 - 2·0	2·1 - 2·5	2·6 - 3·0
Podoe	22·9	2·9	3·1	3·3	-	-
Kpomkpo	11·4	13·8	1·6	4·0	0·1	0·5
Akpokofe	45·2	2·9	2·9	1·3	-	-
Dzalele	20·1	2·7	1·3	1·8	-	-
Waya	4·4	12·2	3·8	3·4	0·3	0·4
Toda	13·7	12·1	32·1	5·7	-	1·3

This table shows first that cultivation beyond two miles from the village is rare in the villages studied and second that in some villages the degree of concentration immediately round the village is higher than would be possible for an indefinitely maintained forest fallow system.[1]

While there is normally little land that is totally uncultivable, some of the best riverside land is subject to flooding. Of the 308 'farms' surveyed in six villages 23 were subject to frequent flood, 225 subject to occasional floods by heavy rain or streams.

1.6.5. LABOUR AVAILABILITY (Table 1.10)

The labour force available is determined by the number of people at home and fit enough to work. There will be those whose major occupation is non-agricultural in the village but there are very few of these who are not available for farm work when required. Also, housework, including fetching water and firewood, must of course always be done. (Children have for the time being been omitted; in no village were more than 15% of the children available applied to useful tasks, and they represent a minor element in the work force). The table shows (1) a small deduction from availability deriving from illness, (2) a substantial deduction due to absence (including work away, visiting, school, but not including marketing) especially among

1. The degree of concentration in some villages is probably greater because the distribution of lands round the village is asymmetrical due to close siting of neighbouring villages.

Table 1.10

Monthly Labour Availability (120 Households July 1970 - June 1971)

			July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
MALE ADULTS	Illness	(%)	3·1	4·0	2·8	3·5	5·0	5·0	3·9	4·6	4·2	1·3	2·0	2·0	3·45
	Absence	(%)	23·3	21·4	13·0	24·5	27·7	22·3	23·2	26·0	24·2	20·1	23·7	25·8	22·93
	Net Availability	(%)	73·6	74·6	84·2	72·0	67·2	72·7	72·9	69·4	71·7	78·6	74·3	72·2	73·62
FEMALE ADULTS	Illness	(%)	4·7	2·6	2·2	3·2	4·0	3·0	2·9	2·6	2·5	2·7	1·3	1·7	2·78
	Absence	(%)	16·3	15·7	12·9	16·4	20·6	18·8	19·8	20·4	21·5	18·2	20·6	21·1	18·53
	Net Availability	(%)	79·0	81·6	85·3	80·5	75·4	78·2	77·3	77·0	75·9	79·0	78·1	77·3	78·69

Table 1.11

Characteristics of Housing

	No. of HH	Av. No. of rooms per house	Av. No. of persons per room	Roofs			Walls				Gutters and Drums	Out buildings	GN Storage	Maize Storage
				Grass	Iron	Alum^{m}	Sun-dried Swish	Concrete Brick	Block	Other				
				Numbers of Houses										
Podoe	21	4·9	1·9	2	17	2	5	8	6	2	13	18	4	7
Kpomkpo	20	4·5	1·4	6	13	1	18	2	0	0	12	16	8	4
Akpokofe	19	3·3	1·5	13	0	6	17	1	1	0	3	5	0	0
Wayą	20	4·3	2·1	6	12	2	12	7	0	1	16	0	5	0
Dzalele	20	3·0	2·0	17	2	1	14	4	2	0	2	15	1	7
Toda	20	3·8	1·5	9	10	1	14	1	0	5	11	0	0	0
Total	120	4·0	1·7	53	54	13	80	23	9	8	57	54	18	18

the men, and (3) though variations between months is not very marked, particularly high availability for both males and females in September and generally above average in April, May,

1.6.6. FARMING CAPITAL

The farmer requires capital to use in association with the land and labour available to him.

In practice, long term capital investment in South-east Ghana is wholly confined to housing and adjoining storehouses. Although described here (Table 1.11) they are generally not assets which are readily tradeable nor do they contribute to any great extent to productive capacity. Indeed expenditure on housing past a basic minimum might be regarded as expenditure on consumer durables which, if capital is scarce, divert funds from farming.

The short term capital of farmers (ready cash and stocks) was difficult to quantify owing to (a) the nature of the extended family within which certain individuals, notably family heads, may be able to assemble sizeable sums for certain purposes, and (b) seasonal variation. Where information was given (May 1970), sums of ready cash between N¢ 10-20 were most frequently reported.

Stocks were almost always foodstuffs wide in variety and small in amounts (30 kinds were recorded; whole cassava and red palm oil were found in over half the households, maize ground and on the cob, kokonte and cassava dough, dried okro and peppers, dried and smoked fish, palm fruits and kernels were found in more than 25% of household stores). In addition, maize is widely stored on raised platforms on the farms and cassava is left in the ground to be harvested as required. Medium term capital held by farmers included tools and equipment - almost always small items, the largest being bicycles and guns. They varied in average replacement value from N¢ 23·25 to N¢ 48 per household as between villages. Livestock are more unevenly distributed between villages; cattle and pigs are unusual; sheep, goats and poultry represent a small widely distributed asset.[1] Valuation of trees has been omitted; so little attention is normally given them it is doubtful whether they can be treated as a capital asset in South-east Ghana.

1. In Podoe and Kpomkpo 16 households had cattle and two had pigs, valued respectively at N¢ 752 and N¢ 125 per household. The value of other animals averaged N¢ 33·45 per household over the whole sample of 120 households through which they were widely scattered.

1.7. FARMING PATTERNS

1.7.1. GENERAL

With a few exceptions in two villages, arable cropping is all-important and livestock production a minor side-line.[1]

Cropping is dominated by a two season pattern. Records of farms cultivated by 120 households during the (M) 70, (m) 70 and (M) 71 seasons, show acres cultivated of 3·3, 2·9 and 3·7 respectively. There was a tendency for farms cultivated to be smaller in the (m) 70 season in most villages.

Continuity of cropping was also investigated. The number used in all three seasons (42·8%) is slightly less than would be expected, if in a static situation, land was being continuously cultivated for six seasons.

Analysis of cropping patterns of householders' farms in M70 showed overall an acreage of 1·21 acres per farm, with on average 2·6 crops per farm. In all, 20 crops were recorded, though only 9 were recorded in all three village pairs. If the proportionate importance of the crop components is estimated in acres occupied, maize and cassava are shown to have been by far the most important crops. Oil palm ranked third and groundnuts fourth.[2] Contrasts show the relative importance of cassava in the West and maize in the East, overall average acreage per farm of both crops being slightly higher than 0·5. It is also significant that, in the sample of farms recorded, approximately 60% of the cropped area was in mixed crops, only 40% being occupied by single or 90% dominant crops, being composed of 9% maize, mostly in the East, 20% cassava, mostly in the West, 8% oil palm, especially in Kpomkpo, 3% groundnut and 0·4% coconut. There are also some differences between the Roadside and Bush villages in the East which it is tempting to relate to market accessibility.

Comparisons of M70 with m70 and M71 suggest that householders' farms carry all the four main crops in the minor season but few subsidiary crops; the pattern in M71 was similar to M70, with some increase in groundnuts.

Cropping and yields are affected directly by a variety of factors in the short run which cause the farmer to modify his plans and which take the result largely outside his control; the shorter the growing season the

---

1. It will be shown in Section 1.8 however that a significant proportion of time is spent on 'subsidiary' activities, such as hunting, fishing, charcoal burning.

2. Drought early in M70 delayed sowing and probably reduced the area recorded in May 1970.

more this tends to be true. These factors include labour availability, both family and hired at crucial times, but also particularly the weather.

The M70 and M71 seasons showed the sharp weather contrasts which are typical and which necessarily render planning a short-term affair and the outcome uncertain. For instance, at Akuse 25·95"were recorded for March-July 1970 inclusive whereas 14·53" fell during the same period in 1971. In 1970 mid March and mid April were dry; excessive rain in May damaged crops and flooded some farms; harvest weather in August was dry and there was no need for artificial crop drying. In 1971 drought persisted from mid-April to the end of May, and rainfall in June was low; rainfall during August, while helping some late planted crops, caused rotting in ripe maize and the germination of unharvested groundnuts.

The m70 season started dry, late rainfall was patchy; crop failures were frequent, though good crops were sometimes obtained where local characteristics of topography, soil textures and depth and drainage characteristics combined to provide favourable soil-moisture conditions. Such short term environmental variations influence the record of practices and opinions reported below.

While many quick decisions may be taken in the light of changing circumstances to affect cropping in detail, a typical sequence of cropping was a six-season sequence with maize grown first after clearing, sometimes mixed with vegetables; followed by maize and/or groundnuts in the first minor season; followed by maize in the third, later interplanted with cassava which may be allowed to continue to grow through to the fifth or sixth season, being cropped little by little over as much as 18 months while regeneration of the natural vegetation is allowed to begin.

The husbandry is characterised by certain phases which may be listed as follows:-

(1) the annual clearing of 'forest' or 'savannah' (the density of vegetation depending in part on the length of the rest period and in part on local soils and soil-water characteristics[1]); this takes place particularly during February-March and also in August-September preceding the minor season; substantial trees, ant hills and growing oil palms frequently are left;

(2) the planting of annual crops, concentrated at the beginning of both seasons but frequently delayed in the major season either on account of weather or to gain benefits from intercropping;

1. The distinction is of considerable importance, for instance in Kpomkpo (see Parker, 1973, p19).

(3) some alternation of extractive and restorative crops, perhaps accidental rather than intentional, in soils which quickly lose soluble nutrients by quick percolation of groundwater;
(4) crop care limited chiefly to weeding, the frequency and timing of which is conditioned by intercropping and whether crops have been planted in rows (row planting may apply to maize and cassava but seldom to other crops);
(5) harvesting spread over time in the cases of maize (a proportion of which is commonly harvested green), cassava and vegetables, but concentrated in the case of groundnuts;
(6) simple storage of maize and groundnuts to extend the period over which home grown food supply is available, to spread the post harvesting task (especially shelling of groundnuts), and to take advantage of seasonal price variations for that portion of the crop to be sold;
(7) home-scale processing for all home-grown food,[1] including the making of kokonte, gari and starch from cassava, the extraction of palm oil and palm kernel oil and the making of akpoteshie, wine and soap from palm fruit, as well as the subsequent incorporation of these and other bome grown ingredients, such as vegetables and purchased foodstuffs, in complex meals.
(8) the marketing, either off the farm or in village or nearby markets, of products which are all surplus to home consumption,[2] generally in small and headloaded quantities and only in a few cases (notably maize and cassava ex-field) in sizeable consignments.

It will now be convenient to consider in some detail the four main crops, preceded by attention to the clearing operation.

1.7.2. CLEARING

Clearing in some degree is required on all cultivated land at the beginning of each season. On fresh land this represents a major effort, or expense when hired labour is used. It is everywhere done by hand, chiefly by men. All vegetation except big trees and oil palms is cut, piled and burned; fences are rarely made.

From the results from a questionnaire served to 146 household heads (AA3) in eight villages (Table 1.12) it was estimated that family labour was able to clear some 75% of the land that had been prepared for M70 and m70, that the average rate paid to hired labour for cutting and burning was N¢ 6·75 per acre. Householders appeared to prefer hired labour from

1. With the exception of maize milling in all villages and cassava grating in the south of the region.

2. Tobacco and cotton were not currently being grown in the villages intensively studied but are dealt with below.

Table 1.12

Land Clearing for 1970

	West	East	Roadside	Bush	Total
No. in sample	66	80	75	71	146
Acres cleared	3·4	3·0	3·1	3·3	3·2
Capabilities of family labour (acres)	3·2	1·8	2·7	2·1	2·4
Average rate for cutting and burning (N¢ per acre)	6·7	6·8	7·1	6·3	6·8
			percentage of householders		
Type of labour preferred:-					
family	9	4	8	4	6
hired, this village	42	64	48	61	54
hired from outside	14	28	25	17	21
communal labour	35	4	17	18	18
Considerations bearing upon land clearance:-					
Cash available to pay labour[1]	67	56	59	63	61
Health[1]	44	4	27	17	22
Last year's clearing[2]	88	41	79	45	62
Household food needs[2]	20	5	23	0	12
Labour available for use[2]	70	75	59	87	73
Weather[2]	62	40	59	41	50

the village to other forms mainly on economic grounds - that they work more efficiently and faster, though it was clear from many answers that this was an unenviable task to be avoided if possible.[3]

The amount of land prepared for cultivation in any one season depends on a number of factors. Considerations volunteered by farmers were particularly (i) whether cash is available to pay labourers and (ii) the state of health of the household. Further questioning suggested a degree of regularity from year to year, but also that it would depend on the availablilty of labour and on the weather. The amount of land prepared did not appear to be closely limited by the food needs of the household.

1. Answers volunteered.

2. Answers to follow-up multiple choice question.

3. It appears to be a task which young school-leavers otherwise unemployed are prepared to do when organised into groups. With the decline of a supply of migrant labourers from Togo, complaints are increasingly heard of a shortage of hired labour and unsatisfactory work by those that are available.

There would appear to be adequate time periods for clearing during January-March and August, when there is little other farm work. Two factors make for difficulty, however: (i) these tend to be months when the availability of male labour is below average (Table 1.10), and (ii) there is a disincentive to clear too long before planting, thereby incurring the risk of growth of weeds starting before the crops.

1.7.3. MAIZE

As the most widely grown crop in the area intensively studied, particularly in the Eastern villages, the husbandry and disposal of maize are of particular concern to the local people. It is important both as a basic home-prepared starchy food and as a cash crop. It is already receiving attention from the government by way of improved varieties, fertiliser trials, and loans from the Agricultural Development Bank; improvements to storage and drying practices have also been given some thought.

Agronomy

Planted in both major and minor seasons, commonly on newly cleared land, and often in a pure stand, the seed used is a mixture of types and colours. A soft floury maize grain is preferred for home consumption. Short and long season types are known to the farmer. Planting is typically in March-April and September, but some maize is planted in May and October. Questioning of 146 householders (AA3) indicated that they related their planting predominantly to the rains. The unreliability of the rains frequently causes establishment failures however and a proportion of plantings fail to reach maturity.

The method of planting is typically random spacing of groups of 2-6 plants at approximately one group per square yard. 15,000 plants per acre are commonly recommended but the village farmers do not normally have such a high population. Random planting in groups using a hoe or cutlass, may be quicker than, and as effective as, planting singly or in rows; planting in rows is of course to be preferred where ridging or mechanical weeding is desirable.

A few farmers are using fertilizer, linked with the newly introduced (and so far unpopular) flint variety Diacol; and a few have been encouraged to increase their acreage in recent years with ADB loans.

Weeding is done by cutlass or hoe. The cutlass method is quicker and leaves the soil less susceptible to erosion. This method which can take

about three man days per acre can be done three times as quickly as weeding by hoe. Householders tend to weed in relation chiefly to weed growth. (AA3). There is currently little crop protection practised.

Harvesting is done by hand as (or before) the grain ripens. Harvesting of the major season crop is especially risky, and the risk is higher in those areas where yields tend to be better.

Storage is partly on raised platforms at the farms or at the homestead, under which fires may from time to time be lit partly to dry and partly to fumigate.

Labour utilisation and yields

Work records, collected in the m70 and M71 seasons over 42 and 33 farms respectively showed similar results in East and West villages. The main differences between the two seasons were (1) in clearing requirements, a higher proportion of Major season crops being sown on newly cleared savannah/ forest, and (ii) in weeding. (Table 1.13)

Table 1.13

Labour Utilisation in Maize Production[3]

	Minor 70		Major 71	
No. of farms	42		33	
No. of acres	79·9		45	
Acres per farm	1·9		1·4	
	Man days[1] per acre	% of labour provided by males	Man days[1] per acre	% of labour provided by males
Clearing	7·3	88·5	14·2	99·7
Cultivating	1·8	61·8	1·6	98·0
Planting	5·4	44·8	4·9	53·2
Fertilising	1·2	59·1	0·3	100·0
Replanting	0·9	73·7	1·1	79·7
Weeding (1)	6·5	69·4	12·6	75·4
Weeding (2)	0·7	100·0	-	-
Harvesting (seeds)[2]	5·2	38·7	6·5	22·7
	28·9	64·0	41·3	71·5

1. Includes men and women only. Children added 18% and 9% to the labour force in m70 and M71 seasons respectively.

2. The bulk of the stalks were left unharvested and removed only at clearing time.

3. For Labour Utilisation by time period, see Appendix VI.

Limited yield records were taken from maize stands.[1] For instance in groups of ten farms in each of the two seasons in Akopokofe and Dzalele yields were 918 lbs. and 1,708 lbs. per acre respectively (mean final threshed dry weight) per acre which were rather lower than in more westerly villages.

A more detailed analysis by Parker[2] in Kpomkpo shows that maize is predominantly a man's crop, grown where possible on cleared forest (rather than savannah) land, where three types may be distinguished. After emphasising the importance of yield for income, Parker identifies two factors as closely associated with high yield - namely location of farm and date of planting and also observes that those stands interplanted with cassava also gave rather better than average yields. Maize is seldom planted more than once in rotations at Kpomkpo.

Disposal

Investigation by questionnaire of a sample of 132 householders (AA1) showed a combination of consumption and sale of maize everywhere to be the most common practice. There was some preference shown for sale outside the village. Price figured fairly prominently in reasons given for the outlets chosen, especially in the Roadside villages, but it was noticeable everywhere that sellers were predominantly unchanging in their channel of sale.

---

1. The method of sampling was the random 20'x20' square, the farm itself having been randomly selected. The samples taken were not large enough to test the effects of rotational and husbandry variables. Farmers estimated rainfall and yield in m70 to be rather worse than average, and in M71 to be very close to average.

2. Parker op.cit. p42, includes the following tables:-

AVERAGE PRODUCTION CHARACTERISTICS OF FOREST MAIZE (per acre)

	M70	m70	M71	Hill	Riverside	Tributary	weighted average
No. of farms in sample	4	10	12	8	8	10	-
Acreage/farm	1.2	0.8	1.2	0.9	1.3	1.0	1.0
Yield (lbs)	985	807	1519	1536	1086	1227	1227
Value of production (N¢)	31.46	24.50	54.42	61.35	39.34	42.45	46.24
Cash ecpenses (N¢)(1)	0.76	2.90	2.72	2.65	0.44	3.95	2.44
Net income	30.70	21.60	51.70	58.70	38.70	38.50	43.80
Total labour input(2)	319	249	220	309	187	263	245
Return to labour (np/hr)	9.9	15.4	23.0	19.0	20.9	14.7	17.8

AVERAGE PRODUCTION CHARACTERISTICS OF SAVANNAH MAIZE (per acre)

	M70	m70	M71	Men(3)	Women(3)	weighted average
No. of farms in sample	22	9	6	18	16	-
Average acreage/farmer	2.22	1.98	2.05	2.71	1.33	2.10
Yield (lbs)	256	437	44	320	180	264
Value of production (N¢)	9.90	17.00	1.70	12.20	6.90	10.20
Cash expenses (N¢)(1)	5.80	8.60	6.90	5.60	6.60	6.60
Net production value (N¢)	4.00	8.30	-5.10	5.60	0.30	3.50
Labour input(2)	62.5	91.0	48.2	67.8	69.1	66.7
Return to labour (np/hr)	6.4	9.1	-10.7	8.3	0.5	5.3

(1) The cost of seed is not included in the calculation but would not have exceeded N¢ 1.00 per acre.
(2) Own family and relatives only; hired labour has been deducted either as cash expenses or in grain (shelling cost).
(3) One farm in each season was run by a mother and son in partnership and arenot included in the data for men and women.

Storage is a practice related to both future consumption and sale. It is notable that in this inquiry of 132 householders, 56 reported that at the time of inquiry (November) they had sold none of the Major season grain they intended to sell. It is therefore not surprising that farmers showed themselves knowledgeable about (1) the seasonal price swing and (2) the problems of storage.

Table 1.14

Expected Prices and Storage Problems

	West	East	Roadside	Bush	Total
No. in sample	53	79	73	59	132
N¢ Price per bag:					
September	8·8	8·7	9·2	8·2	8·7
March/April	14·3	15·0	14·5	14·8	14·7
			% of Sample		
Snags of storing until March:					
Vermin and insects	79	95	86	92	89
Stealing	8	5	7	5	6
Unreliable prices	64	46	44	64	53
Long wait for money	55	13	34	24	30
Shortage of storage facilities	66	52	68	44	58
Expected grain loss %	22	22	24	20	23

The difficulties arising from vermin and insects and inadequate storage facilities were everywhere emphasised (Table 1.14). There was a general readiness to consider innovation here.

Most of the larger villages in the area have a maize mill and occasionally two.[1] The equipment is generally housed in a mud walled or palm-partitioned building covered by a grass roof. Charges for milling are commonly 5np per 2 gallons for dry and 2½np for wet maize. (See Appendix VII3for details of uses.)

1.7.4. CASSAVA

Cassava is grown throughout South-east Ghana. In the intensively studied villages it was overall co-dominant with maize as an occupant of the land, and dominant in the Western villages.

1. Invariably these are 'Premier' mills 1A or 2A manufactured by R. Hunt & Co. Ltd., Essex. They are coupled by a flat belt to a Lister diesel of suitable capacity. 1A Output dry 400lb/hour; output wet 250lb/hour
2A " " 600lb/hour; " " 350lb/hour

Cassava is eaten throughout the year, commonly combined with other ingredients. In addition to fresh cassava, held in the soil until required, it is used in a variety of semi-stable prepared forms - ampesi, kokonte, gari, tapioca; in addition starch is a by-product of the gari-making process (see Appendix VII.2. for details of processes).

Cassava growing was investigated both in the villages intensively studied and at Mafe-Kumasi, some 25 miles due south of Ho. Mafi-Kumasi is also on pallid sands, similar in general to those described above, but some areas may benefit from sideways movement of water from neighbouring areas where impervious rocks are close to the surface, thus being less subject to drought. It is an area which is densely populated; the local clans are currently seeking more land within the boundaries of other villages. Some Mafi-Kumasi land is under continuous cultivation.[1]

Agronomy

In the Intensive Village Survey, Cassava planting during 1970/1 was reported in 9 out of 12 months but most commonly in March, April and September. It is often planted among maize and groundnut stands commonly when these are some three weeks old. Planting consists of cutting short lengths of stem from existing stands belonging to the household and half burying these in loose damp soil.

In Mafi-Kumasi, cassava is planted relatively closely at 17-21". Planting in rows is claimed both to make weeding easier and quicker and to facilitate measurement of the crop when it is sold directly off the field. Small quantities of fertiliser are beginning to be used on some farms. Though many different varieties are grown those most common are Kotoku, Agbaendzi, Ahokpo and Ankrah. All except Ankrah are used for making gari, because, it is said, they do not contain too much water, but Ankrah is used solely for ampesi. All these mature in about 12 months; a new six-month variety is known but is not grown widely.

Weeding is the only cultivation process required, which may be done three or four times during the crop's life. The control of perennial Imperata cylindrica is a particularly severe problem.

In the Intensive Village Survey it was found that the bulk of the cassava from both householder's and family members' plots is consumed in the household. The rest may be used to pay labour, given to relatives (sometimes as payment for services rendered) or sold. Where sold, this is most commonly in the form of fresh roots. Sales most often occur when money is needed rather than when prices are high. Selling cassava roots direct from the farm is preferred.

1. The input-output data were collected by interview during July-Sept. 1971; values tended to be higher in most respects in this more intensively farmed village.

In Mafi-Kumasi selling direct from the farm is a well-established practice, principally to gari-makers who pay N¢ 2 per 'rope' of 64 sq.yds. The same practice occurs elsewhere but is less dominant.

Because cassava is sold in each village (or local market) in four or five forms and in all kinds of containers, current prices in the intensive village survey were hard to establish. They seemed to show wide variation no doubt in part reflecting quality variation. Fresh cassava was commonly N¢ 5-6, kokonte N¢ 6-10 and gari N¢ 16-30 per bag respectively. Also there are marked differences in local price patterns.

Attitude testing in the intensive village survey (AA3) suggested that farmers themselves believed increased production could be obtained, especially by using fertilizers and with better farm maintenance, though the majority believed this would cause a fall in cassava prices. They were of the opinion that they would still want to grow cassava even if more maize were available. There was a tendency for cassava to be the food to be preferred to maize in the Western villages and vice-versa in the East, but in both areas it was commonly believed that if more money were to be badly needed it would be a good idea to grow more cassava.

Processing

Cassava processing is commonly a home industry[1] carried on chiefly by the women. All operations are done by hand, though mechanised grating is becoming common in Mafi-Kumasi and further south. Processed forms of gari and kokonte have obvious advantages as products for sale outside the area because bulk has been reduced and keeping quality greatly increased. Products from this area go not only to local towns like Ho, Ada, Keta and Adidome but also to Accra and as far north as Tamale.

Expansion has occurred in South-east Ghana during the last ten years, especially with the advent of the mechanical grater, which reduces the grating time of 100 lb. cassava from two hours to a few minutes. The women concerned harvest the cassava on the farm where it has been purchased and carry it to the village; these are morning tasks. They then peel, grate, drain, press and roast the cassava, during afternoon and evening.

Table 1.15 shows expected return in Mafi-Kumasi assuming average cassava yield; poor or good yields may cause a range of gross revenue of N¢ 2·85-4·73 and adjusted NCR of N¢ 0·37-2·16. If 2·66 'ropes' are processed per woman per week, weekly earnings will average N¢ 3·43.

---

1. This is not true for Ghana as a whole; centralised processing of cassava chips is a new development. (See Appendix VIII)

Table 1.15

Net Cash Returns From Gari Production, Mafi-Kumasi

(N¢ per 'rope' of 1/76 acre)

Gross revenue		3·785
Cash costs		
Cassava	2·000	
Firewood	0·325	
Grating[1]	0·168	
		2·493
Net cash return		1·293
N.C.R. less depreciation and interest on equipment valued at N¢ 9·9		1·208

1. When mechanised.

It is estimated the work takes 32·7 hours per week. Net cash return per hour of work, after allowing for depreciation and interest is, on average, only 9·8 np. This is a low return for hard work and a degree of acquired skill (especially in roasting), but if kept up for say 50 weeks would represent an addition of N¢ 170 to family income. It is also (like charcoal burning) a task that can be laid aside for child birth, funerals, festivities, etc. Moreover cassava keeps in the ground; the women can avoid oversupplying variable markets.

1.7.5. GROUNDNUTS

Groundnuts are grown in both major and minor seasons but are proportionately more important in the latter. Two local varieties are grown. Azidzi is a red quick-maturing nut (12 weekw), an early variety which can fetch a high price early in the season. Aziyie is brown, higher yielding over a 16 week growing season. Compared to Azidzi it is fairly dormant.

Traditional planting is by random spacing at the quite high density of 40-60 lb. per acre, commonly 25-50,000 seeds per acre. At this density a rapid and fairly complete ground cover is achieved and rosette disease is minimised. Seed cost per acre is of course high (at 15np/lb). Moreover the yield : seed ratio is only 10-20 : 1. (This contrasts with maize where seed cost is 5np/lb for 10-20lb/acre, with a yield : seed ratio of 50-100 : 1). Groundnut growing thus represents a high risk, and tends to be planted after maize. Seed dressing is not currently practised.

Planting takes place normally in April (when drought is a common cause of failure - for instance in 1970) and September.

On clean land with good seed establishment weeding is a small cost; where Imperata cylindrica is a problem, however, careful handweeding is necessary and can be very time-consuming.

Harvesting, as with all other operations is by hand. It is sometimes done prematurely, when the nuts-in-shell are boiled for home use or local sale. Normally the process is to lift by pulling, to gather plants into a circle with tops facing outwards for drying, to strip pods in the field, to dry on the ground at the house, to store in baskets, sacks and mud lined stores, and to shell by hand (using a stone) at the rate of some 20-30 lb. shelled nuts per day.

Labour utilisation and yields

The labour used for groundnut production can be seen to be appreciably greater on field operations (except weeding) than for maize with which it mainly competes (compare Table 1.16 with Table 1.13). The relatively low clearing effort testifies to the fact that it is seldom planted on land newly cleared of forest. It will be noted that women contributed more to the fieldwork than the men, particularly in weeding and harvesting.

Table 1.16

Labour Utilisation in Groundnut Production

	Minor 70		Major 71	
No. of farms	11		13	
No. of acres	11·2		8·8	
Acres per farm	1·0		0·7	
	man days[1] per acre	% of labour provided by males	man days[1] per acre	% of labour provided by males
Clearing	3·4	63·2	3·9	73·5
Cultivating	4·0	57·8	5·2	30·4
Planting	12·7	35·9	7·8	21·7
Replanting	1·2	38·5	-	-
Weeding (1)	8·1	13·2	11·4	5·9
Harvesting	16·3	33·3	20·1	11·7
	45·7	35·0	48·4	21·1

1. Includes men and women only. Children added 20% and 5% to the labour force in m70 and M71 seasons respectively.

As with maize, yield estimates were made on randomly selected farms by the random 20' x 20' square method. In Akpokofe and Dzalele, yields averaged 719 and 779 lb. per acre shelled in m70 and M71 respectively, which were rather lower than in more westerly villages where this crop is less commonly grown. These yields were considered to be about average by the householders themselves. Lower weights in the minor season may indicate lower moisture content. Harvesting in the Major season is hurried to avoid germination of the seed.

1.7.6. OIL PALM

Oil palm is highly important to the people of South-east Ghana for:-
fronds for thatching, shade, fencing, light wall building, baskets, brooms;
oil for soups, gravies and other cooking uses; for soap;
sap of the trunk for wine which in turn is distilled to produce a spirit - akpeteshie.

Although a few plantations are beginning to appear, most of the products come from semi-wild palms which generally receive little attention. This method of husbandry fits in with the prevalent practice of shifting cultivation.

Agronomy

Self-sown seedlings are allowed to grow among arable crops; in some areas young seedlings are transplanted to land newly cleared. When two - three years' cropping has exhausted the soil, the oil palm is left to compete with regenerating woodland. Where land carrying oil palm is cleared, the palms will be left and cultivation will take place round them.

The bulk of the varieties grown are thus local and unimproved; of the 'dura' type. There is some inter-village trade in seedlings. In some villages palms are grown from seed in swampy land; the bulk of those planted are self-sown seedlings however, rather crudely handled and transplanted into small holes with little preparation of the subsoil. Spacing is 8-15', though irregular. 50% survival is regarded as average. This method conforms with a desire to maximise the number of trunks for tapping and to minimise weeding by the development of thick shade (though the high seedling mortality sometimes defeats the second objective).

Rhinoceros beetles and grass cutters are pests which attack the palms; squirrels and rats steal the fruit. Diseases include Anthracnose, Blast and Cercospora lead-spot among seedlings. Trunk rots and moulds also occur. There is no pest or disease control. Accidental firing of bush, or firing for hunting purposes may cause damage to growing trees.

Harvesting of fruit is usually by cutlass or sharpened yam spade when the subtended leaf is removed and the bunch is chopped down. The bunch is often broken up and the fruit transported home loose. Harvesting occurs when the fruit is ripe and in line with household needs and is not concentrated in any particular season. An (unknown) quantity is lost by failure to harvest.

Trees commence yielding at six to seven years of age and are considered to be fit for felling at 10-12 years. Yields produced by unimproved and improved methods are shown in Table 1.18. It is assumed in Col.(1) that planted groves are 30% productive.

The formation of female inflorescences and their fertilisation will be closely affected by adequate spacing, maintenance of vigorous leaf, care with pruning and attention to pests and diseases, as well as choice of superior varieties. Suitable climate is typified by rainfall greater then 4" per month, average sunshine hours more than five hours per day and temperatures within 70-90^{o}F. South-east Ghana production obviously suffers from both managerial and environmental deficiencies.

The effect of the main dry season during December-February is probably the main environmental constraint, which makes itself felt 28-30 months later in the discouragement of female flower origination, and 10-11 months later through the abortion of female inflorescences already formed. Also, particularly in the south of the region, the second dry season may have additional adverse effects. The net effects of these constraints is to introduce a bimodal fluctuation into annual yields. Such fluctuation will be further influenced by year-to-year rainfall fluctuations on the one hand and the steadying effects, where they exist, of soils with good water relations on the other.

The ultimate harvest is of palm-wine or spirit. At an age of 10-15 years the tree is felled and left to lie for a week. The fermented sap is drained over a period of 4-6 weeks from a hole in the trunk, the process stimulated by scorching the cavity. The yield is commonly 4-6 gallons.

Table 1.18

Oil Palm Yield Estimated (per acre)

	Wild types	Improved types[1]
No. of palms (bearing)	30	40
Bunches per palm	5	7
Weight of bunch (lb.)	12	25
Yield of bunches (lb.)	1800	7000
% fruit to bunch	50	60
Yield of fruit (lb.)	900	4200
% of oil to fruit	15	25
Gross yield of mesocarp oil	133	1050
% efficiency of extraction m/c oil[2]	40	40
Net yield of m/c oil (lb.)	53	420
% of kernel to fruit	20	20
% of oil to kernel	50	50
Gross yield of palm kernel oil	90	420
% efficiency of extraction P.K. oil[2]	33	33
Net yield of kernel oil (lb.)	30	140

1. Experimental results
2. Household method

Disposal

All the products of the palm enter into trade, much of which is very local, achieving an 'evening-out' of household supplies within the village. The perishable nature of the fresh fruit and palm wine particularly limit their transport over long distance, especially from villages ill-served by good roads. While all the products enter trade, there is therefore good reason to process at the household or village level.

The most valuable product is mesocarp oil. The oil produced is predominantly 'soft' oil; that is, oil which is liquid at ambient temperatures in the tropics, with a low content of fatty acids. To avoid fermentation and fatty acid production the fresh fruit is boiled. Fermentation for three or four days may be allowed to loosen the flesh and increase the extraction rate but this may lower the quality of the oil.

To produce red cooking oil the fruit is picked from the bunch, washed, boiled for 30-60 minutes, well pounded, put into water and stirred, after which the oil is skimmed off. The oil is heated to drive off water and then bottled.

Palm kernel oil is preferred for frying and may partially substitute for m/c oil especially when the latter is seasonally scarce, e.g. June-

September. The nuts are stored until required. They are cracked between stones during slack periods mostly by the old women, the kernels are fried, ground at the maize mill, the flour is stirred into water and the oil is skimmed off and bottled.

These extraction methods are of low efficiency (see Table 1.18).

Palm wine is consumed for refreshment and on social occasions - as when welcoming guests, at funerals, etc. Palm wine production is exclusively a male occupation. Tapping may be done by the owner of the trees or by specialist wine tappers who buy the tree at an agreed price of NȻ 0·7-1·2. Probably some two thirds of wine produced is sold in the villages or local towns. Fermentation is rapid and deterioration occurs soon in the absence of refrigeration.

Akpeteshie distilling is almost always a specialist village job owing to the capital requirement for the still. (This consists of one or more retorts constructed from 44 gallon oil drums below which a fire is lighted. Copper tubing carries the fumes into a water trough, the condensate being collected in jars or tins.) Yield is 10-12½%. Thriving industries in e.g. Podoe and Dzodze export to Accra.[1]

Soap is in declining demand. It is ill-smelling, and has adverse effects on fabrics and colours. It is made with palm oil, cocoa shells and water. One trip per year is made for cocoa shells commonly to Hohoe. Equal quantities of burnt shells and palm oil are cooked gently over a for several hours during which water is added. The soap rises and is skimmed off. It sells at about 10np per lb.

1.8. RESOURCE UTILISATION

The combination and scale of enterprises decided on by any one household will depend on the objectives of the decision-makers concerned, the resources available and the scope for trade.[2]

The objectives of decision-makers are hard to determine by direct questioning, though some of the attitude testing referred to elsewhere in this report throws light indirectly on them. A number of general conclusions can be drawn from current practice and attitudes expressed. First, custom lays down that each household should be self-sufficient in the main staple foods (and, indeed, that men and women should both bear their share

1. Distilling by eight operators was closely observed by Parker op.cit p79.
2. This last will be examined in Chapter 2.

Table 1.19

Total Activities 27 Families

June 1970 - June 1971

	ADULT MALES (33)		ADULT FEMALES (52)		CHILDREN (66)		TOTAL (151)	
	%	Hrs/week	%	Hrs/week	%	Hrs/week	%	Hrs/week
Illness (I)	3.91	3.28	3.42	2.87	1.23	1.03	1.59	2.18
Away from village (-)	10.07	8.46	10.36	8.70	8.40	7.06	9.44	7.92
Away visiting (v)	5.22	4.38	3.78	3.18	1.10	0.93	2.93	2.46
Away on cocoa farms (Cc)	0.37	0.31	0.02	0.02	-	-	0.09	0.08
Sub-total	19.57	16.43	17.58	14.77	10.74	9.02	15.05	12.64
School (S)	3.93	3.30	1.78	1.50	14.79	12.42	7.89	6.63
Leisure (L)	25.88	21.74	18.97	15.93	58.59	49.22	37.64	31.62
Social activities (T)	6.78	5.70	4.97	4.17	1.22	1.03	3.74	3.14
Communal labour (Cm)	1.71	1.44	0.79	0.66	0.03	0.03	0.66	0.55
Sub-total	38.30	32.18	26.50	22.26	74.64	62.70	49.93	41.94
Farming (F)	28.37	23.83	19.75	16.59	4.60	3.85	15.05	12.64
Housework (H)	4.18	3.51	26.12	21.94	9.44	7.92	14.14	11.88
Marketing (M)	0.72	0.60	7.13	5.99	0.26	0.22	2.76	2.32
Work on relative's farm (R)	0.32	0.27	0.11	0.09	0.02	0.02	0.12	0.10
Work on co-op or group farm (G)	0.33	0.28	0.39	0.33	0.08	0.07	0.24	0.20
Paid agricultural work (A)	1.71	1.44	0.21	0.18	0.02	0.02	0.45	0.38
Charcoal (Ch)	1.83	1.54	1.19	1.00	0.12	0.10	0.86	0.72
Hunting (Hn)	0.31	0.26	0.01	0.01	0.01	0.01	0.07	0.06
Fishing (Fs)	0.04	0.03	0.08	0.07	0.05	0.04	0.06	0.05
Paid non-agricultural work (W)	4.32	3.63	0.92	0.77	0.04	0.03	1.27	1.07
Sub-total	42.13	35.39	55.92	46.97	14.62	12.28	35.02	29.42
Total	100.00	84.00	100.00	84.00	100.00	84.00	100.00	84.00

of responsibility). This preoccupation with food supply derives not only from the low productivity of resources but also the high cost of transport and year-to-year variability of resource productivity. It is fortified by a frequently expressed suspicion of trading.[1] Second, the eagerness to acquire more cash to buy goods and services was nevertheless shown to be strong whenever possibilities of change were discussed. Third, the people of South-east Ghana are, predictably, concerned with both short- and long-term well-being, and this is shown by the combination of crops and livestock they choose as well as by the pattern of their expenditure - not only on food and drink but on schooling for the children also.

Their main resource is their own labour, which is constrained by time, by health and by the conflict between satisfaction derived from productive effort and that derived from leisure or only indirectly productive activity.

1.8.1. LABOUR

The labour resources brought to bear on the household's farms are a combination of family members, hired and communal labour, the first providing the major proportion. The hired labour is largely derived from families who are otherwise engaged in farming on their own account. (For one reason or another some family members do not wish to be subsistence farmers themselves,[2] but there is not a truly landless labourer class which derives from lack of access to land, as is commonly the case in more densely populated countries.

The pattern of family labour utilisation was examined in detail in 27 households spread over the eight villages intensively studied, where they were selected at random. Only two of the 27 householders had major occupations other than farming. This is a proportion smaller than occurred in the larger samples and in this respect the results may be unrepresentative.

Pattern of activities of a sample of families

Table 1.19 summarises the whole record of 13 four-week months starting on June 14th 1970 for all 27 families.[3] Broken down into activity groups it

1. See Parker op. cit. p 91.
2. Until recently large numbers came from Togo, Dahomey and Upper Volta. Recent legislation has seriously curtailed this flow. The current supply is mostly made up of young school leavers.
3. With the exception of the three families in Agodake where recording was not begun until three months later.

is shown that illness and absence from the village reduced the amount of time available for work by 15·05%. The time remaining was split between activities not directly productive for the family's benefit (leisure, traditional social activities, communal labour, school) and activities directly productive. Within the 'directly productive' category, by far the largest part is devoted to farming and household work (which includes fetching water and firewood).

The first general impressions to be derived from this table are that (1) absence from the village is the major factor that reduces the availability of labour. While the figure for sickness is not very high in this sample, it must be remembered that this gives no clue as to the reduced effectiveness caused by chronic ill-health during the time when work is being done. (2) A considerable proportion of everyone's daylight hours is spent in tasks not directly productive as far as the family is concerned. Many of the social activities and the communal labour are of course obligatory and the family's place in society is preserved in this way. (3) Living under rather simple conditions results in a high proportion of time, especially among the women, being devoted to household duties (including the processing and preparation of foodstuffs). This implies that if labour-saving devices were introduced here, more labour might be made available for production.

The total time spent on productive work in the home surroundings represented 35·4, 47·0 and 12·3 hours out of 84 for men, women and children respectively.[1] Considering the time spent away from the village, some of which may be productive time, this is not a degree of productive activity which need be considered as very low by 'western' standards.

It should of course be noted that the categories are often not very clear-cut. It is for instance questionable whether hunting should be regarded as wholly productive or partly leisure - in some villages a significant part of meat consumption is derived from hunting. Marketing (which includes both buying and selling) often includes time which is not particularly active, though rest after a long period of head porterage is obviously necessary.

Detailed information is available about how activities were distributed as between:

(1) groups of villages

(2) seasons of the year

In view of the relatively small contribution of children this group has been omitted from here on.

---

1. This includes travel to work, which could be considerable where farms distant from the village were being cultivated.

Some interesting contrasts occur which seem to tie in with impressions derived from elsewhere, namely:

(1) that the Eastern people are in general more mobile away from their villages, the availability of labour for this reason being less in East than West.

(2) Time spent in leisure and communal work is rather less in East than West, but social activities take up more time.

(3) Productive activities differ rather notably first in the prominence given in the West to charcoal making, hunting and fishing, and to farming, while marketing, particularly among the women takes up more time in the East.

Also it is noticeable that:

(1) Appreciably higher rates of absenteeism away from the village occurred in bush as compared with roadside villages.

(2) Not directly productive activities were greater in Roadside villages.

(3) Predictably, rather more marketing activity was engaged in by the women in Roadside villages.

Non-availability of adult males varies fairly widely between 11·79% and 15·57% over the 13 months, the lowest degree of absence being immediately after Christmas and in July-August at the end of the Major season. Within this category illness shows a seasonal variation with peaks in the middle of Major and minor seasons. Time spent on non-productive activities shows less variation though the sudden effect of the Easter period is noticeable in social activities. Amongst productive activities, farming activities tend to be highly peaked in the minor season when clearing and subsequent cultivations tend to be compressed.

Non-availability of adult females varies between 9·66% and 22·21%. The high points of absence occurring at the end of the calendar year and through the main growing season. Illness reached 5.67% of the time available in May 1971. Time spent on non-productive activities shows less marked variation (21·70 - 30·37%) the highest point occurring around Christmas. Social activities were again noticeably high around Easter. Amongst productive activities, as with the men, farming rose to a peak in the minor season particularly in September-October, overall monthly variation being from 14·99 - 27·36%. The proportion of time spent on housework and marketing was very stable from month to month emphasising the routine nature of these activities. (Together they took about one-third of daylight time.) Other productive activities contributed little to the total but tended to vary seasonally.

It is worth noting that in the busiest farming months there may be considerable variation from week to week. Work done by children rises sharply. Thus in Month 4, week 2 in this year, the proportion of time spent on farming rose to 42·00, 29·83 and 14·48% for men, women and children respectively (that is, 48, 51 and 215% above the annual average).

Contribution of hired labour to farming activities

Other records show that labour may be hired for a variety of activities in village life, including cutting trees for charcoal burning, housebuilding, etc. By far the most important contributions, however, are made in farming activities, ranging from land clearing to harvesting. Maize and groundnuts are the crops most concerned.

The percentage distribution between family and hired labour for maize and groundnuts is shown in Table 1.20.[1]

Table 1.20

% Distribution of Labour, Family and Hired

	Family		Hired	
	Male	Female	Male	Female
Maize				
m70 (W)	48·7	35·2	16·1	-
(E)	55·1	30·2	5·6	9·0
M71 (W)	63·4	15·8	17·8	-
(E)	48·4	18·9	23·1	9·7
Groundnuts				
m70 (W)	39·4	60·4	-	-
(E)	13·2	63·4	13·2	10·2
M71 (W)	14·0	63·0	23·0	-
(E)	7·8	82·8	7·8	1·6

Hired labour tends to contribute a larger share of total labour in maize than in groundnut cultivation. Female hired labour occurred only in Eastern villages. Overall, 19·5% of the adult labour used in maize growing and 9·7% of that used in groundnut growing was hired.

In terms of tasks, hired labour contributed to all stages of maize growing but particularly to clearing. Hired women tended to be concentrated in planting and harvesting. The same applied to groundnuts except that family women were exclusively engaged in the harvesting process.

1. Data are from the same records as quoted in Sections 1.7.3. and 1.7.5.

Average rates for males, females and children in this sample were as follows:

	Days	Rate per day (N¢)
Men	523	0·79
Women	47	0·40
Children	44	0·06

Clearing charges (308 man days) averaged N¢ 0·80 per man day for men.

A few cases of payment in the form of maize were recorded for women employed on maize in the East; group work accounted for some of the labour 'hired' on groundnuts in the East.

Labour productivity

Within the general framework of labour utilisation it is pertinent to ask how labour is allocated between productive enterprises. Absence of prolonged records makes this a highly speculative exercise. Parker's data,[1] from a small sample, give the average returns to labour shown in Table 1.21.

Table 1.21

Average Returns to Labour by Enterprises, Kpomkpo (np/hour)

Enterprise	Sex of worker	Av. returns per hour
Forest maize	male	17·8
Savannah maize	male	8·3
" "	female	0·5
Forest cassava	male	33·0
Savannah cassava	female	12·7
Savannah groundnut	male	-4·1
" "	female	-2·7
Charcoal	male	9·15
"	female	9·23
Distilling[2]	male	10·73
Hunting	male	11·7
Fishing	female	3·9

1. Parker, R.N. op.cit. from various tables in Chapter IV.
2. After deduction of 10% interest on capital.

For the conditions of Kpomkpo it can be tentatively observed that (i) average returns per hour earned by men are, except in the case of charcoal burning, higher than for women, but that, in the important cases of forest maize and cassava this reflects their right to limited superior land, (ii) with the exception of these two cases and of savannah groundnuts, average returns to their labour are fairly close to ten np per hour which is itself not very dissimilar from hired labour rates. These values argue for the maximum utilisation of the forest area (bearing in mind the need to conserve fertility), and the maintenance of a diverse production pattern (bearing in mind that hunting, charcoal burning and distilling need not compete for labour in the crucial seasons).

Interaction of the three main crops, maize, cassava and groundnuts was observed in Mafi-Kumasi. All these crops were grown by the 32 farmers investigated and regarded as capable of expansion.

Table 1.22

Returns to Labour, from Maize, Cassava and Groundnuts, Mafi-Kumasi

	Maize	Cassava	Groundnuts
Yield reported (lb. per acre)	1320	17,404 (7·7 tons)	936
Price per unit (N¢)	12·03/bag	2/rope	28·25/bag
Labour requirements (man days per acre):			
Land preparation[1]	27·65	27·65	27·65
Planting	3·87	4·12	8·00
Weeding	(x2) 18·78	(x4) 74·00	(x2) 20·50
Harvesting	6·31	-2	45·00
Total	56·52	105·77	101·15
Gross revenue per man day (N¢)	1·40	1·43	1·45
Net revenue[3] per man day (N¢)	1·38	1·43	1·36
Net revenue per man day omitting clearing cost (N¢)	2·07	1·71	1·69
Gross revenue per acre (N¢)	79	152	147

1. Assumes forest clearing entirely by hired labour; even so this estimate is high by the standards of the Intensive Village Survey.
2. Assumes crop is sold off field.
3. Gross revenue <u>less</u> seed cost.

Table 1.22 indicates that if these three crops were competing for family labour in a simple way maize would tend to be favoured. But the farmers' choice is complicated by:

(a) the desirability of growing two crops a year on land once cleared
(b) the distribution of labour requirements over the season
(c) the possible benefits of mixed cropping
(d) year to year fluctuations in yield.

A combination of maize (M season)/groundnuts (m season) and cassava, perhaps with the intercropping of maize and cassava as already described is likely to reduce overall clearing costs, result in the best (though still uneven) labour distribution, and provide some hedge against yield fluctuation. Moreover it is likely that this situation will continue (1) as long as hand labour dominates and is plentiful in the area (2) an assured food supply is an over-riding preoccupation. If pressure on land increases but other conditions remain the same, the importance of output of calories per acre may grow, implying more cassava.

1.8.2. CAPITAL

The maintenance of the present level of living and its elevation depend on the saving of surplus from consumption and the use of these savings, together with borrowing, in productive capital investment.

Saving

Very little concrete evidence is available about saving in a rural community which keeps no records. Many questions were put to householders to assess practice and attitudes and the following summary condenses the findings.

Saving is predominantly a domestic practice, commonly involving small amounts of cash, though a few use town banks and thrift clubs (which were regarded as a good thing). Men and women tend to save separately, with responsibilities for spending clearly allocated.

In addition to saving cash, cattle are a convenient way of saving for those who own them and regarded as such by most people.

The need for cash saving in the short term is reduced by cropping in two seasons and by using cassava as a staple. Nevertheless seasonal periods of relative cash shortage were reported in interviews, especially in April, May, June, whereas it was reported to be most plentiful in August and December.[1]

---

1. Records of 41 households in Podoe and Kpomkpo for 1970/1 show farm expenditure to have totalled N¢ 919 or £22 per householder as compared with cash earnings of N¢ 5027 or N¢ 122 per householder. Expenditure and sales were spread fairly evenly through the year; in no two-week period did cash expenditure exceed cash income, taking the sample as a whole.

Low levels of cash savings are of course directly related to the low levels of income and monetization, particularly for those who have no sources of income other than farming. But it was suspected that material wealth is not in particularly high demand and is certainly not shown off. To do so might make the possessor the subject of envy. An attempt at rating the importance of money was made (AA2) with a multiple choice question to 74 householders with the following results:

Q: Some say a man is happiest when he has ..... Which do you consider most and least important?

A: Percentage stating	Most important	Least important
Much wealth	24	4
Many sons	28	-
Many friends	-	31
Good health	38	-
A position of leadership	1	34

Borrowing

Evidence was again hard to come by and questionnaires had to be relied on. The general impression was that under present conditions borrowing was not particularly common. Further inquiry specifically about the financing of farm operations elicited a rather higher frequency of borrowing. In a group of 46 householders (AA6) the answers given about borrowing to pay labour are shown in Table 1.23.

Table 1.23

Borrowing Frequency for Field Activities
(% of replies)

Borrowing for	Regular	Sometimes	Never	No Answer
Maize clearing	17	41	33	9
planting	0	7	70	24
weeding	13	13	52	22
harvesting	0	9	70	22
Cassava clearing	7	39	35	20
planting	0	0	76	24
weeding	0	20	59	22
harvesting	0	0	78	22
Groundnuts clearing	9	24	35	33
planting	0	0	65	35
weeding	2	46	17	35
harvesting	0	2	65	33

Clearing and weeding are seen to be the activities where borrowing may take place, being the tasks for which labour is most commonly hired. The number who said they borrow regularly is however small.

When asked in the same interview, "if you found yourself short of cash for paying labour on your farm who would you borrow from?", 14/28

positive answers cited relatives; when a list of possible lenders was suggested the number of answers was:
relatives (33), shopkeepers (0), other villagers (10), traders coming to the village (4), traders in other towns(1), Agricultural Development Bank (23). (The answers probably represent who they would hope to borrow from).

The prominence of relatives in lending is clear, and was strengthened by further questioning which showed that householders believe that when people borrow they mostly go to their own clan (31/46) The evidence did not suggest that this preference was limited to any particular category of borrowing.

Terms of borrowing

When borrowing from relatives the obligation of the borrower was reported to be predominantly payment of cash interest, but also payment in work on the lender's farm.

Although work in return for loans received was not particularly common, work in return for help given occurred widely - specific mention was made of clearing and felling and planting. All members of the family might be involved in this mutual help.

When borrowing from a shopkeeper or a trader, most householders said interest would or might be paid. The rate of interest quoted varied between 20% and 50% per year (but answers may be unreliable). Some householders also said pledges of assets would also be made.

Of 132 householders who were asked whether they received cash advances for grain when growing maize (AA1) only nine answered affirmatively.

Taken at their face value these answers suggest a great enthusiasm for borrowing in order to expand either individual or group activity. Although placed amid a variety of other questions they may represent very naive reactions to unfamiliar situations, with the respondent assuming, merely because the question was asked, that it must be a good thing. The answers also suggest however that a flood of applications might be expected if credit were made easily available.

In fact, little seems to be known about the few facilities available. For instance, the A.D.B.'s maize loan scheme was known by only 6/46 householders (AA5) and not all of these knew the acreage and loan limits and payment provisions of the scheme. Very few loans have been awarded in the villages intensively studied.

Capital investment

The capital stock of the community is being continuously replaced or added to. This occurs in two forms:

(a) by the expenditure of labour

(i) on the building or repairing of structures and equipment

(ii) on the care of natural processes like trees and breeding animals which at any one time constitute a capital asset.

(b) by the expenditure of funds on purchased items.

The definition of productive capital investment is rendered difficult first because, where production (both agricultural and non-agricultural) is on a small scale and organised around the household, the boundary between capital investment and consumer durables is hard to draw, and second because, with things like animals and trees, consumption may suddenly curtail the growth process.

In S.E. Ghana, communities have the following characteristics:
(1) There is only a modest level of capital stocks. (See Section 1.6.6. above) These are chiefly made up of food stocks, simple tools, animals (not all of which necessarily constitute capital in the breeding sense), and structures including houses the potential productive value of which is debatable. (Some would also include the funds and energy spent on land clearing as a form of investment in land improvement).
(2) Participation in capital creation through labour is spread through the communities' households, chiefly in respect of animal and tree care (both at a very low level by the standards of enlightened husbandry), and, in part, in respect of structure repair and building.

Capital expenditure in 1970-71

In the households in the 20 household sample expenditure was recorded as follows:

		Value (N¢ per household)
(a) Tools and equipment		
1. Tools	350 items	2·38
2. Guns	20 items	2·45
3. Bicycles	6 items	2·02
(b) Structure repair and building		
1. Materials (chiefly iron sheets and cement)	)	10·14
2. Hired labour	52 cases)	

These figures compare with 978 items of consumer durables, with an average value of N¢ 14·71 per household. Investment per household in planting materials, fertilizers and insecticides was negligible.

In addition a few individuals had major capital expenditures, namely:

One corn mill	N¢ 500
Technical College fees	N¢ 200
Secondary School fees	N¢ 150
Distilling equipment	N¢ 265
Sewing machine	N¢ 200

These large individual sums suggest substantial concentrations of wealth in a few hands. While this is not ruled out in the case of some with non-agricultural interests, some of these funds are no doubt accumulated within the family system.

Omitting these large sums, probably less than N¢ 20 per householder is spent on capital investment even remotely related to agricultural production.

REFERENCES

METTRICK, H — Policies and Institutions in Ghanaian Agriculture. University of Reading. Development Study No. 9. June 1971

PARKER, R.N. — The Feasibility of Some Small-scale Development Projects in the Light of a Community's Socio-Economic Structure - A Study of a Savannah Village in S.E. Ghana. Unpub. M.Phil Thesis, January 1973.

ATSU-AHEDOR, V.K. — Agricultural Development in Denu District, Ghana 1956-1968. Min. of Agriculture, Ghana. Mimeo. 1969.

LAWSON, Mrs. Rowena M. — Changing Economy of the Lower Volta 1954-67. I.A.I. Oxford 1972.

MINISTRY OF AGRICULTURE, GHANA (Economics and Marketing Division) — Report on the Ghana Sample Census of Agriculture, 1970. Volume I, March 1971.

WALTER, M.W. (1959) — Dependability of Rainfall in Ghana. Ghana Met. Dept. Note No.14.

WARD, Barbara E. (1949) — Social Organisation of the Ewe Speaking People. Unpub. Thesis. University of London.

BELSHAW, C.S. — 'Traditional Exchange and Modern Markets'. Prentice-Hall, 1965, p46.

CHAPTER 2 THE MARKET ENVIRONMENT

2.1. INTRODUCTION

The householder and his family have a wide choice of markets when selling and buying.

Sales of both raw and processed products may be either to other villages (who may be traders), to traders who come to the village, to local markets, or occasionally to distant urban markets or public corporations.

Purchases of farm requisites may be made from other villagers, traders, or occasionally agricultural officers or public corporations; purchases of consumer goods may be made from village shops, local or town markets.

The pattern of trade is characterised by:

(a) the smallness of quantities sold and bought;

(b) the bulkiness and perishability of some commodities like fruit and vegetvegetables, fresh cassava and fresh fish, which limit trade to local markets in certain seasons, and encourage home processing;

(c) the seasonality of production of some commodities, like maize and groundnuts, which contrasts with the regularity of consumption,[1] resulting in wide seasonal price swings (accentuated by the fact that only a production surplus is marketed);

(d) uncertainty in production, leading to much intra- and inter- village exchange;

(e) poor roads, old vehicles and seasonal rains, which combine to raise marketing costs and to discourage trade;[2]

(f) regular attendance at village markets by some household members and local specialisation in trading, which tend to cause 'export' and 'import' activities to be combined, thus economising in time, transport and credit;

(g) prices of some commodities indirectly affected by government.

These factors together result in a very complex pattern of prices and marketing practices, with many apparent anomalies.

2.2. HOUSEHOLD SALES

2.2.1. WHOLESALE PRICES

Wholesale prices are available from the Ministry of Agriculture,

---

1. For local consumption patterns, see Appendix VII.
2. Transport costs are examined in Chapter 3.

recorded weekly for up to ten markets in the Southern Volta Region.[1]

Maize Graph I shows consolidated price fluctuations in five markets. Maize is grown throughout the region in both Major and minor seasons. The price variation is therefore fairly representative of all markets though early summer prices March-June were especially high in southern markets. Ho prices were lower than average in the winter months. These deviations are probably related to the influence of distance from main producing areas north of Ho and the high population densities of the coastal areas. Average prices per bag (220 lb.) are shown in Table 2.1. The price never fell as low as the government support price in these markets.

Table 2.1 Average Wholesale Prices, 1970 (N¢)

Commodity	Unit	Markets						
		Ho	Dzodze	Denu	Akatsi	Keta	Kpetoe	Adidome
Maize	220 lb	11·44	12·97	12·95	12·69	12·79		
Cassava	200 lb			3·94		4·05		
Gari	150 lb	15·16	13·01		11·90	16·10		
Groundnuts	180 lb		28·34		23·52			
Cowpeas	240 lb		23·08		18·92			
Palm oil	4 gals		7·89	6·69	7·33	7·96	6·90	
P.K. oil	4 gals				6·97	7·19	6·02	6·80
Eggs	dozen	0·74	0·61		0·60			

Cassava Graph II for Keta and Denu only, shows a marked trough in prices in May-July, which is surprising bearing in mind the greater difficulties of marketing, and shortage of maize, at this time of year.

Gari Graph III shows annual fluctuation (for Ho, Dzodze, Keta, Akatsi) similar to maize. Fairly wide variations in price level occurred between markets, possibly reflecting the proximity of Dzodze and Akatsi to those areas where gari is made on a relatively large scale. A comparison of the price levels of cassava and gari (Graph IV) in Keta market suggests that gari was at a premium early in the year.

Groundnuts In both Dzodze and Akatsi, prices were relatively high in the second quarter of the year, as was the case with maize and gari.

Cowpeas In the same two markets, prices were appreciably lower than groundnut prices though seasonal fluctuations were broadly similar.

Palm Oil There is no obvious explanation for the substantial range in average market prices. Dzodze, which might be regarded as the centre of the oil palm growing area of Southern Volta had one of the highest average prices.

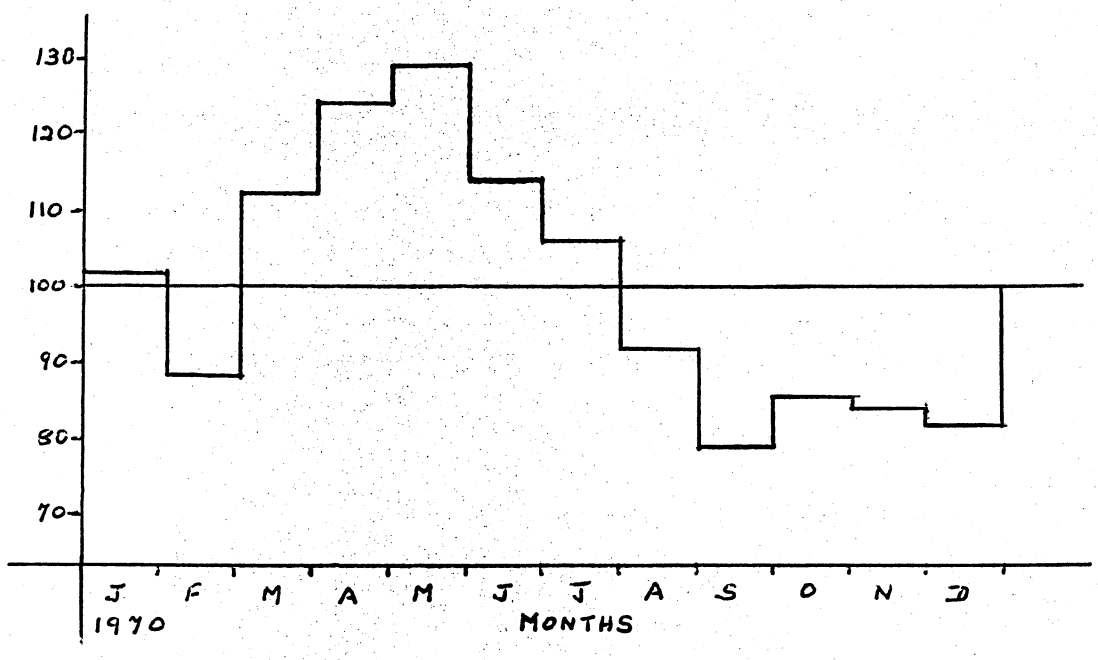
Palm Kernel Oil Seasonal variations of both palm oil and palm kernel oil showed troughs during the second quarter. A comparison of the two commodities in Kpetoe and Keta markets shows rather higher prices for Palm Oil than P/K oil in both markets.

Eggs With the exception of Ho, egg prices were steady throughout the year.

1. Attention is confined to those commodities and markets for which a minimum of 35 weeks' records were available in the calendar year 1970.

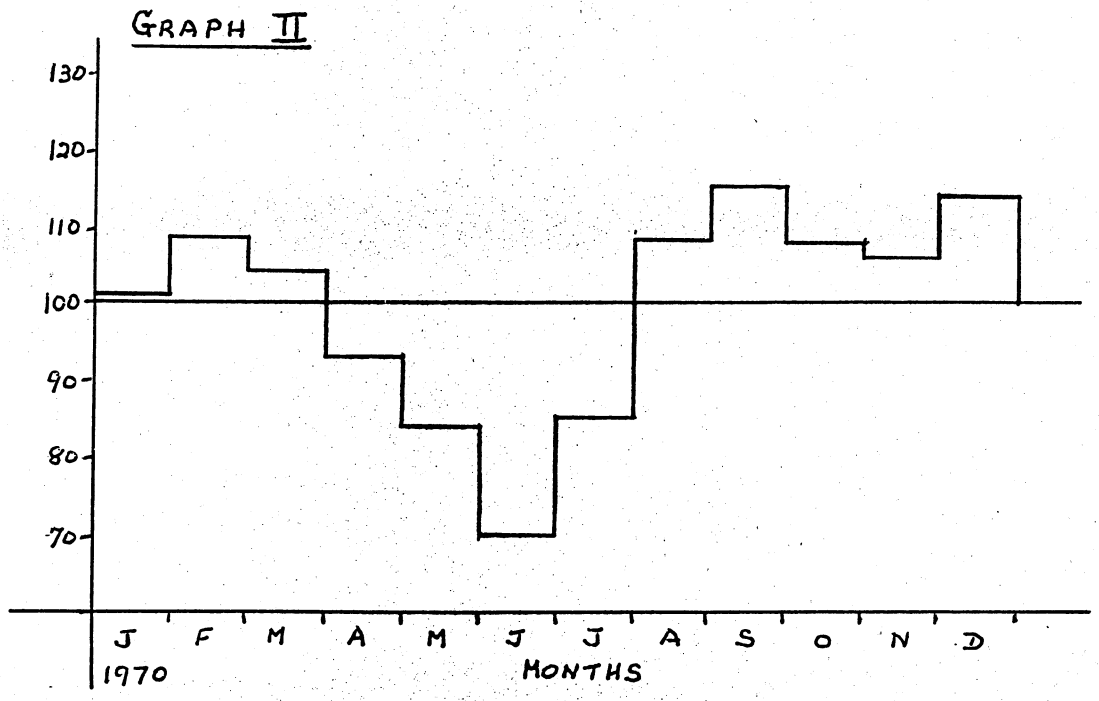
WHOLESALE PRICES

GRAPH I



(a) MAIZE MEAN PRICE = 100

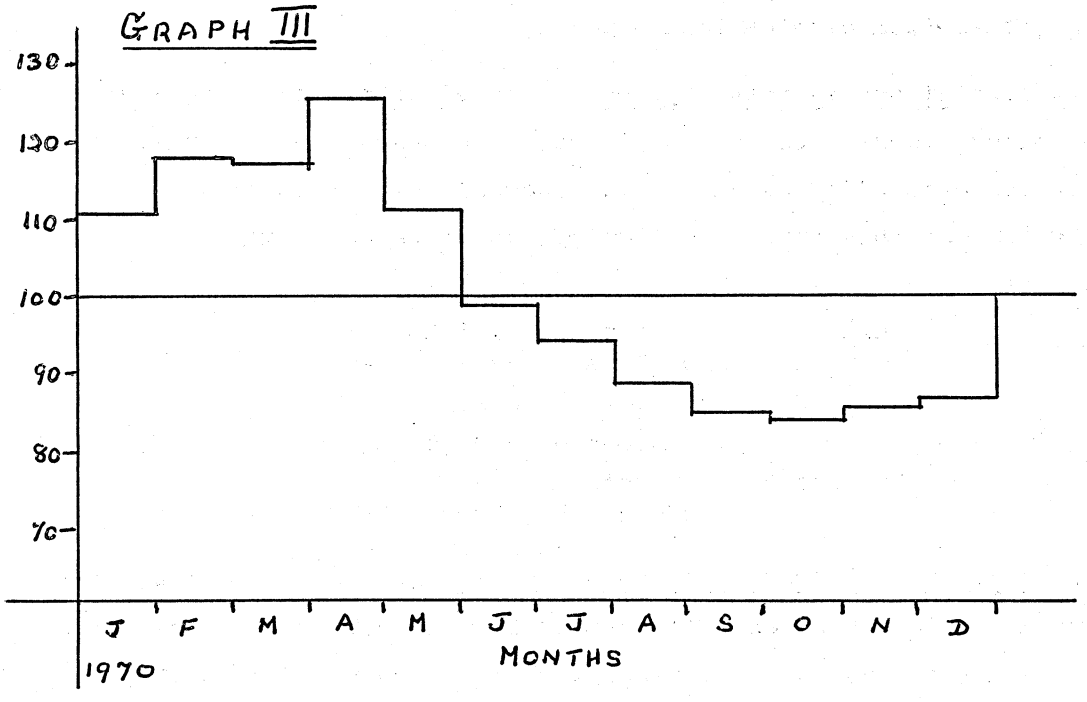
GRAPH II



(b) CASSAVA MEAN PRICE = 100

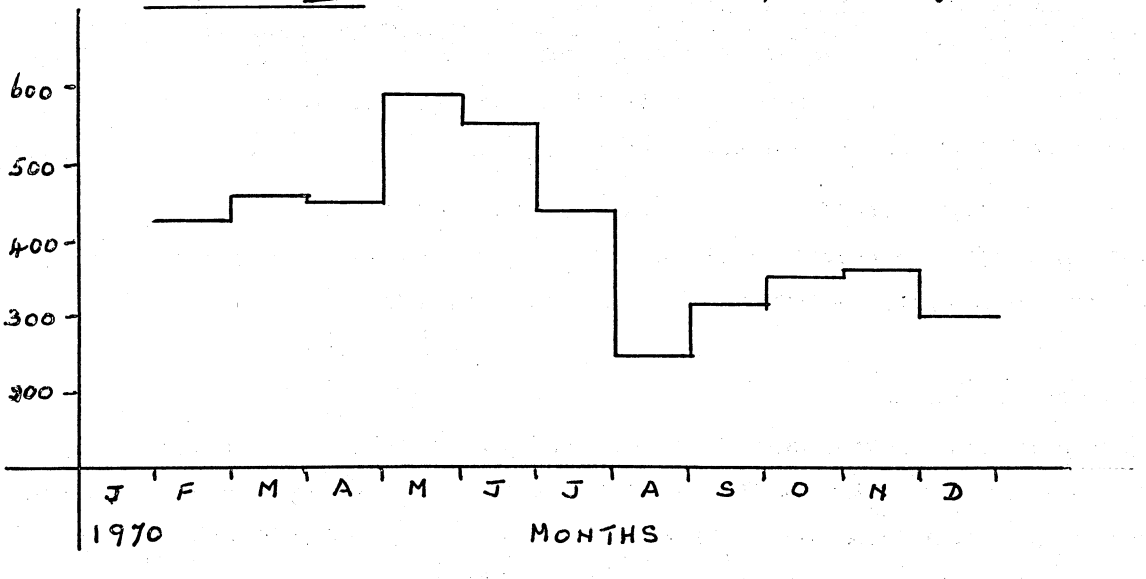
WHOLESALE PRICES

GRAPH III



(C) GARI MEAN PRICE = 100

GRAPH IV for eleven months, Keta only.



GARI IN RELATION TO CASSAVA (CASSAVA ASSUMED AS 100)

2.2.2 RETAIL PRICES

It is difficult to compare wholesale with retail prices because the volumetric measures used for retail sales are imprecise and in some cases very small by comparison with wholesale units.[1]

Seasonal Variations in retail prices Close conformity in seasonal fluctuations were evident between retail and wholesale prices, with minor exceptions in the case of fresh cassava. Seasonal swings about the average (=100) tended however to be slightly more marked in some commodities, e.g.

Maize	retail	80-130
	wholesale	85-129
Gari	retail	81-142
	wholesale	83-135
Groundnut	retail	80-120
	wholesale	85-117

Comparison of retail prices in towns and villages It is of interest to compare retail prices between villages and towns nearby where householders and their wives are in the habit of taking their produce for sale, generally in very small quantities. These prices vary fairly rapidly. Attention here is confined to three weeks' prices, in (a) Western and (b) Eastern villages of the Intensive Survey (see Table 2.2).

Comparability is prejudiced by patchy recording of many prices and by ill-defined units. The table shows:

1. some fairly wide variations between villages and between towns which have been somewhat muted by averaging three weeks' figures
2. a few wide disparities between individual and village averages on the one hand and town prices on the other, e.g. for shallots and garden eggs.

There is no very consistent pattern of price levels except that palm oil and P/K oil prices seem consistently higher in the villages, suggesting that there may have been local shortages during this period.

2.3 HOUSEHOLD PURCHASES

Goods which are not produced locally can be bought in the towns by the villagers or in the village shops. There are 18 shops in the eight villages investigated, varying from one in Akpokofe to three in each of Podoe, Waya and Toda. In all, 158 separate items were recorded as for sale in these shops, in the categories shown in Table 2.3.

---

1. e.g. Cassava is quoted by number of roots sold per 10np; gari, groundnuts, cowpeas are sold by the cigarette tin (of which there are probably some 440 to the bag).

Table 2.2

Selected Retail Prices 1971[1]

(1) Item	(2) Unit	(3) Podoe	(4) Kpomkpo	(5) Kpota	(6) Agodake	(7) Average (3)-(6)	(8) Ho	(9) Frankadua	(10) Akpokofe	(11) Dzalale	(12) Waya	(13) Toda	(14) Average (10)-(13)	(15) Kpetoe	(16) Dzodze
Yam	Single (np)	*[2]	-	-	-	-	-		23½	-	60	*	-	36½	-
Cassava	No. for 10np	3	6	4	-	4.33	4½	4	4½	3½	3	**	3.67	3	3
Plantain	No. for 10np	-	-	-	-	-	3	3	**	**	*	*	-	4	3
Gari	Cig. tin(np)	7½	5	5	5	5.63	5	5	5	5	2½	2½	3.75	6	3
Groundnuts	Cig tin (np)	10	8	8½	6	8.13	8½	7	10	6	10	7	8.25	**	10
Cowpeas	Cig tin (np)	**	-	11	-	-	10	8½	-	**	**	-	-	**	10
Bananas	No. for 10np	*	*	11	-	-	19	16	10	14	-	-	-	**	**
Shallots	No. for 10np	14	-	14	*	-	31	39	-	19	37	36	30.67	31	19
Tomatoes	No. for 10np	7	*	5	**	-	4½	4	3½	4	4	*	3.83	3	3
Garden Eggs	No. for 10np	13	**	8½	32	17.83	20	17	19	40	**	**	-	41	13½
Palm Oil	1 Bottle (np)	42	**	40	33	38.33	32	35	38	27	33	30	32.00	30	27
P.K. Oil	1 Bottle (np)	33	**	35	28½	32.17	25	28	26½	25	25	28½	26.63	25	*
Eggs	Single (np)	5	5	5	5	5.00	7	5	5	4½	5	3½	4.50	7½	8

1. Village values represent averages of three weekly checks in mid April, mid May and mid June 1971. The averages of these (Cols. 7 and 14) have been calculated only where three or four villages have price quotations.
2. Markets with discontinuous reporting.

Table 2.3

Items Available in Village Shops

	Total	Dominant Origin: From S.E. Ghana	Dominant Origin: Elsewhere in Ghana	Dominant Origin: From outside Ghana
Food	40	4	10	26
Drink	11	6	4	1
Tobacco	10	6	4	-
Medical	25	2	5	18
Toilet	16	3	11	2
Clothes	6	2	4	-
Household	50	1	25	24

Comparison of Prices as between Towns and Villages

Table 2.4. shows 19 items commonly sold, their village prices and how these compared with town prices, in April 1971. The table illustrates a fairly wide range of prices between village shops. Table 2.5 compares more closely village and nearby town markets. Though variable, some of the differences are very considerable with village prices being higher. This probably reflects the small quantities handled at the village shops and perhaps the services (e.g. having certain goods when suddenly needed, giving credit) which the village shops provide.

2.4 MARKET PROSPECTS

Events since the publication of Mettrick's report[1] have only tended to strengthen the general conclusions reached then. Bearing in mind the substantial rate in population growth in the country as a whole (for which the partial data available are given in Appendix IX) and in South-east Ghana itself, and taking into account the continuing economic difficulties that the country faces we may expect that:

1. The prices of agricultural products relative to those of other commodities are likely to remain buoyant in Ghana's present conditions.
2. Primary products for export are highly to be desired if they can compete in world markets, and it will be necessary to examine production prospects of any that can be grown in South-east Ghana.
3. Products substitutable for imports will also be valuable; cotton, tobacco and meat are examples.
4. The demand for foodstuffs, which are the chief components of agriculture in South-east Ghana will continue.

1. Mettrick (1971) Chapter 3.

Table 2.4

Retail Prices of 'Imported' Goods

Item	Measure	Village Shops			Town shops[1]
		No. of shops selling	Average price	Highest price	Lowest price	Average
			np	np	np	np
Sugar St.Louis	1 kg	18	36	50	30	29½
Sugar cubes	No./np	18	4½	5	3	4
Salt	Cig.tin	8	5	10	2½	2½
Evaporated milk	Small tin	18	10	-	-	10
Sardines	Square tin	17	15	17½	14	12½
Mackerel	Small round tin	18	14	20	12	13
Tomato paste	Small tin	13	10	12½	10	9
Rice	Cig.tin	12	10½	17½	7½	7½
Gari	Cig.tin	12	4½	7½	2½	3½
Mirinda	Bottle	12	13	15	10	10
Key soap	Long bar	14	64½	70	60	44
Sunlight soap	Long bar	15	14½	15	12½	11½
Omo	Small box	16	23½	25	7½	22
APC tablets	per 25	9	22½	30	15½	15
Elastoplast	Piece	13	2½	2½	1½	2½
Candle	Each	17	5	5	2½	5
Kerosine	Bottle	12	9½	10	5	7½
NMF Kade matches	Box	16	3	5	2½	2½
Small radio battery U2	Each	12	15	-	-	14

Table 2.5

Individual Village-Town Comparisons

No. of Items	Village	Town	Village minus Town prices as % of Town prices	Distance (miles)
14	Podoe	Frankadua	33·06	4
12	Akpokofe	Kpetoe	27·41	5
13	Waya	Ho	10·44	18
13	Kpota	Ho	36·70	18

1. The four towns counted were Frankadua, Ho, Kpetoe, Dzodze.

5. Seasonal swings in prices will persist until substantial investment in storage and/or irrigation results in smoother year-round supplies.

In briefly examining prospects for the region's major products attention will be given to local, home and overseas markets.

2.4.1 PROSPECTS FOR MAIZE

As Mettrick emphasised,[1] maize is the principal cereal consumed in Ghana, at around 60 lb. per head of the population per year. It is particularly popular in the south. Over recent years Ghana has been barely self-sufficient in maize and it is part of the Government's policy that it should be. On the other hand there is probably little prospect for Ghana to become an exporter. Maize prices in Ghana have been consistently higher than world market prices, and yet, as with other food commodities, supply has not matched home demand.

The home market is characterised by:
(1) rapidly increasing population but (2) a rather static level of living. Maize prices have risen unsteadily over recent years but apparently not markedly more than those of other starchy foods (except rice)[2] and not far out of line with the Consumer Price Index.[3]

South-east Ghana is not regarded as one of those parts of Ghana most suitable for the expansion of maize production. In the recent past the production of maize appears to have been expanding particularly in the Ashanti-Brong Ahafo area, while the Government has plans to encourage major expansion in the centre of the Volta Region, with, it is hoped, the financial assistance of the World Bank. From the point of view of the prospects for farmers in South-east Ghana, therefore, the main question is whether future increases in demand in the home market (which are likely at least to keep pace with population growth) will be satisfied by producers in other regions, or whether their own share of the market will be maintained.

Two notable characteristics of the maize market which should be noted in relation to future local policy are (1) the marked seasonal price swing and (2) the distinct qualities of 'dent' and 'flint' varieties

The price swing is characteristic of the Ghana market as a whole (in 1970 the monthly range was 20·84% above and 21·76% below the mean) and local markets keep closely in step. This indicates a strong case for local farmers to invest in storage between September-October and May-June in the following year.

---

1. Mettrick (1971) p.79.
2. See comparison of Accra with Kumasi and Tamale maize prices 1953/4 - 1969/70 in Rourke (1970) and Dalton (1971).
3. Ewusi (1971).

The consumption of eggs per head of the population is low in Ghana and there are signs currently of interest in increasing production in the urban fringes. This could increase the stimulus to expand production of Diacol and other 'flint' varieties.

2.4.2 CASSAVA

The market for cassava and cassava products is complex. On the whole prospects of an expansion of demand appear to be good, arising from both world and home market demand.

(a) Exports

Although Ghana exports very little cassava at present the potential market overseas needs careful consideration. Cassava chips, pellets and meal are used in the compound feeding industry as a substitute for cereals such as barley and maize and to a lesser extent wheat and rye. The degree of substitution depends on grain prices. Thus in the E.E.C. countries where, due to the Common Agricultural Policy, cereals are costing about £43 per ton compared with cassava at £27 per ton, cassava provides 5-6% of compounds. In the United Kingdom grain prices in the past have been lower and cassava has not been used. Cassava starch and flour are used for industrial purposes - notably paper making and paper box manufacture, adhesives and dextrines, textiles and laundry work, foundry industries as a bonding agent, in oil-well drilling, and others. Tapioca and some dessert foods are also prepared from cassava in High Income countries.

In the matter of feeding stuffs, which over the next few years appear to offer the most promising market for cassava, European importers (of whom Germany, followed by Netherlands and Belgium are the main) have tended to concentrate their buying from relatively few sources - notably Thailand, Indonesia and Brazil, often vertically integrating their production plants with supplying organisations. German processors have already shown a small interest in Ghana's cassava. (See Appendix VIII)

Currently the main interest centres on grain prices in the new member countries of the EEC, notably the United Kingdom. With the expectation of continued grain price rises within the EEC as a whole and the United Kingdom in particular, it is forecast that cassava will be introduced more widely into compound foods, rising in the U.K. to some 800,000 tons by 1978/9, representing some £20m at current cassava prices. Tariff regulations on cassava meal and chips[1] will restrict importation.

---

1. Consisting of a fixed element, representing a margin for the Community's processing industry and a variable element representing the levy payable on the grain equivalent.

From 1967 these charges represented 9% of c.i.f. prices.

The prospects for cassava in the starch market of Europe are probably of minor importance. African starch has to compete with high quality starches made from domestic sources and imported maize. U.S.A. however is a large importer of cassava starch, especially from Thailand, where Ghana might compete, given sufficient attention to quality and regularity of supply.

(b) Home demands

Domestic demand is an expanding one. Although there is a tendency to switch from root crops to cereals as incomes rise, rising population is currently a more important factor than rises in income. Moreover cassava has advantages over other roots in that it can be stored better and reduced in bulk for distribution. Also the textile industry which is expanding, and others, can be expected to increase their consumption of cassava starch.

South-east Ghana is situated close to the ports and urban consuming areas. There seems a very strong case for closely investigating the possibilities of expanded cassava production and processing.

2.4.3 GROUNDNUTS AND OIL PALM PRODUCTS

These commodities are less prominent than maize and cassava as sales from farms in South-east Ghana. Although there is scope for expansion (which will be discussed in Chapter 3) it is not likely that the scale will be such as to spill over into the world market where established supplies are already competing strongly for markets which are demanding high quality in (a) edible groundnuts (for confectionery and peanut butter) (b) vegetable oils, and (c) oil cakes,[1] and where, especially in palm oil, supply in the medium to long term may well outrun demand.

The home market for both commodities is however expected to be buoyant, providing as they do important items in the diet of an expanding population. It may be assumed moreover that the income elsaticity of demand is also fairly high[2] - a factor which will be of importance if and when Ghana's economy regains its former momentum. As with maize, the outstanding question is how far farmers in South-east Ghana may expect increased competition in the home market from other regions. While there

1. An important preoccupation of importers in recent years has been the identification and eradication of aflatoxin, which is associated with post-harvest spoiling through excessive dampness.

2. Following F.A.O. projections (1966).

are no specific plans for groundnuts, a plan to develop oil palms in the Kade area of the East Region has recently received the financial backing of the World Bank.

REFERENCES

DALTON, G.E. The Economics of Maize Production. Dept. of Agric. Economics. Univ. of Ghana. Mimeo, 1971.

EWUSI, K. The Rate of Inflation, Variation in Local Food Prices and the Effect of Transport Facilities, in Ghana in the Sixties. I.S.S.E.R. Conference Paper, March 1971.

F.A.O. Agric. Commodity Projections for 1965 and 1966.

INGRAM, Miss J.S. Selected bibliography on Cassava. T.P.C. Report No. G51, 1970.

INTERNATIONAL TRADE CENTRE UNCTAD/GATT. The Market for Manioc as a Raw Material for Compound Animal Feeding Stuffs in the Fed. Rep. of Germany, the Netherlands and Belgium, 1968.

The Market for Starch in Selected Industrial Countries. 1969.

ROURKE, B.E. Wholesale Prices of Starchy Foods in Major Urban Centres in Ghana. Dept. of Agric. Economics, Univ. of Ghana. Mimeo, 1970.

WINTER, J.D. The Market for Edible Groundnuts. T.P.I. Report G.36.

CHAPTER 3 POSSIBILITIES FOR IMPROVEMENT

3.1. INTRODUCTION

In this Chapter possibilities for improvement in the agriculture of South-east Ghana are discussed. These are supplemented, in five cases, by fuller statements in Volume II.

It has not been considered opportune to present a comprehensive and integrated set of suggestions for improvement or to estimate the risk-discounted expected net benefits which might flow from an optimal plan. These steps could only usefully be taken in relation to a Research and Development programme of the kind sketched out in Chapter 4. Nevertheless the need for thinking ultimately in terms of total systems is acknowledged.

Some preliminary thought has been given to services and land preparation. Attention has been then given to the improvement of current lines of production. The possibilities of cotton, tobacco, cowpeas and small livestock, none of which figure prominently in the area, have been touched on. The problems of increasing power for production and processing activities have also been mentioned.

3.2. INFRA-STRUCTURE

3.2.1. ROADS AND TRANSPORT

Here it is intended only to give a tentative answer to the question:- 'How do the costs of road improvement compare with possible savings in transport costs?'

Present conditions

There has been considerable recent improvement in the roads of Ho District which have raised facilities (in relation to popular demand) in this District at least to the level of the others in South-east Ghana. The metalling of Ho-Denu and the creation of all-weather feeder roads Sokode-Juapong and Ho-Adaklu Abuadi have been the main elements. Nevertheless, villagers in the more remote villages, like Agodake and Toda amongst those intensively surveyed, complain of bad travelling conditions.

Transport is to a large extent organised from the market towns though there are a few villagers who have lorries. Vehicles are all privately owned. The main vehicles used and their rated capacity in terms of passengers are Bedford (22), Toyota (15), Datsum (13), Nissan (19), Benz (22) and Commer (16).

Virtually all vehicles are petrol driven; diesels are disliked by mechanics because of unfamiliarity, although their advantages - such as longer life, higher m.p.g., greater reliability - are recognised.

Organisation of services is fairly highly developed. In Ho, for instance, each vehicle park has an elected overseer, who is paid from contributions[1] made by vehicle owners, and whose function is to regulate the flow of vehicles to various destinations and their times of departure. Newcomers are under some pressure to join the system, within which help is given in case of breakdown and other difficulties.

Mammie trucks (mostly Bedfords) are tending to be replaced by faster and more comfortable vehicles for passenger transport on the main routes but they are still used for mixed passenger/goods on the less busy routes. Transport for the two purposes is being increasingly differentiated.

It is estimated that about 50% of drivers own their vehicles; the remainder are owned by small entrepreneurs with 2-4 vehicles each.

Rates for goods transport are variable with distance, season, nature of the road, and type of goods (which includes the bulk/weight ratio and the kind of packing required). They are subject to negotiation. It is common to find however that, in general-purpose mammie trucks, which may not carry more than two tons, or 22 persons, that the charge per 220 lb bag of maize = one person. Baskets, for instance of oranges, frequently cost 30% of a passenger fare.

Possibilities of change

Changes regarded by the local people[2] as desirable would include

1. lower transport charges
2. more frequent services (including institution of services to villages not yet reached).

The transport rates for journeys out of Ho are such as to suggest that they may be related to road surface roughly in a ratio of 1 (metalled) : 2 (feeder) : 2·5 (unimproved). Penetration to the more remote villages at infrequent and irregular intervals will cost even more.

---

1. Which also cover insurance. A sum is paid by each driver before each recognised journey.

2. There has been considerable criticism of transport especially of foodstuffs at the national level where it has been pointed out by Ewusi (1971) that while the number of cars increased by 71·6% between 1956-68 the number of trucks fell by 32·7% and that there was a deterioration in age of trucks in use by 46·7%. Ewusi argues that rises in food prices, a major contribution to inflation in the 60's were much related to transport problems.

An F.A.O. report of 1968 quoted by Ewusi (1971) while showing very wide variations from place to place, gives rough mean transport rates of 5np and 20np per ton mile for goods carried on trunk and feeder roads respectively. This is a bigger differential than mentioned above.

Information gathered in the Survey villages suggests that transport charges of the order of 10, 20 and 25 np per ton mile represents the average current picture, on metalled, feeder and bush tracks respectively.

This order of charges, or by implication, the savings to users that might immediately result from improving the roads (that is, not counting increases in traffic flow that might ultimately occur) has to be set against the costs of road improvement. If consideration is limited to feeder road building, it is interesting that a recent report (Owusu F, 1971) set out the design standards being observed in the national programme as:

Volume of traffic (v.p.d.)	More than 25	10-25	less than 10
Width of gravel surface (ft.)	20	16	12
Min. width of cleared right of way	50	46	40
Estimated cost/mile (N¢)	12,500	10,500	8,300

Bearing in mind that S.E. Ghana is flat savannah country, these figures are probably high. Moreover economies are being introduced, which include narrower minimum widths of cleared right-of-way and higher maximum gradients. Nevertheless, even if cost per mile were only 52% of those tabled,[1] that is N¢7,150 N¢6,000 and N¢4,750 respectively, this still represents a major investment.

Given these rough data, and bearing in mind these gravel roads have high maintenance cost (the National programme has allocated N¢500 per mile per annum) and short life (Owusu suggests only 3-5 years), and adding interest at 10%, the annual charge on the smallest road would be of the order of N¢1,600 per mile.[2]

At ten vehicles per day, carrying two tons each, throughout the year, a reduction of 5np per ton mile means a saving in transport charges on each mile of only N¢365.[3] It therefore appears that <u>either</u> a radical reduction of road building costs <u>or</u> a radical increase in traffic carrying goods and/or passengers would be necessary to justify this kind

1. 1/3 less than national average, with 1/7 saved in economies.
2. This compares with N¢1971 in estimates in a feeder road study by Onyah et al (1971) for Krobo villages.
3. This may be rather low. Onyah et al (1971) estimate estimate savings on <u>running</u> costs of 6·7np and driver's time 0·165np.

of expenditure. The possibility of self-help, using labour with low opportunity cost, needs to be investigated, therefore, as well as, eventually, the stimulus that an improved road would probably give. There is considerable miscellaneous evidence from data recorded in Chapter 1 that villages served by good roads have many social and economic characteristics at variance with those of bush villages, which may indicate that increased accessibility has resulted in social benefits; the effect on land use is less obvious.

3.2.2. WATER SUPPLIES FOR HUMAN DRINKING[1]

General

A pre-requisite for survival, water for human consumption was shown to be a widespread preoccupation of householders during the Reconnaissance, when supplementary questioning on this was carried out in each village. Physical characteristics conducive to shortage are (1) in general a lack of groundwater due to the closeness to the surface of Archaean rocks over much of the region, (2) low, seasonally uneven and unreliable rainfall, to which are related seasonal and unreliable stream flows.

While a few villages have pumps, the majority rely on (a) seasonal streams (b) natural standing pools (c) dug-outs and dammed reservoirs (designed for cattle) and (d) rainwater catchment, mainly from house roofs. Most families have access to a combination of sources, which varies with the season. The distance to water increases in the dry season; this increased effort, which falls chiefly on the women and children thus tends to conflict with harvest and post-harvest rather than with field work.

There is clearly a strong case to increase water supplies for human use for more comfortable living, to improve the quality of water, and if possible to shorten the time taken in obtaining it. Rainwater catchment seems to be the best solution, having the chief merits that first, it is available everywhere, and second, when properly caught and conserved, it can provide high quality supplies.

There are two alternatives:

(i) household catchment[2] either from roofs or nearby ground surface, constructed largely by self help,

(ii) dug-outs and dams constructed by public authority for community use (perhaps combined with stockwatering and irrigation).

---

1. A detailed examination of Water Supplies in Kpomkpo is included in Volume II of this Study.

2. Roof catchment from schools and other public buildings, and ground catchment by co-operating groups would have the advantage of economies in construction, though their control might raise problems.

Catchment tanks

The size of catchment tank is determined by:

(a) the average daily consumption of the household

(b) the length of the dry season.

The length of the dry season is roughly two, three and four months at Ho, Akuse and Keta respectively. If we assume five persons per household, using ten galls/day each[1] or 1,500 galls per month, then the tank size, assuming no additions during this period, would have to be 3,000, 4,500 or 6,000 galls. The catchment area would need to be such as to ensure that the tank is full at the end of the minor season. Because occasional rains can be expected in the dry season, the risk of the tank running dry would be reduced.

The calculation of the optimal catchment area and tank size for any location will depend on the materials available for catchment area and tank respectively, as well as on the soil structure, topography and rainfall regime. These construction costs are currently under study by the Intermediate Technology Development Group. There is a variety of possibilities e.g. for catchment area - cement-stabilised soil, polythene sheet or, in some areas perhaps merely beaten soil; for tanks - concrete, concrete blocks, constructions combining polythene and cement.[2] Until costs can be calculated for varying site conditions, it is hardly possible to carry out the complex estimation of the best combination of catchment area and tank, or indeed the establishment of the case for complete or partial supply by this means. It is of interest however that the building of concrete tanks on current design has been costed as follows:-

A circular concrete tank with capacity of 5,000 galls (Internal radius 6', depth 8', walls 0·3' thick) would provide 20,400 galls., allowing 1,700 galls extraction per month and an average reserve of 1,600 galls at the end of the dry season. The capital cost would be some N¢ 184, giving an approximate cost per 1,000 galls of N¢ 1·16.[3]

---

1. Ample for drinking and cooking, with some for personal hygiene.
2. Already tried in Sudan, Botswana and Swaziland.
3. Calculation was based on the following:

		N¢
(i)	140 cu.ft. of concrete requiring 3,920 lb cement (specified by Bateman)	54
(ii)	galvanised roof	33
(iii)	skilled labour for concreting	24
(iv)	110 sq.yds. catchment (which would have to be larger further south), at 25np per sq.yd.	27·5
(v)	pump	15
(vi)	fence	30

assuming (a) a life of 20 years, (b) interest rate at 8% and (c) monthly rainfall of 4" over 10 months.

(Source: G.H. Bateman, (1972)

Water supply by improved roofing

The catchment area required for self-sufficiency is likely to be larger than the ground area of a typical house. In crowded settlement, ground catchment may be difficult to organise unless it is distant from the dwelling. Roofs clad in galvanised iron, aluminium or tiles provide a ready-made catchment surface.

Improved roofs provide their own material benefits (and disadvantages) and are also regarded as prestige symbols. They are expensive and their introduction could not be entertained for water catchment alone.

Thus, for a typical house with a 40 sq.yard floor area, with roof dimensions of $33\frac{1}{2}$' x $14\frac{2}{3}$', costs are as follows:

		NȻ
(i)	Grass roof erected by householder	11·80
(ii)	Grass roof erected by contractor	19·80
(iii)	Galvanised iron roof erected by householder, with carpenter's assistance, using galvanised nails	173·00
(iv)	Aluminium roof, using galvanised nails	178·20

This compares with cement-stabilised catchment area @ 25np per sq.yd., costing only NȻ 10.

Tiles are not currently being used for roofs in the survey area but it is believed that the pottery industry at Dzalele might be well advised to produce them. Recent trials producing 1' square tiles demonstrated the feasibility. Assuming 1,000 tiles were necessary for the above roof, these would have to be produced for NȻ 120 to achieve break-even with galvanised sheeting, at the same time making adequate allowance for extra paid labour. Even with small quantities produced in the trial the potters were prepared to sell at 10np per tile. Transport costs would rather strictly limit the radius of distribution of such a bulky article. Materials and skills would have to be widely spread if tile roofs were to become common.

Assuming that metal or tile roofs are favoured anyway, the cost of turning them into catchment areas depends on the guttering and piping required to carry the water to storage. The cheapest guttering is probably locally grown split bamboo of 6" diameter, available in 12' lengths in some villages. But the most commonly used material at the present time is 4" diameter guttering made out of 7" wide strips cut and re-shaped from galvanised iron sheets. $33\frac{1}{2}$' of guttering thus costs about NȻ 2[1]. Galvanised piping costs up to NȻ 60 per 22' length. Two drop buckets at the junctions of guttering and pipes would add NȻ 7. Roof catchment,

1. Conversion of galvanised sheets seems a needless cost; it should be possible (perhaps for Government) to organise cheap supplies of suitable design.

given the existence of the improved roof, could hardly be completed for less than N¢ 50.

Improving water quality in tank storage

High quality water can be obtained by leading roof rainfall immediately to a covered tank. Surface catchment, particularly if the surface is subject to human or animal trespass, will require filtration. Unfortunately, if a sand filter is incorporated into a catchment tank its storage capacity will be reduced. When the calculations indicated above have been done the cost of filtration can then be added. It may be that a distinction ought to be made between drinking and other water supplies to the village, two types of catchment being devised for the two purposes.

Purity of water once stored might be economically maintained by two other quite cheap devices:

(a) the use of a semi-rotary pump, costing N¢ 15-30 would prevent infection of the water with dirty buckets at the same time as reducing the effort of lifting

(b) a layer of oil on the water would prevent the laying of eggs by mosquitoes (recognised in some villages as a potent hazard of water storage) and at the same time reduce surface evaporation.

Catchment in dug-outs and dams

Since 1958 the Ministry of Agriculture, through its Irrigation Reclamation and Drainage Division has been developing dug-outs and dams in Southern Volta. By early 1970 42 dug-outs and 43 dams had been completed and many more are in process. Dug-outs are on the average the smaller form of storage (averaging 10,567 cubic yards excavated, ranging from 2,200 - 54,400 cubic yards) as compared with the dams (averaging 25,623 cubic yards excavated, ranging from 3,000 to 83,300 cubic yards). With only three exceptions they have been for cattle watering, but water shortage is such that a number, even though lying some distance from a village, are used for human drinking in addition. Excavated by bulldozer at an estimated average rate of 70np per cubic yard moved, they represent a cheap form of water provision probably at about 0·2np per 1,000 gallons stored.[1] As sources of human drinking they suffer from the serious disadvantage of impurity, which would be virtually impossible to correct in the dug-out and which would require a filtration plant at a controlled outlet in the case of the dam.

---

1. It does not follow that all the water is used, however.

3.3. MAINTAINING AND IMPROVING LAND PRODUCTIVITY

3.3.1. INTENSIFICATION OF LAND USE

As population grows, and assuming that no major opportunities for employment appear elsewhere in Ghana, the raising of land productivity in South-east Ghana is likely to be of increasing importance. This can be considered in two possible phases (a) retaining the present system of shifting cultivation (b) replacing shifting with continuous cultivation. The latter requires heavier initial investment in clearing and probably also in cultivation equipment to keep the cleared areas free of weeds. It can only be contemplated if and when the capital can be found and when it can be ensured that costs and returns for a much more intensive form of agriculture will be favourable.

There is much to be said for continuing rotational cultivation in some form which makes use of natural regeneration of fertility; (1) soil fertility can be maintained without large cash expenditure (2) soil erosion tendencies are arrested, (3) soil water flows are probably steadied on sloping land, (4) the effects of epidemic crop diseases are reduced. On the other hand it has already been reported that in this region the amount of land that can be cleared in one season by a household is smaller than they would wish and that, at least in some village environs, population pressure is such that there is insufficient time for the natural regeneration of the fallow. The use of small scattered plots also has other disadvantages: access is difficult making the carrying in of inputs and carrying out of products very costly in time; vermin from the forest, birds and (sometimes) stealing, reduce production; and seasonal firing of the undergrowth for hunting purposes increases risks, especially in respect of tree crops.

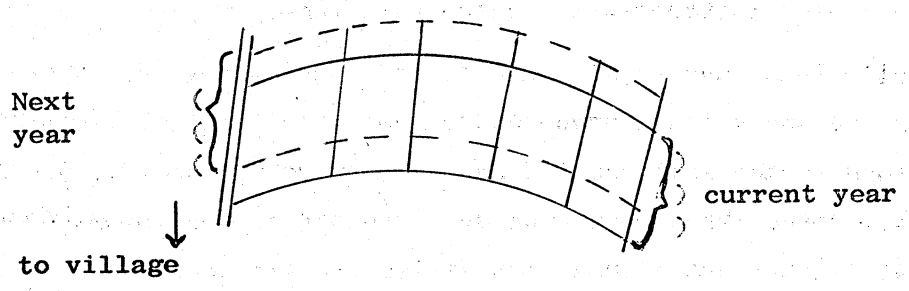
Phase (a) In those areas where sub-regional population density is still under about 50 per sq. mile.[1] and soils are easily cultivated by hoe, it is worth considering a modified form of shifting cultivation. The objective would be family holdings (perhaps more than one farm) of up to 10-15 acres. The land would be cleared in zones,[2] one household's land marching with another, each zone approximating to an arc of a circle whose centre is the village centre, the arc abutting on one of the motorable tracks radiating from the village. Each zone would be moved either away from or toward the village by one third of its width every year. After an adequate period for

---

1. At 54 per sq. mile, assuming even use of land it is theoretically possible to cultivate for three years in 18, providing two cultivated acres per member of the population.

2. This suggestion is not very dissimilar from the 'paysannat' system (see Allan, 1965).

natural regeneration the same ground would be traversed again. The main advantage of such an arrangement would be that all village land would have access to a motorable road, either direct or alongside a neighbour's plot; thus:



But there could be other economies, including sharing of transport vehicles, reduced vermin troubles, eligibility for ADB maize loan.

Such a system would depend on three factors, namely (i) a way of speeding up land clearing which is the main labour constraint, (ii) willingness to co-operate between households, (iii) reasonably uniform land quality. One of the tools required for the first - a power saw - may already be available. Power saws have recently been used in the area for cutting for charcoal (see Vol.II Ch.5). There are signs too, for example at Waya, that householders are prepared to work co-operatively in their own clans. Success in one village might encourage others. Moreover, given basic co-operation in groups, possibilities of other co-operative enterprise mentioned below might follow.

Where clearing in this manner raises soil erosion problems, the planting of oil palms by each householder on the contour might be incorporated in the design, as well as suitable patterns of other crops.

This innovation is of such a kind that only a field trial could determine its practicability.

Phase (b) In areas of dense population or on very heavy soils (in the future) continuous cultivation may be unavoidable.

Mechanised clearing by heavy power units, which includes removal of all trees and stumps, currently costs N¢ 34 per acre[1] (compared with the current contract price of clearing undergrowth and small trees by hand of N¢ 6-7). The subsequent mechanical ploughing and harrowing, generally dispensed with in shifting cultivation, costs N¢ 6 per acre. The thin topsoil layer carrying most of the nutrients may be less available after mechanical preparation, being either disturbed horizontally or buried rather deeply. Only addition of fertilizer will ensure equal performance in the first year.

---

1. These contract rates do not cover costs of operation in present circumstances.

Being costly, mechanical clearing implies cultivation continued over much more than 3 years, if not permanently. Substantial weed growth, particularly perennials, is therefore inescapable and mechanised weeding or chemical weed control will become essential.

While loans may be obtained for such mechanical processes, it is unlikely that many local householders could contemplate independently a sudden leap to the scale and intensity of farming implied, at least until personal fortunes have been expanded by enlarged operations under shifting cultivation, non-agricultural activities or some combination of the two.

3.3.2 SOIL FERTILITY MAINTENANCE

Inseparable from the question of the intensity of cultivation is the maintenance of soil fertility; cropping intensifies with shorter fallows, and the regenerative powers of natural vegetation and soil become less and less effective. The tendency to decline is faster where soils are mineralogically poor and water relations are less-than-optimum - that is, where drainage is either impeded or precipitate. Radically new approaches to soil fertility maintenance will therefore be required over much of South-east Ghana if increased productivity per man is to be achieved on a lasting basis and without a large net decline in population.

There are four possible strategies that can be followed:

(a) intercropping
(b) to introduce rotational farming specifically designed to maintain soil fertility,
(c) to apply organic fertiliser derived from the composting of wastes and faeces of animals and humans,
(d) to apply artificial fertilisers.

Very little thought appears to have been given by researchers in Ghana, to the interaction of crop plants grown either together or in sequence.

Intercropping is already widely practised by farmers in South-east Ghana. Contrary to the tendency for technologists to think and experiment only in terms of single stands, the characteristics of the local physical environment as well as other constraints might well argue for an expansion of this practice, particularly if population pressure increases.

The general issues have been rehearsed by Parker (1969). Detailed empirical analysis and experimentation have been done in the rather different conditions of Northern Nigeria (Norman 1971, Andrews 1972), where it is claimed that

intercropping results both in higher returns per acre and a higher degree of security. Trials in the conditions of Southeast Ghana are required.

Two main rotational alternatives[1] require consideration:

(a) rotation of arable crop plants,

(b) alternating arable crops and leys.

The rotation of arable crop plants has been shown to be effective in a number of tropical situations. The main complementarities are to be derived in the maintenance of soil nitrogen and in the suppression of weeds, pests and diseases.

In South-east Ghana it may be expected, for instance, that mutual benefits would arise from the alternation of leguminous crops and N-extracting food and cash crops. Groundnuts and cowpeas are plants already known and valued that fall in the first category; maize, cassava, tobacco, cotton, rice and sugar, in the second category, are either grown or to be considered.

Groundnuts and cowpeas, though differing in habit and type of product, both provide fairly rapid ground coverage when successfully grown, and restore soil N. The N-extractive food and cash crops, if planted in rows, afford opportunity for efficient hand or mechanical weeding or the use of weedicides.

The high speed of oxidation and leaching means that rotations should be planned for major and minor seasons in continuous succession, care being taken to diversify, however, in such a way as to reduce conflicts in demand for labour.

The use of leys as a restorative following a sequence of arable crops depends on the practicability of introducing grazing livestock (see 3.6.5-3.6.8 below). In the lowland tropics, mixed husbandry incorporating sown grassland - as distinct from naturally regenerated grassland - is rare. Substantial costs arise in stock control, watering, hygiene and dry season feeding, and, in the absence of a fodder legume capable of production without irrigation, the benefits to the arable break are likely to be small.

However, in the long run, the use of leys in a pattern of mixed farming might have substantial advantages. Centrosema pubescens, Glycine javanica and Stylosanthes gracilis could all be grown in South-east Ghana. Centrosema would probably be the easiest to establish; it already grows well locally. Further investigation of these herbage species would be valuable.

---

1. The possibility of growing woody leguminous species does not seem a very attractive proposition on the evidence available, due to difficulties of clearing.

Organic fertilisers

The very low organic matter content of many of the South-east Ghana soils implies that any technique capable of increasing it should be investigated. There are two possibilities:

(a) green manuring

(b) application of crop composts and animal manure.

Green manuring increases the area that must be farmed, it constitutes a cost in itself in materials, and for effective ploughing-in before cropping on the rains, it requires mechanical power. Given the funds and power units however, green manuring could well produce a stimulating effect at an economic cost on light soils.[1]

Crop composts and animal manure in most situations require considerable human effort in the making, as well as better transport than head-loading (which still dominates the economy of South-east Ghana). The source of material can be night soil[2] and household wastes, crop residues either at the field or after processing at the homestead, and manure from livestock. The first four of these five categories are already available in these villages, and cattle are kraaled in the southern part of South-east Ghana; yet very little organic manure is made and applied. It is particularly noticeable that little use is made of maize stalks and other foliage left at harvest.[3]

The difficulties of transport and the labour load are probably not insuperable. If organised clearing (as described in Section 3.3.1) is introduced, fields should be much more accessible to village roads. The use of small carts manhandled and, later, larger carts hauled by tractor, should then be feasible, and waste materials could be concentrated. The extra labour requirement would chiefly relate to materials carted from homestead to land; the assembly of waste in the field at harvest time would probably form part of reorganised harvesting procedures, like the improved stripping of groundnut pods. Pressure on family labour by some standards is even now not very heavy and will be further eased by the use of improved methods in processing and land clearing. Early trials are required to assess the returns to labour likely to be achieved from making and using organic manure; they are likely to be highest on high value crops like vegetables.

---

1. Guinard (1967) reports successful use of a two-three year green manure crop (Stylosanthes) after two or three years of biannual cropping with rice and cotton in Ivory Coast.

2. The hazards to health associated with all methods of sewage disposal make it essential that, in development planning for an increasing population, a comprehensive approach be taken to the expansion of agricultural systems and social services.

3. Too hurried clearance may result in soil erosion during rain storms.

Where grazing livestock can be spatially associated with arable crops the direct grazing of crop residues provides a labour-saving way of spreading manure. But this probably requires a degree of individualisation of grazing herds and cropped and grazed land which as yet does not apply in South-east Ghana. The case of the Serere in Senegal[1] might be taken as a model, where biannual rotation of millet and groundnuts with almost no fallow is maintained by the systematic folding of cattle at a density of some 140 head per 100 hectares, while an equal area of land is kept in permanent grazing. (A leguminous tree, Faidherbia albida, provides additional grazing in the dry season in this case.)

Artificial fertilisers

Very little mineral fertiliser is so far used in South-east Ghana. In part it is replaced by the burning of vegetation when land is cleared. The potential returns to fertiliser are imperfectly known. As cropping periods increase in length, scope for their use is likely to increase. On the poorer soils lower levels of application are likely to be most economic. The knowledge currently available is reviewed under specific crops below.

3.3.3 IRRIGATION

The case at least on technical grounds, for adjusting the availability of water to plants in South-east Ghana is a strong one. While temperature is sufficient for growth throughout the year, major water deficiencies occur in the long (November-March) dry season and short (July-September) dry season, with increasing seriousness towards the south. Moreover the rainfall received is uncertain in timing and incidence.

Irrigation is conceivable at three levels:

(a) as a large-scale scheme along both banks of the Lower Volta; plans have resulted from detailed surveys by consultants but, so far, no development has taken place,

(b) as one use for water collected in catchment tanks, dug-outs and dams; a few dams are currently being developed with irrigation incorporated, by the Irrigation Division of the Ministry of Agriculture,

(c) on a small scale, at numerous sites along the small rivers that drain southward towards the Lower Volta; there has been no exploitation of these rivers as yet.

It is small scale irrigation of the third type that is briefly discussed here.

---

1. See Ruthenberg (1971) p.121.

Basic approach

River courses are widely distributed through South-east Ghana; they are seasonally very variable in flow; some are perennial. A high proportion of village sites are associated with these streams; their banks are therefore accessible to a large number of cultivators. Though variable in detail there appear to be patches of river bank suitable for irrigation and cultivation.

In these circumstances water could be lifted and distributed by pumps driven by diesel engine to a point where field channels would be supplied. Powered distribution through pipes would be required to (i) reduce the disadvantages of local variations in topography and (ii) reduce excessive seepage losses in porous soils. It might be desirable to reduce seasonal fluctuation in stream levels by constructing weirs or small dams.

Pumps would be small and might be fixed or mobile between (say) two or three sites depending on the distribution of irrigable area. The distribution of irrigable land is such that a small acreage might be found in a large number of villages thus providing a supplement to the existing cropped area, where intensive and more reliable cropping can be practised.

A method of development would be required which would recognise the benefit of irrigation to the community as a whole but which would place responsibility for rather skilled farming on a fairly small number of villagers.

A cropping programme would have to be designed to take advantage of an expensive water supply, to coincide with market requirements; these would vary from place to place depending on accessibility to town markets, and over time as taste is developed for new vegetables and fruits or, possibly as the potentialities for cotton and other cash crops are improved.

In short, it is visualised that, as population grows, pressure will increase to improve the productivity of land, in particular that land which, by virtue of location close to supplementary water, is likely to show greatest returns.

Local possibilities

Inquiries were made in two areas within the villages intensively surveyed: (a) the Todzi between Waya and Toda and (b) the Alabo at Kpomkpo.[1]

1. 1958 aerial photographs were useful in (b).

After initial selection of sites from maps, visual inspection, assisted with soil pits, was used to classify land as (i) unsuitable, (ii) suitable for low cost small scale irrigation, and (iii) suitable for larger scale irrigation but with higher water supply costs.

Twelve areas were inspected along some eight miles of the Todzi; three areas totalling some 40 acres and four areas totalling some 146 acres were identified as falling in categories (ii) and (iii) respectively.

Along about the same length of the Alabo, 21 areas were inspected; four areas comprising about 31 acres and four areas comprising 167 acres were similarly identified.

In respect of the Alabo area, preliminary calculations were done of (1) the amount and timing of irrigation required to maintain plant growth through three seasons of 17 weeks, starting in early May; (2) the capital and running costs of supplying water to ensure sufficient supplies, watering every 10 days; (3) the likely order of gross margins to be derived from growing vegetables.for small schemes.[1]

Broader Implications

Taken together with what has already been said about water supplies for human consumption and what is said below about livestock it is suggested that the first requirement is that the water resources of South-east Ghana need careful investigation as a whole to determine how they can best be developed in an integrated programme. Such a programme requires estimation of current supplies of water (1) by streams from outside the region (2) by rainfall within the region before and after utilisation by vegetation, direct evaporation and humans and animals. Against this picture of supply it would be possible to examine the effects of different kinds of development using more water.[2]

At the same time the above suggestions about the possibilities of irrigation make it imperative that small scale trials of local irrigation be carried out to establish the parameters affecting its feasibility.

Armed with these two kinds of information, if the results of the trials are promising, land survey, especially but not exclusively along stream courses should be carried out to establish irrigable sites.

---

1. The detailed results of this inquiry are given in Volume II, Chapter 2.

2. Plans for utilising upstream waters of the Todzi and Alabo (for urban drinking water and sugar production respectively) would reduce water available in South-east Ghana and should be included in any general appraisal.

Finally, an extension unit specifically adapted to educate the local people in this form of agriculture might well be considered. This would depend, of course, on the way extension develops in the region during the period of the survey and trials phases.

3.4. MAJOR CROPS

3.4.1. MAIZE

Varieties

Maize is currently receiving attention from breeders at the Crops Research Institute, Kwadaso. Notably the palatable white-grained Composite 2 has been produced by hybridization, giving an average yield at various trial sites in 1969 of 3,900 lbs/acre.[1] High lycine, lodging resistance and other valuable characteristics are now being added.

So far Diacol (from Colombia) is the only new variety (non-hybrid) widely available to farmers in the Volta Region.[2] Composite 2 is likely to be more acceptable for human consumption on quality grounds. At present the dominant requirements for a successful variety are (1) a soft floury endosperm (2) growing periods suitable for (a) the Major season and (b) the minor season and (c) for late replanting in the Major season, (3) disease and pest resistance. It is unlikely that very rapid and complete displacement of local varieties by new varieties can be achieved under Southern Volta conditions. The best that can be hoped for is a slow improvement of the local gene pool by continuous selling to local farmers of new material.[3]

Although the improved varieties can be expected to outyield local varieties in the Major season no promising new variety for the minor season is yet in sight.

Fertilising

It has long been established that nitrogen and phosphorus are important nutrients for maize. Doubts about economically optimum levels persist however, due to paucity of local trials and the persistence of conditions compounded of year-to-year rainfall fluctuations and traditional methods of cultivation.

Factorial trials carried out by F.A.O. in Major 70 in Kpota (West) and Dzalele (East) gave the results shown in Table 3.1. for plots cultivated by hand.

---

1. This compares with yields of traditional varieties grown commercially estimated at 700 lbs/acre.

2. Ghana's current seed multiplication programme is referred to by Mettrick (1971) p.46.

3. The same argument applies to animals and hybrid vegetable seeds.

Table 3.1

Experimental Plot Yields (lbs/acre)

		KPOTA				DZALELE			
		- - - - P_2O_5 -				- - -			
	Units	0	40	80	120	0	40	80	120
	0	1120	1370	1417		910	1040	1174	
	40	1620*	2491	2045		1515*	1964	1761	
N_2	80	2126	3129	2734		2126	1846	2152	2107
	120		2167	1981	2531		2851	2643	2932

* Values interpolated assuming linear trends

Optimal application will depend on prices of grain and fertiliser and on discounting for uncertainty particularly as this arises from rainfall. If it is assumed that the mid-winter maize price, adjusted for storage losses, is about N¢ 10 per 200 lb bag and that the subsidised prices for ammonium sulphate is N¢ 2 per 20 units of N,[1] and for compound fertiliser is N¢ 2·80 for 15 units of N.P.K., then, on these trial results the application of fertiliser will pay at all levels tried. (See Table 3.2)

Table 3.2

Incremental Return to Fertiliser Applications
(N¢ per acre)

	Units	Kpota trials Added Value (V)	Added Cost (C)	V-C	V/C	Dzalele Trials Added Value	Added Cost	V-C	V/C
(1)	40N	20·0	4·0	16·0	5·0	30·3	4·0	26·3	7·5
(2)	80N	50·3	8·0	44·3	6·3	60·8	8·0	54·8	7·6
(3)	45N, $45P_2O_5$, $45K_2O$	68·6	8·4	60·6	8·2	52·7	8·4	44·3	6·3
(4)	90N, $90P_2O_5$, $90K_2O$	80·7	16·8	63·9	4·7	62·1	16·8	45·3	3·7
(5)	135N, $135P_2O_5$, $135K_2O$	70·6	25·2	45·3	2·8	101·1	25·2	75·9	4·1

The absolute margin over fertiliser cost appears highest at dressings (4) and (5) in Kpota and Dzalele respectively but the ratio of income to cost

1. It might be necessary to add lime to neutralise the effect of acidity.

is better at lower applications.[1] If the fertiliser subsidy were removed and its farm-gate price therefore doubled, net value added would still be positive at all levels on these data. From the national point of view dressings (2) and (3) would appear to be optimal. Risk of rainfall being either deficient in the growing season or excessive at harvest would almost certainly justify a reduced application from the farmer's point of view.

Interest in fertilisers among the householders in the survey area was found to be very lively. It would seem that adequate supply of fertilisers might have positive results, therefore. This must probably be by way of government (i.e. the agricultural assistant, extension) in the first instance.

There is clearly scope for repeating these trials to establish optimal applications over a number of seasons, both Major and minor. The opportunity should be taken at the same time to establish the most effective method of application.

In addition a workable credit system needs to be devised to facilitate the purchase of fertilisers.if, after more comprehensive planning, working capital can be shown to be a limiting factor.

Drying and storage

Householders expected maize prices to rise between September and March by some N¢ 6 per bag. But they also estimated grain losses over this period at 20-25%. There is therefore obviously a strong case for improvement of drying and storage methods.[2]

Maize cobs are commonly left standing some six weeks in the field to dry. Humidity and rainfall are such however that moisture content is still about 17% at harvest and infestation by weevil has already begun. A simple drying device is therefore desirable. A few driers with a batch capacity of about one ton have been set up by U.S.A.I.D. in nearby villages using oil drum air ducts, cement block construction and wood fires. This requires

1. $\frac{V}{C}$ is of course relevant to farmers' choice in deploying scarce cash reserves. For instance, where land and labour are otherwise plentiful some may prefer to spend similar funds on labour for clearing and for extra seed. It is argued rather loosely by some that the value-cost ratio should be at least 2:1 to allow for the additional costs of application on harvesting resulting from fertilising. For instance, see W.R. Sherman, Research Memo No.14 U.S.A.I.D. Accra, May 1970. But this argument appears to assume too high an opportunity cost for the extra labour involved, and also to assume that the output:input relationship is linear.

2. Useful studies have recently been made by F.A.O. and the Ghana Ministry of Agriculture. Rawnsley (1969), Hopp (1971). Discussion was carried further by Dalton, G.E. (1971).

about N₵ 50 to construct and an organisation to run it and has not so far led to any enthusiasm among other villages to copy. Consideration is required to the most suitable (a) size of drier and (b) fuel.

Preliminary impressions are:-

(a) the size of drier most suitable might be that designed for one or two households with an annual throughput of 1-2 tons, built entirely of local materials and avoiding expensive items like oil drums. One of these is described by Rawnsley (1969) consisting of a vertical clay cylinder with thatch roof, the cylinder divided by a transverse clay heat-exchanger[1] separating upper container and lower fire box. Driers of this kind are already in use near the coast in the Volta Region for smoking fish.

(b) a number of fuels are possible including solar energy, wood or charcoal, methane of vegetable origin, hydrocarbon fuels, or waste heat from diesel exhausts or cooking fires. Further thought needs to be given to all but the first of these.

Storage involves (a) 'housing' and (b) phytosanitary measures. The Ewe 'maize-barn' is a commonly used construction even beyond the tribal area. Protection from rain is adequate but cobs, already infected when stored, continue to deteriorate - though cross-contamination between cobs is reduced by retention of the husks. As a result, total loss of some 40% of the crop over a year's storage is not uncommon. Two methods of control are described by Rawnsley (1969). (1) The fumigation of cobs in a plastic envelope, before stacking in a traditional barn at which time an insecticidal dust is added to discourage subsequent attack. (2) Fumigation of shelled maize in jute sacks with a polythene lining.

The first alternative, which represents least disturbance to accepted practices, is estimated by Hopp (1971) to cost 30np per bag equivalent, in addition to the 6np already incurred in barn storage.[2] Storage of the Major season crop without treatment was estimated to yield 5% return on capital per month until November and no return after January, whereas, with treatment, returns exceeding 5% per month were estimated for sale in November-January and April-June. Similar results applied to calculations for minor season crops.

There seems then, a strong case for trying out fumigation of cobs in Southern Volta. The method is chiefly suited however to small quantities stored.

---

1. A clay heat exchanger ensures a partial regulation of heat transfer but suffers from the disadvantage that overheating cannot be quickly corrected. Metal heat exchangers carefully managed might be more effective.

2. All labour charges ignored.

If, as seems likely, expansion of agricultural production inevitably means in part the expansion of maize growing, larger quantities will be produced for sale, increasingly after storage. Mechanised maize shelling followed by bulk drying and storage would then require investigation.

The merit of a sheller, even a small hand machine, is that it could radically reduce labour at harvest time, preceding drying and bulk storage.

Mud built cribs should be studied at this stage, having already achieved success elsewhere in Africa. Cheaply built of local materials by local labour and requiring little maintenance, design should ensure ease of handling; stores should be made airtight to allow fumigation.

Questions to 132 villagers (AA1) suggested that:

(i) they were very conscious of losses

(ii) many realised that chemical treatment and improved storage would reduce these (see Table 3.3)

(iii) most would take official advice even if it resulted in hard work (though many were cautious if cash should be required and a number said they would be unwilling to borrow money for this purpose)

(iv) most favoured a central village store, were prepared to help with labour (though more doubtful about giving money).

The overall impression of the Survey was therefore that the time is ripe for development work in the Survey area on maize storage.

Table 3.3

Attitudes to Improved Storage[1]

No. in sample	132
Percentage of sample:-	
(1) confident that losses could be reduced	48 (15)
Main ways suggested:	
a. chemical treatment	47
b. better storage	10
c. quick sale	3
(2) prepared to borrow to build store	59 (30)
(3) favouring central village store	80 (13)
prepared to help build	92 (6)
prepared to give money	68 (18)

1. Figures in parentheses show those who gave opposite negative answers; all figures in percentage of sample.

3.4.2. CASSAVA

Varieties and fertilising

Cassava planted in South-east Ghana is wholly unimproved. Research on this plant is still in its early stages but some indications of ways of improvement are now coming out of the Crops Research Institute at Kwadaso.

The main variety used to produce fresh cassava in the survey area is Ankrah, which is not responsive to fertiliser.[1] Other varieties are responsive however. In experiments at Kwadaso 86 cultivars have been screened; thirty of these did not respond and in a few naturally high yielders, yields were actually depressed. Varieties Katawia and Ohawu, in plot trials, showed yield increases from 27 tons to 41 tons per acre when fertilised, and harvested after 18 months. (This compares with yields of 5-7 tons per acre currently being obtained in South-east Ghana.)

Kwadaso results also showed that, when harvested at 12 months (probably the most usual time for harvesting), and dried to 9·8% moisture,
(1) starch content varied widely among varieties between 36·1 and 74·8% with average 66%, fertiliser making no difference to the average percentage,
(2) mean protein content was 2·3% in fertilised roots as compared with 1·6% in unfertilised,
(3) fertilisers raised yield levels from 7·37 to 9·82 tons per acre, taking all varieties together.

The main conclusion from the Kwadaso work must be that choice of variety by householders is crucial in determining, first, quality of the root and, second, response to fertiliser. There is also some evidence that there may be a minimum potash requirement which significantly affects cassava yield. Current recommendations from Kwadaso are:

(1) high organic matter is desirable[2]
(2) planting early following deep ploughing seems to produce best results
(3) spacing should be 3' x 3'
(4) hoeing and mulching increase yield
(5) fertiliser can best be applied at the rate per acre of 20N, $20P_2O_5$, 20K
(6) harvest at 12-15 months
(7) process within 24 hours of digging

---

1. It is also not suitable for gari making.
2. Cow-dung is already used at Wute, but, in general, organic matter is in short supply.

The implications of the work at Kwadaso for South-east Ghana are: first that local farmers appear to have some fertiliser responsive varieties. Local selection of those giving the best yields of starch, is necessary, followed by fertiliser-cum-cultivation trials, the objective being to get the most economically optimal variety and treatment; but second the economic optimum policy may be affected by the way cassava is integrated with other crops in (a) inter-cropping (b) cropping sequence; this may influence both yields of saleable product and the efficiency with which resources, especially labour, are used.

Cassava processing

The search for possible improvements must be related in the first place to the labour currently expended. In the Mafi Kumasi inquiries (reported in Section 1.7.4)the women's labour expended in GARI production was as shown in Table 3.4.

Table 3.4

Labour Requirements in Gari Production

Operation	Minutes per 'rope' (64 sq.yds.)	% of total
Lifting	60	8·1
Transport	95	12·9
Peeling and Washing	141	19·1
Grating[1]	5	·07
Filling baskets	6	·08
Filling golvi	17	2·3
Sieving and roasting	378	51·2
Transport to market	36	4·9
Total	738	100·0

1. already mechanised

Lifting was often the subject of complaint where the ground was hard. Clearly a hand tool specially designed for ease of lifting is required to reduce effort; at a later stage this should be an easy process to mechanise if tractor power comes into general use.

Reduction in transporting time of both fresh cassava and gari depends on the feasibility of (a) enlarging acreages and (b) reorganising village clearing (see Section 3.3.1) as well as improvement of roads. If, as was discussed in Chapter 2, South-east Ghana is going to react to very promising market prospects for cassava, this may require programme formulation and execution at both regional and village level.

Peeling is not only time-consuming but wasteful. Some varieties are more wasteful than others; Doku (1969) gives the conversion rate to gari as c 27%. Tests in Mafi-Kumasi gave 48 lb gari (23%) from 209 lb fresh cassava, the peel also weighing 48 lb. The women expect to get 60 lb of gari (27%) per 224 lb of fresh cassava per rope. A peeling machine worked by hand would materially reduce preparation time at least in the early stages of expansion.

Grating mechanisation depends for success on output. Machines currently made in the region have a capacity of 20-30 tons a week (i.e. about 4 acres production) when worked at the rate of 25 hours per week. Where made entirely of metal they cost N¢ 100-140. (Local models tend to be stronger than those made in Accra, incorporating parts salvaged from motor vehicles.) Some machines are made partly of wood and are available at c. N¢ 60.[1] A bowl of dough valued at 15np cost 3np in fuel and engine oil. With fixed charges at N¢ 22·10 per month, an output of 184 bowls a month is required to break-even. This is well within the capacity of machine and workers, 440 bowls being recorded in only one week of work at Mafi-Kumasi. But profitability will still depend on having sufficient cassava and gari makers in the neighbourhood to ensure adequate supply. Alternatively, the engine which is the major investment must be used for maize milling, water pumping, etc., during slack times. This is a kind of development which requires detailed work study, development engineering, economic appraisal and an extension service if risks of failure by private or co-operative enterprise are to be minimised.[2]

The overseas market for DRY CASSAVA CHIPS may influence the pace of expansion of cassava production and processing. At first sight, current figures (N¢ 14/ton paid for cassava to the farmer and N¢ 45/ton paid for chips at the port) do not look promising for either farmer or processor. But a higher price for a quality product, innovations to increase yields and reduce production costs, and larger-scale processing could radically alter the situation.

---

1. Those made entirely of metal have an adjustable 'throat', the machine is high off the ground, facilitating dough collection, and the grating drum is a wooden cylinder with embedded notched metal strips like hack-saw blades. The wooden model has a cylinder covered with a 'cheese-grater' metal strip which is less effective. Other inefficiencies in the wooden machine include imperfectly circular drums giving an uneven result, and the need to apply pressure on the tubers by hand.

2. An agreement between a British engineering firm and the Nigerian Federal Institute for Industrial Research has recently been made to promote the use of a gari processing plant capable of producing up to 10 tons of gari a day. (Financial Times, 1972.)

Further attention should also be given to home supplies of cassava for pig feed, as well as to the use of cassava in conjunction with other flours for human food (Dendy and Clarke 1969) and the utilisation of cassava stalks for particle board manufacture (Flaws and Palmer 1968).

3.4.3. GROUNDNUTS

General

Groundnuts as a crop is generally popular in South-east Ghana. In the villages studied this was more true in the East (perhaps because rainfall tends to be rather less unreliable there). This interest was confirmed during questioning (AA4) when, in a sample of 33 householders, 23 said they would like to grow more in the coming year (1971) than in the previous year. The main constraint was claimed to be labour for planting and cultivating, not because people did not want more income or because income from groundnut growing was likely in their experience to be exceeded by cost (though some did complain of poor yields in the past).

Varieties, fertilising and disease control

The new varieties available (in particular Mani Pintar) have not yet appeared in South-east Ghana. Variety trials are needed. The high labour time required for planting might be reduced by use of a hole-making frame (designed to space seeds at $7\frac{1}{2}$" x 4"). Designed in N.W. Tanzania, the local cost was 26/0.[1]

No fertilising of groundnuts is done and trials are needed. It is expected that single superphosphate at 200 lbs/acre should give a satisfactory response in seasons with good growing conditions; but this kind of fertiliser is not currently available in the region. It would be interesting to establish under local conditions whether groundnuts benefit from phosphate residual from previously fertilised maize. Also it would be worthwhile to examine the economic feasibility of fungicidal sprays, especially against leaf spot (Cercospora arachidicola), over a number of seasons.

Post harvest practices

Current practices are related to the small scale of production. When asked their opinion householders considered that storage was worthwhile though they differed widely about the length of time it was desirable to keep groundnuts, from 3-6 months and sometimes longer. The whole set of current post-harvest practices will need close examination if expansion of production is to be encouraged. (The use of haulms for

1. See G.H. McPherson (1966).

animal feed should be included).

(a) Pod stripping A home-made trestle using local timber and purchased nails and hinges is recommended, following experience in Tanzania, as a way of reducing the time spent in pod stripping, which can best be done close to animal feeding arrangements. A simple thresher may also be justified.[1]

(b) Decortication This, like maize shelling, is a process where much hard labour can be saved by the introduction of a simple machine, which may be justified as soon as output for sale begins to expand. As with maize shellers there are machines driven by human, animal or mechanical power (see Table 3.5). The following are already available to Ghanaian farmers. While all are not equally efficient, a major factor in choice will be scale of output. As with the mechanisation of cassava grating, economies could be derived by linking (say) model (d) with an engine which is also used for driving other processing machinery.

Table 3.5

Groundnut Decorticators : Comparison Table

Model	Price N¢	Capacity lb. per hour	% Whole kernel	Power or hand	Suitability for manufacture in Ho
(a) Agric.Eng.(1)	57	40-80	96(max)	H	no
(b) Skylux	80	200-400	95	H	yes (if modified)
(c) TSPC	60-100	150	90	H	prob. no
(d) Peace Corps	100-200	500	99	D.E. or animal	yes
(e) Agric.Eng.(2)	935 (inc. engine)	1500	80-85	D.E.	no

Oil extraction

The main possibility of large scale groundnut oil extraction in the near future is at the Denu Oil Mill. This plant was initially built to serve the coconut growing area along the Volta Region coast. Owing to Cape St. Paul Wilt the raw material for the factory has never been forthcoming. Its equipment could also be used for extracting palm kernel and groundnut oil however and plans for developing the latter have from time to time been made.

1. An example of this and many other small pieces of equipment may be seen in ITDG's Guide (1973).

For a full year's operation it requires 1,500 tons of raw materials. It is estimated that if this were to consist entirely of groundnuts some 6,000 acres of groundnuts, preferably in the S.E. part of the region would be required.

The Ghana Industrial Holdings Corporation (G.I.H.O.C.) is responsible for the operation of the mill. In 1968 producers were promised fixed prices for groundnuts but these never materialised, thus damaging confidence. In 1970/1 a price was offered of N¢ 196-224 per ton shelled within 50 miles of the factory (i.e. N¢ 16-24 per bag of 100 lbs); but this was below the average market price of N¢ 28, which in the summer of 1971 rose as high as N¢ 34.

3.4.4. OIL PALM

General

Currently the oil palm is 'exploited' rather than cultivated. With a minimum of effort the vegetational regeneration that takes place after arable cropping is assisted to produce a combination of joint products which are essential for simple subsistence living. Two alternative policies of development appear to be possible,

(a) improvement of the traditional system

(b) radical change to predominently commercial oil palm production with certain products given up in favour of economic production and 'export' of palm oil and palm kernel oil.

While the former may be desirable in order to increase labour productivity, and even necessary to maintain supplies of products if continuous arable cultivation becomes common, the latter requires assured markets to justify investment. But there are also other differences. While (a) requires only improved seedlings and education from outside for progress to be made, (b) requires a radically new approach to land, new sources of capital, labour arrangements, and involves a different time scale. These complications do not necessarily rule out (b) though in this case the question is more sharply raised whether introduced scarce resources such as advisers and processing plant are better invested in South-east Ghana or in other areas where the physical and (perhaps) market environments are more favourable. Far more information than is currently available is required about the long-term productivity of different systems in South-east Ghana conditions, before firm conclusions about the best course of development can be reached. There are some questions which can be explored in a preliminary way however. Those concerned with husbandry apply equally to both improvement of the current industry or replacement by plantations primarily for oil.

Husbandry

(1) Improved varieties

1½-2 year old seedlings of improved varieties, with higher yields of fruit and higher oil : bunch ratios (25%, compared with 15% in the wild types), are now available in government nurseries in Southern Volta e.g. at Dzodze. Villagers express interest in these but most claim they are too expensive at 20np per seedling.

(2) Planting and spacing

Yields can be greatly increased and plant mortality reduced by careful planting. Root pruning before transfer, preservation of a ball of earth (nurseries are now growing seedlings in plastic bags), and deep digging to break hard-pan and so improve water supply to, and drainage from, the tree, could all be easily introduced. 30' spacing giving 60 palms per acre is optimal and reduces seedling costs to NȻ 12 per acre. Inter-cropping and the deliberate planting of cover crops could well be investigated.

(3) Fertilising

No fertiliser trials have been done but fertiliser might be expected to give positive results. The sex ratio of inflorescence formation is adversely affected by too high a nitrogen:carbon ratio but nitrogen deficiency would at some level cause stunting of growth. Root growth will particularly need encouragement with phosphates in South-east Ghana soils. Potassium and magnesium are required in large quantities in the fruit. Recommendations elsewhere in Ghana for an annual rate of 1 lb per tree per year of age of each of the main nutrients might be the starting point of local trials (see Hartley, 1967).

(4) Pest and disease control is first a matter of field hygiene in removing dead and rotting plant growth. Rodent control by trapping is already practised around cropped clearings.[1]

(5) Improved harvesting involves substitution of a hook knife for the ubiquitous cutlass, so avoiding cutting of the subtending leaf; indeed, reduction of leaf cutting for the fronds themselves can be expected to increase palm growth and yields, though this may require development of substitutes for brooms, thatch, etc.

These improvements could be expected to raise radically the yield of bunches per acre and even improve the percentage of oil to fruit, perhaps

1. The West African Institute for Oil Palm Research recommend wire netting round all young trees for rodent control.

to some 600 lb of m/c oil (gross) per acre.[1] Seedling, fertiliser and labour costs to 10 years might be as shown in Table 3.6.

Table 3.6

Oil Palm Establishment Costs*

	Cost C	
Establishment (1st year)		
Clearing	6·0	
Felling and burning	10·8	
Ground preparation	4·5	
Planting material	12·0	
Planting	1·5	
Fertiliser	3·6	
Wire netting	15·6	
Weeding	12·0	
		65·9
Plantation Maintenance (Years 2-10):		108·0
		173·9

* Based on Dalton G.E. and Famiyeh. J.A.

Concentration on oil production

Current practice is to take some five years of fruit and frond before felling the tree for a sale price of c. N¢ 1. Supplies of semi-wild palm and the array of market prices for alternative products are presumably such that the discounted net value of fruit yields after 12 years, under present conditions, is less than this. If the above innovations are to be accepted it is likely that a larger return after the 12th year will be sought. Whether this is available depends on the market prices for those products which are expandable. Palm oil and palm kernel oil are the products concerned.[2] Processing costs of these products will also be of critical importance.

Wholesale and retail prices for palm and palm kernel oils are as shown in Table 3.7. World price for palm oil is N¢ 240-280 per ton. (Lever Brothers pay N¢ 330 per ton to the Ghana State Farm Corporation). The future price, therefore will depend on the degree to which expanded production in Ghana as a whole matches demand; the wholesale price could fall to N¢ 260 per ton. But at present Ghana industries need 5,000 tons more than is currently produced.

1. This assumes 40/60 trees in bearing, thus delaying felling to 20-25 years, and a level of yield of 5,000 lb of improved bunches per acre, the figures in Col.2. of Table 1.18 being from experimental conditions.

2. Expansion of palm wine and akpeteshie would be at only about half the pace of the rate of planting if felling were delayed until the 25th year (assuming trunks of the same size are grown).

Table 3.7

Oil Prices (April 1971)
(N¢ per ton)

	Palm Oil	Palm Kernel Oil
Wholesale:		
Kpetoe	448	336
Dzodze	336	
Denu	291	
Akatsi	336	336
Adidome	-	392
Kpove	470	392
(Average)	(376)	(364)
Retail:		
4 Western villages (average)	717	627
Frankadua	627	501
Ho	538	448
4 Eastern villages (average)	538	448
Kpetoe	627	448
Dzodze	448	-

Oil processing

(1) Palm Oil

Currently in the villages bunches are sold at 0·75np/lb and m/c oil fetches 35np/lb. If the net yield per acre is 53 lb of oil from 1,800 lb of fruit (Table 1.18) the raw material cost of a lb of m/c oil is about 25·2np. While no specialised equipment except bottles is required, oil extraction is time-consuming. It is estimated that about one hour must be supplied by a woman per lb of oil made. There is clearly little scope for expansion of household extraction.

The two possibilities available to growers are (a) selling fruit for processing to existing extracting plants and (b) setting up small local plants such as the hydraulic mills used in Nigeria.

(a) Factory processing

Prices for fruit in Ghana vary with oil content as shown in Table 3.8. These prices appear to be rather lower for a given oil content than can be obtained for small quantities in local markets in South-east Ghana. When the cost of transport to distant mills[1] is taken into account this makes their supply relatively unattractive to farmers. At first sight, with raw material costs as low as N¢ 208/ton for fruit of 15% oil content at 80% extraction, manufacturers' margins might be expected to be substantial. Heavy operational costs and low extraction efficiency may result in narrow margins however.

1. Transport costs in the Western Region, per ton of bunches, are: less than 10 miles N¢ 1·08, 10-40 miles N¢ 2·38, and more than 40 miles N¢ 6·48.

Table 3.8

Factory Prices for Raw Material

Oil content	Fruit		Bunch		Raw oil cost N¢/ton	
	N¢ per ton	np per lb	np per bunch Local	Improved	60% extraction	80% extraction
15%	25	1·1	0·6	0·7	278	208
20%	33	1·5	0·7	0·9	275	206
25%	41	1·8	0·9	1·1	273	205

(b) Possibilities of local milling

(i) Pioneer mills of the kind used in Nigeria have a capacity of 1,120-1,344 lb fruit per hour. Working 8-10 hours a day 250 days a year implies a fruit consumption of 2,280,000-3,360,000 lb per annum. In relation to wild palm output of 900 lb/acre this implies 2,533-3,733 acres of oil palm. In relation to improved standards (Table 1.18), 543-800 acres would be required. Whatever the economics of the processing this scale of processing plant would appear to be too ambitious for introduction at once in South-east Ghana bearing in mind the managerial and transport costs of assembling very many small quantities of fruit from a large area. Having developed improved husbandry, better communications and a concentration of ourpur in a suitable area however, this might well be entertained as a second stage.

(ii) Small scale hand-operated presses are of two types: the screw press, and the larger but much more efficient hydraulic press.

One firm of equipment makers in Accra recommends the following combination of machines, which includes an hydraulic press.

1. Steriliser - 45 gallon capacity - 120 lb fresh fruit per batch.
2. Pounding machine - pounds sterilised fruit continuously at 50 lb per minute. The drum has an insulated jacket to retain temperature of fruit and facilitate oil release. A 5 h.p. diesel engine is required.
3. Press - hand-operated mechanism with two baskets, one being pressed while the other is filled.
4. Clarifier - filled with water and heated, oil is injected and is separated into clear oil and wast fractions.
5. Cracker - 10 tons of fresh fruit bunches give one ton of nuts, 95% whole kernels. 5 h.p. diesel engine is required. 1,500 lb of nuts cracked per hour.

The costs estimated, assuming 200 days working at 80% extraction efficiency are shewn in Table 3.9.

Table 3.9

Costs and Returns of Processing with Hydraulic Press

Capital Cost:			N¢	
	Machines		3,500·0	
	Instalment		500·0	
	Housing		2,500·0	
Cost of Production for two tons of fruit bunches per day:				
1.	Depreciation on machinery (life 5 years		3·50	
2.	Depreciation on buildings (life 10 years)		1·25	
3.	Interest on capital (10%)		3·25	
4.	Repairs and spares		1·00	
5.	Raw material (2 tons fresh bunches @ N¢ 17)		34·00	
6.	Labour:			
	i. Separation of fruit from bunches (4)	3·40		
	ii. Sterilising unit (2)	1·70		
	iii. Pounding of fruit (1)	0·85		
	iv. Pressing of oil (1)	0·85		
	v. Clarification of oil (1)	0·85		
	vi. Supervisor	1·50		
			9·15	
7.	Firewood, fuel, transported miscellaneous		5·85	
				58·0
Returns:				
1.	Palm oil - 358 lb @ N¢ 350 per ton			56.0
2.	Kernel - 6% of 2 tons fresh bunch fruit selling at N¢ 8 per 112 lb bag			19·0
				75·0

Margin per day therefore N¢ 17·0

At the prices used (which have been selected to avoid over-optimism in buying and selling bunches and oil respectively) the margin looks substantial. 200 days' working would require 400 tons of bunches; say 500 acres of wild, or 155 acres of improved plantation. This is still a large area of wild palm to organise; but improved plantations with this scale of plant would almost certainly be workable, particularly bearing in mind the higher oil content in the fruit that might well obtain.

To reduce the substantial capital cost, some savings might be made by fabricating the steriliser and clarifier in the village and by leaving out nut-cracking in the first instance. It is also possible that the press might be constructed locally from components; and something might be saved on the building. Even so, finance would have to be organised.

Screw presses have not been found in Ghana. Experience in Nigeria suggests the following comparison:-

Table 3.10

Comparison of Extraction Methods, Nigeria

	Household Method	Screw Handpress[1]	Hydraulic Handpress
% efficiency of extraction	55	65	85[2]
Throughput of fruit (8hrs)(lb)	1-200	8-1,800	7,600
Acres for 200 days supply at 900 lb per acre[3]	22-45	180-400	1,710
at 4,200 lb per acre[3]	4·8-9·5	38-85·5	361
Workers required	2	4	7
Capital cost (£N)	2-5	25-50	560

1. It is possible that a press of comparable size could be cheaply built around a hydraulic jack unit.
2. Pulp heated before pressing. Source Kilby, P. (1967).
3. See Table 1.18.

The introduction of any processing plant will encounter at least five snags, namely:

1. there are currently rather small quantities of fruit for sale over and above village needs,
2. currently unimproved trees will give fruit of low oil content,
3. control over the quality of purchased fruit would be difficult in the short term,
4. even a screw press would require a capital sum (and then perhaps group subscription and operation),
5. the marketing of substantial quantities of oil would require investigation.

Nevertheless, on the basis of the data (Table 3.10), there appears to be a strong case for investigating the feasibility of a screw handpress in the early stage of oil palm development in Southern Volta, while an hydraulic press and associated equipment might find economic employment in an area of existing concentration such as Dzodze.

(2) Palm Kernel Oil

The palm nut is not perishable and can be stored or transported or even exported before extraction. The difficulty of cracking by village methods seems to be the reason why large quantities are kept, possibly as insurance, and finally thrown away.

Yet the value of the oil may be $\frac{1}{3}$ - $\frac{1}{2}$ that of the mesocarp oil and the cake is a valuable protein feed.

The first steps seem to be the provision of a simple nutcracker for those who wish to extract their own P.K. oil. (Currently, working at it from time to time it commonly takes one woman about a week to fill one head pan 2' diameter by 9" deep or c. $11\frac{1}{2}$ gallons. Paid labour earns 60np for this amount).

One head pan costs $37\frac{1}{2}$np for milling. A little oil can be immediately extracted. The rest is extracted by heating in an iron pot with water, at an efficiency of about 33%. The oil sells at 25-30np per bottle.

Priorities

There seems therefore to be scope for improvement in husbandry techniques designed to increase the output of all products, but with an eye on mesocarp oil. At the same time local trials might well begin with small scale extraction plant of the screw or hydraulic press variety; the finding of an effective form of organisation, which might involve changes in the pattern of growing as well as processing, would be of crucial importance. It must be remembered however that such a line of development might well entail some restriction in the production of wine or spirit, which are useful joint products from current oil palm husbandry.

3.5. OTHER ENTERPRISES

3.5.1. COWPEAS (Vigna sinensis)

Cowpeas are already grown by a few farmers in South-east Ghana. Although they will probably remain a minor crop they might well have increased importance, being a good source of vegetable protein and being capable of giving a useful yield in the minor season. They may be used dry or as green pods, or the leaves may be added to soups.

The varieties grown locally are red, though preferences are not strong. Selection has been going on recently at the University's Experiment Station at Kpong. The variety developed there is Coroni, red and high yielding, and is being bulked up for distribution.

Planting in the Survey area is currently similar to maize - 3'x3' with 3-4 seeds per hole, on the flat, with an overall seed rate of 5-10 lb per acre. A rather higher seed rate is recommended (15 lb) with spacing of erect species at 2'x1' and runner types at 3'x2'. The local farmers are already careful to plant late in the Major season to avoid the danger of a wet

harvest and ensuing mildew. A reasonable crop can be expected in the minor season in most parts of South-east Ghana. Fertile soils appear to be no great advantage.

As fertilisers, phosphates are known to have a beneficial effect. The value of other nutrients has yet to be tested. Nodulation and ways of encouraging it also need to be further investigated, though the relevant rhizobia suitable for Vigna spp are generally present in the soil.

Weed competition tends to be most severe in the early stages of growth, before total ground cover has been achieved. Two weedings are the most that are likely to be required. A vigorous growing cowpea crop may have a useful repressive effect on lalang grass.

Harvesting is prolonged owing to uneven ripening, often requiring three picks for a very modest yield. This may not be important as long as the crop remains of minor importance but could become a disadvantage. Breeding work at Kpong is being aimed at a more concentrated ripening.

Yields are currently very variable but probably average 200-250 lb per acre. Experimental yields of 2,000 lb per acre and field scale yields of 1,000 lb per acre have been obtained at Kpong. The great variability seems to be particularly attributable to diseases and pests. Spraying of insecticides is to be recommended. A.N. Aryeetey (Research Officer, Kpong) suggests the following alternatives:

Didigen 4 pints, x 6 applications = N¢ 11·10 per acre

or Agrothion 4 pints, x 3 applications = N¢ 15·24 per acre.

If labour using a knapsack spray at N¢ 1·00 per day, covering 1-1½ acres per day is added, cost including spraying will be N¢ 17·10 or N¢ 18·24 per acre.

Grain yields of at least 700 lb per acre can then be expected; that is two extra bags of 240 lb per bag at N¢ 18-30 per bag. Using Agrothion the net margin over spraying cost would be N¢ 17·76-41·74 depending on the price of cowpeas.

Shelling is, like harvesting done by hand or by beating a bag with sticks, followed by winnowing.

Storage is currently the same as for groundnuts. The chemical treatment described for Maize is also recommended for cowpeas but requires testing in local conditions.

Marketing can be expected to continue to be largely local.

It is therefore judged that there is the strong possibility of expanding and improving cowpea growing in South-east Ghana, with attention to improved field husbandry, especially the spraying of insecticides. Some initial trying out of recommended methods in the locality would be necessary (a) to establish their effectiveness and (b) to demonstrate their worth.

It would not be true to say that groundnuts are a substitute to be preferred; cowpeas are used differently in the local diet and have sufficient agronomic dissimilarities to make a combination of groundnuts and cowpeas preferable to concentration on groundnuts alone.

3.5.2. COTTON

There is a strong case for the encouragement of cotton in Ghana as a substitute for imports. The recently installed weaving plant at Juapong has also introduced a strong local interest within the Volta Region. Another factor which, on paper, would strengthen the argument for growing cotton in South-east Ghana is the existence of heavy black soils stretching across the region from W. to N.E., many of which can be expected to suit cotton.

In recent years the Government has been active through its Cotton Development Board in stimulating the growth of the crop (see Mettrick, 1971, p.56). The functions of this Board include the establishment of ginneries, organisation of the transport of seed cotton, and the encouragement of producers and their organisation into co-operative groups.

It is therefore pertinent to consider the possibilities of cotton in South-east Ghana in this general context, even though attempts to grow cotton have so far been very limited.[1]

Agronomic conditions

The soils most likely to be suitable for cotton are the Black Earths which are most extensive in the Western part of South-east Ghana, and the alluvial soils of some valley bottoms elsewhere. (Soils similar to the Black Earths at Kpong, west of the Volta, have shown themselves capable of 1-2,000 lb of seed cotton per acre under experimental conditions).

The pattern of rainfall presents difficulties:-

(a) the dry season is rather ill-defined with a tendency to showers in most months, thus making a dry harvest period uncertain;

(b) the minor season, with an average of 16" of rain at Akuse and 21" at Ho is adequate on average but subject to unreliability; rainfall declines southward and reliability declines westward;

(c) the dry period July-August tends to restrict the earlier planting of cotton types with a longer growing season.

Suggestions will therefore be related to the possibilities of

(i) rainland cotton growing in the north - say N. and N.E. of Agodake-Kpetsu;

(ii) irrigated cotton further south and west.

---

1. The only cases known in the villages intensively surveyed were unsuccessful attempts in Kpomkpo (State Farm) in 1968 and Waya in 1969.

Experimentation at Kpong

(a) Varieties Experimental work on cotton varieties has been carried out periodically at Kpong since 1958. Egyptian varieties were first tried. An F.A.O. agronomist examined performance of 28 varieties in 1965/6 out of which nine were selected for further study - Allen 333, KK 1543, Deltapine 45A, Acala 1517D, Stoneville 213, S 4727, Delfoe 9, KK 1083 and Deltapine SL.[1]

(b) Planting Kpong experiments seem to have been mainly concerned with planting dates, spacing and fertilising. In 1966 spacing at 8, 12, 16 and 20" on ridges 3' apart indicated that closer spacing was preferable.

Planting dates varying from mid-August to mid-November have been tried at various times. Recent results (1969) suggest the earliest planting dates are most effective, though lack of rain in August may limit the earliest dates to irrigation situations.

Factorial fertiliser trials in 1969 with three levels each on N, P, K showed that N gave the best response at 60lb per acre, K gave a slight response but P only appeared beneficial in combination with N at 60 lb per acre of N. Experiments on trace elements at Kpong have so far isolated none.

The experimentation at Kpong in the variables mentioned seems to have focussed on no very clear-cut possible production policy, though there is the general impression that the rather disease resistant West African varieties like Allen 333, closely planted early in September with high levels of N fertiliser might be expected to do best.

(c) Disease and Pest Control Some experimentation with insecticides (1967/8 Report) suggests a number of combinations are equally effective, so that choice depends chiefly on relative costs.

(d) Irrigation Also in 1967/8 moisture requirement studies were conducted in Kpong. It was reported:

1. that, during 1966/7, rainfall of 15·08" from September-January was sufficient for successful cotton growing; yield was 1,200 lb per acre of seed cotton.
2. that during 1967/8 comparisons between rainfed cotton and irrigated cotton ranged from 1,600 (unirrigated) to 1920 lb, where irrigation water was applied when available moisture fell to 35% of field capacity. 6·75 acre-inches were applied in this last case. Rainfall during the period was 14·87".

Cotton Development Board Experience 1970/1

Under the Area Officer-in-charge, the Cotton Development Board succeeded in getting 179 acres planted in the 1970 season, of which 133 acres were

1.Kpong Research Station Annual Report, September 1970.

harvested. On 14 sites varying in size from 4 to 31·5 acres it is notable that the best yield was obtained on 11 acres of black earth at Adaklu (688 lbs, as compared with an average of 308 lbs for the total area sown).

Inputs were: (per acre)
30 lbs of Allen 333 cotton seed
65 kgs of 19/35/0 (+ 7 sulphur) combined fertiliser
1,000 ccs (in 3 gals water) Endrin DDT
400 ccs (in 3 gals water) Lindane
4 sachets Sevin (in 3 gals water)
These inputs and the spraying were provided free to the farmer.

Clearing cost N¢ 9 per acre.

Ploughing and harrowing cost N¢ 8 per acre.

Sowing was spread from 25th July to late September at 4-6 seeds per hole at 3'x10', with ridging after fertilising.[1] Most crops had only one weeding. Harvesting, started 120-130 days after sowing and lasted 30 days; damage was done by early rains on late-sown crops. Picking was paid at 1np per lb picked, and done at the unsatisfactory rate of 200 lb per week.

Labour requirements were estimated in man days per acre at:

Sowing	4
Thinning	3
Weeding x 2	14
Fertilising and ridging	9
6 Sprayings	6[2]
	36

To this might be added clearing labour, and labour for harvesting at 5 man days per 200 lb of crop.

Yields and Returns per acre A comparison of the total group and Adaklu results appears as in Table 3.11.

Table 3.11

Cotton Yields and Returns to Cotton C.D.B. Trials

	Total group	Adaklu[3]
Yield (lb)	308	688
Price (per lb)	7np	7np
Return	N¢ 21·6	N¢ 48·2
Cash costs:	N¢	N¢
Clearing and Cultivation	17·0	17·0
Picking labour	3·1	6·9
	21·1	23·9
Gross Margin	0·5	24·3
Return per m.d. of family labour	0·01	0·81

1. Sample counts showed that actual plant density closely approximated to theoretical density at Adaklu.

2. Not counted in family labour.

3. 13 farmers made up the Adaklu group. It is noticeable that their individual yields varied between 208 and 1,297 lb per acre, chiefly related to timeliness of operation, particularly weeding.

Prospects for cotton development

The evidence available on which to base a sound estimate is very limited. Development trials are obviously needed to strengthen the indicators. The following points may be made however:

1. Increased skill and experience among farmers should be able to raise yields to at least 800 lb per acre (half the experimental yield) in average rainfall years. Under present conditions this should give a gross margin of N¢ 31·0 per acre and N¢ 1·03 per family man day.
2. This does not compare particularly favourably, from the farmer's point of view, with returns to maize, groundnut and cassava; the comparison with returns to maize is most relevant because this is likely to be cotton's main competitor on the black soils. Cotton's inferiority is greater if we take into account (i) the probably greater uncertainty of yield and danger of spoiling at harvest, (ii) the fact that labour on cotton would make no contribution to home food supply in the event of a generally bad year for food crops.
3. The government through the C.D.B. is paying dearly for the cotton in seed, fertiliser, sprays, (probably) subsidised tractor services, and specialist advice amounting to specialist help in the initial years.

Two questions therefore arise: namely, can the producer expect the market to improve? and, can the government expect a cheaper supply?

The government is already offering a high price to producers by African standards. Currently Ghana is importing some 5,000 tons of cotton lint per annum costing N¢ 2-3 million. At N¢ 500 per ton this is roughly equivalent to 7np per lb of seed cotton. At some stage, moreover it is realistic to expect that farmers will have to bear the cost of purchased inputs. If cotton is to be grown in South-east Ghana therefore the farmers' performance must be so improved that it becomes an attractive crop.

In the north (where the block trial already reported took place) there are the following possibilities:

1. Careful survey and mapping of suitable soils; though heavy soils are best, they must be well drained.
2. Examination of alternative farming systems incorporating cotton which include (i) the present block farm system on newly cleared land (ii) incorporation of cotton, interplanted in alternate rows with maize in the standard (or improved) shifting cultivation pattern (iii) incorporation of cotton in rotation with restorative crops (particularly groundnuts[1]) in a continuous farming system.

---

1. High yields of groundnuts are obtained on the heavy irrigated clays of the Sudan Gezira Scheme.

3. Improvement of the details of husbandry emphasising early planting, close spacing, early weeding, careful spraying, thorough clean-up after harvesting, bearing in mind at each stage the need to improve productivity per man rather than productivity per acre. Small-scale labour-saving devices and the application of work-study to the picking operation should be investigated. The sharpest competition for labour probably occurs at the time of cotton weeding. (The inconclusive trials with weedicides at Kpong could be usefully continued).

In the circumstances it is desirable to proceed slowly, with adequate trials. At the same time the C.D.B.'s policy needs to be kept under review. There is advantage in keeping the supply of seed and the spraying programme under the control of the C.D.B.'s area representative, and in such a way that it is in the interest of everyone who grows cotton to conform. While the most appropriate fertilisers should be easily available in small packs there seems no reason why they should be free of charge. Also, the guaranteed price should reflect the importance of product quality.

Further south and particularly on the western heavy soils successful cotton growing would require (1) irrigation water and (ii) the presence of adequate power (either mechanical or human for cultivation and human for cotton picking). This implies large scale investment and settlement which are outside the scope of this study.

The promotion of this kind of enterprise would have to take into account the fact that Northern Ghana is probably better suited, in seasonal rainfall distribution, for cotton. Nevertheless examination of the possibilities could be made perhaps first in a village like Kpomkpo where a small supply of irrigation water by pump-lift is feasible. It would presumably be desirable to link cotton growing with other crops which could benefit from the same irrigation equipment.

General Outlook

It may be tentatively concluded that:

1. Cotton prices are unattractive to farmers and are likely to remain so while maize prices remain high.
2. Policy should aim at improving technical standards in cotton production.
3. What is required in South-east Ghana is intensive investigation (with C.D.B. co-operation) of ways of improving rainland cotton in suitable northern areas, with, perhaps at a later stage, investigation of the problem of irrigated cotton further south.

3.5.3. TOBACCO

An investigation of current tobacco growing and prospects for the future by G.E. Dalton, assisted by E.H.U. Amankwa is included in Volume II of this study.

The position of tobacco was found to have much in common with cotton. While potentially an important crop as a substitute for imports, its production currently shows little sign of expanding in South-east Ghana. Given the physical environmental conditions and current levels of technology, it would seem that it is not likely seriously to compete with maize as long as maize prices remain buoyant.

3.5.4. SORGHUM

Sorghum is seldom found in South-east Ghana. Limited attention to its potentiality is recommended however, on the grounds that its performance is less susceptible to rainfall uncertainty than maize. The most likely growing season is probably the minor season, using quick-maturing varieties. Attention should be directed particularly towards the West and South,[1] where maize growing becomes increasingly difficult. It has potential usefulness (a) for grain for human consumption, particularly as beer, (b) for grain and/or forage for livestock. (U.S.A.I.D. technical experts have suggested its conversion to silage in other areas of Ghana).

Limited investigation of its potential has been done in Ghana; e.g.:-

i. As part of a set of single-stand and intercropping trials carried out in Nyankpala, Northern Ghana, in 1966 and 1967 where it was compared and combined with groundnuts and maize.[2]

ii. In small varietal trials at Legon and Nungua.[3]

The 1966 experiments in Northern Ghana suggested that with groundnuts, maize and sorghum at N¢ 163, N¢ 50·5 and N¢ 68·2 per ton respectively, groundnuts grown alone, groundnuts planted four weeks before maize, and groundnuts planted four weeks before sorghum gave best gross returns. Where groundnuts were planted at the same time as, or four weeks later than, the cereal, whether the cereal was sorghum or maize was immaterial. Sorghum planted alone gave 1,548 lb per acre (N¢ 48), maize 1,970 lb (N¢ 45). Rainfall at Nyankpala in 1966 was 46·45 inches. These results are hardly relevant to either Major or minor season in South-east Ghana except as an example of the kind of trial required.

---

1. In Ho township it is planted late in the Major season and harvested in the minor season.
2. Y.E.A. Azab (1968).
3. C.W. Cameron and G.C. Ashton (1969).

Trials at Nyankpala in 1967 showed N and P_2O_5 together significantly increased sorghum yields of grain and leaf but local varieties outyielded imported ones.

At Legon[1] yields of up to 3,700 lb of grain and 19,780 lb of green material were obtained with imported NK 300 sorghum (grain yield in a parallel trial at Nungua was impaired by fungal infection).

3.5.5 CATTLE

Cattle do not play a prominent part in the economy of those areas of South-east Ghana subjected to intensive study. They are however an important element in the south and it will be suggested here that their significance should increase and become more widespread.[2]

The case for emphasis on cattle rests on the following arguments:

1. Closeness to a growing urban market for meat, in the more general national situation where it is desirable to move towards self-sufficiency in meat production.
2. South-east Ghana is an area of Guinea Savannah which lends itself to cattle production with moderate investment.

The role played by cattle in the economy at present is one that it is visualised should change with time, in three respects:

First, a large number of Ewe should be persuaded to take a more specifically commercial interest in cattle production rather than to regard cattle as a secret bank or as a speculation;[3]

Second, cattle could in some measure become part of a mixed husbandry system of farming as well as the only product from lands reserved solely for grazing;

Third, a greater product of higher quality should be aimed at.

The programme described here is long-term, though, as with crop husbandry improvement, there is a discernible order of priority in which innovations may be introduced, the early ones being within current resources and relatively easy, as well as being basic to the other later and greater changes. Many of the innovations would be subject to initial research and development.

---

1. Rainfall is not reported.
2. This section has benefitted from the field study of Cattle Production in Tongu District, carried out by G.E. Dalton, assisted by W.T. Haver and B. Honu, which is included in Volume II of this study.
3. See Rowena Lawson (1971)

Possible Improvements

(a) Health measures

The most promising innovations are probably those which represent an intensification of current policies which may themselves be capable of greater effectiveness. For instance, in addition to vaccination against rinderpest and pleuro-pneumonia and the control of Anthrax and Foot and Mouth, vaccination against Brucellosis is to be welcomed.

A determined attack on ectoparasites, including tse-tse fly (by progressive clearing of trees and shrubs, as well as by better feeding to strengthen resistance in the dry period) and ticks (by reactivating and extending spraying facilities) would also be salutary.

Internal parasites, similarly are seldom treated and few farmers appear to know about treatment with Thiabenzole though the Animal Health Division holds stocks.

Better provision of mineral licks and (probably) Vitamin A in the dry season could be expected to give highly profitable results.

(b) Breeding measures

Benefits from a breeding programme would be a longer-term matter. Selective improvement by the widespread adoption by farmers of the bloodless castration of bull calves should come first, while some culling of females might be justified contrary to the current policy of the Animal Health Division who are intent on increasing animal numbers. Crossing with better quality zebu bulls must wait, for full effectiveness, upon the elimination of tse-tse fly and the improvement of nutrition standards.

(c) Nutrition

First, South-east Ghana lacks any policy designed to rotate cattle systematically on the grazing available. To some extent the location of watering facilities are determined by local topography and soils and soil depth; but there seems to have been little attempt to take grazing supplies into account in planning the distribution of water points. Equally there has been little attention given to organising grazing in relation to any one water source so as to ensure best use of grazing and avoid overgrazing close to the water source. (Stock control at the water source would also extend the life and increase the efficiency of use of water points).

Fencing has been suggested as a means of grazing control particularly to ensure a supply of standing hay in the dry season. But fencing is likely to be too expensive in construction and maintenance, except as a method of

controlling access to water, until such time as the value of the off-take per acre of land grazed rises substantially. Careful stock-minding should provide the major control over most of the area for some time to come.

The use of fire - in part to make more easily available the new herbage and in part to facilitate hunting - needs careful investigation to establish its value to cattle raising.

Second, the use of supplementary feed, especially during the dry season, has been suggested. It is unlikely that stock-owners will have the necessary skill and capital to make hay and silage on any scale in the near future, and attention is now focussing on the use of bran from wheat, maize and rice milling. In a report for the Ministry of Finance and Economic Planning[1] a detailed proposal for the utilisation of wheat bran has been worked out which, it is claimed, would result in increased numbers of calves raised, continuous growth of young stock, a basis for the selection of superior breeding animals, and a general improvement in herd productivity. Moreover, it is proposed to do this in a way so as to encourage community action and increase the effectiveness of government fieldworkers. Some details from their calculations are given in Appendix X. There seems every reason to carry out experimentation along these lines.

Third, as already implied, systematic attention is required to the provision of adequate water supplies. This is particularly important to the performance of lactating cows. The costs of long treks by cattle to watering points should be taken into account when appraising construction plans.

(d) New herds and ranches

There is always the hope that a major break-through to a new technology will solve the problems of development. This is not least true in cattle development. The hope is that given sufficient infusion of capital and expertise the combination of constraints which keep the animals (like the humans) in a low-level 'poverty trap' can be broken.

So far there has been no conspicuous success in South-east Ghana. In 1960/61, following a survey by U.S.A.I.D. a paddock grazing and breeding programme was begun but discontinued. Schemes at Atiteti, Tsawla, Adakpo and Wakpo have fallen into disuse.

The setting up of a new herd and associated facilities entails a heavy capital cost; returns tend to be delayed. In order to make such ventures pay a significant increase in performance is necessary, therefore, and, given the long-term nature of the investment, rewards must be fairly certain. For the present less costly ways must be found of introducing the

1. Nathan Associated (1970).

innovations most likely to raise incomes through better health and better feeding.

(e) Marketing

The present marketing system gives little systematic encouragement to the producer to improve the weight or quality of livestock produced. While slaughtering regulations exist they seem not to be enforced. But equally important there has been no attempt to provide facilities to help the livestock owner to finish his beasts. There appears to be a strong case for the investigation and trial on a small scale of feeding arrangements (probably combining fodder and concentrate feeds) designed to improve the finished carcase. Such finishing might take place either in the villages or in feeding lots specially set up for the purpose, directly under skilled management.

Current Plans

1. A proposal, recently prepared by the Ministry of Agriculture is for the establishment of a Cattle Development Commission centred in four major producing areas, including Southern Volta Region. Its programme is designed in three phases:

a. Nucleus-ranch phase in which existing government ranches will
   (a) adapt promising improved technologies to local conditions on a commercial basis,
   (b) produce improved breeding stock, and
   (c) conduct pilot extension operations with a limited number of near-by private cattle producers to perfect workable extension techniques, develop extension personnel capabilities, gauge farmer acceptance of an extension programme, determine credit financing required by farmers to apply improved technology, and identify marketing and other problems that may require attention in the extension phase.

b. Local extension phase in which technical, material and financial assistance within the four districts will be provided to farmers agreeing to take up specified improved practices.

c. Nationwide phase in which extension will be expanded to other promising areas.

In respect of Tadzewu, the plan is to build up a commercial herd of 1,800 cows and a breeding herd of some 400 cows which will provide the other centres, as well as private farmers with improved F1 generation bulls.

While the ultimate goals of the programme are improvement of the national herd, the first phase is planned in strictly commercial terms.

"The internal financial rate of return from the ranch operations is estimated to be in the neighbourhood of 40%". The I.D.A. loan sought would be paid off in 16 years.

A complementary programme of research covering a number of major issues, such as selection of high-performance breeding animals, adapting exotic breeds, pasture improvement, supplementary feed production (including silage and introduced grasses), nutritional deficiency determination and quality/ market price correlation, is being designed.

The proposal is an ambitious one but appears to have some of the essential elements which it is the purpose of this Report to advocate. That is to say, it is proposed to combine the trying out of improved practices with extension services and the training of extension staff.

2. The Agricultural Development Bank is keenly interested in setting up new ranches in sparsely populated Kpomkpo, Zondu and Korlor areas. (The site is bounded on west and east by the rivers Korlor and Aklakpa respectively). The proposal is for the acquisition of the land and finance to develop roads, water supplies, fencing and machinery. It is proposed that 300 acre units should be fenced, containing 250 acres for grazing at a stocking rate of 5 acres per livestock unit, and 50 acres for cropping. It is, among other things, also proposed to establish a compulsory auction market so that all sales revenue would be paid into the Bank.

This is an area of black earths not far from the western villages intensively surveyed. It is of some interest that when 71 householders were questioned (AA2), in the eight Survey villages, about their attitudes to cattle, they gave the following answers:

(i) 6 of the 71 were currently keeping cattle

(ii) 50 saw the main advantage of cattle keeping as the wealth derived, 15 stressed the security this wealth gives. 60 agreed that cattle keeping was an effective way of saving, 28 thought an easy way of making money (particularly those answering in Podoe, Kpomkpo and Kpota).

(iii) 52 professed themselves interested in keeping cattle provided water and fodder were available

(iv) 54 were prepared to borrow to buy cattle, 10 were not

(v) 53 were prepared to pay for water, 3 were not

(vi) 60 thought owners should agree to have their cattle innoculated; 59 expressed willingness to pay for this service

(vii) 55 said they would be happy to have one herdsman look after the village cattle; 3 said they would not.

These answers, though perhaps biased toward enthusiasm for the idea, suggest there is some potential interest in these villages for cattle.

In view of the financial problems in ranch development mentioned, however, it would obviously be unwise to proceed with large scale investment before the technical and management aspects had been thoroughly investigated on a development unit basis.

3.5.6 GOATS

In contrast to cattle, the goat is a small animal and already widely kept in all villages on South-east Ghana. Goat meat is preferred above others. Encouragement in its production could be an important way of increasing the animal protein in the village diet which is currently mostly supplied by fish, eggs and game. There is therefore, potentially a local as well as a more distant market for goat meat.

Present conditions

In the traditional system the goats have a territory based on the village area. They are scavengers and do not travel far into the bush. They may be locally restricted in grazing time during the day and kept in pens at night. (Some village chiefs, e.g. at Waya, apply fines to owners whose animals are found straying through the village). Breeding is random and inbreeding is probably common; the parasite burden is generally high.

Some goats may be kept on isolated farms, and herded with cattle. These animals should be in better condition if their feeding is less restricted.

Possible improvements

(a) Modifications to the existing system are probably limited in scope, but the following are possible:

i. the feeding of cheap concentrate (such as cassava meal or wheat bran) at night, together with urea and molasses,
ii. regular treatment of parasites,
iii. improvement in pen hygiene, including drainage, a roof as protection against rain and sun, and bedding changed regularly,
iv. provision of clean water, for instance with 40 gal drum and drinking valve.

(b) Specialised goat farming either on an individual holding or in a community group has greater possibilities in that the following additional innovations are possible.

i. rotational grazing,
ii. separation of age groups and sexes, and control of breeding.

i. Rotational grazing might well combine the goat's scavenging function on bush to be cleared as well as its function as a grazer of planted pasture. There would be need for some experimentation but mixtures including Stylosanthes and Centrosema species (legumes) and grasses such as Pangola and Star might prove effective. Initial stocking rates might be ten goats per acre. Some form of fencing, either planted or constructed would be essential.

ii. Separation of age and sex groups would be necessary for a policy of improvement by selection, and so flocks of 40-100 would be required. Surplus males would be castrated and young females would not be bred until 10-11 months old.

These two major innovations would facilitate the careful control of mating within the herd as well as the introduction of males from outside; the routine dosing of stock for parasites; the control of mating so that kidding occurs when food is plentiful; a balanced nutrition programme which combines browse and grazing with by-products such as groundnut and cowpea haulms, concentrates such as wheat bran, oilcake, etc. and necessary minerals.

The prospects for specialist goat farming are, of course, essentially long-term and depend upon a substantial increase in local knowledge especially about creating grazing pastures and feeding animals balanced rations. This stage should obviously be approached through stage (a).

3.5.7 PIGS

Like cattle, pigs are relatively uncommon in the villages of South-east Ghana. Their development would represent a major investment effort. Nevertheless, in the longer term their potentiality should be explored.

Possibilities requiring investigation[1]

The main requirements for development would include:

1. improved stock - e.g. imported Large Whites
2. fly and mosquito-proof housing
3. adequate water supply (possibly in part by roof catchment)
4. a suitable feed
5. in due course, adequate marketing arrangements for fresh and preserved meat.

The development of a 'modern' pig industry will depend on the establishment of a cheap feed supply. One possibility to be investigated is cassava, and there may be other local products, such as molasses (from Asutsuare), oilcake, etc. (Silage, currently being investigated at Nungua seems less hopeful).

---

1. High level investment in pig keeping is being currently tried at Peki, west of Ho and outside the region proper. Similar work on a small scale is going on under German guidance on the Plateau de Dayes in Togo using cassava and brewer's waste as the main feed.

On medium-efficiency standards a sow (plus $\frac{1}{20}$ boar) and its progeny in one year of 14 would, if the progeny are taken to 200 lb live weight, require some 12,430 lb of feed. At a ratio of $\frac{2}{3}$ cassava (dry weight) and $\frac{1}{3}$ protein concentrate, the cassava required is 8,280 lb dry weight or about ten tons fresh weight.

It is estimated that such a ratio would cost 3·6-4np per lb depending on a fresh cassava price of 0·75 or 1·00np per lb. The hypothetical cost structure shown in AppendixXIsuggests that a viable enterprise might be developed on these lines. In addition to the sales of pig meat the producer would derive income from the production of cassava which contributed to the ration to the value of about N₵ 155.

Nevertheless this enterprise involves a high level of capital investment and technology. First there is need for a high degree of control of the pigs' environment to maintain health and give protection from sun; an adequate water supply would be essential. Second, health measures and a high degree of husbandry would be required to maintain output efficiency, especially in breeding, feeding and watering. Almost certainly economies of scale in construction and supervision would be derived from an organisation concentrating production (though the individual householder could well have a high measure of autonomy within such an organisation). Third, a steady supply of high quality feed must be assured; it may prove beneficial to chop and steam the cassava.

Local materials would be required, e.g. fencing developed from sawn Borassus palms, thatched roofs, locally made concrete blocks. Thought will be required to adapt designs of construction to local conditions and materials.

3.5.8 POULTRY

Poultry production now occurs at two distinct levels in Ghana. Commercial poultry production is on a medium and large scale, in and around the large towns. Traditional production for home and largely local consumption is spread through all the villages. Although commercial production is capital-intensive the sums required to start are not so great as in pig production. At the village level it is feasible to conceive of stage-by-stage development with relatively modest outlays. Marketing the product is however a major problem and will require solution before poultry production from the villages can be expected on a large scale.

Possible improvements in village production at the household level

A low-cost system of production, primarily for home consumption, is needed in the first instance, which raises productivity and thereby improves

levels of nutrition. This would imply:

1. enclosure of an area with fencing, for instance, of palm fronds
2. simple roosting and resting accommodation
3. good drinking water
4. availability of effective medicines
5. good feed.

The Animal Health Division provides vaccination service at 1np per bird for Newcastle Disease (at one, five, and 16 weeks and preferably at one year plus) and for Fowl Pest. Coccidiosis is also easily treated. Salmonella infections are an additional hazard reduced by hygiene and good feeding.

Good feed requires further investigation but there are many possibilities other than whole maize, which some farmers already use, but which is expensive. Alternatives include palm kernel meal, an apparently unutilised source of protein; cassava, which could be boiled and fed as a mash; and, in small quantities, dried fish meal. A cheap mineral supplement, e.g. 1 salt : 1 lime : 1 bone meal - should be made available through extension channels.

There is a case for keeping poultry at the farm rather than in the village. Theft would be a problem in some areas which might be overcome by the construction of alternative accommodation for family members at the farm. Use of alternative accommodation is a tendency which occurs already in a small way but would be increased with the introduction of different clearing and cultivation (and probably eventually tenurial) arrangements. Water could be provided by catchment tank.

Co-operative production and marketing

Intensive egg and broiler activities might later be contemplated on a co-operative basis in some villages. This would have the following advantages:

(a) the pooling of funds and economies in scale in investment in buildings

(b) economies and competitiveness with well-placed urban producers (like civil servants) in buying inputs and selling output

(c) the concentration of production where extension could be economically applied.

With a substantial and regular flow of production assured, contracts could be arranged with hospitals, schools, army units, etc. It would still be desirable to keep the style of the unit as simple and inexpensive as possible, using locally available materials.

The marketing of broilers is made difficult in that most of the birds are bought live. Unsold birds have a high maintenance cost and suffer from re-marketing.

The present prices in Ho are 45-50np per 1b live weight and 90np per 1b dressed carcass. A day-old chick costs 35np; feed costs 7np per 1b. With an F.C.R. of 3·5 1b feed per 1b live weight gain, a 5 1b bird costs N¢ 1·51. The margin over feed cost would appear to be reasonable given quick marketing and the reduction to a minimum of disease risks.

The marketing of eggs is probably less attractive. Some 12 dozen eggs at 84np per dozen compared with a feed cost of N¢ 7·84 (under intensive conditions) gives a smaller margin from which to pay for the stock, labour, accommodation and services. Cheaper feed and higher performance might well be achieved under co-operative organisation, watched over by effective extension.

A poultry project may well be a village innovation which would attract certain school leavers, and which might even originate in a school project - where the school suitably assisted, initiates the necessary education, the preparation of facilities and encourages families in the initial investment.

3.5.9. CHARCOAL BURNING

General

Section 1.8.1 showed that over the eight-village sample of daily labour records 4·25% of adult males' productive time and 2·13% of adult females' productive time was taken in charcoal making. The figure was higher in the Western villages where (at Kpota for instance) there are some villagers specialising in charcoal burning; in some of the Eastern villages, charcoal making is forbidden.

The importance of charcoal making was investigated by questionnaire among 67 householders scattered among seven villages,[1] who currently had interest in charcoal burning. (AA2)

Of the 67, 50 produce it only at certain times of the year. The main reasons given for making charcoal were:

(a) when money is needed

(b) when there is spare time.

The decision apparently does not depend on high prices nor, particularly, on the availability of wood at the time of clearing.

---

1. Charcoal burning is forbidden in Dzalele.

Marketing

Of the 67 householders interviewed, 54 sold it to carriers at the roadside; ten sold at Frankadua market, three sold personally in Accra, travelling with their product to supervise sale.

For most producers, prices varied during the year, June-July and October being quoted as months of high prices, presumably because supply tends to be lower at these mid-season times. Peak prices quoted ranged from N¢ 1·00 to 2·40 for a bag sold, averaging N¢ 1·67, the price being slightly higher in Eastern villages; it was much higher in roadside than bush villages (N¢ 1·84 compared with N¢ 1·51), probably reflecting the higher transport costs of buyers in the remoter villages. Price variation with quality was only reported in Akpokofe.

Producers' estimates show that overall, an estimated transport cost of N¢ 0·51 per bag is substantially less than the difference between current Accra and local prices (N¢ 2·86-1·37 = 1·49). It was reported in Kpota however that carriers may provide credit. They also pay cash immediately for charcoal. The charcoal price in these circumstances is lower than average - at about N¢ 1·00 per bag.

Possible points of innovation

Clearly charcoal provides a small supplement to income for a considerable number of householders and family members probably at a rate consistent with contract wage rates. It involves little capital investment. Returns depend on the time and skill available, which can be cashed at any time during the year.

It might, from a development viewpoint be viewed as an extractive industry capable of providing capital for investment in other non-extractive productive lines.[1] It needs to be considered whether charcoal burning can be expanded or improved (either by increasing income or by reducing costs).

It is obviously difficult without detailed botanical survey to decide whether the current rate of burning is higher or lower than the rate of regeneration of wood. Some local leaders are strongly of the opinion that the supplies of wood best suited for charcoal are everywhere in decline; that this is most serious in Eastern villages but that, with recent immigration of more people ('squatters') from the south, who are often only concerned with charcoal burning and partial subsistence, the same situation now exists in Western areas. It may be, therefore, that expansion of activity without

1. In questioning 67 householders it was revealed that the majority (39) said they spent some and saved some of the proceeds, none said that they saved all the proceeds.

the large-scale planting of replacements would more quickly result in deleterious effects on soil fertility. Householders were equally divided between positive and negative reaction when asked whether they would be prepared to plant trees for production in ten years' time. There may be a very good case for governments to consider such a policy.

Improvement in efficiency of production is probably possible at present levels of technology, particularly in the care taken to control the rate of burning in the heap. Improvement in the details of the techniques used are difficult to suggest, though spades for earthing up might be more efficient than the hoes currently used.if shoes are worn.

Householders themselves most often mentioned the introduction of power-saws as the best way of increasing income from charcoal, as well as giving more time to the task. A few power-saws have been introduced already; R.N. Parker investigated the economics of this innovation (see Volume II, Chapter 5 of this study), coming to the conclusion that, at least on social cost-benefit grounds power-saws were probably not to be encouraged.

Innovations in transport appear to be worth investigating, particularly if expansion of production is considered feasible. There was considerable interest expressed among villagers at the idea of a co-operative venture to buy a lorry for the transport of local charcoal, the virtue of which, if successful, would be to retain a large proportion of the value of the product within the local community.[1] Villagers sometimes visualised difficulties in setting up and also in operating such a co-operative venture, however. Co-operation in the organisation of local transport might well prove more complex than co-operation in other ways and should be low on the list of possible innovations.

3.5.10 SMALL-SCALE ENGINEERING EQUIPMENT

No comprehensive survey was made of other rural activities, and further investigations, for instance of house building techniques, the design of cooking facilities, etc., are required. Small-scale metal fabrication is perhaps of most pressing importance. The advantages of locally-made equipment over factory-made, and particularly imported, equipment may be considerable. Thus:-

1. Local employment is increased,
2. Local materials, including scrap metal, wood,pottery, could reduce material costs,
3. Equipment design may be better adjusted to local conditions and requirements,
4. Cash outlay, and particularly foreign currency requirement may be reduced.

1. It is true that, already, a few of the lorry operators are local residents.

There seems everything to be gained from increasing local engineering skills, equipment and perhaps, power.

As far as equipment is concerned modest improvements in a few aspects of local blacksmith's technique could radically improve their efficiency. Two obvious deficiencies arise from the absence of:

(a) hand- or treadle-operated grinding wheels, designed to supplement the current hand filing and chiselling

(b) hacksaws, for more precise shaping.

As a second stage, when more power will be required, the introduction of drills, taps and dies, and lathes would be justified, at least in small towns, for more complex fabrication.

This type of development needs to be approached at a regional or national level where investigations would be designed to reveal:

(a) the kinds of equipment (rather than precise models) which can be expected to sell,

(b) the degree to which local materials can be economically incorporated (and, per contra, the kinds of components which may have to be imported),[1]

(c) the scale and kind of technical education local fabricators can best have,

(d) the financial and other facilities that central government must provide,

and where plans for these can be integrated with regional plans for the development of roads, rural electricity, water supplies, schools, markets, administration, etc.

3.6 POWER DEVELOPMENT

It is desirable to think of the development of power as a whole, and the expansion of the use of mechanical power as an extension of human effort. In this way, as the demand for investment in power units grows, it should be easier to find those opportunities (perhaps cutting across the main categories of field work, household or village work, and transport) which are most economic. Only tentative suggestions are made in this section.

3.6.1 OFF-FARM SMALL POWER UNITS

Mechanical power has only appeared at all widely in South-east Ghana in the form of stationary diesel engines adequate for driving maize mills. These engines tend to be underused having little other use than the grinding of maize and sometimes palm kernel for some two hours a day. A number of

1. e.g. ball races, hydraulic units, thermometers, etc.

suggestions have already been made about how the capacity of existing units might be taken up with other activities, notably cassava grating and in providing hot air for driers. In individual cases there may be other possibilities, for instance, water lifting from wells and streams.

While desirable, it appears to be difficult to organise community action for this kind of innovation. Kpota and Abutia Kloe have for instance solved their water problems except for the fact that it has proved impossible to organise on a village basis the running and maintenance of the engines and pumps. In some circumstances, especially if some water were pumped to animals, it might be feasible to leave mechanical pumping to an individual entrepreneur who would charge for his service.

There may of course be justification for tractors, already largely employed on field and transport work, to be used as stationary engines. This is an expensive form of power however; it is only likely to be economic when used sparingly for stationary work, at times in the year when other work is not available, and as long as the value of the work exceeds the operating cost.

3.6.2 SMALL-SCALE POWER UNITS FOR FIELDWORK

The introduction of mechanical power is taking place in South-east Ghana for all purposes without an intermediate animal stage. While there would seem to be a good case for introducing donkeys for transport, ox power for cultivation would probably prove difficult because:

1. very few people already own cattle,
2. cattle are relatively high priced in South-east Ghana,
3. tse-tse fly is prevalent,
4. ox equipment would add substantially to the cost,
5. one ox would require 6-7 bags of maize per year as an energy ration, and the maize price is high,
6. there is no local ox technology.

In areas of light soils there is a case for considering small-scale mechanical power units. At present however such units are expensive, and spare parts are exorbitantly expensive and obtainable only in Accra. Even so it is possible to introduce them at a cost of N¢ 15-30 per acre (covering running costs, depreciation, maintenance and repayment of loan over three years). The main problems would be the managerial ones of (1) ensuring the continuous serviceability of the machine and (2) providing it with a high rate of work, with a high value product.

Various alternative arrangements are possible, including:

(a) the owner-user operating a small machine, at c. N¢ 300, over (say) 5-6 acres of Major and minor season crops, with a good proportion of high value cash crops,

(b) the owner who both uses and hires out his machine,

(c) the owner who combines small-machine work, especially down-the-row weeding, with tractor ploughing and harrowing. (This is a high cost system and would need very careful estimation).

(d) the owner-user with a larger versatile machine - such as the Kubota, with its constant speed engine, at N¢ 1,000-1,500, with the possibility of cultivating a 20-30 acre farm,

(e) the owner-user (or possibly a co-operating group) incorporating irrigation on a small scale.

In addition to cultivation activities such units could be adapted to weeding (the peak labour activity once land is cleared), transporting with a small trailer, planting for straight rows and regular spacing, and perhaps for fertiliser application and spraying in some large units.

In view of all the difficulties, careful trials would have to be followed by equally careful organisation if small power units were to be successfully introduced.

3.6.3 MECHANISATION OF FIELD ACTIVITIES WITH FOUR-WHEEL TRACTORS

The introduction of mechanisation, centred round tractors, whether small or large, represents a major jump in capital investment and associated technology. It is not conceivable that such a change could be financed out of the current income of more than a very few individuals in South-east Ghana.

If the introduction of such equipment is not going to result in the squeezing out of population which depend on the land, one or both of two conditions must obtain: first, land must be available for the extension of cultivation which is not already used by others (and the fact that much of the apparently unused land is under natural regeneration must not be forgotten); second, the introduction of such capital investment must result in vastly increased returns per acre. Also, any major investment in mechanisation will have a direct impact on Ghana's chronic and serious balance of payments and currency shortage problems. The pros and cons of making such a leap forward require extremely careful assessment, therefore, in spite of the general feeling to be found when talking to local people that mechanisation is the process above all to be desired.

Current practice

Tractors were probably first introduced into South-east Ghana when a mechanical group farming scheme was started around Ohawu Agricultural Station in 1956. Today a few farmers have their own four-wheel tractors, mostly in the 65 h.p. category. In the south, Okadze Farms Ltd. hires out five Ford 4000 tractors and there are others hiring out at Adidome (1), Agboase (4) and Akatsi (1), as well as a co-operatively owned tractor at Ho. The Ghana Tobacco Company at Akatsi began to hire tractors to farmers in 1970 and now has seven Ford 4000's. Ampratwum (1971) found 15 tractors in a survey of Ada-Sege area on the southern edge of the region. Very few single-axle tractors are to be found in the area.

Government tractors are to be found on most of the State farms and settlement schemes listed by Mettrick (1971) Appendix III, p.108. In addition the Ministry of Agriculture runs a hiring scheme. This is currently in very bad shape with a very high degree of unserviceability among its equipment and a poor rate of performance. Latterly, policy has been to repair and to sell tractors to farmers, presumably in the belief that individual farmers can overcome the problems of spares, maintenance and supervision that have defeated them. But, as Rourke and Hiadzi (1970) have pointed out, the problems will remain the same.

Performance of tractors has not so far been impressive. Difficulties first arise because fields are widely dispersed, small, irregular in shape and badly stumped. Records of the Ghana Tobacco Company show mean plot size of 0·55, 0·65 and 0·69 acres for three of their tractors. Estimates of acres ploughed per day for the same tractors were 2·83, 3·05 and 2·84.[1]

Seasonality of the work load is another factor making for high overhead costs. This is reduced in South-east Ghana by two cropping seasons and the extent to which the tractor is used for work other than ploughing. Ampratwum (1971) found that private operators averaged 810 hours per year and ploughed 150 acres and harrowed 300 acres. The G.T.C. tractors, which are also used for carting supplies and tobacco, work about 1,200 engine hours per year, which represents a high level of utilisation.

The total cost of ploughing and harrowing per acre assuming 1,000 hours per year, and including an initial capital cost for tractor, plough and harrow of N¢ 6,500 was N¢ 9·76 at Akatsi. This compares with the current government hire charges of N¢ 4 per acre for ploughing and N¢ 2 for harrowing. Private operators charge N¢ 8 for ploughing and harrowing.

1. Ampratwum (1971) estimated an average of 7 acres per day in his survey in Ada-Soga, and a longer working day than G.T.C. employees worked.

Even this rate looks unrealistic in present circumstances;[1] moreover capital charges are tending to rise; but thetractor owner probably has a good opportunity for spreading his fixed costs by undertaking transport of bulky products, especially cassava. (An imported trailer costs N¢ 950 - or N¢ 190 annually assuming 10% interest and a life of ten years - and a locally made one would cost much less.)

Future potentiality

Taking appropriate data from Dalton and Enikwan (1971), Table 3.12 shows the fixed and variable costs to be expected in using 65 h.p. tractors under Ghana conditions. Table 3.13 illustrates how the break-even point is determined for various areas ploughed and harrowed at different rates of charge on the basis of these figures. It will be seen that one cultivation unit must cultivate as much as 400 acres[2] in order to break even on a contract charge of N¢ 10 per acre.

Table 3.12

Fixed and Variable Costs, Ploughing and Cultivating

	N¢
Fixed costs:	
Interest on equipment @ 10%	650
Insurance and licence	68
Tractor driver	360
	1078
Variable costs per acre:[3]	
Depreciation over 10,000 hours	2·16
Fuel and lubricants	4·46
Repairs	0·83
	7·45

Table 3.13

Returns to Tractor Hire (N¢)

Areas cultivated	50	100	150	200	250	300	350	400
Machine cost	1450	1823	2197	2568	2940	3313	3685	4058
Returns @								
N¢ 6/acre	-1150	-1233	-1295	-1368	-1440	-1513	-1585	-1658
8/acre	-1050	-1023	-995	-968	-940	-913	-885	-850
10/acre	-950	-823	-695	-568	-440	-313	-185	-50
12/acre	-850	-623	-395	-168	+60	+287	+515	+750
14/acre	-750	-423	-95	+232	+560	+887	+1215	+1550
16/acre	-650	-223	+205	+632	+1060	+1487	+1915	+2350

1. Rates conforming more nearly to marginal rather than average cost can be justified (i) in the case of private contractors who are seeking to spread fixed costs hitherto carried on too small an acreage or (ii) in the case of a government seeking to encourage cultivation by subsidy.

2. This represents 1,320 hour work per annum.

3. Assume ploughing takes 2·2 hours and harrowing 1·1 hours per acre.

The private investor faces the same order of costs if he seeks to set up in continuous arable farming. He may also incur initial clearing and destumping charges of N¢ 30-40 per acre on woodland savannah. A crude calculation using the input data assumptions in Table 3.14 suggests that an annual yield of 6·2 bags of maize @ N¢ 11 per bag would cover costs on a 100 acre unit:-

	N¢	N¢
Clearing (per an.)	200	
Tractor costs	1,823	
Management	2,450	
Production costs	2,255	6,728
6·2 x N¢ 11 per bag		6,820

If 100 acres is double-cropped with maize and groundnuts 4 bags of maize and 2·5 bags of groundnuts will suffice to cover costs:-

	N¢	N¢
Clearing (per an.)	200	
Tractor costs	2,568	
Management	2,450	
Production costs		
(a) maize	2,255	
(b) groundnuts	3,890	11,363
4 x N¢ 11 per bag		4,400
2·5 x N¢ 28 per bag		7,000
		11,400

The private operator has to satisfy himself that he can expect the yields and prices assumed here to persist before embarking on tractor based farming.

Table 3.14

Input Assumptions (per acre)

		N¢
Maize	Seed	1·00
	Fertiliser (2N)	4·00
	Labour 27 m.d. @ 0·65	17·55
		22·55
Groundnuts	Seed	9·60
	Labour 42 m.d. @ 0·65	27·30
	Mechanised shelling	2·00
		38·90
Maize-Groundnut double cropping		61·45

3.7. SUMMARY OF IMPROVEMENT POSSIBILITIES

1. This is an area where in general the level of natural fertility is low; there may be limited areas in the north and west where production either of arable crops or livestock could be extended, given adequate water supply.

2. Development of water resources for drinking and, to a limited local extent, for irrigation may lead to an increase in the intensity as well as extent of land utilisation. Large scale investment in roads does not appear to be justified at this stage, though self-help by local committees could well have significant benefits.

3. There probably can be substantial improvements in the growing, storing, processing and selling of the major food crops already grown, which can be achieved following effective extension. Many of these innovations need testing at the village level. It is likely that innovations which raise the productivity of land, make modest demands for capital resources and make better use of (rather than substantial additional demands on) labour, are those likely to be easiest to introduce. These include:
   (1) improved seed, medium-level fertilising, better cultivation, and improved fumigation, drying and storage of maize,
   (2) better varieties and the expansion, with better organisation and limited mechanisation in processing, of cassava production,
   (3) improved post-harvest handling of groundnuts,
   (4) improved planting material, increased care in cultivation and, in certain situations, small-scale mechanisation of oil extraction, in the case of oil palm.

4. Though local trials would again be justified there appear to be few other crops with obviously promising prospects. Enough now appears to be known about cowpeas to make it possible to introduce a substantially improved method of production. Sorghum, though not yet locally tried, may for some purposes be a useful substitute for maize. While there is considerable scope for improving the standard of cotton and tobacco growing, these crops may not be sufficiently superior as income earners to maize to cause farmers to grow them while the demand for maize stays high. Where irrigation water can be provided the expansion of vegetable production could well be profitable both for local consumption and, given good road access, for regional markets.

5. It would be justified to extend present methods of improving cattle production though substantial expansion requires a more fundamental (though capital-sparing) programme relating cattle to water supplies

and grazing. In the meantime there is scope for increasing village consumption of goat meat and poultry products by improved husbandry techniques.

6. Charcoal can probably be made by more labour saving methods which may be worthwhile if the labour saved can be deployed productively. Unless it is found possible to maintain soil fertility by improved methods it is doubtful whether expansion of production would give other than short-term gains.

7. Above all a way of making the transition from shifting to more continuous cultivation is required which does not prejudice the maintenance of natural fertility but which at the same time harnesses manpower rather than requires large capital investment. This can only be found by trial and error.

REFERENCES

3.2.1. Roads and Transport

EWUSI, K. The Rate of Inflation, Variation in Local Food Prices and the Effect of Transport Facilities on Local Food Prices in Ghana in the Sixties. I.S.S.E.R. Conference Paper, March 1971.

ONYAH, B.K., SACKEY, J.A., ODONKOR, G.T. and VICKERY, W.E., Agogo-Krobo Market and Feeder Road Study, Dept. of Economics, University of Ghana. Mimeo. July 1971.

OWUSU, F. National Feeder Road Construction and Maintenance. Mimeo P.W.D., 1971.

3.2.2. Water Supplies for Human Drinking

BATEMAN, G.H. Interim Report on a Research Project on Low-cost Water Technologies, March 1972.

3.3.1. Intensification of Land Use

ALLAN, W. The African Husbandman; Oliver and Boyd, 1965. In particular those sections entitled:
(a) The Cycle of Land Degeneration
(b) Remoulding the old Systems.

NYE, P.H. and GREENLAND, D.J. Soil under Shifting Cultivation. Commonwealth Agric. Bureau. 1961.

3.3.2. Maintaining Soil Fertility

AGBOOLA, A.A. and FAYEM, A.A. Interplanting of Maize with Legumes. W. African J. of Biol. and Appl. Chem. 13.(2), 1970.

ANDREWS, D.J. Intercropping with Sorghum in Nigeria. Experimental Agriculture 8. (2), 1972.

DALTON, G.E. The Economics of Maize Production, Univ. of Ghana, June 1971, Mimeo.

DOKU, E.V. Are there any alternatives to traditional bush-fallow systems for maintaining soil fertility? Ghana Farmer No.11, 1967.

EVANS, A.C. Maize and Sorghum with Groundnuts. E. Africa Agric. and For. Journal 26. (1), July 1960.

GUINARD, A.C. Conservation and improvement of soil fertility in Africa, part 2. Wld. Crops 19, 1967.

NORMAN, D.W. Intercropping of Annual Crops under indigenous conditions in the Northern part of Nigeria. I.S.S.E.R. Conference Paper. March 1971.

PARKER, R.N. B.Sc. Dissertation (unpubl.) 1969.

RUTHENBERG, Hans Farming Systems in the Tropics. Ch.6. Oxford 1971.

SHERMAN, W.R. Research Memo No.14, U.S.A.I.D. Accra, May 1970.

3.4.1. Maize

AGBLE, W.K. Improvement of yields of maize in Ghana. Ghana Jl. of Science 3. (1), 1963.

Maize Industry in Ghana. Ghana Farmer 7. (4), 1963.

BOYNES, R.A. Yields of Maize on Four Caribbean Islands as influenced by Variety and Plant Density. Trop. Agric. (Trinidad) 49. (1), 1972.

CUNARD, A.C. Maize Agronomy II. Nutrients and Nutrient Uptake. World Crops 19. (1), 1967.

Maize Agronomy III. Growth and Fertilisers. World Crops 19 (4), 1969.

Maize Agronomy IV. Other Factors, World Crops 19 (6), 1969.

DALTON, G.E. The Economics of Maize Production, Univ. of Ghana, June 1971. Mimeo.

ERKYNN, K.G. Statistical and Economic Analyses of Fertiliser Use in Maize Production. C.R.I. Mimeo, July 1971.

HAIZEL, K.A. Maize Cultivation on the Accra Plains. Ghana Jl. of Science 6. (3 or 4), 1966.

HOPP, H. A Simulation Model for the Financial Return on Farm Storage of Maize. Min. of Agric. 1971 Mimeo.

LEPIGRE, A.L. and POINTEL, J.G. Protection of Maize Stored in Traditional Togolese Granaries. Trop. Stored Prods. Info. (21), 1971.

MILTON, R.F. and TARRETT, K.J. Maize Storage and Transport I. World Crops 21 (5), 1969.

MIRACLE, M.P. Maize in Tropical Africa. Univ. of Wisconsin Press, Madison 1966.

PETERSON, W. A Low Cost Grain Drier for Tropical Climates. Peace Corps. Technical Notes, Aug. 1969.

RAWNSLEY, P. Crop Storage. U.N.D.P.; PL. SF/GHA 7. Technical Report No.1. 1969.

WIGGIN, H.I.C. Western White I - A high lysine maize cultivated for Nigeria. Trop. Agric. Trinidad 47 (3), 1970.

3.4.2. Cassava

AKINRELE, I.A. Nutrient Enrichment of Gari. W. Afric. J. Biol. and Applied Chem. 10 (1), 1967.

AKINRELE, I.A., COOK, A.S. and HOLGATE, R.A. The manufacture of Gari from Cassava in Nigeria. Proc. 1st Int. Congress. Food Sci. and Tech., London, 1962.

DENDY, D.A.V. and CLARKE, P.A. Interim Report on the Use of Non-wheat Flours in Breadmaking. T.P.I. Report No. G50, 1969.

DOKU, E.V. Cassava in Ghana, Ghana Univ. Press, Accra,1969.

FINANCIAL TIMES Putting a Punch into Cassava. 23/2/1972.

FLAWS, L.J. and PALMER, E.R. The Production of Particle Board from Cassava Stalks. T.P.I. Report No. G34, 1968.

LANTEY, B.L. A Prototype Cassava Grater for use in Ghana based on studies of existing graters. Ghana Jl. of Sci. Vol.3. Part 1., 1970.

SUBRAHMANYAN, V., SREENIVASAN, A., BHATIA, D.S., BAINS, G.S. and SWAMINATHAN, N. Processing of Tuber Foods with special ref. to Cassava (Tapioca) into Enriched Macaroni-type Products. Proc. 1st Int. Cong. Food Sci. and Tech., 1962.

UNIV. OF GEORGIA. A Literature Review and Research Recommendations on Cassava. A.I.D. Contract No. csd/2497. March, 1972.

3.4.3. Groundnuts

BLATCHFORD, Mrs. S.M. and HALL, D.W. Methods of Drying Groundnuts
I Natural Methods. Trop. Sci. 5. (1), 1963
II Artificial Methods. Trop. Sci. 5. (2), 1963.

COLLINS, G.A. and COWARD, L.D.G. The Improvement of Land-operated Groundnut Decorticating Machines. T.P.I. Report No. G68, 1971.

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP. Tools for Agriculture. I.T.D.G., London, 1973.

MC.PHERSON, G.H. Groundnut Cultivation in Western Tanzania. Western Res. Centre. Progress Rept. No.2. 1966.

3.4.4. Oil Palm

DALTON, G.E. and FAMIYEH, J.A. Costs and Returns of Rubber and other Tree Crops on Small Holders' farms, Western Region. Dept. of Ag. Econ., Univ. of Ghana. Res. Rept. No. 5. 1971.

HARTLEY, C.W.S. The Oil Palm. Longmans, 1967.

KILBY, P. The Nigerian Palm Oil Industry. Food Research Inst. Studies. VII No.2, 1967. Stanford.

3.5.4. Sorghum

AZAB, Y.E.A. Applied Agronomic Research on Field Crops in Northern Ghana. F.A.O. TA 2596, 1968.

CAMERON, C.W. and ASHTON, G.C. The Possibilities of Sorghum Production on the Accra Plains. Ghana Farmer Vol. XIII No.2 p.70, 1969.

3.5.5. Cattle

LAWSON, Rowena M. Changing Economy of the Lower Volta 1954-67. I.A.I. Oxford, 1972.

NATHAN ASSOCIATES Ghana Sector Studies - Livestock, 1970.

3.6.3. Mechanisation of field activities

AMPRATWUM, D.N. A study of some factors affecting cost of mechanised farm operations in the Ada-Sege Sub District of Ghana. Symposium on Agricultural Engineering. Univ. of Ghana, March, 1971.

DALTON, G.E. and ANIKWAM. Costs and Benefits from Operating Wheel Tractors in the North of Ghana. Mimeo. Dept. of Agric. Econ. Univ. of Ghana.

METTRICK, H. Policies and Institutions in Ghanaian Agriculture. University of Reading. Development Study No.9. June 1971.

ROURKE, B. and RIADZI, M.E.S. The Use of Tractors in the Accra Agricultural District. Accra. Jan 1970.

CHAPTER 4. POSSIBILITIES OF CHANGES IN THE PEOPLE, IN INSTITUTIONS AND IN SERVICES

The effecting of change in agriculture in South-east Ghana implies associated changes in three other directions; namely, the attitudes of individuals, in the relationships between individuals, and between them and those providing services (particularly government). These changes will come about automatically to some extent, but it may usefully be considered whether the prospects for change among the people are good and where positive pressure could be applied to expedite and modify these processes.

4.1. ATTITUDES TO CHANGE

Attitudes in respect of certain possible innovations have already been referred to in Chapter 3. An attempt was also made, by the combining of answers from groups of questions, taken from attitude questionnaires, to test certain general attitudes. For presentation here analysis has been limited to answers from four villages (Podoe, Kpomkpo, Akpokofe and Waya) so as to test relationships with certain characteristics of householders; the four villages were taken as a whole and also in pairs thus examining the effects of village location. Only questions from those questionnaires (AA1 and AA3) which had been put to all the householders in this sample were included in the analysis.[1] Results are tabulated in Appendix V.

The general attitudes tested included interest in material gain, 'investment-mindedness', independence, and co-operativeness.[2] In all these, positive attitudes appeared to be dominant over negative ones. Correlation of attitude with socio-economic characteristics was generally not strong though the amount of schooling received did seem to be positively related with the second and third of these attitudes.

Willingness to borrow, and to take advice, were also examined with equally positive results.

Finally, attitudes were tested as to householders' preferences for large families and for agricultural as contrasted with non-agricultural pursuits. It is interesting that, while there appeared to be preference for (or resignation to) agriculture as an occupation, large families were regarded as preferable only by a minority.

The overall impression of these albeit crude tests seems to be a general state of attitudes conducive to innovation if economically feasible innovations can be found.

---

1. Contingency tests were applied to question groups before being used.
2. This attitude is discussed further in Section 4.2.3.

Table 4.1

Traditional and Agricultural 'Leaders'

Large sample, eight villages

Questions asked:

2.1. Who do you consider the most fortunate man in the village?
2.4. Who is the best farmer in the village?
2.6. Who is the head of your clan?[1]
2.8. Who settles quarrels in your family?
2.12 Who would you go to in this village to learn new ideas?

A. Distribution of answers

Question No.	No. of householders giving usable answers[2]	No. of people mentioned	Column 3 / Column 2
2.1	187	89	0·47
2.4	231	86	0.37
2.6	280	152	0·54
2.8	281	175	0·62
2.12	153	63	0·41

B. Distribution of Mentions

a. Percentage of householders mentioned b. Percentage of number of mentions

No. of Mentions			1	2	3	4	5	6	7	8	9	10-19	20-29
Question No.	2.1	a.	66.1	16.2	5.8	2.3	2.3	2.3	4.6			2.4	
		b.	32.4	15.9	8.5	4.5	5.7	6.8	11.9			14.3	
	2.4	a.	58.1	18.2	8.0	1.1	3.4	2.3	3.4			4.4	
		b.	24.6	15.5	10.1	1.9	7.3	5.8	10.1			24.6	
	2.6	a.	72.4	8.5	6.6	5.3	2.0	.7	.7	.7	.7	2.1	.7
		b.	35.5	8.4	9.7	10.3	4.8	1.9	2.3	2.6	2.9	13.2	8.4
	2.8	a.	74.4	7.9	5.7	2.3	2.8	.6	2.3	.6	1.1	1.1	
		b.	40.4	8.6	11.1	4.9	7.7	1.9	8.6	2.5	5.6	8.6	
	2.12	a.	62.8	11.3	11.3	3.2	1.6		1.6			3.2	4.8
		b.	20.6	7.4	11.1	4.2	2.6		3.7			13.7	36.5

C. Comparisons of Answers (%)

	Answers Similar	Answers Different	Unusable Answers
2.6/2.8	61·7	27·5	10·8
2·6/2·1	6·8	49·5	43·7
2.6/2.4	5.2	64.9	24.9
2.6/2.12	4.7	46.0	49.3
2.4/2.1	7·1	45·3	47·6
2.4/2.12	9·4	38·1	52·5
2.1/2.12	3·2	34·5	62·3

1. Commonly there are four or five clan heads recognised in these villages. Clearly householders often interpreted the question to mean family heads.

2. 'Unusable' answers include mention of 'self'.

4.2. INTRA-PRODUCER ORGANISATION

In a number of foregoing sections it has been suggested that, by concerted action, improvements can be achieved that would not be possible by individuals working independently. Obviously there is a variety of ways in which grouping could occur - in firms with a company structure, in co-operatives with different rules and degrees of integration, in para-state corporations, etc. Some preliminary comment on the feasibility of grouping in addition to those already made, and, if possible, indications of the kinds most likely to succeed, are required.

4.2.1. POTENTIAL LEADERS

It will be recalled that clan loyalties are strong and that many social events, and sometimes the organisation of productive activity, take place within the clan.[1] There are also a number of ways in which clans or their members act together within the village - for instance in village communal work under the village headman, in ritual activities centred on the village headman or priest, and in social activities centred round the church or school. While some of these activities have elements of democratic association and government, the leaders and elders have considerable prestige. This seems to be specially true in the smaller and more remote villages. A sense of hierarchy may therefore be quite strong in matters of organisation.

It does not necessarily follow however that where new organisations for agricultural purposes are formed they would be automatically dominated by traditional leaders. A study of 'leadership', carried out on the large sample (40 householders per village) is summarised in Table 4.1 A. B and C. The householders, in answering five questions, (a) gave widely dispersed answers when naming people respected in one way of another (see Table A. Col.4) though (b) the distribution of mentions were seen, for each question, to single out a small number of men who were often referred to (see Table B, b rows); (c) when the distributions of answers were compared (Table C.) it was noticeable that whereas the man named as chief was frequently also quoted as being the settler of family quarrels (one of his traditional functions), he was seldom quoted as the most fortunate man, the best farmer or the one from whom to learn new ideas; on the other hand (d) there was little coincidence of answers among these last three variables either; (e) the high number of unusable answers reflects the commonness of an absence of orientation towards leaders rather than a reluctance to

1. e.g. In Waya, clan members were organised to clear land and take up a maize loan; they provided labour to rebuild a house after a fire.

answer if the readiness to answer other questions in the questionnaire is acceptable as indicative of co-operativeness.

The picture tending to emerge from this test, therefore, is that the villagers are not markedly docile in following venerated leaders and, if groupings emerge in the future, they will not necessarily be related to the traditional structure.

It must also be borne in mind that the current population is very mobile, a large proportion currently seeking employment outside the village area. These activities imply a substantial degree of independent decision making. They may also imply, in some cases, access to financial resources through absent relatives or distant interests. The numbers within the small sample (20 householders per village) who made very substantial investments during 1970/1 was seen to be small (Section 1.8.2), but their influence could be large. Other recent cases could be cited as, for example, an oil-palm plantation in Kpota, a lorry in Akpokofe. In other words, independent initiative may be possible and more appropriate than group action for some things.

4.2.2. THE GENERATION AND EDUCATION GAP

As Mettrick (1971, p.90-1) has emphasised, Ghana, like many other African countries, is undergoing rapid changes of educational status among the people. The effect is to create a gap between the older illiterate and the younger literate generations. It is often said that the latter have no desire to be semi-subsistence farmers or to live in the countryside. This general situation applies in South-east Ghana and partially accounts for the exodus in search of temporary and permanent work elsewhere.

The existence and likely growth in numbers of primary and middle-school leavers must be taken into account in the planning of organisations in the future. At the present time many are to be found in the villages only seasonally employed as hired labour (they appear to work well in groups on contract clearing work) while some have taken families and farms. They are however reported to be discontented. With expansion of activities, jobs as clerks, storekeepers, drivers, mechanics, etc. in villages and small towns may be expected to absorb some of them; improved income prospects from agriculture might satisfy others. The tendency in the recent past to treat this group as distinct and to incorporate them into settlement farms, workers' brigades, etc. seems to be ill-advised: (1) not many of them have been persuaded to take a permanent interest in farming in this way

(2) there seems much to be gained in preserving the rural social structure within the villages and small towns so that the generations are of mutual benefit to each other even though a greater flexibility and independence in the younger generation is to be expected.

4.2.3. PREPAREDNESS TO CO-OPERATE

Some notion of the preparedness to co-operate was sought in practical situations in some of the questionnaires AA1-6. Four of these questions were as follows:

(1) If it was decided in the clan to group together to clear a big piece of land for tractor cultivation would this be a good idea or not? (AA3)

of 146 householders, 136 said 'Yes', 8 said 'No'.

(2) If someone suggested grouping together to buy a big thing like a tractor or a maize mill, would you join in, wait and see, or let the others carry on? (AA3)

of 146 householders, 109 said 'Yes', 23 said 'Wait', 12 said 'No'.

(3) If you were asked to join a group as the only way of getting a loan (say) for growing maize or groundnuts which you then shared out equally, and if the group was committed to paying back the whole loan after one year even if one of the group was unable to pay his share, would you join the group, or not? (AA6)

of 46 householders 30 said 'Yes', 14 said 'No'.

(4) If a number of people in the village decided to have cattle at the same time as yourself would you be happy to co-operate with them to employ one herdsman? (AA2)

of 78 householders, 53 said 'Yes', 3 said 'No'.

It might be expected, with this sort of hypothetical question that some would answer 'Yes' expecting this to be the answer preferred by the questioner. It is noticeable too that the positive emphasis was less in question (3) which specifically introduced a practical snag. Nevertheless the apparent readiness to co-operate was marked.

One example of group activity already attempted is that at Kpomkpo, which has been encouraged by the E.P. Church. Here a group of villagers (of mixed religion) were formed into a committee to organise, through the E.P. Church, tractor-hire activities. It was intended that the committee should be responsible for establishing members' requirements and getting the work done (by the Ministry of Agriculture), while the E.P. Church

provided credit in the early stages to pay for the tractor hire, as well as supplementary advice and services. In this case firm leadership failed to emerge, though the villagers still talk enthusiastically about co-operation in this and other ways. The lesson to be learned here appears to be that careful guidance by an 'external' manager is likely to be necessary for some time if lasting success in group action is to be achieved.

4.2.4. SUGGESTIONS ARISING

Specific group activities can only be developed after promising innovations have been selected and arranged in programme order and then only on the basis of 'trial and error' after full discussion. This would be the obvious role of a Unit charged with the task of continuously studying and stimulating development.

Group formation would depend on:

a. the technical opportunities
b. the existing institutions, both local and public
c. the personal qualities of individuals.

Where capital and enterprise reside in one man (or a close family) and where efficient use and upkeep of a machine are central to success, single-man or family firms are probably to be preferred if maximum material progress is assumed to be the goal. These are already in evidence in shops and maize mills.

Where a service can be provided only if a number are prepared to invest together, some form of grouping is indicated. Its organisation may be related either to the use made of the services or to the capital stake of each individual, or a combination of both. The type of organisation required would also depend on the number of members, the managerial skill needed and available, and the pattern of expenditure and income to be expected.

In the case, for instance, of a central village grain store used by many individuals, a group organised on co-operative lines with indigenous management supported by official technical advice should be feasible. Starting from small beginnings such an organisation might expand to (a) embrace more members (b) undertake additional functions such as selling grain in bulk, buying farmers' requisites and perhaps channelling credit to farmers. (At some stage it might be necessary to employ specialist management, but it would be desirable that it should begin in a small way with only local presonnel, including (say) a book-keeper and storemen from the literate younger generation.)

Group clearing and cultivating of land (which would probably entail some fundamental changes in land tenure) may require organisation on a total clan or village basis and a willingness to integrate labour rather than capital. This would seem an opportunity for the extension of activities of the traditional local power structure if leaders are also technically enlightened.

The same would in part apply to an irrigation scheme involving a fertile stretch of village lands. However, to the extent that a substantial capital investment and a rather small number of cultivators may be involved, some subsidiary group action is indicated. This could be visualised (1) as a small company investing/farming unequally and paying a rent to the village for land and water, (2) as an entrepreneur selling water to rent-paying cultivators or (3) as an entrepreneur (or company) with share tenants, rent being paid by the entrepreneur to the village. Perhaps, best of all, alternative (3), which would involve the largest number in carrying the initial risks until technical efficiency and market development had been achieved, could lead on to a structure including rent paying tenants with security of tenure.

The introduction of a highly complex new crop, or rotational policy incorporating a new crop, such as tobacco, cotton, legumes or sorghum, would be best achieved by a highly skilled central management with adequate financial backing, probably in part from outside the area. The Ghana Tobacco Company provides a model of the kind of structure though this might be modified for different conditions.

Whichever organisational forms are chosen, early attention should be paid to possibilities of group action among the women. There are a number of reasons for this:

1. Women already show a strong sense of community in these villages.
2. Many of the tasks they traditionally perform, particularly in crop processing, could be improved on the basis of group investment, with a substantial saving in time for other activities.
3. It seems highly desirable that, with expansion of investment in the village, they should not slip into a subsidiary position in village society, with a consequent loss in incentive.

4.3. SERVICES TO FARMERS

4.3.1. SERVICES PROVIDED

The services currently provided to farmers (the general pattern of

which was described in Mettrick (1971, Ch.4.) are weak in South-east Ghana.

There are three District Officers, stationed at Ho, Denu, and Sogakope each controlling a small number of Agricultural Assistants, most of whom are scattered thinly over the villages. While the D.O.'s have Land Rovers, the Assistants have only bicycles (or occasionally motor cycles) and are very limited in their mobility. They have little to pass on to farmers and not infrequently tend to concentrate their attentions on a very few exceptional farmers who have considerable personal resources. Introduced development programmes in South-east Ghana have been confined to the following:

(a) the U.S.A.I.D. Focus and Concentrate programme, centred mainly North of Ho, has two farmers South of Ho,

(b) the F.A.O. Fertiliser programme has only one set of demonstration plots South of Ho, at Ziofe,

(c) other foreign aid has been responsible for stimulating the growth of rice at Afife and for the establishment of the cattle ranch at Tadzewu,

(d) the Ministry's Agricultural College at Ohawu has a minor impact locally.

In addition to the District Officers the Ministry of Agriculture also provides:

1. dams and dugouts mostly for cattle, through its Irrigation Department,

2. machinery services, now very attenuated, from three centres in the whole area,

3. a rudimentary programme to encourage co-operative activities,

4. the regional branch of the Agricultural Development Bank, centred at Hohoe has a lending programme restricted to maize loans, fisheries and export crops (especially ginger). Only the first has any applicability to the farmers of Southern Volta and few loans have so far been made and these mostly to large-scale farmers. (Only one case of a maize loan has been reported from the villages intensively investigated).

4.3.2. SUGGESTIONS ARISING

The purpose of this report is to suggest ways in which farming can be improved largely on the basis of resources already available to the house-holders, making use of what services already exist. Clearly, the call upon government services will depend upon (i) the extent to which productive innovations can be devised and (ii) how far individual, or groups of, farmers can be assisted to introduce them.

This process of assistance is essentially the function of extension workers, and in order to get the process going it is highly likely that the numbers and effectiveness of extension workers will have to be increased. If their work is effective the pressure to use the other services available could become severe.

Increased government expenditure to increase services may therefore be expected in addition to the more effective utilisation of the services already available. Indeed, with the possible exception of the Irrigation and Reclamation Department, the impression has been gained that the services available are too small and poorly equipped to be effective beyond the immediate environs of their headquarters.

The departments of government[1] most concerned are likely to be, in the Ministry of Agriculture, the Crop Production, Animal Health, Animal Husbandry, Mechanisation and Transport, Irrigation and Reclamation, and Economics and Marketing Divisions. In addition, Community Development and Co-operatives Divisions in other Ministries, and the Agricultural Development Bank, as well as the Local Authorities, are directly involved.

In general, the weight of evidence from other countries would seem to suggest that, as far as the direct stimulation of agricultural production is concerned, there is great benefit in linking the provision of advisory work (including farm planning), lending and marketing services together for individual farmers and farmers' groups, even though this may on occasion complicate the extension worker's relation with the farmer.

At the same time there is much to be said for a degree of concentration, while skilled staff are in short supply, on either a few commodities or a few areas where success might be achieved. (On the other hand, there are substantial dangers in concentrating too much on a few farmers).

Any plan for expansion of services must take these two aspects into account within a framework of action which must have a pervasive effect not only on agricultural production but also on many other aspects of domestic and social life in the villages.

A few specific suggestions may be hazarded, which arise from the foregoing analysis.

First, within the Ministry of Agriculture policies already being pursued need strengthening, reorientating in some detials, and tightening in efficiency in some activities. Relinquishment of functions to private enterprise does not seem to be the best solution, at least in the short term.

1. Their roles and strength have been described by Mettrick (1971) p.38-55.

(i) Improved seeds and plants, appropriate fertilisers and insecticides need to be available in adequate quantities to satisfy demand of farmers, in time for optimum use. It is not realistic to expect farmers to be in a position to order and store these materials ahead of time. Their provision by private enterprise in the initial stages presents great difficulties, arising from the small size of trade and the high technological content of the service. There may even be difficulties in finding individuals capable of seed multiplication on the scale and diversity concerned.

It is encouraging that the Crop Production Division has already given thought to (1) ways of selling small quantities, (2) combined packaging of complementary inputs and (3) selling to groups of farmers. The strength of the extension services to provide the essential agents 'on the ground' has been one of the restrictions on developments so far. There is, in South-east Ghana an apparent readiness to accept better materials, but it is not clear that, for many crops, enough is known about what ingredients will be relevant and profitable.

(ii) The demand for machinery services will probably grow. This will be a healthy development as long as long-term fertility is not endangered and as long as the services are really worthwhile from the point of view of the farmers and, at least in the long term, pay their way as far as the Ministry is concerned. It is understandable that there should recently have been some desire for rationalisation in a service that was apparently excessively expensive. Careful planning might reveal, however, where suitable concentrated services, run in such a way that commitments given to farmers are strictly kept, could be operated; it is possible that such a service would be superior to private enterprise in technological flexibility and skill. It should be possible also to ensure greater dependability.

It is to be hoped that kinds of machinery other than that required for powered cultivation would be given attention, though such a development, in many cases, would need to be preceded by research and development.

(iii) Irrigation and Reclamation have in the past concentrated on small dams and dugouts for cattle watering in South-east Ghana. There are encouraging signs that human drinking and small-scale irrigation will in the future be associated objectives in this programme. But, if these two needs are to be serviced (1) a radically new approach may be required to irrigation (outlined in Section 3.3.3 above), and (2) an overall plan for water development is required (in which the resources and expertise of Community Development and the Local Authorities should be integrated).

Indeed, it may be seen as the appropriate role of this Division to act as the chief appraiser of land and water resources in the region and to act for their conservation.

Second, outside the Ministry of Agriculture, the provision of credit, in particular needs further consideration. With the exception of the cash crops cotton and tobacco, which are adequately provided for, facilities are currently poor and will need expansion as production itself is expanded. The Agricultural Development Bank operates a maize loan scheme which, in South-east Ghana, seems to be little used and not well understood. Yet it has some of the ingredients which should make for a workable scheme, given an effective agency for education and loan vetting in the villages, and adequate number of villagers co-operating in the planning of production and (preferably) storing and marketing. It is true that the main element for which credit may be sought is hired labour, but this should change as other materials become available for purchase; part of the loan could then be in kind. It still remains to be discovered (i) what is the best package of inputs and (ii) how effective forms of simple co-operation could so ensure increased yield as to make loan repayment certain. There is clearly danger of disillusion on both sides if these aspects are not carefully investigated.[1]

It must also be discovered whether this form of credit could be operated in the cases of cassava, groundnuts and cowpeas, where an appreciable expansion of acreage can be expected. The assistance of the Co-operatives Division in advising on simple, small-scale forms of organisation could be useful, though trials of these would be equally as important as trials of agronomic innovations.

Where processing innovations are to be encouraged - e.g. shellers, grating machines, oil presses, small engines, - different lending problems arise. To the extent that some of these may represent the investment of single individuals it may be that lending institutions will be able to satisfy themselves about the credentials of the individuals. Such medium-term credit for co-operating groups would present new problems. Again, however, careful testing, followed by careful planning and advice in local circumstances, might provide the basis on which banks could effectively lend.

---

1. The results of the planning exercise reported in Chapter 5 are suggestive of the degree of priority that maize production loans should be accorded in a general programme of improvement.

CHAPTER 5. PLANNING FOR AGRICULTURAL DEVELOPMENT IN SOUTH-EAST GHANA

. . Agricultural development will only proceed smoothly in South-east Ghana (or in any comparable region of Africa) if the nature of the programme being promoted by government is based on a sound understanding of the technical possibilities and a realistic evaluation of these possibilities in the context of the farmers' decision making environment. This Chapter is concerned first with the arrangements required for a flow of reliable information about technical possibilities, and second with a discussion of the planning exercises which must be undertaken to assist this flow and as a contribution to programme formulation at regional level. As a contribution towards the second of the two objectives of this study which were set out in the Foreword, the Chapter concludes with a general review of the whole process of planning in the regional development context.

5.1 RESEARCH AND DEVELOPMENT

5.1.1 NATURE OF THE WORK REQUIRED

In Section 3.7 a number of innovations were identified that warranted immediate promotion in South-east Ghana. But throughout the earlier sections of the same Chapter frequent reference was made to the need for local testing of innovations of possible value in the region. In part, this is a matter of trying out locally the findings of Ghanaian research stations (such as the suitability of maize, cassava and groundnut varieties) and extending trials already going on elsewhere in the Region (for instance, fertilizer trials on maize). It is also partly a matter of importing new ideas from further afield (such as sorghum from N. Nigeria and elsewhere, new varieties of maize and other crops in due course from the International Institute for Tropical Agriculture). But equally it is a matter of taking up existing possibilities and adapting them for local use (like water catchment, small-scale processing machinery). There may be other technical innovations where 'ingredients' put together locally will amount to unique solutions. (This may occur, for instance, in small-scale irrigation and animal feeding).

This part of the programme will require intensive and imaginative local effort as well as close co-operation with other research stations in Ghana and nearby countries. It is possible that some tasks might be 'farmed out' to such stations (e.g. livestock feeding trials at Nungua).

It is not enough however to investigate single technical innovations; whole systems will require assessment if in the long run radical changes are to be recommended. A number of possibilities have been touched on -

such as the 'paysannat' type modification of shifting cultivation, plantation cropping (with under-sown annuals), combined arable and livestock, intensive vegetable growing with irrigation. It would be the function of a development programme backed by agro-economic planning, to examine these in depth from both agronomic and social points of view.

Development is dynamic in two senses: firstly, to climb to higher levels of living the optimum sequence of innovation must be found so that, while land and water resources are conserved, material and human capital grow in step, later steps being made possible by earlier successes; secondly, the environment of decision-making is constantly changing, requiring adjustments in plans; in particular population is growing, markets for inputs and products change, new technology becomes available.

In relation to the first kind of dynamism, it will be necessary for research and development to ensure that the innovations first available are those which are least difficult to absorb: least difficult because they require little capital and know-how, are not socially disruptive, are recognised as closely relevant to the current situation, and involve little or no risk; but also to ensure that, as the householder and his family become used to change, further improvements, more complex in one or more of these ways, are available.

In relation to the second kind of dynamism the research and development programme must be planned ahead so as to satisfy new situations likely to arise, making use of indicators prepared by the government agencies concerned as well as the results of local observations. Such changing factors as the opportunities available for employment outside the area, the attitudes and availability of young people finishing at different levels of education, the demand for different foodstuffs in Accra, and so on, will need to be reassessed periodically and their importance to current development plans estimated.

At the same time as technical change takes place human relationships will also change. While this will be in part reflected in the natural adjustment between households as some change and some do not it will also be necessary to assist groups to form for certain functions. Such functions might be to manage land so as to achieve economies in clearing, fencing and access roads, to pool capital and labour, and to organise palm oil presses, cassava grating, etc. Various forms of organisation containing both horizontal and vertical elements will need to be explored, from time to time influenced by the existing external institutions (like the A.D.B. or the Ministry of Community Development).

Dissemination of the findings of research and development to both men and women, through the Extension service, would be of crucial importance and extension workers would provide vital feedback about the chances of success of new ideas. It has everywhere been emphasised that the field of activity is rural living rather than solely primary production. The extension task would be correspondingly wide.

5.1.2 PROPOSALS FOR A RESEARCH AND DEVELOPMENT UNIT

It is proposed that a special unit be set up for the purpose of Research and Development. Such a unit must combine intensive field work with close contact with a large number of villages on the one hand, and government agencies and the University on the other. At the same time its task will range over problems which vary with location but which are likely to be particularly related to the three major environments represented by the Pallid Sands, the Black Earths (with generally less reliable rainfall), and the Ochrosols (with the lowest rainfall in South-east Ghana).[1]

In these circumstances it is suggested that the Research and Development Unit should have its administrative headquarters at the regional capital Ho, and that its field activities should be built up so as to introduce a new area at (say) two-year intervals, starting with the Pallid Sands. In each of the three areas activities should begin in one village - where possible, one already intensively investigated, where both the agricultural and the social structure are well known. Some trials could well be spread further afield; some trial activities would no-doubt arise from local enterprise - e.g. the formation of a women's group to process cassava or palm oil, or shell groundnuts.

The personnel for such a unit are indicative of the nature and scale of the organisation envisaged. Included would be:

1. Team leader: an agronomist/economist of substantial experience, preferably in countries other than Ghana; carrying the overall responsibility of the Unit; maintaining contacts with Government in the Region, in Accra and in other parts of West Africa (e.g. I.I.T.A.) from time to time; formulating plans and guiding staff members.
2. Two agriculturalists, one specialising in crops, the other in livestock husbandry; their responsibilities to assist in the preparation of programmes of investigation, to supervise trials and pilot schemes, to analyse results, to co-operate with the extension workers, to liaise with relevant sections in Ghanaian

1. In due course activities would be extended North of Ho into more inherently productive areas.

research bodies elsewhere; each to have considerable freedom of choice in his aspects of the overall programme.

3. One agricultural economist to collect relevant local data, to assist in the planning of the Unit's programme, to evaluate the results of trials and pilot schemes and their subsequent effectiveness in the villages.

4. One agricultural economist periodically[1] to examine overall rural development questions affecting the region, including long-term supply and demand in respect of inputs and products, the impact of past and future government policy, etc.

5. An agricultural engineer periodically[1] to investigate and carry out development work on machines and equipment relevant to farm and village processes.

6. Two extensionists, one male and one female, concerned with the two-way flow of information between the research and development unit on the one hand and the extension network and villagers on the other; if possible, both to be Ewe.

7. Supporting staff, including:
   (a) at H.Q., administrative assistant, book-keeper, typist, messenger, drivers
   (b) at each field sub-station, a senior technical officer, two agricultural assistants, supported by temporary staff.

Accommodation and equipment required would include permanent housing at Ho. Apart from adequate office facilities and transport at Ho, it will be necessary to provide a store and office for the team at the selected village(s). Equipment would include standard measuring instruments - rain gauges, balances, etc., - as well as those items specific to the trials and pilot schemes under way. It is visualised that the Unit's activities will closely simulate prevailing local agronomic conditions; heavy capital investment in machinery is rather unlikely to be required, therefore.

While there are arguments pro- and con-, it is considered that it would be preferable if the Research and Development Unit did not have available goods which, given or loaned, could be used to stimulate innovation. The obvious danger would be a reluctance on the part of the villagers to start any new practice without material assistance. Where farmers themselves became the centre of a trial, they would of course receive certain benefits, such as free inputs, product increments, or compensation in the event of opportunity costs.

1. It is suggested that the Ministry of Agriculture at the Centre should have full-time personnel of these disciplines available to service more than one Research and Development Unit of the kind being described here.

5.1.3 ADMINISTRATION OF RESEARCH AND DEVELOPMENT

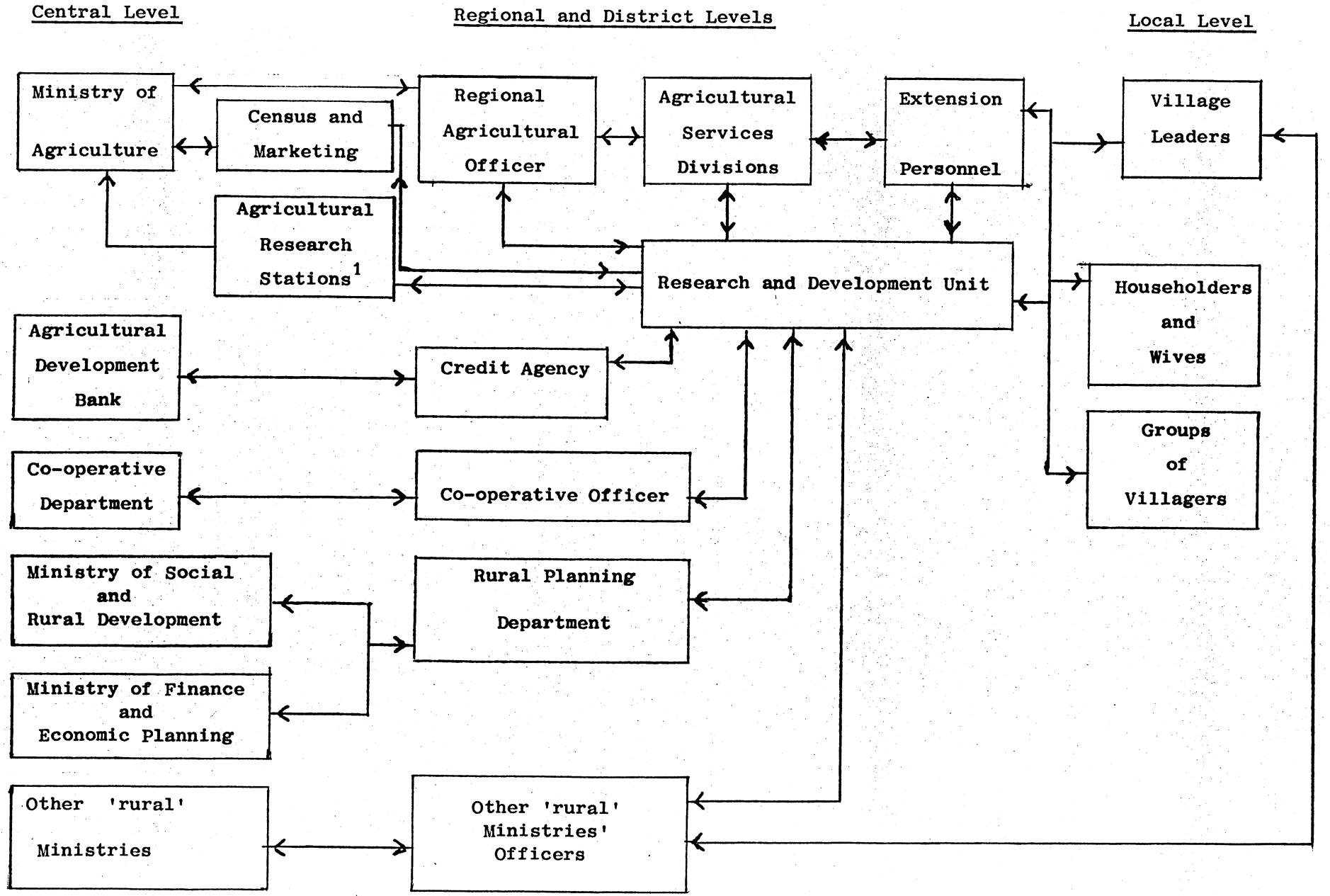
The purpose of the Unit would be to provide, as quickly and reliably as possible, material for Extension workers and others concerned with rural development. Its natural 'home', administratively speaking, is therefore within the Ministry of Agriculture, though other Ministries, notably Community Development, Health and Education are likely to be interested. The new emphasis on regionalisation of government policy is very opportune; it is clearly desirable that the Unit should be administered from Ho and watched over by interested Departments. The participation of the University of Ghana is also desirable. The relationship suggested of the Unit to existing structures is shown in Figure 5.1 a and b.

Administration of the Unit would be directly in the hands of the Regional Agricultural Officer, eventually through a Research and Development Division when other such units are set up in the Volta Region. He may find it helpful to have an Advisory Committee to guide him, which would include representatives from:

the Ministry of Agriculture (programming)
Ministry of Finance and Economics
Volta Regional Council
University of Ghana (Agric. Economics and Extension Departments)
Interested Departments at the Regional level
Agricultural Development Bank

The Advisory Committee would be required to make comments on the policy and progress of the Unit on the basis of reports furnished by the Leader and an annual inspection of its own sub-committee. It is to be hoped that the Advisory Committee would form the necessary link with the Planning bodies recently designed to integrate policies at District and Regional levels, as well as with the centres of policy making in Accra.

Figure 5.1 Research and Development Unit (a) Main Knowledge Flows



1. Including engineering research.

5.2 FARM PRODUCTION PLANNING

Planning exercises are a necessary part both of the provision of material for extension and of programme formulation at regional level. This study in South-east Ghana has only begun to explore the requirements. The starting point is the individual household plan, which is the 'lowest' level of decision making. A Study of this kind was made at Kpomkpo.[1]

5.2.1 A HOUSEHOLD PLAN FOR PRODUCTION IN KPOMKPO

The purpose of this exercise was to build a model of a peasant farming system, to be used to evaluate the likely comprehensive effects of development innovations. It was argued that:

> peasant farmers will, in some sense try to 'optimise' within the constraints under which they operate;
>
> the problem is not so much to improve decisions assuming existing production functions as to seek new production methods and systems, and to identify new constraints on farmer behaviour and those policies which might most effectively relax them;
>
> that decision making will take place in each household in essentially unique circumstances, though many households may be sufficiently similar to justify generalisation beyond the single case.

Single-period linear programming applied to the household economic system was regarded as the technique of analysis likely to be most appropriate. First, it is the most convenient way of representing the problem of a decision-maker who is in an essentially static (one-year) situation motivated chiefly toward self-sufficiency; that is to say, one who has little expectation that circumstances or the resources available to him will change.[2] Second, it is capable of handling interrelated considerations such as production and consumption, consumption and investment, as well as a large variety of activities and constraints. Third, the effects of variations and changes in these input-output relationships as well as activities and constraints can be fairly easily tested. Fourth, certain useful by-products, such as the marginal value of scarce resources, arise from the calculations.

---

1. The following section derives from work done by A.R.C. Low in the course of a post-graduate study. (Low, 1973.)

2. This may be an over-simplification to the extent that planning ahead in the long term for a changing family size, old age, or expected changes in government policies is ignored.

The method followed here was to construct a matrix on the basis of a 'representative farm'; to validate the model by comparing its characteristics with data derived from empirical survey; to test its stability in the face of random variation of input-output values and hypothetical changes in the environment of prices, resources, etc.; and lastly, to test the effects of introducing selected 'improvements'. Kpomkpo was chosen for study, being the village which had been subjected to the most intensive investigation (see Parker, 1973). Supplementary data were also available from the broader study described in the foregoing chapters.

The Matrix (See Appendix XII Figure 1)

There is considerable general evidence that the primary objective of subsistence farmers is security; there are many local signs that this is also true in the relatively unpredictable and unproductive environment of South-east Ghana. There may be three ways of achieving this:

(a) the production of staple food requirements by each household
(b) the maintenance of one's individual position in society so as to enjoy the social security benefits the society offers
(c) the accumulation of cash savings as an insurance against hard times.

If these are the primary objectives of farmers it is logical to make the objective function the maximisation of savings, subject to built-in constraints which ensure self-sufficiency in home staple-food supply and limitations to labour to allow observance of social duties. As was observed in Section 1.6.1, there is in Ewe society limited autonomy for husbands and wives within the household. Ideally it is required to maximise male and female savings individually but such a double objective cannot be accommodated in the Linear Programming model. The model was run first specifying that the woman should achieve a minimum level of saving and that the man's saving should be maximised, and then specifying the maximising of joint saving.

The importance of the uncertainty of crop yield levels in the decision making environment of Kpomkpo is recognised by the introduction of a modification to the savings maximisation objective. Savings are maximised on the basis of average yields but subject to the constraint that, where crop yield levels are uncertain, the essential household food and cash requirements are met with yields that can be expected to be achieved under adverse conditions. Where, as in the case of Major season forest maize production, alternative cultivation strategies may be adopted and the yields expected in adverse conditions depend on the strategy adopted, a

game theoretic approach is adopted to determine the appropriate strategy. The maximin criterion is employed to determine the maximum yield that can be expected with the alternative cultivation strategies under the postulated state of nature that is most adverse in the context of the whole farm planning problem.

Validation of the model inevitably involves a degree of subjective judgement. The results of comparative tests suggest a fairly close degree of conformity with reality in cropping pattern, some discrepancies being explicable as adjustment lags. Marginal value productivities of resources, patterns of labour use and the value of the objective function were also reasonable.[1]

The sensitivity analysis showed the model to be fairly stable. It is likely that recent price rises, for instance, will have little effect on the product mix, though there will have been a noticeable rise in cash (and to a lesser extent real) income. It is also interesting that given the currently accepted contribution of women, the marginal productivity of female labour quickly falls to zero if its availability is increased; this perhaps explains why innovations to save women's time, such as improved water catchment at the house, have not been introduced in Kpomkpo.

Possible Improvements

Six innovations were selected for investigation; the first four were additions to the choice situation facing the farmer (and therefore extensions to the basic matrix) while the last two were changes 'internal' to the current economic system:-

(a) Maize and groundnut production on savannah land, ploughed by tractor with more optimistic yields than obtained recently at Kpomkpo
(b) Forest maize production with improved seed varieties and fertiliser
(c) Cassava processing into gari for sale
(d) The option of utilising short-term credit
(e) Treatment of harvested maize to reduce storage losses
(f) Change in resource availability through investment in improved water catchment equipment.

The effects of including the first four of these were tested singly and in combination with the basic matrix and the matrix modified to incorporate

1. Conformity was increased by introducing a restriction on the sale of cassava in situ. This implies that a market for this product has not yet developed, but there are very recent signs (April 1973) that the local women are beginning to dry cassava in chip form for local sale.

improved maize storage technology or water catchment or both. All possible 63 combinations of innovation were examined. The absence of inclusion, under all conditions, of innovations (a) and (d) reduced positive results to 15 combinations (see Appendix XII, Table 1).

The results cast interesting light in two directions. First they go a long way to explain the recent behaviour of local farmers; second they provide strong indicators to policy makers and extension agents about the kinds and ordering of improvements that might turn out to be effective. It will be convenient here to comment briefly on each innovation in turn.

(a) Savannah maize and groundnuts. The results indicate no advantage in considering this innovation at the input/output levels assumed. This matches the recent experience of the society set up in the village to provide tractor ploughing services. An increase in mechanised cultivation on the savannah can however have a beneficial effect through increasing the amount of savannah cassava grown, thereby decreasing forest cassava and increasing forest maize. The explanation of this however is complex, involving uncertainty considerations, the patterns of essential cash requirements and labour availability.[1] If mechanised cultivation of the savannah is to be increased these calculations show that either higher or more reliable yields of maize and groundnuts must be achieved with better varieties, etc., or alternative crops must be found, or the weeding and harvesting of cassava must be mechanised. There seems (as discussed in Chapter 3) a strong case for research and development effort in these directions.

(b) Improved forest maize practices. Improved practices currently being recommended include the use of Composite 2 and Diacol 153, incorporation in the soil of organic matter from clearing, early planting, application of 20-20-0 compound fertiliser at planting and a top dressing of sulphate of ammonia, budgeted to result in a doubling of maize yield and a rise of net income of N¢ 21·04 per acre.[2] The feasibility of the innovation has to be demonstrated in the whole-farm context. In the Kpomkpo situation the value of the innovation introduced alone, would be N¢ 15·60. This is a scale of improvement which is not very attractive to local farmers (as the reluctance of local farmers tends to confirm), if the problems involved in acquiring

---

1. This is but one of the classic examples from this study of the need for farmers as decision makers, and for those who plan to assist them, to consider innovations in the context of the total economic system (see Low, 1973, page 143).

2. The calculations were made for development areas regarded as most suitable for maize and may exaggerate the possibilities in South-east Ghana (Min. of Ag., 1973,).

the materials and the skills, adjusting taste to a new product and bearing the uncertainty of the innovation, are taken into account. Moreover, the package is probably less valuable to those farmers who command fewer resources and cannot afford to plant a high proportion of their crop early.

Nevertheless, it is notable from Table XII.1 that returns to this innovation are greater when following the improvement of maize storage.

(c) Gari production. Gari production adds little to saving when it is added to the situation assumed in the basic matrix. But the basic matrix includes no limitation on the market for fresh cassava. Where such a limit exists gari can be shown to be highly desirable. With a sales constraint of 0·6 acres of cassava (which may well be realistic for villages like Kpomkpo) gari making increases saving by nearly 100%. It wholly replaces charcoal as an activity. This may be of ecological significance; in any case, as trees become scarcer, charcoal making is likely to be come more difficult.

(d) Credit. It might at first sight be surprising that credit should not be a desirable innovation. In the basic matrix situation however capital is in no time period a limiting factor. Only when cassava sales are restricted and a reduced maize acreage has to be planted late to ensure minimum consumption does cash have a positive marginal value product. Even then the present form in which credit is made available is inappropriate. The Agricultural Development Bank loans are designed to cover short-period capital scarcity, but in Kpomkpo cash is limiting on an overall, rather than seasonal, basis. Short-term loans thus only add to a cultivator's costs in (a) interest charges and (b) causing him to change adversely his pattern of production so as to be able to repay the loans at a certain time of year. On the other hand, if loans were made available for a longer term and average rather than minimum returns from cropping could be assumed, even the higher interest costs involved would be more than covered by the increased production achieved.[1] These calculations illustrate how important is a farm model of this kind when designing a credit policy.

(e) Water catchment investment. The innovation considered is that of increasing roof catchment by the installation of gutters and drains[2] and is treated as a woman's investment because it is her time that is saved. Calculations showed it to be both feasible and profitable in terms of an increased future net income stream though, (as Parker argues,) there may be a variety of reasons why the advantages are not apparent to households.

---

1. Even this argument does not apply where the market for fresh cassava is not restricted.

2. For details, see Parker's calculations in Vol. II, Chapter 1 of this study.

It could be that, given additional health advantages not taken into account here, an educational programme to encourage water catchment is all that is required to cause widespread uptake of the innovation.

(f) Maize storage treatment. The innovation suggested here is the one mentioned in Section 3.4.1, in which fumigation is effected by using ethylene dibromide in a plastic bag. The beneficial effects of this innovation on the objective function of the basic matrix is greater than any of the others considered. Reduced storage losses allow both lower acreages of late planted maize in order to meet essential consumption requirements in adverse conditions, and the storage of maize for sale in high price pericds. More maize is planted early, thereby increasing average yields, and the advantages of adopting improved forest maize practices (which are likely to increase acreage yields but are likely to be less advantageous in adverse conditions), are then greater.

The B:C ratio for the improved maize practices, innovation ((b) above), increases from 1·1:1 to 1·9:1 when combined with reduced maize storage losses. The implication for extension strategy is that the best results can be expected from the improved maize practices innovation when prior or simultaneous reduction in maize storage losses is achieved.

5.2.2 THE SIGNIFICANCE OF THE KPOMKPO HOUSEHOLD PLAN FOR VILLAGE AND REGIONAL PLANNING

The calculations briefly reported in the foregoing section have significance in at least four respects. First, the very construction of the model and its validation have drawn attention to crucial operational characteristics of the household situation in a South-east Ghana village. The integrated character of male and female decision making, the importance of security in circumstances of environmental uncertainty, the effects of seasonal price variation, the effect of seasonal growth phases on consumption and cash requirements, have all been demonstrated.

Second, it has sharpened our knowledge of the scope for improvement in incomes, and the relative merits of various innovations, at least for the village of Kpomkpo.

Third, the results of introducing selected innovations have underlined some of the crucial principles of agricultural development: particularly that the whole economic system must be considered in estimating the likely effect of an innovation, that the sequence and combination of innovations must be carefully chosen, and that the risk element in each new proposal

must be carefully evaluated. These principles have so far been given little attention by technical researchers. Their relevance strengthens the case, made earlier in this chapter, for a research-and-development enterprise as part of the Ministry of Agriculture's programme in the Region.

Fourth, the degree and kind of detail required in data collection have been revealed.

In considering the geographical significance of this exercise, its limitations must be repeated. Continuing study would be required to establish how applicable the model is as household circumstances change, in various aspects, away from what is believed to be a representative system for a Kpomkpo household. Changes eastward and southward in soil fertility, and rainfall patterns, markets for products, opportunities for non-agricultural employment, population pressure, capital resources, could radically alter the character of what is a representative system and thus the feasibility of the innovations considered. Also, it must be emphasised that the array of innovations considered was not exhaustive; conceivably more appropriate ones may have been missed. In a region as diverse as South-east Ghana many more planning exercises at the household level are therefore required. Nevertheless it is claimed that this model represents what is an essential starting point in regional planning, to be replicated (and possibly expanded to incorporate a time element) as planning resources permit.

5.3 SOME GENERAL SUGGESTIONS ON REGIONAL PLANNING

Finally, as a result of these studies in South-east Ghana, it is desirable to point to some general conclusions about how agricultural policy-making and administration can best be assisted by investigation and appraisal.

It has been argued earlier, first that agricultural development should be viewed as part of economic and social development as a whole and second that there is every justification for policy making and administration at regional (as well as national) level. Plans and policies must be determined in the light of local needs and potential, based on the best information available.

At the same time, of course, there will be parallel activities by the State and by individual decision-makers. State activities will impinge at many points both in the form of Surveys (Censuses of population, marketing, land use, etc.), plans and policy formulations on a nationwide scale, and also in the form of projects (such as hydro-electricity schemes, arterial roads, etc.) which have a greater-than-regional impact and significance.

In those societies where the bulk of decision-making is left to individuals, the function of planning is to provide a framework in which policies can be devised which are likely to influence individual decision making at a multitude of places and levels, in the directions of which society at large, as shown through the democratic process, approve. This situation is only slightly altered in those phases when the overt democratic processes are temporarily suspended and replaced by the self-installed government devoted to the obvious or expressed needs of the people. In these circumstances therefore planning must be predictive in the sense that the reactions of individual decision-makers to changing conditions must be estimated and allowed for in long-term plans. Thus, for instance, the setting of 'targets' for production - a common element in agricultural planning - must take into account (a) the way that public demand is likely to change over future years and (b) the way in which producers will find it in their best interests to act.[1]

It is further necessary to emphasise that autonomous decision-makers have a variety of objectives, of which some account must be taken, and also that the decisions of one person (or class of persons) will impinge on those of another by altering his (or their) decision making environment. Planning at regional level must therefore take account of the interaction of decision makers.

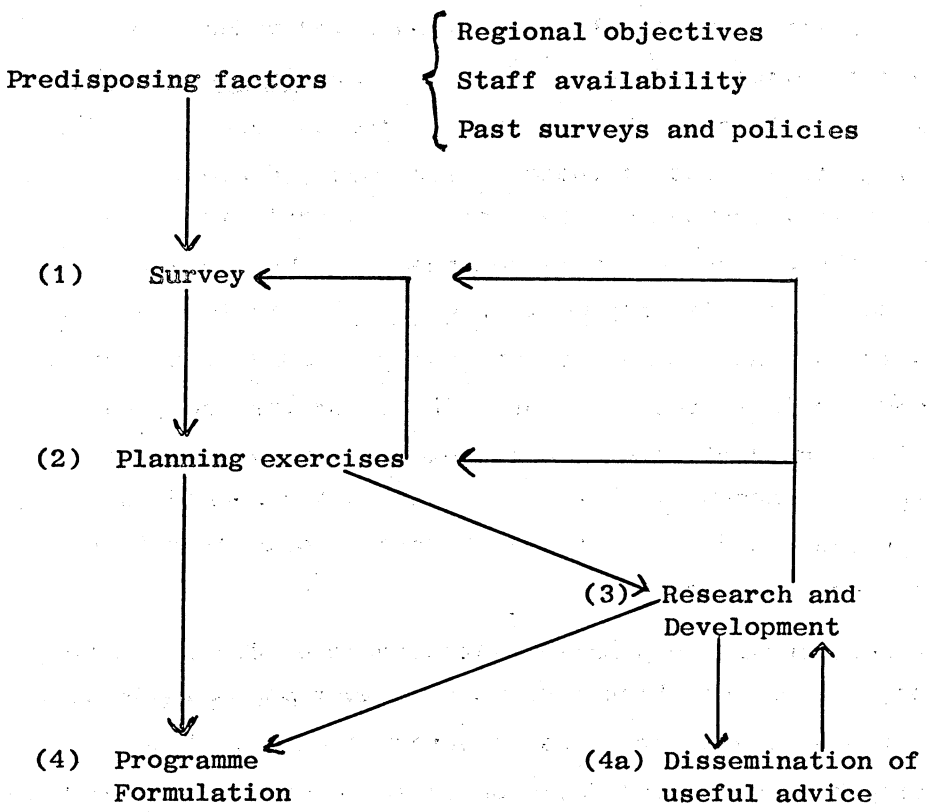
The sequence of activities leading up to policy making which we may collectively call 'planning' may be listed as:
(1) Survey, (2) Planning exercises, (3) Research and Development,
(4) Programme formulation as the basis for policy making and application.
(The first three are equally necessary as precursors to an extension programme aimed at individual decision makers). Figure 5.2 summarises.

Further consideration of the four stages outlined must be preceded by a brief discussion of two matters of over-riding importance in determining the procedures most likely to be suitable. First, there is the question of what is meant by 'region'. Second, the objectives of society and the roles deemed to be important for the agricultural sector within the whole economy, must be established and their implications studied. Although both these matters will be viewed differently in different countries, some degree of standardisation of procedures, derived from what is now a fairly large though unintegrated body of experience in this general field, may be possible.

---

1. It is mistaken to assume either that what the planner considers is good for the consumer will be what the consumer in fact demands, or that, once given a 'target' output, producers will conform.

Figure 5.2 The Planning Process at Regional Level



5.3.1 THE CONCEPT OF 'REGION'

A low-income country is hardly to be found where a large tract of country or body of people is not already organised to some degree for administrative purposes. In devising planning procedures in a decentralised way there will therefore be a natural tendency for new structures to follow existing ones. Nevertheless there may be some scope for fundamental thinking about how best to deploy planning resources. The important considerations which have to be weighed and on which (probably intuitive) decisions have to be made in delineating regions are (a) the size and shape of the area which has to be studied and covered by recommendations,
(b) the number of the population concerned,
(c) the internal diversity of the natural environment and economic and social activity,
(d) the degree of economic and administration cohesion.

The difficulties of defining what a region is have long been a preoccupation of geographers. For the purposes of organisation of the kind with which we are concerned, it is necessary to take into account all those considerations listed from (a) to (d) above. Thus regional agricultural

planning could be ineffective or uneconomic if the land area were too large or too small, if the total population covered were too large or small,[1] if the internal diversity were too great and if internal cohesion were weak.

The Volta Region of Ghana suffers from two major disadvantages when the above criteria are applied. Internal diversity is considerable and, due to its elongated shape cohesion is weak. It further suffers from the drawing of its Eastern (national) boundary which divides in two the tribal territory of the Ewe. Notwithstanding these difficulties it may be realistic to think of Volta Region (with its associated marine fisheries) as a whole for regional planning purposes, but dividing it into two sub-regions (roughly North and South of Ho) for detailed work.

5.3.2. NATIONAL OBJECTIVES

Obviously regional plans must take into account national objectives, whether or not these have been explicitly stated. In the case of agriculture these are reflected through the roles it is intended the sector should play in the whole economy.[2] These roles will vary in emphasis from country to country and region to region and may partially overlap or conflict. Thus the encouragement of food production may overlap with the desire to increase rural employment, but encouragement of production for export may conflict with that of food for home consumption, and so on. Plans for agricultural development at regional level must seek solutions of such issues and moreover must so aim to change local society as to fit in with plans and trends in the nation as a whole.

It is perhaps useful here to draw attention to the central importance of consumption in development. One of the major justifications of regional planning is that by integrating the policies of all Ministries at this level, those Ministries (especially Agriculture) which are primarily production-orientated can better judge the merits of different policy alternatives.[3] Thus policies in land tenure and credit provision, the design of extension programmes, the deployment of machinery services, etc., may all be adjusted to achieve social ends other than, or in addition to, maximum production increases.

In South-east Ghana, the 1971/2 Programme for the Volta Region prepared by the Regional Ministry of Agriculture emphasised the desirability both of increasing food production for home consumption and of increasing the production of exportable commodities. Other aspects of regional objectives have not so far been spelt out in documents that are freely available.

---

1. Both of these considerations apply to all forms of government actions.
2. For discussion see Thornton (1973).
3. J.L. Joy (1970).

5.3.3 STRUCTURING THE REGIONAL PLANNING PROCESS

The area of operations having been defined and national and regional objectives having been formulated, the structuring of the process can be examined. Regional planning in Low-Income countries is still in its infancy. While variations in structure, related to local political, social and economic characteristics can be expected, it is everywhere likely to suffer from two difficulties and these must be accepted. First, as indicated in Fig. 5.2, steps in a planning process are interrelated while the business of planning is likely to be continuous; great flexibility is therefore required in the organisation of those engaged in its different phases, and good communication up and down the chain is essential. Second, there will be a continuous conflict between the desirability, on the one hand, of acquiring more knowledge leading to more detailed and better programme formulation, and, on the other, stringent constraints on skilled manpower; this raises problems both in the short-term - what planning processes it is best to adopt with the manpower available, and in, the long term, how rapid a build-up in staff and activities is desirable bearing in mind the competition in a growing economy for trained staff. These considerations which form the context of planning are seldom made explicit. Yet they are of sufficiently over-riding importance to prevent the perfection of the regional planning process.

A brief review of three approaches to the task of regional planning may serve to illustrate some of its facets.

(1) Collinson's Study of Northwest Tanzania[1]

Collinson's purpose was to explore the role of what he calls Farm Management Economics in Agricultural Development and he confined himself to agricultural matters. Working in an environment characterised by a single growing season and with rather homogeneous subsistence agriculture where one cash crop, cotton was currently being promoted, he arrived at a series of suggestions about what studies, in survey and planning, are necessary as adequate support to an advisory programme. These he rightly conceives as a closely integrated sequence, the requirements of one phase being the determining factor in the design of the preceding one. His recommendations include:

1. the apparatus of calculation by which the current position on a farm may be transformed by way of a series of plans to a pattern yielding superior income via a series of steps in time, which take into account the constraints likely to be crucial - in his case, food preferences and needs, credit availability; the steps are so designed as to

1. Collinson (1971).

conform to socio-psychological 'rules' which, if observed, are likely to increase the chances of successful stage-by-stage innovation.

2. the use of the 'representative' farm as a suitable base for planning and the choice of survey samples of appropriate size and distribution for the identification of farm type and size.

3. methods of data collection (in which direct questioning of farmers bulks large), which are designed to give maximum relevant information of acceptable reliability for minimum cost in field and analysis work.

The conclusions that Collinson reaches, which were derived from personal experience of working over a long period of years on a number of investigations in a single region, cannot in general be faulted. They may be more debatable in detail, and it may also be argued that there are some directions in which he might have enlarged his theme. More emphasis on uncertainty in the planning mechanism (touched on in Section 5.2 above), the interplay of national objectives and optimal courses of action for individual farmers, are examples. It must also be stressed that there are conditions in other regions in Africa which would tend to render Collinson's choices of method simplistic.

(2) Shell International's Village Development Programme

Over some years Shell International has been developing a technique of rural development which is centred on the 'typical' area of a region. In all, seven projects have been started,[1] the general approach having been established first at Borgo-a-Mozzano in Tuscany.[2] The principles underlying the method may be summarised as:

1. Emphasis on balanced community development rather than solely on agriculture.

2. A case study approach where the case is a group of villages making up a commune (Italy) or tambon (Thailand).

3. Limitation of financial contribution to providing project staff, reliance being placed on the peasants' saving from increased production for investment in further development.

4. A sequence of survey, planning and project introduction (preceded where necessary by local trials using individuals and groups of farmers).

Some of the points stressed in the reports coming from these projects include:

---

1. See Shell International (1972). In Brunei a model farm unit approach has been used to test systems for general introduction in the peasant sector - a straight-forward example of Research and Development.

2. Virone, L.E. (1963) and (1969).

(a) the importance of a thorough preliminary survey of physical resources and socio-economic characteristics of the people, with careful land-use mapping

(b) the selection after careful scrutiny, using mostly a budgeting approach, of innovations or small projects starting with the simplest and least risky, ranging from innovations in agronomy to infra-structure and marketing arrangements

(c) the importance of the steady build-up of confidence between extension personnel and farmers, increased by continuity in the employment of personnel from survey through extension and by a variety of educational techniques

(d) use of careful farm case studies, recording progress on a trading account basis, with monitoring of the whole exercise from time to time.

(e) Dissemination of results partly by reports but particularly by on-the-spot teaching courses for extension workers and others.

It should be noted that the dominant criterion for success has been the increase of incomes of those farmers enthusiastic enough to co-operate. The Shell approach therefore makes a somewhat limited contribution to the solution of regional development where objectives might be complex. There has for instance been no attempt to regulate population numbers and employment in the chosen communes; thus Borgo-a-Mozzano's population has declined steeply over the years, whereas the population of Saraphi in Thailand has initially increased due to immigrants attracted by the programme. Similarly, the effects of increased marketed surplus has not been taken into account in plans.

A second characteristic of the Shell approach has been that methods of calculation of plans have been kept simple and decisions to innovate (which are the farmer's) are made on the basis of increased technical confidence and recognised opportunity; it is an approach therefore which is suited to areas of considerable potential and to people easily motivated to develop. It must however be stressed that the encouragement of community action has been a notable feature, no doubt resulting in useful economies and an improved milieu for individual action.

(3) The Bihar Project[1]

This research project initiated at the Institute of Development Studies, University of Sussex, is one of the few to be aimed directly at

1. J.L. Joy (personal communication).

regional planning methods; final results are not yet available. The Kosi area of Bihar State (some 6,400 sq. miles and 6 million people) was chosen as a case study in which, among other things, to formulate the structure of a regional planning model, and to use this model to investigate the implications for a future development period of ongoing and proposed government policies. The model is designed to cover the agricultural sector as well as the major industries linked to it at both the input and output ends; the agricultural sector itself is broken down into sub-sectors representing different groups of cultivators so as to be able to study the inter-actions of decision makers with different combinations of resources.

This is clearly a very large undertaking in terms not only of the size of the case but also of the elaborate nature of the operations and the masses of data to be used.

It is to be hoped it will lead to the recommendation of rather simpler procedure which takes account of the shortage of personnel and time in regional planning.

The three approaches then each illustrate important aspects of regional planning in a predominantly rural setting;[1] not least, the importance of the interrelation between steps in planning, the importance of thinking about rural, rather than just agricultural development, and the importance of seeing development whole, including the inter-actions of decision-makers within the region. Somehow, regional planning, to be successful, must contain all these ingredients. Within the general guidelines, a few comments may be made about detailed procedures, with particular reference to South-east Ghana.

5.3.4 METHODS IN REGIONAL PLANNING

A Regional Planning institution, if technical resources are scarce, must start from small beginnings. Once begun, the process of planning must grow by degrees, expansion being based on demonstration of its usefulness. Joy (1970) has nevertheless warned that the initial investment may have to be substantial; the marginal cost of additional output should fall quickly as useful knowledge and experience are accumulated.

For South-east Ghana, a case has already been made for the setting up of a Research and Development Unit at the village level to test a variety of innovations which may be agronomic, infrastructural or concerned with

---

1. As incomes grow and occupations diversify the location of non-agricultural activities and the relation between urban and rural development become dominating issues of both regional and national concern, bearing on the issue of rural development which is the main theme here.

processing or marketing arrangements. This first step will need to be set in a wider context of interdisciplinary, inter-Departmental regional planning.

The objectives of such a planning enterprise are for the leaders of the nation to declare.[1] As observers, we might guess that the crucial considerations should be (1) the accommodation, in terms (largely) of home-grown food, infrastructure, housing and social services of a population growing at (say) 2% per annum[2] and mainly rural in distribution, (2) provision of opportunuty for the population to raise community levels of living as fast as is consistent with other objectives such as a general improvement in nutrition and variety of occupation (3) the avoidance of large inequalities in income distribution that cannot be dissipated by redistribution within the extended family system, (4) the assurance of employment for all, not least the growing number of primary and middle-school leavers, (5) the conservation of natural resources to a degree consistent with long-term as well as short-term welfare maximisation, (6) the optimal deployment of scarce skilled manpower and financial resources - which implies a concentration on economic growth among small-scale rural producers of agricultural and agriculture-derived products, including those of forest and water origins. (An improved use of the land resource might involve a limited internal migration from the densely populated South-east to the less densely populated West and North.)

In order to formulate sound programmes, further surveys, mostly of a specific kind would be required. A good deal is already known about the natural resources of Ghana in a general way (see Wills 1962). This knowledge, together with Population and Agricultural Censuses carried out in 1970 and market and meteorological data continuously collected, provide much of the base required for mounting a four-phase programme as outlined above, and the appraisal of any specific projects that might arise. The base could be much improved by further surveys of water resources and forest regeneration.

Most Survey work would therefore be geared rather directly to mainly rural development programmes conceived chiefly (though not exclusively) at the farm/village levels. The content and procedure adopted for this survey work would depend on the specific nature of the planning techniques used and the local heterogeneity of economic units. The best approach would appear to be directed toward the identification of households representative of clearly defined types, along the lines expounded by Collinson, backed by a combination of broad reconnaissance and study in depth of small samples.

---

1. Such objectives would have to be consistent with those of other regions of course.

2. This assumes that migration towards large cities outside the region continues unabated, which may, on national grounds be undesirable.

Collinson's emphasis on limited-visit surveys needs to be taken very seriously as an economical method but the complex nature of agriculture in some areas of Ghana, (with two seasons a year, arable and livestock enterprises, a variety of cash products, annual and perennial crops, and complex households where individuals may have more than one occupation) means that great care in choice of survey methods would be required. If diets and changes in them were a central issue, careful observations of nutritional patterns on a sample scale would be necessary. But the desirability of time-consuming studies of this kind (and of day-to-day income-and-expenditure flows and labour utilisation or detailed crop yield measurement) need to be carefully weighed. Sensitivity tests incorporated in exploratory planning exercises might well determine the depth to which this type of data collection, requiring daily and sustained effort, is likely to be worthwhile.

In order to ensure effective data gathering and analysis, optimal decisions about the number, grade, and experience of personnel and their organisation must be taken. Experience in South-east Ghana in this Study underlines the importance of (a) using data collectors in close empathy with local people (b) employing an hierarchy of control which allows careful and frequent explanation to, and checking of work of, data collectors by supervisory staff, as well as (c) maintaining a degree of flexibility in the programme of data collection even at the expense of some loss in streamlining in the coding and analysis phase. Of course the great value of carefully preparing as much as possible of the analysis phase before the main body of data are collected cannot be over-emphasised; impressive routines of this kind have already been used in African surveys.[1]

Planning exercises like surveys, are likely to be constrained, in both scope and method, by manpower considerations.

In rural societies of the predominantly subsistence kind the economic systems at household and village level can often best be considered whole, where production activities lead to consumption and saving, where these lead to work and investment respectively, and where work, investment and natural resource use lead to the next production phase. Linear programming appears to hold great potential in handling the complex linkages involved, when it is desired to optimise or minimise some 'output' or 'input'. Its versatility has still not been fully explored for problems of the type involved here.

---

1. Unzalpi. (1970).

The desirability of integrated planning of the type being explored in Bihar cannot be contested if regional planners are to have better than an intuitive notion of how a multitude of different decision makers will react to proposed possible policies. Nevertheless shortage of manpower and inadequacy of data, at least in the short run, will retard the full development of such practices in Africa. In these circumstances half a cake is better than no cake at all. The development of a few relevant models (see Section 5.2), which, once established, are easy to manipulate, could form a useful basis for a realistic appraisal of specific policies - though interaction of subsectors could be accommodated only in a general way. The results, tempered by the stream of findings from Research and Development could be valuable for both programme formulation and the dissemination of advice to farmers.

Programme Formulation - that is to say, the process of bringing together the results of survey and planning activities, adequately tested by Research and Development - involves the integration of activities which are currently distributed over a number of Government Departments, of which those in the Ministry of Agriculture are likely to be of central importance. Thus both existing and new staff will be involved. To obtain maximum effectiveness requires careful review by experts in administrative procedures, which is outside the scope of this study. It may however be worth observing that, at this stage in regional planning in Ghana, all possible aid should be sought - which might, for instance, include assistance from the Universities and such associated bodies as the Institute for Statistical, Social and Economic Research; and that there might be a strong case for the short-term use of special units either locally based or lent from the Centre to regions in turn, for the carrying out of carefully specified tasks, such as special surveys and investigations and the appraisal of particular proposals.

REFERENCES

COLLINSON, M.P. Farm Economics in African Peasant Agriculture. Unpub. Ph.D. Thesis. University of Reading, 1971.

ELLIOTT, C.M., BESSELL, J.E., ROBERTS, R.A.J., VANZETTI, N. Agricultural Labour Productivity Investigation. 3 Vols. Univ. of Nottingham & Zambia (U.N.Z.A.L.P.I) 1968-1970

JOY, J.L. Report on the Content and Nature of the Evaluation of the Economic Aspects of Kenya's Special Rural Development Programme. Mimeo. December 1970.

LOW, A.R.C. The Application of Linear Programming in Investigating the Consequences of Change on a Peasant Farming System in West Africa. Unpub. Dissertation for M.Agr.Sci. (Tropical Agricultural Development). Univ. of Reading 1973.

MINISTRY OF AGRICULTURE, GHANA. (Planning and Co-ordination Unit) Proposal for Maize Development Project in Ghana. (Annex 14) 1971.

SHELL INTERNATIONAL Shell in Rural Development. Shell Centre. Oct. 1972.

THORNTON, D.S. Agriculture in Economic Development, Journal of Agric. Economics. Vol. 24 No. 2, 1973.

VIRONE, L.E. Borgo-a-Mozzano Technical Assistance in a rural community in Italy. World Land Use Survey : Occasional Papers No. 4, 1963.

VIRONE, L.E. A Practical Approach to Rural Development. Shell Agric. Studies Centre, Borgo-a-Mozzano, 1969.

WILLS, J.B. Agriculture and Land Use in Ghana. London, 1962.

Appendix I List of Participants

1. Advisory Committee[1]

Chairman - Professor La Anyane, Dean, Faculty of Agriculture, University of Ghana.

Members:

Ministry of Agriculture

Principal Secretary, or representative
Chief Agricultural Economist
Chief Crop Production Officer
Chief, Manpower and Training Division
Agricultural Co-ordinator

University of Ghana

Director of I.S.S.E.R. or representative
Dr. B.E. Rourke, Dept. of Agric. Economics
Dr. G.E. Dalton, Dept. of Agric. Economics
Miss J. Steckle, Dept. of Home Economics
Miss Engberg, Dept. of Home Economics
Mr. E. Bortei-Doku, Dept. of Extension

Secretary - Mr. B.K. Sarfo

2. Project Team

Leader - Dr. D.S. Thornton, University of Reading

Research Officer in charge of field investigation - Mr. D.A. Murphy

Research Counterpart - Mr. B.K. Sarfo

Field enumerators: (employed at various times)

Edward Jeboah	Walter Agbagli	Hables Anku
George Semordzi	John Ayesu	Christian Agblanya
J.N. Antwi	Felix Kanye	Edward Baffo
J. Kuffuor	Thomas Hotor	

Part-time Supervisors:

Mr. S.K. N'fodjo, Regional Agricultural Economist

Mr. R.N. Parker, Study and Serve Post Graduate

3. Special Investigators:

Mr. H. Mettrick, Agricultural Economist
Dr. G.E. Dalton, Agricultural Economist
G. Thompson, Engineer

Student Assistants:

E. Amankwa	S. Asare	W. Havor and K. Honu
B. Acquah	F. Akwetey	Miss Brenda Vomwo

4. Additional Independent Studies

R.N. Parker B.K. Sarfo A.R.C. Low

5. Computing and Analysis

S. Nodzeivor R.B. Arkell P. Cheshire

---

1. The Project Leader and Research Officer attended whenever possible.

Appendix II

Papers Already Prepared

1. Mettrick, H. Policies and Institutions in Ghanaian Agriculture. University of Reading. Development Study No. 9.

2. Dalton, G.E. and Amankova, E.H.U. Tobacco Production in S.E. Ghana. Mimeo. Dept. of Agricultural Economics, University of Ghana, 1971.

3. Dalton, G.E. and Akwetey, F. Cassava Production and Processing in S.E. Ghana. Mimeo. Dept. of Agricultural Economics, University of Ghana, 1972.

4. Dalton, G.E., Haver, W.T. and Honu, B. Cattle Production in the Tongu District of S.E. Ghana. Mimeo. Dept. of Agricultural Economics, University of Ghana, 1972.

5. Thornton, D.S. Agricultural Research and Development at the Regional Level. Paper for Ghana Association for Development Studies, Oxford, April, 1972.

6. Thornton, D.S. Research in Village Development in South-east Ghana. An Interim Report. Mimeo. University of Reading, June, 1972.

7. Parker, R.N. The Feasibility of some Small-scale Development Projects in the light of a Community Socio-Economic Study. Unpub. M.Phil. Thesis. University of Reading, 1973.

8. Low, A.R.C. The Application of Linear Programming in Investigating the Consequences of Change on a Peasant Farming System in West Africa. Unpub. M.Agri.Sci. Dissertation. University of Reading, September, 1973.

Appendix III Agricultural Census Data 1970

(a) Occupations of holders and family members

	All Ghana	Volta Region	Ho/ Sogakope	Denu
No. of holders	805,200	108,600	33,100	30,300
Holders with:				
(a) other occupation	19%	41%	**[1]	**
(b) no other occupation	81%	59%	**	**
No.s in households:				
(a) full time on holding	30%	21%	**	**
(b) part time	37%	39%	**	**
(c) not at all	33%	40%	**	**

(b) Household and holding sizes, and types of holding

Mean size of household[2]	5·6	5·2	5·1	5·0
Median size of household	4·4	4·0	3·9	3·6
Median size of holding (acres)	3·6	2·2	1·6	1·8
No. of farms per holding	2·7	2·9	3·3	2·1
Type of holding:				
(a) subsistence only	14%	9%	11%	17%
(b) mainly subsistence	36%	60%	67%	67%
(c) mainly sales	50%	31%	22%	16%

(c) Holder's cropping activities

% of holders growing, and mean acres per holder of:				
Maize	51% 2·2	66% 1·5	55% 1·1	73% 1·9
Rice	8% 2·2	5% 3·1	- -	- -
Cassava	59% 1·7	88% 1·6	92% 1·2	83% 1·7
Yam	26% 2·0	22% 1·5	21% 0·4	- -
Groundnuts	15% 2·0	11% 1·0	21% 0·4	- -
Oil palm	5% 2·0	7% 1·0	21% 0·4	12% -

1. Data not available.

2. Agricultural Census definition of Household: "the persons generally bound by ties of kinship who normally reside together, but not necessarily under the same roof."
(Ghana Census of Agriculture, instruction to enumerators Phase I, 1970, p.13).

3. Throughout this report local usage has been followed - 'farm' applies to the single cleared field, 'holding' applies to the total fields currently cultivated.

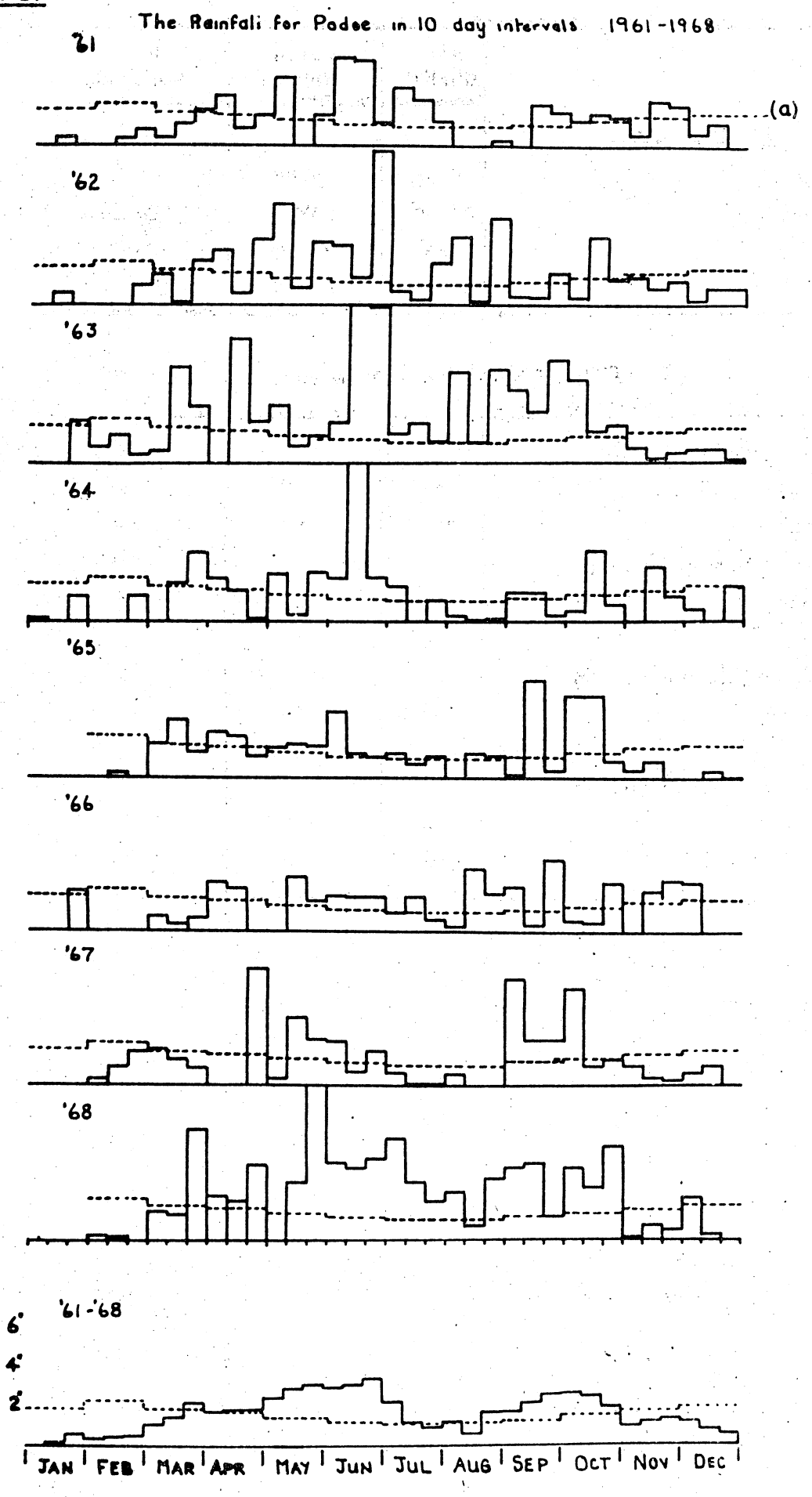
(d) Holders' livestock activities

	All Ghana	Volta Region	Ho/ Sogakope	Denu
% of holders with:				
Cattle	8·6%	2·8%	**	**
Sheep	22·9%	23·4%	22·4%	19·8%
Goats	27·3%	26·9%	29·3%	21·8%
Poultry	57·0%	55·0%	50·0%	58·0%

(e) Areas cropped (in '000 acres)

Maize, major season:				
pure	146	32	9	12
mixed	754	76	11	30
Maize, minor season:				
pure	132	50	9	12
mixed	86	21	3	5
Cassava, major season				
pure	149	45	14	15
mixed	656	105	21	27
Cassava, minor season				
pure	9	4	**	**
mixed	52	15	**	**

Appendix IV



(a) Evap-Transpiration based on Akuse data

Appendix V Attitude Surveys

Six questionnaires were designed to serve two purposes:

(a) to provide information about agricultural practices

(b) to provide indicators to attitudes and aptitudes.

Questionnaires, each consisting of some 30 questions, were served on the following composite topics:

AA1 Maize storage and marketing

AA2 Charcoal and non-agricultural occupations

AA3 Land clearing and cropping

AA4 Groundnuts and credit taking

AA5 Cassava and the role of women

AA6 Palm oil and saving

AA's 1-3 were served on those members of the 'small' sample, in the villages intensively surveyed, to whom the main product concerned had relevance. AA's 4-6 were similarly served on a randomly selected half of the small sample. The number of replies used was 132, 68, 146, 33, 46, 46 respectively from the six questionnaires.

AA1 provides an example of the type of questions used:-

AA1. MAIZE STORAGE AND MARKETING

1. Did you harvest some ripe maize at the end of the major season?

2. Which of the following applies to you?

   a. The family will eat (all of the maize
   (some
   (none

   b. I have at this time sold (all
   (some
   (none of the maize I expect to sell.

3. (a) Do you think it is best to sell maize to others in the village or to people outside?

   (b) Why is that?

PAUSE

(c) Is it because it is easier

or one meets less dishonesty this way
or one gets a higher price
or other reasons

4. (a) Do you always sell your maize to the same person?

   (b) Why is that?

PAUSE

(c) Is it because it is easier?

or one meets less dishonesty this way
or one gets a higher price
or other reasons

5. Will you always follow the same practice in selling maize every year?
6. What price per bag can you expect to get in September?
7. What price per bag can you expect to get in March/April?
8. (a) What are the main snags in holding major season maize until March/April?

PAUSE

(b) Do you get losses from vermin and insects?

Do people come and steal it?

Are the prices too unreliable?

Is it because one has to wait for the money too long?

Is it shortage of storage facilities?

9. Did you take any cash advance for the crop before harvest this year?
10. What proportion of harvested grain would you expect to lose between September and March?
11. Comparedwith the value of your crop at the present time, would you get more or less income from sale in March, do you think?

TALKING NOW ABOUT THESE GRAIN LOSSES. Most people agree that they lose a lot if they keep it six months.

12. (a) Are there any ways of reducing this loss, do you think?

(b) What are they

13. Do you think it is a good idea or not to take such measures, or don't you know?
14. Do you think the Government should give advice on improving storage, or not?
15. Would you accept that advice if you had to pay cash to make the improvement?
16. Would you accept the advice if it meant hard work for yourself in constructing a maize store?
17. If it were necessary to build a new kind of store at your house would you be prepared to borrow money to pay for it, or not?
18. Say you gained 7 N¢/bag by storing and say you had 10 bags to store, what do you think it would be worth paying for a new store?

PAUSE

19. Do you enjoy discarding the old ways and accepting the new, or do you think the old ways are generally better?

20. Would you build a new grain store at your house if others did?

21. If a large grain store was built for the whole village where your own bags could be kept, would that be a good idea?

22. (a) What would the snags be?

PAUSE

(b) Would it be difficult to start off the idea?

Would people co-operate?

Would there be stealing?

23. Would it be a good idea if the Government organised a Co-operative Society to do it?

24. Would you help to build it with labour from your own household?

15. Would you give money towards it?

TRANSPORTING GRAIN: this might present a problem if the amount of grain grown were to be increased:

26. How many lbs of cobs can a man carry on his head?

27. Do you have any ideas about how transport to the house could be improved?

28. If the clan's maize plots were all together in one place every year so that a cart or trailer could be used (pulled by an ox or tractor) would this be a good idea?

29. How much maize do you plan to grow next major season, or haven't you decided yet?

30. When will you decide?

31. Do you always decide at about that time of year, or is it sometimes earlier or later?

32. Do you know what is the lowest price you would get for maize this year, or is there no 'lowest' price?

33. Would you like to see the Government pay a fixed price for corn as has been done for cocoa?

Why do you say that?

34. What should the fixed price be?

35. Bearing in mind all these things we have discussed, what is the best way of going about increasing your income from maize growing do you think?

36. Are you happy with farming or would you rather be away working in a town doing something different?

Analysis has been confined to attitudes only; a list of these (variables 12-20) is given below.

Results of analysis of attitudes of 62 farmers, correlated with their socio-economic characteristics

Table V.1

Basic Socio-economic data of sample of 62 householders

	Variable	Sample	Podoe	Kpomkpo	Akpokofe	Waya
		No. in sample	18	13	15	16
1.	Family size	Average	7·78	8·5	4·1	8·0
2.	Sex of H.H Head	No. of males	18	12	11	14
3.	Age of Head	Average	46·3	46·9	46·0	45·4
4.	No. of wives per male Head	Average	1.3	1·2	0·6	1·1
5.	No. of adults	Average	3·6	4·3	2·3	4·4
6.	No. of children	Average	4·2	4·2	1·8	3·6
7.	Years Education of Head	Average	4·7	1·9	0·8	5·4
8.	Leadership rating[1]	No. with a L.R.	7	2	4	10
9.	No. of farms worked by Head	Average	5·4	8·6	3·9	5·6
10.	Acreage farmed by Head	Average	5·6	10·6	3·2	6·3
11.	Acreage farmed by family	Average	8·4	12·2	5·0	6·3

1. For analysis see Section 4.2.1.

Attitudes investigated:

12. Interest in material gain (5)[2] - as shown by quoting price as the reason for selling maize in a particular way, by stressing the importance of getting value for money, by clearing far more than subsistence need, etc.

13. Investment-mindedness (7) - as shown by willingness to invest in village storage, to save rather than spend, spend on capital items and children's schooling.

14. Preference for income earning rather than leisure (1) - acceptance of advice in spite of hardwork - (inadequate evidence).

15. Independence preferred to conformity (5) - as for instance avoidance of habitual maize selling practice; avoidance of following others in sowing maize, weeding; satisfaction in independent action.

2. No. of questions in group.

16. Co-operativeness (3) - as shown by interest in co-operative storage, willingness to supply labour for co-operative storage; interest in clearing clan land for tractor cultivation.

17. Willingness to borrow (3) - as shown by willingness to borrow for maize store building, buying fertiliser, buying tractors (as one of a group).

18. Willingness to take advice (3) for instance on storage improvement, maize husbandry.

19. Belief that men with large families are better off than those with few children (1).

20. Preference for agriculture rather than non-agriculture as an occupation (2).

Comment

1. Correlations[1] among socio-economic characteristics:
correlations of interest were found between family size and acreage farmed both by the head and by the family as a whole, and between family size and leadership rating of the head; between duration of education and leadership rating; and between leadership rating and acreage farmed by the head. It was notable that increases in schooling for children had not yet had time to cause a negative correlation between age of head and duration of education, except in one village (Waya).

2. Variables 12-16:
All results showed a dominance of positive reactions over negative reactions (though, on this sample, the amount of evidence for income-earning preference rather than leisure is inadequate).

Variable	12	13	14	15	16
Positive answers dominant	47	61	59	47	55
Negative or uncertain answers dominant	15	1	3	15	7

Correlations with socio-economic characteristics included years of education with investment-mindedness and preference for independence (in three villages); leadership rating negatively with independence and with income-earning preference (in Podoe); age of household head negatively with variables 12, 13, 15, 16, in some villages.

---

1. Correlations were accounted reliable if $p < .05$.

3. **Variables 17 and 18:**

Again positive answers dominated:

Variable	17	18
Positive answers dominant	54	43
Negative and uncertain answers dominant	8	19

Positive answers were negatively correlated with age of household head in some villages, and positively correlated with his years of education; number and acreage of his farms is also positively correlated with willingness to borrow. There are some signs of consistency between these and the attitudes reported above, especially willingness to seek advice on the one hand and interest in material gains and investment-mindedness on the other.

4. **Variable 19:**

Preference for large families is not **dominant though the opinion of the sample was not so clear cut (23 : 39). There was a** negative **correlation with age in one village.**

5. **Variable 20:**

Preference for agriculture as an occupation was dominant (43 : 19). There was a tendency for large acreages to be positively correlated and years of education to be negatively correlated. Incidentally, there was also a positive correlation with co-operativeness and with willingness to borrow.

Appendix VI

Estimated Labour Use for Maize — Major Season — Measurement in Man Days per Acre

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing	1	5	5	1	1								13
Cultivating			1										1
Planting			3	2									5
Fertilising				1									1
Replanting													
Weeding (1)				3	9	1							13
(2)													
Harvesting							4	4					8
Total	1	5	9	7	10	1	4	4					41
Percentage	2·5	12·2	21·9	17·0	24·3	2·5	9·8	9·8					100·0

Minor Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing							2	5	1				8
Cultivating								2	1				3
Planting									6				6
Fertilising										1			1
Replanting									1				1
Weeding (1)										7			7
(2)													
Harvesting												1	1
" cont.	6	1											7
Total	6	1					2	7	9	8		1	34
Percentage	17·6	2·9					5·9	20·6	26·6	23·5		2·9	100·0

Estimated Labour Use for Groundnuts

Major Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing			2	5									7
Cultivating			4	2									6
Planting			5	6	1								12
Fertilising													
Replanting													
Weeding (1)				5	18								23
(2)													
Harvesting							18	2					20
Total			11	18	19		18	2					68
Percentage			16·2	26·5	27·9		26·5	2·9					100·0

Source: Intensive Village Survey Records

Estimated Labour Use for Groundnuts — Measurement in Man Days per Acre

Minor Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing								3					3
Cultivating								1	3				4
Planting									9	5			14
Fertilising													
Replanting									1				1
Weeding (1)										5	2	1	8
(2)													
Harvesting												1	1
" cont.	21												21
Total	21							4	13	10	2	2	52
Percentage	40·3							7·6	25·1	19·2	3·9	3·9	100·0

Source: Intensive Village Survey Records

Estimated Labour Use for Cassava

Major Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov.	Dec	Total
Preparing land	9	9	9										27
Planting				2	2								4
Weeding (1)					9	9							18
(2)						9	9						18
(3)									9	9			18
(4)											9	9	18
(5)	9	9											18
Harvesting													
Total	18	18	9	2	11	18	9		9	9	9	9	121
Percentage	14·8	14·8	7·5	1·5	9·1	14·8	7·5		7·5	7·5	7·5	7·5	100·0

Minor Season

Preparing land							14	14					28
Planting								2	2				4
Weeding (1)									9	9			18
(2)										9			18
(3)	9	9											18
(4)				9	9								18
(5)						9	9						18
Harvesting													
Total	9	9		9	9	9	23	16	11	18	9		122
Percentage	7·4	7·4		7·4	7·4	7·4	18·8	13·1	9·0	14·7	7·4		100·0

Notes: 1. Weeding may only be carried out three or four times

2. Cassava is usually sold in situ to gari makers, therefore no harvest labour has been included

Source: Mafi Kumasi Survey Records.

Estimated Labour Use for Tobacco — Measurement in Man Days per Acre

(A) Wute

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing		6	6	6									18
Ridging			6	6	6								18
Planting				3	3								6
Fertilising					3	3							6
Weeding (x2)						7	7	7					21
Top & Sucker							3	3					6
Harvesting								8	8				16
String								7	7				14
Unstring									6	6			12
Transport										2	2		4
Total		6	12	15	12	10	10	25	21	8	2		121
Percentage		4·9	9·9	12·4	9·9	8·3	8·3	20·7	17·4	6·6	1·6		100·0

(B) Tadzewu

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing		6	6	6									18
Ridging			6	6	6								18
Planting				3	3								6
Fertilising					3	3							6
Weeding (x2)						11	11	11					33
Top & Sucker							3	3					6
Harvesting							8	8					16
String							7	7					14
Unstring								6	6				12
Transport									2	2			4
Total		6	12	15	12	14	29	35	8	2			133
Percentage		4·5	9·0	11·4	9·0	10·5	21·8	26·3	6·0	1·5			100·0

Source: Tobacco Inquiry (see Vol.2 Chapter 4)

Estimated Labour Use for Yams — Measurement in Man Days per Acre

Major Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing Land		2	3										5
Mounding		2	4	5									11
Planting and mulching				3									3
Staking and twining					4	4	2	2					12
Weeding				3	3	3	3	3					15
Harvesting									3	2	2	1	8
" cont.	1												1
Total	1	4	7	11	7	7	5	5	3	2	2	1	55
Percentage	1·8	7·3	12·7	20·0	12·7	12·7	9·1	9·1	5·6	3·6	3·6	1·8	100·0

Source: "Economics of Yam Production in Ghana" V.K. Nyanteng

Estimated Labour Use for Cotton

Minor Season

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clearing							3	3	1				7
Cultivating								3	2				5
Sowing								2	2				4
Thinning								1	1	1			3
Weeding (x2)									4	4	4		12
Fertilising and ridging									5	4			9
Spraying (x6)									1	2	2	1	6
Harvesting												5	5
" cont.	5												5
Total	5						3	9	16	11	6	6	56
Percentage	8·9						5·4	16·1	28·6	19·6	10·7	10·7	100·0

Source: F.W.P. Tundie. Personal Communication, 1971.

Appendix VII Food Consumption Patterns

1. Survey of patterns of consumption

A small survey was carried out to obtain some indication of how food consumption varies round the year in the villages intensively surveyed.

Daily visits were paid to three randomly selected households in each of the eight villages for seven days at two-month intervals. Five sets of data were gathered for October, December, February, April, June(1970-71), each set consisting of daily consumption sheets preceded by a short general questionnaire.

1.1 Analysis of questionnaires

Q.1 Is this month generally one when food is plentiful in this village?

Answers:

	Yes	No	N/A	Total
October	13	7	1	21
December	21	1	2	24
February	22	2	-	24
April	12	9	2	23
June	11	11	1	23

Q.2 How about this year? Is food plentiful now, or not?

Answers:

	Yes	No	N/A	Total
October	14	5	2	21
December	16	3	5	24
February	20	3	1	24
April	15	7	1	23
June	14	6	3	23

Answers to Q.1 suggest some experience food shortage in April-June, and in October; Q.2 that 1970/1 was not a very abnormal year.

Q.3 What particular foods are plentiful at this time of year?

Answers:

	Maize	Cassava	Yams	G/N	No. of respondents
October	21	21	2	5	21
December	22	21	7	5	24
February	24	22	1	9	24
April	18	16	-	5	23
June	15	17	-	3	23

The relative infrequency of Maize in June answers and frequency of Yams and Groundnuts in December and February respectively are to be expected.

Q.4 and 5 concerned special celebrations and participation in them during the 3 weeks prior to questioning.

Answers:

	Celebrations counted	Participation	No. of respondents
October	17	15	21
December	23	22	24
February	23	21	24
April	39	39	23
June	30	19	23

Funerals occurred in all periods; Easter affected April, end of term celebrations affected June.

Q.6 Does your family eat maize and cassava mixed together at this time of year, or not?

Answers:

	Yes	No	N/A	Total
October	17	4	-	21
December	21	2	1	24
February	16	8	-	24
April	20	3	-	23
June	18	5	-	23

Q.7 In what proportions?

Answers:

	M more than C	C = M	C more than M	N/A	Total
October	5	1	11	4	21
December	7	3	12	2	24
February	5	-	11	8	24
April	9	2	9	3	23
June	3	-	15	5	23

Q.s 6 and 7 show no very marked seasonal swing; it is surprising that cassava is a relatively small constituent in April. Eastern village respondents showed maize more often predominant in the mix in all months except June.

1.2 Analysis of Daily Schedules

Over each week, records were made of meals taken, foods included, numbers taking meals and the place of eating.

1.2.1 Frequency and timing of meals (Table 'a')

The data showed :

1. A high percentage of rest days, increased by celebrations
2. A high proportion of absentees
3. Frequency of meal taking fairly consistent round the year at about 2·65 meals per person per day, with concentration in early morning and late afternoon. Early morning meals were taken by 81·5% of all people present, late morning meals by 17·9 - 41·9%. Early afternoon meals by 48·0 - 59·1% and late afternoon meals by 96·33%. There was little change in this pattern round the year.
4. A slight but persistent tendency for meals to be fewer per person in West than East.
5. No obvious difference in meal frequency as between work and rest days.

1.2.2. Place of eating

The vast majority of meals were taken at home; only 6·3% of all meals were taken on the farm. These were:

(a) in the middle of the day

(b) most commonly among men

(c) not noticeably variable with season, though February and April were below average

(d) particularly high in Akpokofe and Toda, but low in Podoe and Kpomkpo.

1.2.3. Foods consumed

Seventy ingredients were recorded, ingredients unprepared (r) and already processed at home (c) being differentiated.

Frequency of occurrence was measured according to whether the ingredient appeared, at any one of the 20 meal periods[1] recorded, in more than 50% of meals (A), 25-50% (B), 10-25% (C), 1-10% (D), never (E).

A and B frequency foods - maize, cassava, onion, pepper

A, B and C frequency foods - palm nuts, tomatoes, okro, smoked fish, dried fish, salt.

There was no marked variation in the meal ingredients as between times of day, except that salt was characteristic of late meals and sugar of early meals, that meat was most commonly eaten later, and palm wine was taken in the middle of the day.

---

1. Early morning, October; late morning, October; etc.

Table 'a' Number of meals taken per person present, distinguishing frequency by daily time-period

	(1) No. of household records	(2) Work-days	(3) Rest days	(4) Potential consumers	(5) Number absent	(6) Number present	(7) (6) as % of (4)	(8) Number of meals taken:- Early morning	(9) Late morning	(10) Earley afternoon	(11) Late afternoon	(12) Total	(13) (12)/(6)
October	143	106	37	987	210	777	78·7	618	139	459	700	2052	2·64
December	159	106	53	917	245	672	73·3	527	223	342	647	1739	2·58
February	162	109	53	917	232	685	74·7	593	190	352	647	1782	2·60
April	134	78	56	917	192	725	79·1	596	300	370	706	1972	2·72
June	145	78	50	847	193	654	77·6	531	267	314	644	1756	2·68

There were some seasonal variations, but no cases where one food suddenly became dominant. For instance palm nuts were recorded particularly in December - February - April, garden eggs especially in June, tomatoes and onions especially in October, green beans especially in June, bush meat especially in February, the hunting season,

There was a noticeably high number of ingredients per meal at all times of the day in all seasons.

(c) foods[1] predominated over (r) foods.

1.2.4. Origin of foods

The three months October, February and June were analysed; 14 foods were recorded at least 50 times in any one week.

Origins: S = store, F = fresh from farm, PM = purchased in market, PH = purchased from another household;
symbols record sources yielding more than 25% of answers, capitals indicating dominance.

	October	February	June
Maize	S	S,f	F,s
Cassava	F	F,s	F
Plam nuts	F	F	F
Garden eggs	F	F,pm	F,pm
Tomato	F,ph,pm	PM,f	PM
Onion	PM,ph	PM	PM
Peppers	F	F	F
Okro	F,pm	PM,f	PM,f
Palm oil	PM,s,ph	-	-
Smoked fish	PM,ph	PM	PM
Dried fish	PM	PM	PM
Bush meat	-	F	F
Salt	PM	PM	PM
Sugar	PM,ph	PM,ph	PM

2. Intermediate ingredients

2.1. Ingredients prepared from Cassava

1. Ampesi Cassava roots are peeled, washed, and boiled until soft. (Ampesi is then pounded in a mortar, the smooth dough being fufu, which is eaten.)

2. Kokonte Cassava roots are peeled, cut into pieces, typically 3" x 1" x ¼" and left to dry in the sun. When dry it is milled into flour. In this form it can be stored for up to six months. The flour is then converted to dough by adding water to produce fufu.[2]

---

1. This will include foods held over from previous meals.
2. The same principle applies to the preparation of cassava chips by factory methods for export as livestock feed.

3. Gari Cassava roots are peeled, then grated either by hand or mechanically. The grated cassava is placed in muslin or jute sacks and heavy stones placed on top; it is then left until most of the white liquid has been squeezed out. During this time (two-three days) fermentation has taken place. The solid residue is then sieved to isolate the large pieces which are used either for Kokonte or discarded. It is then either sun-dried or immediately fried. A saucer-shaped clay pan of c. 30" diam. carried on a horse-shoe shaped clay support about 6" high has a wood fire lit below. Cassava is fed into the pan, constantly stirred until brown and crisp, being removed as ready and replaced by new uncooked material in a flow process. Sometimes palm oil is used in the cooking.

4. Tapioca The white liquid from the first 1-2 hours of pressing in the gari-making process is collected. The sediment is allowed to settle and the clear liquid decanted. The sediment is washed and dried and then gently fried. (This required much more skill than gari frying and is done by relatively few village women.)[1]

2.2. Ingredients from other sources

1. Maize is used in two forms (i) either as whole grain, when it is commonly mixed and cooked with cowpeas; or (ii) as flour, now generally milled locally.

2. Cowpeas is normally cooked whole.

3. Groundnuts are (i) rather seldom cooked whole though may be bought roasted from hawkers; (ii) more commonly used as a paste or as an ingredient in 'soup'.

4. Rice is eaten cooked.

5. Yams, cocoyams and plantains are commonly sliced and then either fried as a vegetable or pounded, together with other ingredients.

6. Vegetables are used in great variety, either cooked independently, as part of a 'soup' or as a flavouring (especially pepper) with other cooked foods.

7. Meat and Fish will be prepared in various ways but are often also added as ingredients to 'soup'.

---

1. Starch is also a by-product of gari, made in the same way as tapioca but with the final frying stage omitted.

3. Prepared Foods

The starchy ingredients mentioned above are combined in the ways shown below:

Food	Ingredients	Cooking Method
Akple ('porridge')	Cassava dough, maize flour	Boiled in water
	Kekonti flour, maize flour	"
	Gari, maize flour	"
	Ground cowpeas, maize flour	"
Azibli	Whole cowpeas, groundnut, maize	"
Ayibli	Whole cowpeas, maize	"
Bobor	Cowpeas plus gari	"
Fufu	Cassava, yam	Boiled and then pounded
	Cassava, cocoyam	"
	Cassava, plantain	"
Kaklo	Maize flour, plantain smashed	Fried
	Maize flour (with sugar)	"
	Cassava dough	"
Abolo, Kokui	Maize flour	Steamed
Yakayake	Cassava dough	"

Appendix VIII Large Scale Processing of Cassava

The Asempeneye Company has recently begun artificially drying cassava chips for export to Europe and has plants at several places in Ghana, notably at Kasseh junction and more recently at Koluedor. Other companies have set up plants but so far their success has not been note-worthy. The main problem is that the local price for Cassava is much higher than a large-scale processor can afford to pay if he is to be competitive in the export market. For example, the farmers in Mafi-Kumasi receive almost N¢ 150 per acre which for a seven ton crop is N¢ 21 per ton, in the field. The Asempeneye Company are paying N¢ 14 per ton of cassava at the factory. However, as noted previously the price per acre in Mafi-Kumasi is higher than around Ho or Kasseh junction (N¢ 100 per acre). This however may be due to higher yields. The wholesale price of cassava is N¢ 40-50 per ton in the market depending on the area. The scope for large-scale processing has been the subject of a report by Jeroch,[1] which is drawn on here.

Background

Most of the cassava chips supplied to Germany are sun-dried with a consequence that quality is low so that cassava cannot exceed 10 to 15% of any ration. It is hoped that by artificial drying, as proposed in this scheme, more cassava can be incorporated in a ration. Moreover, since there is a premium for high quality cassava chips of about N¢ 5 per ton, this should increase the profitability.

The price of cassava chips per metric ton was quoted as DM 240 per metric ton c.i.f. Freight and handling charges on this bulky and relatively low value product were DM 85 per metric ton, leaving DM 155 per metric ton f.o.b. at Tema or N¢ 45 per ton.

Currently the Asempeneye Company are treating this venture as a pilot project in a long term investment programme. They are in close co-operation with a German Company who are importers in Germany and who buy the cassava chips on a cash basis on delivery to a warehouse in Tema and thus take care of freight. The Company would buy 200,000 tons if available. The German Company has also developed the plant for drying the cassava and supplies the imported equipment. Although the present scale of operations is quite small, there are some advantages of scale to be obtained especially in respect of freight rebates and bulk transport which would save N¢ 8/ton for bags.

---

1. Jeroch, M. Prospects in the Development of the Cassava Industry in Ghana German Africa Association, Industrial Promotions Department, Hamburg/Accra 1968. Sponsored by German Ministry for Economic Co-operation.

Moreover if lots of 1,000 tons could be shipped, this would justify a pelleting machine which would reduce transport costs and increase the value of the product. Although there are these economies of scale, it is intended to set up small drying plants around the country. Jeroch mentions about 200 such plants. Each plant would be capable in theory of drying five tons of fresh cassava in an eight hour shift which with a 300 day working year amounts to a requirement of 1,500 tons of fresh cassava. With two shifts per day the requirement is 3,000 tons, which with a yield per acre of six tons is equivalent to 500 acres. If the cassava is harvested at 18 months of age, 725 acres of cassava will be in the ground at any one time. Given that the company reckon transport could be organised within a radius of 20 miles, this is not a very large acreage for supplying a single plant.

It is envisaged that local entrepreneurs may supply capital as well as management for a plant, which thereby would make use of local resources and would spread any benefits around the country as well as diversifying the risks which could be concentrated if one large plant were to be operated.

The Plant

The equipment consists of a batch drier made up of three locally made wooden boxes each capable of holding five tons of fresh cassava. Heat is supplied by an oil fired heater blower. A generator set is needed to supply electricity if no grid supply is available. Other equipment includes a cutting machine and tray, together with a building measuring 30' x 120' x 12' plus a house for the manager. A vehicle will also be necessary, although it is not official company policy to carry fresh cassava, (though this is being done at the present time). Six permanent labourers are required at the plant plus a supervisor, clerk accountant and a mechanic. The peeling is done by casual labour.

The capital investment required for a single plant is as shown in Table 1.

Fixed Costs

Assuming an investment of N¢ 12,000 is made and this is depreciated at 10%, the annual capital charge including interest at 10% on the initial capital becomes N¢ 2,400.

Annual Cash Costs

The annual cash costs include charges for the cassava, casual labour for peeling, permanent labour, fuel, repairs, office expenses and transport. Assuming a plant works for one shift per day, then the cash costs per shift are as shown in Table 2.

Table 1.

Capital Investment in Cassava Drying Plant

	N¢	N¢	
Building (could be hired)	1600	-	
House "	600	-	
Generator set	3000	3000	
Heater blower	2500	2500	
Cutting machine and tray	1000	1000	
3 drying boxes	150	150	
Wash basin	10	10	
Installation	120	120	
Lorry (shared with other plant) (could be hired)	4500	-	
1. Fuel tank	400	400	
1. Scale	400	400	
Total:	14,280	7,580	(with hiring)

Table 2.

Daily Cash Costs and Sales

	NC
5 tons of fresh cassava @ N¢ 14/ton	70·0
Peeling @ 15np per cwt	15·0
Permanent labour, 6 men @ 75np/day	4·5
1 Clerk @ N¢ 48/month	2·0
1 Mechanic @ N¢ 48/month	2·0
1 Supervisor @ N¢ 96/month	4·0
Fuel for oil burner, 30 gals @ 45 np	13·5
Fuel for generator 13 gals @ 45np	5·8
Transport, 1·5 tons cassava chips (N¢ 18/trip = 1/6th trip)	3·0
Total:	119·8
1·5 tons of cassava chips @ N¢ 45/ton =	67·5
Add 25% export bonus =	84·3

Even with the export bonus (difficult to obtain) the cash costs exceed the returns by some considerable margin. It is, therefore difficult to see how the venture can be profitable, especially as there is at least another N¢ 6 per shift to be met for capital charges.

Several parts of the above budget are sensitive to changes, the most important being the conversion rate of 30%. Jeroch estimates a conversion rate of 43·5% but in practice the highest rate achieved has been 40% for unpeeled cassava. Assuming a deduction of N¢ 5 per ton is made for unpeeled cassava, then with 2 tons of dried unpeeled chips gross returns amount to N¢ 80. With peeled chips the conversion rate has been found in practice to be about ⅓rd. There is an additional source of income with peeled chips in that the peel is sold to local pig farmers but this fetches a very low price.

Another source of saving is the fuel cost, but in practice it has been found that some lots of cassava have taken up to 12 hours to dry rather than eight, so the fuel costs may in fact be underestimated. A further source of saving would be to run two shifts per day and so spread the capital costs and that of supervision. However, the problem at the moment is that even with one shift, it is difficult for the plant to obtain a continuous supply of fresh cassava. It is imperative that cassava is processed within 24 hours of being harvested.

It is difficult to see the operation proving successful as long as the cost of the raw product (5 tons of cassava) exceeds the price of the final processed cassava chips. If the processing costs for 5 tons of cassava amount to N¢ 50, excluding the cassava, and the final gross revenue is only (say) N¢ 85, then the break-even price for cassava is only N¢ 7 per ton, which is considerably below the current price. There must therefore be a considerable improvement in the efficiency of processing and transportation to Europe as well as a reduction in the market price of cassava before any such scheme will be viable. (Production of cassava must increase both to satisfy Ghana's human demand and also the demand of Ghana's livestock industry, something which is only likely to happen if there is either a big increase in yields or acreage).

A reaction to the scarcity of cassava by the processing companies is to try and grow cassava themselves on large farms using tractors. It must be pointed out that they are not likely to achieve much lower costs than the ordinary small farmer since there is no immediately obvious technological improvement related to cassava production which will increase yields. Furthermore, while they may process cassava grown on their own farms, the opportunity cost of such production will be the local market price less any marketing costs. One must therefore regard the artificial drying of cassava very much as a pilot project until such time as the price ratio of cassava for home consumption and export changes.

Appendix IX Population Data, Southern Ghana,[1] 1960 and 1970

1. Population by Regions (000's)

	1960			1970			
	Males	Females	Total	Males	Females	Total	Percentage Increase in Total Pop'n 1960 to 1970
Western and Central	694	683	1,378	779	796	1,575	14·3
Greater Accra	262	230	492	438	414	852	73·2
Eastern	552	542	1,094	601	613	1,214	11·0
Volta	379	398	774	455	492	947	22·4

2. Population in Southern Districts[2] of Volta Region

	1960		1970		
	Population	Density per sq. mile	Population	Density per sq. mile	Percentage Change in Total Pop'n 1960 to 1970
Ho (including Ho U.C.)	116,993	115	146,006 (37,938)	144	+ 25·2
Tongu	86,056	91	98,601	105	+ 15·4
Anlo North	141,434	242	172,563	295	+ 21·9
Anlo South	69,872	304	76,683	338	+ 11·2
Keta Urban Council	29,711	413	27,404	381	- 7·8

1. Results of the 1970 Population Census are not yet available for all regions of Ghana.
2. The area in which studies were conducted was contained in the first three of these Districts.

Appendix X Calculations by Nathan Associates Designed to Show the Feasibility of Supplementary Feeding

(i) Present situation - 50,000 cattle, owned by 2,000 individuals occupy some 800,000 acres. 22,000 cows produce a 40% calf crop of 9,000 annually. Take-off is 4,300 per annum providing 1,269,000 lb of carcase beef and edible offal.

(ii) Proposals - output to be more than doubled by 1980
by (a) raising the calf crop to 50%
(b) increasing cow numbers at 1% per annum
(c) increasing carcase weight by 10%
giving, at 40np per lb., an increase in value of production from N¢ 500,000 to N¢ 1,240,000.

organisation to be through cattle raisers' associations, handling all functions including the provision of supplies and equipment.

(iii) Programme would include:
(i) calves to be weaned at 8 months
(ii) stores to be fed for 12 months on fresh grazing, standing hay and 3 lb. per day of wheat bran.[1]
(iii) males then to be segregated and fed to slaughter
females to be bred to selected bulls.

(iv) Incentives to commercialisation supplied by the government would include:
(1) the development of markets for weaned male calves
(2) assistance in the growing of females
(3) additional dug-outs and dams
(4) supervision of community paddocks
(5) training of herdsmen
(6) work on education and development with the associations
(7) sponsorship of the handling of commodity inputs

The government would { buy 500 male calves at N¢ 60 per head,
{ take the females, feed, breed and return
{ them free of charge.

---

1. The consultants suggest 'wheat mixed feed' a better name because of higher value than just bran: TDM 89·8%, Dig.Pr. 15·5, TDN 70·8, PR 18·7, Fat 4·8, Ca 0·11, Fibre 7·7, P 1·09, Estimated net energy per 100 lb - 60·7.

Government's:-

Costs	N¢	Returns	N¢
500 calves @ N¢ 60	30,000	425 males slaughtered @ N¢ 130	55,250
200 replacement females for death losses and culling	14,000	175 females slaughtered @ N¢ 125	21,875
		50 bulls for breeding @ N¢ 80	4,000
Cost of bran	22,000		
Other commodity costs	4,000		
	70,000		81,125

The project would be run in three districts with project leaders directly responsible to the Regional Agricultural Officer, Ho, their function being to integrate the local institutions - Animal Health, Animal Husbandry, Irrigation and Drainage, Training facilities at Adidome and Ohawu and State Farms at Adidome, Akatsi, Tadzewu and Afige.

(v) Mixed Wheat Feed is at present exported at N¢ 30 per ton net.

1 lb of MWF + standing dry grass = maintenance

3 lb of MWF + natural grass = 1 lb LWG/day

Dicalcium phosphate and/or urea would be added to boost.

30,000 MWF available would give 10,600 tons increase in live cattle (equivalent to 37,700 head of imported cattle).

Appendix XI Hypothetical Cost Structure for Pig Production Using Cassava as the Main Starch Feed

Feed consumption assumptions:-

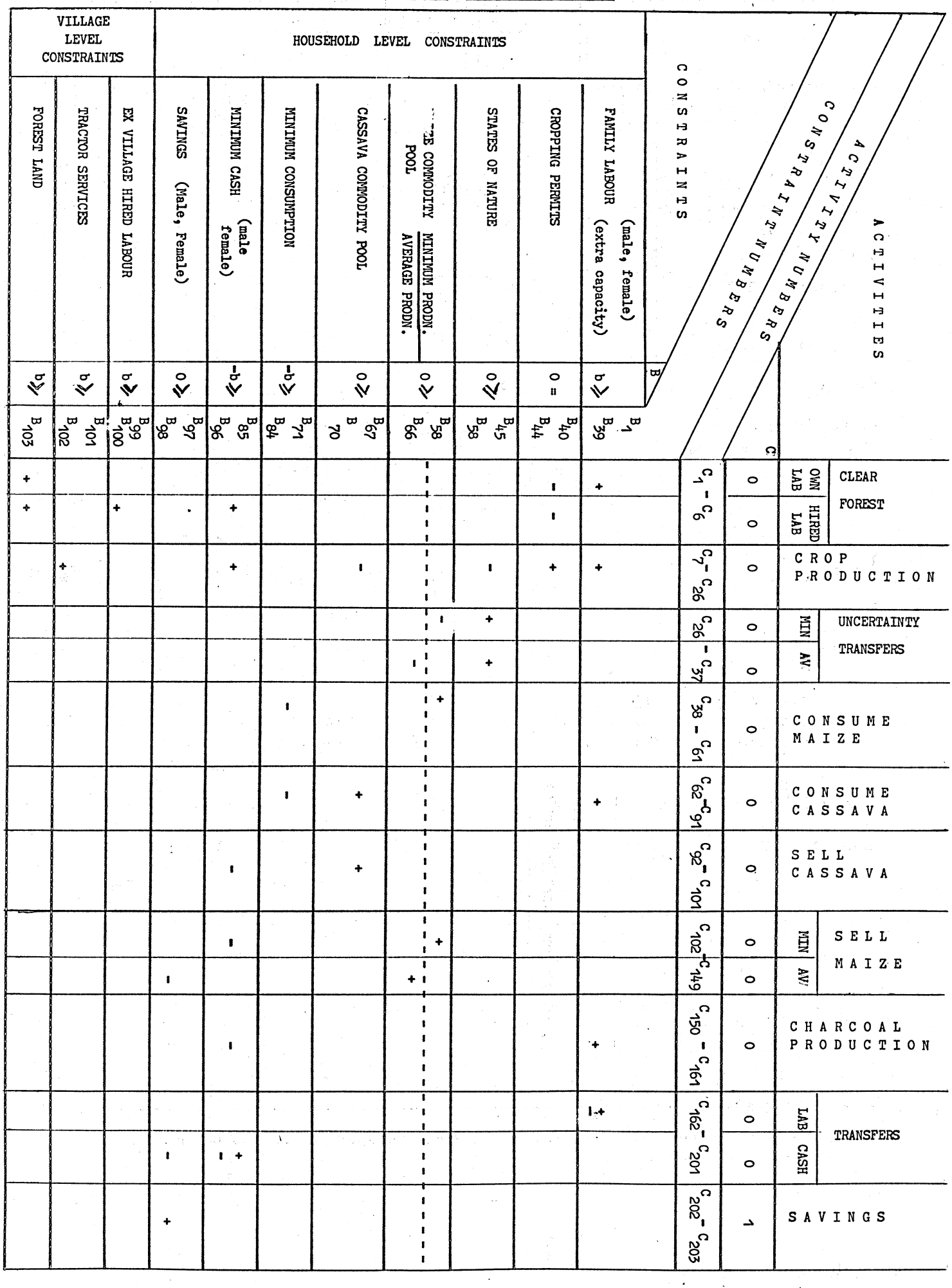
	lb
Sow per annum (including creep feed for 2 litters)	3360
Boar per annum	2200
Fattener to 200 lb	640

Per sow per year:-

Returns		NȻ	NȻ
14 fat pigs at 200 lb @ 25np/lb		700·00	
$\frac{1}{3}$ cull sow		22·00	
$\frac{1}{20}$ boar		3·00	
			725·00
Costs			
$\frac{1}{3}$ gilt		33·00	
$\frac{1}{20}$ boar		6·00	
Feed - sow and boar	3070)		
creep	400[1]) at 3·6np	447·48	
fatteners	8960)		
			486·48
Margin over feed cost			238·52
Feed as % of gross output			65·10

1. It is likely that this element would require special attention and would probably cost more.

Figure 1 Summary Matrix



Appendix XII Linear Programme for a representative farm, Kpomkpo village

The Matrix used is summarised in Fig. 1. (See opposite page)

Notes a) Activities

1. Clearing activities are separated from crop production activities in order to increase flexibility
2. Crop production activities include maize, cassava (groundnuts), and oil palm, produced by men and/or women, in major and/or minor seasons, on forest and/or savannah.
3. Uncertainty transfers are designed to handle the uncertainty of maize yields. (For full explanation see Low (1973), pp 25-34 and p 37).
4. Consumption activities are included for six two-month periods to ensure food sufficiency, taking into account maize storage losses and ground storage of cassava.
5. Selling activities reflect seasonal price variations.
6. Charcoal burning activities are applicable to both men and women at all time periods.
7. Transfer activities allow flexibility in the use of labour.
8. Cash transfers are made to savings and reflect the use and supply of cash over six time periods through the year.
9. Saving activities for men and women are included.

b) Constraints

Constraints fall into two categories - household and 'village'. The former apply to resources controlled by individual households and constraints, influenced by social norms; the latter include forest land, hired labour and tractor services available from government.

Since a representative or model household is used, the household is specified as requiring a fraction of the total resources available at village level. Two (or more) households' trading resources could have been used; however, clear-cut contrasts in household types were not in evidence and the factors determining exchange between households were not sufficiently well known.

(i) at household level.

1. Family labour availability was calculated on the assumption that men and women would be prepared to work, in any two periods of two months

Table 1 Model Solutions for a Representative Kpomkpo Household

	Basic Matrix	Extension of Basic Matrix			Extension of Basic Matrix with water Catchment				Extension of Basic Matrix with improved Maize Storage				Extension of Basic Matrix with water catchment and improved Maize Storage			
		+ (b)[1]	+ (c)[1]	+ (b&c)		+ (b)	+ (c)	+ (b&c)		+ (b)	+ (c)	+ (b&c)		+ (b)	+ (c)	+ (b&c)
Objective function N¢	110.0	125.6	113.5	129.1	118.6	134.3	122.0	137.7	132.7	164.5	136.1	168.5	141.1	174.5	144.3	178.5
Forest land utilised	827.5	733.3	827.5	733.3	827.5	733.3	838.5	733.3	798.6	768.0	798.6	748.9	811.7	784.0	812.3	789.0
Forest Maize (Acs)	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	2.4	1.8	2.4	1.8	2.5	1.7	2.6
Traditional - major	1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4	
minor	.5		.5		.5		.6		.4		.4		.4		.4	
Improved, mixed, major		1.2		1.2		1.2		1.2		.9		1.0		.8		.8
minor																
Improved, pure, major		.4		.4		.4		.4		.9		.8		1.0		1.1
minor		.3		.3		.3		.3		.6		.6		.7		.7
Forest Cassava (Acs)	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0
Savannah Cassava (Acs)	1.7	1.6	1.7	1.6	1.8	1.8	1.8	1.8	1.7	1.6	1.7	1.6	1.8	1.6	1.8	1.6
Production - men	.6	.2	.2	.2	.3	.3	.3	.3	.6	.4	.3	.2	.6	.1	.3	.1
women	1.1	1.4	1.5	1.4	1.5	1.5	1.5	1.5	1.1	1.2	1.4	1.4	1.2	1.5	1.5	1.5
In situ sales - men	1.1	.9	1.1	.9	1.1	.9	1.2	1.0	1.1	.7	1.1	.7	1.1	.8	1.1	.8
women	.3	.3	.1	.1	.4	.4	.2	.2	.3	.3	.1	.1	.3	.4	.2	.1
Gari Production (ropes)			14.2	14.2			14.0	14.0			14.2	14.2			13.2	13.9
Charcoal (bags)	11.1	11.6	.9	1.4	11.0	11.6	1.0	1.6	11.3	11.3	1.1	1.3	11.2	11.2	1.7	1.1
Men	.2	.7	.9	1.4	2.4	1.8	1.0	1.6	.4	.4	1.1	1.3	.2	.2	1.7	1.1
Women	10.9	10.9			8.6	9.8			10.9	10.9			11.0	11.0		
Labour MVP (np/hr)																
Maximum - men	74.7 JJ[2]	42.9JJ	74.7JJ	49.2JJ	74.7JJ	49.2JJ	74.7JJ	49.2JJ	76.0AM	99.0JJ	76.0AM	99.0JJ	76.0AM	99.0JJ	78.0AM	99.0JJ
women	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	22.0	27.0	22.0	27.0	22.0	27.0	20.0	27.0
Minimum - men	9.6DJ	9.6$_{DJ}$	9.6FM	9.6	9.6DJ	9.6$_{DJ}$	9.6DJ	9.6DJ	9.6$_{DJ}$	11.2$_{DJ}$	9.6$_{DJ}$	13.7$_{DJ}$	9.6$_{DJ}$	11.2$_{DJ}$	9.6$_{DJ}$	11.2$_{DJ}$
women	9.6FM	9.6	11.7	11.7	9.6FM	9.6	9.6FM	9.6DJ	9.6	11.2	11.7	11.2	9.6	11.2	9.6	11.2

1. (b) = improved maize inputs (forest) (c) = gari production

2. Months in the year.

up to the level of maximum activity shown by survey records. The work force per household was estimated at one adult male and 1·5 adult females; labour availability per household was therefore

	Male specific	Female specific
basic hours available per period	150	180
maximum number of extra hours available per period	45	95
total number of extra hours available	90	190

2. Minimum consumption of maize, cassava and oil palm products were fixed and independent of each other. Two methods of estimation were used: (a) direct inquiry and (b) calculation of the difference between average production and sales. (Reasonably similar results were derived after allowing in (b) for losses in storage). Consumption of maize and cassava was estimated by weight, oil palm products in cash.

3. Minimum cash requirements were estimated for both male and females on the basis of survey records, and distributed over six two-month periods. (ii) at 'village' level.

4. Hired labour from outside the village was treated as a constraint.[1]

5. Tractor availability was estimated as two for one month per season - a maximum of 56 acres cultivable.

6. Forest land is ultimately limited at 1,100 acres but intensity of cultivation is flexible, with yield level inversely related; optimal intensity under these conditions is determined by labour supply.

---

1. In the case of Kpomkpo the fact that the marginal productivity of hired labour was positive indicates some population increase in the area is possible.

DEVELOPMENT STUDIES SERIES

			Price
1.	September 1966	Contrasting Policies in Irrigation Development: Sudan and India. D.S. Thornton	38p
2.	July 1967	The Marketing of Groundnuts in the Sudan. E.M. Low	38p
3.	December 1967	Agriculture in South-West Nigeria. M. Upton	38p
4.	December 1967	Agricultural Credit in Botswana. A. Harrison	-
5.	May 1969	Irrigation in Botswana. M. Upton	-
6.	May 1969	The Economics of Irrigation Development - A Symposium. S.G. Sandford, R.F. Wynn, D.S. Thornton	38p
7.	February 1970	Agricultural Extension in Botswana. B.G. Lever	-
8.	January 1971	Cattle Marketing in Botswana. D.J. Ansell	-
9.	June 1971	Policies and Institutions in Ghanaian Agriculture. H. Mettrick	-
10.	November 1971	Limes in Montserrat. M. Upton	-
11.	October 1972	Farm Power in West Pakistan. C.E. Finney	-
12.	June 1973	Agriculture in South-East Ghana. Volume I. Summary Report D.S. Thornton	50p
13.	June 1973	Agriculture in South-East Ghana. Volume II. Special Studies G.E. Dalton and R.N. Parker	50p

0 7049 0177 3