MULTI-AGENCY PARTNERSHIPS (MAPS)
FOR
TECHNICAL CHANGE IN WEST AFRICAN AGRICULTURE

RICE PRODUCTION AND LIVELIHOODS IN GHANA

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AAGDS	Accelerated Agricultural Growth and Development Strategy
ADB	Agricultural Development Bank
AESD	Agricultural Engineering Services Department
AFD	Agence Française de Développement
AgSSIP	Agricultural Services Sector Investment Programme
CSPIP	Civil Service Performance Improvement Programme
DANIDA	Danish Development Agency
DFID	Department of International Development
DOC	Department of Co-operatives
GDP	Gross Domestic Product
FOs	Farmers' Organisations

ERP	Economic Recovery Programme
GIDA	Ghana Irrigation Development Authority
GoG	Government of Ghana
GOs	Government Organisations
IFAD	International Fund For Agricultural Development
IRRI	International Rice Research Institute
JICA	Japanese International Co-operation Agency
KfW	Kreditanstalt für Wiederaufbau
LRDP	Lowland Rice Development Project
M-APs	Multi Agency Partnerships
MLA	Multi-lateral Agency
MoFA	Ministry of Food and Agriculture
NGOs	Non-Governmental Organizations
NLC	National Liberation Council
NORRIP	Northern Regional Rural Integrated Programme
ODI	Overseas Development Institute
PP	Progress Party
SAP	Structural Adjustment Programme
SPF	Strategic Policy Framework
UDS	University for Development Studies
URADEP	Upper Region Agricultural Development Project
VIP	Village Infrastructure Project
WARDA	West African Rice Development Association

GLOSSARY OF LOCAL TERMS

Abusua system	Traditional land tenure system within the Akan-Twi ethnic group, where the land belongs to all the family members, but no one bears direct responsibility for it
Abusuapayin	The oldest male member of the lineage
Lean season	Annual food shortage period, usually the time when the crops have been planted, but not yet harvested
Ratoon	Second crop of rice after the first harvest from the same root, practiced under the conditions of abundant rainfall (>1 500mm/annum)
Share cropping	Traditional land tenure system, where the landlord usually gets about ⅓ of the produce, while the tenant farmer has the remaining ⅔ from the parcel of land
Susu collection	Traditional saving system practised by traders
Tendana	Spiritual 'owner' of the land in traditional tenural systems of Northern Ghana
Outdooring	Naming ceremony of newly-born babies, carried out on seventh day after delivery

1. Introduction

1.1 The concept of Multi-Agency Partnerships

West Africa is the poorest region of the world and in most countries the majority of the population depends on rainfed agriculture. Chronic malnutrition is a constant feature of rural life in many areas, partly because agricultural productivity is so low. Technology is generally available to increase productivity but a combination of political insecurity, failing infrastructure and inadequate development of the institutions of civil society have made the transfer of knowledge to poor farmers slow or ineffective. For similar reasons, private sector service providers do not reach many remote, rural areas. In addition, labour migration has the consequence that women are the principal farmers in many areas and are often discriminated against in other sectors such as health and education.

Recent efforts to reform public sector research and extension services in the West African Region and in Nigeria in particular, have been only partly successful. Participatory, problem-driven approaches often exist only in rhetoric in most government organisations (GOs). The pace of reform in GOs along the above lines is slow and new approaches have considered the scope for partnership between RRIs (Regional Research Institutions)[1], GOs, NGOs and where possible and appropriate, farmers' organisations (FOs). It is claimed that Multi-Agency Partnerships (MAPs) such as these can make reorient GOs by making demands on them and complementing their technical skills with those of NGOs in participatory needs assessment, screening of technical options, group formation and promotion of joint action. In the light of the increased emphasis on strengthening civil society, the climate is opportune for extending and expanding such partnerships. Knowledge systems must develop to reflect new conditions.

A number of potential obstacles have to be negotiated if multi-agency partnerships are to serve as a successful link in the technology development dissemination and feedback chain. Power relations between NGOs and RRIs are unequal; they generally have differing philosophies, mandates, ethos, operating procedures, views on accountability, external links with international organisations. In addition, the concept of monitoring *process*, which is essential for course-corrections if Multi-Agency Partnerships are to flourish, is widely unfamiliar to NGOs and NARS (national agricultural research systems).

The project has two elements:

a) research towards recommendations on the modalities of multi-agency partnerships in promoting technical change in West African agriculture.
b) the dissemination of this information through a programme of workshops, visits, Best Practice guidelines and a handbook in English and French.

Case studies on M-APs have been carried out in countries such as Gambia, Zambia, Senegal, Mali and Kenya with varying degrees of success. Participation, rapid feedback, inter-dependence and true partnerships are the hallmark of an idealised M-APs. Experience indicates that greater success in diffusing technologies and in fostering sustainable development can be achieved if farmers actively help to diagnose local problems and participate in developing and adapting new technologies. This requires participatory modes of research and development in which decisions are made in accordance with local resources and needs, as well as fora where their views can be articulated and immediate feedback received.

1.2 Innovation in agricultural production systems

The process of technical change in agriculture in Africa has not been as rapid as many earlier projects hoped (Ruttan 1975; Silberfein 1989; Wiggins 1995). In part this was because existing institutions were poorly adapted and often inadequately resourced in relation to their task. In particular, agricultural research was hierarchic and little attempt was made either to explore indigenous knowledge or to co-operate with farmers in the research process. One donor response was to promote reform of Government Research and Extension

[1] Defined here as agriculture/ NR research organisations having a regional mandate, such as WARDA.

services. Although there have been many attempts to reform Government bodies, institutional resistance has meant that these have generally only moved forward slowly (Ruttan & Thirtle 1989).

The 1970s and 1980s saw a significant growth in field-oriented organisations questioning existing systems of technology delivery and exploring new methodologies for diffusing innovations to farmers (Nindi 1985; Ostrom 1990; Yung, Bosc & Losch 1995). During the 1980s it was increasingly realised that no single category of agency could in itself manage agricultural research and extension, if promotion of technical change in agriculture was to be effective at the local level.

The response was to explore the potential for co-operation between different types of agencies operating in this field. Essentially, there are five types of stakeholder;

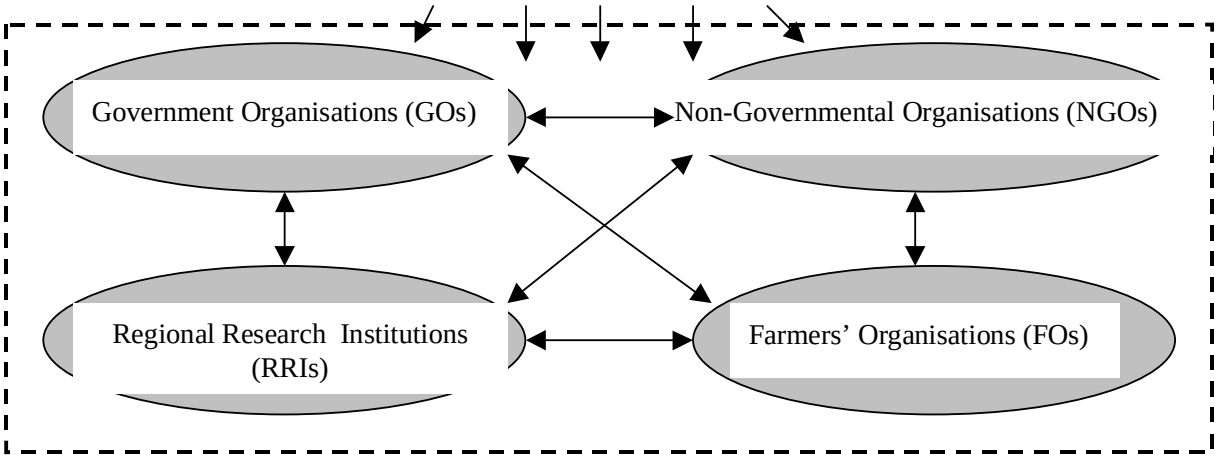
- Government Organisations (GOs)
- Regional Research Institutions (RRIs)
- Non-Governmental Organisations NGOs, Community-Based Organisations (CBOs) *and*
- Farmers' Organisations (FOs)
- Private Sector Service Providers (PSSPs)

There have been a variety of studies describing the process of technical change as managed by individual elements (see articles and references in WARDA, 1994; Winrock 1993, 1994; Arnaiz 1995; Byé & Muchnik 1995). Each grouping has its advantages and demerits; a not entirely attractive element of NGO strategies was to attempt to bypass government.

As increasing numbers of players entered the field it became evident that a synergy would be created by working in partnership (Biggs 1989). These Multi-Agency Partnerships (multi-agency partnership) are described in a country case-studies (e.g. Bebbington 1989 for Ecuador; Diallo and Senghore 1990 for Gambia; Henderson and Singh 1990 for Gambia and Ethiopia; Copestake 1990 for Zambia; Osborn 1990 for Senegal; Musyoka, Charles and Kaluli 1991 for Kenya; Bosc et al. 1995 for Senegal; Collion 1995 for Mali).

An idealised model of the relations between the different agencies is presented in the figure. However, in reality, equitable multi-agency partnership is difficult to establish and monitor. Power relations between local-level NGOs/CBOs and GOs are unequal; they generally have differing philosophies, mandates, ethos, operating procedures, views on accountability, views on rural futures and links with international organisations. The challenge in promoting technical change at the local level is to exploit (even small) areas of overlap in their world-views sufficiently to allow the agencies to work together without neutralising the features that give each their comparative advantage.

Multi-Agency Partnership (MAP)



Experiences indicate that greater success in diffusing technologies and in fostering sustainable development can be achieved if farmers actively help to diagnose local problems and participate in developing and adapting new technologies. This requires participatory modes of research and development in which

decisions are made in accord with local resources and needs (Ashby & Sperling 1994; Bebbington, Merrill-Sands & Farrington 1994; Collion 1995).

Farmers' organisations in West Africa are extremely diverse, in terms of scale/geographical level; gender balance; legal recognition; functions; access to information, training and technical advice; resources; internal decision-making; integration with the technical/economic/social environment. (Beaudoux and Nieuwkerk 1985; Buijsrogge 1989). Such organisations are often focused on either men or women; organisations dominated by men often have the connections to actively seek out funding or partnerships. It cannot be assumed that farmers' organisations are able to make technology systems more responsive to the needs of low-resource members. Those organisations renowned for their "success" in the technology area tend not to represent the poorest farmers but have often received significant amounts of donor money (Carney 1996).

Because most large and centrally administered public extension organisations are unable to respond to such bottom-up and demand-driven activities, the role of participating NGOs has increased in importance. NGOs focus on farmers' needs, stimulate community-based activities, use methods that prove to be effective, and contribute positively to development. They have a major operational advantage in the more fragile and often highly heterogeneous environments. These changes in institutional and methodological scenarios pose problems for any program to accelerate the diffusion of new technologies to farmers.

These changes in institutional and methodological scenarios pose problems for any program to accelerate widespread diffusion of new technologies to farmers. Governmental institutions, constrained by reduced funding, face difficulties in adopting more flexible and participatory ways of working with farmers. Many NGOs, now operating at local and regional levels, often intensively involve farmers and local communities in unconventional ways of testing and diffusing technology. Such practices often lead to gaps in communication and to friction between the organisations developing technology and those engaged in diffusion.

Close collaboration in research and development between governmental agencies and NGOs permits more accurate targeting of potential benefits to participants, more convincing demonstration of impact on farms, and earlier and better feedback to research on farmers problems and their response to research results. Recent projects on seed production in Senegal and on erosion control in Burkina Faso provide evidence of such benefits and impact (Speirs 1991; Mercoiret 1990; Osborn 1990).

Although most NGOs do not engage in applied agricultural research, they are innovative in developing participatory research methods and in adapting technologies to local conditions. Most NGOs recognise the need for strengthened but more flexible and responsive governmental institutions in research and development. At the same time, NGOs seek to maintain independence. Some governmental institutions initially may view NGOs as competitors for attention and funds.

1.3 Rice production systems: a case study

Rice production in West Africa, which includes many of the poorest countries in the world, lags well behind demand and no country in West Africa is self-sufficient. Increasing per capita consumption, especially in urban areas, continues to drive demand upward. Demand grew from five million tons in 1979-81 to over nine million tons in 1989-91. Imports constitute about 40 per cent of the rice consumed and are valued at almost US$1 billion. Rice imports have risen from 1.9 million Metric tons in 1990 to over 4 million Metric tons in 2000.

The role of rice as a staple in many areas means that poor households will face higher costs unless rice can be produced more efficiently without simply increasing input levels. But supply response has been limited: large-scale rice 'projects' have almost uniformly failed and most agencies have concluded that increased productivity will only be delivered through disseminating new technologies in collaboration with farmers.

WARDA's research has shown that substantial yield increases are possible in all types of rice production system through technical innovation. However, this will be in vain without comparable increases in

effectiveness of the knowledge transfer systems. The modalities of working with farmers (for example using Participatory Plant Breeding techniques) are poorly developed or non-existent as are methods of working with CBOs to test and disseminate those technologies.

Without more effective knowledge transfer the development of rice varieties of doubtful value to poor farmers will continue, with the consequence that adoption rates will remain low and supply correspondingly flat, thereby fulfilling FAO projections. More in depth understanding of the effect of the collapse of rice import controls on producer incomes would help to increase production of locally-acceptable rice from farm households, contributing to increased and more stable rural incomes and improved food security.. The main risk over the present project cycle is that unusual climatic conditions will not deliver timely expected yield improvements. However, if the partnership structures are established sustainably by the project, the long-term commitment and financial stability of WARDA should ensure that the process continues and produces the desired results. Since the impact of the project will be to produce a local crop in greater quantities for local markets there is no reason to believe that the impact on public finances or fiscal policy will be anything other than positive.

1.4 Structure of the report

This report covers part of a DFID-funded research project on how the concept of Multi-Agency Partnerships (M-APs) can be implemented in West Africa to bring about technical change in agriculture. Three countries namely Mali, Ghana and Nigeria were selected for the research. M-APs is conceptualised as a structure where GOs, MLAs, NGOs and FOs are in viable, functional and healthy relationships generating positive synergy to bring about technical change in agriculture. No single agency could manage agricultural research and extension, if promotion of technical change in agriculture is to be effective at the local level.

2. Rice production Systems

2.1 The regional context

2.1.1 West Africa

In 1989, the International Rice Research Institute (IRRI), based in the Philippines, 1989, defined three major rice environments, as follows:

Irrigated rice: grown in areas with assured irrigation for one or more crops each year, with some areas served only by supplementary irrigation in the wet season

Rain-fed lowland rice: grown in bunded fields where the water depth does not exceed 50cm for more than 10 consecutive days and the fields are inundated for at least part of the season. Such fields have no access to an irrigation system, but may have on-farm rainwater conservation facilities.

Upland rice: grown in rain-fed unbunded fields with naturally well drained soils and no surface water accumulation.

In addition, according to the international classification developed by the West African Rice Development Association (WARDA), West African rice production systems can be subdivided into four categories:

- Upland
- Hydromorphic
- Lowland and irrigated paddy
- Mangrove swamp

Hydromorphic rice grows in the zone where water is supplied to the rice crop by a shallow ground water table, within the root zone of the rice plant. This condition is usually found on the lower slopes of the toposequence, or in situations where an impermeable soil layer reduces water percolation through the soil. Usually one crop of rice per year is grown under these conditions.

Lowlands or 'inland valleys' are considered to be the most important areas for rice production in sub-Saharan Africa. In the rice fields, levelling and bunding create aquatic conditions, in order to conserve water coming from rain, river flooding or other sources. In irrigated areas, water is distributed by means of a system of irrigation canals. In some areas, basin flooding allows water to flow from one terrace to another. In West Africa, two to three rice crops can be grown annually under irrigated conditions, and in some cases, five crops are cultivated over a period of two years.

Upland rice is grown on free draining soils where the water table is permanently below the root zone of the rice plant and the crop depends entirely on rainfall. Under these conditions, the rice crop can be grown only once a year during a single rainy season. In some parts, of West Africa, bimodal rainy season permits two crops of rice/year, while rice ratooning is also practiced in the areas with approximately 1 600 mm/rainfall per annum. Upland rice ecology is further subdivided into:

- Hill rice ecology, where rice is grown on hills and mountains,
- Flatland rice ecology
- Upland rice developed under ground water and rain
- Upland rice using ground water only

Mangrove swamps are found along coastal areas. They are tidal swamps, flooded twice daily, in which rice is grown along the West African coast. Flooding by seawater usually results in high salinity problems during the dry season. Mangrove swamps usually support only one crop of rice each year, although in some places two crops can be grown annually.

WARDA also recognises the following cultivation systems in West African rice farming:

- Shifting system
- Pioneering system
- Fixed system

Shifting system is characterised with intercropping of rice with other crops, such as maize and yam.
Pioneering system involves growing rice prior to other crops, sometimes as a cover crop, especially in young fruit plantations, and plantations of coffee, rubber and other commercial cash crops.
Fixed system involves permanent cultivation at one location, with fertilizer application, soil erosion control measures, rotation (usually with legumes), weed control, and tillage using animal power, or semi or full mechanisation.

2.1.2 Ghana

Three basic rice systems can be identified in Ghana:

i. Irrigation schemes, which usually produce two crops per year,
ii. Inland valley systems, where rice is rain-fed, but water is retained in the soil due to the hydromorphic nature of the soil and topography and
iii. Upland rice systems, where soil is not classified as hydromorphic, and production depends on sufficient and continuous rainfall.

In a countrywide survey conducted during the 2000/2001 cultivation season, all the above-mentioned categories were taken into account in order to achieve a representative sample of respective ecologies in Ghana. Mangrove swamp ecology, which is of significant importance in some West African countries, does not occur very much in Ghana. None of the farmers interviewed during the countrywide survey cultivated rice under mangrove conditions.

2.2 Rice species and varieties in West Africa

In West Africa, most upland and lowland rice systems involve one of the two varietal types: *O.sativa* (or Asian rice), *O.glaberrima* (or African rice), or a mixture of the two. Therefore, rice culture in West Africa involves planting rice strains of *O.sativa* and O.*glaberrima* using practices that range from rice seeded in dry soil to rice grown in deep water flooded fields. Years of selection under different climatic, soil and cultural conditions have produced marked variability among the West African rice varieties.

In Asia, ecological selection created two varietal types – *O. indica* and *japonica*, with *javanica* varieties within the *japonica* group in different areas of South, Southeast and East Asia. The tall large *javanica* of Indonesian origin is the more recent derivate of tropical continental rice. However, the *javanica* varieties are not considered to have the same level of differentiation as *indica* and *japonica*, and the name *javanica* has an uncertain application, since there is no formal description established (Glaszmann et al., 1986).

Various analyses of the genetic structure of traditional *O. sativa* rice cultivars grown in Africa (Ghesquiere, 1982, Second, 1982) indicate that *O. sativa* grown in Africa is mostly of the *indica* and *japonica* types. *O. glaberrima* is also subdivided into upland types. These types are more similar to *javanica* and *japonica* types than to *indica* types, and crosses between upland *glaberrima* types and *indica* varieties usually result in a high level of sterility.

Traditional *O. sativa* varieties grown in West Africa are usually 130cm. in height, or taller, with moderate tillering ability (5–10 culms *per* plants with close spacing), thick stem, rather long bright or dark green leaves, long and well exerted panicles and a high proportion of thick roots. Some of these traditionally grown varieties tolerate drought moderately well and are resistant to fungal diseases, particularly blast. Grain quality is good by local standards, but the yield potential and grain/straw ratio is low. The varieties lodge badly and do not have a quick response to nitrogen application.

The main differences between *O. sativa* and *O. glaberrima* are presented in Table 1:

Table 1. Main differences between *O. sativa* and *O. glaberrima*

CHARACTERISTIC	***O. sativa***	***O. glaberrima***
Progenitor	*O. rufipogon*	*O. glaberrima*
Habit	Essentially perennial	Annual
Ligules	Long or short	Short and tough
Panicle branching	Many	Few
Varietal differentiation	Highly variable	Limited variation
Ecotypes	Many	Few
Distribution	Cosmopolitan	Endemic to West Africa
Human influence	Intensive	Limited
Stress resistance	Poor	High
Yield	High (up to 250 grain/panicle)	Low (75-100grain/panicle)
Lodging	Low	Frequent
Source: Khush and Toenniesen (1991).		

The origin of the rice plant has long been debated. At one time it was speculated that rice was originally an upland rather than wetland crop (Chang, 1976). Among several existing rice species, two are important for human nutrition, i.e., *Oryza sativa*, grown worldwide, and *O.glaberrima*, grown in parts of West Africa. Little is known with certainty about the rice domesticated in West Africa, and archaeological evidence is mostly lacking. As a result, the subject still remains open to speculation by various authors (Ng, et al., 1991). According to the information available so far, *O. glaberrima*, has been grown in its area of origin in West Africa for more than 3500years (West African Rice Development Association, WARDA, 1998). It probably developed independently from *O. sativa*, domesticated from a different wild progenitor, *O. barthii* (syn. *O. brevigulata*, Jacquot, 1977), which is an annual grass, endemic to West Africa (Oka, 1988). *O. glaberrima* is

a fast growing plant that resists drought, weeds and pests. It needs relatively little care, and people in Africa like its taste and serve it regularly as ritual food at village festivals and weddings as well as on other occasions. Yields of *O. glaberrima* are relatively low, and do not exceed 3t/ha, even with chemical fertilisation. *O. glaberrima* lodges or falls over when the panicles reach the grain filling stage. Each branch of the panicle also holds only a single grain, an obvious disadvantage when compared to *O. sativa*. The African rice species also shatter easily, wasting precious grain.

The dissemination of the Asian cultivated rice *O. sativa* to other parts of the world is traceable historically. *O. sativa* was probably introduced into East Africa when the sea trade between East Africa and ports in Madagascar and India was flourishing. *O. sativa* also moved along the slave-trade routes from Zanzibar to Zaire more than 450 years ago. Portuguese traders introduced the Asian rice either directly from India or from East Africa/Madagascar into Senegal, Guinea-Bissau and Sierra Leone on their return from expeditions to India. *O. sativa* quickly spread to areas where *O. glaberrima* was being cultivated. Today, *O. sativa* is an important staple food crop in several West African countries, including the Gambia, Guinea, Guinea-Bissau, Liberia, Cote d'Ivoire, Senegal, Sierra Leone, and Ghana, where it has replaced *O. glaberrima* in many areas, mainly because of its higher yield potential. However, *O. sativa* also lodges and is susceptible to many diseases and insect infestation. It also does not compete well with weeds and is not tolerant to drought and local pests.

3. Rice cultivation in Ghana

3.1 History of rice production

According to Mobil and Okran (1985), rice has been cultivated in Ghana for a long time. During the 17th and 18th centuries, it was already one of the major commercial food crops. Its importance was next to millet and maize and it was cultivated more than yam and sweet potato, the two principal root crops in the country.

Most of the people involved in rice cultivation at that time were small scale subsistence farmers, who cultivated rice under the bush/fallow system and shifting cultivation, in which rice was cultivated from between two to four years, until the fertility of the soil was diminished. A fresh piece of land was then acquired and the pattern repeated. The original plot was allowed to fallow and was cropped again only if its productivity has been restored after 10–15 years of rest. Although wasteful in its use of land and labour, the system was in the past capable of sustaining the population without noticeable adverse effects on the land. With an increasing population, the system has mostly broken down, and the fallow periods have been reduced to between 2–4 years, with corresponding reduction in yields (Benneh, et al., 1990).

Until the 1920s, most of the rice in Ghana was grown in the Volta and Western Regions, with cultivation carried out mostly by females, while males focused on cash crops such as cocoa, rubber and coffee. Most of the rice varieties were grown without any improvement, as they were inherited from ancestors, and some of these varieties are still in cultivation. In inland valleys, which are one of the main ecological environments in the country, rice is grown in flooded fields.

The rapid development of rice production by large-scale mechanised commercial enterprises during the 1970s and 1980s was full of illusions. Some of the problems that arose are set out below.

Firstly, the development of large-scale commercial farms had no impact on the local rural populations, since the crops cultivated on them were largely intended for urban markets and not as staples for local inhabitants. Secondly, modern techniques, which emphasised cash crops and financial gain, were expected to push traditional farmers aside. The development of animal traction technology for small-scale farmers, for instance, was discouraged at that time through the creation of subsidies for the purchase of tractors, while animal traction implements and animals were not subsidised. However, in 1983, political developments in Ghana resulted in a major change in the economic policy of the country. The government of the day accepted International Monetary Fund (IMF) conditions, and adopted the Structural Adjustment Programme (SAP). The consequences for the rice industry in the country were as follows:

- The progressive liberalisation of both internal and external trade, which promoted a high influx of imported rice into the country. This policy largely resulted in the collapse of large rice mills across the entire country.
- A partial abolition of controlled prices.
- The privatisation of certain state monopolies.
- Subsidy removal on inputs.
- Agricultural credits with high interest rates (36-46%) from the countries' financial institutions.
- Gradual withdrawal of institutional support (machinery and equipment, adequate input delivery).
- Lack of adequate and effective land management and conservation practices for large mechanised and irrigated schemes.
- The virtual collapse of institutional arrangements responsible for the development and maintenance of seed multiplication and also units for variety improvement. The hitherto effective links between researchers, extension and commercially oriented farmers weakened, due to poor remuneration of extension staff and an inadequate supply of logistics for both research and extension.

As a result of these policies, the profits of large scale mechanised rice production dropped drastically. Of three large rice mills in the capital of the Northern Region, Tamale, which were developed during the 1970s, only one is still in operation. While about 35,000 bags of paddy rice were milled there during the season of 1989/1990, only 200 bags were milled in 1992 (p.c. Nasia Rice Mill Manager, Tamale, 2000).

3.2 Rice production: statistical data

Rice is important to Ghana's economy and agriculture, accounting for nearly 15% of the Agricultural Gross Domestic Product (AGDP). The rice producing area represents about 45% of the total area planted to cereals. The rice sector is an important provider of rural employment. It was estimated that an annual average of 34, 600 hectares of land area was under cultivation between 1960–64, with an annual average paddy production of 35,800 tonnes (Ibrahim, 1984).

Table 2. Production estimates of rice in Ghana vs. rice imports (in '000 metric tonnes)

YEAR	YIELD (local production) (1)	RICE IMPORTS (2)	TOTAL CONSUMPTION (1+2)
1970	49	53	102
1971	55	35	90
1972	70	24	94
1973	62	54	123
1974	73	39	112
1975	71	0	71
1976	70	0	70
1977	63	43	106
1978	61	25	86
1979	63	40	103
1980	64	30	94
1981	44	39	83
1982	37	26	63
1983	27	33	60
1984	76	50	126
1985	80	60	140
1986	70	55	125
1987	81	73	154
1988	84	69	153
1989	67	80	147

1990	81	100	181
Source: Statistical service: Quarterly Digest of Statistics (several issues), Ghana			

In the present situation, irrigated schemes and inland valley systems are the major contributors to total rice production in Ghana (Ofosu et al., 1998).

Upland rice production was once important, but the area under this type of cultivation is now thought to be as low as 1000ha (Day et al., 1998). The irrigated rice schemes contribute about 25% of the total national rice production (Manful et al., 1998).

Table 3. Paddy rice production by region, Ghana, 1978–80
(Greater Accra Region excluded).

REGION	PADDY PRODUCTION (000 t)	% NATIONAL PRODUCITON
Northern	170.0	61.0
Western	29.3	10.5
Eastern	22.3	8.0
Brong Ahafo	20.8	7.5
Volta	14.0	5.0
Upper	14.0	5.0
Ashanti	4.2	1.5
Central	4.2	1.5
TOTAL	278.8	100.0
Source: Ghana Statistical Services		

The trend that started in the 1970ties still prevails, and the rain fed rice production in northern Ghana remains high, even though policies have changed, and many of the subsidies, which made rice production attractive for commercial farmers, have been removed. This is evident from Table 4:

Table 4. Production of rice (tonnes) in Northern Region, Ghana.

DISTRICT	YEAR			
	1995	1996	1997	1998
West Gonja	2922	2636	1950	8600
Yendi	2679	2416	1200	300
Bimbilla	609	521	200	200
Gushiegu/Karaga	7652	11550	4400	4000
East Mamprusi	1013	813	280	100
Savelugu/Nantong	5264	7905	5040	1000
East Gonja	8927	7384	5550	12000
Saboba/Chereponi	1554	1186	480	200
Tolon/Kumbungu	3725	5535	5460	3000
West Mamprusi	2679	2235	960	2000
Zabzugu/Tatale	1299	1120	550	800
Total	40318	45297	28067	34198
Source: Ghana Statistical Services				

Table 5. Current rice production in Ghana

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Paddy Production (Mt)	150,9	131,5	157,4	162,3	201,72	215,72	197,1	193,6	209,75	248,7	295,6
Source FAO: 2000, PPMED, 2002											

The result of the gradually worsening situation in rice production within the Ghanaian context is that, currently, even though a large number of people in Ghana is still dependent on the rice cultivation, the country does not produce the national rice requirement (41.2% self sufficiency has been achieved according to WARDA reports, 1986, but the situation varies from season to season). This situation demands high levels of importation, to meet the demand, especially from the growing urban population.

3.2.1. Experiences with irrigated rice production

The self-sufficiency policy, adopted in Ghana during the 1970s, resulted in the creation of the Ghana Irrigation Development Authority (GIDA) of the Ministry of Agriculture as a semi-autonomous organisation in 1977. In GIDA, a lot of emphasis was placed on the development of large-scale irrigation projects for the production of rice. The ultimate aim was to reduce the country's dependency on imported rice. At present, GIDA has more than twenty on-going projects, scattered throughout the country, with sizes of schemes ranging from 10 to about 3000hectares.

The total area developed by GIDA for irrigation and mostly rice cultivation is at present about 10,000ha. Rice yields on the irrigation projects vary between 4.0–6.0t/ha, with an average yield of about 4.6t/ha. Yields of the rice on irrigation schemes, and cropping intensity, are directly related to the amount of water available from season to season. It is estimated that the contribution of irrigated agriculture to the total national rice production needs to be about 24% in order to satisfy national demand.

Table 6. Irrigation projects growing rice and/or other crops in Ghana

Location	Potential area (ha)	Developed area (ha)	Irrigation system (G- gravity, P-pumping scheme)	Major crops cultivated
Ashiaman	155	135	G	Rice
Dawhenya	450	191	P+G	Rice
Kpong	3028	1400	G	Rice, Vegetables
Weija	1200	220	P	Vegetables
Afife	880	880	G	Rice, Vegetables
Aveyime	280	60	P+G	Rice
Kpando-Torkor	400	40	P	Vegetables
Okyereko	100	40	P+G	Rice
Mankessim	320	17	P	Vegetables
Amate	300	101	P	Vegetables
Dedeso	880	30	P	Vegetables
Akumadan	150	65	P	Vegetables
Nobewam	150	120	P+G	Rice
Sata	32	32	G	Vegetables
Subinja	121	60	P	Vegetables
Tanaso	130	64	P	Vegetables
Bontanga	450	450	G	Rice, Vegetables
Golinga	40	26	G	Rice
Libga	35	20	G	Vegetables
Kikam	27	27	P+G	Rice
Tono	2400	2400	G	Rice, Vegetables
Vea	1000	1000	G	Rice, Vegetables
TOTAL	12528	7378		

Source:GIDA 2000

3.2.2 Maintenance of structures

On irrigated projects in Ghana, the farmers mostly do maintenance of irrigation structures themselves. The maintenance is done on the main channels, laterals and sub laterals, head ditches, bunds and drains.

3.2.3 Rice varieties grown on irrigation projects

Among the varieties of rice grown in irrigated areas are high yielding exotic varieties, that are early maturing, and non-lodging, free from disease and acceptable for the market.

3.2.4 Farmers' organisations on irrigated projects

Farmers' organizations, such as co-operative societies, have been formed on most of the irrigation projects. The Department of Co-operatives sends their staff to strengthen these societies and offers training to the members.

3.2.5 Land allocation on irrigation sites

Land Allocation Committees are formed at the various irrigation sites. The Committees are made up of the following members:

- One traditional ruler from the project area
- One official from the Ghana Irrigation Authority
- Three representatives from Farmers Organisations
- The District Chief Executive, who is Chairman of the Land Allocation Committee.

Farm holdings on the project usually range from one acre (0.4 ha) to one hectare.

3.2.6 Government policy on irrigated agriculture

It is the Government's intention to hand over all the irrigation projects to Farmers' Organizations who will be responsible for the administration of the respective projects without any subvention from the Government.

Currently, the Government provides machinery services for hire to the farmers and also carries out rehabilitation works on the projects. Extension officers are also attached to the various projects, helping farmers to improve technology.

3.2.7 Methods of rice cultivation on irrigated schemes

Methods of rice cultivation on the irrigated lands include transplanting, broadcasting, dibbling, and drilling. Transplanting in rows is encouraged, with a planting distance of 20 x 20cm. A few farmers, however, still do randomised planting.

3.3 Commercial rain-fed rice production in Northern Ghana

Most rain-fed lowland rice farmers are poor and cannot take additional risks in crop production. Because of high risks in rice farming regarding situations such as drought and flooding, farmers usually invest very little in fertilizers, herbicides, pesticides, etc. (Alcantara et al., 1984, De Datta, 1986).

The primary objective of farmers in Northern Ghana (according to Lanygintuo, et al., 1997) is therefore the achievement of some degree of security in the relatively unproductive environment that they face. They do this in three ways:

i. Production of their own food requirement by each household.
ii. Maintenance of the individual's position in society so that he or she is entitled to the social security benefits that society offers.
iii. Accumulation of farm returns to meet uncertainty.

In the situation described above, the sustainable production of rain-fed crops is a base for improved food security and also a key to rural and agricultural development.

Experience of the 'Low Risk' World Bank assisted project, 1993, and other water harvesting and bunding initiatives carried out in Northern Ghana, shows that, while the water harvesting and conservation structures developed by such projects are very necessary in terms of improving the water regime for rain-fed rice production, they have limited applicability, mostly due to the high cost of construction and associated problems. Land development in the area, and bund creation, is done mostly by heavy machinery, such as graders. This technology is generally very expensive and out of the reach of small-scale farmers. According to recent findings (Dittoh, et al., 1997), only 36.3% of the interviewed subsistence farmers within the 'Low Risk' project area (Savelugu/Nanton District) still use some water conservation methods on their farms. About 80% have seen how bunding is done, and staff members of the Agricultural Engineering Services Department (AESD) of the Ministry of Food and Agriculture (MoFA) have provided some with training. Out of those trained, however, only 5.3% still practise some form of water conservation on their farms. The introduced technology was clearly targeted at medium and large-scale farmers with adequate financial resources, leaving out resource poor farmers whose need for appropriate technology is most urgent.

The Ministry of Food and Agriculture (MoFA), Ghana, in collaboration with the French *Agence Française de Développement* (AFD), is currently implementing the Lowland Rice Development Project (LRDP) in selected valleys in the Northern Region of Ghana.

The project is a pilot phase of a programme that ultimately aims to increase local rice production, and to match the quality and prices of imported rice. The pilot phase in the Northern Region of Ghana is being implemented in three valleys, namely Kulda-Yarong and Kula Zuwari in Tamale Municipality and Sillum in West Gonja District.

The main features of the project are the use of water regulatory structures to retain runoff water on the fields instead of traditional irrigation. This method is much cheaper than full-scale irrigation, but can be used to produce only one rice crop annually, while traditional irrigation can achieve two harvests each year in Ghanaian conditions.

The project started in the season of 2000 with about 250 ha and expanded its operations in 2001 by a further 500 ha. Yields obtained in 2001 were about 2.6t/ha at the Kulda Yarong project site, as against 0.6t/ha in the nearby fields that lay outside of the project. Farmers are showing interest in this agricultural intensification venture, and there are indications that more farmers will be willing to participate in the forthcoming seasons.

3. 4 Rice research in Ghana

Since Ghana's independence, in 1957, comprehensive rice varietal improvement programmes have been established at the Nyankpala Agricultural Experimental Station (Tamale), and the Agricultural Research Station of the University of Ghana in Kpong. The former screened the varieties adaptable to the upland ecology, while the latter screened varieties for irrigated ecology. The main sources for new rice variety introductions were big international rice research organisations, such as IRRI, IITA and WARDA. From these research stations, many high yielding varieties have been released for commercial production.

Ghana's first rice breeder returned to the country in 1964 after training in the USA and Philippines. Some of the major varieties screened at the stations include the following:

Upland Ecology:

- Basologo GR 19 (C 168)
- Faro 15 GR 21 (Tox516-19-51IR)
- IR8
- IR42
- IR442

Irrigated Ecology:

- GRUG 6 (IR3273-P339-2) ADNY11
- ITA 222
- IET 2885
- IET 1996
- GRUG 7 (Tox725-1-8-201-1)

The recent count also shows that between 1957 and 1983, 16 selected rice varieties have been recommended for use, and out of these, about 11 came from the efforts of Crop Research Institute, after testing at research stations such as Manga, Nyankpala, Kpong or Atebubu. The varieties were tested for maturity, plant height, resistance to diseases, especially blast (*Pyricularia oryzae*) and pest infestation.

Further investigations on cultural practices and times of planting were also carried out, as well as investigations into the optimal seeding rates of introduced varieties. At Nyankpala Research Station, the Ghanaian-German Fertilizer Programme enabled studies of soils and optimum fertilizer rates to be used for each type of soil and rice variety in the environment of northern Ghana (CRI, 1983).

The country's research institutions also invested great efforts in investigating the use of herbicides in rice production. The major weeds were identified and methods of weed control established. Experiments on the research stations established that, under controlled conditions, an increase of 500% in rice production was achievable, with combinations of improved varieties, chemical fertilizer use, two weeding and early planting compared with traditional cultivation of *O. glaberrima* rice, usually grown using only one hand weeding/season, no fertilisation and late season planting in order to avoid risks (Savanna Agricultural Research Institute, 1990).

Technological and scientific advances in the country's rice production occurred simultaneously during the boom years of the rice industry in Ghana, that is, from 1972–82. It is therefore not surprising that the decline in the industry had both technical (described earlier) and institutional components.

It is apparent from the above discussion that rain-fed lowland and inland valley ecologies have not benefited very much from the rice varietal improvement programme. The advance in the rice industry, which favoured large-scale rice farmers of Northern Ghana, did not benefit subsistence farmers, dotted across the country. In most cases, the latter could not afford fertilizer or herbicide, and improved high yielding varieties were also not available to them, since they lived in remote areas away from research stations engaged in rice research.

The Crop Research Institute's Rice Participatory Varietal Improvement Programme, is, in collaboration with WARDA, addressing the situation. Details of the programme are presented below.

3.4.1 Participatory Rice Varietal Research

Conventional varietal screening involves systematic testing in preliminary screening sets, observational yield trials, initial replicated yield trials, advanced yield trials and on-farm trials. Released varieties should correct at least one deficiency in previously released ones.

Rice varieties have for sometime not been delivered to farmers because of some or combination of the following reasons:

> Lack of funds: For example, small grants from the West Africa Rice Development Association (WARDA) Task Force were used to evaluate upland and lowland rice varieties in 1994 and 1995. Varieties were also evaluated in the regional yield stability trials in 1997 and 1998. There has been no sustained funding to advance selections from these for wide-scale testing.
>
> Late delivery of funds: This has reduced the usefulness of some results as varieties have succumbed to mid-duration and/or terminal drought due to late seeding in Southern Ghana. This is particularly true of drought-testing trials carried out in 1998 and 1999.
>
> Lack of logistics for rice project team: For example, there are no serviceable vehicles at present.

The result was the confinement of existing varieties or new introductions to research stations e.g. varieties requested from WARDA in 1998 could not be evaluated in 1999. The experience has further shown that only a few released rice varieties have been adopted by farmers and usually at a very slow rate.

3.4.2 The participatory varietal testing process

102 rice varieties comprising traditional or improved *Sativa/Indica/Japonica*, *Glaberrima*, and *Nerica (Glaberrima x Sativa* interspecific hybrids) were evaluated under upland conditions in Hohoe in 1997 with DFID funding through the University of Reading. Varietal categories were also considered in the selection of 60 of these varieties for testing at Hohoe and Aframso in 1998.

60 varieties were evaluated in 1998 at Nyankpala with WARDA funding. There were 3 evaluations at the vegetative, reproductive and post-harvest stages in 1998. Each of 56 farmers at Aframso and 94 farmers at Hohoe was supplied with two varieties each weighing one kg in 1999. A total of 28 varieties were distributed in different proportions. An essential component of a PVS study is the off-season multiplication of preferred varieties for supply to farmers during the subsequent rainy season.

There were three farm visits in 1999, followed by a general meeting to evaluate varieties. Another PVS is currently being conducted at Abofrem near Bibiani, with funding from WARDA (Dartey, 2000).

3.5 The policy context

3.5.1 General agricultural policies of the government: an historical overview

During the Second World War (1939–45), efforts by the colonial government were mounted to increase food production in the north of the country, as well as elsewhere, in order to eliminate the growing need for food imports, principally in southern Ghana, which was becoming a food deficit area.

The investment in peasant farming was cut back after independence in 1957. During the period 1959–61, Kwame Nkrumah, the President of the first Republic, focused on a socialist strategy of import-substitution, industrialisation, mechanised agriculture and direct public interventions in production and marketing by means of a plethora of institutions such as large-scale state farms, marketing boards and public enterprises. This policy led to a growing need for government revenues and foreign exchange that would finance the ambitious investments and capital/input intensive imports. It also resulted in a substantial investment programme to open up the shallow river valleys of the northern regions for the commercial mechanised farming of rice to feed the southern markets.

After Ghana gained independence in 1957, various agricultural policies were targeted at general food self-sufficiency and, in particular, self-sufficiency in rice production. For instance, during the 1970s (Bozza, et al., 1990) the policy was to develop the flood plains of the Volta and Oti Rivers for rice production; a completely mechanised system was to be put in place to take over from resource poor small-scale farmers. Such policies have resulted in a gradual shift of the majority of rice production from the Volta and Western

Regions to the flood plains of the Volta River in northern Ghana, where, within the Interior Savannah Agro-Ecological Zone, there is about 800 000ha of land suitable for rice production (Dekuku, 1997). WARDA (1986) stated that, during the 1970s, 75% of rice produced in Ghana came from northern sector of the country, with the Northern Region alone accounting for about 60%. This was a result of the 'Operation Feed Yourself' programme, launched by General Acheampong's Government, which focused on food production in the region.

After Nkrumah, the Military Government of the National Liberation Council (NLC, 1966–69) and its elected civilian successor, the Busia regime of the Progress Party (PP, 1969–72) tried to liberalize the economy. The number of state farms was reduced substantially and more room was created for the private sector to participate in the development process (TI, 1993).

Succeeding military and civilian regimes between the early 1970s and mid-1980s (1972–83) further encouraged the dualism in agricultural sectors as they all tended to favour large-scale and capital intensive modes of production over labour intensive farming by small-holders. Setting aside some minor differences in the agricultural policies of the period 1972–83, they can be summarised as follows (Dapaah, 1995, and others):

- A high reliance on the public sector.
- High direct and indirect taxation and under pricing of (industrial) cash crops for the benefit of urban interests.
- Steadily declining public expenditure with a relatively low share being allocated to rural development, including agriculture.
- Increasing budget constraints in combination with increasing foreign exchange related bottlenecks for subsidized agricultural inputs and services resulted in a growing scarcity of agricultural resources.

In the mid-1970s, the military regime tried to achieve food self-sufficiency by means of programmes such as 'Operation Feed Yourself', 'Operation Green Revolution' and 'Operation Haul the Food to the Markets'.

Although these programmes aimed at increasing smallholder food production by enlarging the peasants' access to improved seeds, fertilizers and other inputs at subsidized prices, these scarce resources were mostly diverted to large commercial farms. Moreover, these programmes failed to achieve their ambitions due to reliance on exhortation and moral incentives (rather than economic ones), and bureaucratic military-style organisation, poor planning and implementation, low peasant participation and other factors.

In order to promote greater regional balance and equity, Regional Development Co-operations were set up, particularly in the northern Ghana, to oversee local development projects, for instance, the Upper Region Agricultural Development Project (URADEP), and the Northern Regional Rural Integrated Programme (NORRIP). These projects became important policy instruments for channelling subsidies on inputs, credits and mechanization to particular groups of farmers.

Although regimes operating in the period 1972–83 tried to control food prices and distribution for the benefit of the population, they were predominantly determined by prevailing market forces and hence prices increased rapidly due to growing scarcities and rising marketing costs. From 1983–90, Ghana's agricultural policies and institutions became a major part of the economic recovery and structural adjustment programmes (TI, 1994).

3.5.2 Structural adjustment programme

The Structural Adjustment Programme involved the progressive liberalization of both internal and external commerce, a partial abolition of controlled prices, the privatisation of certain state monopolies and the progressive withdrawal of subsidies. The profits accruing to commercial farmers dropped and this led to a progressive disengagement on their part (Bozza, 1994).

In 1991, the government implemented a Medium Term Agricultural Development Programme (1991–2000), which aimed to achieve complete self-sufficiency in food production by the year 2000. The programme included proposals to diversify staple crops and improve livestock production; farmers were to receive subsidized loans from local banks to purchase high yield seeds and fertilizers.

3.5.3 Current policies related to agriculture

In line with Ghana's objective of becoming a middle-income country by the year 2020, the overall GDP is planned to grow at an annual economic rate of 8% compared with the Structural Adjustment Period. Under the Vision 2020 programme, the agricultural sector is targeted to achieve an annual growth rate of 5-6% in order to ensure food security and adequate nutrition for all Ghanaians, to supply raw materials and other inputs to other sectors of the economy, to contribute to an improvement in the balance of payment and to provide producers with incomes comparable to earnings outside agriculture.

The Ministry of Food and Agriculture, in line with the objective of Vision 2020, has launched an Accelerated Agricultural Growth and Development Strategy (AAGDS) which has been designed to generate sector growth of about 5-6% (currently standing at 2-3%) and thereby fuel an increase in Ghana's annual GDP growth rate to 8% (Ofori, 2000).

The policies and programmes designed to achieve the objectives of the strategy are based on five elements:

- Improve access to market for the promotion of production and export of selected commodities.
- Facilitate access to agricultural technology for sustainable natural resource management.
- Improve access to rural finance.
- Improve rural infrastructure and utilities.
- Build institutional capacity.

The strategy is consistent with two basic orientations of the Government of Ghana, namely:

1. Privatisation - reliance on private sector to lead investment; and
2. Decentralization - devolution of significant responsibilities from central Government to District Assemblies (Ofori, 2000).

There are some problems that seem to have not been addressed by past and present government polices. For instance, can Vision 2020 and the overall GDP of 8% be achieved only through large-scale commercial farms, or should it also embrace small-scale subsistence farmers? The relationship between Vision 2020, food security and self-sufficiency in rice production and the policies of the IMF is also worth examining. Simple needs in improvements of socio-economic needs for thousands of resource poor small scale subsistence rice farmers should be addressed concurrently with needs for technological advances by commercial farmers in order to achieve sustainable rice production in the country.

It is also worth examining why the subsistence farmers, especially on marginal rice lands, have not abandoned local rice varieties, especially after the introduction of *O. sativa*, several centuries ago, but continue to grow and use them for various aspects of their social and cultural life.

Agricultural production in Ghana has declined generally for several reasons. These include the slow adoption rate of improved technologies, the continuous use of traditional implements not suited to large scale production, the advanced age of subsistence farmers coupled with the migration of young people to the cities, lack of credit facilities, inadequate infrastructure development, marketing, and inappropriate policy measures. General agricultural policies by governments since independence have focused on large-scale production of food to meet public demand.

3.5.4 Agricultural policies relating to rice

The development of the entire Ghanaian economy is strongly linked to agriculture, since the agricultural sector constitutes about 40% of GDP. Agriculture is still mostly in the hands of small-scale farmers, including those cultivating rice. Vision 2020 is the document outlining the Ghanaian policy for the development of the overall economy, including the agricultural sector. The Strategic Policy Framework (SPF) outlines the methods that the Government of Ghana (GoG) intends to use in order to reduce poverty and to stimulate the growth of the country's economy at a projected rate above 4% (planned for 2001–2002). The policies and programmes for the agricultural sector are formulated within AAGD Strategy (Accelerated Agricultural Growth and Development), based on elements such as the promotion of selected products, development and improved access to technology, access to financial services, improved rural infrastructure and enhanced rural infrastructure and institutional capacity.

The Agricultural Services Sector Investment Programme (AgSSIP) is another GoG instrument intended to assist the implementation of the government's agricultural strategies by various means, ultimately aimed at the reduction of rural poverty in the country through strengthening and empowering grassroots organisations, improvement of economic infrastructure, and improved access to inputs. The principal objectives of this programme are

- Reduction of the incidence of poverty
- Improvement of capabilities for income earning, especially for vulnerable groups
- Reduction of differences between gender, socio economic and geographical groups scattered around the country
- An overall population living standard improvement.

AgSSIP is sponsored by various donor agencies, such as the World Bank, AFD, DFID, and DANIDA. This programme is supposed to assist Ghanaian agriculture during the next five years, with possible extension, to move from subsistence level towards higher productivity. How much will be achieved with these various government initiatives, especially in the rice sector, remains to be seen.

The change in government in Ghana in January 2001 did not greatly affect the agricultural policy orientation towards rice. Rice is still recognised as one of the vital crops for the country. Since January 2001, plans have been underway for rice imports into the country to be cut by 30% in an effort towards orienting the market to use locally produced grain. The Ghana Irrigation Development Authority is leading efforts to market local rice from irrigation projects under brand names such as 'Pride', 'Yenmo' and 'Rice Master', while trying to study the American methods for rice production and marketing (Daily Graphic newspaper, May, 2002) and improve the processing quality.

Figure 1. One of several brands of local rice currently promoted in Ghana.

3.5.5 Economic policies: credit demand and response from financial institutions

Most Ghanaian rice farmers are small holders with a low level of technological knowledge, which was amply demonstrated in the 2000–2001 national survey results. An obvious way to improve agricultural production in general, and rice production in particular, would be to make credit available to as many of these farmers as possible to improve the technology level at which they are currently operating. Such concerns have been expressed in a number of sources (e.g. Ndulu and van de Walle, 1996).

Ghana has three main commercial banks, with branches distributed throughout the country: the Ghana Commercial Bank, (145 branches), Barclays' Bank of Ghana (26 branches) and the Standard Chartered Bank (21 branches; Owusu-Bi, 1997).

Further financial infrastructure includes six secondary banks, including the Agricultural Development Bank (ADB), with 30 branches, and the Social Security Bank, seven specialised development financing companies, such as the Home Finance Company, and about 125 Rural Banks throughout the country, which are community owned. Semi-formal and informal associations include credit associations, *'susu'* collectors and moneylenders (Owusu-Bi, 1997).

Most financial institutions, including the specialised Agricultural Development Bank, prefer to finance urban-based industrial and commercial activities, rather the rural sector, because of factors such as higher returns on investment and lower levels of risk. An analysis carried out by Aryeetey (1994) indicated that commercial banks favoured allocating loans to large enterprises (about 74% of total loans), while the allocations to the agricultural sector were less than 5%. It is observed that, in 1991 for example, Ghanaian banks received about 100 applications from small agricultural enterprises and only 9 from large-scale enterprises, and about 156 from all the other business ventures put together (traders, construction businesses, personal loans, etc.; Aryeetey, 1996). At the same time, there is a great disparity between the attention given to small-scale agricultural enterprises in Ghana and other countries in the West African sub-region. In Nigeria for instance, an application for a small-scale agricultural loan has about 83% chance of being approved (Soyibo, 1994)

A recent and notable exception is the case of the Lowland Rice Development Project (LRDP), where, in 2001, total credit given to farmers by the ADB was approximately ¢ 809,000,000.00 (about $101,125.0). The recovery rate was 100% (certified by ADB). The case is being studied carefully to determine what were the deciding factors for this success and if the recovery rate can be sustained in the future.

3.6 Bi- and multi-lateral projects

Many rice production projects, mainly focusing on irrigation, have been implemented in Ghana with variable rates of success. In many cases, the projects have represented the ideas of the donor country or implementing agency, with little concern for the needs of the farmers themselves.

Some of the more significant efforts are discussed below. The list is not all-inclusive, but gives examples of efforts by various agencies.

Since the early 1980s, two of the oldest irrigation projects in Ghana, Dawhenya and Ashaiman, both on the main Accra – Lome road near to the port town of Tema, have been considered for rehabilitation by various donor agencies. Finally, the European Union financed the rehabilitation process of only the Dawhenya Irrigation Project with the specific condition that it changed its orientation to the sole production of rice (formerly, Dawhenya grew both rice and vegetables for markets in Tema and Accra). The rehabilitation was successful, and the project was then handed over to farmers. It is still one of the most successful projects in Ghana. The yield of rice, between 6–7t/ha/season, compares favourably with world standards. The Farmer's Cooperative is successfully managing the project with support from the Ghana Irrigation Development Authority (GIDA), which advises on technical issues.

The Dawhenya Irrigation Project was a pilot study for the Kpong Irrigation Project, intended to irrigate about 3 000ha, also to be dedicated only to rice, by pumping water from the Volta River. However, the situation on the two sites is not exactly the same, since the population in the Kpong area favours the cultivation of sugarcane, for which there are suitable natural conditions, and the intensity of labour required for its cultivation is much lower. Implementation of the Kpong project is not yet complete.

The efforts of the Japanese Development Agency (JICA) in the country have also been oriented towards the development of rice production. As a result, the Ashaiman Irrigation project was finally developed into an Irrigation Research Centre, where agronomic rice trials are conducted, together with studies of water management on fields, soil analysis, etc. The Centre serves the research needs of the Ghana Irrigation Development Authority, as well as the farmers on the project. Many Japanese volunteers are brought to the country regularly to help with some aspects of rice cultivation, and other areas of interest.

The Nobewam rice project, in the Ashanti Region of Ghana about 40 km from Kumasi, was established around the mid- 1980s in collaboration with Chinese Government. Chinese engineering and technical support was given in this forest region where the main occupations of the population included gold mining and the timber industry. The local diet in this part of the country is also not based on rice, but on staples such as cassava and plantain. As a result, the project initially encountered very little interest from the local population. It took more than 10 years before the project became popular with the farmers. This interest was partly due to dwindling timber extraction in the area and re-orientation to other sources of income.

Both North and South Korea had, during the 1990s, had their experts in Ghana, working at two different locations on the improvement of irrigated rice production (Aveyime Project, and Saemaul Farms, respectively). South Korea established the training centre in Accra Plains, in order to help and motivate farmers and youth leaders to make rice production their main occupation. Wet rice cultivation, using Korean-made power tillers, was also promoted there.

The Quality Grain Company case is still making headlines in Ghanaian newspapers and is also worth mentioning in this context. The project is located at the banks of the Volta River and is entirely rice based. It started as an initiative between the Ghana Government and an American investors group with the aim of growing rice using methods prevailing in the United States, such as the use of heavy machinery, chemicals sprayed on rice fields from the air, and modern milling methods. Discussions about what went wrong, and a court process, are still underway. The project suffered essential problems between the small-scale farmers in the area and the partly foreign project management team, for instance, a lack of concern for the tenure arrangements, and awareness creation among those who were to be the direct hosts to the project, i.e., the local traditional authority. The project was not accepted well by the local population, who eventually should have benefited from the activities of the company. The local people felt that they had not been consulted on the matter and did not accept the project as their own. The case is still under investigation.

One of the new and successful initiatives in rain-fed rice cultivation is the collaborative effort of the Ministry of Food and Agriculture (MoFA), Ghana, with the French Agence Francaise de Developpment (AFD), to implement the Lowland Rice Development Project (LRDP) in selected valleys in the Northern Region of Ghana.

The project is the pilot phase of a programme that ultimately aims to increase local rice production and to match the quality and prices of imported rice. The pilot phase in the Northern Region of Ghana is being implemented in three valleys, that is, Kulda-Yarong, and Kula Zuwari in Tamale Municipality, and Sillum in West Gonja District.

If the project is successful in Northern Ghana, it is expected that similar schemes will be developed across the country, starting with the Volta and Ashanti Regions. This type of supplementary irrigation scheme is considerably less expensive than the irrigation developments constructed in the past. In the Northern Region, about 1,400 rice farmers are already using the scheme, and it is expected that the training offered to them will enable farmer's cooperatives to take over certain activities, such as rice milling and farm water management. This should allow former subsistence and small-scale rice production to be gradually transformed into commercial enterprises in which farmers' cooperatives make executive decisions.

3.7 Farmers' organisations

Though the co-operative idea was developed in Western Europe, the colonial government initiated and promoted the system in Ghana. It established a specialized Department (Department of Co-operatives) to promote and oversee the rapid development of co-operatives. The direct entrepreneurial role played by the Government came to be questioned as a result of the Structural Adjustment Programme (SAP) that sought to make the private sector take that major role.

The Department of Co-operatives (DOC) was established on 1st April 1944 under the Co-operative Societies Ordinance Law (No. 15) of 1937, and amended by the Co-operative Societies (Amendment) Ordinance 1944, to accelerate the promotion and development of co-operative activities formerly the brief of the then Department of Agriculture.

DOC performed its functions assiduously and this ensured the swift development of the Co-operative Movement, which reached its peak by 1960. In the intervening period, co-operatives have had a chequered operational history due to the depressing circumstances under which they operate and the *ad hoc* nature of government actions on co-operatives.

The Economic Recovery Programme (ERP) has de-emphasized the development of consumer-oriented co-operatives in favour of production-oriented co-operatives. Various committees and World Bank study missions on co-operatives have helped to identify constraints in the co-operative programme and prescribed solutions to accelerate the process. As a result, the co-operatives are expected in the future to contribute to employment generation, improved agricultural practices leading to increased agricultural output, community development, environmental protection, poverty alleviation and mobilization of savings for investment.

There is agreement all over the world that co-operatives contribute effectively to the achievement of a more sustainable relationship between human society and its natural environment. Thus, the United Nations and its agencies encourage governments, in the formation of their national strategies, to take fully into account the contribution which co-operatives are able to make to the solution of economic, social and environmental problems. At its first African Regional Conference held in Lagos in 1960, the International Labour Organisation declared that the co-operative system is "an important means of improving conditions of work, increasing production, and raising standards of living in the rural and urban areas". In successfully helping their members to achieve the goals they set themselves, co-operatives have been an important organizational means for contributing to the achievement of many societal goals.

Currently, the preparation of an organizational manual for cooperative societies is part of the Civil Service Performance Improvement Programme (CSPIP). The process started by conducting a Beneficiary Survey aimed at obtaining the views, perceptions and attitudes of beneficiaries of the services of Ministries, Departments and Agencies (MDAS) to their work and bringing these to bear on the services delivery. It culminated in the development of a performance improvement plan for the Department. The organization manual is a sequel to this process.

The DOC wishes to see: "A developed, vibrant and business-oriented co-operative sector that can contribute significantly to national economic growth by the year 2020". The DOC is to facilitate the development of vibrant co-operative enterprises capable of contributing to employment generation, poverty alleviation, and community development on a sustainable basis for all stakeholders through policy implementation, co-ordination, monitoring, evaluation and regulation based on our belief in self-help, equality and openness.

The objectives that the DOC will pursue are categorized as follows:

- Policy direction
- Technical assistance
- Core activities
- Contribution to the creation of an enabling environment for co-operatives to operate effectively and efficiently.
- Motivation of co-operatives to diversify their activities.
- Provide inputs into up-grading *curricula* of the co-operative college, and help to introduce Intermediate and Advanced Level Courses in addition to improving preliminary courses.

3.7.1 Core activities

i. To update the Register of Co-operative Societies
ii. To sensitise the general public about the benefits of the co-operative method
iii. To intensify education of ordinary members and members of the Management Committees on their rights and responsibilities
iv. To update the knowledge of employees of co-operative societies and field staff of the Department on modern business management practices and encourage specialization among them
v. To network with identified government establishments, agencies and non-governmental organizations that target the rural poor, farmers, and small-scale artisans
vi. To regulate, monitor and evaluate co-operative enterprises
vii. To motivate the vulnerable and the disadvantaged to establish co-operative enterprises
viii. To facilitate the empowerment of women through co-operative ventures
ix. To facilitate the mobilization of domestic savings for investment.

In order to achieve the above-named objectives, the DOC has adopted a collaborative strategy. This is in realization of the fact that co-operative development cannot be the sole responsibility of any one agency, whether governmental or non-governmental. Its development demands provision of a total service package from all implementing agencies targeting co-operatives for development. This has been exemplified by the success stories of project-related co-operatives. The DOC now seeks collaboration with Non-Governmental Organizations (NGOs), public agencies and multi-lateral agencies in its co-operative development effort. Much of the collaboration so far has been in the agricultural sector.

One of the problems facing co-operatives is the inadequacy of capital. Realizing that it is difficult for co-operatives to obtain financial capital from traditional sources, coupled with the need to broaden the capital base, the DOC has directed that every co-operative society which achieves a surplus of income over expenditure should set aside a minimum of 5% of such surpluses as retained dividend to all members – share capital that should be available to members only upon their withdrawal from the society.

The Department also advocates the establishment of a co-operatives development fund and the urgency to return the Ghana Co-operative Bank to co-operative ownership.

It is envisaged that this incentive will entice members to contribute and thus to augment the share capital.

In recognition of the liberalized market policies that the government is pursuing, co-operatives are being educated to look at their enterprises as businesses in competition with other forms of business; and consequently, that they should adopt sound business practices in their operations.

DOC itself is gradually moving away from a paternalistic approach to co-operative development in which it provides a wide range of free services.

Attempts have been made at some cost recovery in service delivery accordingly; co-operatives are now charged nominal amounts for services such as registration and auditing. This move to cost recovery is in keeping with the view that co-operatives should be looked at as business enterprises and that services provided by the DOC should be considered as costs by the societies.

Women's participation in co-operatives has been negligible even though it is acknowledged that they are very important in agriculture where the co-operatives are preponderant. Few women take up leadership positions in the co-operatives. It is to ameliorate this undesirable situation that the DOC set up a women's desk to promote greater women's participation in co-operatives and encourage them to take up leadership positions.

The Registrar of Co-operative Societies is head of the DOC. There are four Deputy Registrars, who take responsibility for Administration, Legal Affairs, Development, and Audit/Inspection respectively. In addition, a Women's Desk has been created to take care of the development of women's Co-operatives. These are all stationed at the Head Office.

Regional co-operative officers, who hold the rank of Assistant Registrars, run the ten Regional Offices. Below the Regional Offices are 110 District Offices. The DOC maintains offices in all the 110 administrative districts of the country.

There are presently about 94 active co-operatives in the Northern Region of Ghana (DOC, May 2002, personal communication). Some other active farmers' groups are also registered under the Village Infrastructure Project (VIP), which is an initiative jointly sponsored by the World Bank, KfW and IFAD to promote rural development in Ghana. The project has been in operation for about two years and has as its main target the improvement of rural livelihoods through the provision of various public goods (dams, roads and markets) and private goods (bullock and donkey carts, power tillers, mills and grinding machines etc.), for organised rural groups across the country. It is envisaged that all the groups registered under the VIP will eventually become fully-fledged members of the DOC in their respective districts.

3.8 Comparative advantages and profitability of rice production

According to Asuming-Brempong (1998), Ghana has a comparative advantage in the production of paddy rice over the other countries in the sub-region. However, it has a disadvantage in the processing and distribution of rice, due to the high cost of processing and poor transportation systems, and is therefore uncompetitive in the market when compared with imported rice.

Analysis of the competitiveness of domestic rice production since the mid-1980s, suggests that the liberalization policies under the Structural Adjustment Programme affected its competitiveness (Asuming-Brempong, 1998).

The erosion of rice profitability in the mid- to late-1980s is demonstrated by the rice-fertilizer price ratio. From 1989, when the liberalization policy was put into effect, the nominal price of fertilizer increased much faster than the increase in the price of rice. The liberalization policy therefore negatively affected farmers' incentives to produce rice in Ghana (Asuming-Brempong, 1998).

Economically, rice cultivation in general is becoming less profitable because of increases in input costs, especially fertilizers, and a poor marketing system. Comparatively, improved rice varieties were found to be more profitable than the indigenous rice varieties in the areas studied.

According to the records of the Lowland Rice Development Project in the Northern Region (Annual Report, 2001), the total cost of rice production in 2001 for farmers on the project was about ¢ 2,244,986.0 (approximately $281.0)/ha. The yield of rice for the same season, therefore, had to exceed 1.5 tonnes/ha for the farmers to break even, and to exceed that figure for them to make a profit, according to rice prices on Ghanaian market in 2001. The farmers were given loans by the ADB to purchase inputs, at an interest rate of about 21%, which is lower that the normal interest rates obtained from banking institutions in the country. The total cost of inputs, together with the credit, constituted about 64% of the total cost of production (¢ 2,244,986.0), while the labour costs (estimated at between 92–110 *mandays*/season) constituted the remaining 36%.

3.9 Production and consumption trends

Domestic rice production in Ghana has been consistently less than its consumption needs. Demand for rice has outstripped supply due to the population increase and to improved standards of living, as well as poor production and marketing arrangements on the supply side. Consequently, government imports up to 200% of local rice production to compensate for the shortfall in supply, which drains the country's scarce foreign exchange (Dogbe, 1996). Rice is imported to Ghana from as many as 44 different countries.

The main countries from which Ghana imports rice are presented in Table 7:

Table 7. Major countries/sources of rice imported to Ghana	
Country (1995–99)	**% – 5 years average**
USA	30.3
Thailand	19.6
Vietnam	19.5
Algeria	11.5
India	8.3
Others combined	-5.8
Total	88.4
Source: Survey by Ministry of Trade and Industry, July, 2000	

Most of the rice importers are private companies (73.2%), with government being responsible for only about 8% of the imports (Ministry of Trade and Industry, 2000). Attractive terms are attached to rice importation, especially from the Asian countries; usually the importer is given rice on 90-day terms, that is, one third of the payment is paid after 30 days, the second third after 60 days, and the final third after 90 days (US Dept. of Commerce, 1999). The interest rate is about 0.5% *per* month. This payment method differs from that of locally purchased rice, where payment is required in full when the rice is bought.

The intensification of rice production would play an important role in the provision of food and cash security to farmers who cannot afford to use irrigation technology. This will help make Vision 2020 meaningful in the lives of farmers.

4. A survey of Ghanaian rice producers in 2000/2001

4.1 Background

A nation-wide survey was carried out in Ghana during the 2000/2001 growing season to determine the major characteristics of present rice production systems in the country. A questionnaire, developed in collaboration with the Overseas Development Institute (ODI), but adapted to local conditions, was used for the data collection. Questions were prepared in such a way as to highlight the basic problems involved in rice cultivation in the country. The questionnaire was administered both at individual and village level, comprising about 1003 individual households, constituting 63 smaller communities within 32 main villages across the country. Details of communities visited during the survey and the number of individual and village questionnaires administered are presented in Appendix I.

The population sampled under the study comprised farmers who cultivate rice, both for consumption and commercial purposes. The 63 communities were carefully selected to represent the various rice ecologies (irrigated, rain-fed lowland, upland, and inland valley ecologies), as well as the various methods employed in rice cultivation (manual, partly mechanised), after a reconnaissance survey was made of potential sites.

The questionnaires were pre-tested in the field for final corrections before administering to the selected communities by enumerators, who were final year (BSc Agricultural Technology) students of the UDS (University for Development Studies). The enumerators were pre-trained by a social-economist/researcher from UDS before moving to the field. In all, ten enumerators were involved in the questionnaire data collection. Two researchers from UDS worked with the enumerators to ensure that the questionnaires were administered properly.

Data collection took place in August/September 2000, that is, during the main cultivation season of the rice crop, with a follow up in the dry season (December 2000 – February 2001) for irrigated rice. The data from the questionnaires were analysed both quantitatively and qualitatively. ACCESS and Excel computer programmes were used for the data analysis.

4.2 Geographical coverage

All ten regions of Ghana were included in the survey. Details of regions and districts are presented in Table 8 and details of individual communities included in the survey are presented in Appendix I.

Table 8. Regional representation	
Region	**Individual questionnaires administered/region**
Ashanti Region	90
Brong Ahafo Region	101
Central Region	100
Eastern Region	77
Greater Accra Region	40
Northern Region	96
Upper East Region	100
Upper West Region	3
Volta Region	199
Western Region	197
TOTAL	1003
Source: Countrywide survey, 2000/2001, individual questionnaire	

In Greater Accra Region, rice is grown only under irrigated ecology, since the scarce seasonal rainfall (500-700mm/annum, distributed over the two rainy seasons, major and minor) cannot support rain-fed cultivation. A sample of about 40 rice farmers, all on irrigated projects run jointly by the government agency (Ghana Irrigation Development Authority, GIDA), and farmers' organisations, was interviewed in this region, due to the fact that the information they could offer did not vary very much from one irrigated project to another.

The largest regional group of rice farmers interviewed (199) was in the Volta Region. This was because the region is one of the traditional rice growing areas in the country, and the ecologies and conditions under which rice is cultivated vary greatly from place to place within the region. A special study on the details of traditional rice farming in the Volta Region is presented in Appendix II.

The lowest number of respondents was interviewed in Upper West Region - only 3 farmers were sampled during the nation=wide survey in 2000-2001. However, in 2002, when a case study on rice production in the Upper West Region was carried out, a sample population of 100 farmers was used (Appendix II).

Commercial rain-fed rice production is carried out mostly in the northern part of the country, especially in the flood plains of the White Volta River in the Northern Region, where about 60% of the country's entire rice production is situated. A study examining the details of commercial rice production in Northern Region is also presented in Appendix II.

About 20 out of the 110 districts in the country were visited during the course of the fieldwork in 2000/2001, representing about 18% of the entire country's territory. The complete list of districts visited during the survey is presented in Appendix I.

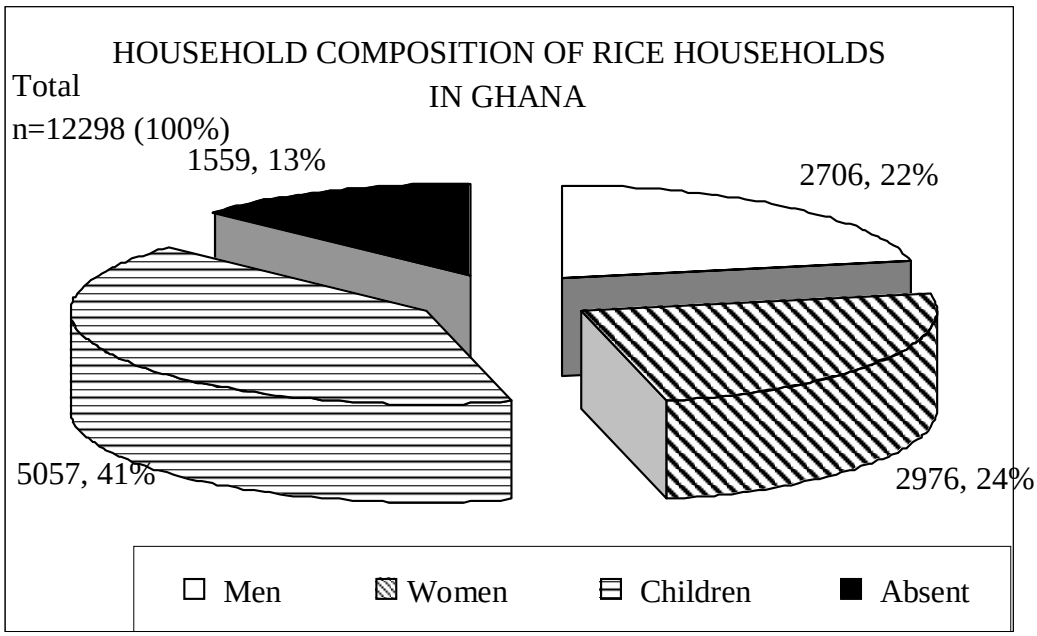
4.3 Socio-economic background of rice farming households

The names of the individual communities, as well as the number of farmers interviewed in each community are presented in Appendix I. The number of respondents depended on the size of the farming community and ranged from 1–40; with an average of about 20 household heads/rice farmers per community interviewed.

From the interviews carried out during the countrywide survey, it was possible to determine the approximate size of household for each of the respondents. The estimated sample population involved in rice cultivation

was about 12, 298. The household size and average household composition was then calculated based on all the information acquired. This information is presented below in Figure 2.

Figure 2. Average composition of rice-growing households



(Source: Countrywide survey, 2000–2001, individual questionnaire)

From the data obtained in the interviews, the average rice-farming household in Ghana numbers about 12 persons, comprising the household head, usually male, with one or more wives, and several children and dependants. Some household members (on average 3 per household) may be absent and engaged in non-farming activities elsewhere; and usually all those members of the household who are present assist with the farming activities. The term "household" in Ghana is usually defined as: "the number of people eating from the same cooking pot".

4.3.1 Rice and gender

Table 9 shows the gender balance among rice farmers interviewed during the survey. More than 70% of all the rice farmers were men. However, there is considerable regional variation within Ghana, partly connected with different ethnic traditions. Within many communities, especially in the northern part of the country, women cannot own land or farm. They can only help in cultivation of their male relatives' farms (i.e., husband's, father's or brother's farm), performing activities such as weeding, or threshing of harvested rice.

Most of the women farmers encountered during the survey were farming rice on the irrigated projects.

Table 9. Gender balance among respondents

Gender	No.	%
Male	715	71
Female	288	29
TOTAL	1003	100
Source: Countrywide survey, 2000/2001, individual questionnaire		

Out of 288 women rice farmers encountered during the countrywide survey, only 63 (6%) mentioned that they are the household heads.

4.3.2 Average age of rice farmers and years of experience in growing rice

The average age of respondents was 41.4 years, with the youngest respondent being 13 years of age, and the oldest 79. Experience in rice cultivation ranged from 57 years of continuous practice to those who started farming in the year in which the interview was conducted (2000/2001 cultivation season). The farmers' length of experience regarding rice farming was considerable for all the ecologies surveyed. For example, for large-scale irrigated rice farming, the respondent with the most experience started cultivating rice in 1967 (33 years of experience at the time of interview).

On the whole, it may be concluded that almost all the respondents had some experience in the cultivation of rice and that the majority of them had practised for several years.

4.3.3 Ethnicity and rice cultivation

In each of the 63 rice-growing communities surveyed, there were several ethnic groups. In total, about 42 different ethnic groups participated in the survey. All these groups cultivate rice regularly. The details are presented below in Table 10.

Table 10. Ghana countrywide survey of rice-growing households: ethnicity and household size.

No	Ethnic group/language	No.	Avg. household size
1	Pepese	1	4.00
2	Ga	3	4.33
3	Ga-Adangbe	28	5.57
4	Akpafu	1	6.00
5	Gwira	24	6.17
6	Wasa	9	6.22
7	Akuapem	2	7.00
8	Chokosi	6	7.67
9	Ewe	114	7.73
10	English	1	8.00
11	Talensi	2	8.50
12	Lolobi	20	8.80
13	Kasem	1	9.00
14	Nzema	52	9.23
15	Guan	41	9.32
16	Fanti	48	9.94
17	Akan	13	10.00
18	Kotokoli	3	10.33
19	Twi	179	10.75
20	Buem	25	10.76
21	Siwu	32	11.00
22	Hausa	22	11.09
23	Buli	20	11.75
24	Sekpele	8	11.88
25	Konkomba	1	12.00
26	Sekwa	37	12.62
27	Bono	2	13.00
28	Krobo	2	13.50
29	Gonja	7	13.57

No	Ethnic group/language	No.	Avg. household size
30	Avatime	25	13.60
31	Busanga	5	13.80
32	Kantosi	1	15.00
33	Kusaal	40	16.05
34	Bi-moba	3	16.33
35	Dagare	2	17.00
36	Samele (Gonja)	1	18.00
37	Ningo	1	18.00
38	More	4	18.75
39	Akyem	74	19.36
40	Grune	39	19.72
41	Dagomba	103	20.38
42	Mampruli	1	24.00
TOTAL	AVERAGE FAMILY SIZE:	1003	11.62
Source: Countrywide survey, 2000/2001, individual questionnaire			

The largest household size was observed among the northern ethnic groups (Mampruli 24.0, and Dagomba 20.38 persons/household, respectively). The smallest households (4–5 members) were found among ethnic groups in southern Ghana (Western and Greater Accra Region, with Pepese and Ga ethnic groups).

4.3.4 Profession of household head

Table 11 shows the primary professions of respondents who participated in the countrywide survey. Most (928, or 92%) of the respondents indicate that they are farmers by profession; a few mentioned trading, teaching, and other professions as their main occupation, with rice farming as their secondary occupation. Out of the total number of 1003 respondents, 428 (42%) indicated that they are members of various farmers associations. The list of farmers associations and their main functions can be found in Appendix I.

Table 11. Profession of household head

Profession	No.
Banker	1
Blacksmith	1
Building draftsman	1
Business woman	1
Businessman	1
Butcher	1
Carpenter	4
Civil servant	2
Contractor	1
Distiller	5
Driver	4
Drug seller	1
Farmer	928
Fisherman	1
Head teacher	1
Herbalist	1
Labourer	1
Mason	1
Pastor	1

Profession	No.
Petty trader	1
Policeman	1
Retired	1
Seamstress	1
Security officer	1
Security man	1
Student	1
Tailor	4
Teacher	13
Trader	19
Watchman	1
Weaver	1
No response	1
TOTAL	1003
Source: Countrywide survey, 2000/2001, individual questionnaire	

About 447 (44%) interviewed farmers were literate, and 514 (51%) mentioned that they were household heads.

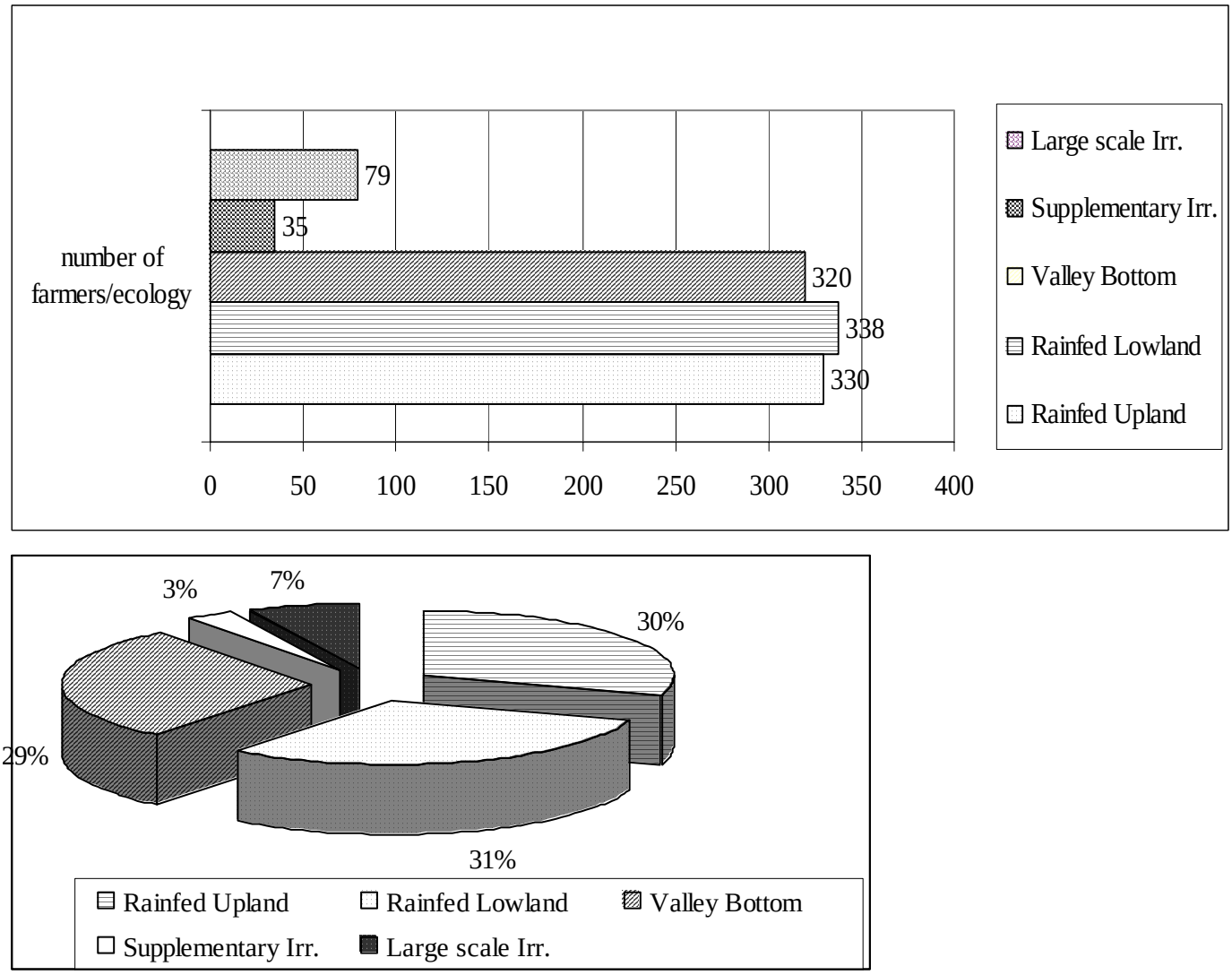
4.4 Ecologies and tenure arrangements

In total, five ecologies were encountered in the countrywide survey, that is, rain-fed upland, rain-fed lowland, valley bottom, supplementary irrigation and large-scale irrigation. No respondents were encountered who farm in the mangrove ecology. There were about the same number of respondents (330, 338 and 320, respectively) for those engaged in rain-fed upland, rain-fed lowland and valley bottom ecologies. The lowest number of respondents (35) mentioned that they farm rice using supplementary irrigation ecology, and about 79 respondents that they use large-scale irrigated rice ecology (Figure 3 below). In some cases, respondents farmed rice in two ecologies, but there were no cases of respondents cultivating rice in three or more ecologies.

The situation regarding tenure within various ecologies is presented below.

The land tenure situation for rice cultivation varies from ecology to ecology, as seen in Table 12. The largest number of rice farmers (412) across all ecologies farm hired land, which they usually take on seasonally (18 farmers pay in kind for land released to them), with a further 280 respondents farming rice on family land, given to them by a family head to use for a certain period of years. Traditional cropping systems in Ghana, such as the '*Abusua system'* prevalent in the Akan-Twi extended family system, where the land belongs to all the family members but no one bears the direct responsibility for it, as well as share cropping, where the landlord usually gets about one third of the produce while the tenant farmer has the remaining two thirds, did not feature very prominently (7 and 13 cases, respectively).

Figure 3. Rice ecologies represented in Countrywide survey, 2000/2001 cultivation season



(Source: Countrywide survey, 2000/2001, individual questionnaire).

4.4.1 Extension advice offered to rice farmers

The most striking fact arising from the responses to the inquiry about extension in rice cultivation is that almost half of the interviewed farmers (492) claimed that they had not received any form of assistance from these organisations. Those who have exposure to some extension advice get it mostly from Ministry of Food and Agriculture (MoFA) extension staff. Only a negligible proportion of farmers received advice from non-governmental (NGO) organisations.

Further analysis of the extension information reveals that slightly more than half (523) of the total of 1003 respondents had received a visit from an extension agent, and about the same number (524) had participated in a farmers' field day. No farmers had received guidance in rice cultivation coming from radio or television programmes, but 113 of the respondents had had the opportunity to read extension leaflets containing advice on rice farming.

This situation poses several questions on the availability of extension service to many small-scale subsistence farmers in the country, especially those in more remote communities. To a large extent, farmers in these areas still practise agriculture in the same way as their ancestors, without the benefits of modern techniques, or improved seed and other chemical inputs. From the survey results, it can be seen that non-governmental organisations should be more involved in rice cultivation by supporting government activities

and helping to improve yields and cultivation methods of rice farmers. Only one NGO (ADRA) was mentioned by the respondents as active in the area of rice farming in the country.

Table 12. Tenure arrangements of farmers growing rice in various ecologies												
TENURE ARRANGEMENTS												
	Own land	**Communal land**	**Hired**	**Inheritance**	**Family land**	**'*Abusua*' system**	**Freehold**	**Loan**	**Share cropping**	**Gift**	**No Response**	***n* per Ecology**
Rain-fed upland ecology	25	67	37	44	130	2	-	-	-	-	25	330
Rain-fed lowland ecology	10	4	145	92	61	5	7	-	13	-	1	338
Valley bottom ecology	20	6	172	23	80	-	12	3	-	1	3	320
Supplementary irrigation ecology	3	-	24	-	8	-	-	-	-	-	-	35
Large-scale irrigated ecology	-	13	34	2	1	-	20	-	-	-	9	79
Total/Category	58	90	412	161	280	7	39	3	13	1	38	
Source: Countrywide survey, 2000/2001, individual questionnaire												

Table 13 shows the list of organisations involved with extension to rice farmers and the number of farmers receiving their assistance.

Table 13. Extension advice to rice farmers	
Institution/Agency	**No**
None	492
ICOUR (semi private company)	14
IDA (Gov. Dept.)	41
IDA/MOFA (Gov. Dept)	2
IPM (participatory training organized by Gov. inst)	1
KIP (Gov. inst)	17
MFLS (Gov. inst)	31
MOFA (Gov. inst)	396
MOFA, NGO	1
SARI (CSIR-research inst.)	8
TOTAL	1003
Source: Countrywide survey, 2000/2001, individual questionnaire	

4.4.2 Cash or subsistence: why grow rice?

In most communities, farmers grow rice both for home consumption and as source of income (cash crop). Rice can be stored for a considerable length of time and sold as and when the household requires money.

In some communities, festivals and rituals, such as sowing/planting dates and harvest festivals, are linked to traditional rice cultivation.

In only four out of the 32 villages surveyed, did farmers claim that they do not eat the rice that they grow, but that they cultivate it exclusively as a cash crop. Details can be found in Table 14 below.

Table 14. Purpose for growing rice crop				
Village	**Cash**	**Home consumption**	**Both**	**Rituals/Festivals**
Abenase			1	
Adubrim			1	
Aframso		1		
Assin Dansani			1	
Assin Praso			1	
Asuatuare	1			
Atia	1			
Avatime Tsadome			1	
Avatime Vane			1	
Banso			1	
Besease		1		
Dompim No. 1			1	
Dugu			1	
Fumbisi			1	
Gbi			1	

Village	Cash	Home consumption	Both	Rituals/Festivals
Godenu				
Gomoa Okyereko			1	
Gowrie/Vea			1	
Kamgbunli			1	
Kusanaba-Zebiw			1	
Nabewam		1		
Nakpanzoo	1			
Njau			1	
Nkwatanan	1			
Nsawkaw			1	
Nyankpala			1	
Oda-Nkwanta				1
Prang			1	
Sandrokofi Bume			1	
Simpa Junction			1	
Twer Nyame			1	
Wiase			1	
Winkogo			1	
Total	4	3	24	1
Source: Country wide survey, 2000/2001, village questionnaire				

4.5 Agronomic practices

4.5.1 Sources of power for land preparation

Machinery in rice production in the country in general is used only for a few operations, such as land preparation. The second mechanised operation is harvesting, especially on irrigated commercial rice farms. Very few rice farmers have access to harvesting machines.

Out of the 1003 farmers included in the countrywide survey, about 165 (16%) mentioned that they use a tractor, with 160 using a power tiller (15%). It is mostly farmers on irrigated schemes, using the wetland preparation method, who employ power tiller cultivation. It is also worth mentioning that a further 108 respondents did formerly use machinery, but stopped in the late 1990s, mainly due to high costs, problems with maintenance, and the unavailability of machinery for hire when needed. This information coincides with the cut back in agricultural subsidies and the initiation of the World Bank's adjustment policies in the country.

Only 70 (6%) respondents mentioned that they use animals; out of which 20 hire cattle for land preparation, while 51 farmers use their own cattle.

As can be seen form the above data, the entire process of rice cultivation in Ghana is still largely a manual activity. Little or no use is being made of animal traction, while those operations that can be mechanised suffered drawbacks during the period of the Structural Adjustment Programme.

Rice cultivation is a very intensive agricultural activity, and about 845 (84%) farmers indicated that they hire labour. 104 hired labour for weeding only, 47 for land preparation only, and others for combined operations ranging from land preparation to harvesting and threshing.

4.5.2 Labour: gender divisions for specific operations during rice cultivation

The following information was obtained regarding the gendered division of labour for various operations required in rice cultivation. Men and women engage in most operations indiscriminately, as is clearly show in Table16 below. However, males are predominantly employed in land preparation and winnowing is predominately a female task. Some operations, such as land preparation, transportation of produce from the farm and harvesting, are partially mechanised.

4.5.3 Services to farmers on large irrigation schemes

Out of 77 farmers using this ecology, 35 have farm sizes of about 2 acres (0.8ha), while a single person cultivates about 3 acres (1.2ha). All the remaining farmers have about one acre of land (0.4ha). 56 respondents harvest two rice crops/year, while the rest (23) harvest only once. Furthermore, 54 respondents obtain seed from the irrigation scheme, while the rest grow or acquire their own seed.

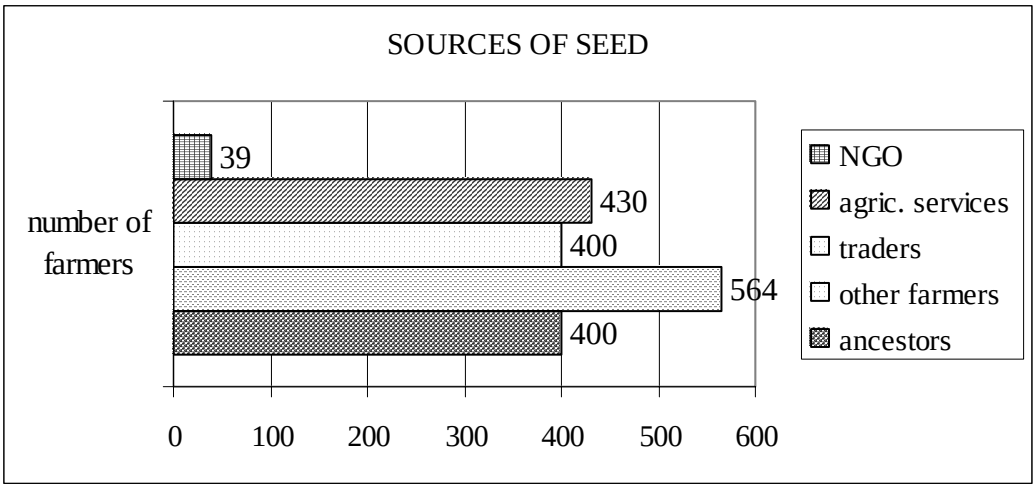
Only three farmers mentioned input subsidy, without specifying which input is subsidized. About 60 claim that they pay for water at various rates, either seasonally, or per unit of land. The rate is not uniform across various irrigation schemes. Mechanised land preparation provided by the project management unit is available to only 40 interviewed farmers in the Dawhenya and Gomoa Okyereko Irrigation Projects, while others have to rely on private individuals. The cost of land preparation at Dawhenya at the time of survey (2000/2001 irrigation season) was ¢ 337, 500ha ($ 40.48), while at Gomoa Okyereko it was from ¢ 250,000 – 200,000ha ($31.25 – 25.0). 32 farmers from Dawhenya and Asutsuare Irrigated Projects had access to harvesting machinery at a rate of about ¢ 625 000ha ($78.12)

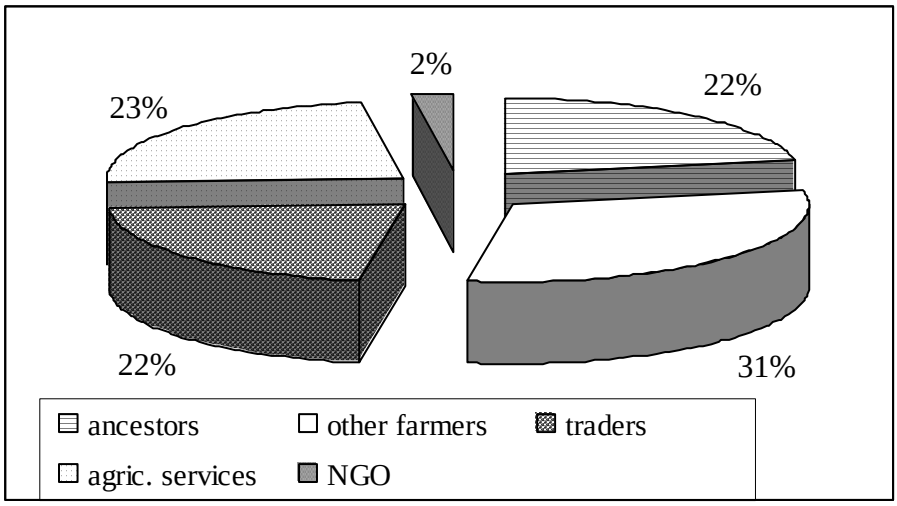
4.6 Seeds and rice varieties

4.6.1 Seed sources

Farmers obtain rice seed from different sources and usually combine them in order to obtain the best seed for their farms. Details of the information given by respondents are presented in Figure 4 below.

Figure 4. Sources of rice seed





(Countrywide survey, 2000/2001, individual questionnaire).

The sources mentioned include traders, other farmers, and ancestors. Reference to ancestors can be interpreted as meaning that the same rice variety seed has been used from generation to generation. This is common in communities known for traditional rice cultivation such as those in Volta Region. Out of 1003 interviewed rice farmers, only 39 mentioned NGOs as a source of seeds for their rice cultivation.

Table 15. Labour distribution during rice cultivation operations															
Activity (n=32)															
Land preparation		**Planting**		**Transplanting**		**Weeding**		**Harvesting**		**Transportation**		**Threshing**		**Winnowing**	
Men	15	Men	5	Men	5	Men	7	Men	8	Men	5	Men	11	Men	0
Women	0	Women	4	Women	4	Women	2	Women	4	Women	8	Women	6	Women	19
Both	10	Both	23	Both	9	Both	22	Both	20	Both	13	Both	9	Both	5
Machinery	7	Machinery	0	Machinery	0	Machinery	0	Machinery	0	Machinery	4	Machinery	6	Machinery	8
Not relevant	0	Not relevant	0	Not relevant (rice is not transplanted in these communities)	14	Not relevant	1	Not relevant	0	Not relevant	2	Not relevant	0	Not relevant	0
Source: Country wide survey, 2000/2001, village questionnaire															

The largest number of respondents (564) mentioned that they obtain seed through exchange with other farmers. The number of farmers who get seed from traders, who prefer seed left to them by ancestors, or who obtain it from the Agricultural Services Department of the Ministry of Food and Agriculture (MoFA) was about the same (Figure 9).

About 298 farmers mentioned that they find it difficult to obtain seed for their farms, while 251 are not satisfied with the seed quality. During the survey, it was revealed that about 377 respondents have heard that new rice seeds are being developed through participatory trials of different rice varieties organised between WARDA and CRI for West Africa. Details are presented in Table 16 below.

Table 16. Problems of rice seed availability and quality		**%** (n=1003)
Problems with getting seed	298	29
Problem with seed quality	251	25
Respondents who have heard that new seeds are developed for West Africa	377	37
Source: Countrywide survey, 2000/2001, individual questionnaire		

4.6.2 Choice of rice varieties and maintenance of agrobiodiversity

Farmers keep and cultivate large numbers of rice varieties for different reasons, therefore maintaining the rich biodiversity pool. In some communities, women and men maintain different rice varieties on their farms, for different reasons, some of which are presented below (results from recent study by Tanzubil et al., 2002).

Table 17. Male and female production practices, Gore, Upper East Region, Ghana		
Item	**Women**	**Men**
Farm Location	Mainly upland (less fertile lands)	Largely lowland
Plot Sizes	0.1–0.3 ha	0.3–2.0 ha
External input use	2–3 bags/ha NPK	up to 5 bags/ha NPK
Field management	2–4 weedings/season	1–2 weedings/season
Varieties grown	Largely local	IR-24, GR 19 (exotic varieties)
Use of produce	Food and sale	Mainly sold
Yield of grain/ha	10 – 30 bags	12 – 38 bags
Source: Tanzubil, B., P. (2002)		

Women generally have access only to marginal lands (in this case, uplands) but, according to the study by Tanzubil et al. (2002), they have better knowledge of local varieties of rice. They also prefer to cultivate local varieties because of their cooking qualities and ability to grow and produce yield under adverse environmental conditions. The same work by Tanzubil et al. (2002) mentioned about 13 indigenous *Glaberrima* and old *Sativa* varieties grown in the Gore area of Upper East Region.

In the survey conducted during 2000/2001 at village level, farmers cited more than 60 rice varieties that they commonly produce. The main characteristics of these varieties and the reasons for their cultivation, as well as some problems that accompany production are presented below in Table 19. As the table shows, most of them are suitable for upland ecology but some varieties can thrive under various conditions. Old exotic varieties, such as the 'Mande', were among the first to be introduced to Ghana from Asian countries under the IRRI collaborative breeding programmes in the early 1960s through the Kpong Agricultural Research Station of the University of Ghana. They were tall and could successfully compete with weeds, which is the

Figure 5. Rice cultivated by the rain-fed lowland system, Sampraso-Ashanti Region; Intercrop with sugarcane.

main reason farmers still cultivate them. Other varieties are preferred because of relatively low level of inputs required, resistance to drought and good taste.

4.6.3 Monocropping and intercropping of rice

Rice is frequently intercropped with other food staples. Farmers from 20 out of the 32 villages included in the survey mentioned that they intercrop rice with other staples (12 in upland ecology, 4 in lowland ecology, and 4 in valley bottom ecology, according to information from village questionnaire administered during the Countrywide survey in 2000/2001). Monocropping is practised only under large-scale and supplementary irrigation.

Crops with which rice are intercropped include roots and tubers (e.g. cassava and plantain), cereals (e.g. sorghum, maize and millet) and other crops (e.g. tomato, okra, beans, sugar cane). The most commonly mentioned combination is rice and other cereal crops, where rice is grown in furrows and sorghum, millet or maize is grown on ridges within the same plot. More often than not, about 3-4 crops are grown together as intercrops with rice.

Table 18. Rice varieties cultivated by farmers and their main characteristics

Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
1	62792		Exotic variety	120	High yielding	Common	Lodging when it is too wet	0	1	0
2	Abankron	Large grains		150	High yielding		Susceptible to various problems	1	1	0
3	Abidjan			150	Good grain quality			0	0	0
4	Afife			120	Does well under any conditions		Requires chemicals; low resistance to weeds	0	1	0
5	Agana			75	Short duration rice		Low resistance to weeds	1	0	0
6	Agbatam	You are late		90	Very tasty		Does not like flooding	1	0	0
7	Akasa	White grain		120	Very tasty	Not common	Affected by diseases	1	0	0
8	Akokora besi	Old man will pound		90-120	Matures early	Not common	Cannot survive well on hilly land	0	1	0
9	Amalbara			90	For consumption and sale		Requires fertilizer; low resistance to weeds	1	0	0
10	Anyofla			90	Does not need much water		Requires chemicals; low resistance to weeds	1	0	0
11	Apalaha	Round and	Not	120				0	0	0

[2] New releases from CRI

Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
		small	cultivated any more							
12	Asaka			105	Early maturing		Low resistance to weeds	1	0	0
13	Awule kpale	Short		90-120	Well filled grain	Common	Easily attacked by pests	0	1	0
14	Bangulame	Very tall		120	Very tasty	Common	Easily attacked by pests	1	0	0
15	Bazolgu			120	For consumption and sale		Worms and weed infestation	0	1	0
16	Bouake	The name is from Ivory Coast		120	High yielding		No problems	0	0	1
17	Buerthe 1891		Exotic variety	120	Found to be high yielding and tasty	Very common	No problems yet	0	0	1
18	C41		Tall, exotic variety			Not common		0	1	0
19	Dagbon begu			120	Nice appearance		Requires chemicals; low resistance to weeds	0	1	0
20	Dmelinga			120	For festivals		Needs a lot of water	1	0	0
21	FARO15		Old exotic variety	90	Does not lodge		Low resistance to drought	0	1	0
22	Gomma	Red rice	Red	90-	Drought	Not		1	0	0

Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
			long grain	120	resistant	common				
23	IET6279		Exotic variety	90-120	High yield and very tasty	Common	None	0	1	0
24	ITA336		Exotic variety	90-120	High yield		Prone to stem borer attacks	0	0	1
25	Jerigonyina			90	For consumption and sale		New varieties have virtually made this variety vanish	0	1	0
26	Kiliga	Round		90	Hunger and economic relief, also good for late planting		Drought	1	0	0
27	Kobenli	Brown grain		90-120	Early maturing	Not common	Affected by diseases	0	1	0
28	Kodak			70	High resistance to weed		Not tasty	1	0	0
29	Kosofu			90	Good for the land		Low resistance to weeds	1	0	0
30	Kotoko			90	Does not shatter		Many people prefer imported rice to this variety	1	0	0
31	Kotuk peliga	White		90	Hunger and economic relief, also good for late planting		Drought	1	0	0
32	Kpukpula	Small seed		90	Early		None	0	1	0

Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
					maturing, Tasty					
33	Kutogsana			90	Good for late planting, hunger relief crop			1	0	0
34	Kutoku	Red		90	Hunger and economic relief, also good for late planting		Drought	1	0	0
35	Kwaku Adu		It is a new variety					0	0	0
36	Local rice		Local	180	It has a good taste and aroma		Lodging	0	0	0
37	Mande		Old exotic variety	180	Can compete effectively with weeds		Weeds and Fertilizer	1	0	0
38	Mmoo khaki	"Khaki" rice		110	Very tasty		Disease, insects, birds, mammals, weeds	1	1	0
39	Mmoofitaa	White rice		120	High yielding		Disease, insects, birds, mammals, weeds	1	1	0
40	Mofufuo	White rice	Long maturing	110-120	Drought resistant	Not common	Empty panicles	1	0	0
41	Mokokoo	Red rice	Short	90-95	Drought resistant, Tasty	Very common	Rodents and birds attacks	1	0	0

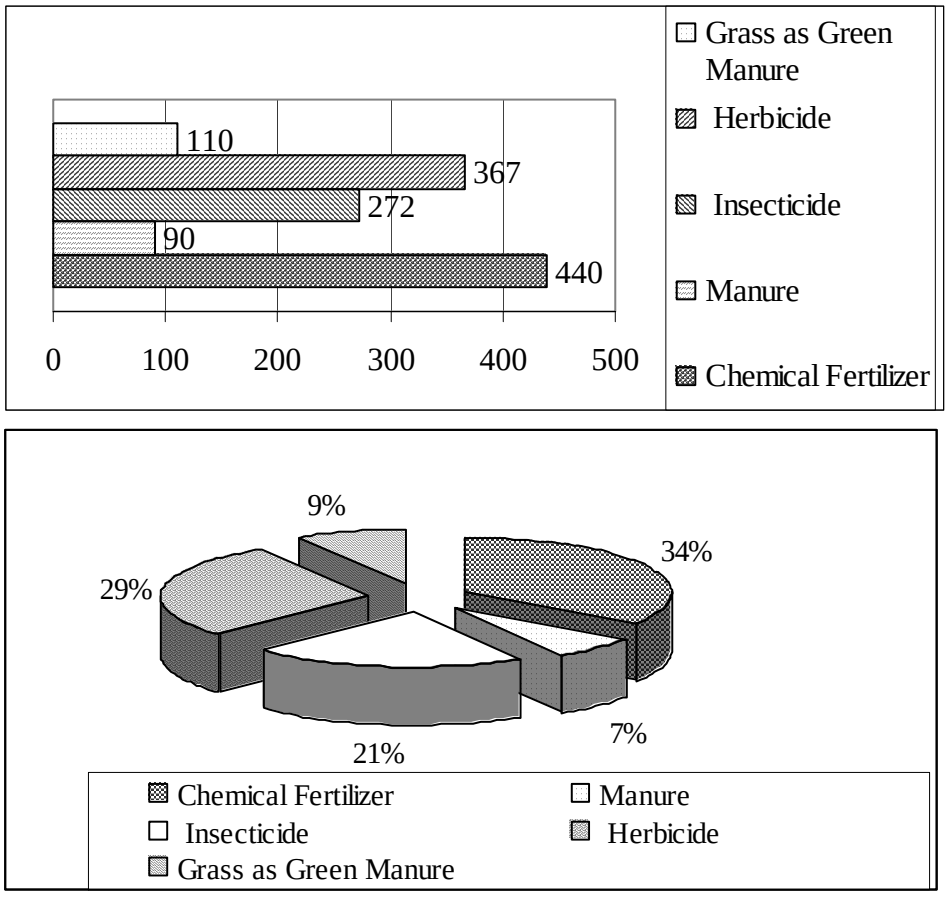
Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
42	Mr Moore		White, It can ratoon	120-150	It can be harvested twice and gives high yield	Common	Late maturing	0	1	0
43	Mufitaa	White rice	Local	150	Tillers well		Cannot compete with weeds	0	0	0
44	Muibonga			90	Very tasty		Many people prefer imported rice to this variety	1	0	0
45	Muikura			120	Good for the land		Low resistance to weed	1	0	0
46	Muikyiim	Round rice		90	High yielding		Do not like flooding	1	0	0
47	Muimulga	Red rice		75	Short duration		Many people prefer imported rice to this variety	1	0	0
48	Muipel	White rice		120	High yielding		Does not like waterlogged areas	1	0	0
49	Muipeliga	White rice		120	Requires water		Needs a lot of rainfall	1	0	0
50	Muisadli	Tail rice		120	Perennial rice		Not very tasty	1	0	0
51	Muizag	Red rice		90	Good for the land. Does well without fertilizer		Does not like waterlogged areas	1	0	0
52	Mukokoo	Red rice	Local	120			Cannot compete with weeds	0	0	0
53	Mupeliga	White		120	Grown where there is enough water		Needs water	1	0	0

Serial no	Variety	Meaning	Origin	Days to maturity	Positive characteristics	How common	Problems	Ecology		
								Upland	Lowland	Irrigated
54	Muubunga	Donkey rice		90	Hunger and economic relief, also good for late planting		Drought	1	0	0
55	Nayiga	Thief		120	Hunger and economic relief, also good for late planting		Drought	1	0	0
56	Nyate Nyaten			90	High yield	Not common	Easily attacked by insect pest	0	1	0
57	Sikamo1		New exotic variety	91	Long grain type	Not common	Prone to whitehead (stem borers)	0	1	0
58	Sinkafazegu	Red rice		90	For consumption and sale			1	0	0
59	Soemui			90	Very tasty		Does not like flooding	1	0	0
60	Tox kabila		New exotic variety	120	High yielding	Not common	Lodging when it is too wet	0	1	0
61	Yelwongo			120	Resembles imported rice		Many people prefer imported rice to this variety	1	0	0
								total no of varieties identified/ecology		
								36	19	3
Source: Countrywide survey, 2000/2001, village questionnaire										

4.6.4 Inputs in rice cultivation

Inorganic fertiliser is the most common input which farmers use in rice cultivation. This is especially important considering the high cost of chemical fertiliser, which is imported into the country. The price of agricultural inputs on the local market is not subsidised in Ghana and farmers bear the full cost of such products. 440 (34%) of respondents mentioned that they use fertiliser for rice cultivation, while 367 and 272 use herbicides and insecticides, respectively. These results are presented in Figure 6 below.

Figure 6. Use of inputs in rice cultivation



(Source: Countrywide survey, 2000/2001, individual questionnaire).

It is clear from the survey results that, in general, the use of organic materials is low in Ghanaian rice cultivation. Only a relatively small number of farmers use some form of organic materials, such as manure or green grass (90 and 110, respectively) as fertiliser for their farms. Non-governmental organisations should assist farmers to make better use of organic materials from their back yard, as well as rice straw. Opportunities to grow green manure after the harvest of rice crop, as fertiliser for the next cultivation season, should also be explored.

About 98 out of 1003 farmers mentioned that they have used some inputs, such as fertiliser or insecticide in the past, but have stopped mainly due to high cost.

In many cases, rice straw is burned on the farms, after harvest, or not used at all, as shown in the Table 19 below, which represents the information obtained from the village questionnaire.

Table 19. Uses of rice straw in village communities	
	No. cases(n = 32):
Straw not used	13
Straw eaten by livestock	6

Straw mulched for fertiliser	9
Straw burnt for fertiliser	5
Straw used in building	4
Source: Countrywide survey, 2000/2001, village questionnaire	

4.7 Constraints in rice production

Discussions about constraints in rice production were held at village level, in 32 villages visited during the countrywide survey. The results are therefore joint contributions from farmers' groups' encountered.

4.7.1 Birds

During the countrywide survey of in 2000/2001, farmers mentioned many types of birds, which attack their farms at various stages of rice plant development (about 47 cases in total). The most important are presented below:

Q. Quelea, as well as various types of weaverbird (e.g. village weaver, *Ploceus cucullatus*), is a common rice pest recognised throughout the country. This bird attacks rice at the grain filling stage and later until the grain ripening stage. The only method of control practised in Ghana is bird scaring, carried out usually by children who remain on the farms for about a month, shouting or using catapults to scare and drive away birds, which come in large flocks. During this period many other activities are postponed, and even the school hours in rural areas are frequently adjusted to allow for early morning periods of bird scaring.

4.7.2 Mammals

Rodents (*Rattus spp*.) attack rice farms, and the farmers mostly mention them as pests that are very persistent at the harvesting stage, especially if harvesting cannot be organised in time. About 41 instances of problems with mammals were mentioned during the countrywide survey in 2000/2001.

In only a few cases, grazing animals, such as sheep, cows and goats, were said to cause damage to rice farms, and only one community mentioned squirrels (Assin Dansani) and monkeys (Bamso) respectively, as pests affecting rice cultivation.

4.7.3 Insects

Termites, caterpillars and grasshoppers, together with stem borers (*Maliarpha separatella, Scirophaga subumbrosa Chilo zacconius, Nymphula depunctalis* etc.), are the insects mentioned by farmers as affecting rice at various stages of development. Those farmers, who cultivate the crop on irrigation projects in Ghana, have benefited from Farmer Field School initiatives and IPM courses, organised by FAO and the local Authority (GIDA). They are usually able to manage various insect attacks better than farmers in the rain-fed ecology.

42 cases of problems with insects were encountered during the countrywide survey.

4.7.4 Diseases

The main diseases mentioned by rice farmers (25 cases) were blast (*Pyriculla oryzae*), white head, and smut. Some farmers also complained about fungal diseases. However, the number of farmers complaining about problems with rice diseases was relatively low.

4.7.5 Weeds

Farmers cultivating rice in all the ecologies recognise that weeds are the most important problem in rice production. About 60 cases were encountered at village level during the countrywide survey. Farmers are able to recognize and describe in detail many types of rice weeds in all the communities where interviews

were carried out. It seems that problems with weeds outstrip those caused by birds, mammals or disease. This is not surprising, considering the fact that only 79 of the interviewed farmers grew rice under fully irrigated conditions, in which the permanent layer of water on fields during the major part of the season suppresses weeds. Coupled with this, the majority of respondents used manual methods in all the operations involved in rice cultivation, including weeding. This makes weeding a very laborious operation that must be repeated over the rice development season at least three or four times. Common weeds present are *Andropogon gayanus, Vetiveria spp., Pennisetum spp.,* together with the *Cyperus rotundus, Cynodon dactylon, Imperata cylindrica, Chromolaena odorata* and *Panicum spp,* and many others. Wild relatives of rice, *O. barthii (O. longistaminata*) also abound in natural rice environments, in inland valleys and river flood plains.

4.7.6 Climatic uncertainty and other constraints

In five villages, farmers mentioned that the rainfall problem was a major constraint in rice cultivation. The rainfall pattern is erratic causing either droughts and/or floods, and these environmental problems result in poor germination, harvest failure and so on.

Farmers also complain about poor soil fertility, as a further limitation to rice production. Difficulties with land acquisition for rice farming were also mentioned as one of the constraints in two communities.

However, the majority of respondents mentioned that their main problem is the lack of credit facilities, and support mechanisms for successful agricultural production, rather than environmental conditions.

4.8 Rice processing

4.8.1 Village processing

In Ghana, most rice production is still in the hands of smallholder farmers, most of them with holdings of less than one ha. Much of the rice is grown from impure seeds, with mixed varieties, resulting in uneven maturity at harvest. Due to the same problem, there are wide variations in the size and shape of rice grains, which adversely affects the quality of milled rice. There is an overall shortage of agricultural machinery that is in a good state of repair across the entire country.

Rice production in the inland valleys, as well as in the uplands, is usually on small, scattered, often-isolated plots. Farmers may thresh paddy immediately after harvest and store it in bags or store it on the panicle in special storage facilities, threshing it in small batches, as and when needed. Threshing is usually done on bare floors, under direct sunshine, and also on the roadside. Consequently, soil particles and stones get mixed with the paddy, which in turn leads to the damage of milling equipment and low-grade rice. Many village communities still de-husk rice grain by pounding with a pestle and mortar.

Figure 7. Rice parboiling by women's group, Savelugu/ Nanton District, Northern Region, Ghana

In northern Ghana, the climate is much drier during the main harvest season (December–January) than in the southern parts of the country. The paddy from the rain-fed lowland ecology is mainly grown in this environment. Under these conditions, rice has to be subjected to the process of parboiling to prevent breakage during milling. Parboiling is an ancient practice common in many African countries, involving the hydrothermal treatment of rough rice, prior to milling. The steps involved in the process include pre-cleaning of paddy to remove stones, weed seeds, and other foreign matter by hand, subsequent soaking, and

then heat treatment. According to De Datta (1981), parboiling gelatinises the starch within the rice grain, causing swelling and fusion within the kernel, and increases moisture content. Rice processed in this way is then dried and kept in the shade for about 12 hours before milling. Hydrothermal treatment increases the shelling efficiency, nutritional quality and milling quality, and facilitates the de-germination and de-hulling process. Parboiling is a vast and important cottage industry in the north of the country, dominated by women who buy and parboil small quantities of paddy on a daily basis. The parboiled rice is then milled locally and sold at nearby markets.

4.8.2 Rice mills

After drying, the grain is bagged for storage, but more commonly for immediate sale to small-scale traders. The traders usually take the rice to small local mills of the Engelberg huller type, which is most common, for processing. The Engelberg type rice huller removes the husk and bran from the rice grain in one operation. This type of rice huller is either imported, manufactured in Ghana by the Intermediate Technology Transfer Unit (ITTU), which is partially financed by the government, or manufactured by local artisans who follow the Engelberg design.

Abukari, et al. (2000) studied the recovery rates of rice grains of different origins from three Engelberg type rice mills, with the following results:

Table 20. Grain recovery rates for rice of various origins milled by Engelberg rice milling machine

Origin:	% Whole grain	% Broken grain	% Un-husked grain
Imported rice mill	60.75	13.88	1.14
ITTU's version of Engelberg mill	51.50	18.98	7.26
Local artisan's (blacksmith's) version of Engelberg mill	50.25	21.27	4.62

Source: Abukari, A., et al. (2000)

As can be seen from the Table 20, the imported rice mills have a much higher grain recovery rate than the locally manufactured mills originating from both local artisans and the ITTU. This is due to lack of local competence in engineering design and lack of skills for drawing and manufacturing most agricultural machines (Faroborode, 2000) throughout the country as well as in the sub region.

The Engelberg type rice-milling machine also produces variable quality and is inferior to the more modern, Satake type rubber roll rice mills. Farmers participating in some rice irrigation schemes also have the opportunity to sell paddy to Satake type mills, either directly or through their farmers' associations. These larger mills, with more sophisticated machinery, have de-stoning devices, as well as whitener for polishing rice after milling, and generally produce better quality rice than local mills.

4.9 Rice marketing

4.9.1 Sources of information on market prices

During the countrywide survey of 32 villages, farmers from 22 villages mentioned that they obtain information on rice prices from traders who come to buy their produce. Furthermore, farmers in 20 villages mentioned that traders, that is, market women, dictate the prices of their produce. In only 8 villages was the price of rice set with community consent.

The results illustrate that in 12 cases, farmers obtain information about rice prices from other farmers, and only in two cases did they get the price from radio broadcasts.

The survey showed, then, that traders dictate prices to the majority of farmers. Thus farmers are at the mercy of traders who buy rice at the lowest price during harvest time. Details are presented in Table 21 below.

Table 21. Sources of information on rice prices	
	No of cases
Other farmers	12
Traders	22
Radio broadcast	2
Source: Countrywide survey, 2000/2001, Village questionnaire	

4.9.2 Problems with marketing

It is usually thought that the 'market women' system in Ghana is a heartening example of female empowerment; and if seen purely from the buyers' perspective this is certainly the case. However, the market queens operate a monopoly system by virtue of access to capital and transport that has acted as a major constraint on innovation in rice production. Some of the problems are set out below.

Market women usually extend credit to farmers so that they can obtain inputs. At harvest time, market women buy rice at the lowest prices, determined by general market fluctuations, from farmers, who have no other option but to sell. The traders then store the produce until the 'lean season' when food is scarce and demand high. Therefore 8 out of 32 communities mentioned during the survey that the prices offered to farmers are generally low (Table 22).

Paddy rice is sold in sacks in Ghana, and a standard sack of paddy weighs approximately 82kg. Lack of measurement standards, referred to as a problem in Table 22, is related to the market women's practice of bringing sacks to collect the paddy from the farmers at harvest time that are much larger than the standard 82kg paddy sack size. Other details related to problems with the marketing system are presented in Table 22 below.

Table 22. Problems with marketing	
Category	**No of cases**
Low prices	8
Lack of standards in measurement	7
Finding market for produce	6
Price fluctuation - due to importation	6
Lack of transportation and storage facilities	5
Source: Country wide survey, 200/2001, Village questionnaire	

5. Conclusions and recommendations

A countrywide survey of rice producing households in Ghana took place during the rice cultivation season of 2000/2001. It was carried out using a sample of 1003 households in 20 districts across the country (18% of the 110 districts in the country). 63 communities, with populations belonging to 44 different ethnic groups, were interviewed, showing that rice cultivation in Ghana is not limited to any particular region or geographical area. The sample included 71% male and 29% female rice farmers.

The survey generally achieved its target of reaching the rural population, whose main activity is rice farming, since 928 (92%) of respondents were farmers by profession. About 44% were literate, and 51% were household heads.

Farmers encountered during the survey farmed rice in five different ecologies across the country, the largest number being within rain-fed upland rice, rain-fed lowland and valley bottom ecologies, which had roughly the same number of respondents (330, 338 and 320, respectively). The lowest number of respondents (35) was engaged in farming rice in supplementary irrigation ecology, with the large-scale irrigated rice ecology being represented by about 79 respondents. Most of the farmers hired land for cultivation of rice, while some cultivated family, or communal lands.

Extension services are available to about 51% of interviewed rice farmers; extension advice is obtained mostly from Ministry of Food and Agriculture (MoFA) extension staff. Only a negligible proportion of farmers received advice from Non-Governmental Organisations (NGOs). In most cases, respondents cultivate rice both for home consumption and as a cash crop. Usually, rice is seen as a crop that supplements the household income, since it is easily stored and kept over long periods of time, and can be sold as and when cash is needed.

Results of the survey show that farmers in Ghana still cultivate rice generally in a traditional manner, with most of the operations carried out manually. Little or no use is being made of animal traction, while those operations that can be mechanised suffered drawbacks during the period of the Structural Adjustment Programme.

Rice cultivation is a very intensive agricultural activity, and about 845 (84%) farmers indicated that they hire labour, 104 for weeding only, 47 for land preparation only, and the rest for combined operations ranging from land preparation to harvesting and threshing. Both men and women perform most operations on rice farms. However, males are engaged predominantly in land preparation, while the predominant female task is winnowing. Some operations, such as land preparation, transportation of produce from the farm and harvesting, are partially mechanised, especially in areas of irrigated rice ecology.

Rice farmers obtain seed from different sources and usually combine these in order to obtain the best seed for their farms. Sources include traders, other farmers, and ancestors (i.e. the same rice variety seed is used from generation to generation). Out of 1003 interviewed rice farmers, only 39 mentioned NGOs as a source of seeds for their rice cultivation. The main source of seed is, however, exchange with other farmers (56%).

Farmers maintain rich diversity of rice varieties on their farms, and during the survey they mentioned more than 60 rice varieties, which they commonly produce. Most of them are suitable for upland ecology, but some varieties can thrive under different ecological conditions. Rice is frequently intercropped with other food staples (e.g. roots and tubers, other cereals, vegetables). Monocropping is practised only under large-scale and supplementary irrigation.

Inorganic fertiliser is the most common input which farmers use in rice cultivation. This is especially important considering the high cost of chemical fertiliser, which is imported into the country. Agricultural inputs in the local market are not subsidised in Ghana and farmers have to bear the full cost of such products. A very small proportion of farmers (about 10%) mentioned that they use organic manure and green grass as fertiliser in rice production.

Farmers cultivating rice in all the ecologies recognise constraints in rice production. Problems with weeds outstrip all the others, such as damage from birds, mammals, insects or disease. This is not surprising, considering that only 79 of the interviewed farmers grow rice under fully irrigated conditions, where the permanent layer of water on the field during the major part of the season suppresses weeds. In addition, the majority of the respondents use manual methods in all the operations in rice cultivation, including weeding. This makes weeding a very laborious operation, repeated over the rice development season at least three or four times.

Harvesting and marketing are the main areas that make rice production unattractive to many farmers. Milling and processing of local rice is far from adequate, owing to the lack of quality mills and competence on the part of local manufacturers and operators. Marketing is in the hands of market women, and prices are low. In some periods of the year, competition from imported rice makes price even lower.

5.1 Conclusions

The picture presented in the rice household survey shows a production that is generally still at subsistence level, in most cases with very little material help from external agencies or government. Mechanisation of the operations is minimal, coupled with very limited access to inputs.

Rice production in the country further suffers from lack of organisation. Farmers are not organised into cooperatives either by the efforts of government, by non-governmental organisations, or through their own initiatives. Very determined efforts will be required in this area to improve the situation.

Research on rice should be coordinated to address these obvious problems and offer material help to farmers in the areas where they are really needed. The present production of rice does not even come close to the population's consumption demand, and a simple reduction in import levels will not be sufficient to boost production if it is not accompanied by an organised and conscientious effort overall to advance rice industry in the country.

5.2 Recommendations

Ghanaian rice producers must compete against imported rice, principally from SE Asia. Although local rice is currently competitive in price, this is partly because poor quality processing and hygiene involve lower costs. The government should pay more attention to upgrading the quality of local rice, perhaps by giving loans for rice-cleaning machines, or at a minimum, facilitating their import.

Ghana represents a major pool of agrobiodiversity in rice, a pool which to date has only been partially and unsystematically sampled. Moreover, some studies show that women are the main conservers of older varieties, which contribute directly to their livelihoods through hardiness, and an ability to yield under difficult challenges from climatic variability, pests and disease. A high priority should therefore be placed on the systematic collection and classification of these varieties with a view to potential further development, as well as permitting a more informed extension advice.

Rice research in Ghana has tended to be donor-driven; until the 1990s almost all focussed on irrigated rice despite its limited importance in the national economy. More recently, the interest in valley bottoms in West Africa, an interest reflected in WARDA literature, has driven a surge of research in this area. But as the survey shows, the great majority of Ghanaian farmers are still growing upland varieties. Moreover these are preferentially the poorer and more disadvantaged groups, notably women. It would seem, therefore, that a major re-orientation of research is required; it should focus on other ecologies and more appropriate cultivars, taking into account the economic and subsistence goals of these groups. The Ghanaian research community therefore needs to press the donors who set the agenda much more strongly, to encourage them to match the poverty rhetoric they so commonly espouse with actual support for plant breeding.

Appendix I

Table 23. Details of communities where individual questionnaires were administered

Serial no of surveyed village/community	Region	Village/community Name	Individual questionnaires/ community	No of questionnaires administered/ region
1	Ashanti Region	Aframso	39	
2		Atia	21	
3		Besease	10	
4		Nabewam	20	90
5	Brong Ahafo Region	Kwame Danso	17	
6		Njau	20	
7		Nkono-Kwaja	12	
8		Nsawkaw	8	
9		Prang	20	
10		Wiase	24	101
11	Central Region	Assin Akontudi	20	
12		Assin Antonsu	19	
13		Assin Dansami	21	
14		Assin Praso	20	
15		Gomoa Okyereko	20	100
16	Eastern Region	Abodan	19	
17		Asutuare	18	
18		Nkwantanan	20	
19		Soabe	6	
20		Soabe-Akim	14	77
21	Greater Accra Region	Ashaiman	20	
22		Dawenya	20	40
23	Northern Region	Dugu	20	
24		Kunkulun	20	
25		Nakpanzoo	17	
26		Nyankpala	19	
27		Tamalgu	20	96
28	Upper East Region	Fumbisi	20	
29		Gani-Sakuo	1	
30		Gowrie/Vea	20	
31		Kusanaba-Zebilla	17	
32		Winkogo	20	
33		Zebilla	5	
34		Zebilla-Zani	16	
35		Zebilla-Zani-Sakoo	1	100
36	Upper West Region	Hamile	3	3
37	Volta Region	Akpafu Mempeasem	28	
38		Akpafu Odomi	4	
39		Avatime Tsadome	22	

Serial no of surveyed village/community	Region	Village/community Name	Individual questionnaires/ community	No of questionnaires administered/ region
40		Avatime Vane	16	
41		Gbi Godenu	40	
42		Likpe Bakwa	31	
43		Likpe Bala	13	
44		Lolobi Ashanti	8	
45		Lolobi Kumasi	12	
46		Sandro Kofi Bume	25	199
47	Western Region	Abenase	20	
48		Adubrim	17	
49		Aggreykrom	1	
50		Amasure	2	
51		Asonti	1	
52		Banso	25	
53		Domiabra	6	
54		Dompim No. 1	7	
55		Kakusoazo	13	
56		Kamgbunli	22	
57		Kobina Anokrom	19	
58		Nsuaem	4	
59		Oda Nkwanta	20	
60		Ohiamadwen	14	
61		Simpa	12	
62		Simpa Junction	4	
63		Twer Nyame	10	197
	TOTAL		1003	
Source: Countrywide survey, 2000/2001, Individual questionnaire				

Table 24. Districts involved in the survey		
No	District	Region
1	Ejisu-Juabeng	Ashanti
2	Sekyedumasi	
3	Atebubu	Brong Ahafo
4	Sene	
5	Wenchi West	
6	Assin North	Central
7	Gomoa East	
8	Birim South	Eastern
9	Kwaebibrem	
10	Dangbe West	Greater Accra
11	Savelugu/Nantong	Northern
12	Tolon/Kumbungu	
13	Bawku West	Upper East
14	Bolga	
15	Bongo	
16	Builsa	
17	Ho	Volta
18	Hohoe	
19	Nzema East	Western
20	Wassa West	
Source: Countrywide survey, 2000/2001, village questionnaire		

Table 25. Farmers' organisations actively promoting rice cultivation		
Name	**Extant**	**Activity**
Gowrie Young Farmers' Association	0	Farming activity, specifically promoting rice cultivation
Simpa Nkwanta Rice Farmers' Group	0	Support farmers in terms of advice and direction
Kamgbunli Rice Farmers' Association	0	Members assist each other in sowing and planting
Catholic Women Farmers' Association	1	Help women in groundnut cultivation through the *nnoboa* system; rice is planted after harvesting groundnuts
31st December Womens' Movement	1	Organising women for income generating activities
Prang Farmers' Association	0	Give financial assistance to farmers to purchase farm inputs and retail to farmers
Aframso Valley Rice Project	1	Mobilise to cultivate rice for community development; also contribute to members financially when in need
Atia Co-operative Rice Growers' and Marketing Society	0	Contribute and help themselves to acquire land and other inputs for farming
Besease Rice Farmers' Co-operative and Marketing Society	0	Growing rice, vegetables and maize
Anum Valley Irrigation Project	0	Mainly rice growing; a farmer-managed project; also help themselves acquire good prices for their produce
Fumbisi Ablliyeri Group	1	Rice, groundnut and millet farmers
Source: Countrywide survey, 2000/2001, village questionnaire		

Appendix 2

Case studies on rice production in Ghana

Rice production in the Northern Region – Isaac Asare

1. **Introduction**

The study examined the characteristics of commercial rice production in the Northern Region of Ghana and carried out a comparative analysis of the profitability of indigenous and improved rice varieties. In summary, it was discovered that 71% of the farmers interviewed cultivated improved rice varieties, while 29% cultivated indigenous rice varieties. It was also discovered that 78% of the farmers who cultivated improved rice varieties made a profit, as against 22% who incurred losses. By contrast, only 46% of the farmers who cultivated indigenous rice varieties made a profit, while 54% incurred losses. Although farmers prefer the taste of indigenous varieties, the high yield of the improved varieties has outweighed the preference for the eating quality of the indigenous rice varieties.

1.1 **Demography of the Northern Region**

The Northern Region, according to the population census of 2000, has 1,805,428 inhabitants, with a population density of 25.7 persons per kilometre, compared to a national average density of 78.9 persons per kilometre. The region's population represents 9.6% of the national total (Statistical Service, 2002). The annual population growth rate was found to be 2.7% for the region as compared to 2.6% for the entire country.

1.2 Objectives of the study

i. To examine the socio-economic parameters involved in the production of improved rice and the production of indigenous rice varieties.

ii. To find out the cost involved in the production of indigenous and improved rice varieties.

iii. To find out the economic returns of indigenous and improved rice varieties production.

iv. To identify the reasons for the differences in the profit margins (if any).

2.0 Methodology and study area

The study was conducted in the Tolon/Kumbungu District of the Northern Region of Ghana. The district has an area of 2,631 square kilometres and lies at longitudes 10^0 0' and latitudes $9^0$25'N and $10^0$0'1W. The population of the district is 122,550 people (National Population Census, 2000). The study comprised the following communities: Dugu, Tolon, Jajirigu, Zanjbalig-bibu, and Ginganni-villi. A sample of 45 farmers was interviewed using a structured questionnaire.

3.0 Results: Socio-economic characteristics of farmers

3.1. Size of farm holdings

The traditional land tenure system has an impact on the size of the land allocated to individuals and their families. The land size of the farmers interviewed ranges from 0.4–2.4 hectares. From the analysis, 44% of the farmers interviewed had size holdings between 0.4–0.8 hectares; 47% had between 0.8–1.2 hectares, and 2% had between 2–2.4 hectares. Farmers who cultivated improved rice varieties had relatively large land size holdings, compared to the farmers who cultivated indigenous rice varieties.

3.2. Method of land acquisition

From the analysis, 93% and 7% of the land, respectively, was acquired through inheritance and gift. This can lead to fragmentation of the cultivated land, since every parent has to share the land among the children. No farmer interviewed purchased or rented land. Most farmers wanted to increase size holding. However, they were generally hindered by the existing land tenure arrangements. Therefore, there is a need for transformational changes at all levels of land tenure arrangements in order to increase production.

3.3. Sources of inputs (seeds and fertilizer)

Most farmers (62%) processed their own seeds from the previous year's harvest and a few (10%) purchased seeds from market and extension agents. The rest of the farmers (28%) got their seeds from other sources, that is, irrigation schemes and nearby countries. Also, most who applied fertilizer purchased it from the market; a few purchased fertilizer from friends, especially cotton farmers in the area. Farmers complained of the high cost of transportation and unavailability of fertilizer on market days. There is a need to provide centres where farmers can get direct access to these inputs in order to lessen their burden in the search for fertilizer and other inputs.

3.4. Type of labour for farm operations

From the data analysis, 56% of the farmers interviewed used family labour; and 24% and 20% used communal and hired labour, respectively. Family labour is used in operations such as planting, weeding, harvesting and sometimes processing. Hired labour is mostly used in land preparation while communal labour is used in carting harvested rice from the field to the storehouse.

3.5. Type of rice varieties cultivated

From the data analysis, 71% of farmers cultivated improved rice varieties, as against 29% who cultivated indigenous varieties. Major exotic varieties cultivated by the farmers are GR 18 and Farro. Each comprises 22% of the total, while Kpukpula, which is local variety, comprises about 13%. Table 26 shows the frequency of the major rice varieties cultivated by the farmers.

Table 26. Frequency distribution of major varieties cultivated by farmers

Major rice varieties grown in the area:	**Frequency (*n*=45)**	**%**
Indigenous:		
Kpukpula	6	13
Anyofula	3	7
Others	4	9
Exotic:		
Mande	2	4
GR 18 (Afife)	10	22
Farro 15	10	22
Tox varieties	3	7
Others	7	16
Source: Field Survey, 2000		

3.6. Reasons for cultivating local and exotic rice varieties

The study revealed that most people preferred the taste of local varieties for preparation of traditional dishes. Other reasons why farmers cultivated the particular rice variety were also examined. The majority of farmers (71%) in the study area cultivated improved rice varieties because of the high yield characteristics and other qualities such as land suitability, disease resistance and recommendation by extension officers; 29% of farmers who cultivated indigenous rice varieties mostly gave reasons such as availability of seed rice, land suitability, disease resistance and drought resistance. Although farmers prefer the indigenous varieties

because of their palatability, the high yield of exotic varieties has, in many cases, outweighed the particular preference for indigenous rice varieties.

3.7. Sources of credit

Agricultural finance is an important component in increasing the total rice output. However, the analysis confirmed that farmers in the study area do not have access to credit facilities. In order for Vision 2020 to become a reality, credit facilities should be made available to farmers through the Poverty Alleviation Fund and District Common Fund as well as other sources of credit, such as rural banks.

3.8. Sources of technical assistance

Technical assistance is important to increase the overall rice production. From the analysis, 16% of the respondents received assistance from friends, 51% received assistance from extension agents, and 33% received no assistance. Lack of technical knowledge could affect technical and economic efficiency in production. Most of the farmers who cultivated improved rice varieties received assistance from extension agents, while only a few farmers who cultivated indigenous varieties received assistance from extension agents.

3.9. Reasons for rice cultivation

89% of respondents gave cash and food security as the motives behind rice production; 11% of respondents gave cash crop alone as the motive behind rice production.

3.10. Marketing of produce

From the data analysis, most farmers (89%) market their produce through private traders who either come to farms or market centres. The government should provide an enabling environment for the private sector to invest in the purchase of farmers' produce after harvest.

3.11 Determination of price of produce

The data suggests that 51% of farmers determined the price of their produce by bargaining, while 13% had their price determined by sellers and 26% by buyers. The government is not directly involved in price determination.

3.12 The role of women in rain-fed lowland rice production

Women play a major role in rice production. Their involvement is important in all aspects of agriculture: sowing, weeding, harvesting, processing and marketing. Although women can have their own farms, the traditional land tenure system does not favour their total ownership of the land. Out of the 45 farmers interviewed only one was a female farmer cultivating rice.

3.13 Problems facing farmers

The major problems farmers encounter are the high cost of inputs such as fertilizer and tractor services during ploughing, and unfavourable markets. Other problems include: poor distribution of rain, infestation from weeds, poor soil fertility, lack of extension services, lack of credit facilities and lack of improved varieties.

3.14 Analysis of profitability

Analysis of the data indicates that 46% of farmers who cultivated indigenous rice varieties made a profit while 54% incurred loss. Their profits ranged from ¢ 364,500 ($43.91) to ¢ 9,000 ($1.08), while their losses ranged from ¢ 343,000 ($41.32) to ¢ 63,500 ($7.65). The high losses incurred were due to adverse weather conditions. Again, 78% of farmers who cultivated improved rice varieties made a profit as against 22% who

incurred loss. Their profits ranged from ¢ 1,888,000 ($227.46) to ¢ 6,500 ($0.78), while their losses ranged from ¢ 4,000 ($0.48) to ¢ 587,600 ($70.79). Farmers who cultivated improved varieties tended to manage their crops well because of the relatively high investment they had made in rice inputs, as compared to farmers who cultivated indigenous rice varieties. However, for those (22%) who incurred a loss the reasons were mainly: improper management, poor soil type and lack of technical assistance. The average cost of production per hectare was ¢ 612,000 ($73.73) and ¢ 280,400 ($33.78) for improved and indigenous varieties, respectively, per growing season.

The average yield per hectare was about twenty (20) bags and ten (10) bags of improved and indigenous rice varieties, respectively. There was no price difference regarding the rice varieties. The average price per bag (82 kg) was ¢ 40,000 ($4.81) at the time of harvest (2000). The average returns and net income of improved varieties were about ¢ 800,000 ($93.38) and ¢187,500 ($22.59), respectively. The average returns and net income of indigenous varieties were about ¢360,000 ($43.37) and ¢79,600 ($9.59), respectively.

Comparatively, from the analysis of cost and returns, exotic rice cultivation is more profitable as a higher percentage (78%) of farmers made a profit. Indigenous rice varieties were considered to be relatively less profitable, with 54% making a loss and 46% making a profit.

4.0 Summary

Rice cultivation in the Northern Region of Ghana serves to meet the financial needs of the household. It also serves to sustain food security during the lean season. Farmers mostly employed family labour. Women play a key role in rice production.

Most (71%) of the farmers interviewed cultivated exotic rice varieties, while 29% cultivated indigenous rice varieties. This can be attributed to the activities of the extension agents and the high yield qualities of the exotic rice varieties. Land size holdings ranged between 0.4–2.4 hectares. Farmers who cultivated exotic rice varieties had larger sizes of land holdings compared to those who cultivated indigenous rice varieties. The data suggested that 78% of farmers who cultivated exotic rice varieties made a profit, and about 46% of those who cultivated indigenous rice varieties made a profit.

Although indigenous varieties are not very profitable, their cultivation has been an activity that farmers use to cushion themselves against cash and food insecurity during the 'lean' season. There are no official marketing channels for rice in the study area. Forces of supply and demand determine the prices. Government policy in rice production has generally been a disincentive for rice growing in terms of costs of inputs and marketing opportunities in Ghana.

Traditional rice production in the Volta Region – Dominic Donya

1.0 Introduction

1.1 Traditional rice cultivation in Ghana

Rice has been in cultivation in Ghana for a very long time. In the 17th and 18th centuries, rice was already one of the major commercial food crops (Mobil J. et al., 1985). At present, rice is one of the major cereals in Ghana. The Ghanaian rice self-sufficiency rate is about 41% (WARDA, 1986), resulting in high annual imports costing around seven million dollars to meet the growing demand (Andriesse and Fresco, 1991).

In the 1920s, traditional rice farmers in the Volta and Western Regions produced most of the rice in Ghana (MoFA, 1999). In the Volta Region, it is mainly women who carry out rice cultivation, while males focus on the cultivation of tree crops, such as cocoa and coffee. Rice varieties of *Glaberrima* origin are grown on the mountains as upland hill rice. In the inland valleys, mixtures of *Glaberrima* and improved types, mostly of *Sativa* origin, are grown in water-flooded fields. Years of selection under different climatic, soil and cultural conditions have produced marked variability in rice grown in the valley ecologies. Traditional rice varieties are of great importance to the people in the Volta Region.

However, records on rice production are lacking and yields are generally low. There is therefore the need to find out the strengths and weaknesses of rice production in the Volta Region.

1.2 Demography of the Volta Region

The Volta region, according to the National Population Census of 2000, has about 1,630,254 inhabitants, with a population density of 79.3 persons per kilometre, compared to a national average density of 78.9 persons per kilometre. The region's population represents 8.7% of the national total (Statistical Service, 2002). The annual population growth rate was found to be 1.8% for the region, as compared to 2.6% for the entire country.

1.3 Specific objectives of the study

i. To identify which local rice varieties farmers in the Volta Region still grow, and to find out the reason(s) why they grow these varieties.

ii. To identify the constraints and/or potentials of traditional rice production.

iii. To identify elements in governmental policy that encourage/inhibit rice production in the region.

2.0 Justification

The Volta Region is the only region in Ghana in which upland hill rice of *Glaberrima* origin can still be found. The inland valleys, which are abundant in the area, also have specific hydrological conditions that are appropriate for wetland rice cultivation.

In the Volta Region, the traditional hill rice varieties are of great importance to people in a range of contexts, for instance, for rituals, as a staple food, and for festivals. Unfortunately, sufficient records on the nature and extent of constraints as well as potentials for sustainable use of the rice ecologies are generally lacking.

Even the names of rice varieties of *Glaberrima* origin are becoming extinct because of lack of records. The only records that can be found are in regard to female farmers cultivating rice in the valley bottoms; hill rice cultivation is not documented.

However, yields of rice are generally low, that is, between 0.5–2 tons/ha (Otto E. et al, 1996). This study will therefore serve as a document indicating the strengths and weaknesses in terms of rice cultivation in the Volta Region. Gathering of information on local varieties will also help to preserve the threatened rice biodiversity in the region and serve as a useful resource for any future work.

3.0 Methodology

3.1 Study area

The study was undertaken in the Volta Region of Ghana, specifically in Ho and Hohoe Districts. 200 rice farmers were interviewed using questionnaires in 10 villages within two rice-growing ecologies selected at random. The ecologies were:

- Upland (hill) rice and
- Inland valley.

The area under study was roughly rectangular in shape, stretching from Avatime in the South ($6^{0}49^{1}$N) to Akpafu ($7^{o}16^{1}$N), along the Greenwich Meridian.

Table 27. Villages visited, their locations and altitudes			
Date	**Village**	**Location**	**Altitude**
10.05.2000	Avatime Vane	N: 6^0 49’44’’ E: 0^0 25’51’’	501 m a.s.l.3
11.05	Avatime Tsadome	N: 6^0 49’29’’ E: 0^0 25’49’’	502 m a.s.l.
12.05	Likpe Bakwa	N: 7^0 09’18’’ E: 0^0 35’35’’	329 m a.s.l.
13.05	Likpe Bala	N: 7^0 12’21’’ E: 0^0 36’51’’	370 m a.s.l.
14.05	Lolobi Kumasi	N: 7^0 12’06’’ E: 0^0 31’59’’	238 m a.s.l.
15.05	Lolobi Ashanti	N: 7^0 12’08’’ E: 0^0 31’14’’	228 m a.s.l.
16.05	Gbi-godenu	N: 7^0 06’07’’ E: 0^0 27’33’’	194 m a.s.l.
17.05	Akpafu Mempeasam	N: 7^0 14’17’’ E: 0^0 28’09’’	279 m a.s.l.
18.05	Akpafu Odomi	N: 7^0 16’53’’ E: 0^0 28’49’’	273 m a.s.l.
19.05	Santkrofi Bume	N: 7^0 13’08’’ E: 0^0 28’41’’	273 m a.s.l.
Source: Field Survey, May 2000			

4.0 Results

4.1 Farmers' profile

Table 28. Distribution and characteristics of the sample		
Farmer Group	**No. of farmers**	**Characteristics**
Avatime Vane Farmers	20	Mostly females (73%); no extension advice; information about rice cultivation on Radio/TV/leaflet limited (20%); have attended Farmers’ Day
Avatime Tsadome Farmers	20	Mostly females (75%); no extension advice; information about rice cultivation on Radio/TV/leaflet limited (15%); have attended Farmers’ Day
Likpe Bawa Farmers	20	Mostly females (75%); no extension advice; information about rice cultivation- NIL; attended Farmers’ Day; and formed co-operative (under 31st December Women Association)
Likpe Bala Farmers	20	Mostly females (71%); no extension advice; information about rice cultivation-NIL; attended Farmers’ Day; and formed co-operative (under 31st December Women Association)
Lolobi Kumasi Farmers	20	Mostly females (72%); no extension advice; information about rice cultivation- NIL; attended Farmers’ Day; and formed co-operative (under 31st December Women Association)
Lolobi Ashanti Farmers	20	Mostly females (77%); no extension advice; information about rice cultivation- NIL; attended Farmers’ Day; and formed co-operative (under 31st December Women Association)
Gbi-Godenu Farmers	20	Mostly females (90%); have more extension advice; well informed about rice cultivation through media; attended Farmers’ Day; and formed co-operative (under 31st December Women Association)

[3] a.s.l.- above sea level

Akpafu Mempeasem and Akpafu Odomi Farmers	40	Both male and female farmers (50% each); limited extension advice; formed co-operative (under 31st December Women Association)
Santkrofi Bume Farmers	20	Mostly females (75%); limited extension advice; information about rice cultivation through media NIL; attended Farmers' Day; and formed co-operative (under 31st December Women Association)
Source: Field Survey, May 2000		

4.2 Gender issues

There is a sexual division of labour between crops. Women are primarily responsible for field crops (rice, cassava and legumes) while men take care of the tree crops (cocoa, coffee, kola and fruit trees). In the Akpafu area, however, men and women have complementary labour roles for crops. Before the arrival of missionaries in the Volta Region, men were traditionally primarily engaged in hunting, fishing and warfare, while women were responsible for gathering wild leaves and fruits for food. The years 1828 and 1947 saw the arrival of Basel and Bremen Missionaries in the Volta Region and the subsequent introduction of coffee and cocoa plantations, which were soon copied by the men. From then onwards, men traditionally controlled these cash crops, giving the women a small share of the income for their work in coffee harvesting, in transportation of cocoa pods to the compound, and in preparing food for wage or reciprocal labour groups.

Men also determine the size of the area to be cultivated in hill rice, since they clear and burn the land and make the fences needed to keep out rice-eating animals, such as grass cutters. Women also specialize in certain operations such as broadcasting, weeding, winnowing and the selection of seeds. Both men and women are involved in other operations, such as harvesting and threshing.

The question about control of the sale of hill rice is ambiguous. The rice may be stored in mud silos at the husband's compound. The house head either establishes a regular routine of giving the rice out to women to cook, or leaves it in unlocked stores for women to take when needed. In some cases, men sell some of the rice to meet the school fees that fall due at the time of the rice harvest, and before their cocoa and coffee cash crop harvest. However, women also may sell some of the rice in small quantities at a time and control the revenue for their needs. In inland valley ecology, rice cultivation is mostly the women's responsibility. The reason is that during the major farming season, men attend to their tree crop farming, such as cocoa and coffee, while the women migrate from areas like Lolobi, Likpe, Nkonya, Alavanyo, Akpafu and Santrokofi to the inland valleys at Gbi-Godenu to cultivate rice. The women farmers control the sale of the inland rice and use the proceeds from their rice farms to buy goods to fulfil their household needs.

4.3 Tenure arrangements

Upland (hill) ecology- Family lands (95%)
Share cropping (5%)

Inland valley ecology- Hired land for seasonal cultivation (100%)

4.4 Cropping Systems

Upland (hill) ecology- Mixed cropping with crops such as cocoa, rubber coffee

Inland valley ecology- Mostly rice as sole crop

4.5 Farm Size

Upland (hill) ecology- 1.5-2.0 ha
Inland valley ecology- 2.5-4.0 ha

4.6 Planting Calendar

As shown in Table 29, the majority of farmers (58%) plant rice in June–July, after the rains have set in (especially those in the inland valleys). Other farmers (35%) plant rice in March–April at the onset of the major rains (this is related to upland hill rice ecology). While inland valley rice takes 3–4 months, from planting to harvest, upland hill rice takes about 4–5 months. This difference is due to the varieties used in the respective cases.

Table 29. Cropping calendar

Month when most of the rice is planted	% of respondents	Month when most of the rice is harvested	% of respondents
January		January	
February		February	
March	15	March	
April	20	April	
May	7	May	
June	40	June	
July	18	July	15
August		August	58
September		September	25
October		October	2
November		November	
December		December	

Source: Field Survey, May 2000

Table 30. Five basic land preparation methods practised in the study area

Method	No. of farmers	%	Ecology
Slash and Burn	75	37.5	Upland
Slash no Burn	25	12.5	Upland
Power tiller cultivation	15	7.5	Inland valley
Tractor Ploughing	20	10.0	Inland valley
Slash, no Burn, cultivation with Hand Hoe	60	30.0	Inland valley
Herbicides application	5	2.5	Inland valley
TOTAL	200	100	

Source: Field Survey, May 2000

4.7 Rice varieties

Hill farmers are indigenous people who plant only local rice varieties, as indicated in Table 5. The farmers' ancestors introduced these varieties into the area. Of *Glaberrima* origin, they have undergone no form of improvement These varieties have grains coloured either white or slightly red and mature within 4–5 months.

The majority of farmers in the inland valley ecology are settlers. These farmers also grow their own local varieties, which they have grown over the years. In addition to local varieties they also use other improved rice varieties obtained from the Ministry of Food and Agriculture (MoFA) extension services.

Table 31. Rice varieties				
No	**Location**	**Local Name(s)**	**Language**	**Remarks**
1	Avatime Vane	Kimimi or Amum	Avatime	Ewes call it 'Molu'; used for rituals and festivals; not improved; normally not sold; red in colour (grain); husk adulterated with black colour.
2	Akpafu	Kamo	Siwu	The same rice is found at Akpafu; might have been introduced from Avatime; used as food for festivals and ceremonies.
3	Avatime Vane	Amu	Avatime	Similar in type, but grows faster; used for festivals and ceremonies; husk not adulterated.
4	Avatime Tsadome	Wosowoso	Avatime	Used as a staple food resistant to birds because of long awn.
5	Avatime	Emuke	Avatime	Staple food; also sold; double husk, therefore better for storage than other types; not improved.
6	Akpafu	Kawumo	Siwu	Staple food; also sold; with heavy grains.
7	Likpe	Sinyadu	Sekwa	Staple food; and sold at market; good taste.
8	Santkrofi	Akwablu	Buem	Staple food; and sold at market; not common, almost extinct; attacked strongly by birds.
9	Likpe	Mabusui	Sekwa	Staple food; and sold at market; not improved. Sticky in structure when cooked
10	Avatime	Klu I	Avatime	Staple food, and sold at market, not improved; originating from Liberia; high yield.
11	Avatime	Kuru	Avatime	Staple food; and sold at market; almost extinct; attacked strongly by birds.
12	Avatime	Klu II	Avatime	Staple food; and sold at market; not improved; originating from Liberia.
13	Gbi-Godenu	Viwono	Ewe	Cultivated mainly in inland valleys; leading variety in its ecology, due to good taste and high yield.
14	Gbi-Godenu	Adaisi	Ewe	Brought in by the wife of Adai; high yielding and good taste.
15	Avatime	Mighty	English	Branching vigorously; preserved by a man named Mighty.
16	Gbi-Godenu	Akpese or Kado	Ewe	Good variety for transplanting.
17	Likpe	Matter	Sekwa	Preserved by a woman called Matter; good taste.
18	Lolobi	Local white	English	Has itching effects when harvested; high yielding.
19	Gbi-Godenu	Khaki	Ewe	Called 'Khaki' because of its grain colour.
20	Akpafu	Madid	Siwu	High yielding; brought by the man called Madid.
21	Santkrofi	Anango	Buem	Weed resistant, due to its height.
22	Gbi-Godenu	Mattin	Ewe	Preserved by a man called Mattin; good taste.
23	Lolobi	Toss	Lolobi	Preserved by a man named Toss; high yield.
24	Likpe	Kabore	Sekwa	Brought by Kabore; high yield.
25	Gbi-Godenu	Kawawa	Ewe	Preserved by Kawawa; drought resistant
26	Gbi-Godenu	Nigeria	English	From Nigeria, resistant to lodging.
27	Gbi-Godenu	Long grain 'perfumed'	English	Fine scent when cooked; grains are long
Source: Field Survey May, 2000				

4.8 Reasons for planting local varieties

The ultimate aims for growing local varieties in the study area are for food (upland ecology) and cash (inland valley). Other reasons given for growing local varieties are:

- For rituals and special festivals;
- For staple food;
- Resistance to birds;
- Convenient for long-term storage.

4.9 Management of ratoon crop

Rice belongs to the *Graminea* family and thus possesses the ability to regenerate itself upon harvesting through a process called 'ratooning', which involves the development of new tillers. According to Chauhan et al. (1985), rice ratooning has many advantages, such as:

i. Lower production cost,
ii. Shorter crop duration.

Research work on the ratoon rice crop has only been carried out at the Gbi-Godenu site (Kranjac-Berisavljevic', 1993). About 40% of farmers left their field to ratoon. Farmers also claimed that seeds from the ratoon crop are the best for planting, since they are free from disease and pests, and in most cases well dried. It is therefore necessary to investigate the management of rice ratooning and educate farmers accordingly.

4.10 Pests and diseases

Table 32. Major pests and diseases

		Local name	**Language**
Weeds	*Scientific name*		
1	Panicum maximum	*Esii*	Ewe
2	Imperata cylindrica	*Ebe*	Ewe
3	Euphorbia spp.	*Miliki gbe*	Ewe
4	Chromolaena odorata	*Acahmpong gbe*	Ewe
5	Commelina esculentum	*Abgenokunoku*	Ewe
Diseases	*English name*		
1	Brown leaf spot		
2	Blast		
3	Yellow mottle		
Field pests	*English name*		
1	Grasscutter (Rodent)	*Nukpui (Exor)*	Ewe
2	Quilla quilla (Bird)	*Xevi*	Ewe
Storage pests			
1	Rat	*Botoe/Kisii*	Ewe
2	Mouse	*Afii*	Ewe
Source: Field Survey May, 2000			

4.11 Storage methods

Table 33. Storage methods for harvested rice		
Method	**No of Farmers**	**%**
Keep the panicle heads in barns/cribs at home	50	25
Keep the panicle heads on raised platforms at home	9	4
Keep the panicle heads in silos	14	26
Threshed and stored in silos	65	32.5
Threshed but spread on floor in the room	10	5
Threshed and stored in sacks (jute, cement paper)	52	26
TOTAL	200	100
Source: Field Survey May, 2000		

4.12 Marketing and processing

Marketing of paddy rice poses no special problem. Marketing outlets for rice in the study area are numerous. Farmers sell to other farmers, local assemblies, and itinerant middlemen. The principal marketing problem the farmers faced was the fact that traders dictate prices and at times buy on credit. Other minor problems were poor quality, poor visual appearance, and high level of foreign materials. The type of processing identified in the study area is small-scale, mainly for local consumption. It involves hand pounding of paddy using a wooden pestle and mortar. Parboiling is not practised in the study area, since there is not a high level of broken grain with these processing methods.

5. Summary

The Volta Region, the only region in Ghana in which upland hill rice of *Glaberrima* origin can still be found, may provide an environmentally sustainable and economically sound base for increased rice production in Ghana.

The study showed that rice farmers in this area are mostly women (above 75%), while men see to the cultivation of cash crops such as cocoa, coffee and kola. Almost all (95%) of the farmers within the hill rice ecology are indigenous people, with the remaining 5% being settler farmers. In the inland valley ecology, however, migrant farmers from Hohoe, Ho and Kpandu districts, who are traditionally growing rice, form the bulk of the respondents. In hill ecology, family land forms the basis of tenure arrangements, while in the inland valleys land is hired for rice cultivation seasonally. Rice yields are generally low (0.5–2tonnes/ha). Factors such as skills in rice cultivation, access to land, access to labour and availability of traditional rice varieties contribute to type of rice cultivation.

The farmers identified about 10 different constraints on increased rice production. The most important of these was weed infestation (65.5%). This was followed by lack of formal credit to farmers (50%), health constraints (47%) related to cultivation of rice, lack of improved seeds (30%), and high input cost (25%).

Government policies have not been favourable to traditional rice production. The cost of inputs is generally high and marketing of indigenous rice varieties is considered to be relatively poor.

Traditional rice production in the Upper West Region – Isaaka Balma Yakubu

1.0 Introduction

1.1 Background to the study

i. The scope of the study was based on the aims and objectives:

ii. To identify rice production areas in the Upper West Region

iii. To identify the constraints and/or potentials of rice production

iv. To identify which local rice varieties in the Upper West region farmers still grow and to find out the reason(s) why they still grow these varieties

v. To identify elements in government policy that encourage and/or inhibit rice production in the Region.

1.2 Physical environment of the Upper West Region

1.2.1 Location, topography and geological features

The Upper West Region (UWR) is located in the furthermost north-east of Ghana. It covers an area of approximately 18,480 square kilometres (7.8% of the country) and is found within latitudes 9^0 35^IN to 11^0 N and from 1^0 25^I E to 2^0 50^IE. The region shares a common boundary with Burkina Faso to the North and West, Upper East Region to the East, and the Northern Region to the South.

The region is geologically part of the high plains that cover most of the North-west of Ghana. These are characterised by a series of wide plateaus made up of Birimian and post-Birimian granites and their weathered materials.

Altitudes vary from 200m to about 350m a.s.l. The highest point in the region is the cone-shaped, granitic Kaleo hill situated about 12km north of Wa with an altitude of 435m a.s.l.

1.2.2 Vegetation

The Upper West Region is characterised by the Guinea Savannah zone to the south and the Sudan Savannah to the north and northeast. The borderline between the two zones is located approximately between Jirapa and Nadoli. The Sudan Savannah is characterised by scattered trees and a sparse ground cover of grasses. Trees commonly found here include *Baobab* (*Adansonia digitata*), *Dawadawa* (*Parkia biglobosa*), *Shea* (*Vitellaria paradoxa*), *Acacia albida* and a species of *Albizzia.*

The vegetation in the Guinea Savannah is characterised by a higher density of pro-climax tree species among which the predominant ones are *Isoberina doka, Isoberina dalxieli, Daniella spp, Khaya senegalensis* and other *Khaya* species, *Diospyros mespilliformis*, as well as *Parkia clappertoniana* and *Vitellaria paradoxa*.

The vegetation has been degraded in both agro-ecological zones as a result of annual bush burning. Slopes are steeper and population pressure higher in the northern part of the region, where erosion is becoming a problem.

1.2.2 Climatic conditions

The climate of the Upper West region is characterised by a short, unimodal rainfall regime and a long dry season from October to the end of April.

The total annual rainfall and the rainfall distribution vary considerably from year to year. In general, average annual rainfall increases from less than 900mm (Tumu) in the North, to approximately 1110mm in the South

(Wa). The long term mean annual temperature for Wa is 27.2°C, with mean maximum and minimum temperatures being 35.5°C and 18.8 °C, respectively.

1.3 Demography of the Upper West Region

The Upper West Region, according to the population census of 2000, is one of the least populated regions in Ghana with a population density of 31.2 persons per kilometre, compared to a national average density of 78.9 persons per kilometre. The region has 573,860 inhabitants, representing 3.1% of the national total (Statistical Service, 2002). The annual population growth rate was found to be 1.7% for the region as compared to 2.6% for the entire country.

1.3.1 Ethnic composition

The majority of the people in the region belong to the Mole-Dagbani group among which the major ethnic groups are: the Dagaaba, Sissala, Wala, Chakali and Lobi. Other ethnic groups in the region include: the Hausa, Fulani, and Mossi, who are settlers from neighbouring countries.

The major ethnic groups are predominantly partrilineal. Islam and Christianity are the major religions in the area exisiting alongside traditional beliefs.

1.4 Agricultural production in the Upper West region

Cereal production is an important component of farming systems in the Upper West region. Important among these are sorghum, millet and, to a lesser extent, rice.

Farmers in the Upper West region grow rice under very trying conditions because of the unreliable climate, diseases and pests. The adverse climatic conditions are coupled with scarce resources at the disposal of farmers, which makes input acquisition a chronic problem. Farmers therefore mostly rely on traditional rice varieties, suited to growing in unfavourable conditions.

2. Methodology

The study involved the use of questionnaires, key informant interviews and focus group discussions to elicit answers on various aspects of rice production on individual and village levels. Questions included:

- Socio-economic issues,
- Tenure arrangements,
- Agronomic issues,
- Reasons for planting rice,
- Marketing and processing,
- Constraints on rice production
- Ecological and environmental issues.

Key informant interviews were used to draw out further information, especially at the village level.

2.1 The study area

Five communities were selected for the study upon consultation with the Ministry of Food and Agriculture Regional Office in Wa in April, 2002. These communities were Zingu and Mangu in the Wa District, and Hamile, Happa and Bamuo (together with Chetu) in the Jirapa/Lambusie District. The study areas are indicated in Map 1. The various villages, together with their approximate locations and altitudes, are indicated in Table 34 below.

Table 34. Schedule of visits to Upper West Region			
Date	**Village**	**Ethnic group**	**Location**
16/04/02	Mangu	Wala	10^0 03^{I}N 2^0 31^{I}W
19/04/02	Zingu	Dagaaba	10^0 05^{I}N 2^0 34^{I}W
24/04/02	Hamile	Sissala	$11^0$0^{I}N 2^0 44^{I}W
27/04/02	Happa	Sissala	11^0 02^{I}N 2^0 36 ^{I} W
29/04/02	Bamuo (with Chetu)	Sissala	11^0 03^{I}N $2^0$05^I W
Source: Field Survey, April 2002			

3.0 Results

3.1 Socio-economic issues

About 32% of interviewed farmers indicated that they were household heads, while the remaining 68% said they were not. This may be due to cultural reasons. A young person cannot lay claim to the headship of a household if his father is still alive and shares the same house with his children. It is only after the father's death that children may be heads of their own households.

Farming is the major source of livelihood for 82% of the respondents, while 11% and 7% respectively indicated that they are employed in the public/civil sector or as traders.

Literacy levels are low in the region and among farmers in particular. About 79% of farmers interviewed have no formal education, compared to 21 % who have had access to some form of formal education.

Table 35. Occupation of household heads					
Occupation					
	Literate		*Illiterate*		
	Male	Female	Male	Female	TOTAL
Farmer	13	-	53	16	82
Trader	2	-	2	3	7
Other	6	-	3	2	11
TOTAL	21		58	21	100
Source: Field survey, April, 2002					

3.1.1 Household profiles

Islam and traditional religion are dominant in the study areas. Polygamy is a normal practice, resulting in large family sizes. The average household size is 16, with up to eight children, three each of men and women and two absentee members. A household normally includes one or more relatives. Absentee members of the household are mostly young men who migrate to the South of the country in search of work. Two forms of migration occur in the region: permanent and seasonal (where absent family members return in time to till the land during the farming season).

3.1.2 Gender issues

Agriculture in the Upper West Region is a male dominated activity and this is clearly demonstrated by the gender composition of the respondents. About 79% of the interviewed farmers were male, compared to 21% females (Table 36). Several factors are responsible for the low participation of females in farming in general. These include: a land tenure and system of inheritance which shows a bias against females, lack of access to resources required for farming by females, and a general lack of female emancipation ensured by a suppressive culture which relegates females to being the "property" of their husbands.

Gender roles in rice production are clearly defined although not mutually exclusive of each other. This is especially true for female farmers who most often carry out all activities by themselves. In general, land preparation is mainly a male activity, while planting, transportation and winnowing are mainly female

activities. Weeding, harvesting and threshing are activities that are carried out by both sexes. Details are presented in Table 36 below.

Table 36. Gender roles in rice production

Activity	**Location**			
	Bamuo	Hamile	Mangu	Zingu
Land preparation	Male	Male	Male	Male
Planting	Female	Female	Female	Female
Weeding	Male	Both	Both	Male
Harvesting	Male	Both	Female	Both
Transporting	Female	Female	Female	Female
Threshing	Both	Both	Male	Male
Winnowing	Female	Female	Female	Female

Source: Field survey, April, 2002

3.1.3 Tenure

In most parts of the study area, land is still available but increasingly becoming besieged by the problem of population pressure, resulting in continuous cultivation and depletion of soil nutrients.

Private land ownership is non-existent in the communities studied during the field survey and land ownership is usually communal with individual user rights. Traditionally, tenurial rights are leased to farmers by the *tendana* (spiritual 'owner' of the land) in traditional tenurial systems of Northern Ghana and are usually hereditary. Land is mostly given free of charge to individual household heads and therefore reselling is strictly forbidden. Customarily, however, the land-receiving party may give a token, usually a few cola nuts or fowls to the *tendana* as a gesture of appreciation, but this is not an obligation. In villages with land pressure, old fallow lands may be relocated. Farmers are free to borrow land or lend it to each other under this arrangement. This is seen as a strictly personal arrangement and does not involve the *tendana*.

Young men and women are allocated land through their fathers and/or husbands, respectively. If land is abundant, young men may request land from their village authorities. Women, traditionally, have no right to own land. They may, however, 'borrow' small pieces of land from their husbands to grow crops such as groundnuts, rice and vegetables. This depends on whether the husband has enough land to grow staple cereals for the household. Where the land is not sufficient, the husband may just allow the wife to intercrop her crops on the household's fields. In such cases, crops grown by the wife are limited to leafy vegetables.

All the above tenurial arrangements were represented in the field study, carried out during April 2002. The majority of respondents (75%) indicated that they had access to their farmlands through inheritance. About 15% of farmers farm on borrowed land, for which they pay a token in kind to the landowners at every harvest. This is not a binding arrangement, but is seen as method of securing a farmer's tenure on borrowed land and depends largely on how serious such an arrangement is adhered to.

All the women interviewed in the study 'borrowed' land, either from their husbands or male blood relations, and were allowed to farm it as long as the owner had no use for it. Thus, tenure security for women is not assured, but depends on the goodwill of the male relations.

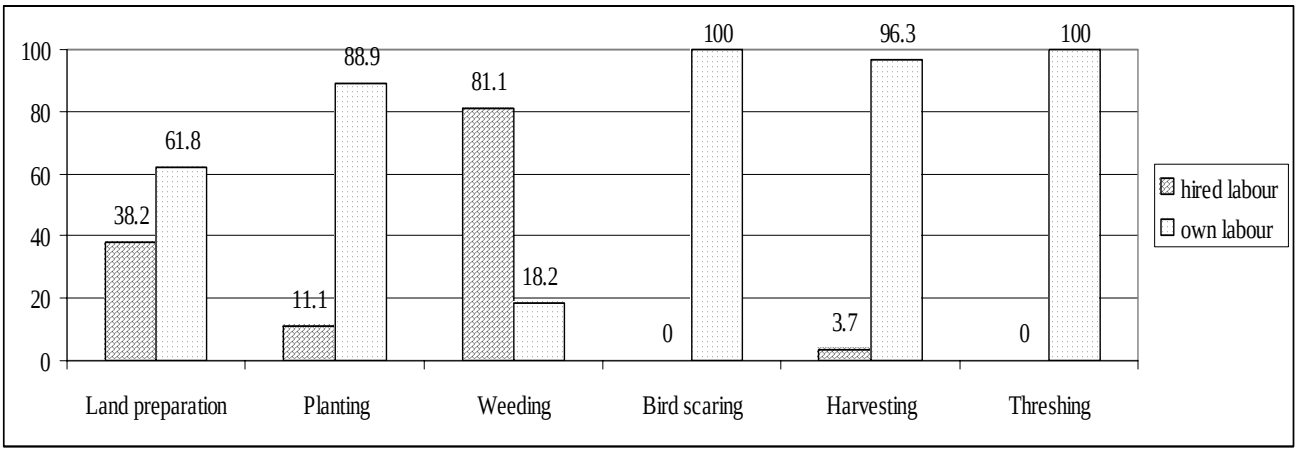
3.1.4 Access to labour

The common practice in the study area is that farmers come together and work in turns on each other's farms to offset the labour shortage during certain critical periods, especially during the weeding, harvesting and planting stages of farm operations.

The majority of farmers interviewed (55%) indicated that they employ labour for rice cultivation while the rest (45%) said they do not. Labour is employed mainly for weeding (81.8%) and land preparation (38%),

and to a lesser extent harvesting (3.7%) and planting (11.1). No labour is employed for harvesting and bird scaring. Bird scaring is normally left to young children in the family. See Figure 8 below.

Figure 8. Requirement for hired labour during rice cultivation, Upper West Region.
(All figures are in %; *n*=100).



The labour rate per man day in the study area ranged between ¢2,000 ($0.24) and ¢10,000 ($1.20) with an average rate of ¢ 4,903 ($0.59), while the average labour rate per acre was ¢ 48,378 ($5.82) and ranged between ¢ 20,000 ($2.40) and ¢ 70,000 ($8.43; 1$ = approx. ¢ 8 300).

3.1.5 Place of rice in rituals and festivals

Rice is not used for rituals in the study area. It is, however, the most commonly accepted food to serve during festive occasions such as Christmas, 'outdoorings', for instance, the naming ceremonies of newly born babies, and marriage ceremonies.

3.2 Agronomic issues

3.2.1 Rice ecologies

Irrigated rice production is insignificant in the Upper West Region in general and particularly in the study area. Rice production is carried out mostly in lowlands and valley bottoms.

3.2.2 Methods of land preparation

The majority (77%) of rice farmers prepare their rice fields manually, using hand hoes, while 8% and 15%, respectively, employ tractor and animal power during land preparation. The reasons given for manual land preparation include high cost and unavailability of tractor services.

It was further found that six interviewed farmers used animal traction and owned their own animals, while the others hired animals for land preparation. This situation is not surprising since animal rearing, especially cattle, is an important component of farming systems in the study area.

Table 37. Sources of power for land preparation, Upper West Region

Manual labour		Tractor power		Animal power		Total
Hired	Own	Hired	Own	Hired	Own	
1	76	7	1	9	6	100

Source: Field survey, April 2002

3.2.3 Planting methods

The most common method of planting rice is by digging holes in the ground with the aid of a hand hoe at the start of the main rains. Dry rice seeds, held in a calabash specially made for the purpose, are then dropped in small quantities into the holes and covered up. This is different from broadcasting, which is used in the waste floodplains of the White Volta, where the bulk of rice production in northern Ghana is carried out. This planting method is suited to small plots generally cultivated with rice in the Upper West region.

The method of planting further allows the intercropping of rice with other crops, which is a common practice in the study area. Rice is mostly intercropped with maize, millet, sorghum, a vegetable such as okra, and yam, especially in the lowlands. Rice is often cultivated in furrows between ridges on the farm. Farmers have higher yields than broadcasting by using this method. Weeding is also easier when rice is cultivated in this manner, even though the labour requirement in land preparation is relatively high, as presented in Figure 8 above.

3.2.4 Cropping calendar

Most of the rice is planted during the last two weeks of May before the valleys and lowlands get flooded. The planting period may extend to June if seasonal rains do not begin early. The time of the harvest depends on the variety cultivated, but on average most of the rice is harvested in September. Weeding is normally done once, 3–4 weeks after planting. However, in dry years a second weeding is needed to keep weeds in check.

Table 38. Rice cropping calendar, Upper West Region

Activity		**Month**	
Land preparation		April–May	
Planting		May–June	
Weeding		June–July	
Harvesting		August–September	
Month when most of the rice is planted	**% Respondents** (n=100)	**Month when most of the rice is harvested**	**% Respondents** (n=100)
May	75	August	20
June	25	September	80
Source: Field Survey, April, 2002			

3.2.5 Seed sources

Farmers obtain seeds from various sources. The common method is to buy from traders (66%). Other sources from which farmers obtain seed include exchange or buying from other farmers (30%) and by also by keeping the seed from traditional varieties, from year to year (9%). These practices often result in seed impurity, which was found to be very common in the study area.

None of the respondents in the study obtained seed from the Ministry of Agriculture or Non-Governmental Organizations.

Table 39. Seed sources, Upper West Region

Seed source	% (n=100)
Traders (market)	66
Other farmers	30
Inherited	4
Source: Field survey, April, 2002	

3.2.6 Farmers' perceptions of seed quality

The majority of farmers (86%) maintain that they do not have problems obtaining seed for rice cultivation. 92% of farmers said that they do not encounter seed quality problems, while only 8% said that they do have certain problems. However, further discussions revealed that farmers perceive seed quality problems only in terms of germination. They did not see the quality of rice as a problem because buyers do not pay attention to the quality of their rice when buying.

About 51% of farmers interviewed indicated that they had heard about new varieties of rice, but have no access to any of these varieties. Farmers in areas closer to Burkina Faso, however, indicated that they benefit from variety exchange across the border.

Table 40. Local rice varieties identified in the study area, Upper West Region

No.	Location	Local Name(s)	Language	Duration	Remarks/Attributes
1	Happa/Bamuo	Mui Pumo	Sissal	90 days	Grain colour: white Husk colour: brownish Tasty Higher rate of expansion Minimum bird attack due to irritating hairs on husk
2	Happa/Bamuo	Kolokolo miise	Sissal	120 days	Grain colour: white Husk colour: brownish Tasty Drought resistant Minimum bird attack (mature with millet which is preferred)
3	Happa/Bamuo	Mui Kiereh	Sissal	90 days	Grain colour: white Husk colour: brownish Tasty Higher rate of expansion Minimal bird attack due to large size Drought resistant
4	Happa/Bamuo	Mui Bino	Sissal	90 days	Grain colour: white Husk colour: blakish Hydrophilic High incidence of bird attack
5	Happa/Bamuo	Mui Gonho	Sissal	90 days	Grain colour: white Husk colour: brownish Ratoon variety Hydromorphic/hydrophilic High incidence of bird attack
6	Bamuo	Kilo	Sissal	90 days	Grain colour: white Husk colour: brownish Hydrophilic High incidence of bird attack
7	Chetu	Kambang	Name of farmer who first introduced it from Burkina Faso	180 days	Grain colour: white Husk colour: brownish Hydrophilic Minimum bird attack: harvested after birds have migrated. NB: Farmers like it because it is harvested after most crops and therefore is not constrained by

No.	Location	Local Name(s)	Language	Duration	Remarks/Attributes
					labour shortage.
8	Chetu/Brutu	Sissala mui/Dagara mui	Sissal/Dagaare	90 days	Grows wild in rice fields Grain colour: reddish Husk colour: brownish Easily spills if not harvested early High incidence of bird attack Spiny husk (making it difficult to harvest with bare hands)
9	Baseble	Nigeria		90 days	Grain colour: white Husk colour: brownish Hydrophilic Long grain
10.	Baseble	Kru		90 days	Grain colour: white Husk colour: brownish Hydromorphic/hydrophilic
11	Baseble	Santamaal		90 days	Grain colour: white Husk colour: brownish Hydromorphic/hydrophilic
12	Lambusie	Kye-Kyi-Ke-Forr	Dagaare	120 days	Grain colour: white Husk colour: brownish Hydrophilic Minimum incidence of bird attack due to irritating hairs on husk
13	Lambusie	Summe da kparu	Dagaare	90 days	Grain colour: white Husk colour: brownish Hydromorphic/hydrophilic
14	Zingu/Mangu	Mui Kpon	Waali	120	Grain colour: white Husk colour: brownish Hydrophilic
15	Zingu/Mangu	Mui Bile	Waali	90 days	Grain colour: white Husk colour: brownish Hydrophilic/hydromorphic
Source: Field survey, April, 2002					

Table 41. Reasons for planting local rice varieties

Reason	% of respondents (n=100)
Local varieties do well even without chemical inputs	65
No access to improved varieties	10
Local varieties are drought resistant	13
Local varieties are tasty	12
Source: Field survey, April, 2002	

3.2.7 Pests and diseases

Pests common in the study area include birds and mammals, such as mice. The most often mentioned disease is rice blast. During drought years, caterpillars often cause extensive damage to rice with most farmers losing their entire crop.

3.2.8 Marketing and processing

The processing of rice is generally poor. This mostly involves threshing by beating harvested rice with sticks on the bare ground on the farm. This practice results in farmers not only loosing some grains, but also leads

to impure grain which normally gets mixed with stones and sand. Rice is normally not milled by farmers before selling. For their own consumption, smaller quantities are pounded with a mortar and pestle and this results in a high percentage of broken grains.

3.2.9 Marketing

All the farmers indicated that they sell their rice to traders who either visit their villages on market days or go to the nearest market centre to meet the farmers there. Traders dictate the price. Seasonally, the price is the lowest immediately after harvest, reaching a peak just before the next planting season. The price of a bowl of rice, the usual measure adopted by both farmers and traders, is on the average 800 *cedis* ($0.09) after harvest and about 3000 *cedis* ($0.36) just before planting (2002 prices).

3.2.10 Cost and availability of inputs

Very few farmers in the study area use chemical inputs in rice production; when used it is restricted to fertilizer (15%). Some farmers also use manure (21%) for fertilization of their farms. Farmers cannot afford chemical fertilizer in most cases. Fertilizer is therefore often bought in small quantities from retailers and applied without regard to the recommended application rates. Although farmers know that little effect can be achieved by this practice, it is done against the psychological backdrop that "if we do not apply fertilizer (no matter how small) we will get nothing from our farms".

Table 42. Input use in Upper West Region

Type of input used	n= 100
Manure	21
Inorganic fertilizer	15
Insecticide	-
Herbicide	-
Grass as green manure	1

Source: Field survey, April 2002

3.2.11 Cost and availability of labour

Cost of labour in the study area is about 4,903 *cedis*/*manday* ($0.59). This rate is not easily affordable for small-scale farmers. The majority of farmers require labour for weeding which, if not done at the right time, can lead to substantial losses of crop. At the peak demand period for labour, farmers sometimes pay as much as 10,000 *cedis*/ *manday* ($1.20).

3.2.12 Extension

Access to extension by rice farmers in the study area is generally poor. Only 25% of 100 interviewed rice farmers have access to extension services from extension agents of the Ministry of Food and Agriculture.

4.0 Conclusions

Rice cultivation in the Upper West Region is a traditional activity that has not experienced many changes over time. It is a risky occupation, due to rainfall unreliability, and farmers mainly grow local rice varieties that can withstand drought and do not require a high level of agricultural inputs. Extension services, advice and new varieties are not very accessible in the study area. About 15 varieties, mostly local, were identified during the field survey in April 2002. The sample comprised 100 small-scale rice farmers.

The main problems in rice production are those of subsistence farming in general, i.e., a lack of labour when required for weeding, the high cost of land preparation, difficulty with processing where mechanization of the operations is almost absent. This situation produces poor grain quality and market prices, dictated by the traders, are generally low.

Traditional production of rice in the Western Region – Bizoola Zinzoola Ganda

1.0 Introduction

1.1 Traditional rice cultivation in the Western Region

In the early parts of the 20th century, the Western Region, together with the Volta Region, was the centre of rice cultivation in Ghana. Its importance for rice production at national level has decreased since that time, but it nevertheless remains one of the important regions for rice production in the country.

1.2 Demography of the Western Region

The Western Region, according to the National Population Census of 2000, has about 1,916,748 inhabitants, with a population density of 80.1 persons per kilometre, compared to a national average density of 78.9 persons per kilometre. The region's population represents 10.2% of the national total (Statistical Service, 2002). The annual population growth rate was found to be 3.2% for the region, as compared to 2.6% for the entire country, which is, apart from urban centres such as Kumasi or Accra, one of the highest growth rates in the country. This is mainly a result of migration of people from other parts of the country to work in the gold mines located in the region. Various ethnic groups are therefore mixed in this area, and most of the traditional systems of farming have been abandoned in favour of the gold mining industry. Mangrove rice farming, which was once practised in this area, has now been totally abandoned; during the survey in May–June 2002, no farmers practising this type of rice cultivation were interviewed.

2 Methodology

The study was carried out during May–June 2002. It involved the use of questionnaires and key informant interviews to elicit answers on various aspects of rice production on an individual as well as village level. The range of questions in the questionnaires included: socio-economic issues, tenure arrangements, agronomic issues, reasons for planting rice, marketing and processing issues, constraints on rice production, and ecological and environmental issues. Key informant interviews were used to extract further information, especially at the village level.

2.1 The study area

Only three communities were selected for the study upon consultation with the Ministry of Food and Agriculture in the Western Region. Part of the reasons for selection included accessibility as well as experience and tradition in growing rice. In total, about 90 farmers were interviewed during the study period in May 2002. The details representing the locations of the visited communities are presented in Table 43 below.

Table 43. Location of communities involved in field survey in Western Region

Village	Ethnic group	Location
Twer Nyame	Wasa	$N05^0$ 04' $W0^0$10 39'
Dompim No. 1	Wasa	$N05^0$ 06' $W0^0$10 40'
Kwabina Ano Krom	Wasa	$N05^0$ 05' $W0^0$10 06'
Source: Field Survey, May 2002		

3.0 Results

3.1 Socio-economic issues

The majority (68%) of farmers interviewed were household heads, with farming as their major occupation (93%). Despite the mining and forest exploration industries in the Western Region, it is still a major food and cash crop growing area with a large influx of people from other parts of Ghana arriving to undertake farming.

The literacy level of the respondents was about 52%, which is a high figure for the farming community in Ghana, especially when compared to results obtained elsewhere during the survey (e.g. the Upper West and Northern Regions).

The out-migration levels were very low among interviewed households, with only 4.4% experiencing out-migration of some members. This is to be expected in the region that attracts people from other parts of the country in search of jobs.

In total, 45.5% of rice farmers were not indigenous to the Western region. They were mostly Ewes, from the Volta Region (44.4%), with 1.1% Asante coming from the Ashanti Region that lies to the north of Western Region (see Map 1). The results confirm the initial assumption that people migrate to the Western Region form other parts of the country to farm and obtain income.

3.1.1 Household profiles

The average household among interviewed farmers had six members, comprising two males, two females and two children. The most frequently occurring household size (mode) was four. This figure is relatively low compared to farming household sizes elsewhere in the country, especially in the northern parts. Smaller household sizes encountered in the Western region could partly be accounted for by the dominance of Christianity and, therefore, monogamy among the people interviewed. Moreover, the higher level of education among farmers could mean that farmers are more likely to adopt family planning practices resulting in smaller family sizes.

The average age of respondents was 37 years and ranged between 18 and 79 years. This indicates a relatively youthful faming population among rice growers in the area.

3.1.2 Gender Issues

Agriculture in the Western region in general is male dominated. About 94% of respondents were male. There appear to be no clearly defined gender roles in rice cultivation in the Western Region as both males and females are involved in almost all the activities regarding rice cultivation. The situation on the ground is presented in Table 44 below.

Table 44. Gender roles in rice production, Western Region

Activity	Dompim No. 1	Twer Nyame	Kwabina Ano Krom
Land preparation	Machinery	Machinery	Machinery
Planting	Men	Both	Both
Weeding	Both	Both	Both
Harvesting	Men	Both	Both
Transporting	Both	Machinery	Machinery
Threshing	Men	Men	Men
Winnowing	Both	Women	Women
Source: Field Survey, May 2002			

3.1.3 Land tenure

The system of inheritance in Western Region is generally patrilineal, where the ultimate right of land ownership is vested in the oldest male member of the lineage, the *abusuapayin*. Once land is allocated to a member of the family, it remains in his possession. Women in this part of the country have a right to land ownership through inheritance.

Systems of land tenure among rice farmers include outright ownership and renting. The *abusua* system of share cropping that is common elsewhere in the region was conspicuously missing among rice farmers. The

majority (53.3%) of rice farmers rent land for cultivation while the rest own the land. Payment is either in kind or cash. Farmers paid between ¢150,000 ($18.07) and ¢500,000 ($60.24) as rent for land/season. In-kind payment ranged from between one and four bags (of 82 kg) of rice/season.

3.1.4 Access to labour

The majority (93.3%) of rice farmers said that they hire labour for farm operations when it is available. However, manual labour is scarce and most rice farmers rely on family labour. Although the Western Region is a major destination for seasonal migrants from other parts of the country, high demand for labour especially in cultivation of cash crops, as well as the mining and timber industry, make it difficult for rice farmers to get access to hired labour. Table 45 below indicates the situation.

Table 45. Use of hired labour for rice production, Western Region

Activity	**% Farmers using hired labour** (n=90)
Weeding	22.3
Land preparation	37.1
Harvesting	50.0
Planting	16.7
Bird scaring	2.2
Source: Field Survey, May 2002	

Labour costs in the study area ranged between ¢3,000 ($0.36) and ¢15,000/*manday* ($1.80) at the time of the study.

3.1.5 Ecologies represented

Various rice varieties, cultivated in diverse ecologies, were identified in the Western Region. These include rain-fed upland, rain-fed lowland and valley bottom ecologies. Most respondents cultivate valley bottom varieties of rice followed by rain-fed lowland and then by rain-fed upland varieties. Table 46 below summarises the situation prevailing in the region.

Table 46. Rice ecologies represented in the survey, Western Region

Ecology	**% Respondents** (n=90)
Rain-fed upland	20.0
Rain-fed lowland	36.7
Valley bottom	43.3
Source: Field survey, May 2002	

Seasonal flooding is a problem for rice farmers farming in the valley bottom ecology; it is not experienced at all in other ecologies. Most farmers in valley bottom ecologies said they have experienced flooding on their farms in the past ten years. 87% had had between one and two floods on their farms in the past 10 years, while the others have experienced up to five floods. This information clearly calls for the construction of water regulatory structures on the farmers' fields for improved rice production.

Farming in valley bottoms has only marginal advantages over farming in other ecologies. 26% of farmers in valley bottoms intentionally trap fish on their farms thus earning additional income, but respondents did not mention any other advantages.

3.1.6 Use of Inputs

The inputs most commonly used by rice farmers in the Western Region were chemical fertilizers and insecticides. This is indicated in Table 47 below. The use of herbicides is understandably low since most

farmers operate on a small scale and find it cost effective to weed their fields manually instead of using insecticides. The use of herbicides was therefore limited to large-scale rice growers. Some farmers mentioned that they did not use grass as green manure because they wanted their farms to be clean.

Table 47. Use of inputs by farmers in Western Region	
Inputs	**% respondents** (n=90)
Manure	5.6
Fertilizer	66.7
Insecticide	71.1
Herbicide	6.7
Grass as green manure	3.3
Source: Field survey, May 2002	

3.1.7 Source of power for land preparation

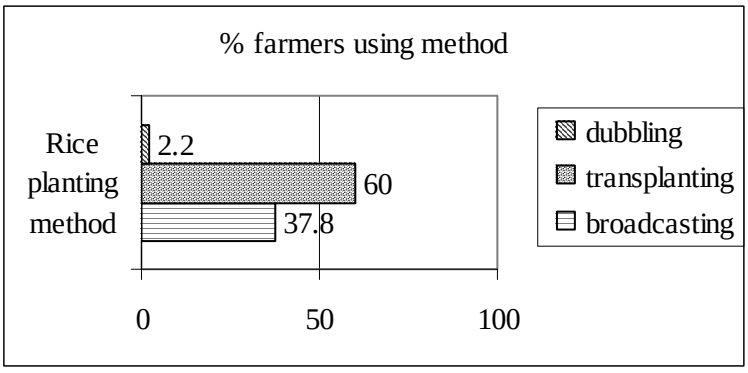
The majority of rice farmers in the Western Region employ machinery for land preparation. About 61.8% of farmers interviewed used power tiller for land preparation, while 37.1% used manual labour. Only one farmer used animal traction. It is significant to note that none of the farmers used tractors due to natural forest prevailing in the study area, making the use of tractor difficult and uneconomical. .

Only 10% of farmers owned the power tillers used in land preparation. The only farmer who used animal traction also owned the animals and equipment.

3.1.8 Agronomic practices

Common planting methods among rice farmers were broadcasting, transplanting and dibbling, as indicated in Figure 9 below. Most of the rice is planted in July and harvested in November. This means that most of the varieties are late maturing.

Figure 9. Rice planting methods used in Western Region
(Source: Field survey, May 2002)



3.1.9 Extension

Rice farmers in the Western Region benefit from extension more than in other parts of the country. About 74% of farmers interviewed indicated that MoFA staff visited them on regular basis. Again, 74.4% said they have heard news about improved rice cultivation on the radio. A further 61.1% of the respondents had attended Farmers' Days organized by the MoFA. However, only 4.4% had ever received any leaflets on rice cultivation.

3.1.10 Farmers associations

Rice farmers in the Western Region belong to various associations, mainly for the purposes of marketing rice and determination of price. About 67.8% of rice farmers interviewed belonged to such associations.

3.1.11 Sources of seed and preferred varieties

Most rice farmers obtain seeds by exchanging with other farmers as well as from the MoFA. Other sources of seed included the ancestors and traders. Table 48 presents the situation.

Table 48. Sources of rice seed available to farmers in Western Region

Seed source	(***n***=90)
Traders (market)	4
Other farmers	37
Inherited (ancestors)	18
MoFA	31
Source: Field survey, May 2002	

Only 13% of rice farmers mentioned that they had problems obtaining seed. About 25.6% said that they experienced seed quality problems. Moreover, 42.7% of respondents said they had heard of new rice varieties being released for farmers in West Africa.

The preferred varieties grown by the farmers are also presented in Table 49.

Table 49. Rice varieties grown by farmers in Western Region

Variety	Days to maturity	Attributes
6279	120	High yielding Water loving
Tox	120	Good panicles
Sikamo	91	Long grain Susceptible to stemborer attack
Source: Field survey, May 2002		

3.1.12 Processing and marketing

The processing of rice involves mainly parboiling, after which the grain is milled. It is women who do the parboiling. The most important problem associated with milling is that the grains break. The breakage depends on the degree of heating the rice is subjected to during parboiling.

The market price of rice ranged between ¢100,000 per mini bag (50kg) immediately after harvest to ¢120,000 later in the season ($12.04 - $14.45). Traders determine the price to the disadvantage of farmers.

3.1.13 Problems

The most common disease encountered by farmers is ‘white head’. Pests include stem borers and weaver birds. Guinea grass (*Andropogon guinensis*) poses a problem to farmers as it is fast growing and can be effectively controlled only by hand weeding.

4.0 Conclusions

Even though the rice farmers in the Western Region of Ghana are among the most educated in the entire country they have many similar problems to those encountered in other parts of the country. For instance, the lack of an organised market policy that is favourable to farmers. Producers are at mercy of traders and, even though most of them belong to farmers' organisations, they seem not to have an effective mechanism for pricing their produce.

Farmers in the Western Region mostly grow rice varieties released through the MoFA, and benefit from extension advice, much more than in the any other part of the country used for these in-depth studies. They had even heard of the new varieties just introduced from international organisations such as WARDA through the efforts of the Crop Research Institute of CSIR, Ghana.

However, the production of rice is still mechanised to a very low degree, and relies on manual labour that is not always available. Rice production in the Western Region competes unfavourably for labour with the much more attractive timber and mining industries.

According to the farmers' own admissions, the quality of milling is poor. The situation with rice production needs to be improved greatly through the conscious efforts of all the stakeholders, since the natural conditions for this type of farming are very favourable and it is one of the traditional rice growing areas in the country.

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