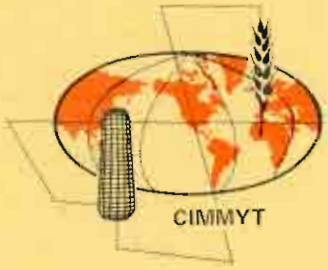
MAIZE IN THE MAMPONG–SEKODUMASI AREA OF GHANA; RESULTS OF AN EXPLORATORY SURVEY

by

Kwasi Bruce
Derek Byerlee
G.E. Edmeades

1980 Working Paper

ECONOMICS PROGRAM



CENTRO INTERNACIONAL DE MEJORAMIENTO DE MAIZ Y TRIGO
INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER
Londres 40, Apdo. Postal 6-641, México 6, D.F. México

MAIZE IN THE MAMPONG–SEKODUMASI AREA OF GHANA; RESULTS OF AN EXPLORATORY SURVEY

by

Kwasi Bruce
Derek Byerlee
G.E. Edmeades

1980 Working Paper

The authors are respectively, Development Officer, Grains and Legumes Development Board, Ghana; Economist, CIMMYT, Mexico; and Joint Coordinator, Grains Development Project, (CIDA/CIMMYT), Ghana. The views expressed in this working paper are not necessarily those of CIMMYT.

INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER
Londres 40, 1er, Piso, México 6, D.F. México

CONTENTS

PREFACE

In cooperation with researchers in many national agricultural research programs, CIMMYT has sought to develop procedures which help to focus agricultural research squarely on the needs of farmers. The process involves collaboration of biological scientists and economists to identify the groups of farmers for whom technologies are to be developed, determining their circumstances and problems, screening this information for research opportunities, and then implementing the resulting research program on experiment stations and on the fields of representative farmers.

CIMMYT's Economics Program has emphasized developing procedures for the first stage of this process, through to establishing research opportunities. The evolution of the procedures, now synthesized in a manual "Planning Technologies Appropriate to Farmers: Concepts and Procedures" has been strongly influenced by collaborative research with many national programs and with CIMMYT's wheat and maize training programs. Our efforts with national programs began in 1974 with Zaire's national maize program, then moved to work in Tunisia, Pakistan, and Egypt. The pace of work accelerated notably in 1976 with assignment of regional economists stimulating similar work in Kenya, Tanzania, Zambia, Ecuador, Peru, Bolivia, Panama, El Salvador, and India. Cooperation with still other national programs is now underway. We believe that the resulting procedures offer cost effective and robust guidelines to national programs.

We are now preparing reports that illustrate the implementation of these procedures in various national programs. While not all such work can be reported, we take this opportunity to thank all of those who have collaborated with us.

This report describes work undertaken with the Ghanaian maize program in an important maize producing region. It emphasizes the exploratory survey -- undertaken by Ghanaian and CIMMYT professionals -- and relates information gathered in the survey to several apparently promising lines of research for improved maize technologies.

Donald L. Winkelmann
Director, Economics Program

MAIZE IN THE MAMPONG-SEKODUMASI AREA OF GHANA
RESULTS OF AN EXPLORATORY SURVEY

I. OBJECTIVES OF THE SURVEY

The CIDA/Ghana Grains Development Project has a basic objective of increasing production and incomes of small-holder maize producers. Effective strategies for achieving this objective can only be designed by considering the present circumstances of these small-holders. That is, strategies must address problems presently limiting farmers' production and incomes and must be appropriate to the agro-climatic environment, input and output prices, resource endowments, and objectives of small-holders.

Various methods are available for obtaining this type of information on farmer circumstances. They range from informal dialogue of researchers and farmers to formal surveys using trained interviewers and a questionnaire. This report presents results from a low cost rapid approach called an exploratory survey in which researchers employ informal interviewing techniques to elicit information from farmers and observe farmers' fields.[1/] This exploratory survey was conducted in October, 1979 over a five day period in the Mampong-Sekodumasi area of the Ashanti Region. (See Figure 1) The objectives of the survey were:

(a) To provide information to design a set of on-farm experiments for developing improved maize technologies for the region. Information was sought on current maize practices and factors limiting production to identify technologies to include in experiments.

(b) To refine the methodology for conducting exploratory surveys in the Ghanaian context and thereby lay the basis for the extension of the work to other maize producing areas of Ghana.

(c) To provide necessary background for the design of a formal survey of maize producers in the region to provide more quantitative information on maize production and practices in the region.

1/ Further information on the methodology underlying this survey is given in Byerlee, Derek, Collinson, Michael, et al, "Planning Technologies Appropriate to Farmers; Concepts and Procedures", CIMMYT, Mexico, 1980

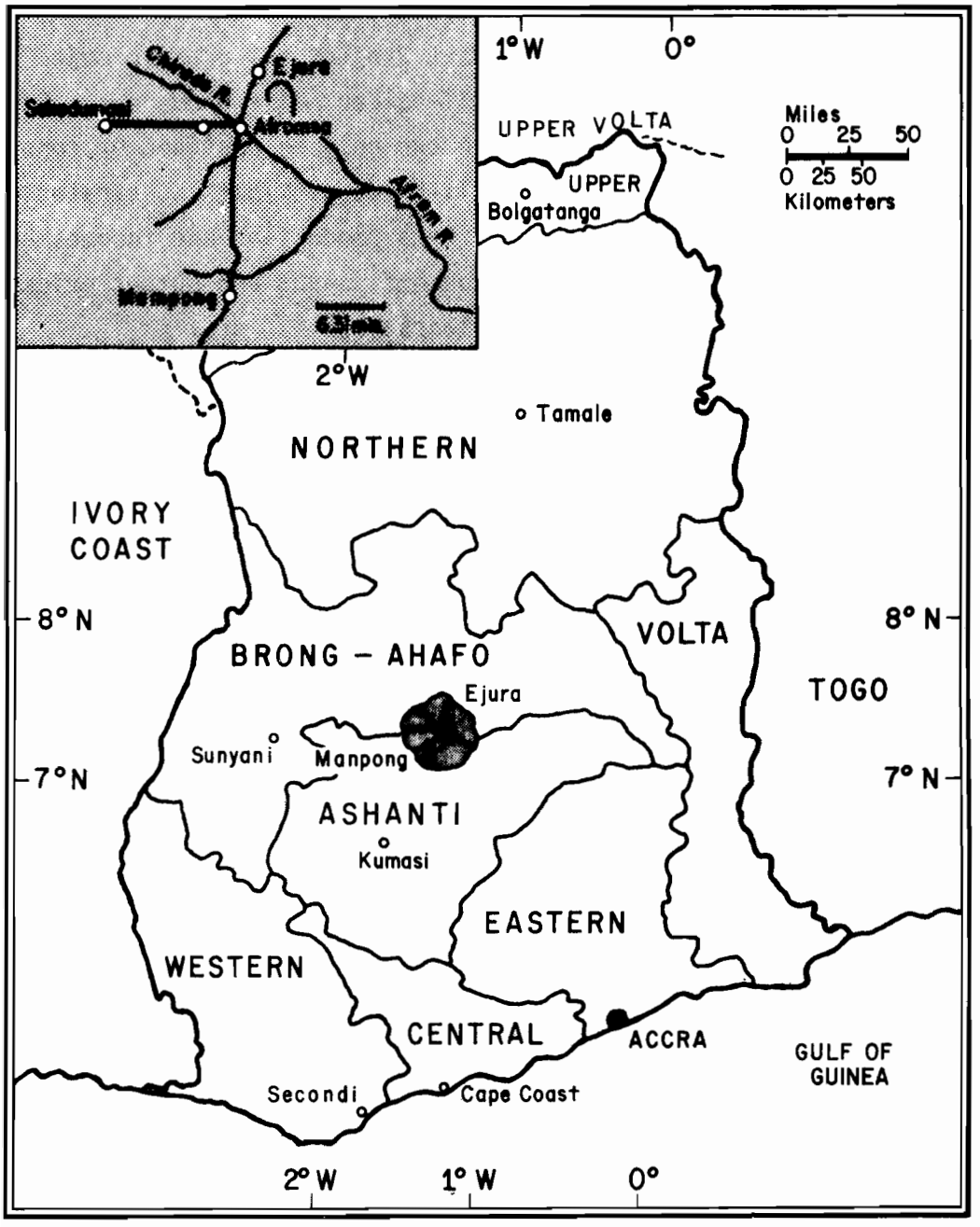


Fig. 1. Map of Ghana Showing the Geographic Position of the Research Area ( )

II. METHODOLOGY OF THE SURVEY

The team consisting of economists and agronomists traversed different parts of the area during a five day period. Information was obtained from the following sources:

(a) Individual farmers were informally interviewed in both short and in-depth interviews about their maize production practices and farming system. These farmers were identified by chance (e.g., farmers in their fields) or because they were or had been co-operators in maize demonstrations of the Grains & Legumes Development Board (GLDB).

(b) Groups of farmers usually including the chief farmer[1/] were informally interviewed about general maize production practices and farming systems in the village.

(c) Maize fields and maize in store were observed often in conjunction with interviews with individual farmers.

(d) Officials of the GLDB, Ministry of Agriculture, the Food Production Corporation (FPC), the Ghana Commercial Bank in Mampong, millers, kenkey makers[2/] and marketing agents were interviewed about maize in the area and input distribution, marketing and processing.

Table 2.1 summarizes the total number of interviews conducted. Most effort was placed on talking to farmers either as individuals or in groups. In addition relevant background data on the area from published and unpublished reports was assembled from Mampong, Kumasi and Accra.

On the whole we learned much in the exercise but because of time limitations, much of the information reported here represents impressions and hypotheses which could be verified through further exploratory survey work or a formal survey. The information is also biased toward villages along motorable roads.

1/ In Ghana, most villages have the office of chief farmer who is elected by the farmers of the village to their spokesman.

2/ Kenkey is prepared from maize dough, moulded into ball and boiled with maize husks or plantain leaves covering them. It is commonly eaten with fried fish, prepared fresh pepper, onions and tomatoes.

Table 2.1 Summary of Information Sources Used in the Exploratory Survey

Village	Individual Farmers Interviewed		Chief Farmer/ Group Interview	Other	Fields Inspected
	Briefly	In depth			
East of Mampong					
Nkwabirim	1	2		Miller	5
Kwamang		1			2
Atonsu			1		
Mpantuasi	1				1
Ankumadua			1		1
Asare Nkwanta	1				1
Aframso			1		
Sekodumasi Area					
Afrante	1		1	GLDB Supervisor	3
Sekodumasi	1	1		Miller	1
Juaho	3		1		6
West of Mampong					
Asaam	2				3
Kofiase			1		1
Mampong				MOA/UNDP Project Ghana Comm. Bank Kenkey Makers FPC Representatives Miller	
T O T A L	10	4	6	8	24

III. BACKGROUND DATA ON MAIZE IN MAMPONG-SEKODUMASI AREA

The Mampong-Sekodumasi area was chosen for this survey for four reasons.

(a) It is an important maize producing area and is particularly important as a maize surplus area.

(b) It is an area of concentration of the GLDB Demonstrations and the UNDP/Ministry of Agriculture Fertilizer Project and therefore provides an opportunity to review farmers acceptance of improved maize technology.

(c) It is convenient to Kumasi, headquarters of the Grains Development Project.

(d) It is an important maize producer in the minor season and therefore provided an opportunity for field observation during the time of the survey.

The area covered by the survey consists of 2,500 km^2 extending east and west of the Mampong - Ejura main road. It includes the most populated portion of Mampong District and the eastern edge of Western Kumasi District. In the 1970 Census of Agriculture (Ministry of Agriculture 1972) 14,980 hectares (37,000 acres) of maize were planted in Mampong District. It was one of the few areas of Ghana where minor season (second season) plantings were almost as important as major season (main season) plantings. Eighty percent of major season maize was intercropped usually with root crops while over fifty percent of minor season maize was sole cropped. In 1970, 57 percent of farmers in Mampong District grew maize with an average of 0.65 ha (1.6 acres). These figures exclude the important maize producing area around Sekodumasi which is in the Western Kumasi District.

The 1970 census data indicate that the other main crops in terms of area were cocoa 64,370 ha (159,000 acres), plantain 43,320 ha (107,000 acres), Cocoyam 28,340 ha (70,000 acres), Cassava 12,550 ha (31,000 acres) and Yam 4,050 ha (10,000 acres).[1/]

IV. EXTERNAL CIRCUMSTANCES OF FARMERS

This section summarizes information on the environment or external circumstances in which the farmer makes decisions. These can be further disaggregated into agro-climatic factors (e.g., rainfall and soils) and socio-economic factors (e.g., markets and land tenure).

1/ Note that these areas overlap because of the widespread practice of intercropping.

4.1 Agro-Climatic Circumstances

(a) Rainfall: The climatic maps of Ghana for agriculture indicates that the mean annual rainfall over a period of 30 years (1936-65) for the Mampong-Sekodumasi area lies between 1400mm and 1500mm (55 inches and 60 inches).

Figure 2 shows the monthly distribution of rainfall in Mampong. Clearly, the major growing season begins in March and major season maize planted then can be harvested by June. There is then a rainfall trough in August. Farmers usually then plant minor season maize toward the end of August which allows two months of reliable rainfall, September and October for maize growth. However rainfall then falls off quite rapidly in November, the grain filling stage of the minor season crop. There is however some risk of rains finishing before the end of October causing moisture stress in the minor season crop at the crucial flowering stage.

(b) Topography: Most of the area is relatively elevated and undulating with an altitude over 200 meters and as high as 600 meters. Soil erosion is potentially a serious problem.

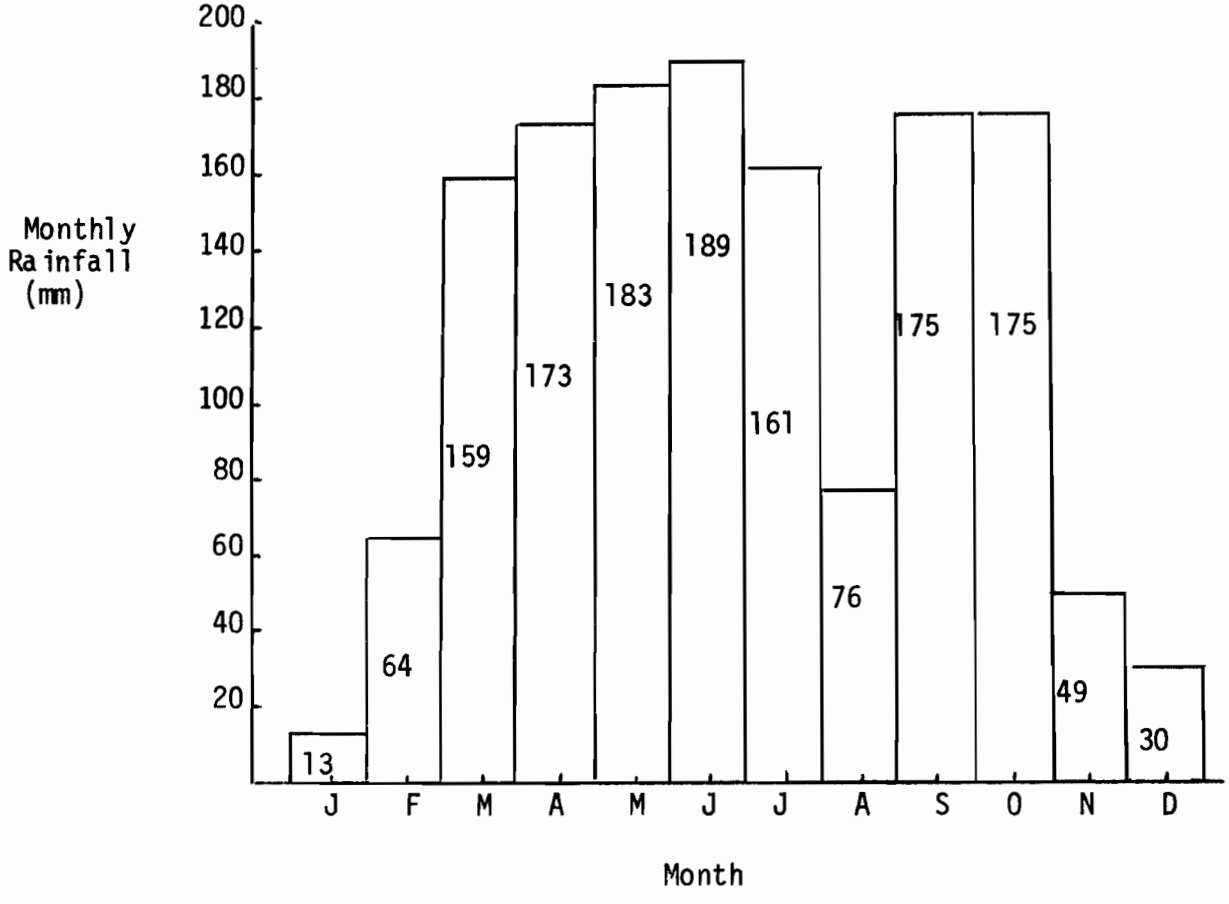
(c) Soils: Soils in the area are characterized by four types of series. Forest Ochresols (Ultisols) are found in areas of high forest which also forms a larger proportion of the soils in the area. Forest Lithosols ⁄Entisols (Aquents; Lithic) are found north of the Forest Ochrosols. Further north in the study area are Savannah Lithosols ⁄Entisols (Ustents)⁄ and Savannah Ochrosols (Oxisols - Inceptisols). Generally the forest soils have a better water holding capacity. Erosion hazard in the area ranges from slight to moderate sheet and gully erosion.

(d) Vegetation: The area is generally in the transition from forest to savannah. Areas of high forests as well as grassland savannah were noted interspersed throughout the area. Most farmers distinguish forest and savannah land although we were often unable to see marked differences in vegetation type. Much of the savannah area is subject to annual bushfires.

4.2 Socio-Economic Circumstances

(a) Population and People: The area has a population of _____ with a density of _____ square km. The dominant ethnic group are the Ashantis with some settled migrants particularly from the north.

Figure 2. Montly Rainfall Distribution in Mampong (Average 1966-75)



(b) Land Tenure: Communal land tenure predominates. With the permission of the local chief it is possible to gain access to land. In the savannah area the user maintains that right only as long as the land is planted. In the forest area where clearing costs are high the user retains rights to the land even after it has gone to fallow. A share tenancy system is also common where the owner of a piece of land receives one third of the produce and the renter two thirds.

Median farm size in the area is probably 2-4 ha (5-10 acres) although some farmers particularly in the Sekodumasi area farm much larger areas (over 40 ha).

(c) Capital Market: The Ghana Commercial Bank (GCB) operates in the area but coverage of the farming population is low in spite of the existence of the Commerbank Farmers Association, which was initiated in 1977. The objective of this scheme is to help small-scale farmers who cultivate grains and vegetables with loans ranging from ¢200.00 to ¢500.00[1/] at an interest rate of 13% per annum. The scheme encountered some problems at the onset with discouraging pay-back rates, and had to be discountinued. During the survey only three farmers (around Aframso, east of Mampong) confirmed having had assistance from the bank to cultivate groundnuts.

Capital can also be obtained in the informal money market at interest rates over 100% per annum. For example, one farmer quoted the interest on a loan of ¢1,000.00 as the repayment of 8-10 bags of maize valued at ¢80.00 ¢100.00 per bag. We did not attempt to find out in what months farmers experience most acute cash shortages.

(d) Labour Market: There is an active labor market in the area with most farmers hiring labor for many operations. The supply of labor varies seasonally as a result of: (i) seasonal migration from the north from December/January to April/May and (ii) seasonal availability of school children in July/August, December/January, and April.[2/]

1/ ¢2.7 = U.S. $1.00 at the time of the survey.

2/ Most children in the area attend at least primary school but do become available during vacations to assist parents and other relatives on their farms in July and August when major season crops are harvested and minor season crops planted.

In terms of farm operations this means that labor is available from migrants for clearing and planting in February and March and to a lesser extent from school children for harvesting in July and planting again in August/September. But in neither the major or minor season does the seasonal availability of labor correspond to the weeding periods in May/June in the major season and October in the minor season and almost all farmers experienced a labor bottleneck in weeding. Farmers also tend to reduce minor season plantings because of a lack of migrant labor in that season.

The daily wage rate is about ₵7.00/day plus the value of meals which would increase the wage to about ₵10.00/day. However most farmers prefer to pay labor at a contract rate per acre or field.

(e) Input Distribution: Fertilizer is the principal purchased input used by farmers. However, only two distribution points, Mampong and Ejura[1/] are available in the area. This means that farmers often have to travel a considerable distance to obtain fertilizer and the resulting transport cost may add 50 percent to the cost of the fertilizer. More importantly, either because of a lack of transport or a lack of fertilizer in store, most farmers complain of non-availavility of fertilizer at distribution points, particularly sulphate of ammonia. Fertilizer is sold at a control price (₵10.00/50 kg bag of 15-15-15 and ₵8.50/50 kg bag of sulphate of ammonia). There was however very tentative evidence that black market prices may add 50 percent or more to these prices.

Seed of improved maize varieties is distributed through the GLDB and the Ministry of Agriculture. Most farmers were able to obtain seed. Similarly insecticides are available through the Ministry of Agriculture and chemical companies operating in the area, e.g., Shell Ghana Limited.

(f) Mechanical Services: A small proportion of farmers mostly in the Sekodumasi area are using tractor services for ploughing. Private contractors who predominate charge from ₵60-₵100/acre while UNDP/MOA working with block farms charge ₵40/acre. GLDB and large growers also provide mechanical shelling services for ₵6.00 - ₵8.00 per 100 kg bag (₵60-₵80/ton). There are also many small mills in the area widely used for making maize flour at a cost of ₵20 per 100 kg bag or ₵0.20/kg.

1/ Ejura, 40 km north of Mampong is outside the study area but exerts a substantial influence on the northern parts of the Mampong-Sekodumasi area.

(g) Maize Marketing: Most maize is sold through private traders. These traders, both men and women travel mostly from Kumasi and Mampong to the villages, buy maize from the farmers and transport it back for sale in the urban centers (e.g., Kumasi, Accra, Takoradi and Mampong). One trader interviewed had four five-ton trucks and handled on the average a thousand bags (of 100 kg/bag) every week. He buys all types of maize so long as they are not weevily and/or mouldy. He encountered problems of lack of spare parts and tires for his vehicles, and particularly this year lack of fuel.

The Ghana Food Distribution Corporation (GFDC) also operates in area, but buys only a small amount of maize at harvest when prices are low. Seasonal price swings are large varying from about ₵100 per 100 kg bag immediately after harvest up to ₵200 per 100 kg bag in April/May.

(h) Processors of Maize: Commercially and domestically maize is processed into various food forms in the area. The commonest forms are kenkey, banku, porridge and maize dough-nuts "Awiesu" in that order. Two kenkey makers, both women, were interviewed during the survey. These women prefer white maize for making kenkey and buy all kinds of white maize so long as it is not weevily or mouldy. One of them who produces fanti Kenkey used three bags (100 kg/bag) every week while the other making GA Kenkey used one bag over the same period. Yellow kenkey(i.e., kenkey made out of yellow maize) does not attract consumers unless there is an acute shortage of white maize. At home banku and porridge is commonly prepared. In the Northern parts of the area Yellow Porridge is preferred in the homes of the migrant settlers from the North.

(i) Extension: Both the GLDB and UNDP/MOA are active in the area. GLDB has run approximately 200 farm demonstrations since 1974. UNDP/MOA have run a set of maize trials followed by demonstrations.

UNDP/MOA are now also working with co-operatives and block farms in the area. The recommendations promoted for maize in the area are shown in Table 4.1.

V. MAIZE IN THE FARMING SYSTEM

5.1 Crops Produced

The major foodcrops in the area are cassava, plantain and cocoyam in the forest area and yams, groundnuts, cassava, cowpeas and rice in the

Table 4.1 Recommendations Maize Production Practices of the GLDB and UNDP/MOA For the Sekodumasi Area

PRACTICE	GLDB Recommendation	UNDP/MOA Recommendation
1. Planting Method	In rows with strings	In rows with strings
2.a. Row distance	90 cm	75 cm
b. Plant distance	30 cm	60 cm
3. Seeds per hill	2	3
4. Seeds/hill after thinning	1	2
5. Fertilizer	15-15-15 Sulphate of Ammonia	15-15-15 Sulphate of Ammonia
6. Rates of Fertilizer and time of application.	4.9 50 kg bags/ha of 15-15-15 at planting. 4.9 50 kg bags/ha of S. Ammonia applied four weeks after planting. (Total 88:37:37 of NPK/ha)	4.9 50 kg bags/ha of 15-15-15 at planting. 4.9 50 kg bags/ha of S. Ammonia applied four weeks after planting. (Total 88:37:37 of NPK/ha)
7. Weeding	1st weeding 2 - 3 weeks after planting 2nd weeding 6 weeks after planting	1st weeding 2 weeks after planting 2nd weeding 4 weeks after planting after the application of sulphate of ammonia. 3rd weeding:- Brushing when cobs are filled
8. Harvesting	---	When cobs are just beginning to droop.
9. Variety	La Posta	La Posta and Composite 4

savannah areas. Maize and groundnuts are grown primarily for sale. Plantain is also widely sold. Two varieties of cassava are grown - six month variety to provide an early source of food and the normal cassava, maturing in one year, that is often kept in the ground as a food reserve.

5.2 Intercropping

Maize is traditionally intercropped with cassava, cocoyam and plantain. In this system maize is planted before cassava and plantain and utilizes available land area when the cassava and plantain are young. Some of the area may be only sparsely planted to cassava and plantains to allow some maize to be also planted in the minor season. The following year cocoyam and cassava are harvested and with further planting of plantains the field may then be used for plantain over a 7-year period. That is the field moves from predominantely maize to cocoyam/cassava to plantain.

In the savannah areas maize is often intercropped with cassava and sometimes with groundnuts and cowpeas. Sole cropping of maize and groundnut is increasingly common in the savannah. In large part this reflects the fact that with maize as a cash crop and with an improved variety and use of fertilizer, four crops of maize and/or groundnuts in a two year period is more profitable than one crop of maize and one of cassava or cocoyam in the same two year period. Nonetheless farmers planting sole cropped maize will usually have another farm for food crops -- cassava, cocoyam and plantains -- on which maize is intercropped in the first season.

5.3 Rotations

Extremely varied patterns of rotations are practiced. On the one hand there was the maize - cassava - cocoyam - plantain system where the field was eventually converted to plantain. On the other hand there were fields that had been continuously cropped to maize twice a year, for several years. Maize/groundnuts rotations were common with groundnuts either in the major or minor season. Because groundnuts are a shorter season crop this rotation gives more flexibility in case of a late start or early finish of the rains. Some relay planting is also practiced with minor season maize planted in the maturing crop of the major season maize. This happens with a late start to the major season rains. Minor season maize must be planted by mid to late August to avoid high risks of crop failure. Planting of minor season maize is less dependent on the beginning of the rains because of residual moisture in the soil from the major season.

In general minor season plantings are less because of higher risks of rains finishing early and because labor is a constraint at planting time.

5.4 The Fallow System

As with rotations the length and frequency of fallow is very varied. In the forest area land may be cropped three years or more before reverting to fallow for 3 to 7 years or more. In the savannah areas continuous cropping is now common particularly where fertilizer is used.

VI. MAIZE PRODUCTION PRACTICES

6.1 Variety and Seed Selection

There are two major varieties of maize used in the area.[1/] The so called local variety is a genetically heterogeneous late white dent. Because of the practice of mixing improved and local varieties it is quite probable that this local variety contains material from Diacol 153 (white flint) and composite 2 (white dent) introduced in the 1960's. The major improved variety is La Posta, introduced in 1974 by GLDB and UNDP/MOA. Most farmers knew of La Posta and many grew it but sometimes mixed with local material. Many farmers also grow both local and La Posta, in separate fields. La Posta has been widely accepted because of its relative earliness (2 weeks earlier than the local) and its yielding ability. The earliness of La Posta is important in ensuring two crops per year. With a late start to the rains La Posta can still be harvested in time for planting the minor season. In the minor season the local maize runs a high risk of an early finish to the rains. However a major problem of La Posta mentioned by almost all farmers is its storability. Farmers have experienced serious problems with weevil infestation. Some farmers attributed this to the poorer husk cover but softer endosperm is probably also a factor. La Posta is also somewhat taller than the local and probably suffers more lodging. Maize is only a supplementary food in the area and farmers seem to accept La Posta for making local foods.

1/ There are also small amounts of composite 4 and "40 day" local yellow maize from the north grown in the area.

Seed is often obtained at harvest from clean, large kernelled cobs and stored in a dry place - e.g., over the cooking area. Many farmers choose a variety of kernel types from dents to flints in seed selection. In this way it seems that farmers have often mixed La Posta with the local ears to preserve variability. In some ways this may represent an insurance strategy especially given the poor storability of La Posta.

6.2 Land Preparation

Most maize farms are prepared by hand usually by a slash and burn system during the months of February and March or much earlier (e.g., December-February) depending on the size of land to be prepared. Labor required is about 20 - 40 mandays/ha depending on the type of bush. Tractor cultivation is used by about 10 percent of farmers usually the larger farmers in savannah areas. Costs are comparable to the slash and burn system but tractors are often not available on time, particularly this year with the fuel shortage.

6.3 Planting

The traditional method of planting is haphazard planting in hills about 1 meter apart using a cutlass or hoe to make holes and placing 2 - 3 seeds/hole to give a planted density of about 25,000 plants/ha. In intercropped stands the density falls to 10 - 20,000 plants/ha. One chief farmer said he uses a pointed stick to make holes while other farmers in his area employ methods which vary from the use of a cutlass to the use of the heel to make holes. The last method is common among the migrant settlers from the north who intercrop yam with maize in the savannah area.

Those who use cutlass use two methods of making holes.

(i) Thrust of the cutlass into the soil at an angle of about 90°, slap the soil to the left then right, drop seeds into the hole and slap to the left again to cover the seed.

(ii) Cut at an angle of about 25° to the ground lift cutlass, pop seed under, withdraw cutlass, let soil cover.

The first method is the more commonly used in the area although covering is relatively poor. Planting with sticks results in a hole of about 7 cm deep. Seeds are then dropped and covered with the foot, usually by a second person walking behind.[1/]

GLDB recommended planting practice is to use a marked string and plant 2 seeds/hole in holes 30 cm apart and rows 90 cm apart and then thin to one plant/hill for a density of 37,000 plants/ha. In practice we observed all shades of planting methods from the traditional to the recommended. Very few farmers even those who have been GLDB co-operators follow the recommended practice. One farmer who uses both the traditional and recommended practice estimates that the traditional planting method uses 5 mandays/ha against 10 mandays/ha for the recommended method. Most farmers who know the recommended method have adjusted it by planting more seeds/hill in fewer hills and then not thinning. This reflects farmers conviction that the change in yields associated with closer spacing (at the same density) does not warrant the increase in cost at planting time. In fact experience elsewhere also suggests that spacing one plant/hill is only worthwhile when machine planting is introduced. The practice of planting in lines usually with a string does seem to have been fairly widely adopted.

Densities observed in sole cropped fields varied from 20,000-45,000 plants/ha with a median around 25,000 plants/ha. Stand problems were evident and farmers complained of problems of birds and lizards reducing stands in the major season. Seed treatment was not a widespread practice although replanting may be done depending on the amount of land to be replanted and availability of labor and/or cash. One farmer in adopting a measure to reduce seed losses to birds plants more seeds on the outside of his field. Others try to plant a field in a short time period to reduce these losses. One chief farmer noted that better stands are obtained by planting with sticks probably because the seed is planted deeper.[2/]

1/ We were unable to observe planting done by the heel by migrants north of the River Afran since we were unable to cross the river due to heavy rains.

2/ This same farmer also emphasized that root lodging is reduced when fields are planted with sticks.

6.4 Fertilizer Use

Most farmers are aware of the benefits of fertilizer use but because of availability problems probably less than half the farmers are using it on maize. We also concluded that it is the larger farmers (four hectares of more of maize) who are now receiving most of the limited fertilizer supplies. We noted many fields of maize of small farmers deficient in nitrogen. This year too, even larger farmers are having difficulty in obtaining sulphate of ammonia for top dressing - probably because of the fuel shortage.

Most farmers, including past co-operators were applying less than the recommended dose - usually 1 to 1.5 50 kg bags each of 15-15-15 and sulphate of ammonia per acre (i.e., up to 70-27-27 kg/ha NPK). Usually farmers followed recommendations of applying 15-15-15 at planting and top dressing after weeding just before tasselling. Generally fertilizer was placed on each hill but not covered as recommended.

6.5 Weeding

Generally farmers weed only once at six weeks after planting. In intercropped maize a second weeding may be done but too late to be of any benefit to the maize. Weeding is usually done with a cutlass and requires an average of 15 mandays/ha.

Farmers experience two important weeding problems. First, because of the labor bottleneck in the weeding period noted above, difficulties are experienced in completing weeding on time with resultant yield losses. Secondly, there are some grassy weeds in the savannah areas which are difficult to control. In particular we noted several fields with a serious infestation of Imperata. This usually occurred with continuous cultivation of maize. Tractor ploughing was recognized as one means of control. Farmers also noted that rotation with groundnuts which requires a thorough hoeing helps to control this grass. However because groundnuts are a labor intensive crop relative to maize it is difficult to establish an effective maize/groundnut rotation.

6.6 Insects and Diseases

Stemborers were recognized as a problem in the minor season and may have caused up to 20 percent loss in one field we observed. Heavy rains are said to aggravate the problem and fertilizer use was noted to reduce the problems

(confirmed by observation). Streak was observed in many fields but was not serious enough to cause losses. Farmers recalled attacks of leaf rust years ago.

Overall there does not seem to be any serious insect and disease problem in the area that would warrant immediate research emphasis.

6.7 Harvesting and Shelling

Harvesting is done by hand requiring 9-12 mandays/ha depending on yields. Shelling requires 0.3 mandays/100 kg bag (3 mandays/ton) or is sometimes done by machine (¢6-8/bag.)

6.8 Production and Marketing

Yields in the 1979 major season varied from as low as 2 bags/acre (0.5 ton/ha) up to 10 bags/acre (2.5 tons/ha) with a median around 5 bags/acre (1.25 tons/ha). Yields of maize in intercropped fields seemed lower.

Most maize is sold, usually to private traders. Some is stored for home consumption. Up to 20% of the crop may be harvested green and boiled and/or roasted both for home consumption and sales.

Because of large seasonal price swings farmers like to store maize until after the low post-harvested prices. Usually maize is stored in the husk in wooden barns raised off the ground. Some farmers particularly those planting La Posta dip the cobs (tips and base) in a DDT solution to reduce storage losses. Others sprinkle a solution of DDT in the barns before storing. In the absence of chemicals a farmer might spread ash on the floor of the barns and its walls before storage.

6.9 Estimates of Labor Requirements and Returns to Labor

Because labor is one of the major limiting factors on crop production in the area, it is instructive to summarize labor requirements for the traditional and recommended maize practices. It should be emphasized that the estimates given are only very approximate.

Table 6.1 gives a breakdown of labor requirements for traditional and recommended practices. For preharvest operations they are expressed in

Table 6.1 Estimates of Labor Inputs/ha for Maize-Sole Cropped in Mampong-Sekodumasi Area on Land Cropped in the Previous Cycle

	Traditional Practice	Recommended Practice
	mandays/ha	
Slashing	24	24
Burning	?	?
Planting	5	10
First Fertilizer Application	-	2.5
Second Fertilizer Application	-	2.5
Thinning	-	5 (?)
First Weeding	16	16
Second Weeding	-	16
Harvesting	5 mandays/ton	
Transportation from field	5 mandays/ton.(?)	
Shelling	5 mandays/ton.	
Total Labor/ha[1/]	61	106
Total Planting-Weeding Labor/ha	21	52

(?) Indicates considerable uncertainty in the estimates.

[1/] Assumes average yields (see Table 6.2) of 1.1 ton/ha and 2.04 ton/ha for traditional and recommended practices respectively.

mandays/ha and for harvest and post-harvest operations in mandays/ton since labor for these operations (when done by hand) tends to vary directly with yields ; Overall then the recommended practices increase labor requirements by about 75 percent. But even more importantly, during the critical labor bottleneck period of planting and weeding labor requirements are increased by about 150 percent. Drawing up a rough budget then in Table 6.2, it is not surprising to find that the return to labor for the recommended practice is very little different to that for the traditional practices although both are above the average wage rate in the area (₡10/day). These figures go a long way to explain farmers only partial adoption of the recommendations (discussed in the next section).

VII. IMPLICATIONS FOR FURTHER RESEARCH/EXTENSION IN THE AREA

Many of the findings from the exploratory survey have implications for future research/extension work aimed at increasing maize production and incomes of small-holders in the area. These implications are discussed with reference to the current recommendations or maize productions in the area, future on-farm experimental and survey work for the area, and broader implications for maize breeding and agricultural policy. .

7.1 Implications for Current Maize Recommendations and Extension Demonstrations

GLDB recommendations for maize production are incorporated into the GLDB demonstration plots which have been widely sown in the area. These demonstrations have played a valuable role in diffusing knowledge about improved maize practices in the area. Farmers in most cases know about La Posta variety and fertilizer use and many have adopted these practices. Nonetheless, farmer experience with these recommended practices have implications for research and extension in the area as the following observations and crude cost-return calculations shows.

Variety: La Posta is well accepted except for its storage problems. The practice of mixing local and improved seed will make varietal improvement slow although probably less risky to farmers.

Fertilizer: When available, farmers want to apply fertilizer except on new land. However, application rates are well below recommended levels - say 50-20-20 NPK versus the recommended 90-40-40 NPK. To pay for the recommended

Table 6.2 Rough Estimates of Returns to Labor for Traditional and Recommended Maize Practices - Mampong-Sekodumasi Area

	Traditional Practice	Recommended Practice
Yield (ton/ha)[1/]	1.10	2.04
Gross Revenue (¢/ha)[2/]	1,100	2,040
Cost of Fertilizer[3/] (¢/ha)	-	192
Gross Income (¢/ha)	1,100	1,848
Cost of Capital on Purchased Inputs[4/] (¢/ha)	-	96
Returns to Labor and Land (¢/ha)	1,100	1,752
Cost of Land Rental (¢/ha)[5/]	366 (?)	366 (?)
Returns to Labor (¢/ha)[6/]	734	1,386
Total labor inputs[6/] (manday /ha)	61	106
Returns to labor (¢/manday)	12	13

[1/] Estimated from average yields on demonstrations in the Sekodumasi area in 1978 of 1.3 and 2.4 tons/ha for traditional and recommended practices. These yields were discounted by 15 percent to allow for generally higher yields on demonstration plots compared to farmers yields (Perrin et al, 1976).

[2/] Price of Maize ¢1000/ton

[3/] Assumes farmers price ¢10/bag (¢5/bag for black market price plus ¢5/bag transport to farm) above official retail price.

[4/] Fifty percent of cost of fertilizer

[5/] We have no estimate of land rental rates. However a common traditional system of a third share to land owners provides a rough guide. The same value has been used for valuing land under recommended practices.

[6/] Includes hired labor. Estimates are obtained from Table 6.1.

dose of fertilizer, Table 7.1 indicates that farmers would need to recieve about 0.4 tons/ha additional yield. An increase of about 0.65 tons/ha would be needed to cover the unsubsidized cost of fertilizer.

Given average yield increases of 1.1 tons/ha[1/] in the demonstrations in the Sekodumasi area and assuming most of this is due to variety and fertilizer, this fertilizer cost (subsidized or unsubsidized) could be covered even discounting demonstration yields by 15 percent[2/]. However, these figures consider average returns. At the margin, the last bag of fertilizer will give lower returns which explains farmers' lower application rates.

Planting: Most farmers who saw the demonstrations had adopted "line" planting and probably also higher densities. However, they had rejected the recommendation for closer spacing (1 plant/hill) and for thinning. These two practices may add each 2 mandays/acre or a total of 10 mandays/ha to planting labor. That is, total added costs are ₵150/ha (10 mandays x ₵10/day x 1.50 capital cost) and an extra 0.18 tons/ha (150/₵850/ton)[3/] are needed to cover this cost. On a 2 ton/ha crop this is about a 10 percent increase in yields and is the maximum that could be expected from closer spacing and thinning versus planting more seeds in fewer hills. Moreover, the real cost may occur if the farmer faces a shortage of labor and/or cash to hire labor at planting and weeding and the closer spacing slows down and delays termination of planting and weeding operations.

Weeding: Farmers generally rejected the recommendation of a second weeding. Assuming 16 mandays/ha for weeding, this would add ₵240/ha to costs (16 x ₵10/day x 1.50 cost of capital). That is, yields would need to increase by 0.3 ton/ha to cover the cost of the second weeding. This is a substantial amount given that labor is critically short at this period.

Total Package: The total recommended package therefore needs about 0.9 tons/ha[4/] extra yield to cover farmers' costs or a little under the increased

---

1/ See GLDB "Maize Demonstrations Programs, Major Season, 1978".

2/ Yields in demonstrations are usually higher than actual farmers' yields because of more intensive management of small plots and earlier harvesting which reduces field losses. See Perrin et al (1976).

3/ Assume maize field price ₵850/ton - see footnote 5, Table 7.1.

4/ Fertilizer - .43 tons/ha, Planting - .18/tons/ha, Weeding - .30 tons/ha.

Table 7.1 Approximate Costs of Recommended Fertilizer Practices

	Subsidized	Unsubsidized
Official price - 15-15-15	¢10.50/bag[1]	¢37.00[2] /bag
- S. of Ammonia	8.00/bag	24.00[2] /bag
Farmer price[3] - 15-15-15	21.00/bag	42.00 /bag
- S. of Ammonia	18.00/bag	29.00 /bag
Total cost recommended levels[4]	192.00/bag	384.00 /ha
Cost of labor (5 mandays/ha for two applications	50.00/ha	50.00 /ha
Total cost fertilizer and labor	242.00/ha	434.00 /ha
Cost of capital - 50% to farmers	121.00/ha	
- 25% to country	_____	109.00 /ha
Total cost with capital	¢363.00/ha	¢543.00 /ha
Approximate yield increase needed to pay fertilizer cost[5]	.40 tons/ha	.65 tons/ha

---

[1] A bag of fertilizer is 50 kg

[2] Crude estimate based on CIF prices at Tema in 1978 of US$100/Ton sulphate ammonia and $US 200/ton 15-15-15 plus a high ¢.62/ton/ km internal handling and distribution costs over a distance of 320 km).

[3] Based on a "black market" mark-up of ¢5/bag for subsidized fertilizer plus ¢5/bag transport cost to the farm.

[4] Recommended levels - 4.9 bags/ha of each type of fertilizer.

[5] Field price of maize of ¢850/ton calculated as ¢1000/ton post-harvest price minus ¢50 (5 days)/ton harvesting minus ¢50/ton shelling minus ¢50/ton handling and transportation.

yields in demonstration (1.1 tons/ha increase in yields in 1978 demonstrations discounted 15 percent gives .93 ton/ha). Seed costs for the improved variety are negligible. Considering unsubsidized prices of fertilizer, the extra yield needed is about 1.10 tons/ha (.65 + .18 + .30) and is above actual yield differences measured in the demonstrations. However, in practice, farmers' returns for using recommended practices are likely to be much higher if: i) farmers can store maize after harvest and benefit from higher maize prices later in the season[1/] and ii) farmers adopt the most profitable portions of the package - variety and a moderate dose of fertilizer.

In summary, maize demonstrations should be continued as they are valuable in disseminating information about varieties and other practices. There are still villages in the Mampong area where maize is widely grown and which have not been targets of either GLDB or UNDP/MOA demonstration programs.

Consideration should however be given to the following immediate changes in the recommendations:

i) Spacing/Thinning: A wider spacing would save planting labor, increase timeliness of planting and facilitate weeding. It is likely that spacings up to 80 cms - 1 meter - between rows and hills would not appreciably affect yields. For example, the density of 35,000 plants/ha under present recommendations could be established by planting 3 seeds/hill, 65 cm apart in 90 cm rows and allowing for an average loss of 30% of seeds due to germination and predators.
ii) Fertilizer: Fertilizer recommendations should be reconsidered in light of substantially changed domestic and international prices of maize and fertilizer since the current recommendations were established. The on-farm fertilizer trials data from CRI and UNDP/MOA could be re-analyzed for this purpose. However, care should be taken to use costs and prices relevant to farmers. That is, experimental yields should be adjusted, transport and capital costs included in fertilizer prices and harvest costs of extra yield deducted (see Perrin et al 1976 and Byerlee and Harrington, 1979).
iii) Weeding: The problem of weeds and weeding will be addressed in on-farm experiments in the area (see below). This, hopefully, will provide a better alternative to a second weeding which most farmers are not in a position to do.

1/ This again underlines the importance of the storage problem with La Posta.

7.2 Implications for On-Farm Experimental Work

During the exploratory survey, both farmers' opinions and our observations pointed to three high priority problems limiting maize production and farmers' incomes in the area and which given existing knowledge offer potential for improved technology through a program of on-farm experimentation. These areas are: a) maize storage, b) maize stand establishment, and c) weed control. In addition, potential for introducing newer varieties from the CRI maize breeding program, also warrants on-farm varietal experiments.

a) Maize storage: Storage of the improved maize variety, La Posta, appears to be a universal problem in the area and one preventing the wider use of La Posta which is otherwise favored for yield and earliness relative to the local variety. Storage problems of improved maize prevent most farmers from benefiting from higher prices for maize several months after harvest and indeed are probably a factor contributing to the wide seasonal price swings observed. Moreover, ability to store maize over a longer period may allow greater flexibility in managing food supplies; maize now is largely used for home consumption in the immediate post-harvest period.

Storage problems of La Posta might arise from relatively late harvesting if for some reason farmers have not adjusted harvesting dates to the relative earliness of La Posta or they might arise form poorer husk cover or softer endosperm or some combination of these.

It is proposed that a storage experiment be set to measure storage losses under four conditions imposed in a factorial design: i) variety (La Posta vs local), ii) harvest date (brown husk stage vs one month later), iii) husk cover (husk vs dehusk), and iv) chemical treatment (Actellic powder vs no control). These treatments should be imposed on groups of ears stored in typical farmers' barns which had no previous fumigation treatment.

b) Stand establishment: The aim of this experiment would be to find the most economic means of arriving at better (i.e., more uniform) maize stands. At present, traditional methods (shallow planting using a cutlass and light covering) suffer from poor stands due to losses from predators. The recommended practice (over-planting and thinning) results in better stands but requires substantial additional labor which competes with the other important activities such as weeding.

This experiment would investigate the following factors in a factorial design: i) oversowing and thinning vs sowing the exact number of seeds per hill, ii) seed treatment vs none, iii) sowing method (e.g., cutlass hole loosely covered vs holes made with planting stick and well covered) and, iv) sowing depth (shallow vs deep).

c) Weed control: There appears to be little flexibility in the current system for improved weed control because of the labor bottleneck at that period. Other crops (e.g., groundnuts) also require weeding at the same time and given current crops and varieties there does not seem much scope for altering planting dates to stagger weeding. Farmers could of course improve weed control by reducing the area planted but are clearly electing to increase incomes through increased area rather than increased yields.

It is therefore proposed that experiments be established to investigate the economics of chemical weed control compared to one or two hand weedings. CRI agronomists have already conducted fairly extensive on-station experiments on chemical weed control which will guide the choice of chemicals and treatment level for the on-farm experiments. At this stage, herbicides for maize are only occasionally available to growers through commercial outlets in Kumasi, Accra and Tamale so introduction of herbicides to small holders in the area will also require changes in the distribution system.

There is likely to be considerable interaction of quantity and type of weeds with crop rotation and land preparation. For this reason, considerable care will be needed in choice of sites for these weed control experiments. Since the large majority of farmers do not have access to tractor ploughing, emphasis should be given to fields prepared by traditional slash and burn methods. Moreover, the fields should represent both farmers who are rotating maize with other crops, especially groundnuts and those who grow continuous maize. It is in the latter fields prepared by slash and burn methods where the weed Imperata is likely to be most troublesome and where current herbicides will be least effective.

A weed control experiment would screen a number of herbicides currently available in Ghana in comparison with handweeding. A later trial would examine rates of only one or two of the most promising of these. A second trial should examine the relationship between several levels of weed control and response of the crop to nitrogen, in order to determine optimal fertilization levels under different levels of weed control.

At present it appears that no single chemical herbicide offers total weed control in maize in this area. At best the chemical will replace the first weeding and slightly reduce the labour requirement of the second weeding.

d) Variety: The screening of varieties for the area should continue with emphasis on yield and storability but also considering earliness and shortness. A variety earlier than La Posta would enable greater flexibility in planting during the major season and also reduce risks from an early finish of rains in the minor season. Farmers would also prefer a variety which withstands lodging better than La Posta.

7.3. Implications for Further Survey Work

Although the exploratory survey has clearly provided much useful information, we recommend that a formal survey of farmers in the area be conducted in the next cropping season. This survey would aim to quantify the extent of some key practices used by farmers (e.g., planting methods, seed selection, time of weeding) and opinions expressed by farmers. General impressions were obtained during the exploratory survey but because of the limited time period and the considerable variation in the area, we did not feel confident in quantifying the extent of various farmer practices and opinions.

Our recommendations for the design and conduct of the survey are as follows:

a) Population of Farmers of Interest: A convenient definition would be the area, largely defined by rainfall, where minor season maize is widely grown.

b) Sample Size: Experience from elsehwere suggest that 100 farmers is adequate to represent the variability in this area. This variability mainly relates to sole cropping v intercropping of maize, location relative to past maize demonstration programs, savannah v forest land, and hand v tractor land preparation - the latter strongly co-related to farm size.

c) Sampling Frame: The sampling frame used by the economics and statistics unit, MOA, seems to be a convenient starting point. It lists farmers for randomly selected census enumeration areas (EA's) and also the crops grown by each farmer. The accuracy of the frame in terms of coverage could be checked with the chief farmer for one or two villages.

d) Sampling Method: Depending on the nature of the above sampling frame, farmers could be either drawn at random from all farmers listed or EA's first drawn at random and then farmers drawn at random within each selected EA. The idea would be to have at least 10 EA's represented. More than 15 EA's would present logistical problems in transportation and establishing cooperation through chief farmers.

e) Enumerators: Two sources of enumerators are possible:

a) As a first choice, sons of local farmers with say a Form III education or above and other desirable characteristics of enumerators. A budget would be required to hire and transport 3-4 such persons for 4 weeks.

b) GLDB field supervisors could be used provided that i) they are carefully screened for quality, ii) they work in areas outside of their normal jurisdiction, and iii) they do not think of the survey as an evaluation of their work.

f) Timing: The survey could begin in say late May or early June when the peak weeding period has passed. This would also enable field observations on stand, weeds, etc. to be made. With three to four enumerators, four weeks will be needed to complete the survey.

g) Questionnaire: A preliminary draft of the questionnaire is included in the Appendix. Note that information on farmer practices is obtained for only one field (farm). Normally farmers we met had only intercropped fields or had most maize sole-cropped with perhaps a small field intercropped. This method of questioning then would obtain information on farmer practices for both intercropped and sole-cropped fields but avoids the time consuming task of obtaining information on practices in each field or for each cropping system. The questionnaire should be carefully tested and refined before the survey begins.

7.4 Broader Implications Arising from the Survey

A number of issues were tentatively identified in the survey which have implications beyond the proposed on-farm research/demonstration program in the Mampong-Sekodumasi area. These issues might merit specific research projects or policy actions if they were found to be common across several important maize producing areas.

a) Fertilizer Distribution: Fertilizer use by small farmers is limited by the short supply of fertilizer and the small number of distribution points. The supply problem this year is probably to some extent a result of the fuel shortage. Nonetheless, farmers often had to travel considerable distances and incur substantial costs to obtain fertilizer at one of the two distribution points serving the area. These increased costs of fertilizer use to some extent reduce the effectiveness of the current subsidy.

b) Maize Marketing: Many farmers are selling maize in the immediate post-harvest period when prices are only about one half of prices later in the season. Although the Food Distribution Corporation operates in the area neither the price paid or the quantity bought is sufficient to have any significant effect on these seasonal price changes.

c) Breeding for Storability: To the extent that there is potential for improved maize storability through breeding a special project in the CRI maize breeding program might be set up to select for maize storability. This, of course, would depend on definition of the current problems with La Posta; whether storage problems relate to poor husk cover or soft endosperm.

APPENDIX

DRAFT QUESTIONNAIRE FOR A SURVEY OF MAIZE FARMERS IN THE MAMPONG SEKODUMASI AREA

1. Inventory of Maize Farms

1a. What farms did you plant with maize this major season?

	Area (acs)	Other Crops in Farm	Date Maize Sown
Farms with Maize Alone			
Farm 1			___ 1 2 3 4
Farm 2			___ 1 2 3 4
Farm 3			___ 1 2 3 4
Farms with Maize Intercropped			
Farm A			___ 1 2 3 4
Farm B			___ 1 2 3 4
Farm C			___ 1 2 3 4
		C=Cassava CY=Cocoyan GN=Groundnut P=Plantain CP=Cowpeas	Insert month and circle week

1b. (If farmer does not know area) Which of these farms is the largest?

Farm N°____

2. Practices for Maize Production

(Enumerator; Choose the largest farm from the above list for the following questions).

Farm N°_____ Area _____

2a. What crops were planted in this farm in?

	Major Season	Minor Season
1979		
1978		
1977		
1976		

M=Maize, G=Groundnuts, CY=Cocoyams, C=Cassava, P=Plantain, CP=Cowpeas, F=Fallow

2b. In what year was this farm last cleared (after fallow)? _____

How long was the fallow period? _____years

2c. How did you obtain this land?

Own Land _____ Chiefs' Permission_____ Share Tenant_____ Other (sp)_____

2d. Practices in this Farm

(Enumerator; complete the following information for this farm)

Operation	Operation Done	Date of Operation	Method of Operation	If manual manday/acre or/farm	If machine cost of rental
Felling, Clearing, Stumping	Y/N	1234	C/T	/	_____/
Slashing	Y/N	1234		/	
Burning	Y/N	1234		/	
Ploughing	Y/N	1234	H/T	/	_____/ac
Harrowing	Y/N	1234			_____/ac
Planting Maize		1234	C/T		_____/ac
" Cassava*	Y/N	1234		/	_____/
" Plantain*	Y/N	1234		/	
Other (sp_____)*		1234		/	
Replanting	Y/N	1234		/	
Thinning	Y/N	1234		/	
First Weeding	Y/N	1234	C/H		_____/ac
Second Weeding	Y/N	1234	C/H	/	_____/ac
First Fertilizer Application	Y/N	1234		/	
Second Fertilizer Application	Y/N	1234		/	
Harvesting Maize		1234			
Harvesting Maize /Weeding*		1234			
Shelling	Y/N	1234	Manual/Mach.	bag/day	/bag
* Intercropped fields only	Y=Yes N=No	write in month & circle wk	C=Cutlass H=Hoe T=Tractor		

3a. Which variety did you plant in this farm (selected farm) this major season?

Local (white) _____ Composite 4 _____

Local (yellow)_____ Composite 2 _____

La Posta _____ Other (sp_____) _____

3b. Which other varieties did you also plant (i.e. in other farms)?

_____

3c. What other varieties do you know?

a. Local (white) _____ Composite 4 _____

b. Local (yellow) _____ Composite 2 _____

c. La Posta _____ Other (sp_____) _____

3d. Which of these do you think is the best variety for you? _____

Why do you think it is best?

Yield _____ Stores better ____

Early Maturing _____ Other (Sp_____) _____

3e. (If farmer did not grow this best variety?) Why did you not plant this variety this year? _____

_____

3f. Of these varieties which do you think yields best when rains are normal_____
yields best when rains finish early_____
stores longest _____
matures earliest _____
lodges most _____

3g. (If farmer plants La Posta) How long have you planted this variety?_____years
Where did you obtain your seed? _____

3h. When did you last buy new seed of La Posta? _____year. Price paid_____/kg.

3i. When selecting seed for planting, have you ever mixed ears of improved varieties and local varieties to plant in the same field? Yes/No.
If so, why did you mix them? _____

_____

4. Planting

(Enumerator; For the selected farm (i.e. largest) obtain the following information)

4a. Can you tell us how you plant maize?

Haphazard_____ In lines _____

(If Hazphazard) Distances between hills _____

Seeds planted/hill _____

(If in Lines) Distances between lines _____

Distance between hills _____

Seeds planted/hill _____

4b. (If planted in lines) when did you begin planting in lines? _____ years.

Do you use a string? Yes/No

4c. Which method do you use for planting maize?

cutlass to make hole ____ cutlass to lift soil only ___

pointed stick ____ heel ___ machine ___ other (sp) ____

5. Fertilizer

(Enumerator; Again refer only to the selected maize farm)

5a. Did you apply fertilizer to this farm this year? Yes/No

(IF FARMER APPLIED FERTILIZER)

5b. How much did you apply of:

15-15-15 ____ bags per acre/farm

Sulphate of Am.___ bags per acre/farm

5c. How do you apply fertilizer? to each hill___

Broadcast ___ Lines ___ Other (sp_____) _____

5d. Do you cover after application? Yes/No

5e. Where did you obtain the fertilizer? _____

5f. How much did you pay this year?

15-15-15	Ammonia	Transport	Other Charges
/bag	/bag	/bag	/bag

5g. Is there any difficulty obtaining fertilizer when you need it? Yes/No

If yes, what type of difficulty do you have? _____

_____

Which type of fertilizer is difficult to obtain? _____

5h. In what year did you begin applying fertilizer to maize? _____year.

(IF FARMER HAS NEVER USED FERTILIZER ON MAIZE)

5g. Which types of fertilizer do you know?

15-15-15 _____ Ammonia_____ Other (sp_____) _____

5j. Why do you not apply fertilizer to maize? _____

_____

6. Production Problems

6a. Of the following which do you consider serious problems in producing maize in this area?

	Serious	Sometimes a Problem	Not a Problem	If serious, specify nature of problem
Planting on time	_____	_____	_____	_____
Loss of seed to birds/animals	_____	_____	_____	_____
Insect damage	_____	_____	_____	_____
Weeding on time	_____	_____	_____	_____
Major season rains start late	_____	_____	_____	_____
" " " finish early	_____	_____	_____	_____
Minor season rains start late	_____	_____	_____	_____
" " " finish early	_____	_____	_____	_____

6b. Of these problems, which do you consider to be the most serious? _____

_____

6c. What can you do to reduce this problem? _____

_____

7. Production, Storage and Marketing

7a. Last year, how much maize did you produce (including maize harvested green?)

Major season - sole cropped _____ bags from _____ acres

Major season - mixed _____ bags from _____acres

Minor season - sole cropped_____ bags from _____acres

- mixed _____ bags from _____acres

Total _____bags of ears in husk/unhusked ears/shelled grain.

7b. Of this amount, how much did you consume at home _____

feed to animals _____

sell _____

other (sp_____) _____

7c. How long did you store most of your maize?

for selling _____ months

eating _____ months

7d. How was the maize stored?

i) Special Barn ____ In House _____

ii) In Husk ____ Dehusked _____

iii) With Insecticide ____ No insecticide

7e. At what price did you sell most of your maize $_____/kg in _____ month.

7f. To whom did you sell this maize?

Trader_____ FDC _____

Other (sp_____)

8. Farming System

8a. Besides your farms where you plant maize, what other farms does your household have?

Farm	Acres	Crops on Farm
1	____	_____
2	____	_____
3	____	_____

8b. Of the crops you grow, what are most important for:

	Crops
Food	_____
Cash	_____

8c. In the whole year, what months are the busiest months for farm work?

	Month	Work to be done*
1.	_____	_____
2.	_____	_____

* Specify crop and job

8d. Which jobs do you feel are not being completed on time?

Job/Crop	Time completed this year	Best Time

8e. Do you normally hire labor for farm work? _____

8f. (If yes) In what months do you hire labor? _____

What wages are paid - cash $_____/day

- food $_____/day

Where do these laborers came from?

Migrants_____ School children_____ Other farmers _____

8g. In what months do you have difficulty hiring labor? _____

Why? _____

8h. In what months can you easily hire labor? _____

Why? _____

8i. For expenses in farming, what is your usual source of funds?

Self____ Bank____ Money lender ____ Friends & Relatives _____

8j. If you borrow $1000 in February from a private lender, how much would you pay back at harvest? _____$

_____ bags of maize

LIST OF AVAILABLE CIMMYT ECONOMICS WORKING PAPERS

Edith Hesse de Polanco and Peter Walker, "A Users Guide to FASAP - A Fortran Program for the Analysis of Farm Survey Data".

Edith Hesse de Polanco and Peter Walker, "Manual Para los Usuarios de FASAP - Un Programa de Fortran Para El Análisis de Datos de Encuestas de Agricultores".

Kwasi Bruce, Derek Byerlee and G.E. Edmeades, "Maize in the Mampong-Sekodumasi Area of Ghana; Results of an Exploratory Survey".

Alan Benjamin, "An Agro-Economic Evaluation of Maize Production in Three Valleys of the Peruvian Andes".

Derek Byerlee, Larry Harrington and Paul Marko, "Barley Production Practices, Problems and Research Opportunities in the Calpulalpan/Apan Valley, Mexico".