

ON-FARM GRAIN STORAGE IN WESTERN KENYA

A Prospective Evaluation Prepared  
for the Population Council

By

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## P R E F A C E

In 1981 the Population Council requested us to conduct a prospective evaluation of the On-Farm Grain Storage Project in Nyanza and Western provinces, of Kenya, then at advanced stages of planning. The Grain Storage Project is being sponsored by the United States Agency for International Development (USAID) and is to be implemented through Kenya's Ministry of Agriculture. As a prospective case this study was expected to develop largely qualitative data whose interpretation would provide some useful guidelines for the modification of project design and implementation. A particular concern of the Population Council in undertaking this study was the grave limitations in the current style of analysis of the impact of development schemes. Among such limitations was the exclusive reliance on economic indicators as a measure of project performance. Another problem was the lack of differentiation of benefits and losses for different kinds of households, and individuals. Naturally, the role of women would be central in many programmes which seek to increase production and family income. Without understanding the process by which people use new resources, and who gains control of such resources it would not be possible to make the claim that despite overall increases in income, any development project would actually benefit the target population.

The specific objectives of this study may therefore be summarised in the following broad questions:

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1. What are the primary determinants of grain production, harvesting and post-harvesting practices, and of sequencing of agricultural activities by household - differentiating household types to look at specifically households headed by women as well as other households?
2. What are the major technical, social and cultural constraints, including those perceived by the recipients, on households to changing current grain production, harvesting and post-harvesting practices, and sequencing of agricultural activities, including decision-making within the households concerning grain production, harvesting and post-harvesting practices, and allocation of output for consumption and/or marketing?
3. What are the perceptions of men and women concerning the on-farm grain storage project, proposed changes in harvesting and post-harvesting practices - including technologies to be employed - and sequencing of activities in the extension strategy?
4. What recommendations can be made on modifications to project design and implementation plan which could result in more favourable investment in the next generation - males and females of the next generation?

These questions are obviously too broad and in order to provide full answers to each of them it would be necessary to generate a mass of primary data. Clearly such a task would

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require greater resources and time than that originally allocated to this study. In the circumstance it was agreed that this prospective study would rely largely on a review of existing secondary data and in-depth interviews. It was expected that such quantitative data as may be necessary would be generated through a questionnaire administered to a very small sample and analysed simply by hand tabulation. Fortunately, it was possible to gather somewhat more extensive quantitative data than was envisaged. But due to limitations of time and resources this data has not been fully analysed. In any case its presentation here would clearly go beyond the original scope of this study.

This report is being submitted to the Population Council and USAID in the hope that it will evoke interest and comments and will lead to re-orientation of the design and implementation of the On-Farm Grain Storage Project. But some of its conclusions may also have far reaching implications on policies aimed at alleviating rural poverty through greater agricultural production and increased incomes to households and individuals. It is our hope that the report will become the basis of continuing dialogue between policy makers, project implementors, the scholastic community and the people of Western Kenya in general.

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## SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

### Introduction

In the last two decades, Kenya has made very significant advances in agricultural development and especially the adoption of high yielding hybrid varieties of maize. The improvement however has not uniformly benefitted all farmers, particularly small-holders who are heavily dependent on the produce from their own plots. In some places the farmers are limited in their capacity to take advantage of the new farming technologies because of inadequate or unreliable rainfall, while in others population growth restricts the opportunity to extend farming acreage. Because of the very low levels of income in such areas small holders often lack any disposable income to invest in the new technology packages that are designed to improve yields.

Generally, the Kenyan small-holders are satisfying about 73 percent of their minimum daily calorific requirement. The 1978-83 Development Plan devoted attention to the alleviation of poverty among the groups who had least benefitted from the past agricultural progress. One way to realise this objective is to increase food crop production, of which grain forms a very important part. But since the target groups are largely subsistence oriented, and therefore relatively less responsive to national pricing policies, tackling the problem of on-farm grain losses would appear to be an important goal. Thus, the On-Farm Grain Storage Project was evolved,

initially to be a pilot project aimed at promoting improved post-harvest grain handling processing and storage among small holders in Western Kenya.

#### Study Objectives

This study of On-Farm Grain Storage in Western Kenya sought to determine the range of grain production activities, including post-harvest drying, storage and other relevant practices, and to assess constraints to the introduction and promotion of new grain storage technology. The study also attempted to identify elements of project implementation which would maximise benefits accruing to different sub-groups among the target population, especially women.

#### Study Area and the People

Western Kenya comprises of two provinces namely Nyanza and Western covering an area of 20,271 square kilometres, which is only 4 percent of the country's land area, with a population of 4,476,619 (30 percent of Kenya's total population. The drainage pattern generally follows the physical relief of the Lake Victoria basin, with rivers Yala, Nzoia, Sio, Nyando, Miriu and Kuja draining the plateaux. Mount Elgon, the eastern sides of Kakamega district and Kisii highlands constitute the main high rainfall core, while the lowlands around the lake receive the least rainfall. The rainfall comes in two marked seasons starting from March to May and a very short one from October to November.

The soils of the region are potentially fertile; generally of volcanic origin on the higher altitudes and black cotton type around the lake.

The dominant cultural and linguistic group in the project area are segmentary societies made up of a series of agnatic lineages which trace their origin from a common ancestor. The contemporary territorial organisation of the region is partly a legacy of colonial rule through the establishment of administrative locations and appointment of Chiefs and Sub-chiefs. The existing pattern of land-use and control are conditioned by traditional land tenure arrangements and the government's efforts to introduce freehold tenure systems through adjudication and registration, mediated by the increasing population pressure. Within the Settlement Schemes which are occupied by ethnically diverse people who are only marginally subject to control by the existing lineage and clan organizations, cultural values, traditional and customary beliefs among the farmers still prevail and tend to be an impeding factor in sound farm planning in which efficient use may be made of mechanised labour saving devices and the application of advance agronomic technologies and inputs.

The project area constitutes the highest and the most extensive population cluster in Kenya. It contains nearly 30 percent of Kenya's population within barely 4 percent of the country's total land area. Rainfall largely influences the distribution of population to the region with relatively sparse population in the lake shore where rainfall is low and unreliable, moderate on higher parts of the plateau, and heavily clustered in areas of heavy rainfall most of the

year. The region has been historically reknown for "labour-export" to areas of commercial farming and urban centres. Urbanization within the region is insignificant, although a few administrative centres have developed, especially since Independence.

Kakamega and Kisii are the most populous districts. The Abaluhya in Western Province and the Joluo in Nyanza Province are the largest ethnic communities contributing 47% and 43% of the region's population respectively, while Kisii form about 19 percent. Dependency ratio is very high. About 50 percent of the population are children under 15 years and about 10 percent are adults over 50 years, indicating that 60 percent of the population rely on a small labour force most of whom lack reliable source of income. The historically high educational attainment in the region has adversely affected rural development since majority of the educated often migrated, to urban centres, contributing little to the development of the region during the prime of their productive years. The consequence has been overburdening of women with agricultural work especially food-crop cultivation.

The fertility rates in the project area are among the highest in the country. Within the region, fertility seems to be influenced by rainfall patterns. Thus in the well-watered cash-crop areas there are higher total fertility rates, while in dry, more subsistence areas, the rates are lower. For example fertility rate of 8.12, 7.27, 5.95 and 5.75

of total birth per women has been recorded for Kakamega, Kisii, Siaya and South Nyanza districts respectively. Breast-feeding is thought to be an important determinant of fertility. It has been argued that the traditional duration of breastfeeding has been reduced, partly as a result of the increased work-load for women. Polygamy, another determinant of fertility, is generally declining under the pressure of land scarcity and economic constraints but remains significant among the Luo.

Land distribution correlates with natural resource endowments. Areas with best resources in terms of adequate and reliable rainfall and fertile soils have the least sizes of holdings. The project document defined "poor small-holders" as those having 2 or less hectares. In Nyanza province this amounts to 64 percent of all farmers while in Western Province it accounts for 56.5 percent. Thus the majority of farmers in the area are not likely to be producing any surplus grains that would present any major problem of storage. It should also be remembered that not all of the small-holder's land would be put under maize, and even if it were, some of the produce would be sold-out to provide cash-income for the purchase of needed goods.

#### General Socio-Economic Background

The economy of Western Kenya is based on subsistence farming and cash remittances from migrant workers, cash crop

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production has been expanding at the wake of high population growth rates while out-migration has significantly diminished. Of the cash crops grown, coffee, tea and pyrethrum have made considerable contributions to expansion of smallholders marketed output in the last two decades. At high altitudes, pyrethrum and tea are grown at medium altitudes, coffee, sugarcane and tea are grown at low altitudes sugarcane and cotton. Since 1964 maize acreage has increased substantially because of the introduction of high yielding hybrids and concurrently maize has become more important as a source of cash income. The area put under hybrid maize is at the expense of other cereals (mainly millet) rather than of local maize- this can be explained by dramatic changes in diet preference, as well as higher sale value of maize than other cereals.

Non-farm rural employment is relatively insignificant in Kisii possibly because of the concentration of a profitable crop mix requiring comparatively more stable year round utilization of labour, a situation in which households are obliged and are able to purchase goods from outside the area. Blacksmithing, making and repairing of roofs and agricultural implements are widespread activities for men in the whole project areas except in Kisii where blacksmiths are vulnerable to competition from outside. Fishing, wood cutting and carpentry are other geographically determined activities. Pottery, basket and sisal rope making are common home-based employment for women, as is beer brewing. Women's part time sector has

lower returns to labour because of over crowding. Against a projected annual growth rate of total labour force of over 12% in the 1980s, recent past annual growth rates in the modern sector have been 6.7%, 1.3%, 2.7% and -0.4% for services, construction, commerce, transportation and communications respectively.

The sex division of labour in agriculture is influenced by the shares of food crops for household's consumption and cash crops. Food crops tend to be cultivated by women and children alone but even in cash crops women tend to do more work than men because of the sex specificity of tasks even though the cash returns accrue to men. Use of children's labour has declined with advances in schooling, but where they help it is generally in women's household associated tasks.

It is generally felt that local maize is more labour intensive than hybrid maize i.e. hybrid maize yields 2½ times as much output per unit of labour as local maize. The greatest constraint on raising small farm productivity is the heavy dependence on family labour. Hired labour being expensive and given the existing sex division of labour, the constraint is firmly on the supply of female family labour.

About one half of smallholders maize passes through the market, and some will be bought back by the producers at higher prices. But only 20% of marketed maize went through

National Cereals and Produce Marketing Board in 1976-7. It is believed that this has since decreased. The problem is lack of official storage facilities which constrains the Board's local buying agents, who nevertheless accommodate this situation by buying at a discount on the Board's price and finding their own outlets. Larger on-farm storage capacities if utilized should raise the immediate post-harvest price, but if existing capacities only were improved this would have the effect of moderating the later seasonal peak in price. Hence estimate of the profitability of improved grain storage practices, to the small holder, must distinguish between larger and better on-farm storage facilities by imputing different values of grain saved. Guidelines are required on extension and credit services before implementation because this is a sector primarily concerning small scale women producers, yet agricultural extension services have focussed on women and/or relatively large scale producers.

Combination of individual parts of harvest and post-harvest practices are numerous. There is suspicion that if larger yields of hybrid maize are to be handled from rapid harvesting to safe storage in a combination of cobs and shelled grains, in a way intended to eradicate losses, the labour input and managerial expertise as indeed the cost outlay will have to rise very sharply. And virtually all of this labour will have to be female labour. The issue in this project then becomes on appropriate range of choice of

combinations of technological parts and not appropriate technology per se.

While cash crops provide the opportunity for asset accumulation and therefore economic growth, the resource base of reproduction (women's food and their own labour earnings) is already increasingly coming under greater strain than ever before. Though cash crops provide incomes for school fees and other domestic expenses, women rarely know how much their husbands earn. Kongstad and Monsted surveying in Western Kenya observed that husbands do not perceive daily household expenses to be their obligation, and more than 40% contributed nothing or just occasionally purchased something. But they paid school fees and financed most of the seasonal farm inputs. There is fear that should men finance On-Farm Storage Project, they may view the stored grain as more of their sphere of economic influence than custom and tradition would permit. Men's cash injection into this reproduction sub-economy could erode further women's effective rights of disposal of food grains. In fact innovations can only be successfully introduced if women become acquainted with the new methods and were convinced of their economic profitability.

#### Summary of Findings

More than 40 percent of all respondents in this study were illiterate. National Literacy Survey (1980/81) showed that 62 percent of rural women aged 12 years and above could not read, a figure nearly double that for male. In the two provinces (Nyanza and Western), the figures for illiterate

women were 71 and 62 percent respectively. The majority of the respondents (93%) reported farming to be their main occupation. However 17% of the respondents also reported having other sources of income. Only 20 percent of all respondents reported receipt of cash remittances from family members with South Nyanza and Siaya showing the highest incidence 40 and 30 percent respectively.

The main crops grown in these areas in order of importance are maize, millet, sorghum, beans, cassava, bananas, cotton, groundnuts, sugarcane, coffee, pyrethrum and tea. Maize and beans offer the best combination of food and cash crops. In Kisii, 80 percent of the population grows hybrid maize as the main food crop. Variability of climatic conditions through the district allows for maize growing all the year round therefore the problem of sale of maize is less acute.

Farming practices range from permanent agriculture to irrigated agriculture which is found in highly marginal areas where rainfall is totally unreliable. Most respondents owned under five acres save in the settlement area of Kakamega district where plots are much larger. But even in this area, 34 percent of the respondents actually cultivated only up to five acres. It was found that 78.8 percent of respondents in Kisii, 80 percent in Busia, 93 percent in Siaya, 95 percent in South Nyanza and 98 percent in Kakamega till land

that belongs to them. Most of the respondents acquired land by virtue of family inheritance. However, in Kakamega 97 percent of the respondents had bought the land they were currently farming. Prices of land are determined by demand and supply and range between KShs 2,000 and KShs 7,000 per hectare in Kakamega and Kisii.

Family labour allocation strategy entails division of labour in which the woman does hand digging, weeding, bird scaring and harvesting while the husband may clear bush and plough. Ideally then the woman is the farmer. She is not able to go out and earn cash except through some cooperative effort within the context of women's group's cash generating activities.

In the low lying lakeshore characterised by sparse rainfall the 511 and 512 hybrid, and Katumani composite are the recommended varieties of maize because of their adaptability and early maturity. In places where two rainfall maxima obtain as in Kakamega, Kisii, South Nyanza and Siaya districts the 611, 614 and 632 varieties of hybrid maize are the most suitable for long rains and 622 in the short rains. In Lugari, a settlement scheme of relatively larger forms in Kakamega, some farmers reported that they still grow 613 in addition to 625 variety, both of which take six months to mature. However 613 is susceptible to destruction by wind prematurely at times 1-2 months before maturity. Local

varieties are still grown in lower Busia, Kisumu and South Nyanza districts. In Samia Location within Hakati Division, Busia, it was reported that local and hybrid maize varieties had equal yields and for local maize, seeds for the next planting season are usually selected from the harvested crop without any noticeable reduction in yields. For hybrid maize it is recommended that new seeds should be planted each season. The seeds sell for Kshs 50 per bag of 10 kilogrammes at Kenya Farmers Association (KFA) depots or at Kshs 55 from agents authorised by the KFA. In some parts of Kisii reduction in yields can be 50% when farmers select seeds from a previous hybrid crop. For planting farmers are advised to use Triple Superphosphate (TSP) fertilizer and a 50 kg bag can be purchased at the cost of Kshs 200. For first weeding Calcium Ammonium Nitrate (CAN) is recommended and 80 kgs are needed for an acre while KFA charges Kshs 138 per bag. Ammonium Sulphate, Urea and Ammonium Nitrate are also recommended for application at the first or second weeding.

Only five of the women farmers (out of 50) reported using ammonium sulphate and acknowledged that it enhances plant growth. The rest had neither heard of it or only vaguely knew of its existence. None of the women used TSP for planting. In Busia, Siaya and Kisumu the women interviewed said that they do not use fertilizers because it is too expensive, however, they reported using cowdung as natural manure.

Both men and women participate in the harvesting of hybrid maize, with women performing the greater number of tasks. Men, women and children participate in transporting the harvest though women have a greater responsibility. In preservation of grain for storage, women provide the bulk of labour in the application of wood ash and chemical insecticide but slightly more men have knowledge of chemical pesticides in grain preservation. Children provide small amounts of labour in all post-harvest activities though greater assistance in transportation from the fields.

About 73 percent of the respondents in Siaya and 24 percent in South Nyanza applied wood ashes to shelled grains to control pests. Application of insecticides is prominent mainly in settlement area of Kakamega district. In other districts wood ashes and chemical insecticides are used in combination. A chemical by the name of Red Triangle (malthion 2%) is recommended for protecting unshelled maize while Blue Cross (malthion 2%) is recommended for shelled maize. Both insecticides protect maize against weevils and angoumis moths. "Elianto" or any other edible oil is good for storing beans and other legumes. In the survey area no farmer used edible oil for storage, most likely because of the prohibitive costs involved.

It is recommended that DDT 5% can be used for planting maize to control stalkborer from destroying young plants, however, in-depth interviews showed that in Kakamega, Kisii

and Busia DDT was used for grain storage. Many of the women interviewed believed that DDT is the best way of controlling weevils because it kills the pests. Some even apply DDT at much higher levels of strength though none of them knew the difference between 5 percent and 75 percent strength and they did not know that it should not be used on maize stored for human consumption. In low lying areas where hybrid maize is not prevalent, wood ash is used predominantly and extension services are hard to come by such that new agricultural information and technical know-how does not easily reach the farmers. In the absence of extension advice the women felt that they knew far more about wood ash and were sure of their safety more than they were with other chemicals about which they only had vague information. Some respondents mix wood ash with DDT in order to stretch the small quantities of the powder they are able to purchase. Only two women out of 50 knew how to apply chemical insecticides, the rest exhibited no interest and said their husbands were the ones who had received instructions on how to use the powder.

The study found out that the problem of self-sufficiency was not one of storage but inadequate production the volume of grain stored after harvest and time release patterns seemed to be determined by need for cash especially among small farmers. However respondents felt that there was not adequate assistance from the Ministry of Agriculture with respect to grain storage practices although this was perhaps not

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a major priority. The Ministry personnel concurred and felt that storage has been neglected with regard to formal training of extension staff and dissemination of information.

The common emphasis of extension strategy has been the progressive farmer approach with the hope that poorer farmers can learn from their experiences. This approach has, however, widened the productivity gap between rich and poor farmers, notwithstanding the fact that it is the small farm sector where food needs and security are critical, for it is at this level that farmers rarely have access to adequate resources to implement recommended practices. Training of extension personnel has been shown to prepare them to serve better-off farmers while the actual ratios of extension personnel to farmers is very low these factors militate against any advantages of the better off farmers over the poorer ones.

Ignorance is a major obstacle to the use of credit; a good number of respondents did not know exactly what loan facilities existed or how and where to apply for them. Women were virtually excluded from access to the two main farm support services.

About 70 percent of the respondents had not obtained any credit at all for their farm operations or inputs despite the fact that a number of credit schemes with fairly easy terms were operational in the area. The public mistrust of the loan and fear of indebtedness partly explains the poor performance of seasonal farm credit schemes in Kenya

especially those focussed on poor farmers outside the cash economy. Farmers expressed disappointment at the poor timing and distribution of agricultural credit - approval took long while inputs arrived too late. This delay is costly to farmers because it implies delay in farm operations culminating in production losses and low yields; yet farmers are still liable for prompt loan repayment.

Effectiveness of any agricultural credit depends on other factors, besides the credit itself i.e. soundness of technical package, farmers ability to implement the package, agricultural support services especially extension and marketing opportunities.

There are two alternative approaches in extension emphasis on personal contact between individual farmers and extension agents and group extension which addresses the average or less progressive farmers in clusters. Individual approach though superior and showing good records of success in production of pyrethrum and tea, is yet to claim any success in the production of food crops especially among poor farmers in non-cash crop area. This may be partly due to low ratios e.g in Kisii, one extension staff was supposed to serve 1500 to 2000 farmers. In Busia, a total of 51 extension workers were serving 200,000 farmers and given these figures, it is evident that extension personnel concentrated on the progressive farmers who are less risk averse. Small farmers need

special attention and greater extension time investment than the existing arrangement can support.

Group extension offers a more cost-effective alternative because of its greater potential for more effective diffusion. However, extension advice on promotion of improved food grain storage has been largely ignored. Only 12% of the respondents had received any extension advice on grain storage; most advice was received in spraying or dusting of insecticides.

The male bias in the delivery of extension and credit services to farmers poses a serious obstacle to the improvement of food production which is in the women domain. The problem is further aggravated by the Ministry of Agriculture which recruits predominantly male officers in technical agricultural extension while in home economics it does not recruit men. There is need therefore to change the image and techniques of home economics to be more consonant with what women have to offer in agriculture and re-orient extension services to move away from the 'coffee' bias to deal more directly with women. Only four out of 50 women had been to a farmer training course and only two of these had been visited by extension workers though none had received any advice on how to build a crib. Women indicated a strong need for credit and extension assistance for a host of farm inputs including the construction of more efficient grain storage.

Women indentified credit needs for hiring labour during weeding and harvesting, construction of drying platforms, construction of storage cribs especially in Kisii and Kakamega while in Siaya and South Nyanza, concern for theft of grains from outside granaries was a major concern. One issue expressed throughout the Project Area, and especially in Siaya, South Nyanza and Busia reported to offsetting marketing and transportation bottlenecks especially since that National Cereals and Produce Board agents would not collect maize from the farm unless it is 10 to 20 sacks or more while the majority of farmers are not able to dispose of more than 2 to 4 bags.

Recommendations and Monitoring Plan

An important assumption behind the On-Farm Grain Storage Project is that a substantial proportion of the harvest of staple grains by poor small holder households is lost due to rodents, insects, poor processing and handling during post harvest operations. But while this belief is fairly widespread among some major donor agencies, including the USAID and FAO, there is little concrete evidence to verify it. While our study revealed an awareness and concern about grain losses during storage, we found that the problem was not given a high priority among our respondents. The indication from our study is that storage per se may be a problem among relatively wealthier small holder households which have experienced increased grain production through adoption of high yielding hybrid varieties and other concomitant technological packages. Indeed, it is likely that when food losses among poor small holders are merely assessed, the extent of loss might prove to be very small. But while this does not negate inadequacy of food among a substantial proportion of small holders within the Project Area, it clearly underlines the need to guard against the false synonymy which equates traditional storage systems with inefficient systems. For it may well be the case that it is precisely the small scale producers in households with little or no surplus food grains who have the cheapest and most effective storage systems.

Although the results of this study are not very conclusive on the major issues — nor were they expected to be,

given its scope, the level of funding and time frame - they would appear to support the conclusion that post-harvest research should be given a major reorientation that aims at the analysis of the distributive impact of technological change among different categories of smallholder households and among members of the household. This in turn would call for carefully planned longitudinal micro-level anthropological studies aimed at monitoring the impact of the Grain Storage Project in Western Kenya well beyond the time it is planned to terminate.

An important measure of the success of the On-Farm Grain Storage Project would have to be increased availability to relatively poor households in Nyanza and Western provinces of good quality food grains. This will be conditioned more by farm productivity, availability of credit, including effective education on credit use, and agricultural extension and marketing including favourable price structures, rather than more efficient storage as such. No doubt reduced wastage resulting from damage by rodents, insects pests and moulds would marginally improve the quantity of grains available to smallholder households.

Unless there are significant gains in grain production in both Nyanza and Western provinces it is very unlikely that improved storage will lead to any significant improvements in food availability among relatively poor households,

although storage will be particularly crucial when higher production is realised. It is imperative therefore that this project be closely linked with other programmes aimed at improving food production if it has to achieve acceptability among the target population. As well as the focussing on storage as such, the project must primarily seek to strengthen existing education and extension capacities and to expand mechanisms for field implementation of innovations aimed at increasing food production. For greater effectiveness extension should focus on women, and this in turn implies increased recruitment in agricultural training institutions.

The impact of the Grain Storage Project on women of different socio-economic groups does not emerge clearly from our study. This is mainly because management responsibilities within the household cannot be easily pinpointed in such a short study. Household decision making patterns are certainly not in a static state and the location of rights and obligations of individual household members tends to shift with broader economic changes. The literature offers little information on decision-making within the household. There is need therefore for substantial refinement of information concerning not only decision-making within the household but also changing cultural perceptions and definition of grain losses, hence a clearer insight on the inherent incentives for loss reduction measures.

There is also the need to conduct detailed investigations to assess the viability of women's groups as an effective channel of communication with small scale farmers. While group approach to extension suggests itself as relatively more cost effective, the majority of the existing groups in Western Kenya are in the nature of work parties which often tend to bring together very poor women (rural proletariat?) rather than full time farmers.

For the continuous activity level evaluation of the Grain Storage Project it is planned to have a team of technical experts, including an anthropologist with specialisation on the role of women in development. This team is intended to continuously collect and analyse technical and socio-economic data on the project operation, assess the acceptability of the project and provide data for impact evaluations. In order to provide sufficient information for the evaluation of the projects long term redistributive effects basic household data needs to be collected over a long period of time. Data of this kind demands more or less continuous work and is impossible to gather in quantitative surveys which often give rather superficial impressions. In the following a plan for the function of the social anthropologist is presented!

- 1(a) A number of one-year case studies of different categories of household farm production including cash remittances.

- (b) A study of patterns of consumption of food grains for the selected cases, including time-release patterns and the degree of consumption of supplementary purchased food grains.
- (c) A study of price and relations between own production and purchased food grains.
- (d) Study of economic magnitude of grain loss and socio-cultural perceptions of loss.
- (e) Cost effectiveness of loss reducing measures and their social benefits to different categories of smallholder households and especially women in the poorer households.

Together with the data collected from the baseline survey, the data generated from this continuing monitoring should provide sufficient information for the year to year evaluation of the actual impact of the Project on different categories of smallholder households, including women as well as its long term impact.

## CHAPTER ONE

### INTRODUCTION

#### A. The On-Farm Grain Storage Project: Objectives and Underlying Assumptions.

In spite of significant advances in agricultural development in Kenya, especially higher yields from the use of hybrid maize, there has been growing concern in recent years over projected rises in food imports. At the same time the overall strategy of the National Development Plan, 1978-83, stresses the alleviation of poverty amongst the smallholder category of farmers, many of whom have not been able to benefit much from earlier agricultural progress. Moreover, in some areas farmers are limited in their capacity to take advantage of new agricultural technologies because of inadequate or unreliable rainfall, while in others population growth restricts opportunities to extend farming acreage.

Of the approximate 1.45 million metric tons of maize produced nationally, 92.5% is produced by smallholders, yet nutritionally smallholders are reported to be satisfying only 73% of the recommended minimum daily calorie intake. If this deficiency is to be reduced without resort to large food imports, net output of grains must increase. To some extent the Cereal and Produce Board can move grains from surplus to deficit areas, but there are transport difficulties in shifting substantial amounts

of grains from its large warehouses centrally located in surplus areas. More serious is the Board's inadequate network of local storage facilities to purchase all that is offered by the numerous producers at stipulated prices and at the right time. Because the primary target group of the strategy of poverty alleviation are overwhelmingly subsistence-oriented as far as grain production is concerned, and therefore less responsive (allegedly) to national pricing and marketing policies, tackling the problem of large on-farm grain losses is an obvious goal. At present, these maize losses are generally believed to be in the order of 16%, but may be as high as 20%. Even if these losses can only be halved by new drying and storage practices, the smallest farmers, it is argued, could still benefit along with large farmers and the country. In Kenya smallholders are defined as farmers with less than 20 hectares but of these 97% have less than 8 hectares. 'Poor smallholders' are defined as having 2 hectares or less of land. The problem that has been identified, therefore, is how to improve self-provisioned food supplies of smallholders, with marketable surplus being of secondary importance.

The On-Farm Grain Storage is intended, initially, to be a pilot project aimed at encouraging improved post-harvest practices in Western Kenya (in Nyanza and Western Provinces) which might be extended to other Provinces later. Its objectives are:

1. to improve post-harvest practices and to reduce losses;

2. to institute improved agricultural extension and administration systems in post-harvest practices;
3. to reach small and poor farmers in particular;
4. to increase the supply of food in the country.

The project's goals by means of achieving these objectives are:

1. to aid in creating within the Ministry of Agriculture the capacity to stimulate interest and participation of smallholders in identifying grain drying and storage problems, and to organize field trials necessary to test and adapt on-farm drying and storage technology to local conditions;
2. to improve the Ministry of Agriculture's capacity to facilitate adoption of on-farm grain drying and storage technology packages;
3. to strengthen agricultural extension and administrative systems in post-harvest storage;
4. to increase the capability of agricultural educational institutions to provide training in on-farm grain drying and storage technology;
5. to make recommendations regarding the need for financial assistance to smallholders to support adoption of new post-harvest practices;
6. to enhance the Ministry of Agriculture's capability to monitor, evaluate and expand the initial project of on-farm grain storage.

A testing and monitoring unit will be established at Maseno, near Kisumu in Nyanza Province. It will be concerned with technical and scientific issues, and will organize field

demonstration to assess the feasibility of improved practices. The unit will be staffed by a crop storage technician, an entomologist, and a social scientist.

There are a number of major problems and a potential contradiction in the outline of the Project as described in the Project document ('Kenya National Crop Storage Study', report prepared for the U.S. Agency for International Development, May 1980.)

B. Initial Questions About the Project

Firstly, although the arguments, summarized above, for reducing losses in harvested grain are irrefutable from a macro viewpoint, it remains to be seen whether this policy is viewed by smallholders themselves as a priority. It may be that, given smallholding household's present allocation of all their resources, their own primary objectives are to raise land and farm labor productivity or to improve their cash flows by more non-farm employment. If this is true, it does not necessarily mean that they would be averse to accepting a non-priority improvement, but it would caution against supposing that planner's arguments can be perceived by micro producing units with the same enthusiasm.

Secondly, and expanding on the first point, the profitability to the farmer of investment in new drying and storage facilities is quite untested. Especially in the case of smallholders, since grains produced are predominantly for self-provisioning (subsistence production), it is not clear how the cash for repayment of credit is to be raised. This is

a basic contradiction in many attempts to raise productivity of self-provisioning, non-commoditized production. It cannot be assumed that part of the imputed value of the grains saved (either through its sale or through its expenditure-displacement) is available for credit repayment because flows of produce, cash income and cash expenditure within the household are to some degree subject to the separate spheres of economic management of husband and wife (or wives). In some cases, there may even be a separation of men's and women's maize fields and storage facilities. This has implications for extension services as well as credit facilities. Thus in contemplating the profitability of new post-harvest investments, it may be necessary to pose the question 'whose profitability?' in addition to 'is it profitable to the household?'

The issues of profitability has yet another aspect to it. If the new post-harvest technology were to make new demands on a household's cash flow or labor time, are there opportunity costs attached to this new deployment of resources! For instance, if women, who are already hard pressed at harvest time, have additional or lengthier tasks imposed upon them, do some of their important household tasks have to be suspended (a welfare opportunity cost) or do they have less time to trade small quantities of beans or vegetables or delay the resumption of some other non-farm employment (an economic opportunity costs)?

The issue of redeployment of labor and/or cash resources may be most critical for the smallest holders of the staple

grains than somewhat larger smallholders: it might be of utmost importance to them to retain what cash income-gaining employment they do have. And for all smallholders the economic opportunity cost of retaining higher share of their crop after harvest (the cost of borrowing to cover expenditure demands and to repay farm credit) has to be added to the cost of borrowing to install a new technology with an unknown economic benefit.

Thirdly, although the Project document recognized the equity issue in that credit and extension services should have the capability of reaching the numerous smallholders and it is planned to provide appropriate financial assistance to smallholders to support new post-harvest practices, it seems likely that credit facilities will have to go beyond mere investments in drying and storage capabilities, if a modicum of equality is to have any chance at all.

Finally, the importance of women's roles in harvesting, processing and storage activities involve much more than was alluded to in the second point above. The labor committed to this sector is almost exclusively women's, as is the obligation to find the household's food. But management responsibilities are not so easily pinpointed, and are certainly not in a stationary state; with every further degree of market-incorporation of a 'subsistence' crop (on the input or output side) the location of these rights and responsibilities tend to change. Investment in drying and storage facilities is one such further degree, and men and women may view its potential differently.

These were our major concerns on reading the Project document and embarking on a field investigation to assist in the more detailed planning of the six goals, but they do in turn lead to subsidiary ones. To respond to them required an investigation of the organization and deployment of smallholder household's resources, household members perception of constraints facing them, and the requirements of support to enhance their ability to save and retain higher proportions of their outputs.

C. Scope and objectives of the study

The aim of this study is to determine the range and types of production, drying storage and handling technology and practices associated with hybrid maize with a view to assessing current practices and constraints to the introduction of new grain storage practices and technology in Western Kenya.

This study is also expected to: develop an optimal data base within the budgetary and time constraints; interpret these data for the benefit of the project; identify elements of project implementation which would maximize benefits accruing to different sub-groups, especially women; include a plan to monitor the effects of the program; and a list of key questions/issues to be raised in future programming for this sector.

The study is therefore woven around the following areas:

1. Investigation of determinants of current grain production, harvesting and post-harvest practices

and the sequencing of agricultural activities by households.

2. Identification of major technical, social, cultural and financial constraints to changing current grain production, harvesting and post-harvest practices.
3. Investigation of perceptions of men and women concerning the on-farm grain storage project and of extension services.
4. Recommendations of modifications to project design and implementation.

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CHAPTER TWO

PROFILE OF WESTERN KENYA

A. Physical Background

The two provinces of Western Kenya, Nyanza and Western, form the greater part of the westward-sloping lands of the Lake Victoria Basin.<sup>1</sup> They cover a total area of 20,721 square kilometer. The basic physical structure of the region is represented by two blocks of plateaux in the north and south separated by an east west trending depression in which lies the Nyanza Gulf (Winam). The highlands slope generally westwards from an altitude of 1800 meters to the lakeshore which stands at 900 meters above sea level. The lowlands around the lake form a trough of low rainfall with a mean ranging from 889 to 1,143 mm.<sup>2</sup> But reliability of rainfall is poor, thus this zone may be considered a generally a rainfall deficit area, although it also suffers from periodic flooding. Ecologically, the lake lowlands may be classified more specifically as "Lakeshore Savannah".

The plateau to the north of the gulf is generally gradual although the gently inclined surface is broken by the volcanic pile formed by Mount Elgon. South of the gulf, Kisii highlands form the south-eastern section of the plateau whose surface decreases in altitude westwards. Rainfall closely correlates with the physical relief of the Lake Victoria Basin: Mount Elgon, the eastern parts of

Kakamega district and Kisii highlands constitute the main high-rainfall cores with ranges of 1524 to 1772 mm, although amounts higher than 2032 mm have been recorded.<sup>3</sup> Generally, there is a decrease of rainfall westwards to the lake shore. The drainage pattern of the Lake Victoria Basin also follows the complex physical relief of the region. Three rivers (Yala, Nzoia and Sio) drain the northern and eastern plateaus.

The whole region generally enjoys potentially fertile soils with ancient volcanic soils on the higher altitudes and black cotton soils around the lake shore. As will be already evident, by far the greater agronomic variations between the administrative districts in the region are conditioned by physical relief. In most of Western province, and especially in eastern Kakamega and northern Bungoma, there is one long wet season (March to May) with a second rainfall in August in the far north. In the rest of the region, namely most of Kakamega, the higher parts of Siaya, Kisumu, South Nyanza and Kisii, there are two wet seasons, long rains (March to May) and short rains (October to November). While this rainfall regime tends to obtain in the lakeshore lowlands the short rains are very unreliable. Thus large parts of Siaya, Kisumu and South Nyanza districts suffer very dry conditions except during the long rains. This means that in the lakeshore lowlands it is not possible to grow two crops a year, particularly of maize which is rapidly replacing millet and sorghum as the preferred cereal staple in the region.

( B ) Social-Cultural Background

The dominant cultural and linguistic groups in the Project Area are segmentary societies made up of a series of agnatic lineages which trace their real or putative descent from a common ancestor. Sub-tribes whose territorial boundaries generally coincide with administrative locational boundaries, constitute the largest jural-political units within which disputes were traditionally settled by mediation. However, because of sub-division of locations during the post-Independence period the number of locations on the project area exceed the number of sub-tribes.

The clan is the major sub-division of the core lineages of the sub-tribe. It further sub-divides into lineages based upon the ancestors who founded them. Traditionally the clan was perhaps the smallest unit within which mobilization for communal work was organized. Although its importance has diminished today, it is still a significant institution around which mutual aid in agricultural operations are furnished by collective work.

Perhaps the most significant territorial grouping in much of the Project Area is the locality or neighbourhood which is made up of the core lineage of one of the clans of the sub-tribe. The focus of unity for the group is that it held a single piece of land, usually with clear boundaries. The right of the elders over the land they occupied were supreme in the sense that no land could be alienated to anyone outside the lineage group.

The contemporary territorial organization within the project area is partly a legacy of colonial rule — through the establishment of administration locations and the appointment of chiefs and sub-chiefs. The chief and his sub-chiefs are perhaps the most important administrative officials within rural Kenya. Through the Chief's Authority Act, the most powerful legal instrument for social control, the Chief is in a position to issue orders affecting practically every aspect of life within his area of jurisdiction. In practice, though these powers have hardly been fully evoked and the chief has recently emerged as the co-ordinator of development activities within the location. But the lowest level of administrative contact is provided by the sub-chief whose area of jurisdiction (sub-location) may contain between 2,000 and 6,000 persons.

The basic layout of villages although roughly corresponding to clan and sub-clan groupings, is characterized by somewhat scattered homesteads on the higher spots and ridges. As a rule a homestead consists of several houses surrounded by a circular enclosure of tree shrubs, more commonly euphorbia. Houses are built in a definite order along the perimeter and may surround an inner cattle keeping area. Interspersed between the houses are traditional granaries constructed from papyrus or supple twigs into a wickerwork and covered by conical roofs. Generally, the layout and use of various buildings within the homestead is strongly determined by cultural rules but these are rapidly

weakening. For instance, an important rule required that a homestead be abandoned once its head died and the sons had grown to set up their own households. However, increasing land pressure has radically slowed this process, although the rules governing the utilization of specific buildings within the homestead are still closely adhered to. One consequence of this is the lingering reluctance of many people, especially in the Luo areas and Busia district to invest in expensive permanent buildings, since in the event of their death, the building would be abandoned. Another consequence is the increasing fragmentation of land rendering even rudimentary farm planning impossible as the parcelised plots are interspersed between homesteads ——— land registration notwithstanding.

As already suggested, the existing patterns of land use control within the Project Area are the result of the interplay between traditional land tenure arrangements and government efforts to introduce freehold tenure systems through land adjudication and registration; mediated by increasing population pressure. It is reasonable to assert that any future agricultural project in the region will have to deal with the emergent patterns of land tenure, which are vested primarily in family or household units. In addition it has to come to grips with the tendency towards fragmentation of holdings which has resulted from the system of succession as indeed from the desire to have access to land of different qualities as determined by local micro-

climatic and soil conditions.<sup>4</sup> The resulting strong binding to different plots was in large measure conditioned by resistance to land consolidation, which has been further compounded by veneration of the dead and reluctance by family members to have other people cultivate plots on which there are graves of their immediate ancestors. An obvious implication of this is the difficulty of evolving sound farm planning in which efficient use may be made of mechanized labour saving devices on any large scale, except in the areas of recent agricultural settlement such as the Lambwe Valley or the Settlement Schemes in Lugari Division of Kakamega District.

( C ) Population Characteristics and Problems

The Lake Victorial Basin constitutes the highest and most extensive population cluster in Kenya. Nyanza and Western provinces combined have a total population of 4,476,619 constituting nearly thirty percent (30%) of Kenya's population within scarcely four percent of the country's total land area.

Population distribution in Western Kenya is generally influenced by rainfall distribution; relatively sparse along the shores where rainfall is low and erratic; moderate on higher parts of the plateau; and heavily clustered in the areas with heavy rainfall throughout the year. Western Kenya has for a long time remained an area of out-migration into areas of commercial farming and urban centers. Urbanization within the region is insignificant, although there

Table 1: Population and Land Area in Western Kenya

	Households	Total Population	Area Sq.Km.	Density	
				1969	1979
NYANZA	463,321	2,643,956	12,525	169	211
Kisii	141,607	867,512	2,196	307	395
Kisumu	97,611	482,327	2,093	193	230
Siaya	89,702	474,516	2,522	151	188
South Nyanza	134,401	817,601	5,714	116	143
WESTERN	332,146	1,832,663	8,196	162	223
Busia	55,105	297,841	1,626	112	183
Bungoma	78,971	503,935	3,074	123	163
Kakamega	198,070	1,030,887	3,495	232	294
Total Western Kenya	795,467	4,476,619	20,721	166	216
TOTAL KENYA	2,956,369	15,327,061	564,162		27

has been a rapid growth of the administrative centers, namely Siaya, Homa Bay, Kisii, Kakamega and Bungoma. Kisumu, while nominally the third largest urban center in the country, has shown signs of stagnation in the last twenty years. But small market centers have proliferated in the farming areas, and it has been argued that it is these centers that spearhead commercial activity in the region.

While within the region Nyanza Province accounts for the majority of the population, Kakamega and Kisii are among the most populous districts in the country as a whole. District densities, however, mask local differentials which underline the severity of land pressure especially in the more productive high potential land areas. Within the two districts, for

instance, the highest densities per square kilometre obtain in Kisii (416), Nyang'ori (566), West Bunyore (627), Tiriki (633), South Maragoli (674), East Bunyore (715), and North Maragoli (748) locations in Kakamega district; and also Majoge Chache (422), Kitutu East (427), Kitutu West (431), Nyaribari Chache (437), Majoge Borabu (446), West Mugirango (501), and Kitutu Central (746) in Kisii district. Lower densities, but generally over 200 per square kilometer obtain in the rest of the districts.

Accurate figures for ethnic composition within the region are not available since census figures relate to country-wide enumeration. But census figures for ethnic composition of the two provinces may be easily estimated. For in spite of the high rates of out-migration, such movements are essentially temporary. The population originating from the Lake Victoria Basin eventually returns to settle in the area, which is regarded as their "homeland". The Abaluhya in Western and the Joluo in Nyanza provinces are by far the largest ethnic communities contributing 47 and 43 percent of the region's population respectively. They also have the highest rates of out-migration. Other groups are relatively sedentary. Among them the Kisii, contributing 19 percent of the region's population, are notable although they have recently shown a tendency to out-migrate, probably in response to acute land pressure, among other factors.

In general, the region is characterized by a large number of dependents. Slightly over 50 percent of the population are children under 15 years, and about 10 percent are adults over 50 years. Thus nearly 60 percent of the population are dependents who rely for their livelihood on a small labor force, a sizeable proportion of whom have no reliable source of income. High educational attainment, historically characteristic of the region has for many years tended to have adverse effects of rural development since the majority of educated persons have been migrants contributing little to the development of the region during the prime of their working years. One effect of this is that the bulk of agricultural production especially food cultivation, has come to be undertaken by women, the demand on whose labor has often been too excessive. But although the urban labour market has been slowing down since the late 1960s and formal sector jobs have become increasingly scarce there has not been any significant switch back to agriculture by the young unemployed men some of whom have had to return to Western Kenya after abandoning job-seeking in the urban areas.

Western and Nyanza Provinces have the highest total fertility rates in the country, except for Central and Eastern Provinces. Within Western and Nyanza these rates vary from 5.61 (total births per women), 5.75 in S. Nyanza and 5.95 in Siaya, to 7.27 in Kisii, 8.12 in Kakamega. The well-watered cash crop areas, where women have a more stable, workload have the higher total fertility rates, and the dry, more subsistence areas the

lower rates. Fertility rates for all Kenya appear to be rising. The 1969 Census and National Demographic Survey (1977) data show that the proportion of women in 30-34 years age group who have less than 4 children has fallen from 18.1% to 14.2%, and the proportion in the same age group with more than 7 children has risen from 19.1% to 20.1%. However, it is not known how these changes are distributed by physical endowment and cropping pattern.

The 1977 National Demographic Survey showed that for Kenya as a whole infant mortality was 83 per 1000, an improvement on the 1969 figure of 119. If breastfeeding practices have remained unchanged this must be the effect of more widely distributed health services. The Rural Kenya Nutrition Survey (February - March 1977) revealed that there were very large differences in breastfeeding practices between Provinces. The proportion of women who stopped breastfeeding before three months of infant's age ranged from 1.0% in Central and Nyanza to 4.1% in Eastern (3.5% for Western). At twelve months, Western and Nyanza had lower proportions of breastfeeding termination (42.9% and 38.2%, respectively) than any other Province, except the Coast. But percentages increased rapidly after that. There is little evidence from these figures that breastfeeding acts as more than a very mild birth spacer on total fertility, and they do suggest that the traditional duration of breastfeeding has been sharply reduced. Moreover, fewer number of feeds per day can have the same

effect on fertility as total termination, and if cash crops and other modern agricultural changes have increased women's workload over the last few decades, it is likely that the women would be more inclined now than before to reduce the number of daily feeds.

Polygamy, the other traditional moderator of fertility, is declining under pressure of land scarcity. Larger proportions of smallholdings and growing numbers of landless are common factors in increasing the incidence of nuclear families. It would seem that the only chance of returning to historical levels of birth spacing would be through a return to longer and fuller breastfeeding (alleviation of women's workload) or through artificial methods of birth regulation. Since the latter have not gained popular acceptance, it is necessary to view the effects of agricultural projects on women's work status and determinants of their ability to command resources. For this and for other important issues related to grain storage, we include a discussion of women's role and access to resources in the next chapter.

Western and Nyanza Provinces are heavily-settled, but following the rainfall pattern it is relatively sparsely populated along the Lakeshores, and most densely populated in the highest parts where there is rain throughout the year. It has an overall population growth rate which has steadily climbed to about 3.5% today from less than 2% in the 1930s. Moreover, as Table 2 shows these Provinces have the highest population density (though not

of arable land) in Kenya.

**Table 2:** 1969 Population Density of Total Land Area and Arable Land, by Province. (Numbers per square Kilometre)

	<u>Total Land Area</u>	<u>Arable Land</u>
Central	127	181
Coast	11	61
Eastern	12	71
Rift Valley	13	70
Nyanza	169	169
- Kisii	304	304
- Kisumu	192	170
- Siaya	151	...
- S. Nyanza	114	116
Western	162	179
- Bungoma	113	136
- Busia	119	122
- Kakamega	220	241

Source: 1969 Population Census.

As would be expected average size of holding is lowest in the best endowed high areas. In Kakamega, for instance, the average holding size is less than 3 acres. Table 3 gives the size distribution of holdings in the two Provinces and in the country.

Table 3: Percentage Distribution of Holdings by Size  
Group: 1974-75

<u>Hectares</u>	<u>Nyanza</u>	<u>Western</u>	<u>All Kenya</u>
Less than 0.5	15.72	21.53	13.91
0.5-0.9	26.18	17.67	17.92
1-1.9	22.03	17.27	26.99
2-2.9	15.23	14.68	15.11
3-3.9	6.79	8.60	8.89
4-4.9	8.13	4.36	7.22
5-7.9	4.09	10.22	6.50
8 & over	1.83	5.68	3.47
	100	100	100

Source: Integrated Rural Survey, 1974-75, Basic Report, p. 44.

The Project document defines 'poor smallholder' as having 2 or less hectares.<sup>5</sup> In Nyanza this amounts to 64% of all farmers and in Western 56.5%. But it can be assumed that smallholders with more than 2 hectares will be included in the Project's long-term target group. The proportion of new landless smallholders is also significant, and given that these households must depend on off-farm employment to make up an adequate income portfolio, their numbers are a measure of the importance of questioning the profitability to some smallholders of investing credit-worthiness and more family labour in improved storage facilities.

Finally, the Table provides an indication of the proportion of farmers who could be self-sufficient in grains if they were able to retain all their grain production. If

a household of six persons requires 15 bags (or 1,350 kgs.) of maize for annual self-sufficiency, then it would require 1 acre (0.625 hectares) of hybrid maize, at least 1.5 acres (0.94 hectares) of local maize with fertilizer, or at least 5 acres (3.12 hectares) of local maize without fertilizer. But not all of smallholders' land is placed under maize, and even if it were some part of the crop would have to be sold to provide a cash income. In very general terms, then, it can be said that considerably less than half of farmers in these two Provinces could be self-sufficient in grains.

( D ) Economic Background

As we have already indicated, for a long time the economy of Western Kenya was based on subsistence farming and cash remittance from migrant workers in the urban centres or areas of commercial farming outside the two provinces. Waller (1968) described Western Kenya as a "Downward Transitional Region" with poor development potential.<sup>6</sup> Until the late 1960's improved standards of living depended on the balance between population outflows and increased development measures".<sup>7</sup> But opportunities for out-migration have significantly diminished in recent years, and although cash crop production has been expanding in recent years opportunities for this are limited. Thus, it is clear that Western Kenya, with its high population density and rapid rate of increase, presents a major challenge to rural development in Kenya. For even if

population growth was to slow down and off-farm employment opportunities to improve, food production would still have to increase significantly.

Of the cash crops grown, coffee, tea and pyrethrum have made considerable contributions to the great expansion of smallholders' marketed output in the last two decades, although their origins in western Kenya go back earlier.<sup>8</sup> In Kisii District this expansion was most marked between 1956 and 1974 with the area under coffee increasing from 876 to 6,700 hectares, that under tea rising from nothing to 5,615 hectares, and pyrethrum increasing from 64 to 8,900 hectares (the last accounting for almost one-third of all Kenya's pyrethrum acreage).

At high altitudes pyrethrum and tea are grown; at medium altitudes tea, coffee and sugarcane, and at low altitudes sugarcane and cotton. Pulses, potatoes and vegetables have also shown significant growth on smallholdings. But in general this cash crop advance has been mostly on the higher, better-watered areas. Between the districts, tea, coffee, and pyrethrum are grown in Kisii; cotton and sugarcane in Kisumu; cotton, sugarcane, and coffee in both Siaya and S. Nyanza; and tea, coffee and sugarcane in Kakamega and Bungoma districts.

In spite of this growth in cash crop incomes, the food situation remains a cause for concern for several reasons. Firstly, it is unclear how much of this cash income has been used for food purchases. Indeed there are indications

that malnutrition may have increased with cash crop production. Secondly, in the past 20 years population growth has been great and the smallholders category of farmers has increased with subdivision while the landless and near landless have increased in numbers. Thirdly, in spite of the expansion of area under cash crops, the large bulk of cultivated area is under cereals, and smallholders remain largely subsistence food producers, as can be seen from Table 4.

Table 4:

Total Area Under Crops, October 1974 - October 1975, by Crop for Small Farming: ('000 hectares)

	<u>Nyanza</u>		<u>Western</u>	
	<u>Pure</u>	<u>Mixed</u>	<u>Pure</u>	<u>Mixed</u>
Local maize	85.4	205.3	10.7	63.6
Hybrid maize	31.7	19.7	94.6	84.8
Finger Millet	16.2	6.9	3.1	19.4
Sorghum	13.4	162.3	3.1	16.9
Other Cereals	0	0.3	3.5	6.6
Pulses & root crops	31.3	97.3	37.8	167.5
Fruit & vegetables	3.2	8.2	9.2	10.1
Sugarcane	41.3	0.2	6.5	0.8
Pyrethrum	9.5	0.4	0	0
Cotton	10.0	15.2	13.7	6.4
Coffee	9.7	4.1	1.1	0.1
Tea	5.4	0.1	1.8	0.1

Source: Integrated Rural Survey, 1974-75, p. 79.

In some areas before the advent of tea, coffee and pyrethrum, maize was the only source of cash income to

smallholders. Today maize is more prominent in lower zones because of competition for land from cash crops in the higher zones, but in all Districts in aggregate terms, more than 60% of land is under maize. Since 1964 maize acreage has increased substantially because of the introduction of higher-yielding hybrids, and concurrently maize has become more important as a source of cash income. In 1974-75 for the whole of Kenya, approximately 90% of the total maize crop was produced on smallholdings and provided 18.2% of the value of sales of agricultural produce of these households. Proportions of local and hybrid maize consumed by the smallholders themselves are not very different: 52.4% and 62.1%, respectively.

Yield differentials of hybrid and local maize must vary with fertilizer application and weeding attention as well as by rainfall pattern. A common quotation is that the yield differential is 3:1. But more specific data suggests that hybrid maize with fertilizer can yield 15 bags an acre, local maize with fertilizer 8 to 10 bags, and local maize without fertilizer 2 to 3 bags. Hybrid maize is more common in Western Province than Nyanza Province, although again there is great intra-province variation. In Kisumu District it is reputed that comparatively little is grown because of uncertain rainfalls and farmers' problems with cash liquidity.<sup>9</sup> It is used extensively in Kisii where one estimate gives the yield as 4,000 kgs. per hectare against 2,500 kgs. for local maize. In Kakamega District its use is widespread, although local maize is still considerably more important. However, in this District where two crops of maize can be obtained hybrid is

more likely to be used during the long rains than the short rains. In S. Nyanza and Siaya, with their large areas of lowlands subjected to flooding and drought, use of the more vulnerable hybrid is not pronounced.

There can be no doubt that hybrid maize has been enthusiastically adopted wherever the environment permitted. On the whole, area put under hybrid maize has been at the expense of other cereals (mainly millet) rather than of local maize. There may be many reasons for this, including dramatic changes in diet preference, exploitation of short rains as well as long rains and higher sale value of maize than other cereals. Whatever the reason, the greater maize harvests have presented more problems for post-harvest practices, particularly in the case of hybrid maize. What is of more recent interest are indications that some farmers in the higher zones may now be putting some of their cash crop land under maize for subsistence purposes. Kisii has been one such district mentioned. This may be due to a shift in relative prices or to subdivision of holdings through inheritance forcing a 'food first' policy on households.

This digression on maize is made to emphasise that grain storage is essentially maize storage, and may become increasingly so in the future.

Although the Project does not include expanding non-farm employment opportunities, a brief review of sources of non-farm income is appropriate because so many smallholding households depend on this additional income, and because total income determines in large part their credit-repayment capacity

and ability to store for own-use their grain output. Non-farm rural employment covers a wide range of activities and are best developed in the Kisumu area. Historically they have been much less developed in Kisii<sup>10</sup>, possibly because of the concentration of a profitable cash crop-mix requiring comparatively more stable year-round utilization of labour, a situation in which households were obliged and able to purchase goods from outside the area. Blacksmithing, including making kitchen utensils, making and repairing of roofs and agricultural implements, is a widespread activity for men, except in Kisii where blacksmiths are vulnerable to competition from outside. Fishing and wood-cutting and carpentry are other geographically determined activities. Pottery, basket and sisal rope making are common home-based employment for women, as is beer-brewing.

Men's non-farm rural employment tends to be full-time or nearly so, but women's is very much part-time. This is because of the greater involvement of women in both subsistence and cash crop agriculture. Women's part-time sector is overcrowded with participants and returns to labour are lower than for men. Its future depends heavily on local demand and therefore on income and specialization of jobs. There is little chance of the modern sector absorbing more than a fraction of those looking for work in future, and in any case will be male-dominated. Against a projected annual growth rate of the total labour force of over 12% in the 1980s, recent past annual growth rates in the modern sector in Nyanza and Western Provinces has been 6.7% for services, 1.3% for construction, 2.7% for commerce, and -0.4% for transport and communications.<sup>11</sup>

A major sector dominated by women is petty trading of a wide range of farm produce in local open markets. Most farming women do some of this, but it has been observed that the incidence depends on marital status (and probably on the stage in the life cycle of the family). Table 5 gives data on this by class of holding and marital status of women.

Table 5: Marital Status of Women Traders Relative to Women in All Households: West Kenya (%)

	Of Women in all households				Of Women traders only		
	Land-Less	Peas-ants	Rich Peas-ants	Total	Peas-ants	Rich Peas-ants	Total
Married:							
1 wife	100	76	78	80	53	71	59
2 wives	-	13	16	13	24	15	21
3 wives	-	2	4	3	4	7	5
Unmarried	-	2	-	1	6	2	5
Divorced	-	2	-	1	8	2	6
Widowed	-	4	3	3	6	2	5
Total	100	99	101	101	101	99	101
Sample Size	21	93	77	191	80	41	121

Source: Sample survey quoted in Per Kongstad and Mette Monsted, op.cit., p. 109.

Of all women traders 26% are from polygamous households against only 16% of all women being in polygamous households. This suggests greater opportunity for trading when there is scope for specialization of tasks (such as child care) in the households. But it may also be due to the high incidence of older women (first wives, divorced and widowed women) amongst

the traders, reflecting the influence of the stage in the family life cycle. Nevertheless, peasant women in polygamous households are more likely to trade than 'rich peasant women in polygamous households; and peasant women in nuclear families appear more constrained to the homestead than 'rich' peasant women in nuclear families. Furthermore, 46% of rich peasant women traders traded 6 to 7 days a week but only 36% of peasant women traders and as much as 41% of landless women traders traded only 1 to 2 days a week.

This summary of non-farm rural activities indicates a contracting cash income base which, if credit-raising and working capital ability is to be maintained per smallholding, must be made up by sales of agricultural produce or by remittances from (largely male) migrant workers. The alternatives are a stationary subsistence farming productivity with continued high storage losses or an infusion of credit into both storage improvement and working capital (or living costs).

Migration of males to find employment elsewhere is widespread and has led to a high male:female sex ratio in towns and a comparatively low sex ratio in rural areas. For example, the sex ratio in whole districts is: 100.9 in Kisii, 103.6 in Kisumu, 84.3 in Siaya, 98.2 in S. Nyanza, 90.3 in Busia, and 92.6 in Kakamega.<sup>12</sup> But in urban areas alone it is 150.6 in Kisii, 126.3 in Kisumu, 129.19 in Kakamega, and 133.8 in Homa Bay. Men also migrate beyond the District and Province (although this is less the case for Kisii men). Different stages of migration of men raises the problem of definition

of a 'woman-headed household', and its implications for extension services and the role of women in credit decision-making. Husbands may return monthly or more frequently, or once or twice a year only.

The absence of adult males can also be seen in dependency ratios (population of 0 to 14 years plus 60 years and over: population of 15 to 59 years). For instance, the ratio is 143.8 in Kisii and 140.7 in Kakamega but as low as 99.1 in Kisumu. Fertility rates also affect the dependency rates, of course, and these do tend to be higher in the better-watered highlands. But a higher dependency ratio does suggest a heavier work burden for women, who are very largely responsible for the reproduction tasks of feeding and caring for household members. It should be noted that these rates are highest in areas most favourable to hybrid maize and even double-cropping of maize, both which require more women's labour than sorghum or millet. Any additional work demanded by improved post-harvest practices may not impress women.

The sex division of labour in agriculture is influenced by the shares of food crops for household consumption and cash crops. Food crops tend to be cultivated by women and children alone, and mostly without hired labour. But even on cash crops women tend to do more work than men because of the sex-specificity of tasks, even though the cash returns accrue to man. In Kisii, for instance, there is a high steady input of women's labour on the very diversified crops<sup>13</sup>. The less peaked seasonal demand for labour here might be another reason why less labour is hired than elsewhere, although the higher

wage rate (than in Kisumu) is probably an influence too. However, less peaked demand need not mean that women in Kisii are not already fully stretched at maize harvest time. The use of children's labour has declined with advances in schooling, but where they help it is usually in women's household-associated tasks.

Kongstad and Monsted reporting on the two Provinces write 'The husband's work contribution shows major variation - and according to many of the women the contribution was very limited and if the husband worked in agriculture, he only helped in certain periods ..... Within Western Province the lowest contribution is found in Kakamega District where only 26% of husbands staying at the homesteads contributed'.<sup>14</sup>

It has been said that local maize is more labour intensive than hybrid maize (even though this must be contrary to technical instructions), or hybrid maize yields 2½ times as much output per unit of labour as local maize.<sup>15</sup> However, a woman obliged to cultivate a plot of maize and concerned about her labour input (particularly if she is not to have full control over the crop) would be interested in her required labour input per unit of land on local versus hybrid maize. With general commercialization of agriculture there has been a decline in labour assistance from relatives and the community, and together with less use of children's labour, the question must be asked 'whose labour has been saved by hybrid maize?' In the next chapter some data on labour input on hybrid and local maize will be examined because it hints at issues that go

beyond presumed optimal labour use. But one concluding remark must be made on agricultural labour. One writer has remarked that the greatest constraint on raising small farm productivity is the heavy dependence on family labour.<sup>16</sup> If this means that family labour is the scarce resource and hiring labour is unprofitable, then with the existing sex division of labour, the constraint is firmly on the supply of female family labour. And if female family labour is particularly stretched at maize harvest time then this has implications for any improvements in drying and storage practices which require more work.

A word needs to be said about the marketing of maize since the Project document implies that since the target group consists of small 'subsistence' farmers, they are not responsive to price and marketing policies; and therefore that any means of better preservation of home stocks of maize (assuming additional costs are no more than the value of what is saved) has no significant economic opportunity cost to the smallholder. Almost one-half of smallholders' maize passes through the market; and some will be bought back by the producers at higher prices. But only 20% of marketed maize went to the Maize Marketing Board in 1976-77, and it is believed that this has since decreased. The problem is lack of official storage facilities which constrains the Board's local buying agents, who nevertheless accommodate this situation by buying at a discount on the Board's price and finding other outlets. This discounted price must approximate the price in the open markets (with seasonal adjustments

through which the bulk of the marketed maize passes. Larger on-farm storage capacities, if utilized, should raise the immediate post-harvest price, but if existing capacities only were improved this would have the effect of moderating the later seasonal peak in price. Hence estimates of the profitability of 'improved' grain storage practices, to the smallholder, must distinguish between larger and better on-farm storage facilities by imputing different values of grain 'saved'. It is against these values that costs of investment and cash income foregone immediately after harvest (when it is most needed) must be set to determine profitability. And the two kinds of improved technology will themselves have different costs.

The Project still requires guidelines on extension and credit services before implementation. This is a new area of policy, and there is little from past to depend on because firstly, this is a sector primarily concerning women and agricultural extension services have focussed on men, and secondly, the rather poor performance of official and cooperative production credit facilities offers little advice on what is essentially consumption or expenditure-displacing credit for grain storage. The Special Rural Development Programme used group extension methods and included techniques involving both men and women. But it would appear that the bulk of extension services directed towards women was in home economics which sometimes touched on women's agricultural in a tangential manner. How this was supported by credit services, for what must have been only part market-oriented production at best, should provide some lessons for this Project.

After a cautious note was struck in 1970, following the large small farm credit programme in the 1960s, due to administrative problems and excessive arrears on repayments, the 1974-78 Development Plan again made small farm credit prominent. To the same problems of the past was added criticism of the selection criteria emphasising availability of permanent wage or salary income rather than use of credit in farming - a clear, if silent, admission that men were not involved in agricultural labour.<sup>17</sup> If this criteria were ever to be applied to storage of a 'subsistence' crop, largely the responsibility of women who do not have access to more than part-time petty manufacturing or trading, the Project would be stillborn. Another question that has been raised is whether there has been much demand for small farm production credit, in view of financial flows back to the homestead from migrant workers. This is a fair question over cash crop production when men control the earnings from them and are usually responsible for remitting back income for farming. It is also understandable when, although cooperatives were expected to unite everybody in rural areas, 'it seems rather that in many places they encourage tensions, arising from a continuous struggle for control over scarce resources on the management committees'.<sup>18</sup> When the Nordic Project, financed by Scandinavian aid, was started in Western Kenya, input and credit distribution became a source of patronage and wealth to those who gained control.

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CHAPTER THREE

WOMEN IN AGRICULTURE

A. Major Issues Relevant to Grain Storage.

A number of key analytical issues and constraints relating to the role of women in agricultural development are of particular relevance to the implementation of the proposed On-Farm Grain Storage Project. In the following pages discussion abstracts the main points in the literature in order to focus on some of the major issues.

As in most tropical countries, it is the case that the greatest proportion of national grain stock in Kenya is held by rural households. In Western Kenya maize on the cob and millet on the head was traditionally stored in woven outside granaries while grain for consumption was kept in large pots inside the house. Seed grain was often kept on a ceiling platform above the cooking fire. While little is known about the determinants of the proportions of crops stored and time release patterns it is generally believed that the extent of grain losses has worsened over the last 20 years while production has either stagnated or only marginally improved especially among poor farmer. This is exacerbated by worsening security situation in the densely populated areas, significant transformations have taken place in grain storage practices within rural homesteads.

Pests of many kinds damage food grains during all stages of their growth. Grain losses can occur in the field from birds, rodents and insects; from insects and rodents while drying; and from insects, rodents, mould and fungi in storage.

Even though insect damage may not be significant in the harvested grain, larvae left within the grain can grow and multiply rapidly in store, especially in humid conditions when the grain has not been properly dried. With a two to three week growth cycle and the right temperature, 50 insects can breed as many as 312 million offsprings in four months.<sup>1</sup>

The prescribed moisture content for safe storage for up to a year (at 70% humidity and 27°C.) is 13.5% for maize and sorghum, 16% for millet and 15% for beans.<sup>2</sup> It is believed that grain is stored in Kenya at much higher moisture levels. The mould that would result encourages faster insect multiplication. Moisture content can be lowered after the grain is stored if the container is ventilated.

Genetic characteristics of grain variety have a strong influence on harvest and post harvest losses, with traditional varieties usually better adapted to the environment.<sup>3</sup> For instance, they may have a lower moisture content when ripe and, drying faster, produce a thicker coat for repelling insects; or their ears may cover the grain more completely to inhibit birds and insects. Leaving such traditional varieties of maize standing in the field for some time could make sense in that there is less labour input in the drying process, but repeated wetting from night rain or dew and drying in a hot sun can cause the grain to crack and so increase the likelihood of insect damage. Birds and insects also favour grains with a higher nutritive content.

Hybrid maize presents particular problems of harvesting and storage preparation - quite apart from the greater yield that must be handled.<sup>4</sup> At ripening it maintains a higher moisture content than traditional varieties so that the grain coats are softer. The fatter cob is less completely covered by the ears. And it has a higher nutritive content. It is therefore more vulnerable to depreciation from several causes if left standing in the field beyond ripening in order to gain advantage from the sun, yet its greater moisture content and volume requires a small revolution in other drying facilities if it is to be harvested early and quickly. Moreover, the period of drying hybrid maize may have to be longer because it does not have the hard endosperm and low moisture content of local varieties. Where the short rains are expected soon after the harvesting of the main wet season crop, corners may simply have to be cut on the drying process, even if limits of available labour and drying space do not exist. If traditional, partly ventilated storage facilities have not been expanded, resort to sacks and other inferior containers may be made.

Open-sided cribs, with rodent baffles, for cob maize are increasingly being adopted in Kakamega and Kisii districts but they incur some substantial expense. Small smoking fires underneath the crib may accelerate drying and repel insects, but the larger farmers tend to prefer chemical fumigants. More recently there has been an attempt to introduce solar

driers consisting of cement platforms on the ground with polythene sheeting for nighttime or wet weather protection. This is effective but relatively expensive. Most of the small-holder farming families appear to rely on drying in the yard and hand shelling of maize which is very labour-intensive. Beating maize in sacks, which may also be resented to often results in incomplete stripping and can cause damage to the grains.

The traditional outside granary is a container about six feet high resting on a raised platform and having a capacity of one-half to three-quarters of a ton. It is made of woven twigs, straw or reed shaped into a large basket, partly sealed in the lower half by a mud or cow dung-caked lining. But as already indicated, these structures are rapidly giving way to jute or sisal bags for shelled grains kept in the dwelling house. While richer families may designate an unoccupied room in a house with concrete floor for such storage, poorer farmers often stand the sacks upright on wooden platforms in any room.

Before the introduction of chemical insecticides and fumigants, wood ash was placed among shelled grains to limit insects. Ash acts as an abrasive on the insects' coats, allowing moisture to escape and so causing death through dehydration. Experts have commented on the effectiveness of this method. There is a long list of insecticides that have been used for stored grains in Kenya. Some are dangerous to humans and can poison the grain. The power of some of them breaks down when they are exposed to light, oxygen or water. It is also

rumoured that grains that have been treated with insecticides sell at a discount in local markets. Fumigants, which kill larvae but are no protection against new infestation have also been used. However, they can be extremely dangerous and should be (but are not always) applied by skilled operators.

It can be seen that the combinations of individual parts of harvest and post harvest practices are numerous. A great deal of work is involved even with poor practices. But what strikes the reader of the technical literature is the suspicion that if larger yields of the difficult hybrid maize are to be handled, from a rapid harvesting to safe storage of a combination of cobs and shelled grains, in a way intended to halve usual losses, the labour input and managerial expertise - not to mention the cost outlay - rises very sharply. And virtually all of this labour is female labour.

What is at issue in this Project's implementation is not just an appropriate technology, but an appropriate range of choice of combinations of technological parts. There are first the physical constraints: constraints of available labour and time (before the next rains) and of drying space. And there is financial constraint of profitability and credit-worthiness. Their resolution would be daunting to the most expert of operations researchers. What it poses for extension services is quite another matter.

B. An Approach to the household economy

Baseline data for agricultural projects are increasingly incorporating a farming systems approach. By this is meant an analysis of farming households' allocation of all their

resources, the interdependence of sub-sectors of the household economy which make up a viable livelihood, and the flows of cash income and own-consumed produce between individual members. It thus embraces a holistic view of the household's economy and its options. Previously, analysis stopped at an aggregate level of the household, which assessed family labour in terms of total adult male equivalents, total assets as though they were available equally to all adult members for what appeared to be profitable investments, and economic opportunity costs of new ventures and practices as though they were felt equally by all members of the household. Today there is growing recognition that the time constraints or underemployment of family labour are structured by sex and age, that different assets and income sources are often under the decisive influence or disposal rights of particular members, and that incentives and trade-offs between options are experienced differentially amongst household members.

Although this study concerns activities which come at the end of strictly agricultural processes, and focus on the preservation and disposal of largely own-consumed output, the resources that are needed for improving their productivity will make demands on other aspects of the household economy. Post harvest activities cannot be seen in isolation from the allocation of household resources to other activities, nor from the cultural norms which delineate this area to be a charge on the woman's labour, and possibly her ability to make investments. But it is also necessary to examine what resource ostensibly under the control of men might contribute to financing post harvest improvements; and what residual must be found entirely from women's labour and personal income base, and the

limits of these.

C. The Rural Household Setting

In order to pose an analytical framework it is desirable to review the literature that exists on the household and women's role in Kenyan agriculture. In the small, but substantive body of material on Kenya the findings are generally consistent. By tradition women did not own land but had rights to farm their husbands' patrimony and to retain the produce for the maintenance of the family. During the colonial period cash crops were produced in varying amounts and in many areas men were drawn off the land into the non-subsistence sectors of the economy. This had the effect of increasing women's work. Since Independence the cash crop sector has advanced rapidly; the growth of towns, government services and reduced farm size have accelerated the withdrawal of men from agricultural labour. With cash crops under the supervision and control of men, women have not had automatic access to the returns to their labour on these crops, yet they have continued in their traditional responsibility of finding the family's food. Women's work in agriculture has increased whilst men's has decreased. The Rural Integrated Survey, 1974-75, showed that, nationwide, 85% of women over 17 years worked regularly on their farms but only 54% of men over 17 years did so. But in Nyanza 92% of women engaging in farming activities did so entirely on their own.<sup>5</sup> Kongstad and Monsted have shown from their sample survey that in Kakamega only 15% of husbands assisted their wives in agriculture. On small farms where no

cash crops were grown husbands did no agricultural work. On large farms husbands are likely to work only in a managerial and supervisory capacity, and then over cash crops exclusively.<sup>6</sup>

The spread of cash crops has caused a division of the household's land into two parts, with one part continuing to bear the major burden of reproduction of the family. Along with the change in economic relations there has been a change in labour relations within the household. Essentially what has happened is that the checks and balances in customary law have not been adapted to modernized agriculture. This situation has been summarized by the expression that is often heard that "husbands farm their wives".

The high premium placed on the education of male children and the resultant job preference outside agriculture account for the structure of population in Western Kenya. One effect of this is that the high dependency ratio exerts considerable pressure on women's labour. Even though family members working outside the area are known to send part of their incomes to their wives and other relatives, the magnitude of such cash remittances is difficult to establish. One study of cash remittance by migrants in Nairobi indicated that about one-fifth of their total wages was sent to family members in their rural homes to meet the cost of school fees and some farm operations (ploughing, weeding, etc.) and other expenses. The amount transferred by individuals was systematically related to income and other socio-economic variables (e.g. education), and individuals with low incomes

tended to remit a much higher proportion of their incomes than those with moderate or high incomes.<sup>7</sup> While such variation may suggest the parlous state of subsistence agriculture as a source of income for the majority of rural inhabitants, there is some indication that the level of non-farm income is a key determinant of the productivity of the farm enterprise.<sup>8</sup>

The division of land between subsistence and cash crops can be seen to mark the end of the stage of a subsistence economy, meaning that all the household's resources were directed at the simple (no surplus accumulation) reproduction of the family. Ironically, while cash crops provide the opportunity for asset accumulation and therefore 'economic growth' the resource base of reproduction (women's food and their own labour earnings) is probably coming under greater strain than ever before. Hanger found that in Embu cash crop income contributed to school fees, clothes and some other expenses, but the women frequently did not know how much their husbands earned.<sup>9</sup> Kongstad and Monsted, surveying in Western Kenya, observe that husbands do not perceive daily household expenses to be their obligation, and more than 40% contributed nothing or just occasionally purchased something.<sup>10</sup> But they paid school fees and financed most of seasonal farm inputs. Of peasant women who traded, 82% received nothing or occasionally something from their husbands (and food and clothes purchases were the most common destination of their own trading incomes).

How much of a contribution to the expenses (food, clothes, shelter, school fees) of what is now a reproduction sub-economy of the household economy - that is to say, how far traditional

law has adapted to a new economic situation - is a crucial issue for women and for the welfare of the household. And it is crucial to the On-Farm Grain Storage Project, since what is mooted is primarily a cost-incurring improvement in the reproduction sub-economy. If husbands do contribute to the costs of reproduction already they would probably be more likely to contribute to the costs of improved drying and storage facilities.

But there is another implication of men's contribution to these improved facilities or accepting responsibility for credit incurred. As with cash crops, if men finance the new drying and storage facilities they may view the stored grain as more their sphere of economic influence than custom and tradition would permit. Already there is evidence that maize land and stores are divided between men's and women's, and even that women's maize stores are not sacrosanct. Men's cash injections into this reproduction sub-economy could erode further women's effective rights of disposal of maize. The views of women on the proposed improvements in drying and storage facilities, by putting before them what might be entailed way of credit required and extension services that are probable, are extremely important.

Decision-making within the household is not just a matter of the nominal outcome of a decision to proceed with some enterprise; it includes one individual's wish to veto the enterprise, and if that wish is not respected by other members of the household, his or her power to subvert the enterprise. For example, in a study conducted in South Nyanza,

it was found that the decision to plough a field as opposed to hand dig may not be as simple as it may sound. Ploughing a field necessitates new crop mixes which may make it difficult for women to grow what they perceive to be essential food crops. For instance, ploughing eliminates the possibility of growing vegetables, pumpkins and legumes which are women's crops while favouring the combination of maize and beans, which are grown both for sale and for home consumption. It was argued that this tends to increase men's control over farm produce (since both beans and maize are marketed) while reducing women's opportunities for earning cash from their traditional crops or obtaining nutritious foodstuffs at low costs from legumes, pumpkins, vegetables, etc.

With so much reliance put on women's labour input their power to subvert is great. And in at least one instance in Kenya they have shown it. At the Mwea Irrigation Settlement Scheme, Hanger commented as follows on the household economy: 'If work in the fields was still largely dominated by women, innovations in agriculture could only be successfully introduced if women became acquainted with the new methods and were convinced by them'.<sup>11</sup> The following case illustrate this issue further:

Case I: In a 1961 study, Hugh Fearn pointed out that the British colonial government complained about low yields of cotton in Nyanza and blamed it on the inability of the farmers to adopt improved methods of farming. However the government agricultural officers had neglected to take into account the fact that women played an important role in food production in

Nyanza. Because there was competition between cotton and food during the peak labour demand for weeding, cotton created for them an additional work burden. It is not surprising that they decided to give priority to food production over cotton. This fact, which had escaped the notice of agricultural extension personnel, accounted for the failure of the campaign to increase cotton production in Nyanza at that time.<sup>12</sup>

Case II: In Central Province women have grown pyrethrum, harvested it and sold it to the Marketing Board. A new scheme, the Million Acre Settlement Scheme, allowed only men to become land holders and members of the cooperatives, and with this new scheme pyrethrum production fell. It was subsequently learned that the women who were still responsible for most of the work involved in the production of pyrethrum had decided to go slow because unlike the Marketing Board, the new cooperatives retained a certain portion of the income from pyrethrum. This money passed on to the men, not to the women who had done most of the work.

Apthorpe writes: 'Before this change (introduction of cooperatives) the growers, who were predominantly women, had taken the dried flowers direct to the Board. They had been paid a 'picking wage' .....(Now) payments were made only to the members of the cooperative society - the ploholders - who were mostly men ..... it was their husbands who received the returns of their labour, albeit with delays and deductions. The women said they received too little to make it materially sufficiently worth their while to continue the labour for

long hours. So....realistically in the circumstances they worked less.<sup>13</sup>

Case III: In an earlier field study in South Nyanza District it was found that women had from time to time neglected to weed tobacco or cotton on schedule as advised by the Agricultural Officer. Upon further inquiries it became evident that the women invested their time and labour in food crops as a first priority before working on tobacco or cotton. Apart from the competition for female labour of cash and food crops it was also the case that the cash proceeds from the sale of tobacco and cotton was paid out through co-operatives to men, the registered land holders. These cash crops therefore appropriated female labour without insuring adequate direct remuneration, and therefore women gave them a low priority.<sup>14</sup>

The lesson from these cases is that a farm household is to be seen as a unit which has a diversity of responsibilities and interests. Women in the farm household have the responsibility of feeding their families and as far as food growing is concerned they will go to great lengths to meet these obligations within the constraints of existing land, labour and capital resources before launching on new crops with additional labour demands. For them profit-making crops are only profitable if food for the family has already been assured. The food first priority should not be taken lightly when efforts are being made to improve the productivity of small farms.

D. Labour Input on Maize

In the previous chapter mention was made of data on labour input for hybrid and local maize, and that contrary to all technical instructions local maize was the more labour-intensive.<sup>15</sup> The data are presented in Table 1, by average, farm size and District.

Table 1: Labour input on hybrid and local maize, by farm size and District.

	HYBRID MAIZE						LOCAL MAIZE					
	No. of Observations		Annual No. days of Labour Input per acre		Aver. Farm Sizes		No. of observations		Annual no. lab. input per acre		Aver. of farm sizes	
	F	F+H	F	F+H	F	F+H	F	F+H	F	F+H	F	F+H
Kisii	25	8	90	124	4.3	7.1	38	6	146	138	4.8	5.0
Kakamega	35	10	29	54	7.7	6.5	69	16	44	57	6.3	5.8
Bungoma	67	20	72	84	13.7	18.1	56	1	84	34	12.3	20.0
Nandi	38	23	34	56	20.8	19.0	42	22	36	43	14.9	21.1
Kericho	22	8	22	38	15.6	19.7	82	3	26	17	11.7	18.4
Kisumu							69	16	112	116	5.1	5.0
S. Nyanza							25	18	118	150	12.3	16.9

F = Family labour only used

F+H = Family and hired labour used

Source: G. D. Gwyer, Labour in Small-Scale Agriculture. An Analysis of the 1970/71 Farm Enterprise Cost Survey, Labour and Wage Data. I.D.S. Working Paper 62, Nairobi, September 1972. Tables 1 and 2.

The first thing to notice is that hybrid maize is more common on larger farms. It has been observed that although larger farms used more total labour, labour input per acre

declines with farm size increases. Therefore, farm size could be one explanation of these strange results. But in Kisii the average farm size of hybrid and local maize users who utilized only family labour showed large disparities. The case of Kakamega is similar (although much less labour was used on maize in this District in all cases.

The same inverse relationship between farm size and labour input per acre can be seen where hired labour is added. In Nandi and Kericho (very large farms) technical instructions appear to be followed in the cases where hired labour is used as well, and differences between labour inputs per acre using only family labour are small.

But an overall conclusion is that on small farms much less labour is used on hybrid maize than local maize, and that this is most marked when only family labour is used. Even if women's available time is restricted, it does not explain why they should be less interested in hybrid maize. One possible explanation is that on some farms there is a mixture of hybrid and local maize and that the latter (requiring fewer cash inputs) is more the province of women and passes into women's granaries. If this is true, then it supports the hypothesis that many commentators on agriculture have made that women will work harder on their own crops, and especially when husbands are absent, neglect their husbands' crops. Again if this is true, it opens up a host of issues for the On-Farm Grain Storage Project.

But another partial explanation could be that hybrid maize is the main wet season crop and local maize the dry season crop, and that women are busy with other food agriculture (beans, millet, vegetables, etc.) during the main wet season.

A final component of a farming systems approach is the resources, again women's, which go into social activities of the family, including caring for the sick, etc. Household and household-associated tasks can take up as much of women's time as agriculture. In seasonal peak periods these tasks can be neglected, and if this happens after a rainy period which increases the incidence of morbidity and during the leanest part of the year, health standards can be affected. One such period is harvest time. With reproductive lives covering approximately 7 live births, women experience many years of continuous pregnancy and breastfeeding - the biological side to reproduction of the family. It is easy for planners to think in terms of 'if only more effort were put into drying, and if only the crop were harvested faster'. But rural women may justify the riposte "enough is enough"!

There is one consideration that planners must include if they hope for a link between agricultural improvements and lowering fertility. Many agricultural improvements impose sharper seasonal peaks of women's workloads when health (particularly indicators of infant morbidity and birth weights) is affected. If it is supposed that healthier children and wider birth spacing lowers total fertility, then there may be a trade off between agricultural improvements and

lowering fertility, unless project designs include a deliberate work-avoidance component. There is a link between the biological and economic aspects of reproduction and it centres on women's access to and command over resources.

As already mentioned, a component of the profitability of investing in improved storage facilities is the cost of the income foregone from refraining from selling grains just after the harvest (or the cost of borrowing). Overall more than 50% of smallholding maize production is own-consumed, but this varies by size of holding. Kongstad and Monsted (for Western Kenya) found that smallholders with less than 0.5 hectares retained 327 KShs. worth (unexplained imputed price) of cereals, sold 335 KShs. worth (presumably valued at a low seasonal price), and purchased 411 KShs. worth (presumably at a high seasonal price).<sup>16</sup> They therefore spent more on cereals than they earned from their sale. This, of course, reflects the debt-trap, but it is to be noted that it is primarily a woman's debt-trap, which must reflect on her individual credit-worthiness. This small size category of holding is often presumed by planners to be the purest of 'subsistence' holdings. The 3 to 3.9 hectares holdings (still smallholding) purchase 506 KShs. of cereals but sell much more, 798 KShs. worth. This clear surplus signifies a measure of credit-worthiness in the reproduction sub-economy, and therefore that any seasonal cash flow problems could be solved by a judicious supply of credit. But for the former category of women who are in an annual cereal deficit, making improved storage practices profitable probably requires a

particular commitment on the part of Government planners, and great persuasion if a woman is to part with her precious off-farm earnings to invest in a risky venture. With so many potential technical options in harvesting and post harvest operations the design of extension services and training of extension staff must be seen as a major determinant of final effectiveness. But what is to be conveyed to the 'farmer'; details of new work practices or financial matters?

Moock has distinguished between farm heads and farm managers.<sup>17</sup> (In 60% of his sample they were the same, that is women; in 28% the relationship of the manager to the head was 'wife', and in 3% 'mother'). Moock defines the functions of the head thus:

'A farm head, who is the allocative decision-maker as traditionally defined, decides what proportion of total farm resources is given to maize production at the expense of other uses, and he or she has the major responsibility for determining the relative factor proportions used in any farm enterprise. By sending a child to school, for example, the head denies all farm enterprises both the labour of that child and the money given as school fees. Moreover, it is the head who must provide the funds for the purpose of hybrid seed and fertilizers and who, at times of family labour shortage during the maize cycle, must agree to hire daily labour ..... Although he (a man engaged in distant activity) delegates a degree of decision-making authority to a farm manager, the farm head who is employed elsewhere keeps in a close touch with his interests at home, by sending and receiving letters, by returning on annual leave, and by using the constant flow of other migrants back and forth as a communicating vehicle'.

Moock adds that 'Not infrequently, government officials point to the preponderance of female managers by way of explanation for low agricultural yields in the (Vihiga) area'. Using a bivariate analysis he showed that there was indeed a

small (but-significant) negative relationship between female management and yield. But when he applied a multivariate analysis (including the variable of women's contact with extension staff) he found women were far better managers than men. (One and one-half bags more of maize per hectare were produced by women managers.

That technical extension should be directed at least to women appears irrefutable. But what of the man's role of 'allocative decision-making'? Labour allocation is, willingly, women's province. But investible liquid assets or credit acceptance is a different matter. Sources of funds, willingness of the guardians of those funds to invest in the reproduction sub-economy, sources of income to repay the credit are questions for sensitive in-depth interviewing.

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## CHAPTER FOUR

### POST-HARVEST PRACTICES IN WESTERN KENYA

#### A. Introduction

In the foregoing chapters we have tried to raise some of the major issues relevant to post-harvest practices in general and especially as they relate to smallholder households in Western Kenya. In doing this we have relied very heavily on a review of the literature. In this chapter we highlight some of our important findings concerning current post-harvest practices in the Project Area. Data for this chapter is drawn mainly from in-depth interviews conducted in all districts of Nyanza and Western provinces between January and June 1982. Although it was not planned to conduct an exhaustive quantitative study, a survey was carried out during the same period some results of which are presented here to augment the qualitative data. The research reported here is thus an effort to marshal basic information concerning the perceptions, attitudes and current practices relating to post-harvest grain processing and storage among inhabitants of Nyanza and Western provinces.

The terms of reference for this study were to explore the major determinants of current grain production, harvesting and post-harvest practices and the sequencing of agricultural activities within households. The second major concern of the study was to explore the major technical, social and cultural constraints, especially those conceived

by the local people (mainly women), to current grain production, harvesting and post-harvest practices.

### Study Design

Respondents for the questionnaire survey were selected by a method of stratified areal sampling. First we identified five representative areas within each of the districts chosen for study. Household heads to be interviewed in the selected areas were chosen from a series of locations across the entire area so that the sample would reflect agro-climatic variations. Each enumerator was assigned a specific number of households the location of which were marked on a Survey of Kenya 1:250,000 scale Topographical Map (Series Y503). The interview schedules used in the survey carried a series of identification numbers indicating the area and specific locality in which the interview was to be conducted. The enumeration process was monitored by one of the authors and the schedules were initially edited in the field for accuracy. Further editing and coding was done in Nairobi to prepare it for analysis using the Statistical Package for Social Sciences (SPSS) in an ICL computer. But the data presented here, in accordance with the terms of agreement, has been subjected only to the most elementary analysis of frequency distribution. Moreover, not all the data generated by the questionnaire is discussed. The discussion that follows incorporates information obtained through the questionnaire survey and in-depth interviews.

Respondents for the study were distributed as shown in Table 1 below. About 30 percent of the respondents were drawn from Busia and Kakamega districts of Western Kenya. <sup>Kisii</sup> Basia, Siaya and South Nyanza districts are generally low altitude, low potential areas as contrasted to Kakamega and Kisii which are high altitude, high potential and high population density areas.

Table 1: Sampled Districts by Sample Size

Province	District	Sample Size	Percentage
Western	Busia	90	14
	Kakamega	101	16
Nyanza	Kisii	170	27
	Siaya	213	34
	South Nyanza	58	9
TOTAL SAMPLE		632	100

The depth study was carried out in the same sample areas, including Kisumu district. A total of 50 women were interviewed. These were all married farming women aged between 26 and 60 years old. They ranged from a parity between 4-12 children. They had little or no formal education and with the exception of two had never held wage employment. The two were once employed as agricultural

assistant/women group leader and church school teacher respectively.

Despite the well documented preponderance of women-headed households in rural Western Kenya, the majority of our respondents to the questionnaire survey were men. This is perhaps a reflection of interviewer bias and the tendency by rural women to defer to their husbands in the presence of strangers. But it may also be a reflection of the closure of the urban labour market already discussed in earlier chapters and selectivity of migrants to urban areas which is

Table 2: Respondent's Relationship to Household Head (percent)

	S. Nyanza	Busia	Kisii	Kakamega	Siaya	Total
Male Head	62	68	67	81	50	
Female Head	17	9	20	16	18	
Wife	18	21	12	3	28	
Son	3	2	1	-	4	
Daughter	-	-	1	-	-	
N	58	90	170	101	213	
No. of women interviewed	12	8	34	16	39	

determined largely by level of education. The fact that over 41 percent of all our respondents had no education at all

would seem to suggest the strength of this possibility (Table 3). Although we have disaggregated the incidence of illiteracy by sex it is reasonable to presume that women constitute a bigger proportion of the illiterates. A 1980/81 National Literacy Survey showed that 62 percent of rural women aged 12 years and above could not read in any language, a figure nearly double that for male illiteracy. In Nyanza and Western Provinces, the figures for illiterate women were 71 and 62 percent respectively. Low levels of literacy leaves women in the Project Area with few or no options for seeking wage employment outside of agriculture. Thus due to lack of skills for

Table 3: Level of Education Attained by Respondents (Percentage)

Education Level	Kisii	S. Nyanza	Siaya	Busia	Kakamega
None	39	29	49	38	32
Some Primary	22	36	29	28	55
Completed Primary	22	16	12	13	1
Some Secondary	4	7	4	6	2
Completed Secondary	3	-	2	2	1
College/University	-	2	-	-	4
Others	10	10	5	14	5
N	170	58	213	90	101

formal sector jobs, women are less likely to migrate outside their rural homes at the same rate as men. For this reason, women are likely to remain the more stable rural population for some time.

Not surprisingly, the majority of our respondents (93 percent) reported farming to be their main occupation. The figures for each of the sampled districts are S. Nyanza 98%; Busia 93%, Kisii 92%, Kakamega 96% and Siaya 90%. An average of about 17% of the respondents also reported having other sources of income in addition to farming. The more important non-farm income earning activities are petty trading and casual labour. Although cash remittances from family members in urban areas is also a significant source of income, only 20 percent of all our respondents reported that they received cash remittances from family members with South Nyanza and Siaya showing the highest incidence; 40 and 30 percent, respectively. The figures for other districts are 12 percent in Kisii, 16 percent in Busia and 5 percent in Kakamega.

In summary, we could generalise that our study sample is made up of poorly educated peasants with little source of income outside of agriculture, except some petty trade and occasional cash remittance from relatives in urban areas.

#### Farming Enterprise and Cropping Patterns

The main crops grown in these areas, in order of importance, are maize, millets, sorghum, beans, cassava, bananas, cotton, ground nuts, sugarcane, coffee, pyrethrum and tea. Of these, maize, millet, beans, cassava, sorghum and bananas, in that order, are grown largely for food with some proportion going to the market. Cotton, coffee, sugarcane, pyrethrum and tea, in that order, are grown largely for sale. Of the food

crops maize and beans offer by far the best combination of food and cash crops. That is, the majority of farmers see maize and beans both as crops for food and for sale suggesting the substitutability of maize and beans for sale should there be a drop in the production or sale price of cotton, coffee, tea or pyrethrum. In Kisii, however, 80% of the population grow hybrid maize as the main food crop and because variability of climatic conditions throughout the District allows for maize growing all the year round the problem of sale of maize is less acute. We noted, for instance, that Kisii farmers, unlike farmers from the other sample areas, rarely sold all harvested maize. They usually store enough to eat because they can expect to make money from coffee and pyrethrum. In 1981, for example, only 150,000 bags of maize from Kisii were sold to the National Cereals and Produce Board (NCPB).

Farming practices ranging from permanent agriculture, shifting cultivation, rainfed uplands agriculture, food agriculture, crop rotation, and inter-cropping all prevail. Intercropping and crop rotation are widely practiced and various crops are grown under these systems. For instance, the survey shows that maize, millet, beans and cotton are intercropped with others in the following proportions: maize(30.4%); beans (27.2%); millet (15.7%); and cotton (11.9%). Also maize, millet, cassava and groundnuts were reported to be grown under rotational agriculture. Permanent agriculture is by far the most dominant cultivation practice in the region. Irrigated agriculture is the least practiced form of cultivation being

found only in highly marginal areas where rainfall is totally unreliable. Shifting cultivation and intercropping are also practiced with a substantial degree of consistency.

The bulk of the land owned by our respondents falls under five acres, except in the settlement area of Kakamega district where plots are much larger. But even in this area it is interesting to note that about 34 percent of the respondents actually cultivate only up to five acres of their land. Of all the land under cultivation a substantial portion is owned by those who are

Table 4: Total Land Owned By Respondents (Percentage)

Total Land Owned (Acres)	Kisii	S. Nyanza	Siaya	Busia	Kakamega
1-5	56.5	5.1	44.6	35.6	1.0
6-10	18.8	8.5	36.2	32.3	48.1
11-15	2.4	6.9	4.2	11.1	43.6
16-20	1.2	6.0	2.8	6.6	-
21-29	1.8	32.0	1.4	5.5	2.0
30 and above	1.2	6.0	-	3.3	3.0
TOTAL	100	100	100	100	100

using the land. It was found that 78.8% of respondents in Kisii, 80% in Busia, 93% in Siaya, 95% in South Nyanza and 98% in Kakamega till land that belongs to them. This indicates that in the sample areas Kisii probably has the highest number of persons using land that they are either renting or on which they live as squatters or tenants at will.

Table 5: Land Total Currently Under Cultivation (Percentage)

Land Under Cultivation (Acres)	Kisii	S. Nyanza	Siaya	Busia	Kakamega
1-5	76.3	43.1	84.5	71.1	33.7
6-10	5.4	31.0	8.9	9.9	54.6
11-15	1.2	8.6	2.4	2.2	7.0
16-20	-	5.1	-	1.1	1.0
21-29	-	10.3	-	-	2.0
30 and over	0.6	1.7	-	2.2	1.0
TOTAL	100	100	100	100	100

Most of the respondents land is acquired by virtue of family inheritance. However, in Kakamega as many as 97% of the respondents had bought the land they were currently farming. Although land prices varied from place to place, determined largely by demand and quality, one acre cost at least KShs 2,000 and could go up to KShs. 7,000 or more. In Kakamega and Kisii, for instance, an acre of land was being sold for as much as KShs. 10,000. These figures indicate the worsening problem of land shortage in Western Kenya which could be a major constraint in the future promotion of hybrid maize. As an accommodation to land shortage intercropping is perhaps the least costly option. It should not be surprising therefore if intercropping, especially of maize and beans increases in the near future. In view of the land shortage the strategy of promoting hybrid maize which has been accompanied by suggestions of a monocrop culture, may have to be reviewed if the concern of increasing food reserves on the farm is to be realized.

D. Women's Right Over Land

Under customary law women do not ordinarily own land except where by virtue of widowhood they become de jure heads of households. Customary law defined a woman's tenurial rights by her structural position as a daughter or a wife. As a wife her rights in land included use rights for agriculture and for grazing animals, right to have a house and yard and finally a burial place if the marriage remained valid throughout her lifetime. In all the in-depth interviews we were not able to find any women who had formal ownership of land under the present individualized tenure system; that is, women who had the titles of the land they were farming registered in their names. The land adjudication procedure which translated corporate (communal) rights into individual land failed to recognise the traditional rights of women in their land as indicated above. It is, however, important to note that the Succession Act of 1981 which recognizes the right of women to inherit land from their fathers regardless of marital status has the potential to ameliorate this situation. There is some fear, however, that the Magistrates Jurisdiction (Amendment) Act of 1981 may be disadvantageous to women, unless the composition and attitude of Elder's Courts created at the village level to hear first stage of land cases and grievances favours a fair appraisal of the status of women regarding current landholding practices.

Family Survival Strategy: Differentiation of Roles in Providing Resources

In the course of field research we were able to detect a family strategy in providing capital and other crops.

Essentially the family strategy implies being able to keep up agricultural and food production using available land and to meet cash needs through off farm employment. Generally, men are responsible for the latter while women take care of the former. It is generally believed that men prefer land preparation, leaving the rest of the work for women while they pursue off-farm cash earning opportunities. Sometimes this involves hiring out one's own labour to better-off farmers for land clearing and other agricultural tasks. Our survey data does not bear this out. But this is perhaps explained by the preponderance of males in our sample.

Men also work on tree crops like bananas and local grown sugarcane which do not require much labour, time or energy. In this and similar instances we discerned what might be called a family strategy in the behaviour and attitude of men and women in the subsistence small farm sector. The strategy appears to be that the man will clear land and, if affordable, organize and manage the ploughing of land. After these farm operations the man will go off to better-off farms or nearby urban or rural employment centers to try to earn a cash income. In the meantime, the woman will continue to prepare land (seasonal cultivation), hand dig where necessary, plant, weed and tend crops right up to harvest and postharvest grain processing and storage. In essence then the woman is the farmer; in addition, she looks after children and provides food for the family on a daily basis.

Thus the following general pattern of division of labour within the household may be discerned. Ploughing is usually done by men. Hand digging is more often undertaken by women, especially on small plots of land. Weeding, bird scaring and harvesting are also done by women. A woman using a hand hoe may dig as much as one acre of land and even up to three acres of land in preparation for planting. This is usually the case when the household does not own a plough or has no money to hire the services from someone else.

The problem we noted, however, was that while the woman remains on the farm partly to release the man's labour for off-farm employment for money, she has no direct say on how that money is spent, although the man may volunteer some of the money or purchase needed goods sporadically. The woman's labour, however, is tied up with child care and food production with few or no options for substitutability. Therefore, she is often not able to go out to earn cash except through some cooperative activity, such as a women's group or when the children are older and she is more able to leave the home. For women in Western Kenya then food production has to be stable enough to satisfy the family food needs and to yield a surplus which can be sold for cash. This implies that some of her own work on the farm has to be made profitable so that she can raise some cash as part of her daily workload.

(F) Maize Production

In the low lying lake shore areas up to 4,000 ft. elevation characterized by dry weather conditions and sparse rainfall

(e.g., lower Siaya, South Nyanza and Busia Districts) the 5-11 and Katumani are the recommended maize varieties. Both are early maturing and adapted to low rainfall conditions. In Kisii variability of climatic conditions enables 612, 613, 614, 622 and 625 to be grown. The 625, only recently introduced, has been found to be best suited to Kisii agroclimatic zones and is high yielding (approx. 50 shelled bags per hectare). It is fast replacing the 613 variety which was the most commonly planted variety.

In places where two rainfall maxima obtain as in Kakamega and Kisii districts as well as upper South Nyanza and Siaya, the 611 and 632 varieties of hybrid maize are the most suitable for the long rainy season (January-June) and 622 in the short rain season (September to December). The 613 variety was initially introduced in the stable rainfall highland zones of Kisii and Kakamega but is now no longer recommended because it needs a long time to mature (approx. 6 months) and because it grows quite tall and is susceptible to destruction by high winds, at times even 1-2 months before maturity (i.e., at the age of 4-5 months).

In Lugari, a settlement scheme of relatively larger farms in upper Kakamega, some farmers reported that they still grow the 613 variety in addition to the 625 variety, both of which take six months to mature. They, however, noted the problem of 613 being susceptible to destruction by winds prematurely. In Busia it was reported that the 622 and 632 are also grown both in the lowland areas above the 5-11 zone and in the highland areas such as Amagoro Division.

In lower Busia, Siaya, Kisumu and South Nyanza districts farmers reported that local varieties of maize are still grown. In the Samia location of Hakati Division in Busia it was pointed out that local maize and hybrid varieties had equal yields. The two varieties are both planted in February-March, weeded twice between March and May, and harvested in July when still green, in August and September when dry and ready for storage. It was also reported that for local maize seeds for the next planting season are usually selected from the harvested crop without any noticeable reduction in yields.

In the low-lying lakeshore areas we noted two problems which could affect the adoption of hybrid maize: First, the early maturing maize and Serena sorghum tend to mature ahead of other crops and much grain loss is experienced because birds eat most of the grain before harvest. Secondly, hybrid maize does not really do too well in these low lying regions because of instability of rainfall. Farmers are, therefore, forced to devote a substantial amount of their time to growing local varieties of maize and other food crops such as cassava and sweet potatoes, as well as other varieties of millet as an insurance against crop failure and grain losses to birds.

For the successful production of hybrid maize in the long rainy season, farmers are advised to start land preparation in November either by ploughing or hand digging. If natural manure is to be used, cow dung is added to the cultivated field at this stage. Land is then turned over again in December and planting is done in January.

It is usually recommended that new seed should be planted each season. New seed can be bought at the price of KShs. 50 per bag of seed weighing 10 kilograms if purchased direct from the Kenya Farmers Association (KFA) depots or at KShs. 55 for the same quantity if purchased from an agent authorized by the KFA.

According to some Crops Officers, there are two main advantages in obtaining new seed for each planting season. First, it ensures that farmers get disease free seed; and second, it ensures that crop productivity can be maintained and even enhanced throughout the cropping seasons. Experience in some parts of Kisii District suggests that reduction in yields can be as high as 50% when farmers select seed for planting from a previous hybrid crop (i.e., second generation seed) and that yield can be progressively reduced in quality over time.

Although new seed is recommended by the Agricultural Extension Staff, an overwhelming majority of our respondents did not purchase new seed every season, except in the Settlement Schemes in Kakamega district, where maize is cultivated on a relatively large scale. Farmers selected seeds from their own fields and purchased new seed only in the next year. In this way they avoided expenditure on new seed which would amount to KShs. 100 or 110 for two growing seasons. This may also affirm the assertion made earlier that hybrid maize is generally planted during the long rains while local varieties tend to predominate during the short rain season. At least two weeding are usually recommended for hybrid maize. First when the maize plant is 7 days old and has two

ears; and second weeding when the plant is 25 days old. However, we did not find farmers who observed this schedule. The common practice we found was first weeding in February, a month after planting and second weeding in March/April.

For planting farmers are usually advised to use Triple Superphosphate (TSP). One bag of TSP weighing 50 kg. is enough to cover one acre of land (2.2 hectares) and can be purchased at the cost of KShs. 200. For first weeding Calcium Ammonium Nitrate (CAN) is recommended. One and a half (1½) bags weighing 80 kg. are needed for one acre of land. The KFA price per bag is KShs. 138. Ammonium Sulphate, Urea and Ammonium Nitrate are also recommended for application at the first weeding. However, if cost permits, a second application of fertilizer is recommended just when maize tassels begin to form.

Only five of the women farmers (out of 50) reporting using ammonium sulphate acknowledged that it enhances plant growth and makes maize ears much darker. This is presumably because the fertilizer increases the chlorophyll-manufacturing capacity of the plant. The rest had either never heard of it or only vaguely knew of its existence. None of the women used TSP for planting. In Busia, Siaya and Kisumu the women interviewed said that they do not use fertilizers because this costs money. However, they reported using cowdung as natural manure. Cowdung is inexpensive and can be collected from ones own or neighbour's cowsheds and does not require a substantial cash outlay. One acre of land needs at least 10 wheelbarrows of cowdung. One wheelbarrow-full of cowdung

weighs approximately 5 kg. when the cowdung is dry, crumbly and light in weight. However, it could weigh up to 10 kg. when the cowdung is wet and has stayed long in the cowshed making it thicker and heavier in weight.

Trade agents are widely used in local market centres to market farm inputs including maize seed and fertilizer on behalf of the KFA. These are usually private individual, entrepreneurs who take on the job of an agent in addition to running a store, a restaurant or small business in the market centre. They are permitted to sell at a profit of KShs. 5.00 and not more so that a 10 kg. bag of seed costing KShs. 50 at the KFA depot will sell for KShs. 55 if bought through an agent. Sometimes this saves farmers the long walk or wait for a bus to the nearest KFA depot which might cost more than KShs. 5. In Kisii District alone there are some 301 agents authorized to market KFA seeds and fertilizer. But the distribution of agents in Busia, Siaya and South Nyanza is poorer. Agents are, however, not trained nor are they under any obligation to inform farmers about the proper use and/or dangers of poor application of chemical fertilizers and insecticides.

(G) Post-harvest Grain Processing and Storage

Our survey indicates that both men and women participate in the harvesting of hybrid maize, with women performing the greater number of tasks. Bird scaring is largely done by women and children with some assistance from men. Guarding the crop from wild animals and thieves is done by men with

some assistance from women. While men, women and children participate in transporting the harvest home, women have the greater responsibility for it. Table 6 below shows the percentage distribution of participation by household members in these and related post-harvest activities on a full-time basis in all the sampled areas.

Table 6: Participation in Post-harvest Activities by Sex (Percentage).

ACTIVITIES	ADULT PARTICIPATION %		CHILDREN	
	Male	Female	Male	Female
Harvesting	50	52	8	4
Bird Scaring	19	30	16	13
Guard Crop	27	6	1.7	4.1
Transport	59	82	35	29
Drying	13	73	6	13
Threshing/Hulling	22	78	13	16
Dry after Threshing	12	70	7	12
Winnowing	20	79	13	15
Treatment by Wood Ash	15	50	4	6
Treatment by Chemical Insecticides	29	54	8	11
Storage	37	78	10	12

From Table 6 it is evident that apart from harvesting itself, virtually all post-harvest activities are left to adult women. Only in the area of transporting produce from the field after harvest do men reportedly provide a substantial amount of labour (59%). But women still do more of this work. Drying, threshing or hulling, drying after threshing and winnowing are largely undertaken by women. It is noteworthy that in the case of preservation of grain for storage

women provide the bulk of labour both in the use of wood ash and chemical insecticide but that slightly more men have knowledge of chemical pesticides than wood ash in grain preservation.

The pattern of children's work is also noteworthy. Children provide small amounts of labour in all post-harvest activities. However, small boys appear to put in more work in harvesting, bird scaring, transport and in threshing/hulling, as well as winnowing. It is possible that the lower participation rates for girls in those fields is because girls are putting in labour time in water carrying, child care and housework which boys are rarely expected to perform. Children provide greatest assistance in transportation of produce from the field represented by 35% for boys and 29% for girls. It is also the case that girls assist their mothers in such tasks as threshing, winnowing, drying and storage which are usually done by adult women.

(H) Knowledge and Use of Pesticides

Data from our survey show that the most common method for controlling insect pests is the application of wood ashes to shelled grains. About 73% of the respondents in Siaya district and 24 in South Nyanza and Kakamega districts reported they used this method. Next in importance is the application of insecticides which is particularly prominent in settlement area of Kakamega district 34 percent. In the other districts it appears that wood ashes and chemical insecticides are used in combination.

According to the advice of Agricultural Officers, a chemical by the name of Red Triangle (malathion 2%) is recommended for protecting unshelled maize to be put in a crib. It is a dusting powder for use on maize cobs. Blue Cross, also a malathion 2%, is recommended for shelled maize. It is to be mixed with the maize before maize is put in sacks. Maize treated with Blue cross should not be consumed before 10 days. Blue Cross comes in 400 gram plastic bottles which is enough to protect 5 sacks of shelled maize. It costs KShs. 5.00 per bottle at the present time. Both these two insecticides protect maize against weevils and angoumis moth, the two major pests. The latter is a white, dusty little moth which attacks stored maize.

It is advisable that farmers clean out their cribs, or sacks or storage bins, and sun dry the maize once again before reapplying the chemicals. Elianto or any edible oil is good for storing beans and other legumes. When applied over the grain the smell chases away weevils. In the sample areas, however, we did not find any farmer who used edible oil for storage, most likely because of the fairly prohibitive costs involved.

One alarming finding which needs to be critically examined is the use of DDT in the care and storage of produce. Usually it is recommended that DDT 5% can be used for planting maize to control the stalkborer from destroying young plants. However, from the in-depth interviews all respondents in Kakamega, Kisii and Busia

said they use DDT for grain storage after harvesting. Many of these women believed that DDT is the best way of controlling weevils because, of course, DDT does kill these pests! When asked to show if any packets of the chemical existed we were shown packets marked DDT 75% which is certainly far too strong either for planting or for storage purposes. DDT at any strength can go into the plant system in early growing stages and remain there and can be ingested by human beings even as late as seven months later when the crop is harvested. On the packages there were no warnings of the dangers of DDT for human consumption. And the main problem is that none of the persons interviewed knew the difference between 5% and 75% strength and had absolutely no knowledge that DDT should never be used on maize stored for human consumption. The chief attraction respondents would say that "it really works: it kills the pests and therefore must be good!" It appears that at some point DDT 75% strength was given to farmers growing cotton to use as a spray against cotton pests. However, it has found its way into the storage of hybrid maize probably through agents who market it to whomever will buy without due warning to farmers. The use of DDT on maize needs to be reexamined, especially since it has long been established that it is a health hazard.

Wood ash is bitter and highly irritant to weevils, the major pest in hybrid maize. After 3 months this irritant effect diminishes and new ash has to be applied.

We found that respondents in the low lying zones of Siaya, Busia, Kisumu and South Nyanza still use wood ash for most grain storage purposes. In the highland area, especially Kisii and Kakamega and in the newly settled areas such as the Lugari settlement scheme (Kakamega) farmers did not exhibit knowledge or practice of using wood ash for storage. Here we were told that wood ash is not as effective as DDT. It would seem that in the low lying areas where hybrid maize is also not well adapted are also the areas where wood ash is used. Extension services are hard to come by in these areas where wood ash is used. Extension services are hard to come by in these areas and new agricultural information and technical know-how does not easily reach the farmers in these areas. The farmers reported that wood ash was cheap and was something they were able to prepare and use by themselves. The women learned the use of wood ash to preserve stored grain from their mothers. In their mother's generation storage clay pots were used. These pots were usually filled with dry grain and placed one on top of the other and the top one was sealed with cowdung. They were therefore, quite airtight and together with ash could protect grain for long. Even grain in the granaries (traditional storage cribs) were dusted with wood ash for protection. In the absence of good extension advice, the women felt that they knew far more about wood ash and were sure of their safety more than they were with other chemicals about which they only had vague information.

Some respondents said they mix wood ash with DDT in order to stretch the small quantities of the powder they are able to

purchase so as to avoid expense. Red Triangle and Blue Cross, the two malathion chemicals, will protect unshelled maize from weevils for up to six months. When at six months the maize is sun dried again and dusted with wood ash, the maize could go for up to one year without spoilage. Only two women out of 50 in the in-depth interview said they knew how to apply these two chemicals; the rest exhibited no interest and said that their husbands were the ones who had received instruction as to how to use the powder. Our survey data show this to be the case particularly in Kakamega where application of insecticides emerges more (98 percent) as a male adult than female (87 percent) activity. In all other districts, however, this appears to be predominantly female task.

(II) Post-Harvest Grain Losses

The problem of grain loss associated with poor on-farm grain storage conditions cannot be underestimated. In 1977, for example, many Kisii farmers were not able to make money from the sale of maize because the National Cereals and Produce Board declared their produce to be wet and affected by weevils as a result of poor storage on the farm. In 1978-9, when the district had a bumper crop of maize, there were not enough on-farm storage facilities to cope with the harvested produce. In Kakamega the 1977-8 and 1978-9 bumper harvest experienced losses because harvested maize had to be stored in the open. And even though additional stores were built it was expected that this could not correct the situation and that the 1980 crop could suffer the same fate. In both cases the losses

were attributable primarily to inadequate off-farm storage and poor marketing outlets for maize. Yet it is also evident that the question of adequate on farm storage has to be given greater emphasis in its own right so that it can offset problems relating to inadequate marketing systems as well as unprecedented rise in maize yields.

Two types of grain losses were identified in this study. First there are what one might call production losses. These losses can occur when the quality and timing of weeding is poor; when excessive heat prevails accompanied with little rain; and also when spacing is poor (the ideal spacing being 1 ft. between plants and 3 ft. between rows). These types of losses, except for poor rainfall, can be corrected by knowledge of appropriate farming techniques. The second type of grain loss is associated with post-harvest grain handling conditions and practices and can occur as a result of the following:

- (a) loss through wild animals, e.g., monkeys, porcupines, ground squirrels, mice, rats and moles. In particular it was found that wild animals are a menace in Busia and South Nyanza Districts, both of which have extensive forested areas where these wild animals abound. This also explains the significance of the item "guarding crop against wild animals" in Table 6 above.
- (b) reduced yield per land unit where no new seed was used (Weight per kilogram of hybrid maize is higher for new seed than seed selected from a previous crop);
- (c) loss through insect pests, weevils and angoumis moth

being the leading pests. According to some agricultural extension staff, some districts may experience as much as 30-40 percent post-harvest loss due to weevils alone;

- (d) loss through poor handling of produce. Even under the best conditions there is loss still associated with the sun drying of maize for 3-5 days during which time maize is carried back and forth from the house to the sun.

An important assumption behind the proposed On-Farm Grain Storage Project is that inadequacy of storage particularly of food crops may force farmers to sell their surplus produce when prices are low, thus having to buy when prices are high. But many of our respondents during the in-depth interviews were not convinced that the problem of food self-sufficiency was primary one of storage. Rather it was felt that it related to inadequate production. The volume of grain stored after harvest and time release patterns seem to be determined largely by need for cash, especially among small scale farmers. As shown in earlier chapters time constraint for drying and inadequate storage capacity are both problems of particular concern to relatively large scale and hybrid maize producers in Kakamega and Kisii districts and the higher parts of South Nyanza.

Paradoxically, there were very few traditional granaries within the Project Area at the time of the survey. And some of the granaries available were not being used. Many families

were employing several method of storage at the same time, thus one possible interpretation of Table 7 below is that the majority of smallholders hold their maize on the cob in the granary only temporary. Once hulled the maize is transferred in sacks, steel drums, tins or pots and kept within the dwelling house.

Table 7: Availability and Conditions of Grain Processing/ Storage Facility (Percentage)

STORAGE METHODS	Conditions of Grain Stored			
	NA	GOOD	POOR	TOTAL
Maize Huller	98.6	1.3	0.2	100
Outdoor Maize Grib	70.2	21.2	9.0	100
Solar Dryer	91.4	8.2	0.3	100
Sorghum Granary	76.0	22.0	2.0	100
Maize Granary	33.5	56.0	9.7	100
Sacks	35.4	55.5	9.0	100
Drum Condition	84.0	14.0	3.0	100
Clay Pots	58.0	39.0	3.0	100
Others	99.0	1.0	-	100

Respondents complained that there was not adequate assistance from the Ministry of Agriculture with the design of on-farm storage facilities. This fact was also confirmed to us by some of the Ministry personnel whom we spoke to in the districts and provincial offices. They believed that storage has been a neglected area with regard to formal training of extension staff and dissemination of information.

### Conclusion

The general picture then is that production of maize and other food grains in Western Kenya is of peasant nature, characterised by small holdings and little use of purchased inputs (except hybrid seeds) and hired labour. Farmers in the Project Area have very good knowledge of crop husbandry particularly of their traditional crop varieties, but they have poor knowledge of post-harvest grain handling and storage. With the recent and expected increases in food production and yields per unit land as well as labour, it is clear that more attention needs to be given to grain storage. Farmers have lost knowledge of traditional grain handling and storage practices without acquiring an accurate knowledge of new pest control techniques. They also lack information and resources (including adequate labour) to adopt the new facilities currently being promoted by the agricultural extension staff. Many of the respondents in our survey did not use the recommended insecticides and some of those who did appear not to have used them correctly. Thus the need for strengthening extension in respect of grain storage cannot be overemphasised. Since post harvest grain handling and storage activities, as our survey has shown, is the concern of women it is important to see women as the target population for the proposed project; hence the necessity to focus extension of post harvest technology on women.

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CHAPTER FIVE

AGRICULTURAL CREDIT AND EXTENSION

A. Introduction

While official policy in Kenya places strong emphasis on agricultural credit and extension as essential support services for the intensification of agricultural development, research and farmers' experiences suggest that there are continuing problems associated with access to and efficiency of these two services.

As far as institutional credit is concerned, it has been pointed out that institutional credit has reached a minimal number of small farmers; repayment records have been disappointly low; and even where credit has been provided this has not led to any general increase in farm productivity, and in certain cases has even created distortion of farmer expectations given available resources on the farm.<sup>1</sup>

Agricultural extension has also come under some criticism both from researchers, extension personnel themselves and farmers. Traditionally, the common emphasis of extension strategy has been the progressive farmer approach with the hope that poorer farmers can learn from these experiences. However, a number of shortcomings in this strategy have been identified. First the progressive farmer bias has been shown to widen the productivity gap between rich and poor farmers. Secondly emphasis favoring crops oriented to the cash market

at the expense of food production has been challenged on the grounds that it is in the small farm sector where food needs and food security become critical especially since at this level farmers rarely have access to adequate amounts of cash or resources to implement recommended practices. Thirdly the training of extension personnel has been shown to prepare them to serve the better off farmers while the actual ratios of extension personnel to farmers is such that there are more farmers than the staff can adequately cover. Both of these factors reinforce the advantage of the better off farmers over the poorer ones.

The majority of farmers too while recognizing the potential of agricultural credit in improving farm productivity are often dismayed by problems associated with the distribution of agricultural credit and the lack of information as to how to apply new techniques in agricultural production. And in a few cases there is an attitude among some farmers that tends to equate formal credit through public institutions with a virtual gift. But for the discouraging bureaucratic obstacles perhaps the number of such farmers opting for official credit and contributing to the abysmal repayment rate would be much higher. It would appear however that ignorance was a major obstacle to the use of credit. In the study area for example, we were impressed by the number of persons who said they did not know exactly what loan facilities exist or how and where to apply for them. Many of them did not have any knowledge of criteria for eligibility to farmer training opportunities or credit.

The situation of women farmers is even more acute. The point has been made in several studies that despite their key role in agriculture, women have virtually been excluded from access to the two main farm support services, namely extension and credit.<sup>2</sup> This is partly because conventional extension strategy is biased toward cash crops production and also towards men who are often assumed to be the farmer. It may also have to do with relatively low levels of literacy among women.

B. Some Constraints to Credit Utilization

Despite their expressed financial needs, farmers in Western Kenya are generally reluctant to take initiative to approach credit institutions and they would prefer to obtain cash through informal, personal, non-commercial arrangements which provide the predominant source of rural credit. But it would appear that farmers in the Project Area are somewhat sceptical of the use of any credit for their farm operations and inputs. About 70 percent of the respondents in our sample had not obtained any credit at all for their farm operations during the current crop year despite the fact that a number of credit schemes with fairly easy terms were then operational in the area. Those who had inquired about or applied for farm credit expressed dissatisfaction with formal credit as shown in Table 1 below.

Table 1. Reasons for Dissatisfaction with Formal Credit

	F	%
Approval of Applications too long	140	53.6
Excessive Security Demanded	32	12.3
Delays in Disbursement	51	19.5
Amount Required not Obtainable	15	5.7
Application too involved/Costly	12	4.6
Repayment Rates too high	7	2.7
All above reasons	4	1.5
TOTAL	261	99.9

Although we were not able to ascertain the actual number of applicants for farm credit against the number of recipients, it was evident that farmers are very skeptical about the possibility of obtaining credit from formal institutions. The general belief is that while so many do indeed apply, only very few in fact get loans; and in the view of many those receiving credit are the least deserving. The public mistrust of the loan process and fear of indebtedness perhaps explains, even if only partly, the poor performance of seasonal farm credit schemes in Kenya, especially those focussed on assisting poorer farmers outside the cash economy. The mistrust of credit institutions is reflected in the explanation in our survey as to why respondents would not seek a loan during the current year. Clearly, the majority of farmers would not seek any farm credit because they believed

Table 2: Reasons for Non-requirement of Credit

	F	%
Sufficient Cash	24	8
Present Debts too high	26	9
Loans too risky	104	35
Application Will not be Approved	94	32
Other	44	15
<b>TOTAL</b>	<b>296</b>	<b>99</b>

the credit arrangement itself was too risky or that their applications would not be successful. But this situation is in turn a reflection of farmer's ignorance about credit arrangements, poor support services and inappropriate technical packages.

The poor performance of small-holder credit in Kenya is illustrated the experience of the Integrated Agricultural Development Programme (IADP) which was designed in 1972. The implementation of Phase I of the IADP covered the period of 1976-1981/2. This phase was started initially in 14 pilot districts within Central, Eastern, Nyanza and Western Provinces. Its main objectives were stated as being to reduce small-holder farming production constraints, through improved agricultural extension, farmer and staff training, input supply, marketing, credit and price control. The pertinent basic features of the program were that the services were to be directed to poor farmers. Land was not required as

a collateral for loans but a 'security' or 'anchor crop' eligible for inputs and which could be easily sold to make repayment easy was to be identified as part of the package. Extension and credit was to cover the whole farm and food crops were to be given assistance and inputs. But despite these broad objectives the programme has concentrated largely on credit. Although Phase I of IADP had a target of 70,000 farmers to be reached by 1981 with disbursement of 2800 million shillings by the first quarter of 1980, only 40,350 farmers have been covered.<sup>3</sup>

Throughout our field work, farmers expressed their disappointment at the poor timing and distribution of agricultural credit. Many farmers who had previously applied for credit said they would not apply for a loan any more because approval took too long; and therefore, inputs arrived too late to enable them to make use of it at the right time. Lateness in the delivery of credit was also corroborated by data from a baseline study on cooperative farming. It constitutes one of the basic reasons for farmers' dissatisfaction with existing credit arrangements. Poor timing and distribution of credit can be costly to farmers since delay in receiving inputs means delay farm operations and leads to production loss and low yields. It has been noted, for example, that inputs have sometimes arrived as late as six months which seriously affects the yields, yet farmers are still liable for loan repayment. Not surprisingly, the default rate on rural credit schemes tends to be very high.

High loan repayment rates are critical for the success of any seasonal credit scheme to small holders. However, the overwhelming observation on the IADP is that the repayment rates are quite low. Even though the average loans have been quite small (Kshs. 1000 - 1500), repayment has been low (24 percent from societies to Unions and only 18% from Unions to the Cooperative Bank). Experience suggests that defaulters do not usually go back for a second season which means that the recovery of borrowed money is slow and unstable. It is also likely that credit may not have any significant impact on general farm productivity because farmers defaulting on their credit also tend to avoid meeting agricultural or other extension staff. This problem is also partly connected with the small farmers' inability to raise cash needed for loan repayment at the appropriate time. For instance, farmers are not able to meet high repayment deductions, especially in a bad year when there is crop failure due to drought or floods. This was the case in 1980 when the Kano Plains area (Kisumu District) was offered the IADP credit with sunflower as the anchor crop. In that year both maize and sunflower failed, leaving the farmer with a loan to repay and no source of revenue from which to meet these repayments.

Farmers need an anchor crop that has been tested and which has a reliable yield record for the particular agro-climatic zone. However, if the anchor crop itself offers no security, the farmer cannot be expected to absorb this double loss in a second season. While changing food

preference in favour of maize has discouraged the growing of millets and sorghums in the low-lying lake plains, there is no guarantee that hybrid maize will always do well nor that the anchor crop will do well when maize fails. It cannot be overemphasised that the effectiveness of any agricultural credit scheme depends on other factors beyond the terms of the credit itself. These include the soundness of the technical package, farmers ability to implement the package, agricultural support services, especially extension and marketing opportunities including appropriate price incentives.

C. Inadequacy of Extension Services

An effective agricultural extension is crucial in promoting the adoption of improved farm practices. Over the past twenty years Kenya has expanded the size of the extension staff quite significantly but the performance of this service has not been particularly remarkable. This may be partly because the ratio of extension staff to farmer is still very big. This is further compounded by low incentives especially low pay and low status, insufficient logistical support (especially transport and operating funds), duplication of effort and lack of efficient linkages with research stations.

During the colonial period extension contact with African farmers in Kenya was somewhat ambiguous in that extension agents were also responsible for enforcing unpopular land conservation regulations, and facilitating other government efforts such as prohibition of cultivation

of certain cash crops. Not surprisingly extension agents lost considerable influence in the period immediately after independence. And although their focus shifted from coercion to persuasion the tendency to formulate extension advice with little regard to the farmers socio-economic circumstances and to concentrate on progressive farmers has continued.

Discussion of extension strategy in Kenya generally revolves around two alternative approaches: emphasis on personal contact between individual farmers and extension agents and group extension which addresses the average or less progressive farmers in groups or clusters. So far, however, the individual approach, with particular focus on specific crops, e.g. tea, or pyrethrum, has demonstrated remarkable success. But this approach has not proved satisfactory in promoting increased food production among poor farmers in non-cash crop area for reasons already enumerated in the previous paragraph and particularly the very high extension staff-farmer ratios.

At the time of our field work, one extension staff person in Kisii district was expected to serve between 1500 and 2000 farmers. In Busia, a total of 51 extension personnel was serving some 200,000 farmers. Because of the high ratios there was a tendency for the extension staff to concentrate on wealthier and better educated progressive farmers who are more receptive to innovation, and better able to accept any economic risks entailed by it. This approach would then rely on diffusion of good farm practices and innovation from the rich to poor farmers.

The diffusion approach centering on progressive or

"master" farmers has been criticised for aggravating rural inequalities in that it tends to promote the transfer of resources to the relatively better off while failing to recognize the crucial importance of the communication and identification gap between the wealthier progressive farmers and the bulk of the rural peasantry. Small farmers need special attention and greater extension time investment that the existing arrangements can support.

Group extension offers a more cost-effective alternative because of its greater potential for more effective diffusion. It is likely to reach a larger number of farmers representing different socio-economic categories in a given time while economising on transport and fuel. However, for group extension to succeed on a wider scale, a great deal more preparatory work needs to be done in order to ensure the effectiveness of the extension agents. Experiments conducted during the early 1970s by the Institute for Development Studies, University of Nairobi, in Migori, Tetu and Mbere as part of the evaluation of the Special Rural Development Programme, clearly demonstrate the advantages of the group extension approach in conjunction with both farmer and extension staff training.<sup>4</sup> But the suggestion of the greater effectiveness of group extension, especially to promote specific practices or packages, need not imply discontinuing one-to-one farmer/agent contact. For there still remains the need for follow-up at the farm level.

The results of our survey clearly show that while extension advice has given some attention to promotion of increased food production, storage has largely been ignored. Only 12% of our sample had received any extension advice on grain storage. Of all the activities associated with hybrid maize production, it would appear that farmers received the most extension advice on spraying or dusting of insecticides. In South Nyanza, 17 percent of farmers reported having received advice on pesticide use. In Busia the proportion was 9 percent; in Kisii it was only 7 percent and in Siaya it was down to only 4 percent. But even these modest figures did not seem to make any difference on the level of knowledge about the use of chemical insecticides or improved grain storage practices. Evidence from our in-depth interviews clearly suggest the lack of knowledge of the correct use of chemical insecticides among both male and female farmers.

D. Lack of Access by Women to Credit and Extension

As we have already shown in earlier chapters, women form the bulk of the agricultural work force in rural Western and Nyanza provinces. It is a serious matter, therefore, that agricultural support services like credit and extension hardly reaches women. The male bias in the delivery of extension and credit services to farmers poses a serious obstacle to the improvement of food production. This bias rests on three assumptions widely held by agricultural extension staff: (1) that farmers who are concerned with or who have responsibility for improvements in farming practices or acceptance of new scientific advances in

agriculture are men; (2) that once the men have the technical information they would transmit it to women and (3) that since women are under the direction of their husbands they do not need to be consulted.

Such views are further reinforced by the division in the Agricultural Ministry between technical agricultural extension, which recruits predominantly male officers, and home economics, which does not recruit men. For instance, in the General Agriculture diploma course at Egerton College during 1982, only 6 women were enrolled in a class of 50 trainees. But in the Home Economics course at the same institution there was not a single man in the course in which 38 women were enrolled. The situation was almost similar in the certificate courses for Agricultural Technical Assistants who are expected to provide the first contact with farmers. At the Eldoret Institute, for instance, only 38 women technical assistants were enrolled in a class 197 Technical Assistants during 1982. Although there has been official expression of the need to expand the training and recruitment of women extension staff this appears to be constrained in part by the limitation of dormitory space for female trainees. But the bias in extension training to the disadvantage of on-farm storage, especially of food grains would appear to be related to the cash crop or "coffee" bias mentioned earlier.

Invariably, the training of extension staff reflects a bias toward cash crops - usually non-edible cash crops like coffee, tea, cotton, etc. - and the home economists learn more

about kitchen gardening and household based skills. Needless to say, both types of training do not prepare either the extension staff or home economists to prepare projects and information which truly meets the needs of women as agricultural producers. The solution must be both to change the image and techniques of home economics to be more consonant with what women have to offer to agriculture and to re-orient extension services to move away from the 'coffee' bias to deal more directly with women where they have a responsibility for farming a particular crop (whether cash crop or food crop).

In the field interviews only four out of 50 women in our sample had been to a farmer training course. Two had been visited by extension workers and none had received any advice on how to build a crib. Women farmers indicated a strong need for credit and extension assistance for a host of farm inputs including the construction of more efficient-grain storage. In a survey of the Farm Inputs Supply Scheme (FISS) in Nyandarua, Nandi and South Nyanza districts during 1982, it has been shown that only 11 percent of all the credit recipients were women - and none of the loans were for storage.<sup>5</sup>

There is a strong feeling among both male and female farmers that current credit schemes emphasize production to the exclusion of storage. Storage assistance should be included in the credit and extension package. Although the need for drying platforms was raised, we had strong impression that farmers wanted drying platforms for beans which can be dried at home. In most areas, beans and maize mature about the

same time. Beans can be uprooted and dried on platforms as soon as the grains have matured. Green maize, however, is more susceptible to spoilage and, therefore, farmers prefer to leave maize on the farm for some time until the low moisture content has been achieved.

The following credit needs were frequently identified by women in the course of in-depth interviews:

- (1) Labor for weeding and harvesting. This is to augment female labour at harvest time because there are other crops to be harvested at the same time as maize. Weeding period is also as much of a labour bottleneck as is the harvest time.
- (2) Construction of drying platforms. This was stressed also as a means of freeing female labour since the grains can be left on the platform overnight thus releasing the labour to remove it each evening.
- (3) Construction of storage cribs. The cost of purchasing timber, nails, and corrugated iron sheets for storage cribs can be high. Since most subsistence farmers, and women in particular, do not have reliable income, it should not be expected that they can meet the costs of construction and maintenance of modern-type cribs. In Kisii and Kakamega, we were impressed by the farmers need for this kind of storage facilities. In Siaya, Kisii and South Nyanza, however, concern with theft of grains from outside granaries was so strong that it would suggest assistance with various forms of in-house storage.

- (4) Marketing and transportation bottlenecks. Male and female farmers are not satisfied with the present marketing arrangements for maize. The current practice is that the National Cereals and Produce Board (NCPB) agents are to pick up maize in sacks from farmers and transport it to the depot. However, these agents and even the NCPB itself will not pick up maize unless it is between 10-20 sacks or more. Many farmers may not produce this quantity of maize but may have as many as 8 or 9 bags for sale. Some of them usually have an average of 3-4 bags of maize to be delivered. When the agents fail to pick up maize, the farmer has almost no alternative, especially in cases of inadequate storage facilities, but to sell in a hurry at any price. Therefore, a credit package which relates marketing, transportation and storage together is particularly important for farmers to avoid hurried sales of produce at the harvest time and/or spoilage owing to poor storage. These factors are a disincentive to farmers, especially where production problems have been overcome.

Footnotes

1. Ruigu, G. and Patrick O. Alila (1981) "Cooperative Farming in Nandi: South Nyanza and Nyandarua: FISS Basine Studies." Report prepared for the Ministry of Cooperative Development. Research and Evaluation Unit, Nairobi.
2. Boserup, Ester (1970) Women's Roles in Economic Development. George Allen and Urwin London.
3. Livingstone, Ian (1981) Rural Development, Employment and Incomes in Kenya. International Labour Office. Jobs and Skills Programme for Africa (JASPA) Addis Ababa. p. 115.
4. IDS (1975) SRDP: Second Evaluation of the Special Rural Development Programme, Occasional Paper No. 12; Institute for Development Studies, University of Nairobi, Chapter 8.
5. Ruigu, G. and Patrick Alila (1981) op.cit. (un-analysed data).

Table 1.

Respondent's Relation to Head of Household (Percentage)

Relations	DISTRICT				
	S. Nyanza	Busia	Kisii	Kakamega	Siaya
Male Head	62	68	67	81	50
Female Head	17	9	20	16	18
Wife	18	21	12	3	28
Daughter	-	-	1	-	-
Son	3	2	1	-	4
TOTAL	100	100	100	100	100
N =	58	90	170	101	213
No. of Women Interviewed	12	8	34	16	39

Table 2.

Household Size (Percentage)

Size	DISTRICT				
	S. Nyanza	Busia	Kisii	Kakamega	Siaya
5	17	14	18	21	16
8	38	35	31	42	31
10	20	27	24	15	25
12	16	14	10	15	16
12	9	10	17	7	12
TOTAL	100	100	100	100	100
N =	47	84	160	93	195
N.A. =	11	6	10	8	18

Table 3: Participation in Post-Harvest Processing and Storage Activities

(i) South Nyanza

ACTIVITY	ADULTS						CHILDREN					
	Male			Female			Male			Female		
	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No	N
Chasing Birds	48	52	(21)	78	22	(23)	75	25	(24)	61	39	(24)
Guarding animals , thieves	86	14	(43)	42	68	(19)	13	87	(15)	33	67	(15)
Harvesting	95	5	(39)	96	4	(51)	54	46	(22)	45	55	(20)
Transport	91	9	(34)	88	12	(43)	45	55	(22)	45	55	(22)
Drying	44	56	(18)	94	6	(51)	19	81	(16)	12	88	(16)
Threshing/Hulling	35	65	(17)	92	8	(51)	25	75	(16)	13	87	(16)
Dry after threshing	31	69	(16)	91	9	(47)	25	75	(16)	7	93	(15)
Winnowing	31	69	(16)	94	6	(47)	18	82	(17)	7	93	(15)
Ash treatment	28	72	(15)	25	75	(14)	28	72	(14)	21	79	(14)
Treat Insecticide	67	33	(12)	78	22	(19)	20	80	(10)	22	82	( 9)
Storage	76	24	(34)	96	4	(52)	6	94	(16)	6	94	(17)

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(ii) Busia

ACTIVITIES	ADULT						CHILDREN					
	<u>Male</u>			<u>Female</u>			<u>Male</u>			<u>Female</u>		
	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No	N
Chasing Birds	89	11	(45)	94	6	(54)	73	27	(11)	71	29	(17)
Guarding thieves/animals	96	4	(27)	83	17	(24)	50	50	(0)	13	87	( 8)
Harvesting	95	5	(57)	98	2	(74)	75	25	(12)	75	25	(16)
Transport	91	9	(71)	91	9	(81)	82	18	(28)	52	48	(19)
Drying	88	22	(35)	100	-	(71)	77	23	(13)	70	30	(10)
Threshing/Hulling	89	11	(28)	98	2	(65)	82	18	(11)	70	30	(10)
Drying after threshing	87	13	(30)	100	-	(67)	78	22	(27)	50	50	(24)
Winnowing	85	15	(20)	94	6	(70)	67	33	( 9)	40	60	(10)
Ash treatment	86	14	( 7)	59	41	(27)	28	72	(18)	75	25	( 4)
Storage	85	15	(20)	86	14	(71)	50	50	( 6)	78	22	(18)

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(111) Kisii

ACTIVITIES	ADULT						CHILDREN					
	<u>Male</u>			<u>Female</u>			<u>Male</u>			<u>Female</u>		
	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No	N
Chasing Birds	78	22	(23)	95	5	(43)	80	20	(31)	65	35	(23)
Guarding (animal/thieves)	100	-	(31)	67	33	(6)	63	37	(8)	63	37	(8)
Harvesting	81	19	(96)	99	1	(153)	74	26	(74)	75	25	(79)
Transport	80	20	(90)	100	-	(150)	73	27	(74)	74	26	(78)
Drying	46	54	(41)	99	1	(143)	38	63	(37)	67	33	(66)
Threshing/Hulling	49	51	(37)	98	2	(145)	39	61	(33)	70	30	(60)
Drying after threshing	47	53	(38)	100	-	(139)	40	60	(35)	67	33	(63)
Winnowing	28	72	(28)	100	-	(131)	36	64	(31)	67	33	(57)
Ash treatment	95	5	(45)	100	-	(72)	58	42	(12)	66	34	(21)
Treat. Insecticide	83	17	(89)	99	1	(110)	36	65	(28)	41	69	(32)
Storage	87	13	(91)	98	2	(134)	40	60	(35)	57	43	(35)

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(iv) Kakamega

ACTIVITIES	ADULT						CHILDREN					
	<u>Male</u>			<u>Female</u>			<u>Male</u>			<u>Female</u>		
	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No	N
Chasing Birds	100	-	( 4)	75	25	( 4)	-	-	-	-	-	-
Guarding animals/thieves	100	-	( 1)	-	-	( -)	-	-	-	-	-	-
Harvesting	98	2	(82)	88	12	(94)	97	23	(62)	86	14	(51)
Transport	99	1	(76)	90	10	(76)	96	4	(51)	82	18	(39)
Drying	100	-	( 5)	86	14	( 8)	100	-	( 3)	100	-	( 7)
Threshing/Hulling	100	-	(71)	89	11	(80)	94	6	(52)	82	18	(38)
Drying after threshing	100	-	( 6)	100	-	( 3)	100	-	( 2)	100	-	( 4)
Winnowing	100	-	(64)	89	11	(79)	93	7	(46)	81	19	(37)
Ash treatment	93	7	(14)	94	6	(17)	100	-	( 5)	80	20	( 5)
Treat. insecticide	98	2	(68)	87	13	(76)	94	6	(50)	82	18	(40)
Storage	100	-	(75)	90	10	(84)	94	6	(48)	77	23	(40)

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(v) Siaya

ACTIVITIES	ADULTS						CHILDREN					
	<u>Male</u>			<u>Female</u>			<u>Male</u>			<u>Female</u>		
	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No	N
Chasing Birds	76	24	(59)	81	19	(95)	86	14	(59)	76	24	(51)
Guarding animals/thieves	99	1	(75)	33	67	(18)	14	86	(14)	20	80	(15)
Harvesting	93	7	(152)	99	1	(200)	86	14	(98)	72	28	(103)
Transport	92	8	(141)	99	1	(190)	85	15	(99)	81	19	(93)
Drying	38	62	(53)	99	1	(197)	21	79	(42)	37	63	(54)
Threshing/Hulling	33	67	(49)	98	2	(192)	13	87	(38)	34	66	(50)
Drying after threshing	41	59	(53)	98	2	(195)	13	87	(38)	33	67	(51)
Winnowing	52	48	(67)	97	3	(196)	37	63	(51)	37	63	(54)
Ash treatment	50	50	(54)	97	3	(175)	22	88	(37)	31	69	(42)
Teat. insecticide	49	51	(35)	96	4	(117)	8	92	(24)	27	73	(30)
Storage	55	45	(63)	96	4	(179)	3	97	(34)	12	88	(42)

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Table 4: (i)

Theft of Grains from Outside Granaries

Was there theft of grain last year	DISTRICT				
	S. Nyanza	Busia	Kisii	Kakamega	Siaya
Yes	75	41	71	31	55
No	25	59	29	69	45
TOTAL	100	100	100	100	100
N =	57	76	170	94	207
N.A. =	1	14	-	7	6

Table 4 (ii)

Has theft increased or decreased	DISTRICT				
	S. Nyanza	Busia	Kisii	Kakamega	Siaya
Increased	96	71	93	23	82
Decreased	4	29	7	77	18
TOTAL	100	100	100	100	100
N =	45	38	117	65	122
N.A. =	13	52	53	36	91

Table 4 (iii)

Why has theft increased	DISTRICT				
	S.Nyanza	Busia	Kisii	Kakamega	Siaya
Because of hunger	35	74	28	-	38
Poor harvest	19	1	2	-	20
Increase in population	12	3	17	47	11
Lack of jobs	2	10	5	53	21
People are lazy	2	10	6	-	5
Need for money	2	3	3	-	-
Lack of land	21	-	30	-	-
Drunkenness	7	-	9	-	5
Education	-	-	-	-	-
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
N =	43	31	109	17	132
N.A. =	15	59	61	84	81

Table 5  
Major Problems Perceived by Respondent

MAIN PROBLEM	DISTRICT				
	S. Nyanza	Busia	Kisii	Kakamega	Siaya
Too much rain	3	8	1	-	4
Too little rain	57	12	5	2	60
Lack of land	-	4	49	3	3
Lack of pasture	2	10	10	-	6
Hunger-Lack of food	2	3	4	-	2
Poor health	2	14	6	26	3
Poor Communication	13	33	21	65	17
Lack of School	2	4	2	1	-
Livestock diseases	19	12	3	3	6
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>101</b>	<b>100</b>	<b>101</b>
N =	58	90	169	98	210
N.A. =	-	-	2	2	3