Rapid Rural Appraisal of Post-Maturity Issues in the Central Region of Malawi.

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December 1996

Report R2358(S)

Project No A0549

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Acknowledgments

The authors would like to thank ActionAid Malawi, for organising the availability of the former SIP Monitors, and the Monitors themselves for the good solid fieldwork that they put in. In addition, thanks are due to Staff at the MoALD, in particular Drs Kampani and Matabwa, Mr Anex Umphawi and Mr. Charles Kanyinji. The staff from Lilongwe and Salima ADDs and Chitedze research station who played an active part as RRA team members are to be commended for the speed with which they assismilated unfamiliar methodology and for the diligence with which they applied it in the field.

Finally, the authors would like to thank Mrs Celia Cruz at the British High Commission, Lilongwe, and Messrs Chirambo and Musopole at AAM for the excellent administrative arrangements which allowed the fieldwork to proceed smoothly.

EXECUTIVE SUMMARY

i. A rapid rural appraisal of problems related to household food security was conducted in six villages in three agro-ecological zones in Central Region, Malawi. The study focused on post-maturity issues. Problems faced by rural communities can be divided into those which occur before harvest, at harvest and during storage, and finally during processing and marketing.

ii. Farmer groups interviewed regarded these issues as constraints to food security but production problems, including input prices, field pests and diseases and land access and land productivity were of greater concern. Nevertheless, the RRA identified post-maturity problems which if addressed would make a significant impact on the well-being of rural communities. Many of the problems were inter-related and cannot be easily solved in isolation. The key constraints were as follows:

- Drying of cereals and legumes (the introduction of improved drying cribs, as has been done in several African countries with varying degrees of success, may be a possible intervention here).
- Difficulties in transporting ripened and partly or fully dried crops from the field to the household.
- Insect pests of cereals and legumes. This includes Larger Grain Borer which has been found throughout the country. Low cost, sustainable solutions are required. These could complement on-going GTZ work which is focusing on biological solutions to LGB, and would link up with NRI research on botanical and inert dust insecticides which is taking place at Chitedze Research Station, Lilongwe.
- Researchers do not understand farmers' perceptions of losses and how these are reflected in decision-making concerning crop disposal. Moreover, existing methods of loss assessment used in Malawi are either too crude or too technically complex to be used as effective instruments by research or extension fieldworkers.
- The decline in natural materials required for store construction (there may be a need to identify alternative methods of storage if alternative construction materials are not available).
- Growers of onions require improved storage technologies to prolong shelf life.
- New varieties of perishables, such as tomatoes and cabbages, are required to change the growing season to avoid gluts. Alternatively, growers need to diversify out of these crops to other vegetables for which new markets may have to be found.
- The lack of credit facilities for farmers requires research into the transfer of ideas from inventory credit schemes to the Malawian context.

iii. To address these issues an integrated approach is required which would build on the results of the current study to: deepen understanding of identified constraints; identify any additional constraints; introduce appropriate techniques to overcome the constraints; initiate trials to assess efficacy of the solutions; assess the socio-economic viability of improved technologies; encourage the uptake of these technologies using resources of the government extension services and NGOs; and monitor and evaluate uptake and efficacy.

Chapter 1
INTRODUCTION

Smallholder Production and Post -Maturity Environment

1. Major changes in both food security and livelihoods have occurred in Malawi over the last 10-15 years. Since 1980, the population has nearly doubled. Each family has less cultivable land and the land is cultivated more intensively. In conjunction with the effects of widespread deforestation, this has led to an ever accelerating decline in soil fertility. Although the issue of land reform has belatedly entered government and donor policy agendas, in the medium term production increases will have to come from increased yields as opposed to increased hectarages. Agro-forestry initiatives are now being introduced on a national scale. However, for the immediate future at least, self sufficiency in the staple food crop (maize) at smallholder level requires hybrid varieties and fertiliser. The drought of the early 1990s, combined with certain political influences, precipitated the breakdown of the credit system some 3-4 years ago. Moreover, farm input prices have increased dramatically owing to the removal of input subsidies and devaluation of the Kwacha. The upshot is that in the absence of handouts a smaller than ever minority of farmers are able to access fertilisers and HYVs in sufficient quantities to attain self-sufficiency. In recent years, major production deficits have been avoided only by widespread input distribution programmes which are probably unsustainable in the long run.

2. Market liberalisation, drought and political change have also affected the post-harvest situation at farm level. The role of the Agricultural Development and Marketing Corporation (ADMARC) has been diminished, and private traders have come into the market place. Access to markets has been increased in some areas through private trader activity, but reduced in others owing to the closure of some ADMARC Markets. In the past, there has been a high level of dependency on ADMARC which has enjoyed various monopolies in internal and external trade, and farmers are finding it difficult to deal with the new, more liberal, policy environment. Liberalisation, together with straitened economic circumstances of the 1990s, and greater perceived personal freedoms, have significant implications for post-harvest constraints and opportunities faced by Malawi's farmers.

Previous Studies on Farm Level Post-Maturity Issues

3. Most farm level post-maturity studies in Malawi have concentrated on losses. Within these, the focus has been on a few crops only, most notably maize, either in storage or at the processing level. In the late 1970s and early 1980s, Golob assessed losses in farm stored maize, groundnuts and sorghum. The studies took place in the Shire Valley Agricultural Development Project (SVADP) area in the Southern Region, and in the Lilongwe Land Development Project (LLDP) area in the central region. The results from both studies indicated that storage losses were low: in the LLDP, mean losses after 10 months storage were less than 1.5% by weight for maize

and less than 1% by weight for groundnuts (Golob, 1981(a)), whilst in the SVADP losses were 3% or less for maize and 2% for sorghum (Golob, 1981 (b)). At about this time a further study was undertaken in Phalombe, also in the Southern Region, which produced similar results (GOM, 1982).

4. In contrast to the low levels of losses reported in these earlier studies it was widely felt that with the spread of high yielding varieties, storage losses could significantly increase. Evidence on this point is mixed. The results of a 1994 GTZ survey carried out in Karonga and Chitipa Districts in the Nothern Region indicate "very low weight loss figures ...[which]... reconfirm the findings from former surveys in the country" (GTZ 1994). The mean weight loss after 9 months was 5.1%, insects were the main cause of loss, followed by moulds. Losses caused by rodents were insignificant. A key factor behind these figures was that the hybrids were either sold or consumed first, before major losses could occur. One of the interesting things about the study was that whilst weight loss was lower for maize dusted with Actellic 2% than for untreated maize, the difference was not statistically significant, raising the possibility of inappropriate application, poor quality of the chemicals or that insect damage in non-hybrids was too low to be influenced by chemical application. In contrast to the GTZ work, a recent nationwide study by CODA and Partners, a Kenyan Consultancy firm based in Lilongwe estimated an average maize loss over a 6 month period of 17.7% (CODA 1996). The main reason for the discrepancy in the CODA and GTZ figures was that in the former study the average loss total was raised significantly by a very high loss figure for hybrid maize (62.2%) (Losses in "local" varieties were estimated as 5.2%). Within Malawi there has been some questioning of the CODA results, as the methodology used was based on a single spot estimate from farmers and it does not appear to take account of the fact that, as noted by the GTZ study, many farmers sell or consume hybrids quickly.

5. In terms of storage losses in other crops, information is quite limited. The most recent estimates have been produced in the CODA study. Here it was estimated that mean national level smallholder storage losses in 1995 were 1.0% for rice, 46.7% for pulses, 13.3% for sweet potato, 35.7% for Irish potato, and 20.0% for groundnuts. Given the question marks over the CODA methodology, it is difficult to know how much weight should be given to these figures.

6. The issue of seed storage practices in central Malawi has been reviewed by Wright and Tyler (1994) and Wright et al (1995). The studies concluded that on farm seed storage using traditional methods was generally very good. The key criterion used to determine quality of storage was germination rates. It was found that germination was in excess of 70% for the major food crops. Whilst vigour may give a truer indication of the efficiency of seed storage, it appears that traditional storage techniques are generally of high quality, although improvements are possible (Wright et al, 1995).

7. In terms of processing losses, again the focus has been on maize. Studies done by Mtimuni and Cusack and also Ninje in the early 1980s found that around 40% of the weight of the original maize grain was lost during local processing into refined white flour. Ninje further reported that when corrected for crude extraction rate, the

crude protein and energy losses in processing came to 45% and 55% respectively of the processed grain (studies quoted in GOM 1995) .

8. Information on handling of crops in Malawi has tended to focus on the drudgery involved, and the impact that this has on time allocation patterns, particularly of women (Cammack, 1996). Consequently, there has been some interest in mechanical methods for threshing cereals and plucking groundnuts. In line with this, the CODA study makes several recommendations for mechanical interventions (although it is not clear that the farmers interviewed expressed interest in these). Drying of crops is another issue that has received some attention. The practice of leaving cereal crops to dry in the field can lead to significant insect infestation if prolonged and also increases the chances of theft (UNICEF, 1996). In terms of fruits and vegetables, whilst traditional methods vary across the country, some practices such as sun drying and blanching (part boiling) are common throughout Malawi. Such methods are cheap and not time consuming or expensive, however they tend to deplete nutrients, particularly vitamins. Dried fruits and vegetables are commonly stored in earthenware pots. As long as the fruits and vegetables are thoroughly dried they can be stored for many months with no adverse effects (UNICEF, 1996). These traditional methods are applicable only to crops consumed on farms, as fruits and vegetables are always marketed fresh.

9. The introduction of structural adjustment policies and agricultural input and product market liberalisation in particular has disrupted the equilibrium of the traditional post-harvest system. The implications of grain market liberalisation have been studied by Coulter (1994), Tyler and Harding (1994) and Tyler and Bennett (1995). One of the major issues arising from this work is the effect of the reduced influence of parastatals in purchasing and distribution of smallholder crops, and the concomitant encouragement of private traders. Of particular influence here is the loss of the guaranteed market for grain surplus shortly after harvest, which had previously relieved the producer of storage and quality maintenance problems (Tyler and Bennet, 1995). The implication of such changes is that methods of conserving grain safely on the farm take on a new importance.

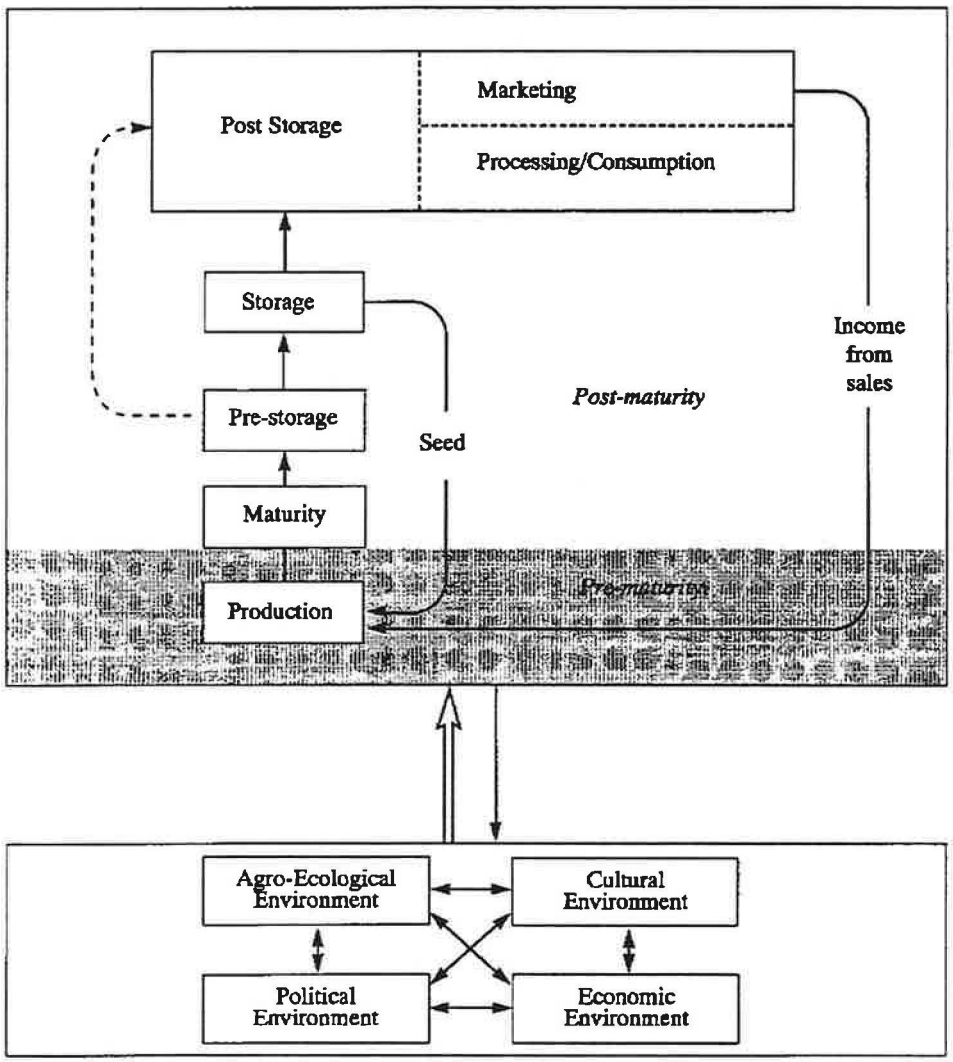
The Rationale For the RRA

10. There appears to be a reasonable amount of information on smallholder post harvest issues in Malawi, although much if not most of it is rather maize focussed. Moreover, it also appears that, as yet, very few attempts have been made to gain farmers' perceptions of the salient issues. This is a particularly important need in the context of the significant economic, political, demographic and social changes that have taken place in the country over the last 10-15 years. It was in this context of change that it was felt necessary to undertake a broadly focused pilot study using participatory methodologies.

Conceptual Framework.

11. The study was organised around a simple conceptual framework which sought to delineate the basic influences on smallholder post-maturity commodity systems. Figure 1 sets out the framework.

Figure 1: Conceptual Framework for Smallholder Post-Maturity Systems.



The framework provided the basis for the direction of questioning in the study, and served to organise thoughts on identification of post-harvest constraints.

Objectives

12. The objectives of the study were to:

- identify the key constraints in post-harvest operations for important food security crops (as identified by the farmers themselves);
- use this information to identify priorities for research and development.

Chapter 2
METHODOLOGY

Introduction

13. Although the Ministry of Agriculture and Livestock Development (MOALD) has a strong commitment to post-harvest research, its extension personnel are not particularly well trained in this aspect of agriculture and are not particularly conversant with problems faced by farmers. In addition, most staff have not been trained in PRA/RRA. It was decided, therefore, to seek the assistance of Action Aid. Eight Action Aid monitors joined staff from the Ministry's extension and research wings on a two day training workshop (5 - 6 December). Two teams of seven then spent a week in villages on the Lilongwe plateau, along the Salima lakeshore and in the Dedza/Ntcheu hills interviewing farmer groups, before re-convening on Friday 13th of December for a final debriefing and brainstorming session.

Village Selection

14. Six villages were selected with the aim of providing a flavour of the key issues and concerns in each of the major agro-ecological zones in the central region. It was felt that this would be a large enough sample to allow identification of key researchable constraints, indicative of each zone, through offering "windows into regions"[1].

15. The two villages visited in the plateau zone were around 60 km apart, one to the north and the other to the south of Lilongwe and both about 1000m above sea level. Situated on the Lilongwe plain, they experience a tropical continental climate, with a mean annual rainfall of between 800 and 1000 mm, and a mean annual temperature of 18-22°C. Latosols, strongly leached acid soils, cover most of this area, although seasonally waterlogged hydromorphic soils are found locally in *dambos*. This area forms part of the main maize and tobacco growing belt which stretches from north of Liwonde in the south to Mzimba in the north. The predominant tribal group in the Lilongwe area is the Chewa.

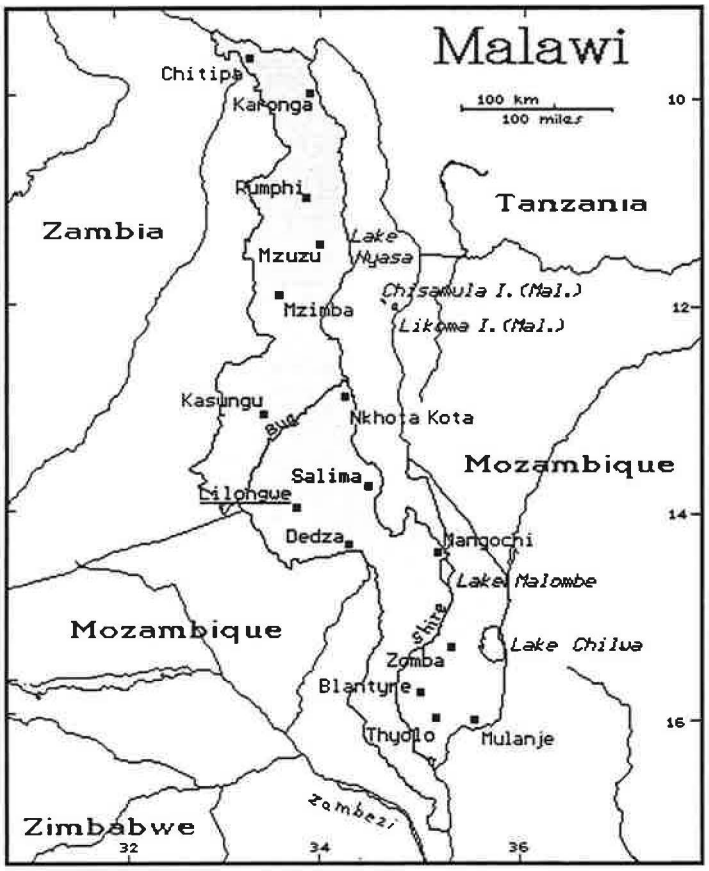
16. In the central region, the rift valley zone consists of the lakeshore plain. With an altitude of 470-600 m above sea level, it is hotter than other parts of the central region (22-24°C as the annual mean) and the soils are generally better (calcimorphic alluvial and hydromorphic predominating). It can also be wetter: historically, mean annual rainfall has ranged from 1500-2500 mm. Millet and rice are commonly grown here (as well as maize), and cotton is an important cash crop for many farmers. The two villages visited in this zone were fairly close to one another in Salima District.

17. The high plateau / mountain zone consists of areas where the altitude exceeds 1500 m and the climate, particularly the low temperature (mean annual temperature 15-18°C), is the dominant environmental influence. Rainfall is typically 1000 -1500 mm and the soils are generally either shallow stony lithosols on the slopes or humic

[1] As described in Chambers (1983)

ferallitic soils on the plateaux. In this zone, RRA teams visited one village in the Dedza highlands, near to the Lake Malawi escarpment, and one village on the Ntcheu plateau. This part of Malawi is known for its temperate horticultural crops and "Irish" (European) potatoes. The main tribe in this area is the Ngoni, descendants of the South African Zulus.

Figure 2: Location of Villages Visited



VILLAGE	LOCATION	ZONE	DATE VISITED
Bwetu	30 Km North of Lilongwe, Lilongwe District	Plateau	09.12.96
Chimango	30 Kms South of Lilongwe, Lilongwe District	Plateau	10.12.96
Mikuju	12 Kms South of Salima, Salima District	Rift Valley	09.12.96
Mpunga	9 Kms South of Salima, Salima District	Rift Valley	10.12.96
Kalilombe	4 Kms South East of Dedza, Dedza District	High Plateau	12.12.96
Kadzakalowa	15 Kms North of Ntcheu, Ntcheu District	High Plateau	12.12.96

Group work within villages

18. In addition to stratifying the survey sample by agro-ecology, it was also necessary to capture intra-village socio-economic and gender issues. To cover these, each RRA team split into pairs, with each pair taking one of three groups.

(a) A womens group;
(b) A group consisting of heads of those households which exhausted supplies of staple food (maize in all cases) by or before *October / November;*
(c) A group consisting of heads of those households which exhausted stocks of staple food (maize) by or after *December*.

19. Each group consisted of between 5 and 10 individuals. Participants were taken through a series of ranking excercises. The diagrams produced were then reviewed to gain further insights into key issues, problems and solutions.

20. In addition, RRA team leaders conducted semi-structured dialogues with a larger group consisting of men and women of all ages and wealth status. Further details of the methodology used in the villages can be found in the appendix.

Chapter 3
RESULTS

Post-Maturity Problems in Perspective

21. In each village visited, farmers were asked to give an overall ranking of agriculturally related problems. This allowed the importance of the post-harvest problems investigated in the study to be put into a broader perspective The results of this exercise revealed that pre-maturity constraints to household food security were viewed as being more important than post- maturity constraints. Out of seven ranked classes of constraint, four were production related and three were post-production related. Table 1 summarises the results:

Table 1: Important Agricultural Problems: Farmers Rankings

CONSTRAINT	CLASS	NO. OF VILLAGES IN WHICH THE CONSTRAINT WAS MENTIONED[2]	OVERALL RANK
Input prices	Pre-maturity	5	1
Field pests and diseases	Pre-maturity	4	2
Land access and land productivity issues*	Pre-maturity	4	3
Post maturity handling problems	Post Maturity	4	4
Marketing problems	Post-maturity	3	5
Storage pests	Post-maturity	3	6
Labour costs and availability	Pre-maturity	2	7

* Encompassing: soil erosion, poor rains, poor access to upland and dimba (seasonally waterlogged hydromorphic soils).

22. For a significant proportion of farmers, the severity of production problems result in short storage periods (i.e. under 3 months) and small amounts of marketable surpluses. In this sense, there is a link between alleviation of production problems and the relevance of post-maturity interventions for household food security: the importance of post-maturity problems and, therefore, the impact of post-maturity interventions on food security will be magnified to extent that production problems are successfully tackled.

[2] The figures presented in this table are the results of an excercise conducted at the start of each village excercise. Farmers were encouraged to take an overall and **general** view of constraints to household food security.When asked to focus **specifically** on post-maturity problems, the frequency of problem identification increased, and this is reflected in subsequent tables in this report. This does not, however, invalidate the results in table 1, as the focus of the questioning leading up to this table was much broader. If the focus had been on **production** problems then the frequency of problem identification for these problems would have increased also.

Main Food Security Crops

23. Within each village, each group of farmers was asked to list and rank crops in terms of their contribution to household food security. All crops, not just food crops were considered. For each crop, groups were asked to indicate whether the crop was normally grown for food, for cash or for cash and food. In those (frequent) cases where crops were sold as well as consumed, farmers were asked whether the crop was grown *mainly* for cash or *mainly* for food. In some cases both the cash and the food function were equally important, but in many cases one or other function predominated. Table 2 indicates that there are clear differences between agro-ecological zones.

Table 2: Main Food Security Crops: Farmers Rankings [3]

Plateau[4]		Rift Valley[5]		High Plateau[6]	
Rank	Food / Cash	Rank	Food / Cash	Rank	Food / Cash
1. "Local"[7] maize	F	1. "Local" maize	F	1. "Local" maize	F
2. Tobacco	C	2. Beans	**F** / C	2. Beans	**F** / C
3. Hybrid maize	F / C	3. Rice (Mpunga)	**F** / C	3. Horticultural crops[8]	F / **C**
4. Groundnuts	F / C	3. Sorghum (Mikuju)	**F** / C	4. Hybrid maize (Kadzakalowa)	F / C
5. Soya beans	F / **C**	5. Sweet potatoes	**F** / C	5. Irish potatoes (Kalilombe)	F / C
6. Beans	**F** / C	6. Cassava	**F** / C	6. Finger millet	F
7. Cowpeas	**F** / C	7. Cotton (Mikuju)	C	7. Soya beans	F / **C**
8. Sweet potatoes	**F** / C	8. Tobacco (Mpunga)	C		

Note: Where crops are used for both cash and food (F / C) bold type face signifies the main function of the crop. Thus (**F** / C) means that the main function is food. Where there is no bolding the food and cash functions are roughly equal in importance. Names in ( ) refer to specific villages.

24. These results are very much in line with what is already known about the differing importance of various crops in the three agro-ecological zones. In addition, the results illustrate the universal importance of "local" - i.e. non-hybrid - maize as the main staple food. Whilst hybrid maize is also consumed, it is not seen as being of such central importance to food security as "local". Beans - probably the second most common ingredient in the diet of most rural Malawians - are widely grown. However, they are seen to be much less important in the plateau villages than in the other two zones. This can be explained to some extent by the high profile of tobacco as a cash

[3] These ranks are derived from aggregation of focus group assessments in each village. Through the process of aggregation, some variation between and within villages is lost.

[4] Other crops mentioned included: Vegetables (F / C); Cassava (**F** / C); Irish potatoes (F / C)

[5] Other crops mentioned included: Sesame (F); Cowpeas (**F** / C); Vegetables (F / C)

[6] Other crops mentioned included: Finger Millet (F); Wheat (F); Pigeon peas (F) and Sorghum (F).

[7] It is difficult to talk of purely local maize in many areas in Malawi today, much of the "local" maize is the product of crossing with various types of improved varieties, this has affected both yield and storage characteristics. Farmers, however, always refer to this non-hybrid maize as "local"

[8] The most important crops in this category are: tomatoes, onions and cabbage, although rape, okra , chinese cabbage and carrots also figure.

crop: there is less need for farmers in these areas to grow beans as they can buy them using the proceeds from sales of tobacco. Of the six villages visited, the level of commercialisation of agriculture is lowest in the lakeshore villages. Here, the food function of important food security crops is more evident than in the other villages. A final point to note is the importance of horticultural crops in the high plateau villages.

Key Problems and Issues Identified for Food Security Crops

25. After ranking the importance of various crops in terms of their contribution to household food security, the focus of attention was switched to the three or four most important food security crops identified per farmer group: Each group was asked to talk about the key post-maturity problems that they faced for each of these crops. Facilitators encouraged farmers to think systematically about the key problems faced by focusing on difficulties encountered during each post-maturity operation (e.g. drying, transporting, processing etc.). Several issues were raised in relation to each crop. These can be grouped under three headings: pre-storage; storage and post-storage. The following sections give details on the types of problem faced in the villages visited for each of the key food security crops (excluding tobacco).

Cereal Crops

Maize:

26. As well as the ubiquitous "local" varieties, the main hybrid varieties planted by smallholders are MH16, 17 and 18 and NSCM 41. MH12 is also used. Planting takes place at the onset of the rains which normally start between October and December. Harvesting of early maturing hybrid varieties can take place as early as February or March, but in most areas in Central Region, April, May and June harvesting is more common.

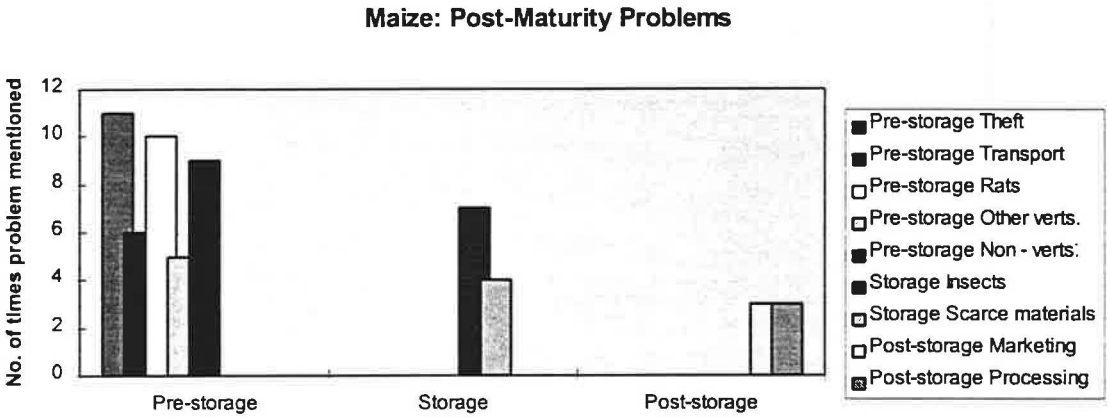
27. Although maize is harvested in a variety of ways, the following sequence of events is typical if not universal. At maturity the crop is normally left to dry in the field, the plants are then cut and stooked, before being transported back to the home, to be stored either in the nkokwe or in bags. Most farmers store their maize in the nkokwe. This structure generally lasts for 2-5 years, although repairs, undertaken around harvest time, are necessary on a yearly basis, as is construction of the roof. After removing from storage, maize destined for consumption by the household is shelled and then processed into *nsima*. Marketed maize is left unshelled until being either transported to the local ADMARC market or is bought by private traders.

28. When undertaking post-harvest operations in a household, someone has to make decisions (*decision making power*) and someone has to do the work (*responsibility*). It is well known that both men and women are involved in decision making and responsibility, and they may be joined by their children and / or other family members when undertaking certain operations. Interestingly, during the fieldwork, perceptions differed quite markedly between women and men as to their

respective share of *responsibilities* and *decision making power*. All the groups of women interviewed felt that they, the women, were *responsible* for most of the operations, whereas the men were more inclined to feel that the division of *responsibilities* was more equal. Similarly, women were inclined to report that they had *decision making power* over certain operations which the men believed were in the control of men! Despite this, there were some commonalties, for example on perceptions of the *responsibilities* and *decision making power* over processing (women) and nkokwe making (men).

29. Maize was cited as a key food security crop by each farmer group in each village. Farmers were asked to express the three most important post-harvest problems that they faced. At the aggregate level (over all villages and all groups) pre-storage problems predominated, followed by storage problems. Figure 3 presents the responses in more detail.

Figure 3: Maize: Most Important Post-Maturity Problems



30. The chart combines responses for hybrid and non-hybrid maize. "Local" maize was mentioned in all villages and hybrid maize was mentioned in three villages by four separate groups. Marketing problems and damage to the crop from weevils in storage was relatively more important for hybrid than for "local", reflecting the poorer storage characteristics and greater likelihood of sale of hybrid varieties. In other respects, the responses for hybrid and non-hybrid were broadly similar.

31. Taking hybrid and non-hybrid together, it can be seen that the three most commonly mentioned problems were all pre-storage: theft, rat damage and non-vertebrate field pests. Weevil damage during storage was the most frequently mentioned storage problem (mentioned by six of the farmer groups)[9]. Post-storage problems were mentioned less frequently than these pre-storage and storage problems. Processing problems i.e. distance to maize mills (mentioned exclusively by women in relation to local maize) and marketing problems (by better off men in relation to

[9] The frequency with which weevil attack was reported and the absence of any mention of rat attack is very much in line with the results of studies carried out in Karonga and Chitipa districts in Northern Region in a 1993 GTZ study (GTZ 1994).

hybrid maize) were ranked as one of the top three problems in three cases each. The key marketing problem was perceived cheating by ADMARC. Farmers complained that they felt that ADMARC officials were tampering with the equipment used to weigh the maize being bought .

32. Focusing on storage, the fieldwork illustrated that there are distinct seasonal patterns not just in utilisation of food but also in perceptions of utilisation and losses. It appears that people's perceptions of losses are also related to the use of the crop. Cultural celebrations such as weddings and festivals take place soon after harvest, a lot of food is consumed and some is wasted, thrown away for dogs and pigs. More generally, from harvest in May up until about August, people consume possibly more than is required (there is a popular belief that people are not satisfied if there are left-overs on the plate after a meal). As the year progresses, more and more people run out of food, theft increases, and pest attack increases on the diminishing stock of stored grains and legumes. Farmers perceptions of loss also change: they become more sensitive to the levels of loss.

33. In addition, it appears that perceptions of loss are also influenced by end use For example, in Chimango village (Lilongwe district), the perception of loss was greater if maize was used for sale than if it was used for consumption, because, even if weeviled, farmers argued that they could still make *nsima*[10] (although it would not taste as good), whereas weight loss would mean lower market prices. In addition, it was noted that if the germ is eaten then the crop will not germinate thus leading to a big loss in terms of seed. However, it can still be eaten. If the endosperm is attacked then the farmers noted that it could still be used as seed and food. On this basis, even though weight loss might be the same, the farmers perceived the germ loss as more important than the endosperm loss. The key point is that perceptions are related to the functional uses of the grain.

Other cereals:

34. Other cereals were of some importance to household food security in the Salima and the mountain villages.

35. In Mijuku village, Salima, rice was regarded as a cash and food crop by all focus groups. Theft came out clearly as the most important problem with respect to this crop. In Mpunga, women regarded sorghum as a food crop, whereas the men tended to see it as both food and cash. Several of the post- harvest problems for sorghum in this village were due to pests either in the field (birds, rodents, livestock) or when the crop was drying on the platform at home (termites, weevils, rodents and poultry). As in other villages, lack of oxcarts for crop transport increased crop losses in the field and scarcity of materials made platform construction difficult.

36. In the high plateau villages, sorghum and finger millet were rated of some importance. Sorghum was rated as third most important food security crop by the

[10] *Nsima* is the name given to the maize patties that are regarded as the staple food in most parts of the country.

women's group in Kalilombe village, Dedza, and finger millet was viewed as being of moderate importance in both Kalilombe and Kadzakalowa village, Ntcheu. Field pests caused the biggest problems for these crops; birds, livestock and poultry attacked the crop whilst it was still in the field. In addition, losses arose from shattering during winnowing.

Legumes:

37. Legumes of one sort or another are regarded as being important food security crops in all of the villages visited during the survey (Table 1). In the rift valley and high plateau villages, the key legumes are beans, whereas in the two Lilongwe villages, groundnuts and soya beans assume a fairly high profile, with beans and also cowpeas being mentioned.

38. Beans were found to be used mainly for food, in contrast to soya which was regarded as more of a cash crop, at least as far as men were concerned. Groundnuts generally appeared to fall somewhere in between beans and soya on the food-cash continuum.

39. After being dug up, beans, typically, are dried in the field before being transported back to the household where the drying continues. The crop is then threshed and stored, either in bags, the *nkokwe*[11], or clay pots. The beans may or may not be protected against insect damage, although most of the groups interviewed in the survey indicated that they did protect the stored crop. The threshed crop is removed and winnowed before consumption or sale.

40. Post harvest operations for groundnuts are generally similar to those for beans although there are two key differences. The first is that groundnuts, unlike beans, are commonly stooked (put in heaps in the field) after uprooting which can exacerbate the risk of theft and insect and rat damage. Secondly, the process of removing the unshelled nuts off the plant (stripping) is considerably more arduous than removing beans from their pods, and is regarded as time consuming and tedious by most farmers.

41. Whilst the operations for soya are basically the same as for beans, threshing and winnowing the crop is much more unpleasant due to irritation of eyes, lungs and skin by tiny hairs that fly off the plant.

42. In terms of responsibilities and decision making power, as was the case for maize, there were some clear differences in perceptions between male and female focus groups. Taking all post-maturity operations for all three crops together, women felt that they had at least as much decision making power as men. In contrast, whilst they accepted that there were several operations where there was joint decision

[11] *Nkokwe* is the name given to the rounded structure, commonly constructed from either bamboo stalks and/or grasses and strengthened by branches, which is used for storing cereals and legumes. Typically about 2 metres tall and betwen 1 and 2 metres across, *nkokwes* rest on logs and are situated close to the house.

making power, men felt that in general they had a higher level of decision making power than women. This was especially true for groundnuts and soya, but less true for beans. This may be because beans are more universally regarded first and foremost as a food crop.

43. Notwithstanding these general differences in perception between men and women, all groups accepted that men were responsible for and took decisions over store construction and women were responsible for and took decisions over processing. In addition, women agreed with men that they (the men) were more likely to make the decisions over marketing of crops.

44. Taking an overall view encompassing all three legumes, pre-storage problems accounted for 49 of the 70 responses; storage problems accounted for 11, and post-storage problems (marketing) accounted for 10. Table 3 gives more details.

Table 3: Post-maturity problems in legumes (Number of times particular types of problem were ranked as important by focus groups)

	Pre-Storage.							Storage.				Post-Storage.	
Crop	Theft	Trans port	Rats	Other Verts.	Non-Verts	Rotting in the field	Other	Rats	Theft	Insect damag e	Scarcit y of Mats.	Mkting	Proce ssing
Beans	3	1	1	3	6	4				4		4	
G.nuts	8	2	1	5	3		3	4	2		1	4	
Soya	2			3	1		3					2	
Total	**13**	**3**	**2**	**11**	**10**	**4**	**6**	**4**	**2**	**4**	**1**	**10**	**-**

Scarcity of mats = scarcity of materials for nkokwe construction

45. Problems with beans were at their worst in the field after harvest and before storage. It is here that vertebrate and non-vertebrate field pests do their work, where theft occurs and where rotting and sprouting takes place. All this suggests that the length of time that the crop is left to dry in the field after uprooting should be examined further, and ways of drying at the homestead should be investigated. Insect attack (weevils and termites) in storage was also a problem, mentioned by six farmer groups drawn from three of the survey villages, and ranked as an important problem by four of the groups. In terms of marketing, farmers complain about low prices. This is a function of the timing of sales, which are at their peak immediately after harvest, when cash is needed.

46. For groundnuts, like beans, the majority of problems fell in the pre-storage category. Within this category the main areas of concern were theft (easily the most frequently mentioned problem) and losses from vertebrates (mainly dogs). Within the other categories, rat attack in storage was also mentioned by some of the focus groups, as was low prices and cheating at ADMARC at the time of marketing. The low prices are caused by high sales after harvest.

47. Farmers complained of lower than expected prices for soya at ADMARC markets, arguing that they had been led to believe that soya prices would be higher in 1996 than they were in 1995. The expectation of higher prices induced a response which increased supply, whilst demand for the crop actually contracted. The government is trying to encourage the growing of soya for family consumption. However, as most men tend to view it as a cash crop, the sharp reduction in prices may result in a switch away from the crop in the next growing season. As with groundnuts and beans, problems occurred in the field due to theft and livestock damage. In addition, several farmers complained of coughing and itching during threshing of the crop.

Root crops:

48. Of the three root crops covered in the study, sweet potato is the most widely grown, mentioned in all villages by all but three focus groups. It was ranked as an important food security crop only in Salima, however, where it was used for both cash and food. Cassava is also widely grown. Like sweet potato, however, it was regarded as important only in Salima where it was used as both a cash and a food crop.

49. Being a temperate crop, Irish potatoes were grown widely only in the mountain zone villages. In Kalilombe village the crop was ranked as important to household food security for all groups, in contrast to Kadzakalowa where it was of minor importance. Only the better-off in Kalilombe regarded Irish potatoes as a cash crop, whereas other groups in the mountain villages grew the crop for cash and food or for food only.

50. After lifting, cassava is typically transported back to the home. Processing or marketing begins almost immediately owing to the rapid deterioration of the crop after it has been removed from the ground. In the Salima villages, processing involves peeling and drying before bagging in sacks and is carried out by women. Men are responsible for marketing, whilst the arduous process of digging up and transporting the crop is done by the whole family. Women have decision making power over processing whilst men make the marketing decisions.

51. In contrast to cassava, sweet and Irish potatoes can be stored. After harvesting, sweet potatoes are typically stored in a pit *(nkhuti),* and may be protected with ashes. In the Dedza village, storage of Irish potatoes was effected through the use of a raised platform *(thandala).* The gender division of decision making power and responsibility appeared similar to that for cassava.

Table 4: Post-maturity problems in root crops (Number of times particular types of problem were ranked as important by focus groups).

Crop	Pre-storage						Storage		Post-storage	
	Theft	Transport	Rats	Other verts.	Non-verts.	Rotting in field	Scarcity of materials	Weevils	Processing problems	Mkting problems
Cassava (a)	3	2	1	3	1	1		1	2	
S. pots (b)									2	3
I. pots (c)		2			2					3

Key: (a) Responses from Mijuku village, Salima; (b) Responses from Mpunga village, Salima
(c) Responses from Kalilombe village, Dedza

52. Pre-storage problems predominated for cassava in the Salima villages. As with other crops, a key factor appeared to be the length of time that crops were left in the field after maturity. Theft, livestock attack and rotting were all mentioned as issues in the pre-storage period, as was the cost of ox carts to transport harvested crops to the home. Transport difficulties were a factor behind the length of time that crops remained in the field, and were often caused by theft of work oxen needed to pull oxcarts owned by farmers. At the storage stage, weevil attack was highlighted as a problem in one of the villages, and at the post-storage stage, livestock damage during processing was mentioned in both villages as an issue of some concern.

53. Sweet potatoes were mentioned by women in one of the Salima villages, for them the major problems occurred during processing, when shortages of water and firewood made cooking difficult, and marketing because of lack of transport (ox carts) and money to pay market fees.

54. In relation to Irish potatoes in the Dedza village, marketing problems were the main concern. The basic issue here was low prices, caused by timing of sales and high levels of competition from Mozambican farmers just over the border. During pre-harvest operations, insect damage to crops in the field, damage caused by climate, and transport difficulties were mentioned, and in relation to storage the main difficulty was availability of materials for construction of the storage structure (*thandala*).

Horticultural Crops:

55. The key horticultural crops grown in the central region are tomatoes, cabbages and onions, with rape, Chinese cabbage, mustard and okra also widely grown. The crops are normally grown on *dambos* (seasonally waterlogged hydromorphic soils). In all the villages visited during the pilot, farmers grew some or all of these crops, although the importance of the crops in terms of household food security varied widely. It was in the mountain zone villages that horticultural crops assumed most importance. Tomatoes in particular were ranked highly (3rd or 4th) in Kalilombe (Dedza), whilst in Kadzakalowa (Ntcheu), onions and/or cabbages and/or tomatoes together were ranked as either third or fourth most important food security crops.

56. After lifting and transporting back to the home, onions may be dried and stored or they may be marketed immediately. In contrast, cabbages cannot be stored

easily and must be marketed. Tomatoes can be dried and stored for home consumption, but since they are grown predominantly (although not exclusively) as a cash crop in the villages surveyed, most of the crop is marketed as soon as it has been harvested. It appears that men take all the important decisions with respect to post-harvest operations for these crops (and even the women's groups agree on this!), probably because in these villages they are very important cash crops. It is not altogether surprising that most of the problems raised by farmers are related to marketing. Table 5 illustrates this.

Table 5: Post-maturity problems in horticultural crops in mountain villages (Number of times particular types of problem were mentioned by focus groups).

Non-marketing related problems		Marketing related problems				
Transport from field to home	Rotting in storage (onions)	Rotting	Losses through pest attack	Lack of market outlets	Transport bottlenecks	Low prices
3	1	3	4	3	2	3

57. Key marketing related issues included: low prices (due to seasonal supply gluts which have been exacerbated over the last few years by Mozambican produce coming onto local markets); lack of physical marketing outlets; transport bottlenecks in getting produce to markets; rotting at market and whilst waiting for transport to market and; pest damage to produce (rats, insects, maggots and birds).

58. In addition to these marketing problems, considerable losses occurred due to overripening at harvest time. This was caused or exacerbated by bottlenecks in transporting crops from the field. This was a particular problem in Kadzakalowa, where the hilly terrain made use of ox carts difficult. Some farmers attempted to get around this problem by selling crops at the field.

59. As noted earlier, onions are sometimes stored. Farmers attempt to cure the bulbs, characteristically by tying the tops of bulbs in bunches and hanging them on a horizontal pole. However, rotting can be a problem and this was certainly the case in Kadzakalowa, where farmers requested assistance on how they could preserve their onions better.

Chapter 4
CONCLUSIONS AND RECOMMENDATIONS

Summary of post-maturity constraints

60. The following table summarises farmers views as to the key post-maturity constraints for each crop.

Table 6: Post-maturity constraints for important food security crops: Farmers views.

Crop Type	Crop	Areas[12]	Pre-storage	Storage	Post - storage
CEREALS					
	Non-hybrid maize	All	Theft; rats; insect field pests; transport	Weevil attack during storage; shortage of construction materials.	Distance to maize mills
	Hybrid maize	All	As above	As above	"cheating" at ADMARC; low prices
	Rice	Rift	Theft		
	Sorghum	Rift, Mountain	Field pests; (insects, rodents, livestock)	Scarcity of construction materials	
	F. Millet	Mountain	As above; shattering		Shattering during winnowing
LEGUMES					
	Beans	Rift, Mountain	Theft; insect field pests	Insect attack	Low prices
	G.nuts	Rift, Plateau	Theft; insect field pests	Rats	Low prices, "cheating" at ADMARC
	Soya	Plateau	Theft; livestock damage		Low prices
ROOT CROPS					
	Cassava	Rift	Theft, livestock attack, rotting, transport	Weevil attack	Livestock damage during processing
	S.potatoes	Rift			Processing difficulties (water and firewood); transport to market and market fees.
	I.potatoes	Mountain	Transport, insect damage	Shortage of construction materials	Low prices
HORT. CROPS					
	Tomatoes	Mountain	Transport		Low prices, crop deterioration, transport
	Cabbage	Mountain	Transport		As above
	Onions	Mountain	Transport	Rotting	As above

Priority Areas For Research

61. The fieldwork has highlighted the fact that farmers face problems at several stages from the time at which crops are mature. These problems can be viewed as post-maturity constraints to smallholder commodity systems (see Figure 1) and the following paragraphs give some pointers as to how particular problems might be tackled.

[12] This column denotes where the crop is an important food security crop. It may be grown in villages in other zones, but is not regarded as important for household food security by farmers in those villages.

Pre-Storage Areas:

A. Early Harvest, Drying and Transport of Cereals and Legumes.

62. The field work strongly suggests that many of the critical post-harvest problems for cereals and legumes occur during the period after maturity when crops are drying in the field. Thorough drying is essential if crops are to store well, yet the practice of leaving the crops in the field substantially increases the chances of theft and losses due to vertebrate and non-vertebrate attack. It appears therefore that there is a need for research to look into low or no-cost technologies which can dry crops effectively but minimise the chances of theft and pest attack.

63. From the point of view of security and management, the optimal solution is probably to dry crops at the home. However, the field work revealed that transport can be a critical constraint. Moreover, lack of physical space at home may be another constraint which restricts the potential for effective drying. Rapid moisture reduction can be achieved by removal of husks/pods and drying on ventilated platforms or in well ventilated stores, but this will invite further pest attack unless protectants are used. Moreover, the introduction of new structures may be constrained by shortages of locally available construction materials unless alternative and sustainable sources of material can be found.

64. One possible way forward would be to look into the introduction of drying cribs, which have low requirements in terms of construction materials and which might work alongside the traditional *nkokwe*. It may be feasible to consider one store type for short term storage, mainly for drying, and another for longer periods. Improved cribs have been developed, introduced and extended, with varying degrees of success, in Nigeria, Kenya, Benin, Cameroon, Ghana, Tanzania, Uganda and Zambia (Tyler and Harding, 1994). Another approach would be to experiment with the drying properties of smaller nkokwes, encouraging farmers to construct say two small nkokwes as opposed to one large one, as smaller structures should effect faster drying.

65. In either case, assuming that technically effective structures can be developed, their impact on reducing losses will be influenced, possibly quite heavily, by the alleviation of transport bottlenecks from the field to the household. Moreover, even if theft and pest damage are low during the drying period, difficulties in transporting crops from the field to the household means that crops may be left longer than they need to be - thus resulting in damage and theft to the well dried crop. In addition to drying technologies therefore, there is an argument for research into appropriate transport technologies.

66. It is recommended that the relationship between improved transport and the storage impact of improved drying structures be studied and, depending on the outcome of this study:

(a) Plans for trials with improved methods for crop drying be drawn up with a view to implementation in selected villages in the three main agro-ecological zones in the central region *and*

(b) **Proposals for improving transport links be developed and put forward to relevant donor agencies, NGOs and Government ministries.**

Storage Areas:

B. Reduced Construction Material Requirements for Storage Structures

67. Following on from para. 63 above, scarcity of materials for construction of *nkokwes* came up as a problem in the fieldwork in several of the villages, both during the formal ranking exercises and during more informal discussions. Some attention to the problem of scarce construction materials could pay dividends in relation to encouraging uptake of improved storage structures, and such attention is in any case likely to become increasingly pertinent for construction of the traditional n*kokwe* in the context of the high rates of deforestation in Malawi.

68. It is recommended that the possibilities of using reduced levels of traditional materials and /or new materials - such as mud - in construction of *nkokwes* be thoroughly researched. Such work might usefully draw on and modify the results of NRI research on storage structures in Zimbabwe and Northern Ghana.

69. The actual levels of storage losses were not quantified in the study, and as noted in the introduction, estimates of actual levels of loss can vary considerably (vis. GTZ 1994 versus CODA 1996). Notwithstanding this, the results of the survey indicate that insect and / or rodent damage are regarded by farmers as an issue for certain crops. Moreover, in the context of (i) grain liberalisation, which increases the likelihood of longer on-farm storage, and (ii) confirmation of the arrival of the Larger Grain Borer in Malawi, an argument for further research into storage improvements is strengthened. GTZ is presently working on biological control methods for the LGB, and this might be complemented by research into other forms of low-cost pest control, including plant insecticides and inert dusts, which NRI and MOALD are already undertaking at Chitedze Research Station. In addition, there may be spin-offs from current NRI work in Northern Ghana which is looking to produce low-cost storage protection technologies.

70. It is therefore recommended that preparatory work be carried out on the possibility of introducing research results for Chitedze and Northern Ghana into farmers' stores in Malawi.

C. Farmers Perceptions of Maize Losses and Rapid Post-Harvest Appraisal Techniques.

71. The fieldwork highlighted the fact that farmers' perceptions of maize losses may not correspond with scientific estimates (see paras. 32-33 above for farmers perceptions). The existing literature illustrates the fact that consensus on losses is elusive and also that existing methodologies for estimating losses can be time consuming, costly and reliant on a certain degree of technical competence which may not always be forthcoming. Taken together, these two issues have important implications for the relevance and likely adoption rate of interventions.

72. **It is therefore recommended that:**

(a) **The nature of farmers perceptions of grain losses - and in particular how these vary with the end uses of the grain - be studied in greater depth.**

and

(b) **The rapid loss assessment methodology for maize and pulses which has been developed in West Africa also be introduced in Malawi.**

D. Storage of Onions

73. Unlike varieties of tomatoes and cabbages, onion varieties can be stored. It is clear that farmers growing onions would benefit from better storage technologies.

74. **It is thus recommended that trials with improved storage technologies which are currently being implemented in Northern Ghana by NRI be replicated in Malawi.**

E. Inventory Credit

75. Experience in other sub-Saharan countries with inventory credit has been mixed (Coulter, 1994). It may however, represent a way forward for those farmers who are forced to sell a large proportion of their crop soon after harvest to honour debts built up over the course of the season and/or to meet pressing problems such as school or hospital fees and non-food expenditures. Inventory credit, by allowing farmers to retain a greater proportion of their crop in the immediate post-harvest period, can boost incomes by allowing sales to proceed later on in the season when prices are higher. Experience has implied that there are certain factors which can have a great bearing on the likely success of inventory credit. However, no detailed research has been carried out in the Malawian context to test for the suitability of this system for smallholders.

76. **It is therefore recommended that the possibility of introducing schemes similar to those already in operation in other sub-Saharan African countries be explored.**

Post-storage Areas:

F. New Varieties of Tomatoes, Onions, Cabbages.

77. Two of the key problems faced by vegetable farmers are that all the crops mature at the same time thus there are seasonal gluts in supply: and tomatoes and cabbages in particular stay fresh for limited periods only. Thus there is a case for introducing new varieties that mature earlier/can be harvested earlier/ have better storage characteristics.

78. It is recommended that steps be taken to introduce such varieties on a small scale in high plateau areas in the Central region. Before introduction takes place, a full literature review of vegetable farming systems, followed (probably) by a socio-economic study will need to be effected.

G. Putting Recommendations into Practice

79. Researchable areas A to F above can be tackled in various ways, however, the key to their success will be relevance to the actual situations faced by resource poor smallholders. It is for this reason that a focused and integrated programme of adaptive research *in situ* at the village level is the preferred implementation model.

80. It is therefore recommended that research into areas A to F above be conducted in a small number of pilot villages, backed up by on-station work at Chitedze as appropriate. The research should take a systems approach to post-maturity constraints, drawing on the conceptual framework used for this initial RRA. This village focused programme would build on the results of the current study to: deepen understanding of identified constraints; identify any additional constraints; introduce appropriate techniques to overcome the constraints; initiate trials to assess efficacy of the solutions; assess the socio-economic viability of improved technologies; encourage the uptake of these technologies using resources of the government extension services and NGOs; and monitor and evaluate uptake and efficacy.

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Appendix

FIELDWORK METHODS:

IDENTIFICATION OF CROP POST-MATURITY RESEARCH ACTIVITIES IN MALAWI: CENTRAL REGION PILOT STUDY.

I. STUDY DESIGN AND METHODOLOGY

INTRODUCTION:

The pilot study is a needs assessment exercise. Designed to identify researchable constraints within the post harvest system, and also to elicit farmers views as to how best these constraints can be addressed. The post harvest system encompasses all those activities that take place once the crop has reached maturity up until the time that it is consumed, either by the farmer who has grown it or by non-farm consumers.

Six villages will be visited during the pilot study. Two villages are situated on the Lilongwe - Kasungu plain, two in the highlands around Dedza and Ntcheu, and two along the lakeshore near Salima. This selection ensures representation of the three major agro-ecological zones in the central region.

The study consists of five basic components, which will be facilitated by study team members:

1.	Village introduction: BREAK INTO GROUPS	(20 minutes)
2.	Crop listing and ranking	(30 minutes)
3.	Post harvest crop operations (including gender divisions)	(1 hour)
4.	Post-harvest constraints	(5 - 6 hours)
5	Evolution of storage systems	(1 - 1.5 hours)

Aside from component 1, each component will be carried out using sub-groups. Components 2 to 4 will be carried out with three focus groups. Component 5 will be carried out with an old peoples group.

In order to accomplish all the required tasks under each component, it will be necessary to split into sub-groups. Each sub-group will consist of two team members.

COMPONENT 1: VILLAGE INTRODUCTION

Time:	20 minutes
Participants:	Whole village
Pilot Team Structure:	Whole team together
Objective:	To introduce the team and the objectives of the exercise
Tools:	None

Methodology:

- Presentation by team spokesman, answer initial questions from the villagers.

CHECKLIST:

- ◊ *Who we are*
- ◊ *What we are here to do*
- ◊ *We are not promising any handouts*
- ◊ *If we understand their village, then we can be in a position to help them in the future, if money becomes available*
- ◊ *we know that they have plenty of knowledge and we want to learn from them*

Particular care to be taken to explain exactly why we are visiting the village. The objective is to learn from the farmers about their farming, and in particular about their post harvest problems and their suggested solutions to these problems. They will be teaching us, therefore we are the students and they are the teachers.

GROUP FORMATION:

After completing the introduction, four groups are formed. Each group should consist of 8 to 10 people.

The groups will comprise the following:

group (a) will consist of poor men;
group (b) will consist of non-poor men;
group (c) will consist of women;
group (d) will consist of old people.

The definitions of poor and non-poor will need to be discussed on a cases by case basis with local agriculture staff. Notwithstanding this, it is envisaged that *time when stocks of staple food run-out* will be the starting point for group formation. To facilitate discussions in each group, the pilot study team will split into pairs, each pair taking groups (a), (b) and (c). The team leaders will use an interpreter to tackle group (d).

COMPONENT 2: CROP LISTING AND RANKING

Time:	30 minutes
Participants:	Groups (a), (b), and (c).
Pilot Team Structure:	Sub-groups working in pairs.
Objectives:	To obtain a full list of crops grown, whether these are mainly food, mainly cash, cash and food. To determine the five most important crops in terms of household food security.
Tools:	SSI, Ranking

Methodology:

- Ask what crops are grown by the group
- For each crop, ask whether it is grown mainly for cash, mainly for food or is it grown both for cash and food fairly equally.

Ask group to rank each of the crops in terms of their contribution to household food security. Which is the most important crop, second most important etc. Use a matrix drawn on the ground:

CROP	RANK
Local Maize	1
NDDF Tobacco	3
Beans	2
Sweet Potatoes	5
Cow peas	6
Groundnuts	4

CHECKLIST:

- ◊ *What crops **and what varieties** do you grow?*
- ◊ *Are they food crops, cash crops or both food and cash*
- ◊ *If they are both food and cash, are they mainly food or mainly cash*
- ◊ *Are there any other uses for each of the crops, apart from food or cash (e.g. beer, fodder etc.)*
- ◊ *Of all the crops, which is the most important for household food security?*
- ◊ *Which is second most important?*
- ◊ *Which is third most important? etc.*

COMPONENT 3: POST HARVEST OPERATIONS

Time:	60 minutes
Informants:	As for component 2
Pilot Team Structure:	As for component 2
Objective:	To obtain a the sequence of post harvest operations for the most important food security crops. To determine the responsibilities of men, women and children in each of the operations for these crops.
Tools:	SSI

Methodology:

- On the basis of the rankings done in component 2, select the five most important crops in terms of food security **(excluding tobacco).**
- Ask the group to list every operation undertaken from the time that a crop is mature until the time the crop is sold (including taking the crop to market) or consumed. Go crop by crop, starting with the most important food security crop, then the second most important etc. After each operation, ask the group about responsibilities for undertaking the operation, i.e. who is responsible for carrying out the operation: men or women or both?. Are children involved? If both men and women are involved, who does most of the work, is it the man or the woman? Are men/women hired in for the task, or is it just family labour?
- On the basis of the answers to these questions, select the operations which are carried out by the group (remember that the group will be either men or women).

For this question, there is no need to draw a matrix on the ground. Instead, recorders should tabulate responses in their notebooks:

Example

1. Most important food security crop: LOCAL MAIZE:

OPERATION	RESPONSIBILITY
Drying whilst still planted	Children (to scare off monkeys etc.)
Stooking	Men
Transporting to home	Women and men
Drying	Women
Threshing/shelling	Women
Winnowing	Women
Bagging	Women
Putting in nkokwe	Men and women
Pest control	Men
Removing from nkokwe	Women
Processing	Women
Marketing	Men usually

COMPONENT 4:POST HARVEST CONSTRAINTS

Time:	5 - 6 hours
Informants:	As for component 2
Pilot Team Structure:	As for component 2.
Objective:	To obtain a logically consistent ranking of post harvest problems faced by farmers. To obtain farmers views on solutions to the key problems identified by them.
Tools:	SSI, Preference ranking, direct matrix ranking, pairwise ranking.

Methodology:

- **Direct Matrix Ranking:** Go back to the most important crop. Go though the gender relevant operations for that crop one by one. For each operation, ask the group whether they face any problems in the course of carrying out the operation. After they have listed all the problems that they face for that particular operation, ask them to rank the problems. After they have ranked, go on to the next operation and repeat i.e. ask them to first mention and then rank the problems. Go through each operation in this manner, finishing with the final operation i.e. consumption or sale. It is possible that for some operations the group may not mention a problem. In this case, after giving them ample opportunity to consider the issue, move on to the next operation

Example: Let us observe the following conversation between the PRA facilitator and the group:

Facilitator: *.....Chabwino, you have told me that the most important food security crop is local maize, and that the first operation undertaken after the crop has reached maturity is drying before Stooking. Are there any problems with this?*

Group: *Yes, one problem is theft by humans, another is theft by monkeys and a third is insect attack.*

Facilitator: *Which problem is the most important?*

Group: *OK, that one is easy: theft by monkeys. Those monkeys, I tell you....eee, they are a big problem!*

Facilitator: *Which is second most important?*

Group: *Well, on balance, theft by humans is next*

Facilitator: *Aha! very interesting, thank you very much. So if theft by monkeys is most important and theft by humans is second most important, then damage by insect is third, not so?*

Group: *Well, yes you are right, insect damage is a problem, but the other two are more important for local.*

Facilitator: *And out of monkeys and humans, monkeys are more of a problem to you?*

Group: *Yes.* **Facilitator:** *Zikomo!.*

The discussion can be facilitated by drawing a matrix on the ground:

Example

1. LOCAL MAIZE (Poor men's group)

Operation	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5
Drying	Monkeys (1)	Human theft (2)	Insects (3)		
Stooking	Monkeys (2)	Human theft (1)	Insects (3)		
Transporting	Distance from home (1)	Losses (3)	Cost (ox cart) (1)		
Putting in nkokwe					
Crop Protection	Insect damage (1)	Rodent damage (2)	Mould (4)	Theft (3)	Rain damage (5)
Marketing	Transport to market (2)	Low prices (1)			

- **Preference Ranking:** After problems occurring in the various operations have been mentioned and ranked (numbers 1-5 in example above) by the group, remind the group of all the problems that they have ranked as number one for this crop. After reminding them, ask them to pick out the most important problem of all the number ones. Then ask them to pick out the second most important, the third most important etc., until all the number ones have themselves been ranked (letters a-e in the example below).

- Go back to the most important number one. Ask them why it is most important, and ask them if they can think of any solutions, partial or total. Go on to the next most important number one, and ask again about solutions. Do this for all the number ones.

- Move on to all the problems that they have ranked number two, ask them to pick out the most important of all the number twos. Finally, move on to the number threes, ask them to rank all the number threes

  Example

  This exercise is carried out using the matrix that has already been constructed.

Operation	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5
Drying	Monkeys (1) [c]	Human theft (2) [d]	Insects (3) [c]		
Stooking	Monkeys (2) [c]	Human theft (1) [d]	Insects (3) [a]		
Transporting	Distance from home (1) [e]	Losses (3) [d]	Cost (ox cart) (1) [e]		
Putting in nkokwe					
Crop Protection	Insect damage (1) [a]	Rodent damage (2) [a]	Mould (4)	Theft (3) [b]	Rain damage (5)
Marketing	Transport to market (2) [b]	Low prices (1) [b]			

Number ones: In this case the most important number one is insect damage in storage (underlined in above example), followed by low prices for the marketed crop (underlined), and then monkey theft of the crop whilst it is being dried, followed by human theft whilst Stooking, and finally the distance covered to transport the crop from the farm to the home and the cost of ox cart transport for taking the crop to the home (these last two are ranked equally)

Number twos: Here, rodent damage in storage is most important, followed by transport to market, followed by monkey damage whilst Stooking, and finally human damage whilst drying before Stooking.

Number threes: Finally, the most important number three is insect damage to the crop whilst Stooking, followed by theft from the nkokwe, followed by insect damage during drying in the field and finally losses during transport from field to home.

- **Pairwise Ranking:** After they have done this, ask the to compare this most important number two with the list of number ones. Where does this most important number two fit in? This can be done using pairwise ranking . Again, ask them to think of solutions to this most important number two. After they have attempted this, ask them to compare this most important number three with the list of number ones. Where does this most important number three fit in? As for the most important number two, ask them to think of possible solutions. NOTE: It is probably best to do this step orally, i.e. not to attempt to complicate an already cluttered matrix still further.

- After all the rankings have been completed for the most important crop, move on to the second most important crop and repeat the procedures. After the second most important crop has been covered, move on to the third most important crop and so on. If time permits, cover all five crops.

COMPONENT 5: EVOLUTION OF STORAGE SYSTEMS

Time:	1.5 -2.0 hours
Informants:	A group of old people, me and women
Pilot Team Structure:	Peter and Neil, working with the DO
Objective:	To find out how storage structures have changed over the years in response to certain parameters e.g. changes
in	cropping patterns, availability of materials. To obtain farmers views on structures used at present: materials, durability, advantages and disadvantages.
Tools:	SSI

Methodology:

- Focus group discussion, using the DO as translator.