Traditional seed-saving practices in Northern Ghana and Central Malawi

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TRADITIONAL SEED-SAVING PRACTICES IN NORTHERN GHANA AND CENTRAL MALAWI

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GLOSSARY OF ACRONYMS AND TERMS USED

GHANA

Chenchangku - a circular mat structure, usually made from elephant grass, roofed with thatch and raised on a short rectangular platform

GGDP - Ghana Grains Development Project

Kambonn - similar to the *chenchangku* though usually made from sorghum stalks

Kuntchun - a lidded basket, covered in mud or cow dung, raised on a platform and covered with a conical thatch roof

LGB - Larger Grain Borer (*Prostephanus truncatus*)

MoA - Ministry of Agriculture

pito - local sorghum beer

WPP - woven polypropylene

MALAWI

ADD - Agricultural Development Division

ADMARC - Agricultural Development and Marketing Corporation

chibuku - millet beer

dimba - areas of low-lying land used for off-season cultivation, typified by vegetable gardens planted next to water courses.

nkhokwe - traditional woven basket store

NSCM - National Seed, Cotton and Milling Ltd. (previously the National Seed Company of Malawi)

MoA - Ministry of Agriculture

nsima - a stiff porridge made from mixing maize flour in boiling water

RDP - Rural Development Project

SACA - Smallholder Credit Agricultural Administration

SSMS - Smallholder Seed Multiplication Scheme

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INTRODUCTION

1. It has been estimated that, for all food crops grown in developing countries, some 80% are planted using home-saved seed (Delouche, 1982). Despite this predominant use of retained seed very few studies have examined the techniques used by small-scale farmers in storing this seed to maintain acceptable viability. This contrasts considerably with the extensive literature available concerning high yielding or modern varieties. A recent review (Wright *et al*, 1994) highlighted this dearth of knowledge and recommended that field studies of traditional systems be undertaken to redress the balance.

2. This report details the results from short surveys undertaken in two markedly different agro-ecological areas of Africa; the first from northern Ghana, the second from central Malawi. Both sites have the advantage of being ethnically homogeneous, allowing a single vernacular language (and therefore translator) to be used.

3. The Northern Region of Ghana was selected as representative of a semi-arid area. It also produces a wide range of crops and, although there is no great land pressure at present, there are temporal and labour pressures associated with the rainfall pattern that allows two crops per year to be grown.

4. In contrast, the central region of Malawi has a high dependence on a maize-based cropping system with quite strong land pressure, exacerbated by the unimodal rainfall pattern that generally allows only one crop per year to be grown.

5. In each country the objectives of the study were to:

a) provide a better understanding of small-scale seed

retention practices using rapid rural appraisal techniques; and

b) identify the need for any further studies.

6. It should be stressed that, in reality, 'local' varieties are usually a mix of the original landraces combined with genes from degraded introduced varieties such that true local varieties no longer exist. In this report 'local' is used to denote varieties that farmers store and save under traditional conditions and which are not one of the newer 'improved' varieties. It fell within the scope of the work to examine why adoption of the improved varieties has, generally, been so poor.

7. In the notes given for each of the crops, it must be stressed that these are details as reported by the farmers and therefore may reflect their perceptions rather than the reality (e.g. in their assessment or ranking of the principal loss causing factors).

NORTHERN GHANA

Methodology

8. The work was undertaken from 17-30 October 1993 and a rapid appraisal technique employed. Approximately one week was spent with key personnel - officials from the Ministry of Agriculture, National Seed Service, Seed Inspection Service, plant breeders, socio-economists, seed growers and distributors, to put current findings into context (Annex 1 details persons met). The second half of the programme included informal group interviews in 13 villages (Annex 2) during which farmers were asked about their seed storage practices, criteria used in selection of seeds and varieties and the success of the methods employed (Annex 3 gives a list of the topics covered). Typically, farmer groups were dominated numerically by men. To redress the balance, efforts were made to actively encourage women's participation in the discussions and in one case, through use of female extension staff, an entirely female group was addressed.

9. The villages were chosen at random with the proviso that they should be representative of the different agro-ecological zones and would allow discussions about as wide a range of crops as possible. During the course of the village interviews, the authors were always accompanied by a member of the Ministry of Agriculture staff who acted as both facilitator and translator.

Description of the survey area

10. The Northern Region of Ghana represents almost 30% of the land area of the country whilst supporting only 9% of its inhabitants (1.4 million persons). The region is therefore sparsely populated with only 20 persons per km^2. Although there is little pressure on land at present the

majority of farmers work small plots, with 68% of them cultivating less than 2 ha. (MoA, 1993a). Land passes from a father to his sons and, as a result, plots are becoming more intensively used as they support an ever increasing population.

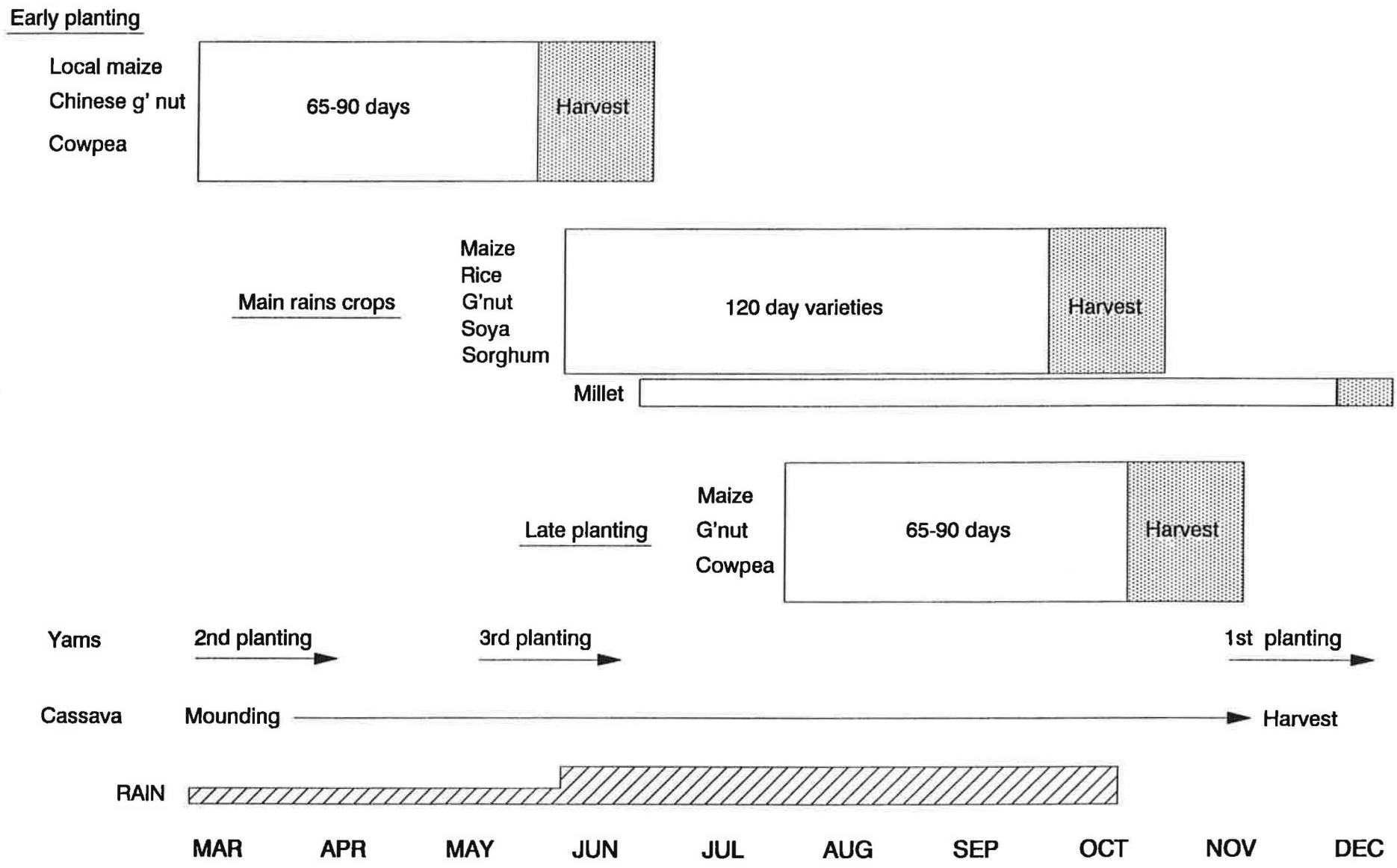
11. The region is divided administratively into 13 districts with Tamale as the Regional centre. The survey was conducted mainly within a 80 km. radius of Tamale. This made the work logistically simpler whilst allowing a range of agro-ecological zones and crops to be investigated. It also coincided with a traditional area peopled largely by members of the Dagomba ethnic group.

12. The region is typified by rains that may begin in March but with the bulk falling between June and October. This allows the production of several crops per year from the same plot of land (Figure 1).

13. A wide range of crops are grown in Northern Region, many of which are significant on the national scale. The region accounts for 55% of rice, 52% of millet, 50% of sorghum, 19% of maize and 17% of yam produced in Ghana (Quansah and Ofusu, 1992). Farmers also grow significant quantities of groundnuts, cowpeas, pigeon peas and garden vegetables. In a survey carried out in the Dagomba area, heads of households ranked maize, sorghum, yam and cassava as their four most important crops (Abu, 1992). The typical cropping system, except for groundnuts and cotton, is intercropping (Baur *et al*, 1989).

14. An important farming technique employed throughout much of the survey area is that of compound farming. This involves an area of permanent cultivation around the homestead which, typically, has higher fertility than the more distant bush farms because it is here that wastes from the household are thrown, acting both as fertiliser and

Figure 1. Cropping calendar for Northern Region, Ghana



compost. The crops, and indeed the crop varieties, associated with the compound farm and the bush farm differ and serve different functions in providing for the family. This is an important point with regard to farmer varietal selection and will be further discussed in the sections on individual crops.

15. Responsibilities within a household dictate to some extent choice of crop grown and the care given to it. For example, in the survey area the head of household has prime responsibility for feeding the entire family and therefore concentrates on staple food crops. The women, whilst involved with all aspects of farming, particularly planting and harvesting, have principal responsibility for vegetable crops (the so-called soup ingredients). Dependent adults, typically young men, devote more time to the production of cash crops, such as groundnuts, rice and cowpeas, once their daily commitment on the head of household's land is completed.

Traditional seed-saving techniques

Maize

16. Maize seed is selected at harvest time with cobs being chosen for large size and good colour. Seed grain is kept apart from grain destined for food and local and improved varieties are stored separately. Bunches of up to 40 cobs are hung in trees, under eaves or over the kitchen fire and are frequently covered with polythene or a broken gourd to prevent rodent attack. Cobs may also be stored in sacks (farmers storing in woven polypropylene (WPP) sacks left them open to prevent the risk of heating and premature germination). Some farmers placed their cobbed seed maize at the bottom of stores (*kambonn*) and then covered them with the shelled maize destined for consumption. [Other farmers used mud silos for shelled food grain and placed whole

plants of a local herb (Labiatae) in layers as an insect repellent]. The local varieties are reputed to be more susceptible to insect attack than the improved varieties (this includes field as well as store infestation). The level of infestation is dependent, in part, on time of harvest so that both early and late harvesting will result in greater losses than maize harvested at physiological maturity.

17. Cobs hung in trees can be inspected daily, those in sacks every three days or so. Any cobs showing signs of infestation are re-dried in the sun and damaged cobs removed. Sacks are moved to a different place from where the infestation took place. In Kunkunzoli and Kitiek villages where the Larger Grain Borer (LGB) is a newly arrived pest, some of the farmers had their cobbed seed stocks completely destroyed and had to source seed from other farmers or the market. In these areas with high LGB risk it is clear that farmers will have to change their seed storage practices.

18. In years of poor rain, seed losses are greater because the maize fails to reach optimal maturity. A similar situation arises with early maturing maize planted at the beginning of the rains and harvested in May. At this time, drying conditions are poor and so most of the grain is kept for food. Some however is often required for planting at the end of the season, in July (Figure 1). The grain destined to be seed is placed over the kitchen fire to enable drying to occur.

19. The men have primary responsibility for the selection, storage and inspection of the seed maize. The women are normally charged with the cleaning of infested material.

20. With the first rains, mounding for cassava planting takes place followed by planting of the local, yellow,

maize. This is followed one month later by planting of the improved, white, maize. At planting, the farmers either shell all the saved cobs and then select out the good grains or they save only those grains from the central third of the cob as planting material. If there is insufficient seed, grains are hand-picked from the remaining food stock. Farmers have no way of assessing viability of the seeds and so they plant 2 seeds per hole. They maintain that germination is generally very good but some losses occur in the field for reasons other than poor viability (e.g. rodents).

21. Seed, of both local and improved varieties, can be retained. Improved seed is only bought once a drop in yield from retained seed is noticed.

Sorghum

22. The crop is brought to the house to be dried. The large panicles are then separated to be saved for seed and hung, on the head, in trees or under the eaves. They may also be stored in *kambonns* or pots/gourds. At planting the heads are threshed and planted with no further selection beyond the rejection of smut and mould damaged heads. Different varieties are kept separate because of their different end-uses. There are few reported storage problems.

23. If the previous year's crop was good, the sorghum is monocropped, if poor it is intercropped with groundnut and maize. Diehl (1985) found that 24/25 farmers interviewed kept sufficient sorghum and millet seed back to re-plant if necessary.

24. Yield is considered the most important trait (ahead of, for example, stalk length, even though the stalks have a wide range of practical uses).

Rice

25. Rice yields are becoming so low in places that insufficient is produced to re-plant the same area (one farmer admitted to re-growing rice on the same plot every year for the past 21 years using seed saved from one year to the next). Despite this, farmers still grow rice, along with maize and sorghum, to spread the risk of crop failure. Seed is frequently exhausted before planting because it has to be used as food.

26. There are two distinct strategies for rice management:

a) Farmers do not separate varieties and harvest when the longest maturing plants are ready. This results in the loss of grains from the earlier maturing varieties.

b) Farmers take great care to separate varieties. Women are often sent to the fields after harvest to glean grains of prized varieties. The long maturing varieties are then planted in water rich areas whilst early maturing types are put on areas with less good water supply. If varieties do become mixed the farmers take the seed to market, sell it as food, and then use the money to buy the particular variety they want.

27. Rice is deemed ripe if the plant looks dried and the panicle is bent. There is no seed selection at harvest. Panicles are placed in stores (*kuntchun*) and threshed as required. There are no germination tests and germination is frequently poor. This is ascribed to poor drying at harvest. Seed is broadcast at planting.

Millet

28. Seed can be stored in large gourds or panicles hung in the eaves. Nyanteng (1972) notes the use of gourds and

earthenware pots, for the storage of millet and sorghum, which are plugged with mud to make them air-tight.

Cowpea

29. Cowpeas are harvested (there are often several pickings, one week apart) and brought home to sun dry for up to 4 days. Moisture content is judged with a bite test. The pods are then threshed and stored. If insufficient is stored, seed is bought from the local markets. Seeds are not actively selected. Seed can be mixed with shea butter oil and left in the sun. Insect attack is prevented because of the oily texture and the heat generated. Other farmers grind neem seeds, apply ash, or use local aromatic herbs to mix with the seeds. Seed can also be stored in earthenware pots, gourds or other convenient containers (e.g. agrochemical bottles). Traditionally, seeds were sewn into children's pillows; the pummelling the pillows got during sleep acted as a way of preventing infestation.

30. At planting time, seeds are hand-picked from the remaining stock. Multiple seeds per hole take account of any post-planting losses.

Groundnuts

31. Groundnut is grown as a cash crop and frequently the entire stock is sold to meet financial commitments. It is a valued crop because it is less dependent on good weather than, for example, rice although it is very labour intensive.

32. Seeds are often bought from the market where quality is judged by size and colour. Seed may also be bought or bartered from other farmers. For those who have sufficient quantities, food and seed are kept stored together and left in the shell. There is no selection of seeds at harvest

(this would be very time consuming and not considered worthwhile by many farmers, bearing in mind that they frequently sell all of their stock anyway).

33. Groundnuts are usually harvested communally. The plants are left to dry in the field for 3-4 days. When the pods are considered sufficiently dry (assessed by shaking or with a bite test) they are taken back to the house. Groundnuts are stored in the shell in sacks, *chenchangku*, *kambonn* or *kuntchun*. Principal causes of loss during storage are rodents and moth larvae. Stock inspection is only carried out when groundnuts are being withdrawn for sale or consumption. Farmers disagreed whether there is a difference in losses suffered by the different varieties. Groundnuts may be stored for 12-15 months.

34. For planting, pods are cracked (communally) a maximum of one week before the planting date, although 1-2 days is more normal. The farmers are well aware of the negative effects on germination of cracking the pods too long before planting. Large grains are taken preferentially for planting. It is planted in a pure stand and different varieties are planted in different fields. Germination is generally good so only one seed per hole is planted.

35. Quick maturing varieties of groundnuts, e.g. Chinese, can be cropped twice within the same year (Figure 1, page 5) The second crop is planted using seed obtained from the first harvest.

Soya

36. Soya is a relatively new crop and is actively promoted by the government. Seeds are distributed by the Ministry of Agriculture, but can also be bought from the market. Seed is sufficiently scarce that it is not given or exchanged freely.

37. The crop dries whilst still in the field. It is harvested communally and then brought to the house where it is left for two days before threshing. After threshing, the grains are dried for one more day before being stored in sacks. The sacks may be stored in the house or inside a traditional store. Grains may be stored for 9 months. The sacks are regularly inspected. If insects are found, the soya is sold or consumed. The most serious storage problem is posed by rodents. It is the men who are responsible for soya storage.

38. The only selection of seed takes place just prior to planting when healthy grains are hand-picked. Soyabean is planted as a sole crop and 2 seeds per hole is the normal practice. Germination is said to be very good, although farmers noted that grains stored in WPP sacks resulted in very poor germination which they attributed to poor air flow. [Of the two principal soya varieties, Salintuya I is described by the breeders as having *good* storability whilst Salintuya II has *very good* storability].

Bambarra groundnuts

39. These are dried whilst still in their pods. They are stored outside the house in jute sacks where they stay until they have been rained on 2-3 times. This is said to improve the subsequent germination as well as loosening the 'pod' from the nut. The nuts are cracked in a mortar to remove the pods and cleaned by winnowing some 1-2 days before planting. Germination problems are rare so only one seed per hole is planted. Germination takes about 10 days.

Vegetables

40. Seeds are stored in gourds. No problems with storage were reported.

Varietal choice and farmer strategies

41. During the course of the farm survey several features of their seed management and crop selection strategies became clear:

a) farmers grow a wide range of crops as well as a wide range of varieties of those crops;

b) this diversity reflects the variety of end-uses to which the crops are put (different dishes, for sale or for storage), the farmers' efforts to minimise the risk of potential crop failure and the need for given varieties to fit into a mixed cropping environment;

c) farmers were very aware of the need for good quality seed and for conditions favourable to the maintenance of seed viability;

d) storage of traditional varieties under traditional systems gave acceptable levels of germination/plant establishment on planting;

e) farmers used criteria other than simple yield potential in deciding whether to adopt new varieties or not; and

f) farmers are not inherently opposed to improved varieties - in some cases local varieties had been abandoned in favour of improved ones. What is important is that improved varieties should be at least as good as existing varieties in terms of valued characteristics as well as having some additional benefits.

Maize

42. Local (yellow) varieties have stable yields and the taste is preferred. These early maturing varieties are planted at the beginning of the first rains - on the compound farm. This provides the first foods after the 'lean season' (April - July). High yield from this crop is less important than an assured harvest. Some of the traditional varieties are prone to corn borer attack but are still grown because of the need to produce an early crop. Some farmers now grow short-season improved varieties e.g. Safita-2 (95 days to maturity) in place of their traditional varieties.

43. Improved (white) varieties are planted during the main-season, particularly if the crop is destined for sale, when high yield is a desirable trait. These longer maturing varieties tend to be planted on the bush farm. All improved maize varieties are composites (some work on hybrid maize has been undertaken but, as yet, none have been released) and so only require replacement every 3-4 years.

44. Short-season maize can also be grown towards the end of the rains. The seed is derived from maize grown at the beginning of the rains or from the market (where much comes from Brong-Ahafo Region where the season begin earlier - farmers say this seed from further south matures more quickly than home-produced seed).

45. Farmers will either grow their first maize crop on the compound farm and their second on the bush farm or vice versa, depending on the urgency of the families food needs.

Sorghum

46. Both red and white varieties are grown. Red has a better market and is used in brewing local beer (*pito*) and

for making porridge. White sorghum is used to make one of the staple dishes, T.Z. (*tuo zaafi*).

47. One farmer grew unnamed traditional varieties of red and white sorghum. The red yielded more, but in years with heavy rain and subsequent waterlogging, the white is more productive.

Rice

48. Almost all rice in Ghana is imported. Rice is grown as a cash crop although many farmers are reducing their rice area due to low yields and unpredictability of the rains.

Cowpea

49. The local varieties are often creeping types (which means they are prone to rots during heavy rains) with low yields and low value, although they are said to be tastier. In addition, because of higher pest resistance, they do not need to be sprayed against field pests and so the leaves can be harvested to make traditional vegetable dishes. Early maturing cowpeas can be double cropped in the same year.

50. There are many varieties each grown for their own particular characteristics. For example:

Black-eye - very good market
Brown-eye - requires very little rain and is therefore useful at the beginning of the rains or at the end of the season.
Vallenga - an improved red variety which is very early maturing (60-65 days). However it is heavily attacked in store.

Groundnut

51. A wide range of varieties are grown to cater for different situations. For example:

> *Manipinter* - requires good soils. Late maturing. Has a good market but is difficult to store because of its high oil content (47%).
> *Bugola* - local variety, high yielding with a ready market. Performs well even on poor soils.
> *Chinese* - early maturing (93 days) and consequently not so high yielding. Can be double cropped in the same year. Has a good market.

52. The local varieties typically have lower oil contents and so are preferred for the preparation of pastes for home consumption.

Soya

53. Introduced to supplement or replace cowpea in the diet, it is being readily adopted because it doesn't require spraying in the fields (unlike the improved cowpeas) and because, being early maturing, it produces a crop even in drought years. Some farmers are replacing rice hectarage with soya because of the formers reliance on water supply, and increasingly poor yields.

Constraints and areas requiring further consideration

54. Farmers do not perceive their current seed selection or storage techniques as being problem areas. Farmers are, however, acutely aware of the need to increase productivity on their farms to support an increasing population of dependents. They appreciate the benefits of the new, high yielding varieties, but adoption of these has been poor.

The reason for low uptake is due in part to the following, which will be considered in turn:

a) availability of seed;

b) the requirement for external, often costly, inputs;

c) risk aversion by farmers; and

d) released varieties' characteristics not meeting the needs of the farmers.

Availability of seed

55. Seed distribution in Ghana is entirely in the hands of the private sector. The dealers have commercial interests and so try to maximise their turnover whilst keeping costs (particularly transport) to a minimum. As a result the majority of the seed dealers in Northern Region are based in Tamale with other, smaller, outlets in Yiendi and Damongo. Villages away from these main towns are very poorly served in terms of seed supply. There is also a conflict of interest between the dealers and farmers over seed type. Farmers prefer composites because the seed can be retained on farm and only replaced every 3-4 years. In contrast, dealers would prefer to carry hybrid stock, which the farmer needs to replace yearly, thereby ensuring their business and making it simpler to assess the quantities of seed to be held in stock.

56. Lack of seed has been highlighted in previous studies. For example, GGDP (1991) in a survey of 332 maize farmers from throughout the country, noted that 62% of respondents gave seed unavailability as the main reason for non-adoption of new varieties. Similarly, Abatania and Albert (1993), in a survey of 80 farmers in the north of Ghana, found that 2/3 expressed lack of legume seed as being a major problem.

57. Seed is expensive and therefore inaccessible to the poorer farmers. In 1993, costs (in cedis per kilo) for maize were as follows:

Foundation seed	778 c/kg
Certified seed	311 c/kg
Food grain	105 c/kg

The need for additional inputs

58. The new varieties generally require extra inputs to realise their full yield potential. The cost of these chemical inputs was highlighted as a constraint by half of the legume producers interviewed (Abatania and Albert, 1993) in the north of Ghana and by half of the maize growers in a country-wide survey (GGDP, 1991). In addition, the required inputs are often not readily available because of the poor performance of the agricultural input markets (Donhauser and Kipo, 1988).

59. It is widely assumed that high yielding varieties are necessarily more beneficial than local varieties. Cost: benefit analyses have been undertaken in the past to compare the relative merits of growing local varieties with no inputs against improved varieties with inputs. However at the time of the analyses, fertilisers were distributed free. They are now very expensive. If the cost:benefit analyses were to be re-done using the new, realistic, non-subsidised, prices, it is probable that many of the new varieties would appear less attractive economically than has previously been claimed.

Risk aversion

60. Risk aversion was a notable aspect of all discussions with the farmers. Of paramount importance is the need to

produce sufficient food for the family irrespective of the weather conditions. Farmers spread the risk of potential crop failure by planting a range of varieties so that some crop will be harvested whether the rains are early or late. Different varieties are planted for different end-uses; for sale or home consumption, for eating or brewing, early maturing to give a crop soon after the hungry season or longer maturing to give a higher yield during the main-season.

61. Risk aversion can be manifested in other ways. Farmers want to be seed secure i.e. they need to ensure that sufficient seed is available, either stored on the farm or in the marketplace, to satisfy their planting requirements. Diehl (1985) reported that of 25 farmers interviewed, 24 saved sufficient sorghum and millet seed to re-plant at least once, thereby anticipating any disaster that may befall the crop.

Appropriateness of new varieties

62. Farmers in the north of Ghana are typically operating on small plots with limited resources. They do not produce their crops under agriculturally ideal conditions. For new varieties to be accepted by farmers, they must be able to out-yield local varieties under adverse conditions and at input levels which are realistic for the small-scale farmer. This point has been made elsewhere for cowpeas, that must be used in conjunction with inputs if the benefits are to be realised (Donhauser and Kipo, 1988), but it is only recently that changes have been made to plant breeding strategies, even though many of the high yielding varieties were seen to be disappointing, or even produced less than traditional varieties on infertile soils (Ibrahim, 1986).

63. Historically, plant breeders have placed highest priority on increasing yield. Aside from yield, other

parameters considered were typically pre-harvest, for example disease or drought resistance, maturation period and plant height. Little or no breeding has been done expressly for good storability.

64. Adoption rates reflect how closely the released varieties match the farmers varietal needs. Dakurah *et al* (1992) working in northern Ghana asked farmers to list important characteristics for new maize varieties: 70% stated yield; 31% drought resistance; and 30% price. They also found farmers wanted early maturing varieties of sorghum that could bridge the hungry season along with high yield and drought tolerance. In legumes, earliness to maturity was the most favoured trait followed by drought resistance (Abatania and Albert, 1993).

65. Farmer acceptability, although not having had the prominence it deserved, has played a part in breeders programmes. Most maize varieties in Ghana are derived from La Posta - a floury, dent variety brought to Ghana in the 1970s and chosen because it closely matched local preferences.

66. Placing an over-riding priority on yield improvement alone has led to some releases not fulfilling their promise. Aburotia, an improved, white, dent maize is high yielding but short-strawed and is therefore prone to rodent attack in the field.

67. Dakurah *et al* (1992) found that 80% of the red sorghum planted by farmers was local. When Framida, an improved high yielding red variety, was released it was not liked because of its poor storability and because it did not prepare well in food. New sorghum varieties are erect, tight-headed and sweeter than traditional varieties. They are, as a result, more prone to bird attack than the traditional varieties, whose heads droop and whose seeds

have better glume cover. They are also, typically, later maturing and therefore avoid times of high bird pest activity.

68. F-mix is an improved groundnut variety on general release. It has not been well adopted, despite being high yielding, because it proved to have poor drought resistance and because, having a sharp suture between the two pod halves, cracking the shell by hand was painful.

69. The improved varieties of rice are reportedly preferred for taste although they suffer more from bird attack. That other considerations, aside from yield, are also important to the farmer is shown by Rock 3, a long stemmed local rice variety, that is grown because it competes well with weeds.

70. Individual varieties are not considered in isolation by farmers, but rather as a component of a package of crops to be grown in any given year. An appreciation of this approach has led to changes in the breeding strategy in Northern Region. Nyankpala Agriculture Research Station is the main plant breeding centre for the north of Ghana. Following a recent review, the research emphasis has shifted to a farming systems approach (from one that concentrated on breeding individual crops) that employs multi-disciplinary teams working more closely with local farmers to ensure compatibility of released varieties in the farming system. As an extension to this, the maize breeders have begun an association with the Food Research Institute to examine the suitability of new maize varieties for a range of processing possibilities (including their use in traditional dishes).

71. Although in its early stages, the new farming systems approach should allow breeders to more closely tailor their programmes to match the farmers requirements. For example, most traditional cowpea varieties are photoperiod-sensitive which are well suited to relay cropping. These flower after

the maize harvest and therefore form pods when there is no competition from the maize (Singh and Rachie, 1985). The cowpeas released by the breeders have, by contrast, been largely photoperiod-insensitive varieties (K Marfo, pers. comm.).

72. It has often been said that farmers are highly conservative and that is why apparently superior varieties are not adopted. In fact, farmers are not inherently opposed to new varieties; we found farmers who no longer grew any local varieties in favour of improved varieties because of the benefits available. For example, one unnamed local groundnut variety is high yielding but late maturing (5 months) and therefore is more at risk from the uncertainties of rainfall. It has now been largely replaced by earlier maturing, and therefore more secure, improved varieties. Poor adoption generally represents a flaw (from the farmers' point of view) in the variety that has not been adequately addressed by the breeders.

The need for future studies

73. It became clear during the course of the survey that frequently the characteristics of the released varieties do not match the farmers' requirements. Following the recent review of the breeding programme at Nyankpala, the philosophy underlying their approach has been significantly shifted. Previously the programme focussed on individual crops with yield increase being used as the principal measure of success. The new approach adopts a farming systems stance with multi-disciplinary units acting as on-farm research teams. This radical change in policy has still to pay dividends (1993 was its first year of operation) and it is not clear how well the avowed change of approach will translate into reality. It is important that breeders appreciate that characteristics quite apart from yield are important to the farmers. It is equally important

that the measure of success of a breeding programme is not evaluated in terms of yield increase but in terms of more pragmatic markers such as farmer adoption rates.

74. An assumption underlying much of the extension work to promote new varieties is that the improved varieties, being higher yielding, give a better economic return to the farmers than local varieties, despite requiring higher input levels. This assumption is given some credence by cost: benefit studies carried out when input prices were markedly lower than at present. If promotion of improved varieties is to be continued (with all the extension costs that that entails), this effort can only be justified if there are clear economic benefits to the farmers, under prevailing cost levels. It is therefore essential that new cost: benefit analyses be performed to take account of the current cost realities.

75. Accessibility of seed as well as timeliness of availability are crucial elements affecting uptake of new varieties by farmers. The seed sector is in the private sector and there is little incentive for seed traders to establish outlets outside of the main centres because of high transport costs. This aspect requires further consideration with a view to improving the seed distribution throughout the region.

76. The Ministry of Agriculture is actively promoting the use of soya bean in Northern Region. Seed is currently distributed through the Ministry, a practice started to familiarise farmers with the new crop, and farmers appear to be keen to adopt soya into their farming system. Some farmers have already started to save soya seed for planting the following year. We heard conflicting reports, both from the farmers and the breeders, as to how well soya bean maintained its viability in store. Soya, because of its high oil content, is generally considered to be a poor

storer. If soya is to play a significant role in the future, studies must be undertaken to establish the extent of the problem relating to viability, and ways to minimise its impact under the farm conditions found in northern Ghana.

CENTRAL MALAWI

Methodology

77. The work was undertaken from 3-18 November 1993 and a rapid appraisal technique was employed. Approximately one week was spent with officials from the Ministry of Agriculture, Seed Technology Unit, plant breeders, socio-economists, seed growers and distributors to put the current findings into context (Annex 1 details persons met). The second half of the programme involved informal group interviews in 8 villages (Annex 2) during which farmers were asked about their seed storage practices (Annex 3 gives a list of the topics covered). Women were generally well represented in the groups and a particular effort was made to involve them in all aspects of the discussions.

78. The work area was confined to the Lilongwe Agricultural Development Division (LADD), one of eight administrative divisions in Malawi. Each ADD is further divided into Rural Development Projects (RDP) of which LADD has five. The villages were chosen at random with the proviso that they should be representative of the different agro-ecological zones and would allow discussions about as wide a range of crops as possible. To achieve this goal, villages in each of the RDPs were visited. During the course of the field work the first author was accompanied by Mr Joseph Chibwe of the Chitedze Agricultural Station's Crop Storage Unit, who acted as translator and facilitator, as well as by local extension staff in the respective villages.

Description of the survey area

79. Lilongwe ADD has an area of 11,700 km^2 and supports 22% of the population with an average population density of 133 persons per km^2. Some 89% of the rural population farm plots of 2 ha. or less and land pressure is becoming

increasingly severe (Lorkeers and Venema, 1991). The population are all Chichewa speakers and are ethnically homogeneous.

80. The area is typified by a single rainy season per year, lasting from November - April. This normally only allows a single cropping season per year. The exceptions are low lying areas where the water table is high and along watercourses where crops can be grown in the dry season. This *dimba* cultivation is not significant in terms of area but does provide an important source of fresh produce and income during the dry season, particularly in Dedza Hills and Ntcheu RDPs.

81. The Lilongwe ADD is dominated by maize. It is estimated that 59% of cultivated land is occupied by maize in pure stand and a further 22% by maize intercropped with pulses and groundnuts (Lorkeers and Venema, 1991). *Phaseolus* beans are the principal pulse crop although soya, cowpea and pigeon pea are also grown.

82. It is estimated that 20-25% of the maize and 30% of the rice area is planted with improved hybrids.

83. A significant episode in Malawi's recent past was the drought of 1991/92 that affected most of southern Africa. In Malawi as a whole, the maize harvest was down 52% against the long term average, with some parts of the country, particularly in the south, suffering considerably higher losses than this (Action Aid, Malawi, pers. comm.).

Traditional seed-saving techniques

Maize

84. Maize is usually dried on the plant before harvest and will sometimes be stooked. Maize seed can be stored as cobs

(in traditional *nkhokwe* or over the kitchen fire) or as shelled grain (in sacks), and kept separate from food stocks. Cobs placed in the *nkhokwe* continue to dry in store thanks to the open weave of the store walls. Women have the prime responsibility for the seed selection of all food crops. A common practice is that seed is selected each time cobs are removed from the *nkhokwe* for consumption. The shelled seeds are then added to the seed stock which gets progressively larger as the season advances. If at planting time there is insufficient seed available it is the man who is charged with making up the shortfall.

85. Some farmers prefer to keep all their maize together and then select seed just prior to planting. Size is the main criteria for selecting good seed. Colour of grain is unimportant with farmers planting both the white and red grains from the same cob. When selecting from cobs only the seeds from the central third of the cob are used. If seeds show signs of insect infestation the women winnow and re-select good seed by hand-picking. Chemicals (e.g. Actellic) or traditional admixes are only rarely used.

86. The farmers are aware that a given 'local' variety is, in reality, a mixture of several different varieties. However, the farmers continue to treat it as a single variety when it comes to planting, thereby perpetuating some genetic heterogeneity in the field. Where local varieties are more obviously distinct they are planted separately. At planting, 3-5 seeds are planted per hole. High planting rates are to take account of the post-planting losses suffered due to rodents, termites and wild animals. Fields are checked 1 week after planting, or when germinated plants have 2 leaves, and gaps in the plant establishment are re-sown. Germination is considered to be good. If planting cannot be done when the farmer would like to for some reason, the maize can be soaked (for several days) in water up until planting is possible. This is said to allow the

seed to advance to the physiological state it would have had, had it been planted.

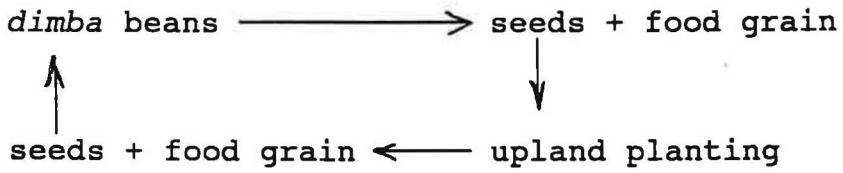
87. Following poor harvests, farmers will exchange seed between themselves. This may be given free to close family members or otherwise in exchange for other goods or services. After the drought what little seed was available was shared out within the farming community so that everyone had access to the local varieties.

88. Maize seed is stored for a maximum of one season. Some of the farmers growing the new top-cross hybrids MH17 and MH18 are re-cycling the seed and are happy with yields derived from the F2 generation.

Phaseolus beans

89. Beans are often threshed and a proportion removed, at random, for storage as seed. Other farmers only select seed just prior to planting. There is no selection beyond the removal of shrivelled grains. It is the women who are responsible for seed care (we heard them described as the treasurers whilst the men were the chairmen!) and they will do periodic inspections. If there are signs of insect infestation, they re-dry the seeds in the sun and then store them in a new place. They mix bean seeds with Actellic or alternatively tobacco or wood ash and store in sacks [Cromwell and Zambezi (1993) note that some farmers mix beans with sand, finger millet chaff and blue gum leaves]. Some farmers plant varieties separately (even though the seeds may be stored mixed together in the same container); others plant out as varietal mixtures. Beans may be planted out as a pure stand (only dwarf varieties) or, more commonly, as part of an intercrop (either regularly or randomised through mixing of maize and bean seeds prior to planting). There are no problems with germination. Fields are checked after 3-4 days and gaps re-filled. Where beans

are intercropped, only the maize is re-planted if there are gaps in the field because this is considered to be the main crop. For those farmers with *dimbas* it is possible to get two bean crops per year with some beans from any given harvest being used to seed the next crop:



Groundnuts and Bambarra groundnuts

90. After harvesting and stripping from the haulms, groundnuts are sun-dried whilst still in their shells and put into sacks. The sacks are put in *nkhokwes* or placed on platforms in the house. No seed selection is done until planting time when a sample of nuts is taken from the main stock at random and shelled. Only large grains are chosen for planting. Germination is not a problem and so a single seed is planted per hole. Fields are checked after 1 week and any gaps re-planted. Some farmers soak the seeds prior to planting to promote germination. Farmers try to retain enough groundnuts to meet their seed needs.

91. Bambarra groundnuts (ground beans) are kept in a similar way to groundnuts. They are very resistant to pests and so do not suffer any storage losses.

Cowpea

92. Cowpeas are either left in their pods and stored in *nkhokwes* or the pods are threshed and the grains put in sacks in the *nkhokwes* (c.f. *Phaseolus* beans which are always threshed). At planting time the pods are cracked (if unshelled) and healthy looking grains taken as seeds. If

insect attack is obvious in the *nkhokwe*, unshelled cowpeas are threshed and good grains may be selected for seed at this time. The seeds are then treated with Actellic, tobacco or wood ash - all of which are said to be effective. The wood ash is often derived from the burnt haulms of the plant. At planting, grains are winnowed and one of several strategies may be followed.

a) The grains are mixed with a quantity of maize seeds. During planting, 3-4 maize seeds are placed in each hole. The cowpeas, which have smaller seeds, slip through the farmers' fingers as the maize is planted, in a fairly random fashion, and so gets planted with the maize.

b) Maize is planted out alone, followed the next day by beans or cowpeas. Three seeds per hole are planted between two maize stations.

93. Cowpeas have a low-lying, creeping habit whereas many of the beans are climbers and will use the maize plants as supports. Cowpea is not grown as a pure stand.

Soya

94. Soya is a relatively new crop but is appreciated for its nutritional qualities and is being actively promoted (production of the crop has risen from 836t in 1988/89 to 13,660t in 1992/93 (MoA, 1993b)). When the plant is almost dry in the field (before shattering begins), it is uprooted and then further dried on a mat or the compound floor. When some pods begin to split the plant is considered ready for threshing. The pods are beaten with sticks whilst still on the floor or after having been put in sacks. The loose grains are then further dried. Limited selection takes place, in that shrivelled grains are removed for immediate consumption, the rest being stored for use as both food and

seed. If insect infestation occurs farmers sometimes use Actellic or hang bags/sacks of grain over the fire. The grains are periodically inspected and if insect infestation persists the seeds are re-dried in the sun. Although the men are normally responsible for inspection it is the women who undertake the cleaning.

95. Soya is treated as a single variety and seed is replaced every 3-4 years. Farmers plant 2 seeds per hole although there are no apparent germination problems (this contrasts with other reports from Malawi that, under hot conditions, 50% of seed viability can be lost in nine months (Cromwell and Zambezi, 1993)). Prior to planting, the seeds are sometimes mixed with a rhizobial inoculum that assists in nitrogen fixation (this is commercially available at a minimal cost of 1.50 Kwa per acre). Soya is usually grown as a sole crop except in areas where land pressure is severe in which case it is intercropped with maize (2 rows of soya; 2 rows of maize etc.). Farmers are aware of the nitrogen fixing properties of soya (and groundnuts) and so will often follow it with a maize crop.

Finger millet

96. Finger millet is grown as a cash crop and for the production of the local strong and well-flavoured beer (*chibuku*), although maize has largely replaced it for brewing. After harvest the unthreshed panicles are put directly into the *nkhokwes*. There is no distinction made between grain for consumption and for seed. There are no in-store treatments. Grains are threshed as they are needed. At planting, a pinch of seeds is placed in each hole between maize planting stations. Germination is good, although if there is too much rain during the initial stages of germination, the seeds die. The women are responsible for the grain because it is they who brew the millet beer and who sell the grain for cash. Inspections take place

only during the periodic withdrawals. Although insects are not important in store, rodents can pose a serious threat, and some farmers reportedly use rodenticides.

Rice

97. Rice is a crop of negligible importance in Lilongwe ADD. There is no seed selection; seed is taken from the remaining rice stock at planting time.

Pumpkin

98. Grown intercropped with maize, beans, groundnuts and tobacco. At harvest, the pumpkins are split, the seeds scooped out, dried thoroughly (moisture content is assessed through 'feel') and placed in any convenient container. (They do not stick the seeds on their outside walls as is done for cucumbers). The seeds can be kept in this way for two years. In good years some pumpkins are harvested and left whole to dry. They are then stored in the house or *nkhokwe* and, in this form, are used exclusively for seed. At time of planting, the pumpkins are split open and the seeds planted immediately.

Other vegetables

99. Principally cabbage, tomato and onion. Farmers tend to buy cabbage and onion seeds every year because of the difficulties of producing their own seeds. Tomato seed can be recycled and is replaced every 2-3 years. Germination is sometimes extremely poor even though bought through official marketing channels - in one survey of seed quality, only 20 out of 39 samples from a range of commercially produced vegetable seed showed adequate germination (Seed Services, 1993).

Varietal choice and farmer strategies

100. During the course of the survey, several features of their seed management and crop selection strategies became clear:

a) if farmers grow a certain crop, they will grow several different varieties, which may include hybrids, of that crop;

b) this diversity is in part explained by the different end-uses to which the crops are put, the importance attached to 'traditional' varieties, the over-riding need of the farmer to maximise his chances of harvesting sufficient food irrespective of the prevailing climatic conditions, and the need to integrate the crops into a mixed cropping environment;

c) farmers are aware of the need to use good planting material and the effects that climate, particularly humidity, can have on seed viability;

d) traditional storage techniques gave acceptable germination levels when used with traditional varieties;

e) farmers used criteria other than yield alone in deciding whether to adopt a new variety or not; and

f) farmers are constrained by financial parameters in adoption and/or continued use of improved varieties of the 'secondary' crops (as illustrated by the groundnut pricing structure, paras 116-17).

Maize

101. The farmers grow both improved hybrid and local maize:

Hybrid maize: tends to mature earlier, has better yield and is therefore particularly good for farmers with low stocks or insufficient land and for those who wish to sell. Many of the hybrids are given on credit because of their higher costs. Some farmers prefer not to enter into these type of arrangements because they fear the consequences of non-repayment.

Local: used for home consumption because the flour extraction rate is better and the yield of *nsima* from a given volume is greater. The local maize also has much better storability.

102. A range of local varieties exist each with specific properties:

Bantum, which may be derived from a Zambian composite, is kept for its high yielding properties. Another, unnamed, variety produces yellow flour which has special uses for some groups. Others are quick maturing and so give an early harvest after the lean season.

103. Many of the improved varieties were not popular because they were dent and were therefore:

* softer with poor storability
* produced lower quantities of the favoured fine white flour (*ufa woyera*) used in the preparation of the staple dish, *nsima*.
* poorer tasting (MH12)

104. The new top-cross hybrids MH17 and MH18 are flinty hybrids with many of the valued characteristics of local varieties plus higher yields. We spoke to some farmers who had entirely discontinued local maize production in favour of these improved varieties.

105. Farmers often prefer to keep some local varieties:

a) for the sake of tradition;

b) because of the expense associated with the need to replace hybrid seed every year, whereas local seed is described as free; and

c) because hybrids typically require extra inputs such as fertilisers.

Phaseolus beans

106. Dwarf and climbing varieties are grown. There are early and late maturing types in each group and these are kept apart. Dwarf varieties may be grown as a monocrop but climbing varieties are intercropped with maize. The climbing varieties tend to have higher yields than the dwarf varieties. A wide range of bean varieties are kept because of differences in taste and cooking properties. The late maturing varieties have the added advantage that the leaves, which are used as a vegetable, can be harvested over a longer period of time. Leaf abundance is not a major criteria for varietal choice.

107. Farmers expressed a desire to continue growing many of the local varieties, even those with low yields, for the sake of 'tradition'.

Groundnuts

108. A wide range of varieties are grown, each with their own set of valued characteristics:

> *Kalisele* - a local, small grained, early maturing variety. It is appreciated because it gives many pods and is therefore useful as a source of seed.
>
> *Manipintar* - matures in 130-140 days and so escapes drought in poor rainfall years. It is sweet tasting and so saved for home consumption.
>
> *Chalimbana* - is late maturing (140-150 days) and high yielding with large grains. In areas with sufficient rain this is the preferred variety.

109. The high oil content varieties e.g. Manipintar do not store well under domestic conditions (Cromwell and Zambezi, 1993).

110. Groundnut production is declining because the rains are said to be getting shorter, it is a very labour intensive crop and the pricing structure implemented by ADMARC have made the crop increasingly unattractive to farmers.

Finger millet

111. There are two groups of local finger millets, those in which the panicles are straight and those in which the panicles curl over. The latter produce the higher yields and are preferred. However much of the seed needs to be bought from the market at planting time and farmers are unable to tell, from appearance, which variety they are buying.

Dimba cultivation

112. *Dimba* (flood-plain) cultivation is used largely for the production of vegetables. In practical terms the *dimbas* allow the planting and harvesting period to be extended. The same crops and varieties of crops that are grown on the main farm are also grown on the *dimbas*. Maize can be planted earlier (August) than is usual for the main farm (November) and is then harvested during the main farm crop growing season. Yields from the *dimba* and the main farm are the same. Seed for the *dimba* plantings is taken from the same sources as seeds would be for main farm planting.

113. Beans can be planted in the *dimba* in August. This not only provides the basis for an early crop but also, by sowing, makes those seeds unavailable for other purposes i.e. the farmers use the *dimbas*, in part, as a form of seed security or seed storage. By August, the pressure on household resources is great; this is the lean season and there is a high demand for food and a constant need to sell crops in order to realise an income. By planting in the *dimba* the farmer is assured of a continuing seed supply.

Constraints and areas requiring further consideration

114. Farmers did not perceive their current seed handling and storage techniques to be problematic. They were aware of the potential benefits of the newer varieties, and appreciated that as land pressure becomes more severe so yields must be improved. Despite these pressures, adoption of improved varieties has been poor for, amongst others, the following reasons, which will be considered in turn:

a) seed availability;

b) the requirement for costly additional inputs;

c) risk aversion by farmers; and

d) appropriateness of new varieties to the farmers' situation.

Seed availability

115. There is a shortage of seeds for crops such as sorghum, beans, groundnuts and vegetables (Seed Services, undated) and, even when available, farmers find it difficult to afford the prices demanded for commercially produced seed. To help overcome this financial constraint, the Malawian government began the Smallholder Seed Multiplication Scheme (SSMS) in 1977. The SSMS is designed particularly for the secondary crops which are, typically, the open pollinated crops such as groundnut, *Phaseolus* beans and pigeon peas which the commercial sector has little interest in producing. However, the SSMS has had only a limited effect, at present, on satisfying the seeds needs of the farming community. This is shown clearly in Table 1.

Table 1. Smallholder seed production programme, 1992

Crop type	Seed required / tonnes	Certified seed available / tonnes
Beans	397	67
Soyabeans	351	10
Pigeon peas	332	none
Groundnuts	3600	100
Rice	762	500
Groundbeans	7	none

Source: Seed Services (undated)

116. ADMARC has a role in assisting the farmers by purchasing seed after harvest, taking responsibility for good storage and then re-supplying the farmers at planting time. Unfortunately, the pricing policy of ADMARC has frequently tended to discourage production of seed (and limit seed availability) at farmer level. This can be seen

using the Manipintar prices for the 1993/94 season as an example.[1]

ADMARC buy groundnuts (unshelled) : 90 t/kg[2]
ADMARC sell groundnuts (unshelled): 117 t/kg

117. Underlying these prices is a significant set of subsidies (NSCM who produce seed commercially, sell 25 kg packs of unshelled groundnuts at the equivalent price of 3.56 Kwa/kg). The objective of these low prices is that at harvest farmers will sell groundnuts to ADMARC, who then store them until the planting season, when they are sold back to the farmers. The selling price (and therefore the related buying price) is kept low on the assumption that, irrespective of the price given at the beginning of the storage season, farmers will have very little money left when they need to buy groundnut seed back in again. The system fails because traders, who sell the groundnuts as food, will pay higher rates for the groundnuts than ADMARC. The result is that seed does not get sent to ADMARC with the consequence that there is always insufficient seed available when it comes to planting time. [A similar situation applies with other crops; whilst ADMARC will pay producers 65 t/kg for pigeon peas, traders will pay up to 2 Kwa/kg].

118. Hybrid maize seed is distributed through the many ADMARC outlets. Farmers complained that the timeliness of seed delivery to the depots was sometimes poor with the other major constraint being the price of the seeds themselves.

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1 ADMARC supplied a series of price sheets to the author showing a disparity of prices for the same commodity. It should be appreciated that even if the prices shown are not correct, the point made remains the same.

2 1 Kwacha (Kwa) = 100 tambala (t)

The requirement for additional inputs

119. It is a common feature of improved varieties that yield benefits are only realised when grown in conjunction with extra inputs. This dependence on the use of fertilisers and/or chemicals can act as a disincentive to their use by resource-poor farmers, particularly when the current prices are considered (urea costs 64.2 Kwa per 50 kg bag); Kydd (1989) has even argued that the use of high yielding maize varieties will be a direct function of the price of fertiliser. Approximately 70% of ADMARC's sales are done on credit; farmers receive the required inputs and then have to repay in cash after harvest. The credit system is administered through the Smallholder Agricultural Credit Administration (SACA) which historically worked well, with very high rates of repayment (although only reaching 23% of farming households: Mr Kaimila, pers. comm.). However, following the serious drought of 1991/92 when farmers were forced to defer payments, coupled with the populist comments of opposition politicians urging farmers to default, repayment rates have slumped below 15% for the 1992/93 season. This will have serious repercussions in this, the 1993/94, season since only those farmers belonging to farmer clubs that have cleared their debts can negotiate new loans. In the absence of these loans, the improved packages (seeds plus inputs) will undoubtedly be outside the reach of many farmers.

120. Recent (unpublished) work undertaken at Chitedze Agricultural Research Station offers some hope to farmers for cutting input costs. Comparisons were made of traditional and improved maize varieties under different management regimes. Some F1 hybrids (NSCM41 and MH18) showed maximum rates of return (i.e. giving the best cost: benefit ratio to the farmer) at half the recommended fertiliser rate. This conflicts with national policy which promotes maximum yield (through use of the higher fertiliser

application rate). In addition, for the varieties tested (MH12, MH16, MH17, MH18 and NSCM41) all except NSCM41 showed better rates of return for the F2 generation (i.e. when the seed was re-cycled for a second year) with, at 40 kg/ha nitrogen, virtually no difference in yield to the F1. If these results can be confirmed with subsequent trials, it would suggest that farmers can reap maximum economic benefits from using improved seed at half the approved fertiliser rate and then saving seed for re-planting the following season. Not only would returns be maximised but capital outlays will also be reduced.

Risk aversion by farmers

121. The farmers' primary consideration is to harvest sufficient food to feed the family. Under the uncertain conditions afforded by subsistence agriculture on small plots, farmers grow a wide range of crops and many varieties of those crops. In the event of one variety failing, the farmer can fall back on his other varieties or crops. Varieties may also be maintained because they have specific end-uses dictated by for example, taste, tradition or physical characteristics such as cooking time or colour. This has been reported for maize by Smale (1991) and for beans by Martin and Adams (1987).

Appropriateness of new varieties

122. Farmers are not intrinsically opposed to new varieties. Poor adoption rates often reflect a failing of 'improved' varieties to fulfil the criteria demanded by farmers for their crops. Maize is the principal crop in Malawi and can be used as an instructive example. As long ago as 1959, Ellis pointed out that whilst yield is an important trait in maize, resistance to insect attack during storage and consumer acceptability were also of great importance.

123. Maize is primarily processed into *nsima*, the staple dish. Ellis (1959) showed clearly that flint maize produced 12% more flour than dent, thereby supporting the preference of the population for flint maize. Despite this early awareness of farmer preferences, breeders still released many denty hybrids (e.g. NSCM41 and MH12) because of their higher yielding characteristics and because of the greater range of dent germplasm available for breeding programmes (Kydd, 1989). These varieties were adopted by farmers wishing to market their maize but local maize was still grown to satisfy food requirements. Only recently have semi-flint hybrids (MH17 and MH18) been released and these were shown, during the survey, to have already established themselves as being popular with farmers. Smale *et al* (1993) have also reported similar findings. This change in breeding philosophy towards farmer acceptability has also been evidenced in the fact that new varieties are now routinely tested for their storability and for their poundability.

124. It has been suggested (Dr Zambezi, pers. comm.) that the drought of 1991/92 has altered farmers' perceptions of the relative merits of the different maize types. The local varieties (which, at 150 day, are late maturing) were severely affected by the drought whereas the shorter period improved varieties (MH18 matures in 120-130 days) were less so. As a result adoption of improved varieties has increased from approximately 10% pre-drought to approximately 20% post-drought.

The need for future studies

125. The survey showed that of the many factors influencing the seed sector, the most significant was the pricing policy adopted by ADMARC. The issue of agricultural subsidies has become somewhat contentious over the last few years. The World Bank had encouraged Malawi to remove all subsidies but

in reality they were simply reduced. It is essential that this question is re-addressed for two main reasons:

a) the price structure provides no financial incentives to farmers to produce seed; and

b) the private seed companies (NSCM and Lever Brothers), who have to produce and sell seed at commercial rates, are finding it increasingly difficult to compete.

126. The role and questionable desirability of subsidies should lead on to a general re-appraisal of the SSMS. The SSMS clearly does not produce sufficient seed to meet requirements, in part because of the prices offered to farmers, but also because of planning and logistical shortfalls. The concept underlying the SSMS is a good one, but its implementation has been poor. The SSMS needs to be run within the constraints of the available resources. For example, at present, seed crops are grown on a large number of small plots. The Seed Services team, whose remit it is to certify the SSMS seed, find themselves spread too thinly; it would be more practical to have fewer seed sites, on larger plots, more closely spaced to allow a more rational use of the Seed Service's time.

127. Vegetables are an important component of the diet as well as being a useful cash crop. Farmer sources and the Seed Services Unit both note the highly variable quality of the seeds produced commercially. Although the Seed Services Unit have made a start, this problem needs to be further addressed to establish causes of poor viability and the necessary remedies implemented. If necessary, guidelines and standards for producers and importers should be drawn up to improve handling and storage practices.

128. In the 'Seed Science and Technology Action Plan' (Seed Services, undated) it is suggested that the following be published:

a) a 'Guide to Seed Production of agricultural and vegetable crops in Malawi' as a reference tool for seed growers, extensionists and the general farming community.

b) 'Seed rules and Standards of Malawi' for use by seed growers, seed inspectors and the trade.

If the seed sector is to be rationalised in any way, it is critical that these basic publications be produced.

RECOMMENDATIONS

129. This report summarises the findings from two short surveys that used rapid appraisal techniques. The results bear out the success of the technique and allow country-specific recommendations to be formulated. A synthesis of observations made throughout the surveys allow general recommendations to be made, applicable on a wider scale than just Ghana and Malawi. These are presented separately below.

Country recommendations - Ghana

a) The recently adopted policy of plant breeding that acknowledges the importance of the farming system should be maintained, with farmers' views playing a central role in breeding objectives.

b) Cost:benefit analyses should be carried out to compare the two basic production strategies: improved varieties with high inputs versus local varieties with low input levels. Without this basic data, obtained under farm conditions, the validity of promoting new varieties is open to question.

c) Options for improving the currently poor availability of commercial seed outside the main centres should be considered.

d) Soya bean, an increasingly popular crop, is susceptible to viability decline. This should be quantified under small farmer conditions and, if necessary, appropriate remedial actions be investigated.

Country recommendations - Malawi

a) ADMARC's pricing policy must be reviewed with especial regard to the use of subsidies.

b) The structure and running of the Smallholder Seed Multiplication Scheme should be re-appraised.

c) The causes of poor vegetable viability in commercial seed needs to be investigated.

d) Seed production and seed standards publications should be produced.

It should be noted that for the above recommendations to be implemented, external assistance and support will need to be provided.

General recommendations

130. The review that prompted this study (Wright *et al*, 1994) highlighted the scarcity of information on current seed care practices used by small-scale farmers. The two surveys show the value of the rapid appraisal technique in enabling a descriptive study to be made of farmer techniques whilst establishing the constraints on, and the priorities of, the farmers. Further studies are undoubtedly required and should address the following areas.

a) A third short survey should be undertaken to examine farmer practices under climatic conditions unsuitable for seed storage e.g. in the humid tropics.

b) Farmers want to grow the most suitable varieties for their own circumstances, which may not be the modern varieties. Farmers must be assisted to store

seeds of those crops and/or varieties for which no suitable 'improved' alternative exists.

c) Plant breeders should be assisted to understand farmers' needs and priorities so that breeding programmes can become more focussed. This will inevitably involve a move away from breeding primarily for increased yield.

d) Studies should be undertaken to establish the relative merits of current farmer seed handling and storage practices, to determine the optimal techniques for maximising subsequent crop yields.

e) Studies need to establish and assess the success of coping strategies used by farmers for maintenance of varietal diversity during adverse conditions e.g. drought.

f) Ministries of Agriculture should be aware of the potential problems associated with the promotion of varieties that are inappropriate for small-scale producers.

g) Ministries and potential donors involved in supporting the small-scale seed sector should be fully sympathetic towards the needs and priorities of the farmer end-user.

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ANNEX 1. Persons met

Northern Region, Ghana

Emmanuel Frempong, Regional Crop Services Officer, MoA.

Fusseini Haruna, Regional Post-Harvest Officer, MoA.

Adam Dawedu, Technical Assistant, MoA.

Vivian Dartey, Women in Agricultural Development, MoA.

Henry Akanko, National Seed Service (Northern Sector)

Mr Acaab, Seed Inspection Service

Dr H Quarshie (soya bean breeder), Nyankpala Agriculture Research Station.

Dr Salifu (entomologist), Nyankpala Agriculture Research Station.

Mr T Kipo (evaluation and monitoring), Nyankpala Agriculture Research Station.

Dr Helmut Albert (economist), Nyankpala Agriculture Research Station.

Dr P Salah (maize breeder), Nyankpala Agriculture Research Station.

Dr K Marfo (legume breeder), Nyankpala Agriculture Research Station.

Moustafa Adamo, Regional Officer, Grains and Legumes Development Board.

Mr A Zakariah, Manager, Nazia rice mill.

Mr J Madugu, Secretary, New Seed Growers Association

Osman Abdul-Rahman, Global 2000

Lilongwe ADD, Malawi

Tom Barrett, Natural Resources Adviser, British High Commission.

Odinga Jere, Programme Assistant, British High Commission.

Dr A Mkandawire, Coordinator Bean Programme, Bunda.

Dr Vas Aggarwal, CIAT Bean Programme, Bunda.

Cuthbert Chimbe, Head of Crop Storage Unit, Chitedze.

Joseph Chibwe, Crop Storage Unit, Chitedze.

Dr Jeff Luhanga, Seed Technology Unit, Chitedze.

Fred Nyondo, Economist, Chitedze.

Dr Batson Zambezi, Chief maize breeder, Chitedze.

Mr H Soko, Grain legumes breeder, Chitedze.

Mr K Whisler, General Manager, NSCM.

Mr Mbonda, Farm inputs, ADMARC.

Mr Muyaya, Programme Manager, Lilongwe ADD.

Mr Kumwenda, Divisional Agricultural Officer, Lilongwe ADD.

Mr N Yabwalo, Project Officer, Lilongwe West RDP.

Mr D Gwande, Project Officer, Lilongwe East RDP.

Mr D Yona, Project Officer, Thiwi/Lifidzi RDP.

Mr E Konje, Project Officer, Dedza Hills RDP.

Edson Musopole, Action Aid.

Mr Kaimila, Deputy Administrator, SACA.

Malcolm Blackie, Rockefeller Foundation.

ANNEX 2. Villages visited

NORTHERN GHANA

Tamale district

Village	Interviewees
Tampe-Kukuo	2 men
Cheshegu	4 men
Nangbaguyapale	2 men
Gbambaya	1 'modern' farmer
Tugu	4 men
Juni	3 men
Golinga	4 women
Lahagu	2 men
Jerigu	4 men

Savalugu district

Layilgu	4 men; 1 woman
Kpaling	5 men

Saboba district

Kunkunzoli	2 men
Kitiek	3 men

The interviewees column notes the numbers of main respondents, the groups were invariably larger than this and women were usually present. Although the women were often not the prime respondents, they were generally seen to concur with the men's views.

CENTRAL MALAWI

Lilongwe West RDP

Village	Accompanied by:	Interviewees
Nyangu	D/O, Mr Kasawala	7 men; 3 women
Kamanga	F/A, Mr Mankhwazi	3 men; 2 women

Lilongwe East RDP

Phatha	F/A, Mrs Makande	2 men; 3 women
Kalumbu	D/O, Mr Mulengari	4 males

Thiwi-Lifidzi RDP

Chimombo	--	4 men; 5 women
Kumitengo	Asst D/O, Mr Changiza F/A, Mr Kadziweni	4 men

Dedza Hills RDP

Kantchito	F/A, Mr Mwandira	2 men; 5 women

Ntcheu RDP

Kangoma	F/A, Mr Msukwa	5 men; 4 women

Note: D/O - Development Officer
F/A - Field Assistant

ANNEX 3. Topics to be covered during village surveys

For home-saved seed:

moment of seed selection (pre-harvest/ at harvest/ pre-planting)

criteria for seed selection

conditioning practices (e.g. drying)

handling practices (if any)

storage practices - volumes involved, storage vessels, care of seed during storage (inspection, admixtures etc.), storage periods, are seed varieties kept apart/mixed, is seed kept apart from food grain

pre-planting activities (any re-selection of seeds?)

planting practices (single/multiple seed per hole, mixed cropping in fields, seed dressings)

estimates of success of seed storage techniques (germination, yield)

who is responsible for decisions concerning seed/seed storage

Perceptions:

are farmers happy with current practices, do they see a need for change, are they aware of any losses, are they considered significant

do they treat local/improved varieties differently - if so what is the basis for this difference - are farmers aware of differences in the storability of different varieties

how well do the commercial seed sources cater to the needs of the small farmer

Policy issues:

what is the Ministry policy for promotion of new varieties / farmer retained seed

what are the cost:benefits of using improved / traditional seed