Value Chain Analysis for Soybeans in Malawi

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List of Acronyms

CARE	Cooperative For Assistance and Relief Everywhere, Inc
CARO	Chief Agriculture Research Officer
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center)
CNFA	Citizens Network for Foreign Affairs
DCARO	Deputy Chief Agriculture Research Officer
DED	Deutschen Entwicklungsdienstes (German Development Service – Peace Corps)
FtF	Farmer to Farmer
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation - USAID)
IITA	International Institute of Tropical Agriculture
LAPE	Lakeside Agro-Processing Enterprise
LER	Land Equivalent Ratio
MOA	Ministry of Agriculture
NGO	Non-Government Organization
REAP	Rural Enterprise Agro-Business Project
USAID	United States Agency for International Development

Executive Summary

The evaluation of the value chain for soybeans in Malawi showed that Malawi like most developing countries might be defined as an economically suppressed economy, in which consumer prices for goods produced in Malawi are typically prices at one third to one fifth the US prices while imported goods include fuel cost are at a premium to the US prices. In addition wages are suppressed even more then consumer prices, although the request for civil servant salary scale was never obtained. The net result was that wages were so low that most people were not able to afford sufficient calories to be able to effectively work in the field for more than a couple hours a day. The actual energy balance is that it takes 2000 calories to sustain someone and 270 to 340 calories per hour for field work or a total of approximately 5000 calories per day. A person living at the poverty level in Malawi can only afford to purchase about the 2000 calories just to sustain themselves with little or no energy for field work. Subsistence stocks are about the same with farmers typically setting aside four bags of 50 kg each. This amounts to 200 kg/year/adult or 547 g/day and slightly more than 2000 calories. This is very consistent with Millennium Village estimates of 1.1 Tons/family of 5.7 which amounts to 192 kg/year or 1930 calories per day. Thus to really effectively promote value chain enterprises, including soybeans, it might first be necessary to evaluate how to make major reduction in the drudgery farmers have. This again implies development projects that provide smallholders access to contract mechanization. This may actually have been the key to the success of the green revolution in rice producing Asia that is mostly overlooked by the development community.

Within this overall economic environment the value chain effort is to facilitate the introduction or enhancement of high value cash crops by evaluating all the links between the smallholder producers and the final consumer, with an emphasis on the producers and private dealers that purchase from the producers and advance the commodities up the value chain to the processors and on to the consumers or export markets. This includes any valued added processing that may enhance the value of the crop as it moves up the chain, independent of simply moving up the chain with the normal costs of transport and handling.

For soybeans the value chain appears to have become well established over the past 20 years when the consultant first evaluated soybeans in Malawi while he resided in Malawi and worked with the MOA research program. Soybeans do not appear to have many quality concerns which also hinder the problem of maintaining genetic identity. There is a problem of nitrogen fixation as the rhizobium for soybeans is specific to soybeans and does not cross inoculate with other legumes. This mean in order to get the benefit of nitrogen fixation it is necessary to inoculate the seeds the first time they are planted in a specific field. Inoculation is available but the logistics can be a problem. The result is that soybeans are often grown more as a grain crop relying on artificial fertilizer then nitrogen fixing legume crop. The breeding program headquartered at

Cheditze is working on promiscuous lines of soybeans that will cross-inoculate with native rhizobium. Progress is being made but it is still few years away from wide spread release.

Soybeans are self-pollinating and thus do not lose genetic purity with retaining the seed from generation to generation. This is being done with some farmers having retained seed for up to 10 generations. This also means the variety identity has been lost. Within the logistical limitations of a country like Malawi this most likely a good thing and should not be considered a problem. New varieties should continue to be introduced and variety keep track of at least initially. If important the farmers will respond to variety identification, if not the introduced variety will simple disappear.

The demand for soybeans has increased substantially over the past 20 years. This is mostly for processing into confined animal feed, but there is some direct consumption. Commercially the direct consumption is mostly as infant and baby formula and handled almost exclusively by RAB Processors. There is a substantial amount used by various NGOs in supplemental feed programs dealing with a largely captive audience in school lunch programs, hospitals, orphanages and refugee relief programs.

Procurement of soybeans is done mostly by direct purchase by the large processors such as RAB, Global Trading, Farmers' World and Export Marketing. They operate either through permanently established outlet stores scattered through the country like RAB's Kulima Gold Depots that sell various commodities to the community and then purchase goods from the farmers, or via temporary buying centers established by renting facilities during the buying season and then disappearing between buying seasons. Smaller processors attempt to do the same but really don't have the means. They could appreciate some assistance from the CNFA agro-dealers to represent them to the growers. This is something CNFA may need to work out on behalf of their dealers and value chain representatives. One concern in the procurement of soybeans and other commodities is that farmers may be using a financial management strategy of retaining their assets in kind as long as possible and then monetizing only what is needed to meet immediate financial requirements as holding cash would be too much temptation for various members of the family.

Finally, a list of possible future studies have been provided covering soybeans and other related issues associated with promoting value chain enterprises.

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Introduction

This report is an analysis of commodity market chains in Malawi with a special reference to Soybean. It was made as the initial Farmer-to-Farmer volunteer consultancy to Malawi under CNFA sponsorship. The consultancy took place between 21 February and 18 March 2009. The consultancy involved various interviews with different links in the value chain from the farmer producers to the processors utilizing soybeans for various consumers or animal feed products. A daily log of the consultant's activities is included in Annex 1.

It also marks the return of the volunteer to Malawi after nearly 20 years. During his prior time in Malawi from 1986 to 1990 he served as the agronomy advisor to the adaptive research commodity group, one of seven commodity groups into which Malawi agriculture research program was divided. This was the on-farm research component under the Chief Agriculture Research Officer (CARO). It was also part of CYMMYT's Africa Maize Based Farming System initiative and coordinated extensively with CYMMYT's regional offices for East and Southern Africa in Nairobi and Harare. In his capacity as the agronomy advisor to the Adaptive Research Program the volunteer traveled throughout Malawi and became familiar with agriculture systems in the entire country. Also, as a pure coincidence one of the last activities undertaken by the advisor was an analysis of the production and marketing potential for soybeans. This was done working closely with Dr. Pickford Sibale, the DCARO for Chitedze at the time as well as Coordinator for the Legume and Oil Seed Commodity group. This resulted in two brief papers that served as the starting point for this consultancy. The papers are included as Appendix 2 to this report and serve as the base line survey for the consultancy.

This report will look at the overall economic environment of Malawi as a developing country, how this could compromise the ability of farmers to timely implement agronomic recommendations for value chain crops, as well as the overall competitive efficiency of the private sector to provide farmers the best support services in terms of returns for the crops they market or costs of inputs procured. In addition the report will look at how soybeans fit into the overall multi-enterprise smallholder farming system in which priority has to be given to food security crops over cash crops. Also, the report will look at the indigenous value chain for soybeans and other cash crops that tend to be marketed in conjunction with soybeans to see what if anything can be done to facilitate an enhancement of the soybean value chain.

Economic Environment of Malawi

Malawi, like most developing countries, might best be defined as having a suppressed economy relative to the more developed countries. This results in both income and consumer prices being much less than in developed countries. Typically consumer prices for goods produced in Malawi will be 1/4th to 1/3rd the US prices (Table 1). However, those goods imported into Malawi will be at a premium to US prices. This will include fuel prices, a major cost in marketing produce, which are more than double the US prices. These consumer price comparisons for Malawi are highly consistent with data obtained from developing countries not only in Africa but Asia, the Middle East and South America as well[1]. Income typically is suppressed even more than consumer prices. Typically a civil servant in countries like Malawi annual salary will be comparable to a US Civil Servants monthly salary, resulting in a considerable higher percent of income committed to essential goods.

The consumer price information in Table 1 provides an initial estimate of what impoverished individuals can afford to consume and allows an estimate of the energy they have to engage in field work in support of value chain enterprises including soybeans. This in turns leads to computations of the estimated number of hours a person can morally or ethically be asked to work in support of a development project, and then how long it will take to complete various agronomic tasks from land preparation to harvesting, threshing and winnowing, relative to the time projected or implied with production recommendations. Expecting individuals to work in excess of the calories available can only be done at risk to their overall health and well being of the individual.

As most of these consumer goods are provided by the private sector, the table also leads to an appreciation of the overall efficiency of the private sector business model and value chain links.

Dietary Energy Balance

Labor Oversight

Somehow in the rural economic development effort, very few individuals conceptualize on the importance of labor to implement programs, even those requiring extensive manual labor as it the case of agriculture in Malawi. Typically, the availability of labor is assumed to be in amble or even surplus without any verification. This is often accepted without any documentary proof and in fact may be in critically short supply within a smallholder community. In addition while donors usually consider beneficiaries diets' to represent both under nourishment, in not having enough to eat, and malnourishment, in not having the proper balance between energy, protein

[1] http://lamar.colostate.edu/~rtinsley/ConsummerPriceComparison.

Table 1. Comparative Consumer Prices (Malawi vs. USA)

Commodity	Malawi Price		US Price		Adjusted to US$ & Common Unit			Compar-ison Ratio
	Price	Unit	Price	Unit	Malawi	US	Unit	Ma/US
Dry Goods								
Flour	120	kg	1.18	lbs	0.80	2.60	Kg	0.31
Sugar	140	kg	0.69	lbs	0.93	1.52	Kg	0.61
Salt	120	kg	0.49	lbs	0.80	1.08	Kg	0.74
Pasta	520	kg	1.53	lbs	3.47	3.37	Kg	1.03
Rice	220	kg	0.64	lbs	1.47	1.41	Kg	1.04
Maize Flour	120	kg	0.84	lbs	0.80	1.85	Kg	0.43
Soybean	350	kg	1.99	lbs	2.33	4.38	Kg	0.53
Veg.Oil	400	kg	2.89	qt	2.67	2.72	lit	0.98
Coffee	1,900	kg	11.88	lbs	12.67	26.14	Kg	0.48
Tea	400	kg	8.99	lbs	2.67	19.78	Kg	0.13
Dry Beans	250	kg	0.54	lbs	1.67	1.19	Kg	1.40
Dairy								
Eggs	25	ea	0.08	ea	0.17	0.08	ea	2.01
Milk (UHT)	200	lit	0.75	qt	1.33	0.71	lit	1.89
Margarine	740	kg	3.00	lbs	4.93	6.60	Kg	0.75
Yogurt	480	lit	2.99	qt	3.20	2.81	lit	1.14
Meat								
Beef	550	kg	2.49	lbs	3.67	5.48	Kg	0.67
Chicken	390	kg	0.79	lbs	2.60	1.74	Kg	1.50
Pork	1,000	kg	1.13	lbs	6.67	2.49	Kg	2.68
Goat	740	kg	5.02	lbs	4.93	11.04	Kg	0.45
Fish	300	kg	5.49	lbs	2.00	12.08	Kg	0.17
Vegetables								
Tomatoes	100	kg	1.39	lbs	0.67	3.06	Kg	0.22
Carrots	200	kg	0.65	2 lbs	1.33	0.72	Kg	1.86
Beans	500	kg	2.49	lbs	3.33	5.48	Kg	0.61
Peas	400	kg	2.50	lbs	2.67	5.50	Kg	0.48
Onions	160	kg	0.69	3 lbs 1.25	1.07	0.51	Kg	2.11
Eggplant	250	kg	1.99	lbs	1.67	3.50	Kg	0.48
Potatoes	120	kg	0.70	lbs	0.80	1.54	Kg	0.52
Sweet Potatoes	100	kg	0.79	lbs	0.67	1.74	Kg	0.38
Cassava	150	kg	0.99	lbs	1.00	2.18	Kg	0.46
Cabbage	50	kg	0.67	lbs	0.33	1.47	Kg	0.23
Cucumbers	100	kg	0.75	lbs	0.67	1.65	Kg	0.40
Fruits								
Bananas	100	kg	0.69	lbs	0.67	1.52	Kg	0.44
Pineapples	160	kg	4.99	3.5 kg	1.07	1.43	Kg	0.75
Mango	200	kg	0.83	14 oz	1.33	0.73	Kg	1.83
Avocado	160	kg	2.00	lbs	1.07	4.40	Kg	0.24
Other								
Gas	220	lit	1.89	gal	1.46	0.50	lit	2.93
Diesel	199	lit	2.19	gal	1.33	0.58	lit	2.29

Exchange rate US$ = MK 138 Date: 4 Apr. 2009

and other essential components, this is rarely factored in as an impediment to the implementation of projects to a alleviate poverty and address the problems of insufficient diet. The following analysis is an attempt to take a closer look at the calories individual have available relative to the calories needed to implement a development program such as a soybean value chain.

Energy Balance

The dietary energy balance is an analysis of the amount of caloric energy people are expected to exert in cooperating with development projects intended for their ultimate benefit relative to the amount of energy they can afford or otherwise have access to such as from subsistence stocks. In general an adult requires some 2000 to 2200 calories just for sustaining biological function without undertaking any strenuous work. If a person is expected to do manual agriculture field work such as general weeding with a hoe or the more strenuous digging for land preparation they need an additional 270 to 340 cal/hr. If they are expected to work a full 10 hr day, this will require an additional 2700 to 3400 cal. for a total of 4700 to 5600. A good round number estimate would be 5000 cal/day. That is actually an enormous amount of food (Fig. 1). It represents:

- 1.37 kg Uncooked Rice (3.85 kg cooked), or
- 1.38 kg Maize Flour (8.33 kg cooked) , or
- 4.09 kg Plantains, or
- 3.43 kg Cassava, or
- 5.83 kg Sweet Potatoes, or
- 1.37 kg Wheat flour or pasta



Fig. 1. 5000 calories derived from 4.09 kg plantains (18 fingers), 5.83 kg Sweet potatoes (21 tubers), 3.34 kg cassava (10 roots), 1.37 kg or maize, rice or wheat (2 bowls on right).

The consumer price information in Table 1 than allows an estimate of how much it will cost for a person to purchase the 5000 calories needed to complete a full day of agriculture field work. (Table 2).

Table 2. Cost for 5000 calories in Malawi (US$)

Source	Amount	Price/kg	Total
Maize	1.37	0.71	0.97
Rice	1.37	1.29	1.77
Pasta	1.37	3.06	4.19
Cassava	3.43	0.88	3.03
Sweet Potatoes	5.83	0.59	3.43
Potatoes	7.24	0.80	5.79

If a person is living at or below the international standard for poverty, usually defined as US$ 1.00 /person/day of which the maximum that can be spent on food is US$ 0.80, only maize comes close to providing sufficient calories to work a full field day. In Malawi, as in many developing countries, the price of maize, or other primary staple crop, has a government imposed ceiling price to assure affordable food supplies for the urban poor. Certainly the data in Table 2 justifies the importance of having this ceiling price so the urban poor can afford sufficient food to avoid starvation. However, such ceiling prices can have serious impact on the production economics of the commodity involved, in this case maize, and render it non-economic to produce or at least reduce the optimal level inputs like fertilizer and reduce the overall yield potential, and thus national food security. This is an important analysis for government policy makers and well outside the scope of this report, other than a note in passing.

An alternative way of looking at this is to estimate how many calories a person, living at the poverty level with only US$ 0.80 available to spend on food, can purchase and how many hours that will allow that person to work per day (Table 3).

Table 3. Calories for US$ 0.80 & Number of Working hours

Source	Calories	Hr. of labor
Maize	4,136.25	7.80
Rice	2,256.14	0.93
Pasta	954.52	-3.82
Cassava	1,321.67	-2.48
Sweet Potatoes	1,166.38	-3.04
Potatoes	692.00	-4.77

This again highlights that only maize will allow an individual at least an opportunity to work most of a day. Rice will allow someone to work one hour a day. All the other common food energy sources in Malawi will not provide sufficient calories to sustain an individual let alone do any work.

While the above analysis is based on purchased food it is recognized that most smallholders retain maize for consumption. Based on a couple interviews during the consultancy, the typical consumption from subsistence stocks in rural Malawi would be approximately four bags of 50 kgs ea of maize per adult per year. This would amount to some 200 kg/yr or 547 g/day. That would provide a diet of 2030 cal/day as the primary source of dietary energy. However, it could be supplemented with other sources of calories such as dry beans, etc, but not enough to total the 5000 needed for a full day of agriculture field work. Also, wages for agriculture work were quoted in Dedza at MK 200/day (US$ 1.44) without lunch. This would allow the purchase of somewhat more calories than mentioned above. Finally, the prices quoted are for the open market in Lilongwe. Thus, it is possible that costs could be lower in rural areas and people would have access to subsistence stocks that might provide additional food although this needs to be carefully evaluated. The four bags of 50 kg each per person is very consistent with the Millennium Village project with allocates 1.1 tons of maize per family of 5.7 people[2]. This amounts to193 kg/per/yr or 529 g/day with provides 1930 cal/per/day or about 5% less than stated by the farmers which is neither significant nor substantial difference.

Drudgery Relief

The results of this is that in a manual agriculture society such as Malawi there is just too much drudgery in the system to balance out the available dietary calories with the calories being exerted. This is a marked difference with the basic premise upon which rural development has been based over the past 40 years. The basic premise put forth 40 years ago as hypothesis but without any research evaluation, is that farmers were deliberately spreading out their basic crop establishment in a strategy of risk aversion. As usual and mentioned above the assumption was that labor was in ample or surplus supply. However, if the diet was limited and the people seen loafing around the village in the afternoon were really hungry and exhausted instead of lazy in need of motivation the basic premise is completely reversed and farmers are actually mandatory risk takers, with their very survival dependent upon it. In reality they are **maxed out** to the limit their available labor and caloric energy will allow, and the limited calories has resulted in the substantial, usually eight weeks or more, spread in crop establishment, the observation of which is the bases for the contention of smallholders being risk averse.

The solution is programs that substantially reduce drudgery which immediately implies some endorsement of mechanization. This is most likely the underlying reason for the success of the green revolution in rice producing Asia, as concurrent with the development of high yielding varieties and related technology farmers, at their own expense, shifted from animal power mostly with water buffalo to power tillers. This halved the crop establishment time and with the rice

[2] http://www.pnas.org/content/104/43/16775.full.pdf+html

production under control allowed a near spontaneous diversification to different value chains including high value enterprises such as aquaculture with poultry suspended above (Fig. 2).

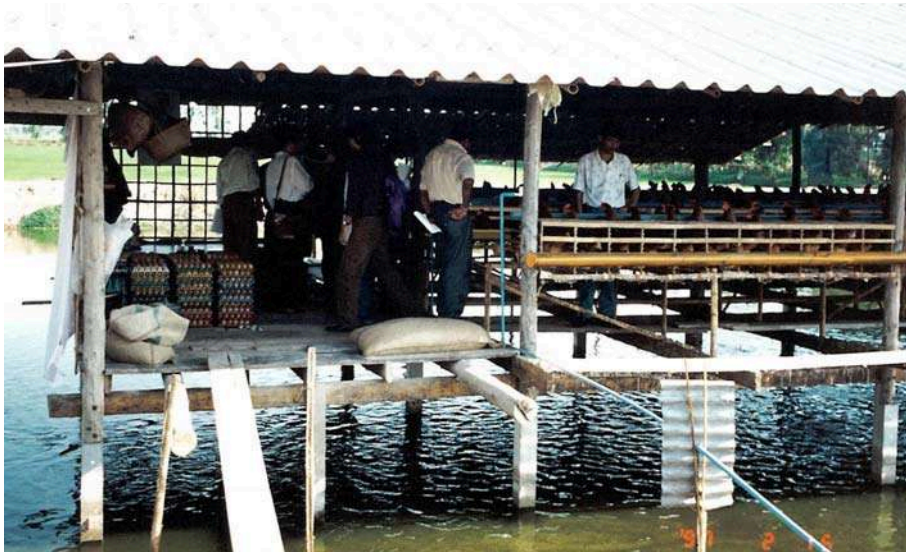


Fig. 2. Value Chain of Poultry over Fish made possible by converting from animal power to power tiller in Thailand.

However, smallholder maize producers in Africa cannot afford to purchase tractor nor does their holding justify individual ownership of tractors. The key is to **access** to individually owned private tractors for contract tillage. It is very difficult to perceive how Africa can make substantial progress with value chain cash crops without following the example of Asia and remove substantial amounts of the drudgery from the manual agrarian system. Thus one aspect of value chain implementation might be enhancing access to mechanization or other means of enhancing the resources smallholders have to manage their lands.

Unfortunately, the development community is reluctant to endorse mechanization for smallholder communities claiming they cannot manage the maintenance of the machinery. This is very inconsistent with field observation in which contract mechanization is moving into smallholder communities, but again self-financed as occurred in Madibira, Tanzania (Fig. 3)[3]. Even in Malawi a smallholder farmers in Mchinji are able to quote the prevailing rate of MK 6,000/ha (US$ 43.50) for land preparation. In Zambia, Tanzania and Uganda it is also possible to get quotes for contract land preparation. It **is very difficult for this writer to see how value chain enterprises can make substantial contributions to poverty alleviation until the drudgery is sufficiently addressed to reduce the overall crop establishment time** so the value chain crop will have optimal yield potential, or addition land can be cultivated in a timely manner so the value chain crop is not substituting for an already produced crop.

[3] http://lamar.colostate.edu/~rtinsley/Madibira.htm



Fig. 3. One of Several Private Tractors Recently Acquired by Individuals in Madibira, Tanzania for contracting to smallholder along with trailer for hauling goods.

Perhaps the most effective development project to promote crop based value chain enterprise would be to acquire old 65 hp tractors in the US, disassemble them for shipment to Malawi, obtain a reconditioning kit to recondition them upon arrival, containerize them three per 40 ft containers, ship them to Malawi, recondition them upon arrival, and market them to individuals within smallholder villages. The estimated final sales price in Malawi would be $12,000 to $15,000 per unit. This is a cost deemed reasonable in Uganda by the author's host on a previous FtF assignment. Microfinance projects could assist community members to acquire the tractors.

Business Efficiency

The other major aspect of the consumer price comparison is that it implies a tremendous efficiency in the private sector business model that will be difficult to compete with. With most of the locally produced consumer goods being produced and marketed at a fraction of the US costs while the fuel cost, which are a major marketing consumable, are double the US prices, there has to be a high element of cost cutting business efficiency. True some of the reduced cost can be attributed to low wages, but these low wages are also contributing to the dietary energy imbalance. The low wages most likely do not fully account for the reduced consumer costs. It could easily represent an economic environment that is curtailed by the money available to purchase goods and thus a business model that has a very low profit margin.

If this is the case substituting an alternative model such as a cooperative in an attempt to provide better returns to the producers will have to be extremely careful in keeping the overhead costs down or the envisioned financial competitive advantage could quickly disappear. In addition the

consignment marketing with delayed payment could be considered considerable inconvenient the highly cash conscious smallholders. These two concerns usually combine and result in the majority of commodities being side sold to the private traders, and this being a reasonable and astute business decision by the smallholder producers. Meanwhile, those promoting a cooperative business model as part of development projects often resort to deceptive, if not outright dishonest reporting practices. The most common mechanism is to overlook the overhead cost of operating the cooperative, which typically are around 30%.

Value Chain Concept

The idea of looking at value chain for cash crops in smallholder communities is to look at the full linkage between the production of an agriculture enterprise such as soybeans and the final consumer utilizing the goods produced. It often involves what are expected to be high value crops that are often quality sensitive crops requiring extra care to obtain the quality or critically timed marketing opportunity. This is usually something smallholders have difficulty obtaining and high value does not always result in high profits[4]. It can easily result in high discards. Also, a value chain projects tends to imply more an introduction of a crop or other farm enterprise not being produced in a community, rather than facilitating an already well crop established and responding to the normal fluctuation in agriculture production caused by variability in rainfall or other climatic variables and acreage planted as farmers try to guess what crop will bring them the best return each year. When a value chain project does become involved in a well established value chain enterprise it can be difficult to separate the project's contribution from any spontaneous response by the smallholder farmers to normal variation in rainfall or other climatic variable or estimations of what crop will give the best return for a given year and an acreage adjustment accordingly.

Value chains do address the most essential determinant of what farmers will produce within the crops or other farm enterprises that are possible within the physical environment. This is the market structure. Once any subsistence needs are met the marketing system controls what farmers emphasize. The key to this marketing link are the often the village based family enterprises such as CNFA's network of agrodealers, who provide the producers with inputs and purchase their produce and then forward the produce down the value chain to the processor or consumers, etc. These village based family enterprises deal with the smallholder producers, who are usually also their neighbors and friends, as the individual private entrepreneurs they are, and avoid trying to convert them to community farmers as with an imposed cooperative business model. Also, given the overall economic environment mentioned above, these local business service providers, with their low overhead costs and razor thin profit margins, usually provide the producers the financially best deal available. Since they also deal strictly in cash, it could also be the most convenient.

[4] http://lamar.colostate.edu/~rtinsley/HighValued.htm

For the purpose of this analysis the emphasis will be on the producer and the agrodealers as the processors and consumer are well defined, well established, and need little additional facilitation once a link between agrodealers and processors are established. Once disposed of and payment received, most producers have little, if any, interest in what happens to the crop. Trying to extent that interest up the value chain with hope of getting additional returns, usually incurs more overhead costs than benefits to the producers. This is particular true for the major agri-industry companies in Malawi often with regional connections. These would include RAB Industries, Export Trading, Farmers' World, Trans Global, etc.

Value Chain Enterprise as Part of Whole Farming System

One of the concerns with value chains as currently envisioned is that they, like most research and extension programs, tend to concentrate on an individual crop or animal enterprises and overlook that, from the producers perspective, the value chain enterprise is one of several enterprises they are involved with. The overall objective of the farmers is usually not to maximize returns to any one particular enterprise such as soybeans, but to maximize returns to all farm enterprises. The result is farmers have to allocate their limited labor and other operational resources where they will provide the greatest return each day. Thus they will reduce the management level on some enterprises to increase the management of others. This would include what order the value chain crops will be planted relative to the other crops, including the critical subsistence food security crops, which for Malawi would usually be maize. Thus a reasonable amount of time needs to be allocated to the higher priority crops before expecting farmers to turn attention to the value chain crop. For soybeans in Malawi higher priority crops may include maize, and groundnuts before soybeans. Thus once the season begins farmers might not start working with soybeans for a month or more while they get their maize and other crops established. Also, any effort to enhance the resources the farmers have to manage their land, such improved access to contract tillage, has to be done on a whole farm basis, since expediting any enterprise will ultimately expedite the intended value chain enterprise. Along this line has to be a concern for casual labor. This is often derived from other farmers and, while there may be many reasons for farmers to opt to do a day of casual labor, for cash or kind, it has to be at the expense of their own garden. From the community and development effort perspective this is like *"robbing Peter to pay Paul"* as the development effort has to look beyond any cooperating individual for a more community outlook and needs to show economic improvement through the community. When casual labor is derived from other farmers, at the expense of their gardens, it can represent a zero sum effort or possible a negative effort for the total community productivity perspective.

Finally unless there is a major effort to enhance the operational resources available to the farmers to expand their cropped area, for which land appears to be available, the introduction of a value chain crop or other enterprise can only be seen as a substitution for crops produced by the farmer. Thus the net gain for the value chain has to be the value of the value chain crop minus

the value of the crop it is replacing. To overlook this substitution and credit the total returns of the value chain enterprise would be a major misrepresentation of the impact of the value chain enterprise. Care also has to be taken that the crop being replaced is not the main subsistence crop as the risk taken for the value chain crop could be the food security of the cooperating farmers. For soybeans in Malawi the crop being replaced is most likely either maize, the primary staple crop for Malawi, or groundnuts, another legume crop that has a higher potential for village consumption and village based cottage industries such as oil extraction. Groundnuts may also be an easier crop to cultivate because of promiscuous rhizobium inoculation with native rhizobium. The MOA expects the groundnuts will be the primary replaced crop, but this needs to be confirmed.

In addition, the current marketing system may be consolidating several crops such as maize, soybeans, and groundnuts into a single purchasing effort. The value chain program needs to follow this example to compete effectively with the alternative marketing opportunities or the value chain could quickly become non-competitive. Perhaps it might be better to define the soybean value chain as soybean and related enterprises.

Soybean Value Chain

Soybean – The Crop

As a crop soybeans can be an important component of a farming system, particularly as a cash crop. While there can be some domestic or village based uses for soybeans as tofu and soymilk, and this may be common in Asia, in Africa it will most likely be primarily a cash crop flowing into the agri-industry complex. There may be some local used of the maize – soy blend for breakfast porridge, it most likely will remain a very minor component of soybeans usage. However, there is a substantial demand for soybean for the direct consumption in infant and baby formula and for nutrition relief programs operated by different NGOs working with hospitals, orphanages, and refugee relief efforts. However, the major demand may continue in what appear an expanding confined animal industry, particular small scale poultry, and perhaps small scale dairy operations.

Soybeans also represent a crop that is not perishable and with little apparent quality concerns, which makes for an easily managed value chain, but with limited value added opportunities. Some concern has been expressed on too small a bean for one of the promiscuous lines, but that is the only quality concern. For the most part from the processors perspective any old soybean will do. Soybeans are also self-pollinated so seed can be retained at the farm or village level with little if any genetic deterioration for several generations, which appears to be the case in Malawi. Soybeans are a leguminous crop that can fix nitrogen. However, the nitrogen fixing bacteria (*Rhizobium japonica*) is very specific to soybeans and will not cross inoculate with the

indigenous strains of soil rhizobium that automatically inoculate groundnuts, beans and other commonly produced or wild legumes. Thus soybeans are often produced more as a general grain crop than nitrogen fixing legume crop.

Soybeans appear to have become a fairly well established crop in Malawi as well as other African countries over the past 20 years within both the large scale and smallholder farming communities. It appears that production is reasonable well synchronized with demand, as much as that is possible given annual yield variation attributed to normal annual variation in rainfall and other climatic factors, as well as acreage shifts as farmers try to predict what cash crop will provide the best returns each year and adjust their acreage accordingly. This is noted by the ease with which the large processors can arrange to import soybeans in deficit years or export soybeans in surplus years. Thus, if soybean production is well synchronized with needs, the question becomes how much need is there for a value chain program to facilitate soybean production and linkage to the processors.

In Malawi soybeans are primarily used full fat which raises concern for shelf life of the product before the oil becomes rancid. This was estimated at approximately one month, which is substantially better than rice bran which also contains 20% oil, but can go rancid in a matter of days. Removing fat by extracting the oil in soybean is rather expensive as with only 20% oil, a physical extraction process, which typically leaves 10% oil in the cake, will only recover 50% of the oil. To effectively recover all the oil requires the more expensive hexane extraction process. There was talk 20 years ago about building a hexane extraction plant in Malawi to be shared by the different oil processors, but apparently it has not as yet materialized. Inquiries were made in both Blantyre and Lilongwe but there seemed no immediate interest. Soybean oil is medium quality oil (Table 4), that in the US is largely a by-product of the soybean feed business and often goes into the Bio-Diesel effort. However, in Malawi with so many people on marginal diets, the dietary concerns that push soybean oil into the Bio-Diesel program, would not apply and soybean oil could be a reasonable healthy source of cooking oil.

Soybean Production Issues

There are several issues regarding soybean production that need to be considered in promoting the value chain and what is the status of these concerns.

Breeding: IITA has a soybean breeding program at Chetidze with a full time expatriate breeder. The work is concentrating on developing promiscuous lines of soybeans that will inoculate with the indigenous Rhizobium in the soil. This has been an ongoing research effort for many years that I thought had been dropped as not possible. However, there does seem to be some progress with some lines developed at IITA headquarters in Nigeria. There is one line presumable in use but the seed size appears small so it is not widely used and represents the only quality issue

identified. There are other lines being considered and it is expected to have some available within the next couple years. Some have been advanced to on-farm trials and thus subject to informal release.

Table 4. Comparative Value of Soybean Oil with Other Type of Oil

Type of Oil	Cholesterol, mg/10 ml	Saturated Fat, %	Poly-unsaturated Fat, %	Mono-unsaturated Fat, %
Vegetable Oil				
Soybean Oil	**0**	**15**	**61**	**24**
Sunflower Oil	0	11	69	20
Corn Oil	0	14	61	25
Olive Oil	0	14	9	77
Rice bran	0	18	45	34
Groundnut Oil	0	18	34	48
Cottonseed Oil	0	27	54	19
Palm Oil	0	52	9	39
Coconut Oil	0	92	2	6
Animal Oil				
Lard	13	41	12	47
Beef Tallow	15	52	4	44
Butterfat	36	66	4	30

Source: Meesang, N. 2002. AIT Dissertation

Other breeding concerns are for maturity with emphasis on early maturing that will be a better fit with late planting. However, typical of single commodity researchers the emphasis was on full season soybeans that should be planted with the first rains and the "farmers will need to be instructed to comply with this recommendation". This again highlights the lack of conceptualization on labor availability and other operational resources, and belief that labor is in infinite supply with plenty of dietary energy to accomplish what is needed. It also highlights the narrow vision of researcher to fail to appreciate the full range of farmer enterprises and integrate their research into the multiple farm enterprises.

How practical this is, is uncertain as it implies either mechanical land preparation or dry season land preparation with very hard soils. There is concern with photoperiod sensitivity for the delayed planting. Soybeans are normally very photoperiod sensitive that can be a problem even in the tropics, with only one or two hours of daylight differences between longest and shortest day. It is something that needs to be kept in mine, but may not prove a major concern.

Inoculation and Molybdenum: With the problems of rhizobium specificity it was necessary to see if the soybeans were nodulated and actively fixing nitrogen. There are inoculums for soybeans available in Malawi through Chetidze. These are normally moist inoculums that require refrigeration until used. How effective this is may still be a question. It is often logistical difficult to get viable inoculums that may require refrigeration to the farmers along with the seeds in a timely manner. This could be a place where CNFA's agro-dealers could become

involved in support of smallholder soybean producers. Thus during the limited field visits plants were sampled to check on the nodulation and active fixation. While there were nodules on some plants and couple did show the pinkish color indicative of active fixation, most case the nodules did not appear active. This also applied to one groundnut sample. The problem may be Molybdenum, a micro-nutrient essential for nitrogen fixation. This needs to be looked at, although the legume scientists at Chetidze should be fairly knowledge of the problems.

Seed Viability: Seed viability has long been a problem with soybeans particularly when grown in the hot low altitude tropics. In Thailand soybean germination can dramatically decline to unacceptable low levels within six weeks of harvest. In Thailand there is an extensive informal network of moving seed around the country including between provinces so a seed maintenance crop can be grown during the hot dry season to keep seed viable. However, discussions in Malawi indicate that this has not materialized and with the relatively cool off season, the seeds will remain viable during the dry season under ambient conditions at the farm level. Perhaps this is not a problem, but one that needs to be monitored.

Seed Quality and Genetic Identity: Another concern is for seed quality and genetic identity. For a self pollinated crop like soybeans there is little, if any, genetic loss with retaining seed for several generations. This has happened in Malawi with some farmers claiming they purchased seed when the initially planted soybeans 10 or more years ago and have retain it since. Seed companies do not appreciate this, but the logistic of providing certified seed for each farmer each year is a massive undertaking that for self-pollinated crops is difficult to justify. In Thailand the MOA's seed division routinely had available only sufficient soybean seed for $1/6^{th}$ the crop. Rarely would they sell or otherwise distribute all of this. In Colorado less than a third of the wheat acreage is planted with certified seed. Unfortunately, with the long term retention of seed within a village the genetic identity of the variety can be lost and in Malawi it has become lost. This is also true in Thailand where seed is moved about each year to preserve viability until the specific variety is no longer identified. Apparently, from the farmer and processor perspective it is not that important.

As new varieties are introduced from the breeding program, maintaining genetic identity can be important. Thus as varieties are introduced, even as part of an on-farm verification or demonstration program, it is important to make certain the variety is clearly and predominately identified. If it is a good variety and appreciated by the farmers, most likely they will want it clearly identified and be happy to assist with this. Such varieties would be high yielding, large bean, promiscuous lines, or early maturing lines with a noticeable difference in maturity or tolerance to delayed planting. If varieties are introduced that are not sufficiently different from what is already being produced the new variety will simply disappear into the mix.

Genetic Pump: One idea that occurred to me while working an input voucher program in Afghanistan is the concept of a genetic pump. That is annually introducing small quantities, perhaps no more than 10 or 20 kg, of several promising lines into a community for verification, demonstration, and informal distribution. After the crop is harvested the cooperating farmers, in the next season, is free to multiple the seed for sale to his neighbors. This is actually a low risk distribution system as, if the farmers don't really like the variety they will simply market the grain with the rest of their crop and the variety simply disappears. However, if they like it they will quickly multiply the seed and sell it to their neighbor, while keeping close taps on the variety identity. With the 40 to 1 multiplication ratio for soybeans, 10 kg of initial certified seed should provide 400 kg of first generation and 16,000 kg of second generation. The latter should be adequate to blanket most communities. The Ministry is actually working on a similar concept of providing a limited amount of seed to different members of a farmer's association to multiply for their personal use rather than sale within the community. However, if the farmers appreciate it, it will be informally multiplied and sold within the community for seed.

Crop Management: While most of the soybean crop, particularly on large farms, will be managed as a monoculture planted in a garden sequence after maize, or perhaps maize and groundnuts, some of it will likely be intercropped. Two intercropping combination were observed. The first was with groundnuts. This is actually a very good combination as it has a taller short maturity crop such as soybeans being grown with a shorter longer maturing crop such as groundnut. This allows the taller early maturing crop to have the full canopy and full access to solar radiation when it needs it most. It is then removed so the longer term crop has the full advantage. Such combination will give the highest land equivalent ratio (LER), perhaps as high as 1.25, it would take 1.25 ha of monoculture to produce the same amount as was produced with a 1.0 ha intercrop. The other intercrop was a soybean maize combination. This is much more casually managed as it involves a tall long season crop with a shorter earlier maturing crop in the shaded lower canopy. This will never yield much and farmer will not put a lot of effort into the combination. Most likely these are late planted maize fields with limited yield potential and reasonable open canopy that the farmer added the soybeans to get what he could with little if any extra effort. In both cases the farmers should be allowed to continue as there is no harm and some return from both practices.

Land Preparation: Traditional land preparation has been initiated with the first rains. However, there has also been a long standing promotion to do this during the dry season. I have normally considered this nearly impossible unless the soils were fairly light. Apparently, this practice has caught on and is being used fairly widely. It was mentioned on a couple field visits. However, how extensively it is practiced needs to be more fully evaluated along with the soil types involved.

Partial Budget: An interest was expressed in developing an economic partial budget for soybean production. This was looked at but without complete success. Getting fundamental information of labor costs were difficult with the farmers interviewed. Most of them were too large for an appropriate sample. Also, the large famers were compensating their permanent employees with both cash and kind. The latter was in the form of maize and beans, usually sufficient to feed an entire family. Thus the best guess of labor cost came from the farmer near Dedza who paid casual laborers MK 200/day (US$1.44) for an eight hour day going from 7 am to 4 pm. No lunch was provided. The other estimate was MK 1000 for 17 rows and an expected time requirement of five hours. This does not really make sense and it is expected the value was only MK 100 (US$ 0.72). Thus, I would suggest the MK 200/day would be a reasonable labor cost for an initial partial budget. This would then have to be multiplied by the number of hours required to complete the necessary tasks of producing a crop of soybeans. While it is fairly simple to determine the different activities involved in raising soybeans (Table 5), getting the time required to compete each task is difficult. An effort to obtain values from the internet was made but with incomplete results.

Table 5. Initial Estimate of Partial Budget for Soybean Production (1 ha)

Activity	No. Hr.	No. Day	MK/day	Total (MK)	US$
Manual Land Prep	300	37.5	200	7500	54.37
Hand Planting	172	21.5	200	4300	31.16
Hand weeding (2x)	70 x2	17.5	200	3500	25.36
Hand Harvesting					
Manual Threshing					
Bagging					

Soybeans Demand

There appears a substantial and growing demand for soybeans in Malawi. This is mainly as a cash crop, with very limited village based consumption. Most of the demand is in the confined animal feed operations that appear to be expanding with increase in population and urbanization. This would mostly be the poultry industry with some dairy. There may be a limited demand for cattle or goat feed accompanying any stall feeding program promotions, but most likely cattle and goats will continue to be mostly grazed on communal lands under very casual management. In a labor stressed environment farmers really do not have the time to maintain stall confined animals, particularly during the periods of extensive agronomic field work.

There is also limited demand for direct human consumption of soybeans. This could be partly attributed to the need to heat treat soybeans to remove the trypsin inhibitor enzyme. Most of the demand for adult human consumption is through NGOs looking at enriching maize flour with up to 20% soybean flour. This enriched flour is used for captive audiences such as school lunch programs, hospitals, orphanages and refugees programs. There is a limited amount used directly either by individuals retaining subsistence stocks for making an enriched breakfast porridge, or

purchased in the open market (Fig. 4.). The only estimate of subsistence use was 0.5 bags or 25 kg to go with 4 bags totally 200 kgs of maize. The impression is that the soybean enriched maize nsima does not have as firm a texture as the plan maize nsima, and is meeting resistance as a general substitute for nisma. This limits it use to breakfast. When used for direct consumption the soybeans are roasted for up to 45 minutes prior to grinding and mixing with maize flour. This process overcomes the tyrosine inhibitor.



Fig. 4. Vendor in Lilongwe Market Selling Soybeans Along With Other Beans. Soybeans are in the Center.

It should be noted that relying on NGOs for long term marketing has to be done with caution. NGOs should be considered as only a temporary market associated with different development or relief projects and not as a permanent part of society. Thus, it should be anticipated that NGOs will have a life expectancy of 10 years or less. Thus, while they can be used as an initial market, diversification away from NGOs should be a reasonable priority to assure the continued sustainability of any value chain, soybeans or otherwise.

The other use of soybeans for direct consumption is in infant and baby formula. This is all processed and it the only form of soybeans available in super markets. The biggest user for direct commercial consumption is RAB Processor. This is a local large agro-industry company. It originated in the broad based process consumer food business and then branched out into the animal feed business. Basically this is the opposite of other large agro-industrialists, who are using soybeans primarily in their feed operations after getting started with cream of maize, and needed to dispose of the maize bran. Cream of maize is the high value nisma made by first briefly dipping the maize kernels in water for an initial milling that removes the husk. The dehusked maize is than redried and the bran winnowed out before final milling to make cream of maize flour.

Soybean Procurement

Large Dealers: The actual procurement of soybeans from farm communities appear to be mostly done by the large processors directly and not via contractors or other middle persons. There are basically two models in use. These are:

1. For those companies that maintain retail outlet stores scattered throughout the country, the outlet store becomes buying point or a regional center for several temporary buying points. This includes RAB processors with its 63 outlet stores scattered across the country under the name Kulima Gold Depot (Fig. 5). The outlet store dealt with fertilizer, pesticides, seeds as well as some consumer goods, but mostly in larger quantities then most villagers would like. This would include 25kg bags of wheat flour that might be more suitable for a village bakery then individuals. They also market various building supplies. Farmer's World also maintained several outlet stores across the country.



Fig. 5. A RAB Processing Retail Store in Lumbadzi North of Lilongwe

2. The second model would be for those processors that do not maintain outlet stores. They would rent temporary space in an empty building for the buying season, and post a buyer there to buy commodities (Fig. 6). These would include such organizations as Global Trading and Export Marketing. This is very similar to low overhead model that was explained to me some 20 years ago when I first looked at soybeans in Malawi (Appendix 2), and also saw in Madibira, Tanzania for rice, as well as Dunavent's cotton procurement from smallholders in Zambia (Fig. 7).



Fig. 6. An empty building two doors away from the RAB processing depot shown in previous figure that will be rented by Export Trading during the buying season for purchase of different commodities including soybeans.



Fig. 7. A Temporary Low Overhead Storage Facility Used by Dunavent Cotton Buyer in Zambia. Keeping Operating Costs to a Minimum

These large buyers operations have buying floats of around MK 20,000,000 (US$ 145,000). This is based on what is needed to fill a truck to haul the good to the processing location. When 80% of the float is depleted the buyers call their central office supervisors who arrange for the trucks to come collected the purchased commodities and replace the float. Again this is identical to what was reported 20 years ago.

There were a couple other large dealers, such as CP Feeds, that are completely vertically integrated and do not become extensively involved in the marketing process. They operated some 5000 ha of farm land, producing maize, groundnut and soybean that then flow into their feed industry and on to their poultry or dairy operations. Thus while they have a high demand for soybeans, contributed to the overall acreage committed to soybeans, they produced most of what they needed, directly imported or exported any shortages or surplus, and are ultimately small players in the open soybean procurement effort. Likewise, Mulli Brothers operated with very close links to the government with major contracts for the school lunch program. They had major warehouse facilities outside Lilongwe for holding either inputs or produce. They were also not major contributors to the open market for soybeans.

Small Dealers: While these main processors directly purchase the bulk of the maize, groundnuts and soybeans that are not retained for subsistence use, there are other buyers. They would include some regional processors like Asime Milling in Dedza, LAPE (Lakeside Agro-Processing Enterprise) outside Lilongwe and JJ Enterprise in Lilongwe. Asime was interested in soybean for feed, mostly going to small scale dairy customers with some poultry feed beginning to be made. He drifted into the feed business from the cream of maize business as a means to make use of the maize bran. He procures his soybean directly from growers in and around the Dedza Hills area, where soybeans were introduced to Malawi and have been grown for nearly 20 years. This was mostly brought directly to his processing facility by the growers or someone representing the growers. JJ Enterprises was looking at working with the nutrition programs of the World Food Program and World Vision. The owner had previously worked for Global Trading. LAPE was just getting started and mostly interested in the small scale dairy because the owner had previously worked with Land o' Lakes. These processors found getting involved in procurement was inconvenient and may provide a major opportunity for CNFA's agro-dealers to become involved in representing them to the producers.

In addition to these processor buying directly for their own needs there were some independent buyers buying small amount that eventually would be bulked up and sold to the larger processors. This included some of the CNFA agro-dealers (Fig. 8) one of whom actually rents the part of her building to Kulima Gold Depot. There could be an opportunity for the CNFA agro-dealers to represent some of the larger or perhaps some of the medium sized companies interested in soybean procurement. The end result was that during most of the buying season, farmers could have up to 10 buyers vying to buy their produce. Thus there should be ample competition to assure the farmers get a reasonable deal. There are some price differences between and within dealers. This largely depends on the volume involved, and the need to bulk up small quantities into the standard 50 kg bags. In this case these independent buyer and buying floats would be limited to MK 1,000,000 (US$ 7,250) and insufficient to fill a large 10 ton truck. They then had to sell their purchase commodities to the larger agro-industry or consolidate with

other small buyers to ship the good to the processor. They could also resell directly to consumers in the village, etc.



Fig. 8. Sakata Trading, a CNFA Agro-Dealer, and Small Scale Purchaser of Commodities Who Also Rents Part of Her Building to Kulima Gold, a Major Commodity Dealer for RAB Processors

Marketing Games: Also there are some games being played between buyers, particularly the small buyers, and sellers, with the seller adding additional junk into their bags to make them heavier, and the buyers adjusting springs in their balances to weigh less. These games appear well know and each is aware of the other. Best be called a draw, although at times the buyer may have to clean the produce before marketing it up the value chain, and discount the price paid to cover the cleaning cost. This was similar to what was observed in Madibira, Tanzania for rice and with particular concern for in-kind loan repayments. The expectation of substantial amount of junk within a bag of grain could be a major reason the informal credit seasonal interest rates are quoted at 100%, but once discounted for the junk discarded could be a relative reasonable interest rate.

Financial Management Strategy: The procurement season seems highly prolonged for a single season rainfed climate. The procurement will begin in May and continue to January. With a single crop the expectation would be that the main harvest for maize, groundnuts and soybeans would begin in May and extend no further than early July. Even allowing for manual shelling of maize and groundnuts, and manual beating threshing of soybean, plus sun drying and bulking into the standard 50kg bags, the entire harvest should be available for marketing no later than late August. Thus, why does the procurement extent to January? The best explanation is that farmers are holding their crops off the market and storing them in their home assuming the risk for any post season losses. Assuming no moisture problems, typically grains like maize, rice and

soybeans can be held for up to three months or three generations of grain weevils, before the infestation become sufficiently noticeable to down grade the grain. Even than for reasonable small lots typical of what a smallholder would be retaining it is possible to chase the weevils away by laying the grain out in winnowing baskets, allow the sun to warm the grain. This will make the weevils sufficiently uncomfortable they will run under the basket so the grain can be rebagged weevils free.

The retaining of grain in kind could be waiting for seasonal adjustments for a better price, a hedge against inflation or perhaps a deliberate financial strategy in which it is better to hold you assets in kind rather than monetize them. If held in kind it would reduce the temptation for husband to grab some and head to the bar for some refreshment and perhaps some companionship, or prevent teenage daughter from grabbing a little to get her hair done, etc. There was a distinct gender difference in selling of commodities. The men would more likely bring in whole 50 kg bags for sale. Women were more incline to bring in small quantities in the order of 10 to 15 kg for marketing. This would imply they were selling commodities to meet immediate cash needs on a daily or weekly basis. Perhaps this should be referred to as the proverbial strategy with appropriate proverb being *"Lead me not into temptation"*. This whole strategy would go against any development project cooperative idea of consigning produce to the cooperative for bulking into a large enough volume to get a volume bonus on the sale, but using a consignment sale with three or more weeks delay in the grower receiving his payments. This is consistent with Madibira, Tanzania where farmers would retain their rice harvest often consuming half the floor space in their homes (Fig. 9). At the time the thought was for whole bag sales, but it could have been for smaller amounts. The importance of this financial management strategy could be an assignment for future FtF volunteer to detail.



Fig. 9. Rice (100 kg/bag) Being Stored in a Villagers Home in Madibira, Tanzania.

Market Information: A couple inquiries were made to determine what the market information system was on soybeans and other commodities in the age of cell phones that reach to at least the village level if not some of the smallholder producers (Fig 10). It was known that the big dealers were in contact with market conditions throughout Malawi and the region, but it was not possible to determine how the small dealers were getting information. It is possible that the information is largely one-sided in favor of the large buyers, but within the overall economic environment in which private sector profits are razor thin this could still represents a reasonable equitable distribution of information. More complete evaluation of the information system could be a task for a future FtF volunteer. USAID in investing heavily in market information systems on the assumption there is either none or at best a very rudimentary one. However, it might be both rudimentary and effective and USAID effort mostly redundant. Since business cannot operate in an information vacuum, most likely some information system exists.



Fig. 10. Member of rural smallholder community using a cell phone in Zambia

Distance Discounts: With most of the major processing facilities in Blantyre, in the southern part of the country and with diesel prices twice the US price, transportation can be a major marketing cost. The discount in price received for a commodity due to distance is normally borne by the farmer as a discount on what the buyers could pay to compensate for the extra cost, and similarly on extra costs of inputs procured, as well as overall production economics. At present the distance discount is MK 4.00/kg in Lilongwe. This can rapidly translate into MK

2.00/kg for the Ntcheu area, MK 6.00/kg for Kasunga or Mchinji, MK 8.00/kg for Mzuzu and MK 10.00/kg for Karonga. This still represents travel on the tarmac, additional costs would incur for off-tarmac travel, to obtain or distributes goods.

Prospects of Soybean Value Chain

It appears that over the past 20 years soybeans have become a fairly well established crop within the Malawi farming systems that is well synchronized with demand. The question then is does it need additional facilitation or has it reached a point where it is self sustaining and will continue to grow or contract as the need evolves without any major external effort. It would appear this is the case.

Role of CNFA Agro-Dealers

CNFA's network of Agro-Dealers could provide a major input into the advancement of value chain enterprise for soybeans as well as other commodities. The community based family enterprises that encompass the agro-dealers are well located in rural areas where they can serve farmers and other community members as long standing friends and neighbors in what is basically a symbiotic relationship[5]. They will also deal with farmers as the individual entrepreneurs they are, without imposing any artificial organizational structures on the farmers as often is done with well intended development projects working with cooperatives, but often overlooking the cumbersome overhead costs of operating a cooperative that renders cooperative non-competitive with private traders such as the agro-dealers. Thus the agro-dealers will often provide the farmers not only the best financial return but also the most convenient for services provided. In the case of a soybean value chain these agro-dealers could assist with the sale of soybean rhizobium inoculums. CNFA's agro-dealership is similar to the REAP (Rural Enterprise Agro-Business Project) in Zambia that was USAID funded and implemented by CARE. Perhaps CNFA program was developed from the REAP project.

One major contribution for CNFA's agro-dealer network might be to serve as representative for different processors in need of procuring commodities like soybeans, with prospects to expand into maize, groundnuts and perhaps sunflowers, if that value chain is developed. Some of the small and medium size processors expressed an interest in CNFA's agro-dealers undertaking this effort. The larger processors were somewhat more skeptical based on previous experience. The problem is the need to accept a purchasing float from the processor they are representing and appreciate this as a float and not a loan. The difference being that the goods purchased with the float belong to the processor and not the agro-dealer. This has been a problem for large processors trying to work with local agro dealers. CNFA could play a substantial role in making these links. The problem of a purchasing float was the ultimate reason the REAP project finally

[5] http://lamar.colostate.edu/~rtinsley/AssistingSmallholders.htm

collapsed some two years after donor funding ended. However, these dealers were not representing any processors.

CNFA might also look at representing Cheetah in their paprika procurement from smallholder producers. They might provide the farmers a better return than cooperative model used in Zambia that require a volunteer input from GTZ's DED, that is the German version of the US Peace Corps[6]. It might also be similar to the way Amanita procures commodities from smallholder communities via some Middle Eastern agro-dealers also in Zambia.

Finally, with the Malawi government like most governments in developing countries effectively stalled to the point it can barely meet personnel obligation, with very limited operational funds to manage programs[7], the agro-dealers could become a major distributor for extension leaflets and other informational publications. They also have a vested interest in terms of opportunity for selling inputs and purchasing commodities, etc.

Pesticide Safety: One concern did develop regarding the handling of pesticides within the shop. One CNFA dealer showed the typical need to repackage pesticides into packets more in need by their clients (Fig. 11). However, in so doing they were not able to retain the label with all the warning needed to assist in safe handling by clients once purchased. Here again is where CNFA could be a major help in providing photo copies of labels so they can be included with the smaller packages of the pesticides. We very much want to avoid the tragedy that befell the Philippines a few years when some 27 school children died because someone mixed up wheat flour with a pesticide in preparing a snack for sale to school children m (Text Box 1)



Fig. 11. CNFA Agro-Dealer With Unlabeled Pesticide Packages.

[6] http://lamar.colostate.edu/~rtinsley/SMC-RLT-Report.pdf
[7] http://lamar.colostate.edu/~rtinsley/FinanciallyStalled.htm

Box 1. Philippines Poisoned From Cassava Snack Containing Insecticide Instead of Wheat Flour

Twenty seven elementary school children died in the Philippines last week when a local vendor mistook insecticide for wheat flour.

Reynoldo Wycoco, the investigating officer announced that they found a can of insecticide that looked similar to wheat flour at the home of the vendor who sold the cassava snack to the students. Twenty seven students aged 7 to 13 years died and over 100 became sick by eating a cassava snack sold at the entrance to San Jose School at Central Mabini on Bohol Island.

We are investigating this as a possible pesticide poisoning because we found what looked like wheat flour in the vendor's home Mr. Wycoco reported to the Philippine Daily Inquirer. We will shortly be able to identify what the pesticide was. One difficulty we are having in the investigation is that the parents are reluctant to have autopsies performed on their deceased children in fear the autopsies will disfigure the remains. Only the parents of one seven year old victim agreed to the autopsy.

The first time this was reported it was thought the vendor had improperly prepared the cassava and left toxic amount of cyanide in the cassava, or had mixed rat poison with the cassava. Cassava is a common food in the Philippines and other tropical countries where it is used as a substitute for rice.

Rough Literary Translated from Viet Business – News Magazine Vol. 24, 25 March 2005

Future Farmer to Farmer Possibilities

As part of the assignment CNFA requested an indication of future farmer to farmer consultant to support the value chain needs for soybeans and other perspective value chains. The following are submitted for consideration.

1. Undertake a more comprehensive partial budget analysis for soybeans and other crop grown in conjunction with soybeans including the net value of soybeans relative to the crop they replace.

2. More detailed analysis of the dietary energy balance to get details on what the caloric intake is for farmers, how this might impact on the number of hours they can be expected

to work and the level of effort that can be sustained when doing field work. This would again be reflected in the extent of time needed to complete different agronomic task across a farm and community.

3. Similarly, where does the community casual labor force come from? Does this represent other farmers doing casual work for a day at the expense of their own fields and how this might represent a “robbing Peter to pay Paul” scenario as was mentioned in Mchinji in what on a community basis could be s zero sum effort. This would include the reason farmers would undertake a day of casual labor at the expense of their own production, etc.

4. Evaluate the availability for contract tillage among smallholder communities and its impact on overall timing of crop establishment and increasing the yield potential of soybeans or other value chain crop. We were able to get a quote in Mchinji of MK 6000 or US$ 42. I can also get quote for Zambia and Uganda as well as seeing tractors for that purpose in Tanzania. This goes into the means to overcome the dietary calorie imbalance. It also represents the only way a value chain introduction can be expected to compete as something other than a direct substitute for crops currently being produced.

5. What is the strategy for financial management among impoverished smallholder communities and how much of that relies on holding their assets in-kind for as long as possible rather than monetize them. Then marketing only what is needed to meet immediate cash needs on a daily or weekly basis. What is the gender division in this financial management strategy? How does this impact on development cooperatives trying to help farmers by having them consign their crops to the cooperative for bulking and getting a higher price how-be-it with a delay between consignment and payment, typically of three to six weeks?

6. In this age of cell phones that penetrate to the village level, what is the indigenous market information system that allows processor and buyers to quote the price for different commodities including soybeans. In the context of a suppressed economy, as described at the beginning of this report, how one-sided is the information system, but likewise how effective is it in getting the smallholder producers a reasonable fair price.

7. What is the potential for CNFA agro-dealers to be procurement representatives for commodity processors including soybeans but also beans, groundnuts and maize? What would it take to organize this for the mutual benefit of farmer, agro-dealer and processor as well as which processors would be best served between the large and small processors?

8. What are the prospects for developing a value chain project around sunflowers as an oil seed crop? Sunflowers have an agronomic advantage over soybeans in that they are best when planted late, well after the maize and other crops are well established. They are then sufficient ability to extract moisture from the soil taking advantage of late season rains and extending well into the dry season. When planted early they tend to get mildew and other fungus problems. Also, with 40% oil it is possible to physically extract 75% before leaving 10% in the cake. Sunflower oil is good quality oil that Unilever and National oil were considering 20 years ago.

9. What would be the possibility of working with Cheetah, who office and warehouse is between Lilongwe and Chitedze, to have CNFA's agro-dealer network become the buying point for Cheetah's paprika, effectively replacing the out-grower schemes using the cooperative model and requiring volunteer assistance from the German DED, their Peace Corps program.

Appendix

Activity Log and Notes
Linking Smallholder Soyabean Producers To Potential Markets
Incorporating Soyabeans in the Farming Systems of Malawi

CNFA – Soybean Value Chain

Activity Log and Notes

Sat., 21 Feb.	Departed Fort Collins, 12:30
Sun, 22 Feb.	In transit all day
Mon, 23 Feb.	Arrived in Lilongwe, 13:30, checked into Cluny Lodge
Tues, 24 Feb.	Briefing by CNFA staff covering both administrative and technical concerns. Briefing was conducted by Emanuel Nasasara & Quirino Dawa. We visited USAID to meet with Mark Viscoky who was well briefed on USAID's expectations. Mentioned considerable problems with side-selling but would not suggest modifying basic business model. Missed meeting with private trader in the afternoon, but did visit open market in Area 2, old town. Collected most of the consumer price data and did the computations in the evening. Missed meeting with Farmers' world.
Wed, 25 Feb.	Visited Cheteze and met with Chris Moyo formerly of Adaptive Research program in Karonga now with IITA. He is working on roots & tubers, but we were joined by the soybean agronomist. We reviewed concerns for integrating soybeans into basic maize cropping system, and concerns for seed viability or rhizobium specificity and prospects for promiscuous soybean lines. We made arrangements to meet with breeder next week. We also meet with Patrick Mviha, former adaptive research posted to Salima, but now in charge of technology transfer. Afternoon, met with Total Land Care headed by Trent Bunderson, but he was not available due to arrival of granddaughter. Trent and I came to Malawi together in 1986 and he has remained ever since. I will contact Trent later for some personal visit time. TLC is an NGO that is an continuation of Trent's agro-forestry effort. They are working on a variety of activities centered around land conservation, with additional concerns for child welfare etc. They pointed out that there was considerable demand for soya products in the refugee effort and NGO promoting better nutrition. These would include World Vision, Save the Children and CARE. They need to be contacted to see what the demand is and where they received the material.
Thu, 26 Feb.	Mostly a travel day to Blantyre with stops to visit a farmer prior to Dedza, the pottery place in Dedza, and a small miller in Dedza. The group of farmers consisted of three farmers only one really was primary speaker. He managed 25 ac of cash rented land. Of these he planted 10 ac to maize, 5 ac to groundnuts and 10 ac. to soybeans in that order. He used hired labor at MK 200/day for 8 hours with no provided lunch. He was using retained seed that he had retained since he first cultivated soybeans some 5 years back. The soybeans were marketed through Export Traders

via local temporary buying points. This was very similar to what was reported to me 20 years ago and repeated in Tanzania and Zambia. Visited one field and it looked good. Also observed some groundnut soybean intercropping that looked promising as soybeans is the taller but shorter seasoned crop while groundnuts is the shorter longer seasoned crop. Also, there was some maize soybean intercropping but it looked very casual and thus low yielding. The farmer did give an estimate of home consumption of soybean as"breakfast" porridge. He claimed to consume about three 50kg bags of maize a year and some 0.5 bags of soybeans. The maize would amount to diet of some 2000 cal./day. Second stop in Dedza Hills was Asumi Mills and owner Mr. P. Kamela. This was a small mill with a capacity of 8.5 t/day of cream of maize flour. The bran then became a means of getting into the feed business with an emphasis of dairy calf mesh. This was a mixture of 76% maize brand, 20% soybean, 2% salt, 2% limestone. This was mostly a manual operation. The soybeans were cooked for 45 minutes prior to being ground and included in the feed. This was full fat and had an estimated shelf life of a couple weeks. He bought most of his soybean from local farmers delivered to the door although he did make some collections. He did not use any commodity dealers.

Fri. 27 Feb. In Blantyre for meeting with some of the large processors. First visit was RAB processors. This is a big local food processor dealing mostly with consumer goods that I originally met with 20 years ago in my initial evaluation of soybeans. They use soybean in their baby formula and include a maize soybean mix for breakfast porridge that is intended for both children and adults. They had a requirement of some 6,000 tons/yr that they purchased directly from farmers via temporary purchasing agents mentioned by the farmer dealing with Export Trading. They preferred to do this directly rather than via commodity dealer. They were also purchasing all commodities they needed. They did not seem to be interested in contract farming. They maintained some 63 trading outlets distributed through the country. These were a combination of input supplier and commodity purchasers. They handled most of the commodities including soybean they needed. They claimed to be dealing with commodities in general, but only on a small scale for surplus or deficit in their own stock. They would export or import soybean depending on international market and supplies. But mostly it was internal.

The second visit was Global Trading. It was another large commodity processing operation in Blantyre. Very much in the similar mode except

they did not have permanent outlet shops that RAB had. They also produced cream of maize and used the brand to go into the feed business. They were looking at some 40 t/mo. They complained of difficulty getting sufficient supply in the South and the high cost of transporting claiming it was some MK4000/t to move material from Lilongwe to Blantyre over the highway with additional costs for off tarmac. With diesel prices twice the US price this is not surprising.

Sat. 28 Feb — This was mostly a travel day returning to Lilongwe. However, I was hoping to visit the Millennium Village site at Mwandama near Zomba, which we basically drove by. Having email the Millennium Village project headquarter prior to coming to Malawi and mentioning my interest to CNFA prior to coming I was disappointed arrangements could not be made. Given the webpage is now approaching 2 years without revision, the failure to respond to my email inquiry, the complete discouragement in visiting and lack of road sign on the main highway, one can only get very suspicious that something is just not right.

There was a planned visit to C-FISH. This is a newly created NGO sponsored by USAID and implemented by CONCERN International out of San Diego. They are interested in promoting smallholder fish pond cultivation using local tilapia. They have been in existence for about a year. They have a long ways to go. However, they are in contact with World Fish, the CGIAR center of aquaculture. They might also contact AIT in Bangkok who has an excellent program on aquaculture aimed at smallholders and offer a MSc degree which USAID should find acceptable as USAID was one of the original founders of AIT. They are anticipating some demand for Soybean in their feed, but it is too early to estimate how much and when the demand will materialize. They did mention there is one large aquaculture project in country. It is MALDCO owned by Press Holdings and thus owned in proxy by the government. I would suspect it operations are more like ADMARC than a successful business. C-FISH did have a soybean consultant recently and we have requested her report.

Sun. 1 Mar — Day off and opportunity to return to St. Peters for services

Mon. 2 Mar — Back to work with three visits. First was a return to Chitedez to meet with the IITA soybean breeder Dr. Hailu Tefera from Ethiopia. He updated us on the progress with promiscuous soybeans and the prospects appear better than expected with several lines available some with good seed size. He was emphasizing full season soybeans with the expectation they could be planted with the initial rains. This is most likely unrealistic as farmers will most likely concentrate on maize cultivation for at least

	the first month. He was concerned the delay would bring some photoperiod sensitivity into play and the crop would flower prematurely. Even in the tropics this can be a problem. I hope they can make an adjustment other the teaching the farmers to plant early. The second visit was with JJ Enterprise and John J Banda. This was a start-up company that was just getting into the agriculture commodity trading business. It was expected to mostly supply some of the NGOs with major nutrition programs, for orphans, hospitals, refugees, etc. It is a good means to start a business but NGO are usually a temporary operations and not long term. He was still working out the details of his procurement and input distribution system but looks like he will keep it simple. We wish him good luck and will keep in touch. Returning from JJ Enterprise stopped at the market to get some photos of the soybeans in the market. Also, we interviewed a merchant who mentioned that she would collect 5 kg of several grain beans including soybean from Dedza and bring them to Lilongwe on the top of a mini-bus. She would then mark them up something like 300% from MK 350 to MK 1000 for retail sales. She hopes to gross about MK 6000 per day to support a family of 8 plus 2 orphans for a total of 10 people. The last visit was with CP Feeds. This was part of an integrated self-contained value chain starting with 5000 ha of cultivated land in Kasunga, proceeding with a feed processing effort, to a major poultry program involving 1,000,000 broilers as well and good layer business, and continuing to a dairy operation. This was virtually all self-contained with the bulk of the needs being met by their own production and only limited and emergency supplies being purchased or sold outside the organization. They did mention a preference for fish meal both because of the high protein content and amino acid balance. This was very impressive, but not really relevant to our needs.
Tue. 3 Mar	Martyrs Day Holiday, remained in Guest House
Wed 4 Mar	Mostly around the office met with Roland to discuss Monitoring and Evaluation. Not really my specialty did what I could. Felt a little blind-sided. In the afternoon met with group to look at value chain as a whole. Needs some works.
Thur 5 Mar.	Again a busted day around the office so I glanced through the value chain methodology text sent. Not really impressed seem to overcomplicate intuitive analysis. Also, more concern with social issues than pure business. This could easily render value chains non-competitive. The text did not really look at indigenous value chain as the starting point.

Fri. 6 Mar	Morning visit to LAPE – Lakeshore Agriculture Processing Enterprise. This was mostly a small scale oil extraction company seeking mostly the cake for animal feed. The owner was a former Land O Lakes employee. They were extruding sunflower, cotton seed, and soybean. They were shying away from groundnuts because of shelf live problems. Apparently, sunflower, cotton and soybean could be kept for a month after processing before becoming rancid while groundnut could be kept only two weeks. He also noted the heat generated during expelling would be sufficient to fix most of the cake for the expected shelf life. We had a good discussion on the animal business particularly small scale dairy. Commodity procurement was a problem as he had to do it himself and would look forward to CNFA facilitating links to agro-dealers capable of procuring the commodity. He had confident in CNFA's dealers and would trust them with sufficient procurement floats to make the purchases. Afternoon visit was to Mulli Brothers. This is a large commodity procuring company with very good ties to the government and was dealing mostly in government contracts for maize soybean blend to be used in the school lunch program. It looked totally independent and not really what we should get involved with. They did have amble warehouse space with a capacity of 3000 ton. Currently the warehouse was full of fertilizer designed for tobacco but could be used for other crops.
Sat. 7 Mar.	Day off at guest lodge working on reports, etc.
Sun, 8 Mar	Day off attended services at St. Peter's had lunch with Lien Le, old Vietnamese friend from previous time in Malawi.
Mon. 9 Mar	Morning in office working on report. Afternoon visited the MOA Crops Division to talk with S.L. Khosa, head of the division on soybean production. He mentioned there was an estimated 75,000 ha of soybeans in production this year. Also, mentioned that this soybean was substituting for groundnuts and cowpea instead of maize. He also mentioned that the government was subsidizing soybean by providing limited amounts of seed to farmer groups to for seed increase and distribution within their communities. Also mentioned was that all ADDs were provide two tractors for contact to farmers. As public sector tractors they will most likely only last 3000 hours instead of the intended 10,000 and will only be sufficient to serve special individuals instead of general smallholder populations, Second meeting was with World Vision and former colleague from Chitedze. They mention their needs for soybean to mix into a fortified maize meal for distribution to school, orphanages, hospitals and refugee

centers. They had three areas they were working. They produces some maize and soybean but also procured through dealers such as JJ Enterprise. They also had their own roasting, grinding and blending facilities at their primary locations. Request they supply some material to sample and they promised to do so. I had dinner with Claudio and family.

Tue. 10 Mar. Morning meeting with Pickford Sibale the former Coordinator for legumes, fibers and oilseed and the individual who originally got me involved with soybeans 20 years ago. Good visit and catch-up on former colleagues. He is now working with a DIFD funded NGO named Research Into Use that tries to get research sitting on the shelf and facilitate it adoption. One of his interests is soybeans. However, the program looks like a lot of administrative bureaucracy and facilitated meeting yet still overlooking if the farmers have the means to utilize the research information even if it was well communicated to them. We need to keep in touch. Lunch was with Lien and family but delayed return. Afternoon visited Janet Matemba one of CNFA's agro-dealers under the name Sakata Trading on the road to Kasunga. It was an interesting visit. She is dealing with both providing inputs and small scale procurement of maize. She does not have sufficient float to make major purchases. Most of her clients are women marking small amounts that she bulks up for sale to major processors. Her self-financed float is around MK 1,000,000 compared with RAB float of MK 20,000,000. She did indicate an interesting potential financial management strategy for impoverished smallholders. That is keeping their assets in kind rather than cash and monetizing them when necessary to meet immediate cash needs. This avoids the temptation of spending and possible miss use. It also makes consignment sales such as through a cooperative or other farmer organization with a delayed payment highly inconvenient. It was also noted that one the buying season started there could be a number of buyers in the area. Kulima Gold Deposit the RAB outlet network was immediately next door, and a couple building away was an empty building usually rented by Trans Global for their purchaser. We did visit a very progressive farmer who doubled up as minister, but he was not growing soybeans.

Wed. 11 Mar Planned on day in office and lunch with Trent Bunderson but had opportunity to visit some farmers near Bunda. This was interesting. It was basically an estate run by someone who originally came to Malawi 12 years ago with Concern International. There were several soybean fields some under consolidate management of the owner, some under association management and some under individual smallholder

management. Sounded like a conceptual mess. Did look at several fields and checked for nodulation and fixation. First field and groundnut field showed nodulation but no active fixation. Second field was nodulation with desired pink color indicating active fixation. Generally the crop looked medium to reasonable production. During a small delay did have an opportunity to look at some used drip or micro sprinkler irrigation lines, some vegetable nurseries and some women compressing paprika. These we were able to interview. They received MK 5000/month for working on the estate. They also managed some 6 ac on their own. It took them some 2.5 months to establish their crops mostly because they could only work one hour per day after completing the estate work. On days off they could work more on their gardens but this was only 3 hours. Estimated calorie consumption was 4 bags of maize or 200 kg. This would amount to 550 g/day and a diet of only 2000 calories from maize plus whatever other calorie source they might have.

Thur. 12 Mar. Only one visit scheduled with Export Trading. This is a major regional commodity trader and processor. They purchase maize and soybean for making the fortified porridge with a 35 – 65 mix. That is 15% more soya then other mixes. They marketed the blend strictly to NGOs such as the World Food Program and GTZ for use in nutrition programs, thus a captured audience. The impression is people really don't like the blend and most of it goes to the artificial, temporary nutrition programs rather than open market. The exception is RAB processors who make a baby formula and infant food. They used the same basic procurement procedure with branch office and extra buying point during the buying season starting in April and extending to January. We suggested the work through some of CNFA agrodealers. They were interested but had problems in the past with side selling to other dealers and keeping the float. This could be an opportunity for CNFA to facilitate a better more reliable contract, etc. Export Trading tended to look at the commodity market regionally with cross border procurement and sales according to local market conditions, and recognizing that border controls could be very easily circumvented, as I have experienced on a few occasions in the past.

Fri. 13 Mar. This was intended as a major field trip to meet with farmers. However, it might be some question if the farmers and means of meeting them was most effective. The first farmer was actually a large tobacco farmer with some 100 employees that he provided a salary MK 2500 plus one sack of maize and access to one acre of land. He was farming with his brother who lived in the city but managed part of the land including the soybean

fields. He had about five acres in soybean. This was planted after maize and tobacco, but he owned a MF 390 tractor for his basic land cultivation, etc. We checked for nodules found a few but inactive.
The second farmer was similar to the first in that he was a large farmer with over 100 ac. He was farming maize and soybean, but had intended to also grow groundnuts. He had hoped to rent a tractor for MK 60,000/ha. (US$ 428.00). That is a bit high, would have expected rates of MK 6000 or US$ 42.00. Instead he did everything with hired labor either full time or casual. The casual labor was assigned piecemeal tasks of 17 rows a day for MK 1000. The expectation was a 5 hour work day from 6 to 11 in the morning. Full time workers were provided MK 2500/month plus maize and beans. With manual labor he had one month delay between his maize and soybean planting. That sound about right for manual operations. He claimed to purchase seed but of unknown variety.
The third visit was actually a group meeting arrange via the RAB Kulima Gold Depots. The meeting was in town rather than the field and attended by some 30 people including 5 women. Sorry, but I have problems with group interviews and don't trust the information collected. However, from what best could be determined they had been growing soybeans for some 10 year. They were using retain seed with no problems of germination or seed viability through the off season. They had also lost tract of any variety, if they ever knew it. They were also growing maize and groundnuts being planted in the sequence of maize, groundnuts, before soybeans. However, they claimed little delay as they did their basic land preparation during the dry season over a 3 month period. I am somewhat surprised at this. I know it has been widely promoted for years but did not think it could be widely accepted as working dry hard soils takes considerable extra energy. I hear them but need some additional confirmation.

Sat. 14 Mar	Remained in hotel working on report
Sun. 15 Mar	Attended St. Peters for last time and remained at the hotel working on report
Mon. 16 Mar.	Presented final seminar and related completion work
Tue. 17 Mar	Departed Malawi for Colorado and home
Wed. 18 Mar	Arrived in Fort Collins
	End of log

Linking Smallholder Soyabean Producers To Potential Markets

By

R.L. Tinsley [8]

Introduction

For soyabeans to become recognized as major and important crop in Malawi, it will have to become a viable cash crop. With the current means of determining agricultural production, it is only those crops handled by ADMARC that are counted, subsistence crops are not really part of production tabulations. Thus, for soyabeans to become viable, a market demand must be determined and the linkages between the demand and the farmer producers established. For this reason when the Soyabean Production Project was originally conceived, the first thing done was to determine the market potential, and how farmers could be connected to the market. This paper is largely a report of those initial meetings and the subsequent follow-up discussions.

Soyabean Demand

Last April the soyabean production team visited Blantyre and met with Grain & Milling, KK Millers, RAB Processors, National Oil, Capital Oil, Lever Brothers, and ADMARC. The objective was to determine present and future demand for soyabeans both as a source of protein and edible oil. The results was a major demand for soyabeans from all three millers but no immediate interest by the oil manufactures.

Each of the three milling companies were interested in obtaining 10,000 tons of soyabeans per year. They would use these in their animal feed mixtures as a direct substitute for

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imported fish meal, which has a landed cost of MK 3,000 per ton. Both Grain & Milling and RAB Processors were also interested in soyabeans as part of baby formula. Both currently manufactured baby formula. Grain & Milling's baby formula was under contract to the World Health Organization for use with the refugee programme. RAB Processors baby formula was sold directly to Malawian consumers. In the baby formula the soyabeans would replace groundnuts, and was actually the preferred source of protein. All three of the millers were interested in the whole bean, and were not concerned with the oil content. Their products were moving fast enough to prevent the oil from becoming rancid and spoiling the products. The carbohydrate content of the oil was more important for them then the potential rancidity.

The lack of interest by the oil manufactures in soyabean oil was related to the limited recovery. Soyabeans has about 20% oil. With normal pressing or extruding methods currently used in Malawi for manufacturing oil there is normally about 10% residual oil in the cake. Thus soyabeans would yield only about 10% oil. In contrast groundnuts, sunflower, cotton seed contain between 30 and 40 percent oil which would give a 20 to 30 percent recovery. The efficient recovery of oil from soyabeans requires an solvent extraction process. This is both an expensive and relatively dangerous process. However, there are plans for constructing such a plant that would be jointly operated by the three oil manufacturing companies. It would allow the processing of soyabean oil as well as improve the recovery of oil from other sources. It was estimated that there was enough volume to keep a small plant operating full time.

Against this 30,000 ton demand, last year (1987-88) there was approximately 200 tons produced by General Farming and delivered to Grain & Milling. In addition RAB Processors obtained about 10 tons from Dedza through a private trader, and 200 tons through ADMARC. We were also informed that KK Millers actually milled 1500 tons under contract to a poultry producer near Blantyre. The poultry producer had grown the soyabeans, and recovered the milled product for blending its own feed. The total production was approximately 2000 tons or 6% of the millers current needs.

From this it appears that the 30,000 ton demand is really the bottom figure and could easily expand as production increases. Also the difference between the demand and the production is sufficient to adsorb all anticipated production increases during the next couple years.

Marketing Soyabeans

ADMARC

ADMARC Overview: In any discussion of marketing agricultural commodities, the first organization thought of is ADMARC. ADMARC is a large para-statal corporation with a large bureaucracy that is mandated by the Government to handle all non-perishable agricultural commodities. It is required to retain the same prices throughout the country, maintain buying

points reasonable accessible to the most remote farmers, buy any amount of produce offered, bulk it, transport it to the market, and sell it. It is supposed to do this at a break-even cost. It was originally established as a monopoly in commodity procurement and distribution. Although in the last few years, the monopoly operations have been reduced by encouraging private traders.

As with most para-statal organizations there is no real incentive for managerial efficiency and, like most para-statal organization throughout the developing world, it has proven to be relatively inefficient. The need to break-even while serving remote areas without any incentive for efficiency results in rather high price differentials between the buying and selling price. Last year ADMARC bought soyabeans at 47 t/kg and sold them to processors for MK 825 /ton. ADMARC was charging MK 355 /ton for bulking, storage, and transporting. The result of this high overhead is the farmers receive low prices for commodity and the consumers pay high prices for finished products. This partly contributes to the reason soyabean oil from Argentina can be landed in Malawi, despite the high transport cost from Durban, cheaper than groundnut oil can be manufactured in Malawi from groundnuts grown in Malawi.

Cost Accounting: In a subsequent visit to ADMARC while preparing this paper, I asked for the breakdown of the difference between the buying and selling price of different commodities. I am not certain I followed the reason behind all the different costs, but the breakdown for a ton of soyabeans is in Table 1.

Table 1. Summary of ADMARC Price Differential for Soybeans*

Direct Cost	
Purchase from farmer	$208.90
Direct purchase expense	36.44
Crop factor	1.33
Total Direct Cost	**$246.67**
Indirect Cost	
Depot charges	$22.67
Market charge	30.22
Administrative cost	15.55
Finance cost	8.89
Total Indirect Cost	**77.33**
Total Cost	**$324.00**
Adjustment in total cost**	$337.78
Selling price	**$366.67**
Profit margin	**$28.89**

*Values are per metric ton. The currency is US$ converted from

Malawi Kwacha at 2.25 MK = US$ (1989).
** A fudge factor that was never fully explained

As can be noticed in Table 1 an interesting item not directly included in the accounting is transport cost. I would have expected transport to be a major line item.

Other Responsibilities of ADMARC: In addition to buying and selling produce, ADMARC has several other unofficial functions, for which it does not receive any compensation. These include:

1. Being the primary, if not the sole, source of crop production information for the Government. It is from ADMARC purchases the Government determines if there is sufficient commodity to meet the countries needs, and if not what food imports are required. With the increase in private traders, there is a need to develop a better method of tabulating the agricultural production. I think this could be reasonable easily done with a little thought. Perhaps accounting at the buyers. There is a rather limited number of them, or a combination of buyers and large private traders with substantial storage capacity.

2. Another job ADMARC does is assist the ADD in the collection of credit and possible taxes. As I understand it, extension field assistance will frequently be at ADMARC buying points to collect outstanding credit when farmer offer their produce for sale. ADMARC having originally advanced the farmer inputs on credit has a vested interest in assisting with these credit collections. This could cause some major problems in the future, if commodities like soyabeans are marketed primarily through private traders, and ADMARC suspects it will not receive the produce from which it can deduct the loan, it might become very reluctant to release inputs on credit.

Problems with ADMARC: Despite ADMARC's mandate to buy all non-perishable commodities, it does not always work smoothly. Several problems have been identified by different Adaptive Research Teams at various places in the country and with different crops. These include:

1. Limited Cash Float: Many ADMARC buying points will have only limited cash floats available to buy products. The float could be as low as MK 2000 or MK 4000. When this money runs out the manager must close shop and process for additional funds. The process can take two or three days, or even weeks. Meanwhile farmers have to wait with their goods. The example comes from Nkhotakota cotton buying. In this case the farmer may have had to hire an ox-cart for as much as MK 5-00 per trip to bring his cotton to the buying point, and unless he wants to hire the ox-cart for another roundtrip, he has to

remain at the buying point and sleep on his cotton until the manager obtains the money to buy it.

2. Wrong Receipt Book: Apparently in some places ADMARC maintains separate receipt books for each commodity. Thus the farmer my bring a commodity to the buying point and not be able to sell it because the buyer does not have the correct receipt book. The example comes from sunflowers in Jenda.

3. Limited Buying Season: ADMARC has an established initial date for buying maize. It is established as 1 June. However, individual markets may not open until later. In Blantyre the rains normally start earlier then the rest of the country. Farmers usually plant earlier so their crop will matures and be ready for market as early as late March. If they are in need for the cash and ADMARC will not buy maize until at least 1 June, the farmers are forced to sell to private traders. Without the competition from ADMARC the private traders can buy at less then ADMARC prices. We have heard of prices being as low as 1/2 the ADMARC price.

All of these problems have been identified during the three years that I have been in Malawi. I think it is possible to substitute soyabeans for cotton, sunflower, and maize in each of the above cases. In planning for soyabean production, there is a need to have some contingency plans to deal with each of these problems, if they occur.

Private Traders

The alternative to ADMARC are the private commodity traders. Until recently they were restricted to dealing with perishable commodities or other items ADMARC did not deal in. Now they are being encouraged to compete openly with ADMARC. Generally despised and written off as "crooks", "undesirables", etc., most of them are actually ADMARC contract haulers. However, they can be considerable more efficient than ADMARC in collecting and moving commodities from many parts of the country. If effectively regulated they can provide the farmers with a better more reliable marketing system than ADMARC.

Mohamad Hassen: Probably the best know private trader in Malawi is Mohamad Hassen. His operation is headquartered in the Thyolo - Mulanje area with field operations as far as Zomba and Dedza Hills. At one time he operated 20 lorries but now operates only 4 lorries, 2 seven-ton and 2 ten-ton. He had an unhappy experience while diversifying into the bus business. Last June I spend a very pleasant couple hours discussing the private trading business with him.

If the information he provided is correct, his basic operation is to place a "Capital", who is really his accountant representative, and five buyers in an area. The buyers are all located within about 5 km from the Capital. The Capital is provided with a MK 20,000 float. Considerable more than provided to ADMARC buyers. The Capital visits each buyers each day, checks on the product purchased, and provides them additional funds. When his float is reduced to MK 4000, he calls Mohamad. Mohamad sends out the four trucks to pick-up the produce, and replenish the MK 20,000 float. The MK 20,000 essentially buys four full lorry loads of commodities. His four lorries will hold a total of 34 tons of commodities. If he spends the entire MK 20,000 float his average purchase price will be 58 t/kg.

Mohamad deals mostly with maize, beans, pigeonpeas, chickpeas, etc. All the commodities he buys he brings to his home in Mulanje to check the weights and store until marketed. Most of them he sells to the estate owners in the southern region who partly pay their workers in-kind with maize and beans. He also sell to millers such as KK and RAB, and he cooperates with ADMARC in provide export commodities when ADMARC's supply is short. Sometimes he sell directly to a South African exporter. His sales to ADMARC are at more favorable prices than ADMARC offers the farmers. He sells to ADMARC at close to the ADMARC selling price.

Last year for the first time he actually dealt in soyabeans from Dedza Hills. He learned the soyabeans were available, mentioned this to RAB who said they were interested, and offered him a factory landed price of MK 650 per ton. With this commitment he proceeded to buy the soyabeans at 47 t/kg (the same price as ADMARC) transport them from Dedza to Mulanje and back to Blantyre, a distance of approximately 400 km or one third the length of Malawi. His bulking and transport cost were MK 180 per ton in contrast to ADMARC's MK 355 per ton. He was very happy with the arrangement until I informed him RAB and KK Millers had offered us a factory landed price of MK 800 per ton. He then realized he lost MK 1500.

Private Traders Limits: In thinking of private traders it has to be remembered that they are primarily business man interested in making a profit. They do not have an assured salary, or someone to adsorb any losses. They will thus restrict their activities to the easier markets to services and will not venture into the remote areas, or only go to remote areas when readily available markets are accommodated.

Processors Price to Private Traders

The processors such as Grain & Milling, KK Millers and RAB Processors, are mostly interested in having produce delivered to their respective factories in either Blantyre or Lilongwe. They therefore offer private traders a factory landed price. In our meetings last April all three millers indicated a willingness to buy soyabeans for MK 800 per ton. This is just under

the ADMARC price of MK 825 per ton. However, given that the soyabeans are substituting for an imported commodity costing MK 3000 per ton, it is possible to consider soyabean prices of MK 1000 per ton or more. There is no concern over where the soyabeans came from or what the transport cost are. That is something the private trader has to work out. The processors generally would like to receive full lorry loads of goods, although they will accept lesser amounts. A full lorry could be either 7 or 10 tons. However, it does not have to be a full lorry of one commodity. They are happy to receive a lorry of mixed commodities such as 7 tons of maize and 3 tons of soyabeans. They have the warehouse space to separate the bags and store them until needed.

ADMARC The Private Trader Regulator

If we carefully look at Mohamad's private trading in soyabeans, the offers we received from the processors, and the price Mohamad received from RAB Processors, it becomes apparent that ADMARC may be a very effective regulator of the private traders. However, because of ADMARC's high overhead cost, ADMARC could be the private traders best friend, while being the worst enemy of both the farmer and the consuming public. Note the following:

1. Private traders like Mohamad will offered farmers ADMARC's buying price of 47 t /kg for soyabeans, as Mohamad did in Dedza Hills. With no other alternative why buy for more then ADMARC.

2. The processors offered us just under the ADMARC selling price for soyabeans delivered to their factories. They offered us MK 800 per ton compared to ADMARC's MK 825 per ton. As long as the commodity is available, or ADMARC has the main supply there is no reason to go higher.

3. If there is a compromise, it will favor the processors rather then the farmer, as with RAB's offer to Mohamad of only MK 650 per ton when willing to pay as much as MK 800.

We have noted a similar operation in Jenda involving sunflowers. Lever Brothers and a private trader working with them offered farmers 36 t/kg or 1 t/kg over ADMARC's 35 t/kg, and cornered the market. Lever Brothers and their friend removed 1200 tons of sunflower from the Jenda area in contrast to ADMARC's 25 tons. Included in the 1200 tons were uncounted tons of sunflowers grown across the border in Zambia. This reversed the normal flow of sunflowers from Malawi to Zambia. This year the Zambia sunflowers were marketed in Malawi.

I seriously doubt if the 1 t/kg price difference was the main reason the farmers opted for the private traders. I think it also involved the convenience of avoiding some of the problems

mentions earlier in dealing with ADMARC such as limited float, wrong receipt books, loan collections, etc. I also think the official records, if depending on ADMARC, will show a decline in sunflower production in Jenda this year, when in reality there was a large increase, or at least an increase in sunflowers marketed in Malawi.

As I review this data, I would carefully note how the private traders happily and profitable operate just inside the ADMARC buying and selling prices. I would therefore contend that ADMARC is a very effective regulator of private traders. I would further content that ADMARC could raise its buying price by 20 to 30 t/kg for most commodities without lowering its selling price. The private traders could still happily and profitably operate throughout most of the country.

From a theoretically concept, if ADMARC would only dapple in the market at between 10 and 20 percent of the volume, instead of dominate the market, it could provide a viable alternative to private traders, and thus serve as a very cost effective regulator of the private sector while providing a valuable service to the more remote areas. You could probably monitor ADMARC market share as a means of determining how competitive its prices are. If ADMARC's share raises above 20% the price is too high for the private traders to be profitable and unless it is a remote area you would want to consider other crops for the area. Likewise if less then 10% the price is too low and needs to be raised to assure the farmers receive a better return. Finally, I would contend regulating the private sector and accessing the more remote areas is the major role of a government owned para-statal like ADMARC, and a major improvement over some of the large bureaucratic regulatory agencies used in many developed countries to control their private sector. When viewed as regulating agent and remote area operator, a para-statal plays an important and vital role in the economy. I would think the government could easily justify operating subsidies for regulating the private traders and servicing the remote areas. I have felt this was true in other countries, but never had the opportunity to collect data to so clearly illustrate the contention.

Private Trader Range

Using the ADMARC buying selling price differential as the regulating control on the private traders, and assuming most of the private traders cost are associated with transporting the produce from buying point to processor, it is possible to compute the distance or range from the processor's factory the private traders can operate and make a profit. In making the analysis two transport cost are used. These are 35 t/ton/km and 50 t/ton/km. These cost are used because they are the ones mentioned to me by various sources. The 35 t/ton/km is the price ADMARC offers to haulers, while the 50t/ton/km is the open market rate. If we use Mohamad experience with soyabeans in Dedza his profitable bulking and transport returns of MK 180 per ton over the 400 km from Dedza to Mulanje and back to Blantyre his cost amounted to 45 t/ton/km or somewhere

comfortable between the two rates. All of these transport charges are based on roundtrip from the source with the assumption of an empty return. Any back hauling is pure profit. I would suspect that most transporters can arrange back hauling at least 25% of the time. The analysis is in Table 2.

Table 2. Private Traders Estimated Range

Commodity	ADMARC Prices (US$/T)			Transport Range (Km)	
	Buy	**Sell**	**Diff.**	**ADMARC Rate ($0.15/t/km)**	**Open Market Rate ($0.22/t/km)**
				---------- km*----------	
Soybean	209	367	158	1053	718
Sunflower	160	338	178	1171	820
Groundnuts	378	533	155	1000	700
Beans	213	421	208	1137	936
Cowpeas	133	300	167	1074	752

* Differential / Transportation rate

From Table 2 it can be easily seen that private traders could easily collect soyabeans from as far as Mzuzu, if not Karonga, and profitable deliver them to milling companies in Blantyre. The same would be true for most commodities as there is relatively small differences in the ADMARC markup. To look at it somewhat differently, Lever Brothers saving by buying sun-flowers in Jenda and transporting to Blantyre themselves as compared to having ADMARC handle them would be MK 130 per ton at the 50 t/ton/km rate and MK 214 per ton at the 35 t/ton/km rate. This is based on the Jenda being 560 km from Blantyre so that their transport cost would be MK 280 and MK 196 per ton, and the difference in ADMARC buying and selling price being MK 410 per ton. It is note worthy that Jenda is approximately 2/3 the distance from Blantyre to the furthermost point in Malawi, Chitipa.

I seriously doubt if you want it to be profitable to haul goods from the most remote corner of the country all the way to Blantyre. With commodity processing in Lilongwe and perhaps in Mzuzu in the future, I would think the profitability range should really not exceed about 600 km.

Direct Links From Producer to Processor

Since neither ADMARC nor the Private Traders appear willing to give the farmer the best price, are there any ways in which the farmer has the potential to get a price closer to what

the processors are willing to pay? Our discussions in Blantyre last April indicated there are a couple ways worth examining. They are however very location specific. They include:

1. **Blantyre Milkshed:** The milkshed area in Blantyre offered one possibility. KK Millers makes weekly deliveries of feed to the bulking groups. Thus it has a truck moving through the area. The truck should be able to back haul any soyabeans or other products the farmers have directly back to a user with an established demand. The bulking groups already have some accounting infrastructure that is associated with bulking milk and distributing feed. It should not be too difficult to modify these accounting activities to bulk-up and sell soyabeans or other commodities. To accomplish this will require some degree of facilitation to establish the link between miller and bulking group.

2. **Mzuzu Milkshed:** A similar situation might exist in the Mzuzu milkshed. There Grain & Milling provides feed to the milkshed. However, we understand, they do not deliver the feed. Instead the farmers have to come and collect it. If the farmers are arranging transport to Mzuzu to buy feed they can haul in soyabeans. Grain & Milling should be willing to buy the soyabeans at a reasonable price. They are operating trucks between Mzuzu and their factory in Lilongwe. Thus the transport from the Mzuzu depot to the factory should be a rather easy in-house activity. Again, the accounting system should be in place with little modification, but it may require some facilitating to establish the linkage.

There are probable other examples that could be developed locally depending on the crops being grown and activities of the processors. Another possible example using sunflower instead of soyabean is National Oil in Mzuzu. They have recently acquired an estate with an old tung oil press. They are thinking of pressing edible oil with the press. There main thought are on cotton seed oil, but they might also be interested in the sunflowers being produced in Jenda.

SUMMARY

In summary there appears to an sufficient demand for soyabeans by the milling companies to justify a production programme. Connecting the miller to the farmers could be done by either ADMARC or private traders. Because ADMARC prices are usually followed by the private traders, ADMARC without any formal contacts tend to effectively regulate the private traders. For this reasons there is no real monetary difference to the farmer if he deal with ADMARC or a private trader. However, there are several procedure issues that may make the private traders more convenient for farmers to deal with. Also, since private traders are more efficient than ADMARC, the national economy is probably better served by allowing the private traders to handle the bulk of the commodities in areas they are willing to operate. If Government

would accept ADMARC main role in the economy as the private sector regulator and agent for the more remote area, rather then being the primary commodity handler, it might be possible to reduce the traders private margin and allow the farmer a higher return. Other means of providing the farmer a higher return would be through very location specific opportunities that link farmers directly to the users. Such opportunities may exist in such area as the Blantyre and Mzuzu milksheds.

Incorporating Soyabeans in the Farming Systems of Malawi

By
R.L. Tinsley [9]

Introduction

Soyabeans is one of the more important grain legume crops in the world. It has a very high protein content, reasonable oil content, and potential to fix nitrogen well in excess of it own requirements. It thus can assist in soil improvement leading to a higher level of sustainable agriculture, with minimum inputs.

Soyabeans have a rather bland taste, so they can be readily combined with other ingredients and will assume the taste of the other components. For this reason soyabeans can be used for a wide variety of different highly nutritious products including those for direct human consumption as well as indirect consumption via animal feed. Soyabean products can be prepared both at home or through commercial producers. However, soyabean products take more time and technical knowledge than most other legume relishes. For these reason soyabeans tend to be more an industrially processed then home processed commodity.

There are a few problems with soyabean productions and utilization, particularly for smallholder farming systems. These include the specificity of the rhizobium, the limited viability of the seed, and the presence of a trypsin inhibitor. The specificity of the rhizobium implies, that unlike other legume relish crops, such as beans, cowpeas, groundnuts, etc. in which the same rhizobium bacteria will inoculate and fix nitrogen with many legume species, soyabeans require a specific rhizobium species. Thus while most legumes will nodulate and fix nitrogen from rhizobium bacteria already in the soil, soyabeans have to be inoculated before they can effectively fix nitrogen. Likewise, unless proper storage conditions are maintained, the seed will not survive the off-season, make subsequent season planting problematic. The presence of the

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trypsin inhibitor necessitates that soyabeans be cooked to degrade it before being consumed in large amounts, as a regular component of the farm family diet.

Because of the problems associated with home processing, the specificity of the rhizobium, and the seed viability, soyabeans have been difficult to incorporate into the smallholder farming systems of the developing world. The exception to this is Asia where the crop originated. Although I have seen soyabeans under smallholder conditions in Malawi and elsewhere, I have never seen a well nodulated nitrogen fixing soyabean plant on a farmers field. If soyabeans are not nodulated and fixing nitrogen, then one of the main reasons for producing them is lost. Devising ways to overcome these problems is one of the major objectives of this course. I am confident this can be accomplished.

Uses of Soyabeans

At Home or On-Farm

As a home or farm consumed crop soyabeans is a subsistence crop. As such it normally is not simply boiled and eaten like beans, cowpeas and groundnuts. Instead it has to be pounded into a flour and blended with other ingredients. Once pounded into flour, it can be mixed with nsima to form a nutritious protein enriched nsima. Also once pounded it can be boiled and strained, resulting in a suspension similar to milk. This can be consumed as a nutritious milk substitute, and child weaning food. Once in the milk form it can be participated with a simple chemical such as $MgSO_4$ to form curd. The curd can be fried and used as a meat substitute. Although these uses are possible, they will require some extensive extension education before becoming recognized and utilized by most home makers. If used regularly to enhance home nutrition in a area of malnutrition, improved child health should be visible noticed within about three weeks.

As an Industrial Crop

As an industrial crop soyabeans is a cash crop similar to other cash crops produced by the farmer. As such the decision to grow soyabeans is purely an economic decision based on production cost and return economics. Once in the industrial sector, soyabeans becomes a main source of processed protein or edible oil. As a protein source, in Malawi soyabeans will substitute for imported protein sources such as fish meal and be blended into animal feeds. It can also be processed into weaning formulas for babies, or commercially prepared enriched nsima. There is a potential for soyabeans to be used in cooking oil, but it is really not as good as either groundnut, cotton seed, or sunflower. The oil content of soyabeans is only 20% compared to 30 to 40 percent for groundnuts, cotton seed and sunflower. Since the pressing or extruding processes currently used in oil manufacturing in Malawi leave 10% oil in the cake, the oil

recovery from soyabeans is only about 10%. Economically extracting oil from soyabeans will require a expensive and dangerous solvent extraction plant.

In many industrial countries the processing of soyabeans has become even more sophisticated. Processed soyabeans substitute for many meat dishes that are often difficult to differentiate from the real product. You can sometime find ground beef labeled texturized vegetable protein, or artificial seafood. Most of these products have a soyabean base, and are much more tasty then plan soyabean curd.

Production of Soyabeans

Pure Stand Soyabean

Under smallholder conditions soyabeans can be produced either in pure stand, or intercropped with large cereals. The cereals usually considered for intercropping with soyabeans are maize and sorghum.

The production of soyabeans in pure stand is fairly straight forward. For Malawi the recommended practices are published in the annual Guide to Agricultural Production. There is little need to modify these without knowledge of local conditions. Under favorable conditions well nodulated soyabeans can produce from 1500 kg/ha to 2500 kg/ha without organic manure or chemical fertilizer. A yield in this magnitude is favorably compared with local maize yields and even some improved maize yields.

From a farming system perspective the major concern with pure stand soyabeans is, what crop is it replacing. In an area in which all the land is being utilized to the limit of farmers resources, the production of soyabeans can only be accomplished at the expense of another crop. At present there are major shift in land use each year between maize and groundnuts. The shift is with the cash segment of these crop acreage, rather then the subsistence segment. The annual land use shift is directly dependent on the relative price of each. As a cash crop soyabeans can easily join in this annual land use shift. However, substituting one crop for another does not really increase total or aggregate agricultural production in an area. However, a shift from local maize to soyabeans could result in a more nutritious aggregate product and have a net benefit in that regard. In contrast a shift from groundnuts to soyabeans would not modify the aggregate production in an area.

Even in areas in which there appears to be additional land available for cultivation, the potential for soyabeans or other crops to occupy the "free" land depends on the resources available to the farmer. There is only a finite amount of land a farmer and his family, limited to using hand tools, can cultivate. Thus for soyabeans to make a solid and complete impact on total

agricultural production, it may require providing the farmer with an increased resource base with which he can cultivate a larger area. This would normally imply an increase in mechanization such as acquiring work oxen, or small tractors, etc. Hiring additional labour would most likely not result in an aggregate community production increase. For an increase in hired labour to increase the aggregate production of an area, it would be necessary to have a true landless labour pool. However, in a society in which most people are allocated some customary land, using hired labour would be at the expanse of managing the labourer's own land. The labourers would thus be late in establishing their own gardens which would reduce their yield potential. Thus while hiring labour may increase the production and income of the hiring farmer, the lower management of the hired farmer would decrease his production leaving the aggregate community production equal or perhaps slightly lower.

Intercropping with Soyabeans

In Malawi a large percentage of the relish legumes are grown intercropped with maize or sorghum. This includes beans, cowpeas, pigeonpeas, and to a lesser extent groundnuts. In a similar manner soyabeans can be easily grown intercropped with maize or sorghum. In such maize legume mixtures the maize crop is usually considered the main crop and the legume a bonus crop. The objective of the intercrop combination is to obtain as much soyabean as possible without sacrificing the maize. It is normally not possible to produce an intercropped legume without some loss of yield to the maize. Although, within the Adaptive Research Programme, there have been individual cases where, when no fertilizer was applied, a maize bean mixed crop had maize yields higher than the pure stand maize control. With the lack of applied fertilizer, it was thought some of the N fixed by the beans became available to the maize after the beans matured. Rather this could happen with the later maturing soyabeans is questionable. The positive response of maize to intercropped beans is unusual. The more common response is for a relatively minor, non-significant, losses in maize yield (Table 1).

Table 1. Yield Of Maize & Intercropped Dwarf Beans & Soyabean at 2, 3, 4 Beans Between Maize Planting Stations Using Local & Hybrid Maize (tons/ha)

Treatment	Local Maize			Hybrid Maize		
	Maize	Beans	Soyabeans	Maize	Beans	Soyabeans
Pure Maize	1.95			4.74		
Beans						
2 Beans bet. Sta	1.37	0.22		4.48	0.18	
3 Beans bet. Sta	1.64	0.39		3.71	0.21	
4 Beans bet. Sta	1.46	0.48		3.13	0.35	
Soybeans						
2 Beans bet. Sta	1.41		0.32	4.16		0.39
3 Beans bet. Sta	1.37		0.45	3.70		0.49
4 Beans bet. Sta	1.67		0.72	4.03		0.77

Data is from LADD LNE RDP for 1987/88 season

It is expected that most of the soyabean production in Malawi will be produced as an intercrop with maize. As an intercrop it will be less likely to be replacing other crops, except in such intensively cropped area as Zomba and Chirazulu where all the maize is already intercropped with one or more legumes.

Double Canopy Evaluation: When examining a maize soyabean intercropping combination, it is necessary to examine it as a double canopy situation in which the maize occupies the upper canopy and receives full sunlight, while the soyabeans are in the lower canopy. In the lower canopy, once the maize starts to elongate, the soyabeans are subjected to extensive and progressively greater shade. Thus during the critical pos filling period for soyabeans, the crop receives only limited amounts of sunlight. For this reason there is a major decline in potential yield for the intercropped soyabeans compare to pure stand. The expected yield drop would be from approximately 1500 kg/ha down to 500 kg/ha. The maize, since it still has full sunlight, would have a lesser yield reduction. Also, the more vigorous the maize crop, as when well fertilized, the more shade the soyabeans are subjected to and the lower their potential yield. For this reason intercropping with soyabeans will most likely be more common with local maize at low fertilizer rates, then with hybrid or composite maize at high fertilizer rates.

Enhancing Intercropped Soyabeans: Accepting that the mixed maize soyabean combination will substantially reduce the yield potential of the soyabeans, there are several things that can be done to promote the soyabean component of the mixture, without jeopardizing the potential maize yield. The first is to utilize shorter statue maize varieties. The less height of the maize the less intense the shade and the more sunlight will penetrate to the soyabeans. This is consistent with the general objectives of the maize breeding programme, and a characteristic of the newly released composite maize varieties such as CCC and CCD.

A second option would be to look for maize varieties with narrower leaves. Screening for narrow leaves is not currently an objective of the maize breeding programme, and would only be included if the objectives were modified to developing varieties specifically suited for intercropping. The narrow leaves would again allow more light to penetrate to the soyabeans. However, with both of these options there is the alternative of increasing the maize yield by increasing the maize plant populations.

A third option focus on the soyabean variety. It is possible to screen soyabeans for shade tolerance. In most crops there is some varietal differences in tolerance to shade. Selecting for large leaves might be an initial indicator of shade tolerance. Larger leaves should be more efficient in adsorbing the limited light that penetrated the shade from the maize. As the lower canopy crop of the mixture, shade tolerance would be a definite advantage. If soyabean production in Malawi is going to be primarily as a lower canopy intercrop with maize or

sorghum then screening for shade tolerance needs to be incorporated into the soyabean variety improvement programme at some point.

A final means of enhancing the soyabean component of a maize soyabean intercrop combination would be to open up the maize canopy by reducing the maize population. This could be done by increasing the distance between planting stations. However, this would most likely have a substantial impact on maize yield that would most likely not be acceptable.

Advantages of Soyabeans vs Other Legumes:

When compared with other legume maize intercrops, soyabeans will usually yield slighter higher as an intercrop with maize than will beans. Yield expectations for intercropped soyabeans would be 500 kg./ha or more compared with 300 to 400 kg/ha for beans. This is indicated with Adaptive Research data from Lilongwe North East RDP in the 1987/88 field trials using both local and hybrid maize (Table 1). The reason for this could be several. Soyabeans tend to mature later than beans. They usually mature in mid April just after the rains stop. They may thus avoid some of the pod pest and diseases, which beans suffer from when maturing while the rains are continuing. As a lower canopy crop the beans or soyabeans experience less air turbulence that would promote drying. Thus the short legumes are in a more humid environment when intercropped then when grown in a pure stand. The higher humidity would be more advantageous for some pest and diseases. Also, the morphology of the soyabean plant may help. The soyabean pods are located very close to the main stem and not out on the branches as with beans and cowpeas. Thus they will remain well above the soil, and not droop into the moist soil which again could be favorable for pod infecting diseases. However, soyabeans do not have the potential for early relish use such as bean leaves and fresh pods.

Cultural Practices for Intercropped Soyabeans: With intercropping systems most of the cultural practices are controlled by the main crop in the combination. In the case of maize/soyabean, the maize cultural practices would determine such things as time of planting, weeding, ridge spacing, fertilizer applications etc. In working with intercrops it must be noted that usually they require more labour then pure stand crops. Thus when farmers are intercropping some operations in other gardens may become delayed. The farmer has to evaluated the impact of the potential delays with the benefits derived from the intercrop.

The Adaptive Research Programme has conducted several studies on some of the more specific needs of maize soyabean mixtures. Most of these have been conducted by the LADD and MZADD ARTs. There results are still preliminary, but worth noting. As mentioned earlier there are variety differences both in the potential of soyabeans to yield in a lower canopy inter-crop, and the impact on maize yield. It is thus necessary to develop some composite analysis of the combined potential of the two crops. This is illustrated in the study in MZADD that looked

at five soyabean varieties intercropped with maize. Based on one year results, the suggestion is that Hardee would be the best variety. Orbi actually yielded more soyabeans but only by suppressing the maize yield by nearly 50% (Table 2).

Table 2. Yield of Maize & Four Varieties of Intercropped Soyabeans From MZADD ART 1998/99 Season (Tons/ha)

Soybean Variety	Maize	Soyabeans
Hardee	4.05	0.424
Gedulu	2.87	0.421
Obri	2.47	0.537
Kuku	4.04	0.257
Bosier	4.99	0.111

The studies in LADD were really looking at spacial arrangements and plant population of the intercropped soyabeans. The results indicated that yield increased as population increased from 2 to 4 bean stations between maize stations (Table 1). However, trying to integrate the yield response, with seed supply, and labour requirements, the ART leader settled on the 2 beans between stations as the most cost effective. At this point the choice is really a manner for farmers discretion, and depends on his total resource base. Note that this plant population is well below the recommended pure stand soyabean plant population. If you plant 2 soyabean stations of 3 seeds each between the maize planting stations, you will require 6 seeds per 90 cm instead of 18 seeds. Also, since you be using the maize ridges at 90 cm instead of flat rows at 45 cm, there will only be half the number or rows. The seed requirements are reduced to 1/6 or 15 kg/ha.

Irrigated Winter Soyabeans

There is a major interest in producing soyabeans in the irrigation schemes during the winter. These are irrigation schemes are designed for growing two rice crops per year. However, most of the land in the schemes is not used for two rice crops. Part of this is because, with the current rice varieties, bluebonnet, double cropping rice is not a comfortable fit. With the summer crop requiring 120 days and the winter crop 150 or more days there is just not enough time for two comfortable conversions of 60 days each. The new rice varieties will improve the problem, but still not allow a really comfortable fit. Another reason is that many farmers manage land outside the schemes. They must plant this land with the first rains as other rainfed farmers do. The irrigation water provides more flexibility in managing the land in the scheme. The result is that most of the summer rice in grown four to six weeks later then anticipated. Thus substantial rice planting continues from the intended mid-December until mid-February. The final reason is that some schemes do not enough water in winter for growing a complete rice

crop. All the scheme are simple river diversions without any storage structures. Thus as the flow of water declines during the dry season the water available in the schemes also declines.

Because of the problems of double cropping rice in the schemes, the possibility of growing other crops like soyabeans is a good one that deserves serious consideration. Crops like soyabeans will require both less time to grow and less water. Also, a winter crop of soyabeans could be very helpful in assuring fresh viable seeds for the summer crop. In using the schemes for summer seed productions the ADD may have to assist in the collection and distribution of the seed under some very limited time constraints. With winter irrigated soyabeans there are several problems that need to be carefully considered.

The first of these problems is that of timing. Since soyabeans do not have any dormancy period at maturity, they have to be planted early enough to assure they are harvested before the on-set of the rains. If the soyabeans are planted late and heavy rains occur before they are harvested, there is a high likelihood the beans will germinate in the pods. To avoid this the deadline for planting soyabeans in the irrigation schemes should not exceed mid-July. Planting after mid-July is really gambling that the on-set of heavy rains will be later then "normal". Planting by mid-July will mean the crop is planted while temperatures are still cool. This will slow the initial growth of the crop and reduce the yield potential, but it can not be avoided if the crop is not to conflict with next rainy season. If the rice crop was planted and matured as intended, planting soyabeans by mid-July would not be a major problem. However, since most summer rice is planted four to six weeks late, the conversion from rice to soyabeans before mid-July becomes very tight and even problematical. Some of the late planted rice may not actually be harvested until early to mid-July.

The need for a rapid conversion from rice to soyabeans and then back again will require some modifications of the recommended soyabean agronomic practices. The most critical one will be growing the soyabeans on the flat rather then ridges. Without extensive mechanization, it will require too much work and take too much time to annually convert the field from the flat for rice, to ridges for soyabeans, and back to the flat for rice. Growing soyabeans on the flat is not really a problem. The second modification may be to stubble plant the soyabeans directly into the rice stubble. This is a common practice for soyabean, mungbeans and other pulses in many part of Asia. If the soil is loose enough to make small furrow between the rice rows the soyabeans can be planted in the normal manner with a row of soyabeans for every two rows of rice and the seed spaced the recommended 5 cm between plants. Planting between alternate rice rows gives a row spacing of 40 cm, which is reasonable close to the recommended 45 cm. If the soils are too hard or sticky as at Lifuwu, then the soyabeans will have to be dibbled one station at a time. This is more time consuming and may result in much lower plant population then recommended. Using multiple seeds per station would partly compensate for the lower number of planting stations. Again a soyabean row should follow every other rice row. The stubble

planting of soyabeans after rice works well because the flooding of the rice fields has reduced the amount of upland weeds in the field, and ratooning rice is a very weak plant that will not provide any major competition to the soyabeans. The idea was tried last June at Lifuwu. The crop actually germinated very well. However, later water management resulted in stunted growth and overall poor yield. With improved water management, it should become a productive soyabean management practice.

The final concern with growing winter soyabeans in the irrigation schemes is the water management of the soyabeans. There is considerable differences in managing a flooded rice crops and an upland crop like soyabeans. With rice the main objective is to maintain a flooded condition. This can frequently be done by a continuous application of relatively low discharge or flow and the entire rice paddy be managed as a unit. For upland crops the important thing is to get water on and off fairly quickly. Thus it is important to have a relatively high discharge, and some drainage potential. If the available discharged is relatively low as at Lifuwu, this will require subdividing the rice paddy into several long narrow basins of between three and four meters wide with a head ditch to distribute the water to each basin, and collection ditch at the opposite end to allow easy drainage. The flow of water can be concentrated in one basin at a time. Once the water has filled a basin, the flow can be diverted to the next basin, and the water in the first basin released from the lower end. Alternatively, if the available discharge is higher such as at Nkhata, small distribution ditches can to be placed all around the basin and through the center. This will allow the water to be rapidly distributed to the entire field before being applied to the soyabeans, and then the surplus water rapidly removed. In either case the guiding rule is that the water should be applied and drained free within 24 hours. If water remains longer then 24 hours the soil will become chemically reduced and crop suffer severely.

The next water management concern is the first irrigation and total number of irrigations. Since soyabeans rapidly imbibe water and start to germinate, the initial irrigation or planting irrigation should be one or two days before planting. The water should be applied and allowed to infiltrate and drain until the soil is firm enough to walk on. Planting should be immediately thereafter. If you plant and then irrigate the rapid imbibing and sprouting of the soyabeans will take place under moderately reduce soil conditions and result in poor germination, as was illustrated in demonstration trial at Nkhata Scheme last winter. Once the crop is established the irrigations should be fairly regularly at about two or three week intervals until after the crop has flowered and the pods are beginning to fill. At that point the irrigations should stop. This should make a total of four or five irrigations.

SUMMARY

In summary soyabeans have the potential to become a major component in the farming systems of Malawi. The crop can be grown for both subsistence use and cash income. Soya-

beans in Malawi are more apt to be grown intercropped with maize then in pure stand. As an intercropped there is less potential for it to displace other important crops. Historically there have been some major logistical problems in promoting smallholder production of soyabeans. However, with some good planning and some facilitating from the ADDs these problems can be easily overcome. In addition to the main summer production, there is a good potential for additional soyabean production in the irrigation schemes. Soyabeans could be a more comfortable double crop combination then a second rice crop. The advantages included shorter growing season, lower water requirements, and source of fresh seed for the summer crop. With irrigated winter soyabeans there are several management problems that will need to be resolved.