The Context of Smallholding Integrated Aquaculture in Malawi: A Case Study for SubSaharan Africa

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What direction should SubSaharan African agriculture take — industrialized or smallholder agriculture? The author says that a compromise, using the best elements of each, would be best, but in order to develop a strategy, the target groups need to be understood. Here the Malawian situation is given as an example: the degree of food "insecurity"; the fact that little smallholder produce is sold; and ways of improving productivity and production. The benefits of integrating aquaculture into farms is seen to make good sense biologically. If socioeconomic constraints can be overcome, widespread adoption of integration would provide at least medium-term relief, while larger-scale mechanisms are developed.

Malawi is facing a crisis (Table 1). By the year 2000, the population will probably be in excess of 11 million. If current trends continue, almost 9 million of these people will live on 1.5 million ha of arable land. If the average rural household size does not increase above the current 5.4 members, then each family will be farming an average of 0.9 ha. In 1993, only farmers who worked more than 1 ha could grow enough to feed their families. Right now, only 45% of farmers have more than 1 ha of land. Overuse and poor management of soils guarantee that the ability of the land to feed a family will decrease, while population growth insures that the number of people to feed will increase. Social, economic and environmental turmoil are almost inevitable.

What are the rural development options? Would we attempt to develop industrial capacity as rapidly as possible and hope that the government will be able to build quickly the necessary institutions to distribute resources and food to the population? Or should we work with the rural poor directly to increase local financial and food security and hope that economic growth in small farming communities will somehow be able to build infrastructure for future generations?

There are advantages and difficulties associated with both approaches. Industrialized agriculture may lead to the greatest accumulation of capital in the shortest amount of time but, rather than providing jobs, most modern agricultural technology actually reduces the need for human labor. As land and employment opportunities are diverted from smallholders to industrialists, government must provide, from industrial tax revenues, new housing, education and job opportunities. Otherwise, urban slums, filled to bursting with unemployed refugees from the villages, become breeding grounds of disillusionment, despair and, ultimately, violence. This scenario has been well-documented in both industrialized and developing countries.

Efforts to directly improve the lot of rural smallholders *in situ* have also faced problems. Even when the right economic or technological solutions to a problem can be identified, there are often strong social constraints to their adoption. These constraints tend to be highly idiosyncratic between cultures and therefore not amenable to generalized remedies. Millions of dollars and person-years have been spent trying to find ways around these constraints. The sad fact is, modern technology employed at the wrong place or time has actually made life worse for many poor communities.

Table 1. Malawi vital statistics.

Population (1987)	7.9 million
Annual population growth rate	3.7%
Fertility rate	7.0
Estimated population in 2000 AD	11.7 million
Estimated population in 2015 AD	21 million
Life expectancy (1987)	46 years
Under five mortality rate	275/1,000
Urban population growth rate	7.3%
Population < 15 years old	48%
Rural population (1987)	88%
Average rural family	5.4 persons
Rural pop. density (arable land)	174 per km^2
Average smallholding (1993)	1.2 ha
Average smallholding in 2000 AD	0.9 ha
Real GDP growth rate (1987)	-0.2%

Sources: U.S. Department of Defense. 1973. Malawi: a country study. Government Printing Office, Washington, DC; Bonzon, A. and B. Horemans. 1988. Socioeconomic data base on African fisheries. FAO, Rome; U.S. Department of State. 1989. Background notes: Malawi. Bureau of Public Affairs, Washington, DC.

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A compromise combining the best elements of the purely industrial and purely grass roots approaches will probably be that which is the most useful in solving real rural development problems. For such a strategy to evolve, we need a clear description of what we hope to do and a precise characterization of the target group. In general, however, the socioeconomic and agroecological context within which rural African communities function is poorly understood. In this respect, the case of the relatively well-documented Malawian smallholder might serve as a useful starting point from which can be built a deeper and more general understanding of how smallhold farming communities operate.

Land and Food

In 1993, Malawi had approximately 1.3 million farms directly supporting 6.8 million people. As Table 2 shows, the vast majority of these farms are very small, averaging 1.2 ha among smallholders. Farms this small are not reliable food production units. A recent Bunda College study found that 55% of smallholders fall short of being self-sufficient in food. Farmers with less than 0.5 ha under cultivation are only able to produce 30% of what they need to feed their families.

This food security shortfall has immediate ramifications for household nutrition, particularly among the young (Table 3). Nationwide, 43% of children under five years of age are more than 20% underweight, and 56% are stunted.

In an effort to meet basic food requirements, smallholdings are dedicated almost entirely to edible crops, the main ones being maize, pulses, peanuts, manioc, sorghum and millet (Table 4). Purely cash crops account for less than 8% of total smallholdings. As Table 5 shows, smallholders eat the vast majority of what they grow. Of the food crops, only improved maize is marketed to any great extent and this is primarily due to the need to repay fertilizer loans.

Improving Farm Productivity

If mass starvation and/or perpetual inputs of external food aid were to be avoided, the imbalance between farm output and food requirement must be corrected. The most commonly proposed solution is to intensify land use by adopting new crop varieties and applying fertilizers and pesticides (Table 6). Unfortunately, the resources with which to access these classical technologies are severely limited among smallholders. Even by eating 20% less than they should, only 33% of farmers manage to actually sell for profit any of their produce. According to government statistics, the per capita annual disposable income in 1981 was 20 Kwacha. While this has certainly increased, the prices of fertilizers, pesticides and improved seed have also gone up. Since 1980, consumer prices have risen by almost 300%. Furthermore, credit is unavailable to the majority of smallholders. By current

Table 2. Landholdings in Malawi.

Number	Percentage of farms	Hectares per farm	Total hectarage	Percentage of land	
300,000	23.0%	<0.5	92,256	4.4%	
420,000	31.9%	0.5-1.0	310,992	4.9%	
260,000	19.9%	1.0-1.5	316,944	15.1%	
140,000	10.9%	1.5-2.0	242,544	11.6%	(Smallholders)
130,000	9.8%	2.0-3.0	305,040	14.6%	
55,000	4.2%	>3.0	220,224	10.5%	
4,100	0.4%	148	605,000	28.9%	(Estates)
1.3 million			2.1 million		

Source: Government of Malawi. 1988. Statement of Development Policies 1987-1996. Office of the President and Cabinet, Department of Economic Planning, Lilongwe.

Table 3. Food insecurity.

- 43% of children under five are more than 20% underweight.
- 56% of children under five are stunted.
- Children under four receive only 57% of estimated food requirements.
- 28% of 12-23 year olds are underweight.
- Children under 15 are 20% underfed on average.
- Vitamin and nutritional deficiency is the third leading cause of hospital deaths.
- Adults in rural communities are 19% underfed on average.
- Energy intake for all age groups is 64-72% of estimated requirements.
- Over the year, the average rural family consumes 1.6 meals per day.

Sources: Ettema, W. and L. Msukwa. 1985. Food production and malnutrition in Malawi. Center for Social Research, University of Malawi; Mtimuni, B.M. and D.M. Chilima. 1993. Changing dietary patterns, food preferences and household food security in Malawi - issues for research. Paper presented at the Joint UNICEF/IFPRI Workshop on Food, Agriculture and Nutrition Policy in Malawi, 3-6 May 1993, Lilongwe.

Table 4. Smallholder crops.

Crop	Hectarage	Per cent of land
Maize	1,042,000	70.0
Manioc	73,000	5.0
Sorghum millet	35,000	2.4
Pulses	850,000*	57.0
Peanuts	400,000*	27.0
Rice	9,000	0.6
Sweet potatoes	4,000	0.3
Tobacco	48,800	3.3
Cotton	37,000	2.5
Tea	15,600	1.0

* Mostly intercropped with maize, manioc, millet or sorghum.
Source: Government of Malawi. 1988. Statement of development policies 1987-1996. Office of the President and Cabinet, Department of Economic Planning, Lilongwe. 198 p.

Table 5. Selling food.

	Per cent of smallholders who sell: All	Some	None
Cassava	0	33	67
Sweet potato	0	34	66
Local maize	0	34	66
Improved maize	38	43	19
Rice	0	31	69
Peanuts	1	48	51
Pulses	0	25	75
Sugar cane	1	39	60
Bananas	0	55	45

Source: Ettema, W. and L. Msukwa. 1985. Food production and malnutrition in Malawi. Center for Social Research, University of Malawi).

Table 6. Average productivity in kg/ha/year.

	Smallholder average	Realistic potential	Per cent difference
Maize	2,800	6,200	123
Pulses	250	4,000	1,500
Sorghum	1,225	3,500	145
Rice	2,025	3,150	56
Peanuts	730	2,250	208
Cotton	660	2,000	203

Source: Manda, D.R.B., B.H. Dzowela and W.H. Johnson. 1985. Agricultural research resource assessment in SADCC countries: Malawi Country Report. USAID, Washington, DC.

guidelines, less than 30% of farmers qualify for agricultural credit and then only for maize and rice. As a result, inorganic fertilizer supplies only an estimated 27% of needed nitrogen for smallholder farms.

Another possible way to increase agricultural output is by cultivating previously unused land (Table 7). Malawi has an estimated 39,027 km² of arable land of which about 18,000 km², or 46%, is currently unused. Of this, 7,000 km² is located in national parks. If all the unused land outside of the parks were distributed among the existing smallholders, the average landholding would go up to 2 ha per farm (Fig. 1). Within 20 years, average landholdings would be below the critical 1-ha size. We would postpone rural starvation by 10 years.

Table 7. Malawian geography.

Total area	118,484 km²
Total water surface	24,210 km²
Total land area	94,274 km²
Slopes >12%	23,700 km²
Dambos	6,200 km²
Sub-marginal land	25,400 km²
Arable land area	39,000 km²
Currently used land	21,000 km²
Vacant land in parks	7,000 km²
Other vacant land	11,000 km²

Sources: US Department of Defense. 1973. Malawi: a country study. Government Printing Office, Washington, DC; ICLARM/GTZ. 1991. The context of small-scale integrated agriculture-aquaculture systems in Africa: a case study of Malawi. ICLARM Stud. Rev. 18, 302 p.

From this, two things become clear: population growth must be brought under control and any sustainable improvement of farm production must rely on the resource base which already exists on smallholdings. A first step, the mixing enterprise, has already begun. While 80% of the maize crop is still in pure stands, almost 500,000 ha are intercropped. The synergistic benefits of true integration, however, will require the recycling of nutrients and other resources from enterprise to enterprise. In small-scale trials, fishponds have been shown to serve as effective bioreactors in this process, substantially improving whole farm productivity. Applied on a larger scale, what is the potential for small-scale integrated agriculture/aquaculture to meet the food security and rural development needs of Malawi's smallholders?

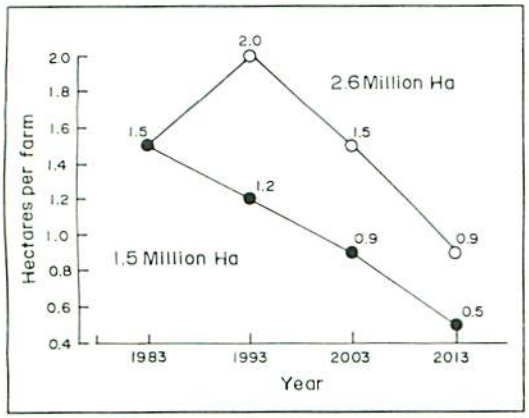

Fig. 1. Landholdings per farm household.

Integrated Farming Systems

An integrated farming system is one in which waste material from one enterprise is used to improve production on another, thus increasing the efficiency of both. Several benefits accrue to the integrated farmer:

- minimizes waste leading to locally improved environmental quality;
- reduces need for fertilizer leading to increased profitability;
- improves soil structure leading to increased fertility;
- increases fish production leading to improved household nutrition; and
- reduces dependence upon outside inputs leading to increased stability.

Taken together, these add up to a more economically and environmentally sustainable farming system.

Fig. 2 demonstrates the theoretical potential of integrated aquaculture to improve the sustainability of a typical smallholding in southern Malawi. If the diet generated by the mix of crops used in this example can be said to be "typical" then both farms can feed themselves. The benefit of integration in this scenario is largely a result of the farmer requiring fewer external inputs. Data from ICLARM's work in southern Malawi and other sites indicate that this is only part of the picture. If integration involves the introduction of a small fishpond, farm productivity and profitability actually increase. If these findings can be replicated on a larger scale, such an integrated farming system has clear potential to improve food and economic security in rural farming populations.

From a biological point of view, the theoretical potential of integrated aquaculture is beyond dispute. The big question which remains is whether the socioeconomic and cultural constraints to its adoption can be overcome. ICLARM is trying to answer this question as part of its current research agenda and how to approach it was the main subject of the ICLARM/GTZ Workshop on Aquaculture Policy Options in Zomba, Malawi.

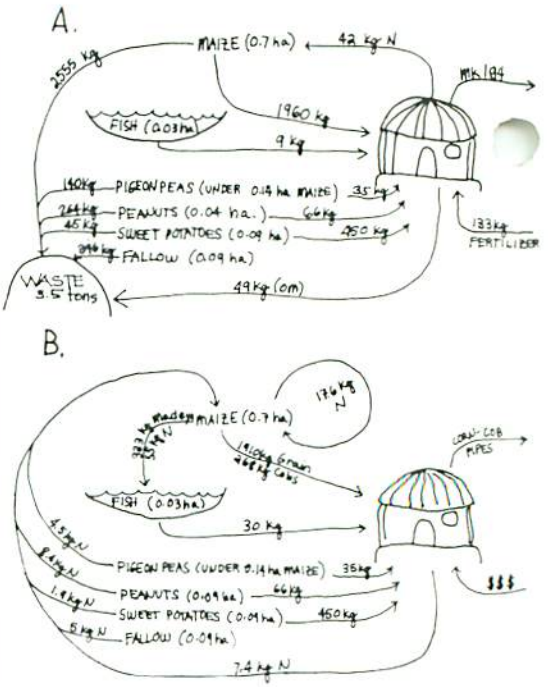

Fig. 2. A theoretical 1-ha Malawian farm before (A) and after (B) integration.

Integrated aquaculture will certainly not solve all the problems faced by rural farmers. Coupled with effective population control, however, more sustainable integrated farming may well provide shorter and medium-term relief to poor smallholders, and give developing-country governments the breathing room needed to develop the necessary infrastructure and institutions that will lead to long-term prosperity.

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