SADC/ICLARM Research Report 8

Integrated aquaculture-agriculture adoption and impact in rainfed farming systems in Sakata, Malawi.

Fredson J.K. Chikafumbwa and Randall E. Brummett

INTEGRATED AQUACULTURE-AGRICULTURE ADOPTION AND IMPACT IN RAINFED FARMING SYSTEMS IN SAKATA, MALAWI

Fredson J.K. Chikafumbwa and Randall E. Brummett
ICLARM
P.O. Box 229
Zomba, Malawi

Abstract

ICLARM introduced integrated aquaculture-agriculture (IAA) in Sakata, Malawi three years ago. Since that time, and without extension support, the number of farmers with ponds increased from 4 in 1993/94 to 12 in 1995/96. To learn why and how IAA is spreading, a study of impact and adoption was conducted in the 1995/96 production season. Interviews were conducted with farmers to discuss IAA and collect data on farm function through the use of bioresource flow diagrams. Motivations given by farmers as to why they adopted IAA were to improve household nutrition and income. Constraints to adoption identified by farmers were availability of labor and capital to purchase inputs.

On 13-14 March, 1996, all farmers stocked *Tilapia rendalli* of 2-6 g at a density of 2 fish/m^2. Pond sizes ranged from 30 - 180 m^2, averaging 88 m^2. Feeding frequency ranged from 0 to 4 times per week with total dry matter input ranging from 0.5 to 90 g/m^2/week. The main fish feeds were maize bran and vegetable wastes including leaves from pumpkin, sweet potato and cassava. Culture period ranged from 86 to 189 days, depending upon water holding capacity of the ponds. Production ranged from 99 to 1,471 kg/ha, depending upon inputs and culture period. Reflecting their stated motivation in adopting IAA, 50% of the farmers sold part of the fish harvested. Four farmers made plans for storing seed for the coming season. Other farmers saved part of their profits for fingerling purchase. All farmers took fish for home consumption and gave some away to relatives and friends.

INTRODUCTION

Integrated aquaculture-agriculture (IAA) research, development and extension has been concentrating on areas with perennial water supplies. However, many smallholder farmers in Southern Africa could substantially increase their cash income and improve opportunities for household food security by adopting integrated rainfed fish culture (Brummett and Chikafumbwa 1995).

ICLARM began studying rainfed aquaculture technology appropriate for African smallholders on four farms in Sakata, Malawi during the 1993-94 production cycle (Brummett and Chikafumbwa 1995, Brummett and Noble 1995). That initial study used bioresource flow diagramming (Lightfoot et al. 1991) to introduce the idea of integration to farmers. The net impact on household income averaged 15% on selling 40% of an average fish standing stock at harvest of 628 kg/ha. Pond size averaged 69 m^2. Since that time, 8 additional farmers have adopted IAA without contact from the extension services.

A serious complication to rainfed fish farming is the necessity to purchase new seed stock each year. In light of the increasing financial difficulty which African governments are facing, subsidized sources of fingerlings are drying up. The purpose of this study was to determine why and how IAA spread in Sakata and to learn more about how rainfed IAA impacts the farming system and how the relationships between farmers might overcome problems of fingerling supply.

MATERIALS AND METHODS

The investigations reported here were conducted in Sakata, Traditional Authority Kuntumanji, Zomba District, Southern Malawi. Twelve farmers, four of whom had previously been exposed to integrated aquaculture-agriculture (IAA) were involved. Bioresource flow diagramming (BRFD) following the methods of Lightfoot et al. (1991) was used to characterize each farm in terms of land area, crop diversity and the inter-relationships between farm activities. Unlike Lightfoot et al. (1991) who tried to capture data for the entire farm and the associated household, resource flow data collection was limited to activities which either directly affected, or were affected by, the pond.

Farmer interviews were conducted to determine why they had adopted fish farming, what constraints were faced and how they were overcome. Data on farm family size and composition and sources of fuel wood (as a potential indicator of farming system sustainability were also collected.

To validate the impressions of the farmers and quantify the impact which IAA has had on these farms, a field trial was conducted. The ponds, all hand-dug by the farmers themselves, averaged 87.9 m^2 (40-180 m^2) and were stocked at a density of 2 fish/m^2 with *Tilapia rendalli* fingerlings of 2-6 g average weight on 13-14 March 1996. Fingerlings were given free in order to control their species, number, age and size. Farmers were requested to keep records of pond inputs (material type, quantity and frequency of use). Some farmers were provided with spring scales to facilitate data collection, while others used volumetric methods. Decisions on the type of inputs, quantities, and frequency were determined by the individual farmers.

Monitoring of pond water levels and collection of farmer's pond feeding records were carried out during weekly visits which began, due to serious waterlogging of roads in the area, only after the second month of the trial. Samples of materials used as pond inputs were collected and analyzed for dry matter using standard methods. Final production data was collected directly by researchers who also monitored how the crop was disposed of.

RESULTS

Data on farm families and landholdings are shown in Table 1. Family sizes ranged from 2 to 9 with an average of 6 members per family. The number of children (school age and below) in these families ranged from 0 to 6. Farms were fragmented with an average of 2.9 plots (range = 1-5). Average total land area was 1.4 hectares ranging from 0.20 to 2.75 hectares per farm. Each family owned 1-2 dimba (vegetable) gardens of 0.1 to 0.8 ha. Three-quarters of the farmers cultivated all their land. According to farmers, lack of labor resulted in three farms with uncultivated plots. There was no organized system of fallowing. Pond sizes ranged from 38 to 180 m^2 with an average of 87.9 m^2.

Figure 1 is a bio-resource flow diagram (BRFD) of the pond component of the farming system extrapolated from the 12 farmers to produce an average farm. All farmers grew different types of crops on their farms and were practicing mixed farming (Table 2). Maize was the main crop grown as a staple food. The other crops were grown in small quantities either mixed with maize or mixed in separate plots. The major crops were cassava, sorghum, rice, pigeon peas, groundnuts and sweet potatoes. Many other crops were grown in smaller quantities. Seven farmers raised at least some livestock (chickens, goats, rabbits, cattle).

Farmers also grew different types of fruit trees (mangoes, guavas, papaya, oranges, etc.) and other trees (*Eucalyptus spp*, *Teminalia catappa*, *Cassia* sp., *Gmelina arborea*) for timber and firewood (Table 3). Farmers collected adequate firewood from pruning fruit and other trees. As these farms are all surrounded by other farms with no easy access to forests or untended land, families must grow their own firewood or get it from relatives. Lack of cash and transport are additional incentives to be self-sufficient in fuel wood.

As mentioned above, only four farmers' ponds were stocked with fish in Sakata in 1993/94 (Brummett and Chikafumbwa 1995). Two of these had extended their ponds prior to 1995/96 season. Vegetable production near and/or around ponds had been initiated by three of the four original farmers. In 1996, there were twelve farmers (three had revitalized abandoned ponds and five had constructed new ponds). The additional eight farmers started fish farming after learning from neighboring farmers who had constructed ponds in 1993

Smallholding IAA farmers in Sakata, Malawi, can be classified according to the water storage capacity of their small ponds: short-term (4-6 months), medium-term (7-9 months), and long-term (10-12 months). In the 1995/96 season, rainfall was 1196 mm and the average water holding time for rainfed ponds in Sakata was 155 days (120 - 279 days).

Summary of fish stocking and harvesting data is shown in Table 4. Fish increased weight in all farmers' ponds. Highest mean harvest weight was 53.6 g and the lowest was 8.5 g. The culture period ranged from 86 to 189 days (ponds filled with water in mid-December, but were only stocked in March). Data was not collected from two farmers ponds because their ponds dried up in less than 2 months, prior to when roads were passable after the heavy rains, and were harvested in the absence of the researchers. *T. rendalli* production varied among the farmers from 99 to 1,371 kg/ha. Seven farmers captured wild catfish (*Clarias gariepinus*) fingerlings and stocked them along with the *T. rendalli* without counting or weighing. The fish in four farmers' ponds had specific growth rates above 1.50 %/day. Fish were harvested when water was getting too low in ponds. Fish survival was poor (32 and 64%) in most farmers' ponds except for four who had survival above 70%.

The main pond input used by all farmers was maize bran (Table 2). Other major fish pond inputs used were sweet potato, cassava, turnip leaves and groundnut straw and leaves. Occasionally, farmers applied manure (goat, chicken and rabbit manure). The average feeding frequency was 1.7 times per week and varied among farmers from 0 to 4 times per week. The total feeding rate of farmers' actual dry matter inputs were below the minimum pond requirement of 35 g dry matter/m^2/week (Hepher and Pruginin 1981; Chikafumbwa 1990). Farmers rarely applied manure to their ponds because of the limited numbers of livestock and the fact that their free ranging made manure collection virtually impossible. Two farmers applied inputs above the minimum probably because their ponds were relatively small.

Most farmers did not provide adequate amounts of inputs to their ponds because they depended too heavily on maize bran, the input promoted by the extension services, based on previous experimental results and the recommendations of development projects (Balarin 1987). Noble and Chimatiro (1991) found that the amounts of maize bran available on southern Malawian smallholdings is inadequate to support good fish production. In addition, due to labor and water constraints, Malawian fish ponds are most active during the parts of the year when maize bran is scarce. When both maize bran and labor to put it into the pond are available, during the hot-dry season, the maize bran is often used for human food (Kadongola 1990). When both maize bran and labor to put it into the pond are available, rainfed ponds are usually dry.

More abundant at the right time of the year are other agricultural wastes and green vegetation. However, these were applied to the ponds in relatively low quantities. Reasons for this failure to utilize the available knowledge on the range of possible inputs is under investigation, but many years of exclusive focus by the extension services on maize bran may be partly responsible.

Farmers valued fish as a source of income and household nutrition. This was demonstrated by the way fish were disposed of at harvest. All farmers took some fish for home consumption and gave away some to relatives and friends. It was also valued as an economic asset. Six farmers sold fish despite small harvests and many people went away without the fish they wanted to buy. Fish farming was a valuable activity. Those farmers whose ponds dried up took the initiative of negotiating with farmers who had water in their ponds to assist in keeping some fish for them for next season's restocking.

A potential problem of managing *T. rendalli* ponds in this way was identified. The *T. rendalli* stocked at the small size used in this study did not breed during the culture period. All farmers selected bigger size fish for sale and home consumption and put back small ones for next season's restocking. They may thus be selecting against fast growing fish, which practice may ultimately result in lowered fish growth, yield and farmers' morale (Eknath 1991).

maize bran and other materials ranged between 0.5 and 90 g dry matter/m^2/week. Among the nine farmers, only two input more than 35 g dry matter/m^2 per week.

Fish harvested were partly sold, used for home consumption, given away to relatives and friends or kept for restocking next season (Table 5). Six farmers sold part of the fish harvested at different prices. They sold *T. rendalli* and catfish. Fish were sold at different prices which ranged from 4 fish of approximate average weight 70 g for MK10.00 to 12 fish of approximate average weight 35 g for MK10.00. Price per fish increased with the increase in fish size, but on a dry weight basis was higher for larg fish. One farmer exchanged part of her fish for maize. Seven farmers kept some fish for restocking in the next season. Only three farmers had water in their ponds at the end of the study and they kept fish for four other farmers in preparation for next season. One farmer decided to keep all the fish for an upcoming family celebration.

DISCUSSION

Farmers participating in the experiment were generally satisfied with the results and excited about the prospects for the coming years. Nevertheless, fish production was poor among most farmers because of low input rates and low fish survival. For example, Messers C. Michi and Mposa input at relatively high rates, but experienced fish survivals of only 50% and 32%, respectively. Poor survival was probably due to birds and/or human predation in the shallow ponds (Brummett and Chikafumbwa 1995) exacerbated by the ease with which *T. rendalli* can be captured, a reason cited by many farmers for desiring to stock the more difficult to catch Oreochromis shiranus in the coming years.

One farmer, Mr. Daudi had poor fish growth because his pond was too small and he over supplied it with inputs. Mr. Y. Michi had the highest fish production, due largely to having increased the stocking density by transferring fish from another pond which dried just one month after stocking. This observation suggests that a high stocking density (3-4 fish/m^2) of small size fish may give higher fish yields from rainfed ponds with short culture periods, provided they can be adequately supplied with inputs.

The average land holding size of 1.4 hectares among families adopted aquaculture suggested that they had adequate land to support their families(Brummett 1995). Two farmers had less than 0.5 hectares for cultivation. Farmers grew a wide variety of crops and were aware that the residues from these can be used as pond inputs (Table 2). Waste materials generated from their crops could have supported a higher fish production (Noble and Chimatiro 1991). Regardless, 78% of the

Table 2: Crops grown, livestock raised (number) and materials used as fishpond inputs by IAA farmers in Sakata, Malawi during the 1995/96 growing season.

Farmer	Crops grown	Livestock raised	Pond inputs used
A. Abasi	Maize, sweet potatoes, cassava, cow peas,pegion peas, sorghum, rice, turnips,		Maize bran, cossava leaves, sweet pottato leaves, termite, turnips leaves, goat manure,
F. Abasi	Maize, sorghum, rice, bulrush millet, sweet potatoes, cassava, ground nuts, pegion peas, pumpkins, sugar cane, bananas		Maize bran, sweet potato leaves, cassava leaves, turnips leaves, goat manure,
C. Michi	Maize, sorghum, rice, bulrush millet, sweet potatoes, cassava, pegion peas, ground nuts, bananas, paw paw,	Cattle (5) goats (1)	Maize bran, cattle and goat manure, paw paw leaves, termites, ground nuts leaves/stovers
Y. Michi	Maize, sorghum, sweet potatoes, cassava, cow peas, yellow gram, bananas, sugar cane, bamboos paw paw, okra, pepper	Goats (4) chickens (6)	Maize bran, sweet potatoes, pumpkin leaves, banana peals, termites
J. Mposa	Maize, sorghum, rice, sweet potatoes, cassava, pegion peas, ground nuts, pumpkins, cocoa yams, egg plants, tomatoes	Goats (2) rabbits (3)	Maize bran, sweet potato leaves, goat/rabbit manure, groundnuts stovers, napier grass, kitchen left over
N. Kasichi	Maize, rice, sweet potatoes, cassava, pegion peas, cow peas, groundnuts, bananas, trnips, paw paw, cocoa yam, okra, sugar cane, bamboos, guavas, tomatoes, onion, tobacco	Cattle (4) goats (6) chickens (2)	Maize bran, pumpkin leaves, cocoa yam leaves, sweet potato leaves, rotten fruits, goat manure, termites, kitchen left over
Ng'ombe	Maize, sorghum, rice, sweet potatoes, cow peas, pegion peas, groundnuts, pumpkins, banana, sugar cane, cocoa yam,	Chickens (4)	Maize bran, sweet potato leaves, pumpkin leaves, cocoa yam leaves, goat manure, termites
A. Daudi	Maize, rice, cassava, sweet potatoes, cow peas, groundnuts, sugar cane,		Maize bran, sweet potato leaves, pumpkin leaves
Keyala	Maize, sorghum, rice, sweet potatoes, cassava, cow peas, groundnuts, pumpkins, bananas, tobacco, pawpaw, sugar cane	Goats (6)	Pumpkin leaves, sweet potato leaves, goat manure, maize bran
T. Masamba	Maize, sorghum, rice, sweet potatoes, cassava, cow peas, pegion peas, groundnuts, bananas, sugar cane, paw paw, turnips, tomatoes, guavas,		Maize bran, sweet potato leaves, pumpkin leaves, goat manure, termites
Nyambalo	Maize, rice, bulrush millet, cow peas, groundnuta, bananas, sugar cane,	Ducks (5)	Maize bran, pumpkin leaves, chicken manure, leucaena
Mtepa	Maize, sorghum, rice, sweet potatoes, cassava, cow peas, pegion peas, groundnuts, pumpkins, bananas, okra, tomatoes,		Maize bran, sweet potato leaves, pumpkin leaves, termites

Table 1: Characteristics of integrated aquaculture-agriculture (IAA) farms and farming families in Sakata, Malawi during the 1995/96 growing season.

Farmer	Family adults	members Children	Land No. of fields	Total land size (ha.)	Dimba No.	Size (ha.)	Pond size (m^2)	Homestead (ha.)	Uncultivated land (ha.)
A. Abasi	2	0	2	1.21	2	0.81	107	0.4	0
F. Abasi	3	5	4	2.02	2	0.51	171	0.1	0
C. Michi	2	5	3	2.73	1	0.3	180	0.3	0
Y. Michi	4	2	6	2.73	2	0.3	128	0.3	0.2
J. Mposa	2	4	2	0.71	1	0.2	55.5	0.6	0
N. Kasichi	4	2	3	1.32	2	0.8	68.8	0.4	0
[1] Ng'ombe	4	5	3	1.82	2	0.4	104	1.62	0.81
A. Daudi	3	4	1	0.2	1	0.1	64	0.4	0
Keyala	4	4	5	2.42	2	0.51	55	0.4	0
T. M[illegible]samba	2	6	2	0.71	1	0.4	38	0.81	0
Nyambalo	2	5	2	0.4	1	0.61	70	0.1	0
Mtepa	2	0	2	0.61	2	0.26	50	0.61	0.16

[1] Widow living with her children and grandchildren

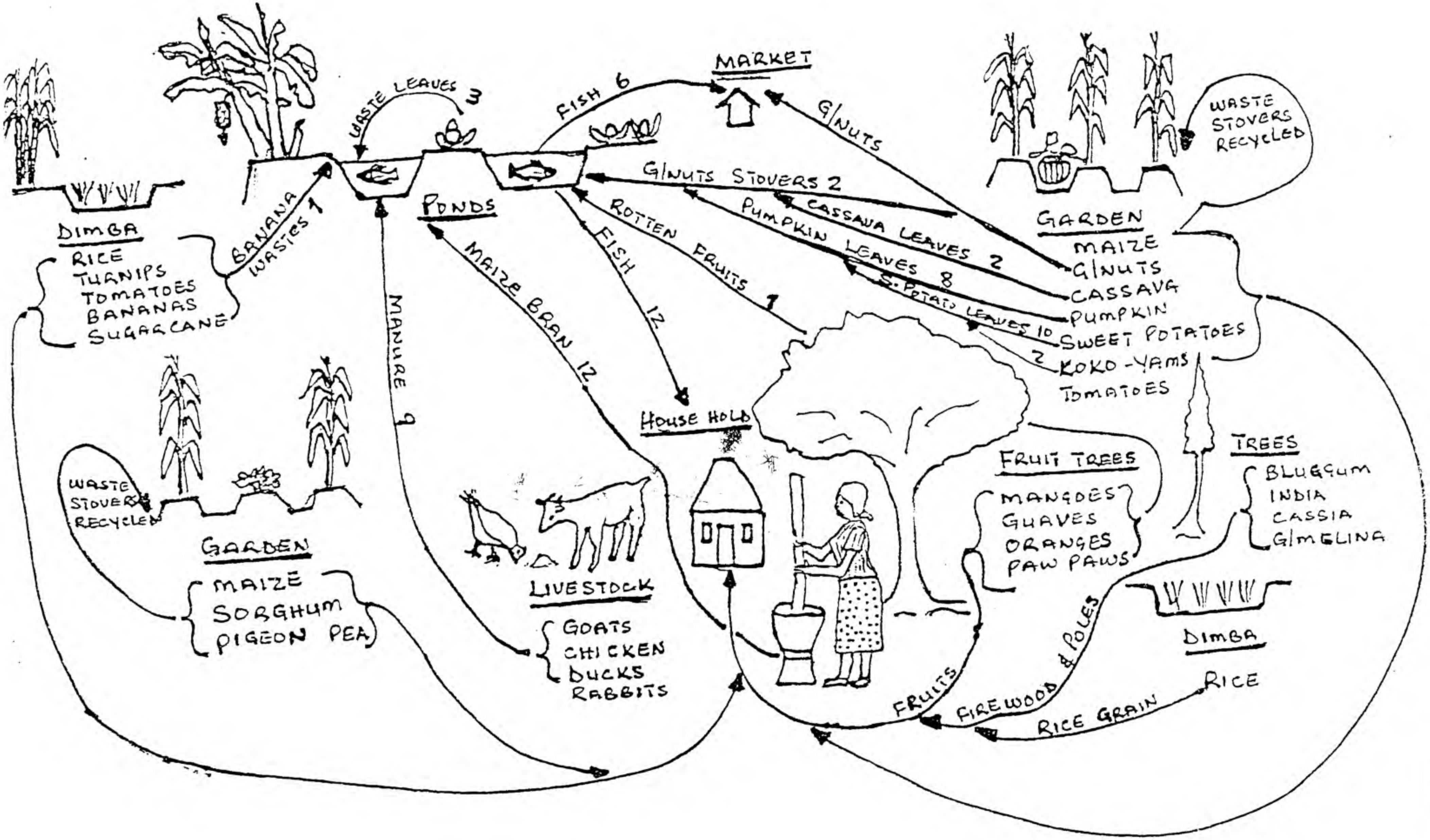

Figure 1. Qualitative bioresource flow diagram of the farming systems extrapolated from the average of 12 integrated aquaculture-agriculture (IAA) farmers in Sakata, Malawi. Numbers associated with materials going to ponds indicate number of farmers using particular input to fish ponds.

Brummett, R.E. 1995. The context of integrated aquaculture in Malawi: a case study for sub-Saharan Africa. Naga 18(4):8-10.

Brummett, R.E. and Chikafumbwa, F.J. 1995. Management of rainfed aquaculture in Malawian smallholdings. Paper presented at the Pacific Congress on Marine Science and Technology (PACON) Conference on Sustainable Aquaculture, Honolulu, Hawaii, USA.

Brummett, R.E. and Noble R.P. 1995. Aquaculture for African smallholders. ICLARM Tech. Rep. 46, 69 p.

Chikafumbwa, F.J. 1990. Studies on napier grass (*Pennisetum purpureum*) as a pond input for the culture of *Tilapia rendalli* and *Oreochromis shiranus*. M.Sc. Thesis, University of Malawi, Zomba.

Eknath A.E. 1991. Simple broodstock management to control indirect selection and inbreeding: Indian Carp example. NAGA, The ICLARM Quarterly14(2): 13-14.

Hepher, B. and Pruginin, Y. 1981. Commercial fish farming. Wiley-Interscience, New York, U.S.A.

Lightfoot, C., S. Feldman and M.Z. Abedin. 1991. Households, agroecosystems and rural resources management: a guidebook for broadening the concepts of gender and farming systems. ICLARM Educational Series 12. Bangladesh Agricultural Research Institute, Joydepur and International Center for Living Aquatic Resources Management, Manila, Philippines.

Kadongola, W.K. 1990. Maize (*Zea mays*) bran as a supplemental feed in the culture of *Tilapia rendalli* and *Oreochromis shiranus*. M.Sc. Thesis University of Malawi, Zomba,

Noble, R.P. and Chimatiro, S. 1991. On-farm biotic resources for small-scale fish farming in Malawi. In B.A. Costa-Pierce, C. Lightfoot, K. Ruddle and R.S.V. Pullin (eds) Aquaculture Research and Development in Rural Africa. ICLARM Conf. Proc. 27. Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) and International Center for Living Aquatic Resources Management, Manila, Philippines (extended abstract).

In 1994, there were four farmers who had ponds in Sakata. In 1996, the number increased to 12 without any direct extension effort in the area over the period[1]. Fish farming was spreading through contacts from farmer to farmer. The benefits of having a pond were obvious to the farmers and resulted in an average increase in pond size from 69 m^2 (Brummett and Chikafumbwa 1995) to 87.9 m^2 over the 1993-1996 period. It was also interesting to note that one farmer decided to keep all the fish for future use. This suggested that there may be a wide range of reasons for keeping and/or growing fish.

During the 1994/95 drought year (<500 mm of rain in an area which normally receives 1050 mm), when pond water levels never got high enough to stock tilapia, one farmer decided to collect catfish fingerlings from the wild for stocking in his pond. After three months the fish were harvested and eaten or sold for a profit. Following his advice in 1996, six other farmers collected catfish fingerlings and stocked their ponds. One other farmer had an accidentl catch of catfish at harvest. This is clear evidence of the interaction and sharing of information and new technologies among farmers. It also indicates that farmers are willing to explore new ways of improving fish farming.

Follow-on work in Sakata will concentrate on the obvious problem of fingerling supply for farmers with short and medium term ponds. The four farmers who had more experience in fish culture had observed that *O. shiranus* is not only more difficult to catch but also reproduces more prolifically in ponds than does *T. rendalli*. They have consequently proposed the stocking of either all *O. shiranus* or a polyculture of *O. shiranus* and *T. rendalli* in the coming years. Two farmers who had previously received training had successfully produced fingerlings for sale in the past, but in 1994/95 their ponds dried up as well. The three farmers who have longer-term water are new entrants. It remains to be seen if they can be trained by their fellow farmers for the benefit of all, or if additional training by researchers and/or extension will be necessary.

REFERENCES

Balarin, J.D. 1987. National reviews for aquaculture development in Africa:12 Malawi. FAO Fisheries Circular, 770.12. Rome, Italy.

[1]A local radio program broadcasts occasional messages about the benefits of fish farming and has thereby increased awareness nationwide.

Table 3. Summary of trees grown by IAA farmers in Sakata, Malawi.

Farmer	Fruit trees	Trees	Source of household firewood
A. Abasi	Guavas (3), mangoes (7), wild loquat (50		Relatives
F. Abasi	Mangoes (10), gvavas (4), papaya (15), wild loquat (3)	*Eucalyptus* spp. (34), *Teminalia catappa* (3), *Gmelina arborea* (4), *Cassia* sp. (1)	Own and relatives
C. Michi	Mango (2), papaya, granadillas, banana, orange, mulbery, wild loquat		Relatives
Y. Michi	Papaya (10), mango (8), tangeline (7), alvocado pears (4)	*Gmelina arborea*, *Eucalyptus* spp.	Relatives
J. Mposa	Custard apple (3), mango (7)	*Eucalyptus* spp. (10)	Own
[1]N. Kasichi	Bananas, guavas, papaya, mangoes, avocado pears wild loquat, lemons, oranges,	*Eucalyptus* spp., *Cassia* sp., *Teminalia catappa*, *Gmelina arborea*, *Toona ciliata*	Own
Ng'ombe	Mangoes (10), lemon (1), orange (1), wild loquat (1), grape fruits (1), tangeline (1) bananas	*Eucalyptus* spp. (20) *Toona ciliata* (4), *Teminalia catappa* (6), *Gmelina arborea* (3),	Own
A. Daudi	Mango (7), lemon (1), orange (2)	*Toona ciliata* (1), *Cassia* sp. (1)	Own + buy
Keyala	Papaya (10)	*Eucalyptus* spp.(135)	Own
T. Masamba	Guavas (3), mangoes (7), wild loquat (5)	*Eucalyptus* spp.(13), *Teminalia catappa* (4), *Toona ciliata* (2),	Own
Nyambalo	Orange (9), mango (I) custard apple (1)	*Eucalyptus* spp.(5)	Own
Mtepa	Mangoes (6), lemon (1), orange (1)	*Gmelina arborea* (4), *Teminalia catappa* (12)	Own

Note: [1]Number of trees planted were over 30 for each type
(..) Number of trees available at the time of data collection

Table 5. Summary of how harvested fish were disposed of by IAA farmers in Sakata, Malawi at the end of the 1995/96 growing season.

Farmer	No. of fish sold and amount realized	No. of fish for home consumption and giving away	No. of fish kept or transferred for restocking
A. Abasi[1]	86 *T. rendalli* = MK210.00 (5.8 kg)	10 *T. rendalli* (0.67 kg) 2 catfish (1.1 kg)	*75 T. rendalli* (2.7 kg)
F. Abasi	96 *T. rendalli* = MK159.00 (6.1 kg)	47 *T. rendalli* (3 kg) 14 catfish (0.8 kg)	157 *T. rendalli* (5.6 kg)
C. Michi	94 *T. rendalli* = MK 130.50 (4.2 kg) 28 catfish = MK 54.00 (3.5 kg)	78 *T. rendalli* (2.8 kg) 17 catfish (2.2 kg)	
*Y. Michi	266 *T. rendalli* = MK 225.00 (12.5 kg)	141*T. rendalli* (4.9 kg) 12 catfish	
*J. Mposa	19 catfish = MK 39.00 (1.1 kg)	41 *T. rendalli* (0.9 kg) 8 catfish (0.5 kg)	
**N. Kasichi	none	35 *T. rendalli* 9 catfish	*98 T. rendalli*
*Mai Ng'ombe	60 *T. rendalli* = MK80.00 (2.7 kg) 33 *T. rendalli* (1.5 kg) (Bartered with maize)	[illegible] T. rendalli (2.6 kg) 6 catfish (1.5 kg)	
**A. Daudi	none	57 *T. rendalli* (0.9 kg)	53 *T. rendalli* (0.6 kg)
Keyala	none	*35 T.rendalli* (0.3 kg)	none
T. Masamba	none	31 *T. rendalli* (0.5 kg)	none
Nyambalo	none	all	none
Mtepa	none	all	none

Note: One US Dollar = 15 Malawi Kwacha (MK) in 1996

1 = catfish was not stocked in the pond

* = fish was initially kept in the pond rent to Mai Ng'ombe and was remove for home consumption because of water problem

** = farmers kept fish for restocking at A. Abasi ponds