POND DYNAMICS/AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM
RESEARCH REPORTS
Sustainable aquaculture for a Secure future

Small-Scale Fish Farming in Rwanda: Data Report

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Introduction

This data report presents information collected in a survey of 267 fish farmers in Rwanda in September 1991. The findings are discussed in CRSP Research Report 98-124 entitled, "Small-Scale Fish Farming in Rwanda: Economic Characteristics" (Hishamunda et al., 1998). The Research Report contains enterprise budgets for individual and cooperative enterprises that raised fish and alternative crops. These enterprise budgets demonstrate that fish production yielded the highest net returns to land, labor, and management. Additionally, the Research Report compares the carbohydrate yield and protein costs of fish with those of alternative crops, and concludes that sweet potatoes produced the highest yield of carbohydrates and that soybeans were the least expensive protein source. The results of the study demonstrate that fish culture is a superior production system in terms of cash income per unit of land when compared with other crops raised in the *marais*, or valley lowlands, in Rwanda.

This data report presents information collected in the survey that, while supplemental to the original research objectives, may be of interest. Section 1 contains 15 tables and 3 figures, which summarize the supplemental data collected by the survey instrument. The questionnaire itself comprises Section 2. Section 3 contains the criteria which were used to classify survey responses as unreliable, factors for converting various measures of crops and inputs into kilograms, and secondary data from the literature which were used to compare the nutritional values of various crops in the Research Report. Sources of secondary data used in the study are listed in the Literature Cited section.

Section 1. Supplemental Data

Table 1. Sampling frame for cooperative and individual fish farmers surveyed in Rwanda, 1991.

Type of Farmer	Sampling Universe[a]	Sample Size	Interviewed	Refused Interview	Not Contacted	Completion Rate
		Number				*%*
All Farmers	2300	280	267	10	3	95
Cooperatives	1250	167	156	8	3	93
Individuals	1050	113	111	2	0	98

[a] Source: Hishamunda (1991)

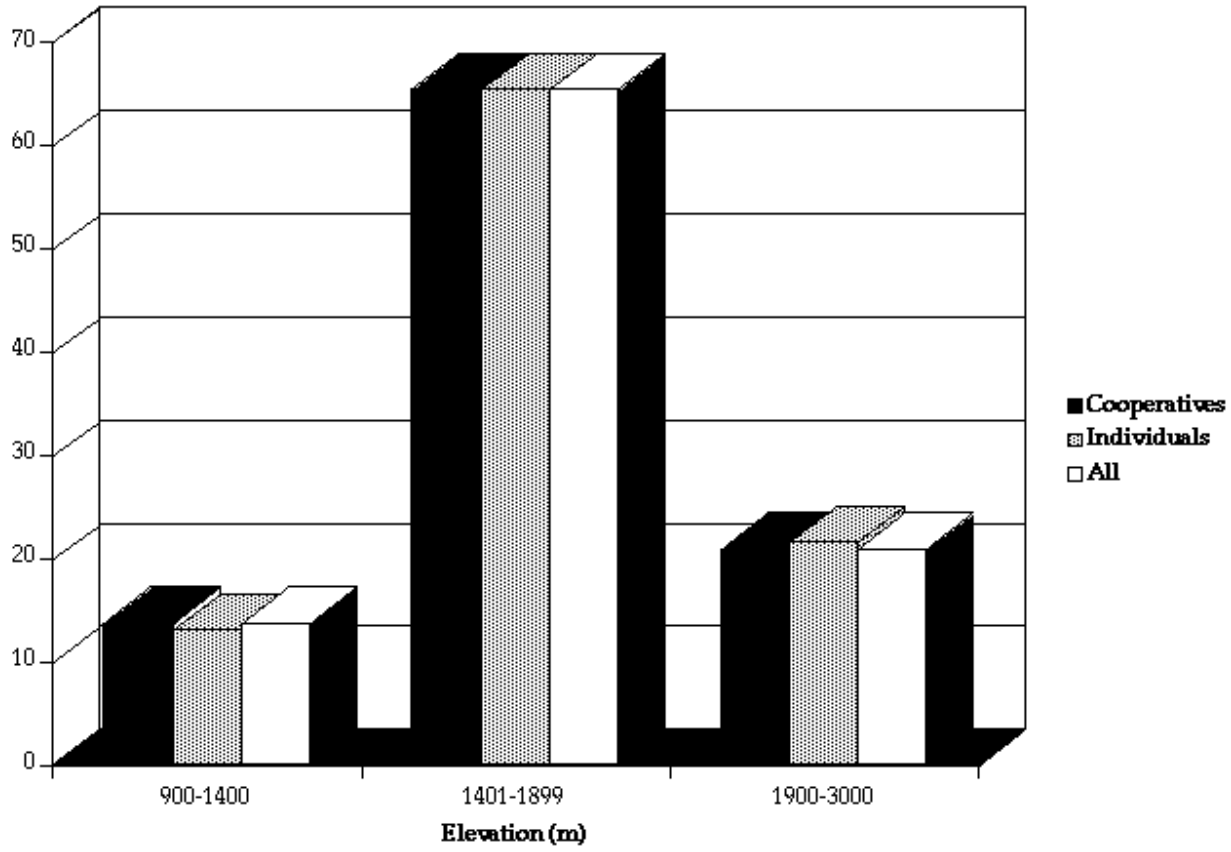

Figure 1. Percent of individual and cooperative farmer respondents by altitude (Survey of Rwandan fish farmers).

Table 2. Farm size and land holdings of cooperative and individual fish farmer respondents (Survey of Rwandan fish farmers, 1991).

Type of Respondent	Farm Size in Study *Marais*		Additional Holdings	
	Mean (Are) [c]	*Range (Are)*	*Number*	*%*
All (N = 257)	32	1 - 603	161	63
Cooperative (N=151)[a]	51	1 - 603	116	77
Per Member (N=151)	4	0 - 44		
Individual (N=106)[b]	4	1 - 16	45	43

[a] For cooperatives, one questionnaire was blank, and four were not usable.
[b] For individuals, one questionnaire was blank, one was missing, and three were not usable.
[c] 1 are = 100 m^2.

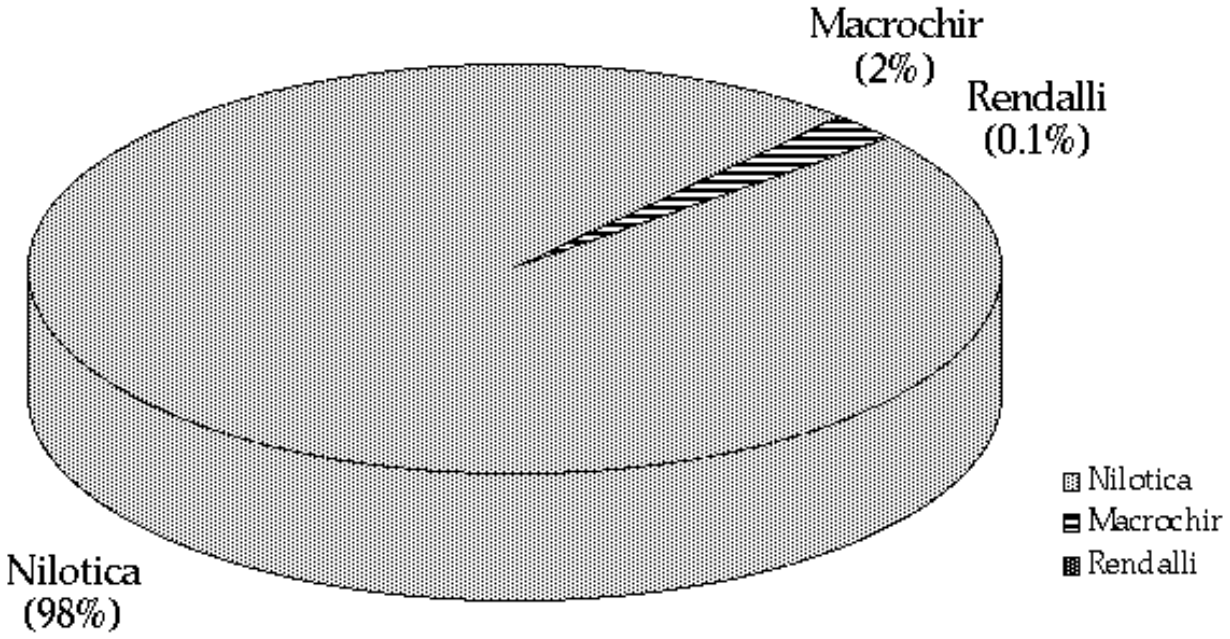

Figure 2. Monoculture tilapia species stocked (Survey of Rwandan fish farmers, 1991).

Table 3. Area cultivated and percentage of total cropped area for individual and cooperative respondents per crop (Survey of Rwandan fish farmers, 1991).

Crop	Area Cultivated (ares)		% of Total Cropped Area	
	Mean	*Range*	*Mean*	*Range*
BEANS				
All	2	0-80	7	0-49
Cooperative	4	0-80	8	0-49
Individual	0	0-2	6	0-47
CABBAGE				
All	1	0-100	4	0-63
Cooperative	2	0-100	5	0-63
Individual	0	0-0	0	0-7
CASSAVA				
All	2	0-100	5	0-74
Cooperative	3	0-100	5	0-74
Individual	0	0-2	0	0-50
FISH				
All	3	1-15	11	1-100
Cooperative	4	1-15	8	1-100
Individual	3	1-15	80	33-100
IRISH POTATO				
All	2	0-200	7	0-94
Cooperative	4	0-200	8	0-94
Individual	0	0-0	0	0-6
MAIZE				
All	2	0-70	6	0-61
Cooperative	3	0-70	6	0-49
Individual	0	0-3	3	0-60
PEANUTS				
All	0	0-0	0	0-5
Cooperative	0	0-0	0	0-0
Individual	0	0-0	0	0-5
PEAS				
All	0	0-1	0	0-17
Cooperative	0	0-0	0	0-0
Individual	0	0-1	0	0-17
RICE				
All	0	0-0	0	0-10
Cooperative	0	0-0	0	0-0
Individual	0	0-0	0	0-10
SORGHUM				
All	3	0-100	9	0-96
Cooperative	5	0-100	9	0-96
Individual	0	0-8	6	0-67
SOYBEANS				
All	3	0-305	8	0-79
Cooperative	4	0-305	8	0-79
Individual	0	0-1	0	0-23
SWEET POTATO				
All	9	0-600	29	0-99
Cooperative	16	0-600	31	0-99
Individual	10	0-1	3	0-35
TARO				
All	4	0-475	13	0-99
Cooperative	7	0-475	14	0-99
Individual	0	0-1	3	0-20

Table 4. Tools owned by cooperative and individual fish farmers (Survey of Rwandan fish farmers, 1991).

Tool	% of Farmers Who Own Tools	Average Cost and Range for Fish Production (RF [a])
BASIN		
Cooperative	29	340 (150-600)
Individual	66	340 (230-700)
BASKET		
Cooperative	54	81 (25-420)
Individual	86	78 (78-400)
BUCKET		
Cooperative	32	450 (100-1,200)
Individual	62	438 (100-1,220)
EARTHEN JAR		
Cooperative	14	106 (30-280)
Individual	75	126 (20-400)
FORK		
Cooperative	4	550 (0[b]-600)
Individual	12	363 (0[b]-600)
HOE		
Cooperative	78	394 (0[b]-600)
Individual	98	412 (250-600)
MACHETE		
Cooperative	70	235 (125-420)
Individual	94	229 (200-400)
PICK		
Cooperative	2	430 (0[b]-460)
Individual	31	449 (0[b]-1000)
SHOVEL		
Cooperative	52	459 (0[b]-800)
Individual	69	452 (0[b]-750)
WHEELBARROW		
Cooperative	11	4,650 (0[b]-7,500)
Individual	20	4,364 (0[b]-9,000)

[a] US$1 = RF145.

[b] Gift from government or non-governmental, non-profit organization.

Table 5. Age, education, and marital status of cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Parameter	All Respondents		Cooperative Respondents		Individual Respondents	
	%	*Yr.*	*%*	*Yr.*	*%*	*Yr.*
AGE (yr) (N=236)						
19-30	17		18		15	
31-55	72		78		65	
56-78	11		4		20	
Average Age		41		40		43
Range		19-78		22-62		19-78
EDUCATION (yr) (N=256)						
0	20		19		22	
1-6	56		52		62	
7-12	21		26		13	
13-17	3		3		3	
Average Years Education		5		5		4
Range		0-17		0-17		0-14
MARITAL STATUS (N=256)						
Single	4		6		2	
Married	96		94		98	

Table 6. Size of pond, labor, and cost of ponds constructed by cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Category		All Respondents (Mean and Range)		Cooperative Farmers (Mean and Range)		Individual Farmers (Mean and Range)
NUMBER OF RESPONDENTS		68		52		16
MEAN POND SIZE (Ares)		4 (1-15)		4 (1-15)		3 (1-14)
MEAN COST (RF[a] are^{-1})		7,435 (2,000-25,600)		7,807 (2,000-25,600)		6,228 (2,500-13,643)
LABOR (Person-day are^{-1})						
Hired		48 (0-1,332)		46 (0-1,332)		56 (0 -700)
Family		343 (0-2,464)		393 (0-2,464)		180 (0-868)
Total		391 (26-2,464)		438 (26-2,464)		235 (46-868)
TYPE OF LABOR						
Hired	No.:	6	No.:	4	No.:	2
	%:	8	%:	8	%:	12
Family	No.:	50	No.:	38	No.:	12
	%:	74	%:	73	%:	75
Family / Hired	No.:	12	No.:	10	No.:	2
	%:	18	%:	19	%:	13

[a] US$1 = RF145.

Table 7. Type of supplier, means of acquisition and price of fingerlings for cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Category	All Farmers (N=195)	Cooperatives (N=120)	Individuals (N=75)
SUPPLIER			
Government Station (%)	36	36	36
Private Farmer (%)	64	64	64
MEANS OF ACQUISITION			
Buy(%)	64	63	64
Gift(%)	6	7	5
Own(%)	30	30	31
PRICE PAID BY FARMER (RF[a])			
% Reporting Prices	53	66	32
Mean	330	320	390
(Range)	(100-800)		(200-800)

[a] US$1 = RF145.

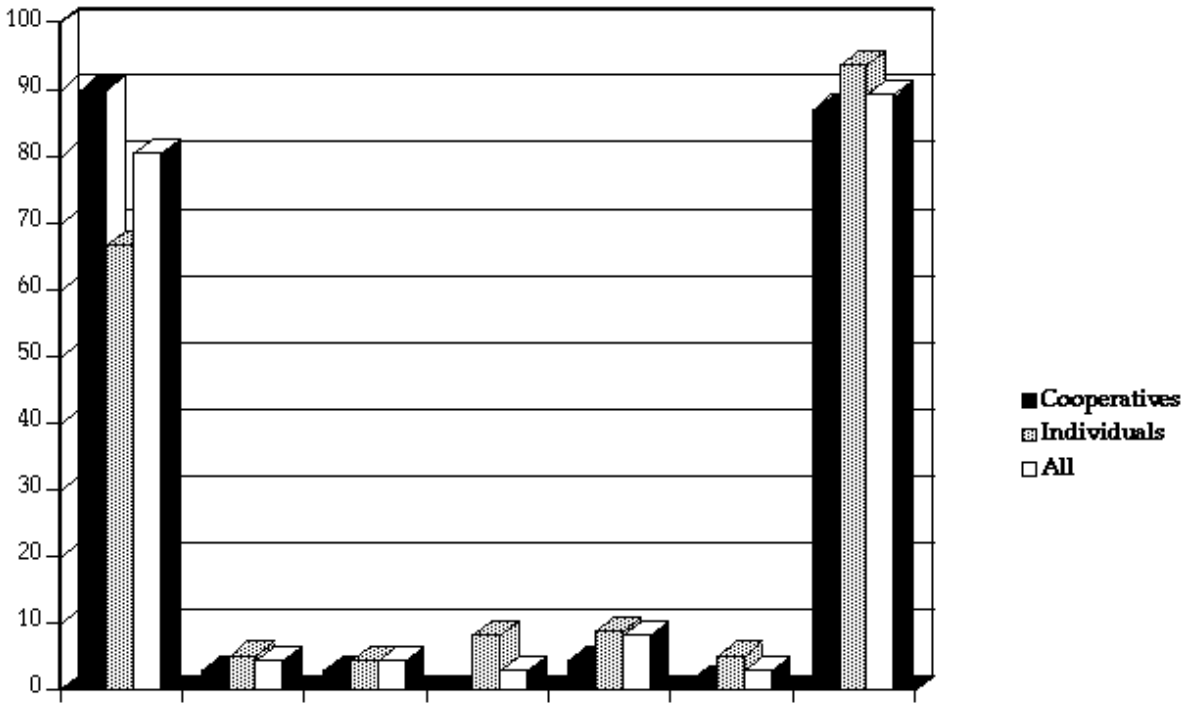

Figure 3. Feed and manure use by cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Table 8. Frequency of applications of feed and manure and of compost mixing for cooperative and individual farmers (Survey of Rwandan fish farmers, 1991).

Respondent	**Frequency of Activity Per Month**					
	Feed		Manure		Compost Mixing	
	Mean	*Range*	*Mean*	*Range*	*Mean*	*Range*
All Respondents (N=222)	4	(0-7)	1	(0-8)	2	(0-7)
Cooperative Farmers (N=130)	3	(0-7)	1	(0-3)	1	(0-7)
Individual Farmers (N=92)	4	(0-7)	1	(0-8)	2	(0-7)

Table 9. Labor activities and frequency performed by cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Labor Activity	**All Respondents** (N=222)	**Cooperatives** (N=130)	**Individuals** (N=92)	**Frequency of Labor Per Month**
	%	*%*	*%*	*Mean and Range*
Add Water	93	92	95	1 (0-4)
Plug Leaks	48	48	49	0 (0-2)
Cut Grass for Feed	96	95	98	0.75 (0-2)
Cut Grass for Compost	85	87	83	0.25 (0-0.75)
Pull Weeds	69	69	70	0.25 (0-1)
Pond Surveillance Frequency	48	45	52	2.5 (0-7)
Time Spent (min)				
Average:	44	62	20	-
Range:	0-1440	0-1440	0-180	-

Table 10. Production cycle, average weight of fish at harvest, annual net yield, percentage of marketable weight fish of total net harvest, and recovery rate[a] of tilapia for cooperative and individual farmer respondents (Survey of Rwandan fish farmers, 1991).

Category	**All Respondents**		**Cooperatives**		**Individuals**	
			Mean and Range			
Production Cycle (mo)	11	(5-48)	11	(5-26)	11	(5-26)
Average Weight (g)	173	(40-537)	174	(40-537)	172	(64-298)
Annual Net Yield (kg are $^{-1}$yr^{-1})	16	(1-49)	16	(2-49)	17	(1-37)
Marketable Weight / Total Net Harvest (%)	82	(40-100)	81	(40-100)	83	(44-100)
Recovery Rate [a] (%)	77	(19-100)	76	(22-100)	79	(19-100)

[a] Recovery Rate = Number of fingerlings stocked / number of above-fingerling-size fish harvested.

Table 11. Use of total harvest, marketable fish, and fingerlings (Survey of Rwandan fish farmers, 1991).

Use[a]	All Respondents		Cooperatives		Individuals	
	% of Respondents (N=223)	*% of Harvest (N=187)*	*% of Respondents (N=128)*	*% of Harvest (N=105)*	*% of Respondents (N=95)*	*% of Harvest (N=82)*
TOTAL HARVEST						
Sold	90	56	89	57	90	55
Consumed	92	28	87	32	100	24
Gave Away	73	11	61	7	88	16
Restocked	78	6	73	5	84	6
MARKETABLE FISH						
Sold	86	61	85	67	87	62
Consumed	85	31	83	34	99	25
Gave Away	44	8	43	5	78	13
Restocked	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FINGERLINGS						
Sold	45	65	44	64	46	67
Consumed	29	0	23	0	27	0
Gave Away	39	6	34	7	45	5
Restocked	78	29	73	29	84	28

[a] Farmers made more than one use of fish.

Table 12. Percentage of cooperative and individual farmer respondents who sold fish by the kilogram, piece, and bucket (Survey of Rwandan fish farners, 1991).

Unit of Sale	All Respondents (N=184)		Cooperative Farms (N=104)		Individual Farms (N=80)	
	% of Farmers	*Price Received (RF[a] kg^{-1})*	*% of Farmers*	*Price Received (RF kg^{-1})*	*% of Farmers*	*Price Received (RF kg^{-1})*
Kilogram	92	147	93	145	91	149
	range of prices received: (100-257)		*range of prices received:* (100-257)		*range of prices received:* (100-250)	
Piece	7	184	6	-	9	-
	range of prices received: (110-257)					
Bucket	1	100	1	100	0	-

[a] US$1 = RF145.

Table 13. Number and percentage of cooperative and individual farmers who sold fish under the following market categories: non-wage-earner neighbor, wage-earner neighbor, marketplace, restaurant, and bar (Survey of Rwandan fish farmers, 1991).

Type of Customer[a]	All Respondents (N=184)	Cooperatives (N=104)	Individuals (N=80)
	%	%	%
NON-WAGE-EARNER NEIGHBOR			
% of Respondents	74	67	82
% of Harvest [b]	64	60	70
WAGE-EARNER NEIGHBOR			
% of Respondents	24	22	27
% of Harvest [b]	16	15	18
MARKETPLACE			
% of Respondents	18	21	14
% of Harvest [b]	14	17	10
RESTAURANT			
% of Respondents	3	4	1
% of Harvest [b]	1	2	0
BAR			
% of Respondents	6	8	4
% of Harvest [b]	5	6	2

[a] Fish farmers sold to more than one customer.
[b] All means ranged from 0 to 100 with the exception of individuals who sold to restaurants (means ranged from 0 to 33).

Table 14. Number and percentage of cooperative and individual farmers who received cash or credit payments for fish sold (Survey of Rwandan fish farmers, 1991).

Respondent	Cash	Credit
ALL RESPONDENTS (N=184)		
% of Respondents[a]	98	10
% of Fish Weight Sold	94	6
COOPERATIVES (N=104)		
% of Respondents[a]	100	8
% of Fish Weight Sold	96	4
INDIVIDUALS (N=80)		
% of Respondents[a]	96	12
% of Fish Weight Sold	92	8

[a] Some farmers sold fish for both cash and credit.

Table 15. Percentage of cooperative and individual farmer respondents who allocated fish production income to fish production, agriculture, school fees, household needs, miscellaneous needs, and bank accounts (Survey of Rwandan fish farmers, 1991).

Respondent	Fish Production	Agriculture	School Fees	Household Needs	Miscellaneous Needs	Bank Account
ALL RESPONDENTS (N=199)						
% of Farmers[a]	52	8	34	74	6	17
% of Fish Income Allocated	23	5	13	46	3	9
COOPERATIVES (N=111)						
% of Farmers[a]	44	8	27	62	5	24
% of Fish Income Allocated	24	5	11	41	3	16
INDIVIDUALS (N=86)						
% of Farmers[a]	63	8	44	91	6	8
% of Fish Income Allocated	23	5	14	53	4	2

[a] Fish farmers allocated income to more than one category.

Section 2. Survey Instrument

ECONOMICS OF AQUACULTURE SURVEY IN RWANDA
"PERSONAL INTERVIEWS"

I. PERSONAL DATA

1. Name of owner Sex
2. Name of person interviewed Sex
3. Age of owner
4. Number of years of formal education

II. FAMILY INFORMATION OF OWNER

5. Marital status: single married divorced
6. Total number of families
7. Family composition:

The Active Members of your family	Male	Female
a) 9-14 yrs old		
b) 15 yrs and up		

Non-active Members
a) due to age
b) due to other reasons (explain)

Number of children in school:

8. Primary School
9. Secondary School a) publicly
   b) privately
10. Universities a) publicly
    b) privately

11. Number of members who migrated to a city:

Male	Female	Destination

12. What is your principal activity during:
    a) rainy season b) dry season
13. What are your secondary activities during:
    a) rainy season b) dry season

III. FISH POND MANAGEMENT

14. Do you ever purchase feed for your pond? Yes No
    If yes go to 15. If no, go to 16.

15. I would like you to indicate to me the amount of fish food you purchase for your pond per growing cycle.

Feed	No. of Buckets	Wt. of Bucket	Price/Bucket
1. Brewers waste			
2. Setaria leaves			
3. Other grass			
4. Taro leaves			
5. Rice Bran			
6. Diverse rests cereal-mills			
7. Other (describe)			

16. Could you indicate to me the time per day worked it takes to perform these following activities:

Activity	Time/Day (Min)	No. of Days/Week (Total)
1. Feeding		
2. Adding Manure		
3. Add and stir compost		
4. Adding water		
5. Plug a leak in dike		
6. Cut grass for feed		
7. Cut grass for compost		
8. Pull weeds from pond bank		
9. Watch the fish		
10. Guard the fish		
11. Other		

IV. HARVEST AND USE OF PRODUCTION

17. May I know the time it took to perform these activites the last time you harvested this fish pond?

Activity	Time in minutes	No. of persons needed (include self)
1. Cut levee(s)		
2. Drain pond		
3. Get fish out		
4. Remove excess mud		
5. Sell fish		
6. Clean and repair levee(s)		
7. Close levee(s)		
8. Refill pond		

18. The last time you harvested your pond (total), I would like to know these the following:

	a Amount harvested (kg)	b Consumed at home (kg)	c Given away (kg)	d Sold
1. From species stocked				
2. From wild species				

19. Also, the last time you harvested your pond, I would like to know this information related to fingerlings:

	Amount harvested (kg)	Consumed at home (kg)	Given away (kg)	Sold
1. From species stocked				
2. From wild species				

20. For the quantity sold, could you tell me the following:

Category	Quantity (kgs)	Avg. Wt. (grams)	Place of sale	Unit(kg or piece)	Price/Unit	Method of sale
1. Food fish						
2. Fingerlings						
3. Wild adults and fingerlings.						

Remark: Use the following codes:

for (1) =	for (2) =
a) "Nyi" = neighbor	a) "Ide" = credit
b) "Kozi" = wage earner	b) "Kas" = cash
c) "Soko" = market	c) "Guna" = barter (explain)
d) "Res" = restaurant	d) "Ndi" = other (explain)
e) "Bari" = bars	
f) "Ndi" = other (explain)	

V. METHOD OF DISPOSAL OF MONEY OBTAINED FROM FISHCULTURE

21. I would like to know how you spend the money obtained from fish sale (your fish ponds)

Method of Disposal	Amount in money in Rwanda Francs
1. Buy tools for fish culture	
2. Buy fish food	
3. Pay school fees	
4. Buy inputs for ponds	
5. Buy household goods	
6. Others (list)	

VI. FARM SITUATIONS

N.B. For cooperatively managed ponds, you are requested to report information related to the "cooperative" itself. Avoid reporting one related to the individual answering on the behalf of that entity.

22. I would like you to tell me if you would have another plot beside this one you've used to build your fish pond.

Category	Site 1	Site 2	Site 3	Site 4
1. Location				
2. Valleys or Hillside				
3. Number of Plots				
4. Area, Plot size				
5. Principal crop				
6. Is there a fish pond				
7. Individually owned (yes or no)				
8. Owned / Leased / Permitted				
9. Production obtained (kg or bucket) If bucket was used, then weigh 1 (one) bucket, and report the weight in kg. (Use a separate sheet if different crops.)				

23. Could you indicate to me the number and kind of farm animals you have?

Animals	Average age (months)	Number	Estimated value / group (Rwandan Francs)
1. Cows			
2. Sheep			
3. Goats			
4. Chickens			
5. Pigs			
6. Ducks			
7. Rabbits			
8. Geese			
9. Other (list)			

VII. LAND ALLOCATION AND CROP PRODUCTION

Situation

24. Could you tell me how you use your land (rent or leased) to produce crops and which production you obtain from each crop?

Crop	Area in acres	Production / cycle (baskets or Kg)	Number of cycles / year
1. Sweet potatoes			
2. Irish potatoes			
3. Cassava			
4. Taro			
5. Bananas			
6. Coffee			
7. Sorghum			
8. Maize			
9. Sweet peas			
10. Beans			
11. Soybeans			
12. Peanuts			
13. Rice			
14. Cabbage			
15. Other (mixed cropping, list)			

b. Equipment used to produce:

25. May I know, among the following equipment, which one(s) you are using on your farm?

Equipment	Average age (months)	Number	Initial Value / tool (Rwanda Francs)
1. Machetes			
2. Hoes			
3. Shovels			
4. Picks			
5. Forks			
6. Wheelbarrows			
7. Basins			
8. Buckets			
9. Baskets			
10. Earthen Jars			
11. Other (list)			

c. Seeds-Fertilizers-Soil preparation labor and others:

26. Can we talk about seed you use in farming?

Seed	Quantity (bag (pile) kg)	Price / bag (pile or kg)	Method of payment	Origin
1. Sweet Potatoes				
2. Irish Potatoes				
3. Cassava				
4. Taro				
5. Bananas				
6. Coffee				
7. Sorghum				
8. Maize				
9. Sweet Peas				
10. Beans				
11. Soybeans				
12. Peanuts				
13. Rice				
14. Cabbage				
Other (mixed cropping,..., (list))				

Remark: Use the following codes:
for (1) = a) "Ide" = credit; b) "Kas" = cash; c) "Guna" = barter (explain); d) "Ndi" = other (explain)
for (2) = a) "Nyi" = neighbor; b) "Soko" = market; c) "Mbere" = Research Station / Agricultural Projects

27. Of the following inputs, could you tell me which one you use?

Inputs	Quantity	Area of use (acres)	Total price (Rw. francs)	Method of payment	Origin
1. Lime					
2. Chemicals					
3. Organic fertilizers					
4. Herbicides and Pesticides					

Remark: Use the following codes:
for (1) = a) "Ide" = credit; b) "Kas" = cash; c) "Guna" = barter (explain); d) "Ndi" = other (explain)
for (2) = a) "Nyi" = neighbor; b) "Soko" = market; c) "Mbere" = Research Station / Agricultural Projects

28. I would like you to try to remember, and indicate to me the labor hired to work on cash crops from soil preparation to yield stockage.

Crop	Area Planted (acres)	No. of workers	Total days worked	Hours / day worked	Wages / day	Method of payment
1. Sweet Potatoes						
2. Irish Potatoes						
3. Cassava						
4. Taro						
5. Bananas						
6. Coffee						
7. Sorghum						
8. Maize						
9. Sweet Peas						
10. Beans						
11. Soybeans						
12. Peanuts						
13. Rice						
14. Cabbage						
15. Other (mixed cropping (list))						

Remark: Use the following codes:
a) "FRW" = Rwandan francs
b) "Iryo" = Food
c) "Nzoga" = Beer
d) "Dehe" = work in group
e) "Ndi" = other (explain)

29. This time I would like you to tell me the labor used on the following crops, including your own labor, plus other non-paid labor, from soil preparation to harvest.

Crop	Area planted (acres)	No. of workers	Total days worked	Hours/day worked
1. Sweet potatoes				
2. Irish potatoes				
3. Cassava				
4. Taro				
5. Bananas				
6. Coffee				
7. Sorghum				
8. Maize				
9. Sweet peas				
10. Beans				
11. Soybeans				
12. Peanuts				
13. Rice				
14. Cabbage				
15. Other (mixed cropping, list)				

30. I am interested in knowing the method of soil preparation, time of preparation and tools you used to do so for each crop.

Crop	a Area planted(acres)	b Stage 1	c Stage 2	d Stage 3	e Total days worked	f No. of workers	g Tools used
1. Sweet potatoes							
2. Irish potatoes							
3. Cassava							
4. Taro							
5. Bananas							
6. Coffee							
7. Sorghum							
8. Maize							
9. Sweet peas							
10. Beans							
11. Soybeans							
12. Peanuts							
13. Rice							
14. Cabbage							
15. Other (mixed cropping, list)							

31. Could you indicate to me the method of sowing, time of sowing, and tools you used to do so for each crop.

Crop	a Area planted (acres)	b Method Sowing	c Days used to plant	d No. of workers	e Qty of seeds	f Unit used (kgs or bag)
1. Sweet potatoes						
2. Irish potatoes						
3. Cassava						
4. Taro						
5. Bananas						
6. Coffee						
7. Sorghum						
8. Maize						
9. Sweet peas						
10. Beans						
11. Soybeans						
12. Peanuts						
13. Rice						
14. Cabbage						
15. Other (mixed cropping, list)						

Remark: Use the following codes:

for (1)
a) "Rongo" = line
b) "Twobo" = holes
c) "Nja" = broadcasting
d) "Nwa" = mouth
e) "Ndi" = other (explain)

for (2) It is just a figure; let us say the quantity of seeds used in 3 kg. You shall write the number "3". The unit will appear in the next column.

32. We have talked about inputs in question #27, I would like to know more about the method of their application and time spent to apply them.

Crop	Area planted (acres)	Gara	Ganda	Rera	Gara	Ganda	Rera	Rongo	Towbo	Nja
1. Sweet potatoes										
2. Irish potatoes										
3. Cassava										
4. Taro										
5. Bananas										
6. Coffee										
7. Sorghum										
8. Maize										
9. Sweet peas										
10. Beans										
11. Soybeans										
12. Peanuts										
13. Rice										
14. Cabbage										
15. Other (mixed cropping, list)										

33. I would like to have the following information related to the use of pesticides and herbicides such as DDT and others.

Crop	Areas planted (acres)	Time spent to apply (hours)	Cost of pesticide	Name of pesticide
1. Sweet potatoes				
2. Irish potatoes				
3. Cassava				
4. Taro				
5. Bananas				
6. Coffee				
7. Sorghum				
8. Maize				
9. Sweet peas				
10. Beans				
11. Soybeans				
12. Peanuts				
13. Rice				
14. Cabbage				
15. Other (mixed cropping, list)				

34. I still need information from you concerning the use of traditional fertilization (organic). Could you indicate to me the following:

Crop	Area planted (acres)	Number of baskets used	Weight of basket (kilos)	Rongo	Towbo	Nja	Rongo	Towbo	Nja
1. Sweet potatoes									
2. Irish potatoes									
3. Cassava									
4. Taro									
5. Bananas									
6. Coffee									
7. Sorghum									
8. Maize									
9. Sweet peas									
10. Beans									
11. Soybeans									
12. Peanuts									
13. Rice									
14. Cabbage									
15. Other (mixed cropping, list)									

35. Could you indicate to me the time spent weeding your crops?

Crop	Area planted in acres	No. of workers	Total of days worked	Hours per days worked	Hand	Hoe
1. Sweet potatoes						
2. Irish potatoes						
3. Cassava						
4. Taro						
5. Bananas						
6. Coffee						
7. Sorghum						
8. Maize						
9. Sweet peas						
10. Beans						
11. Soybeans						
12. Peanuts						
13. Rice						
14. Cabbage						
15. Other (list)						

36. I would like you to indicate to me the time you spent thinning your crops.

Crop	Area planted in acres	No. of workers	Total of days worked	Hours per days worked	Pull-up	Machete	Other (specify)
1. Sweet potatoes							
2. Irish potatoes							
3. Cassava							
4. Taro							
5. Bananas							
6. Coffee							
7. Sorghum							
8. Maize							
9. Sweet peas							
10. Beans							
11. Soybeans							
12. Peanuts							
13. Rice							
14. Cabbage							
15. Other (list)							

37. I would like to know the time it took you to harvest your crops

Crop	Area Planted (acres)	No. of workers per day	Total days worked	Hours per day worked	Tools used
1. Sweet potatoes					
2. Irish potatoes					
3. Cassava					
4. Taro					
5. Bananas					
6. Coffee					
7. Sorghum					
8. Maize					
9. Sweet peas					
10. Beans					
11. Soybeans					
12. Peanuts					
13. Rice					
14. Cabbage					
15. Other (mixed cropping, List)					

38. We have talked so much about crops but we did not reach the production subject. Could you tell me how you use the production from each crop?

Crop	Unit	Quantity harvested	Consumption by owner	Quantity sold	Quantity given away(free)	Quantity stored
1. Sweet potatoes						
2. Irish potatoes						
3. Cassava						
4. Taro						
5. Bananas						
6. Coffee						
7. Sorghum						
8. Maize						
9. Sweet peas						
10. Beans						
11. Soybeans						
12. Peanuts						
13. Rice						
14. Cabbage						
15. Other (mixed cropping, List)						

Use the following codes: (1) kg = kilos; (2) Ndobo = bucket; (3) Tebo = basket. If the basket has been used as a unit, the interviewer is to weigh and report the equivalent in kg of a basket of each crop. If he cannot, he is requested to approximate and tell us how many buckets are required to fill up one basket for each crop.

39. For the quantity sold, I would like to know the following.

Crop	Place of sale	Unit used	Price per unit	Method of sale
1. Sweet potatoes				
2. Irish potatoes				
3. Cassava				
4. Taro				
5. Bananas				
6. Coffee				
7. Sorghum				
8. Maize				
9. Sweet peas				
10. Beans				
11. Soybeans				
12. Peanuts				
13. Rice				
14. Cabbage				
15. Other (mixed cropping, List)				

Remark:
Use the following codes: for (1) = a) "Nyi" = Neighbor; b) "Kozi" = wage earner; c) "Soko" = market; d) "Res" = restaurant; e) "Bari" = bars; f) "Ndi" = other (specify)
for (2) = a) "Kg" = kilo; b) "Ndobo" = bucket; c) "Tebo" = basket; d) "Bdi" = other
for (3) = a) "Deni" = credit; b) "Kas" = cash; c) "Guna" = barter (specify); d) "Kdi" = other (specify)

VII. FRUIT CROP PRODUCTION

40. Let us talk about the status of the fruit orchard.

Crop	Young plant	Bearing	Value of annual production (CRF)	Condition of crop
1. Bananas				
2. Coffee				
3. Avocado				
4. other				

Remark: Use the scale from 0-5 based on your own judgement of the crop condition.
Scale:
(0) = might be uprooted
(1) = very bad condition
(2) = bad condition
(3) = good condition
(4) = very good condition
(5) = excellent condition

41. Could you tell me the amount of time you spend guarding your crops?

Crop	No. of persons (at one time)	No. of hours used(day)	Total number of hours per week (include all persons)
1. Bananas			
2. Coffee			
3. Avocados			
4. Others			

42. Also, I would like to know the following:

	Bananas	Coffee	Avocado	Other (specify)
1. Number				
2. Price of small seedling trees				
3. Total days to plant				
4. No. of workers				
5. Totals days to weed				
6. No. of times to weed per year				
7. Hours spent harvesting				

43. May I know the use of your annual harvest from each of your fruit crops?

Remark: 1 = kg: if this is the unit used

(1) "bare" = number if this is the unit used (example: 2 bananas, 10 avocados)

(2) "Tebo" = basket if this is the unit used

44. I would like to know the following for the quantity sold.

Crop	Place of sale	Unit used	Price by unit	Method of sale	Total amount received
1. Banana					
2. Banana juice					
3. Banana beer					
4. Coffee					
5. Avocado					
6. other(specify)					

Remark: Use the following codes:

for (1) =
a) "Nyi" = neighbor
b) "Kozi" = wage earner
c) "Soko" = market
d) "Res" = restaurant
e) "Bari" = bar
f) "Ndi" = other

for (2) =
a) "Kg" = if this is the unit used
b) "Bare" = if sold by each item
c) "Tebo" = if sold by basket
d) "Cupa" = if sold by bottle
e) "Kani" = if sold by pot (121)
f) "Saha" = if sold by plate (show # of plates)
g) specify other units

for (3) =
a) "Deni" = if it is by credit
b) "Kas" = if it is by cash
c) "Guna" = barter
d) "Kdi" = other means (specify)

45. I would like to know if you have any additional source of income.

Type of activity	Annual Revenue	If it is cooperative, do you save your money in the cooperative bank (y or n)
1. Masonry		
2. Carpentry		
3. Sewing		
4. Sawyer		
5. Wood cutting for fuel		
6. Raise trees, sale lumber		
7. Charcoal		
8. Any type of trading		
9. Outside hire		
10. Other (specify)		

VII. POND RECORD INFORMATION

Remark: The following information should be obtained from the pond chart. However, if the pond chart is incomplete with respect to the following questions, the interviewer is requested to try to obtain the lacking information from the pond owner or person interviewed.

46. Name of pond owner sex (m-f)
47. Name of the marais the pond is in
48. Altitude of the marais
49. Pond address
    Prefecture Sub-prefecture
    Commune Sector
    Cell
50. Number of ponds owned (not shared with others)

	a	b	c	d	e
No.	Pond area (acres)	Year construction began	Year achieved	Maraias (sic)	Commune

51. Number of days it took to build the pond and cost of construction.

	a	b	c
Pond #	Total days	Total amount paid	Total Man-days worked by the pond owner, his family, relatives or friends (unhired)

N.B. * = Example: If 10 persons work for 1 day, then you will write 10 man-days. If the 10 persons worked one and a half days the number of man-days is 15.

52. Ponds commonly shared with others (for cooperatives should be reported under #50)

Pond #	Area (acres)	Year Construction began	Year achieved	Marais	Commune

53. Days and money spent to build the pond.

Pond #	Total days (hired days)	Total amount paid	Man-days worked by owners	Total number of the community owning the pond	Total given on page 1 for cooperatives

54. Record pond stocking information.

	a	b	c	d	e	f
Pond #	Area (acres)	Date stocked	Fish Species	Number of fish	Origin	Total Amount

55 Report the quantity of fertilizers-per-type-used to fertilize the pond during the last growing cycle. The pond above is No ___ has an area of ____ ares.
Application number

N.B.:* = (1) Quantity, put the number of unit used, example - if on a given date, two cow manure were put, write 2 under NKA. Then, on the last column, put a cross mark under "Tebo", and so forth.
(2) NKA = cow; RUBE = pig; HENE = goat; NKOKO = chicken; NGWE = rubbish; TSI = grass; NGE = mixture; TEBO = basket; MUBA = bag; and FANI = wheelbarrow
(3) Weigh the basket, bag, wheelbarrow on each type of fertilizer used and tell the quantity (in Kg).

56. Report feed used in one pond during one growing cycle.

The pond above is No. __ has an area of ___ acres, was stocked on ___ and was harvested (drainage) on ____.
No. of times fed

N.B.: * = (1) VZO = brewers waste; SORI = rice bran; SET = setaria; TEKE = taro; NSI = grass; HERI = divest, cereal wastes; NDI = other (specify); MBE = cup; BO = basket; NSI = + I SHYI = handful; MUBA = bag.

Say, if hands were used to feed with brewers waste 3 times and if three hands were used, put under "VZO" the number three at the same level of the line "times" put 3 tro. Thus, in the last column, put a cross mark under "SHYI", and so forth.

** (NSI = closed hand; SHYI = closed two hands; and MUBA = bag.

57. Report fish production of this fish pond from the beginning of production.

The above pond is No __. The area is ___ acres.

	Food fish harvested	Fingerlings harvested	Date	Fish stocked
Time				
1st				
2nd				
3rd				
4th				
5th				

58. Interviewer, we would like to know the time you took to fill in this sheet with each fish farmer and with each cooperative. Fill in this table from the time you started the interview

Date	Time(hour from your house)	Time you arrived at the pond	Cooperative	Person	Time you finished the survey	Time you got home
	a	b	c	d	e	f

59. Interviewer, tell us all thee problems you had filling in this form from the first to the 57th question. All problems such as-

a) not to be able to understand some questions; specify the number and tell us how you think they should be well stated.

b) concerning equipment: specify (what to do to alleviate those problems the next time).

c) problems related to measuring planted fields.

d) miscellaneous problems (specify).

Section 3. Additional Information

Table 16. Criteria used to classify responses as unreliable.

Response Type Rejected	Reason for Rejection	Reference
All	Interviewers filled forms without asking farmers	Interviewers
Pond Construction	Pond built in zero days Pond built using more than 130 person-days are[1]	Moehl and Hishamunda (1987)
Yields, Sales, Consumption	Quantity sold, consumed, given away greater than quantity harvested Harvest not used	

Table 17. Units to convert crop volume to weight (kg).

Crop	Bucket	Basket
Sweet potato	8	18
Irish potato	10	15
Cassava	8	20
Taro	12	20
Sorghum	10	-
Corn	8	-
Sweet pea	10	-
Beans	10	-
Soybeans	10	-
Peanuts	10	-
Rice	15	-
Cabbage	-	-

Table 18. Units to convert feed and fertilizer volume to weight (kg).

Material	Bucket	Basket	Cup	Handful	Pile
Brewers waste	-	-	0.25	0.075	-
Rice bran	8	-	0.20	0.070	-
Cereal wastes	8	-	1.20	0.070	-
Leaves	3	-	-	-	-
Compost	-	10	-	-	15

Table 19. Conversion factors of crops in protein, carbohydrates, energy, and protein efficiency ratio (PER)[a] by type of crop[b].

Crop	**Protein** (g / kg)	**Carbohydrates** (g / kg)	**Energy** (kcal / kg)	**PER** (%)
Sweet potato	19	260	1080	-
Irish potato	12	170	574	-
Cassava	5	378	1023	-
Taro	14	260	789	-
Sorghum	71	710	3037	178
Corn	85	710	3225	112
Sweet peas	205	570	3121	157
Beans	196	166	3031	148
Soybeans	311	200	3670	232
Peanuts	117	170	2780	165
Rice	40	770	2070	218
Cabbage	15	40	0.23	-
Fish	180	0	0.95	355

[a] Weight gain / protein consumed.

[b] Sources: Bodwell (1977), FAO (1970), and Ministère de l'Agriculture, de l'Elevage, et des Fôrets (1989).

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