Chapter 6

Pilot project

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6.1 Objective

Pilot project aims at verifying the effectiveness and appropriateness of draft Master Plan and Action Plan presented in the Interim Report prepared in September 2007.

6.2 Implementation plan

Among the orientations and activities presented in draft Master Plan, following items are experimented as pilot project.

- Association with agriculture and livestock
- Farmer to farmer type extension
- Effective use of reservoir dams
- Brackish water aquaculture
- Aquaculture in whédo
- Strengthening of farmers group
- Reduction of women's work load

The relation between draft Master Plan and pilot project is shown in Table 6-1.

6.3 Selection of project sites (beneficiaries)

The project sites were scattering all over the country, without concentrating in the south, in a sense of development that corresponds to the aquaculture potential (see Fig. 6-1). Attention was paid to choose project sites representing the potential zone shown in "3.8 Classification of aquaculture potential" for selection of sites. Presence of fishery extension officers of CeCPA is also keen to the site selection because CeCPA and CeRPA play an important role for the smooth implementation of pilot project. The relation among project sites, potential zone and pilot project is shown in Table 6-2.

Table 6-1. Relation between draft Master Plan and pilot project

Orientation	Activities	Pilot project						
		Association with agriculture and livestock	Farmer to farmer type extension	Effective use of reservoir dams	Brackish water aquaculture	Aquaculture in whédo	Strengthening of farmers group	Reduction of women's work load
Capacity development of farmers	1) Support to the capacity development of farmers group						X	
	2) Support to the capacity development of business management						X	
Cost down of aquaculture business	1) Promotion of non-feeding aquaculture with fertilization	X						
	2) Development of small-scale net cage culture			X				
	3) Development of pellet feed of reasonable price		X					
	4) Promotion of catfich cultue by plastic sheet tank		X					
Improvement of productivity of aquaculture	1) Improvement of the broodstock of Tilapia							
	2) Improvement of pond culture technology							
	3) Improvement of catfish seed production technology							
	4) Development of brackish water fish for aquaculture				X			
	5) Use of non-utilized water bodies			X		X		
Strengthening of technology extension system	1) Extention through "farmer to farmer"training		X					
	2) Development of training materials		X					
	3) Training for extension staff of CeCPA							
	4) Establishment of a data collection system for auqaculture statistics							
Collaboration with agriculture	1) Establishment of distribution system for high yield breed and fertilizer							
	2) Small-scale irrigation for rice cultivation	X						
	3) VegeTable culture							
	4) Processing of agriculture products							
Collaboration with livestock	1) Pig farming	X		X				
	2) Chicken farming (broiler)	X						
	3) Sheep and goat farming	X						
	4) Rabbit farming	X						
	5) Forage crop cultivation	X		X				
Reduction of women's work load	1) Introduction of cassava processing machine							X

Table 6-2. Relation among project sites, potential zone and pilot project

Project sites / Pilot project	Kantego	Zonmon	Pénéssoulou	Tchi-Ahomadégbé	Monkassa	Hala	Lotin	Tchakalakou	Couffonou	Gangbang
	Covè	Zagnanado	Bassila	Lalo	Malanville	Tori-Bossito	Avrankou	Toucountouna	Kpomassè	Adjohoun
	Zou	Zou	Donga	Couffo	Alibori	Atlantique	Ouémé	Atacora	Atlantique	Ouémé
	Non-drainable pond aquaculture zone 1 in the South	Non-drainable pond aquaculture zone 1 in the South	Northern area	Drainable/Non-drainable pond aquaculture zon	Along the Niger river	Non-drainable pond aquaculture zone 2 in the South	Catfish auqaculture zone	Northern area	Brackish water aquaculture zone	Catfish aquaculture zone
Association with agriculture and livestock	X	X	X	X	X					
Farmer to farmer type extension						X	X			
Effective use of reservoir dams								X	X	X
Brackish water aquaculture										
Aquaculture in whédo										
Strengthening of farmers group			X	X	X					
Reduction of women's work load					X					

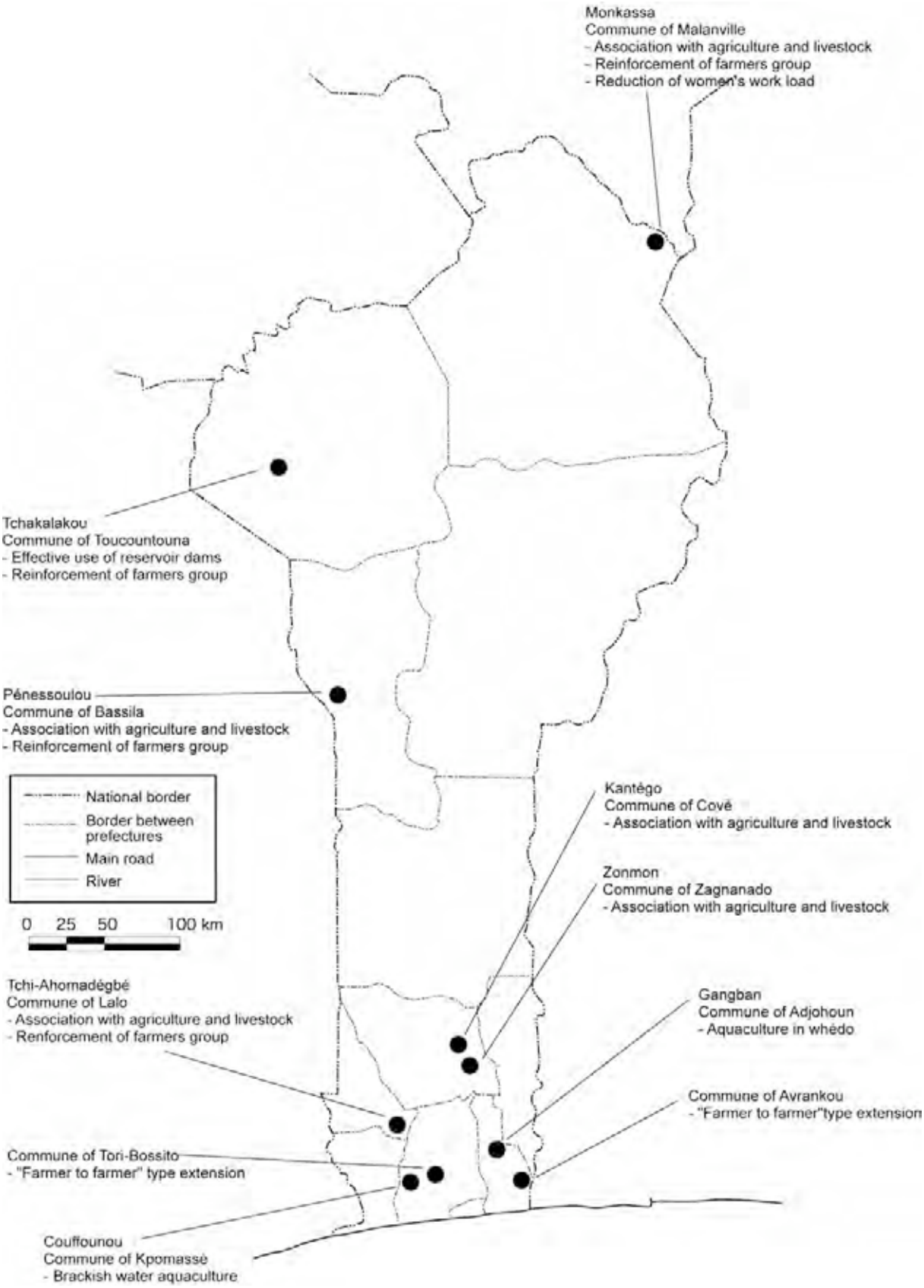


Fig. 6-1. Sites of pilot project

6.4 Implementation schedule

Pilot project was implemented from November 2007 for the period of 12 months. The implementation schedule by project is shown in Table 6-3.

Table 6-3. Implementation schedule of pilot project (1 of 2)

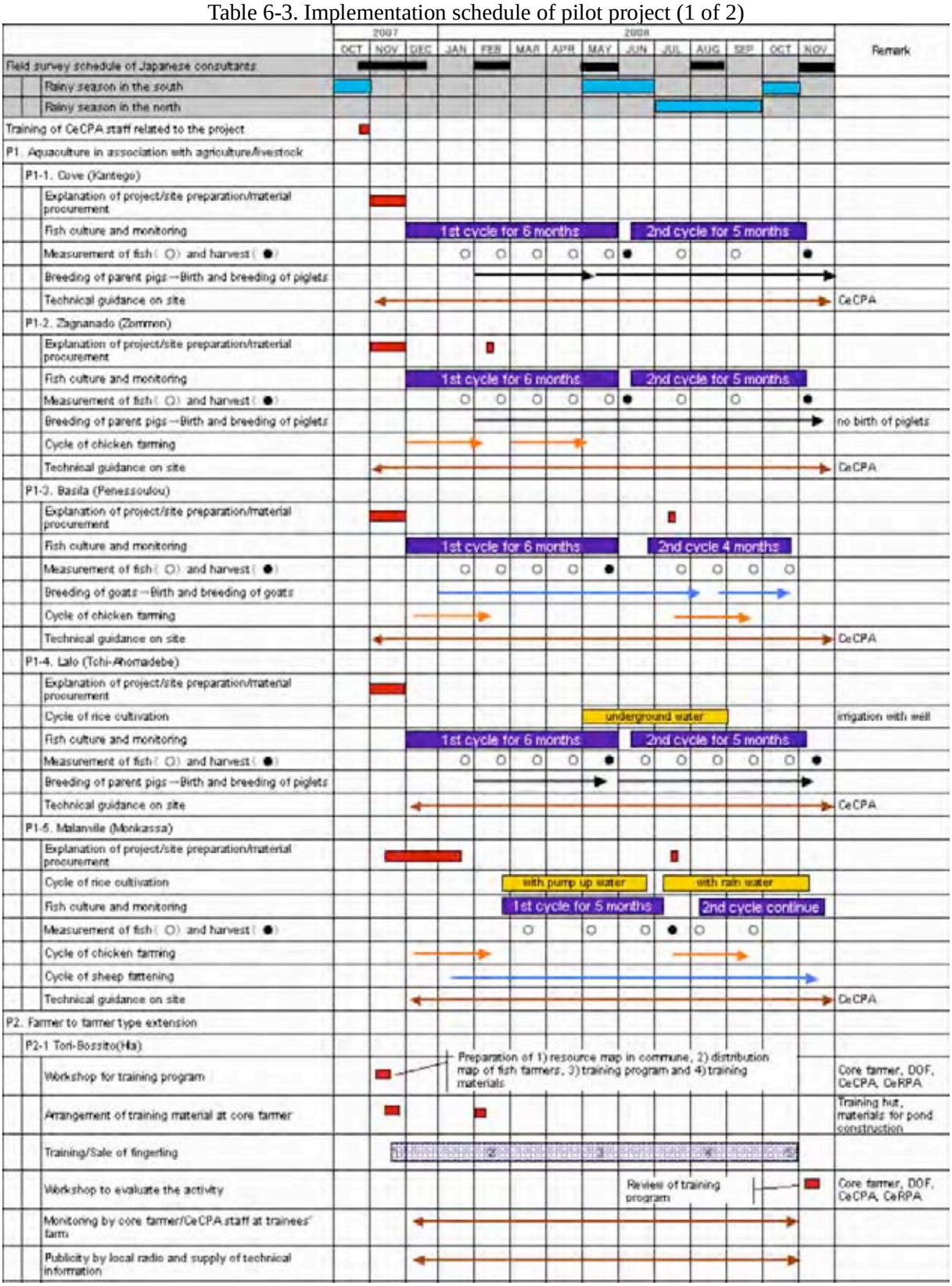
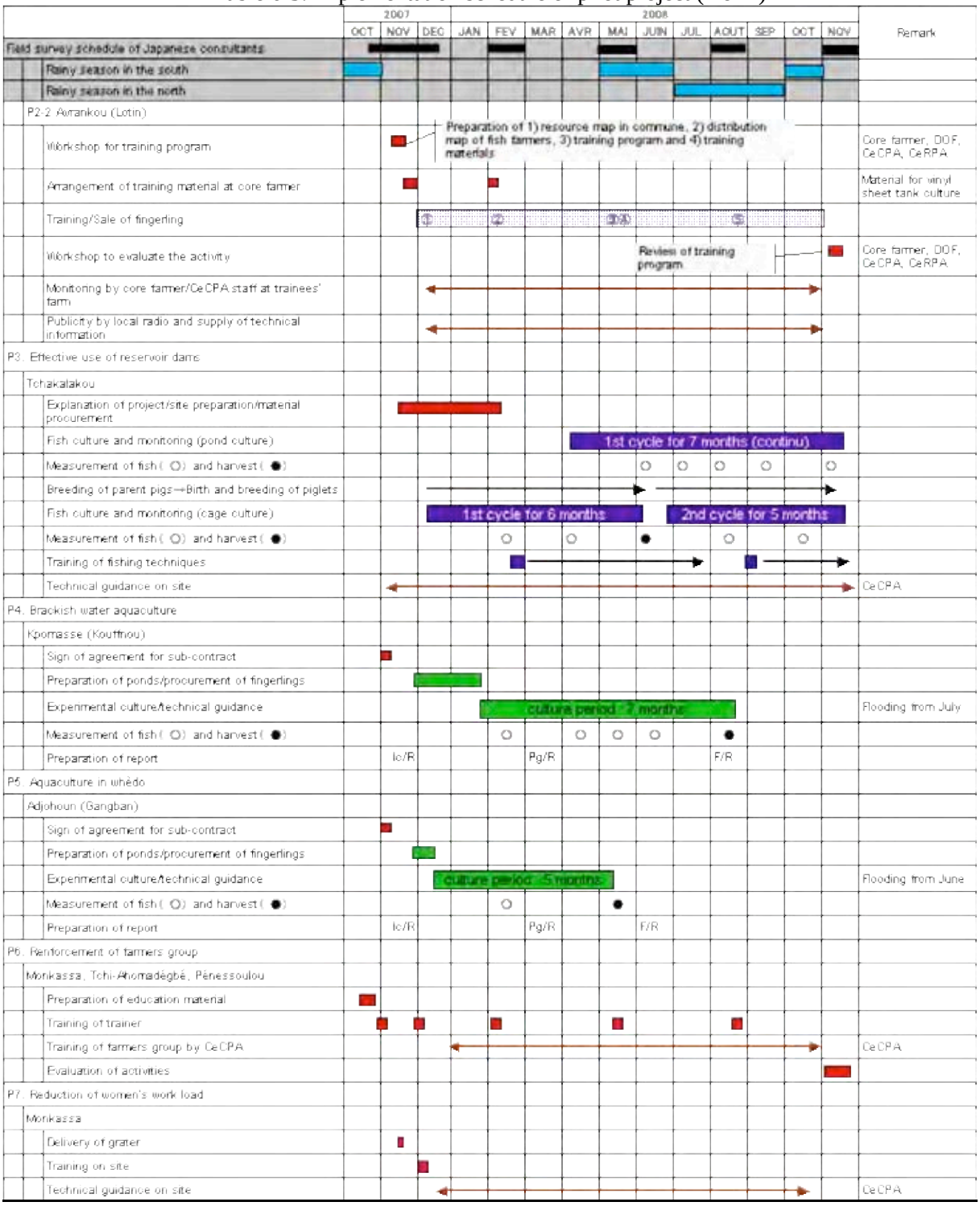


Table 6-3. Implementation schedule of pilot project (2 of 2)



During the project period, mid-term evaluation were made in February, May and August of 2008. And Final evaluation was made in November 2008. Daily monitoring of project activities on sites was carried out by the counter-parts and extension officers of CeCPA.

6.5 Content and evaluation of activities
6.5.1 Collaboration with Agriculture and Livestock

(1) Outline of activities
With respects to fresh water aquaculture, feed cost makes up the major financial charge and their cut is an important concern. Within the framework of this pilot project, a model of aquaculture with lower cost through the promotion of an integrated aquaculture utilizing animal manure, and a combination of rice-cultivation and aquaculture, is examined.

A variety of animals such as pig, chicken, sheep, goat and rabbit was introduced depending on the condition of each site and also forage crops to be given to those animals such as kang kong, yam, soy bean and maize was also cultivated.

The present pilot project was conducted on 5 sites throughout Benin. Activities relating to each site are recapitulated below.

1) Village of Kantègo, commune of Covè
The project consists of experimental Tilapia culture in association with agriculture and livestock in three (3) fish ponds (144-300 m^2) situated in Mr. ABADA Roger's farm, that is a core farm in the village of Kantègo, located in the commune of Covè .The first trial aims at carrying out a non-feeding aquaculture that phytoplankton who grows and propagates in the fertilized pond with the dejections of animals such as pigs and goats. A technical guidance is simultaneously provided concerning the growing of forage crops such as maize. In the second trial, a feeding aquaculture was implemented by using local stuff.

i) Pig farming
The input of the project permitted to construct a pigsty to procure from the state-owned farm in Kpinnou, a boar and two (2) sows aged six months, kept for culture purposes (30-40 kg) and which are cross-breeds between "Landrace" and "Large White". Pig farming started from November 20, 2007 with the aim of bringing forth of piglets. Originally, pigs were primarily fed on compound, but instructions were given to utilize in parallel wild kang konges and taros, cultivated in the farm.

ii) Tilapia culture
Tilapia- culture was carried out in a manner indicated on Tables 6-4 and 6-5.

The pond 2 was fertilized with dejections produced by the piggery within the framework of the first culture trial (since November 28, 2007). And in the case of pond 3 in which the pigsty is not rigged up, dungs of goats and sheep, or of cows were transferred to the manure pit built away. And spring water is led to the manure pit and subsequently over flown to the pond for fertilization purposes. Pond 1 is a control-pond. It was fertilized with the content of bags filled up with dungs of chicken, and the fish were fed on a powdered feed (maize bran and fish meal) prepared by farmers.

Manure pit fitted out outside aquaculture ponds serves as basins for primary decomposition of animal dejections (Fig. 6-2). The principle consist of pouring in aquaculture ponds the liquid floating over the surface (liquid manure) obtained after anaerobic decomposition of dejections, method which seems to have resulted in good performances in Cambodia (Technical handbook prepared by Freshwater aquaculture improvement and extension project in Cambodia, 2008).

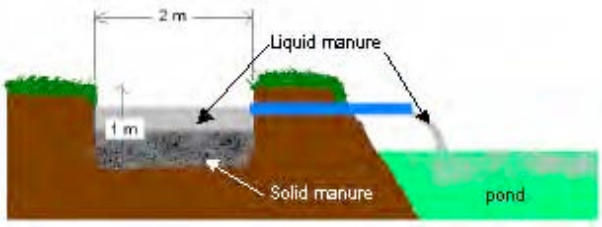


Fig. 6-2. Structure of manure pit
Source: Technical handbook prepared by Freshwater aquaculture improvement and extension Project in Cambodia (2008)

The fingerlings obtained by reproduction during the first culture trial were used to carry out the second

culture trial in ponds 1 and 3 from June 10, 2008. During this second trial, a technical training was provided to make pellet feed using manual meal chopper by addition of a binder (cassava flour known as "gari") to local ingredients.

The composition of this feed was the following: mixing in equal proportion of fish meal, maize cake and rice bran. Its unit price amounted to 162FCFA/kg. PACODER Covèred feed cost for the first month. From the second month, the farmer prepares feed and PACODER contributed half of the expenditures. On July 25 (45 days after the start of trial), the ponds were stocked with Clarias fingerlings (8g, 40FCFA per individual) so as to repress the natural reproduction of Tilapia.

Table 6-4. Outline of the first culture trial (Covè, from November 28, 2007)

Ponds	Species	Fingerlings			Type of culture	Observations
		Density (fish/m^2)	Weights (g)	Number		
No. 1 (144m^2)	Tilapia	3	29	432	Fertilization and nutrition carried out according to the traditional method.	Compare the growth as a blank
No. 2 (300m^2)	Tilapia	3	29	900	Fertilization-based. By manure pit, non-feeding	Use of dejections from a piggery
No. 3 (175m^2)	Tilapia	3	29	525		Use of cow dungs collected outside the farm and of goats and sheep raised in the farm.

* The fingerlings were supplied from Tohonou seed production center.

Tableau 6-5. Outline of the second culture trial (Covè, from June 10, 2008)

Ponds	Species	Fingerlings			Type of culture	Observations
		Density (fish/m^2)	Weights (g)	Number		
No. 1 (144m^2)	Tilapia	7	11	1,008	Feeding by using local stuff.	The stocking of ponds with the 113 Clarias fingerlings (8g, July 25)
No. 2 (300m^2)	Tilapia	(The 1st culture is proceed with)			Feeding as above from September1st.	
No. 3 (175m^2)	Tilapia	5	65	875	Feeding by using local stuff	The stocking of ponds with the 100 Clarias fingerlings (8g, July 25)

* The fingerlings are those, which reproduced in the ponds during the first trial.

iii) Growing of forage crops

Advices were first given to cultivate maize and soybean, main ingredients for compound in the farm.

The local variety of maize is usually utilized, but its yield per unit surface, 0.7 ton/ha in average, is low. With the cooperation of the Department of Agriculture, the present pilot project procured seeds of enhanced variety, DMR, the yield and the growth period of which are respectively higher and short. The variety DMR is a local variety, which has been enhanced by the National institute for Agricultural Research of Benin. (INRAB). Its period of growth is short- from 75 to 90 days –and a yield of three (3) tons can be affected by fertilization. Even without fertilizers, a crop of 1.5 ton is possible over fields with fertile soil. As many farmers are not accustomed to apply fertilizer to maize, the fertilizer was prepared for one quarters (1/4) hectare – a bag of NPK (Nitrogen, Phophorus, Potassium) and 25kg of Urea- with a view to enabling them to recognize how efficient the use of fertilizer is.

System of production of maize seeds
In order to multiply them, the seeds of DMR are subcontracted with the farms that produce seeds through Benin seeds producers' National Association 'ANASEB). Grown seeds are marketed by Government authorized seed distributors.

2) Village of Zonmon, Commune of Zagnanado

This pilot project is virtually similar to that of Kantègo, Commune of Covè. The beneficiary is Mr GANDAHO Jacques, in the village of Zonmon, commune of Zagnanado that is nearby the commune of Covè. Regarding agriculture and livestock, the demonstration has been made for pig farming and chicken farming (the culture of broilers). A technical guidance was provided regarding the cultivation of forage crop. And the breeding of broiler was also tried in this site.

i) Pig farming

As in Kantègo, commune of Covè, the project invested to build a piggery, to procure one boar and two (2) sows aged six (6) months (30- 40kg). Pig farming started from December 4, 2007, with aim of bringin piglets. Originally the pigs were primarily fed on compound, but instructions were given so as to use in parallel the wild sweet potatoes (kang kong) grown in the farm.

ii) Chicken farming

The project invested to construct a hen- house to carry out two times of chicken farming (broiler production) from December 2007 and March 2008. 200 chicks of Belgian origin were purchased from a local importer for the first trial and 100 locally- bred chicks were used for the second trial, which totaled 300 chicks. The dung's obtained were utilized for the fertilization of fish culture ponds (essentially pond 4).

iii) Tilapia culture

Aquaculture without feeding, the same method as on Covè's site was implemented for the first trial and feeding aquaculture for the second trial. The outline of the aquaculture carried out is shown in Tables 6-6 and 6-7. There are some ponds located on the hill fed by spring water and some other ponds located in marshy areas (separated a part of swampy areas with dike). These two types of ponds were experimented during the culture trials.

The feeds and a way of cost sharing for the second trial is same as that in Covè. On July 25 (52days after the beginning of the trial), some fingerlings of Clarias (8g, 40FCFA/fish) were stocked in the ponds so as to repress the natural reproduction of Tilapia.

Table 6-6. Outline of the first culture trial (Zagnanado, from November 28, 2007)

Ponds	Species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	Weight (g)	Number		
Ponds situated on the hill						
No. 1 ($100m^2$)	Tilapia	3	29	300	In principle, with fertilization by manure pit without feed.	Use of des dejections from a piggery
No. 2 ($120m^2$)	Tilapia	3	29	360		As above. (water of the pond flows in from pond 1
No. 3 ($160m^2$)	Tilapia	3	29	480	In principe, with fertilization without (manure pit), without feed.	As above. (water of the pond flows in from pond 2
Pond in the swampy area						
No. 4 ($400m^2$)	Tilapia	3	29	1 200	In principle, with fertilization by manure pit without feed	Use of dungs from a hen-roost.

* The vendor of fingerlingsis is Tohonou seed production center

Table 6-7. Outline of the second culture trial (Zagnanado from June 3, 2008)

Ponds	Species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	Wieght (g)	Number		
Ponds situated on the hill						
No. 1 (100m^2)	(non used)					
No. 2 (120m^2)	Tilapia	5	8.7	600	With feed by using local stuff.	The stocking of ponds with the Clarias fingerlings about 80 fish/pond
No. 3 (160m^2)	Tilapia	3.75	8.9	600		
No. 3b (120m^2)	Tilapia	5	3.7	600		
Pond situated in swampy area						
No. 4 (400m^2)	Tilapia	(1^{st} trial continues)			in principe, with fertilization, without feed.	Use of dungs from a hen-roost and of dejections from a pigsty.

Note: Fingerlings stocked in ponds located in an area of hills are those which breed during the first trial.

iv) Growing of forage crops

Like in Covè, 20kg of DMR seeds and 8 kg of soybean seeds were supplied and advices were provided concerning the cultivation. Taros were cropped in a field of 20 m^2 in taking into account their growth, but that were transplanted near the river because of their poor growth.

Kang kong grows as a wild plant in the surroundings of fish-culture ponds, advice was given to keep growing all year around.

3) Village of Tchi-Ahomadégbé, commune of Lalo

The goal of this pilot project is same as in the communes of Covè and Zangnanado described respectively in (1) and (2), but many different points are noted on this site: the target farm is a group of fish farmers; the water source of the fish ponds is flowing well; the association with rice – growing is taken into account; besides Tilapia, Clarias is targeted as well, etc.

At present, there are 30 abandoned ponds that were once built by SONGHAI. In using a part of these ponds, a trial of aquaculture associated with farming and livestock without feeding and another feed – based trial were carried out in this project..

i) Pig farming

This site possessed unemployed decayed pigsty that was repaired and used in the project. Like on other sites, a boar and three (3) sows aged six (6) months (30-40kg) were purchased and farmed from December 4, 2007 with the purpose of produce and sale of piglets.

ii) Rabbit farming

The caracteristics of rabbit culture is easy to multiply and less costly to breed, so that it can earn money in a short cycle even if the amount is small. Farming of ten (10) femalles and two (2) males initiated from late Mach 2008.

iii) Tilapia culture

On this site, non-feeding aquaculture that consists mainly in fertilizing the pond by manure pit and feeding aquaculture with pellet feed were simultaneously performed for comparison purposes (see Table 6-8). The aquaculture trial was held once.

In the area of feeding aquaculture, the pellet feed produced and sold by SONGHAI in Porto-Novo was used. It contains (30%) raw protein, 9% moisture according to the analysis of Abomey-Calavi University.

Table 6-8. Outline of the first culture trial (Lalo, from November 29, 2007)

Ponds	Species	Fingerlings			Type of culture	Remarks
		Density (indiv./m^2)	Weight (g)	Number		
No.1 (1 125m^2)	Tilapia	3	29	3 375	With fertilisation par by manure pit without feeding.	Use of dejections from piggery
No.2 (500m^2)	Tilapia	5	29	2 500	With pellet compound-based feeding	At times with fertilizer

* The vendor of fingerlings is Tohonou seed production center

iv) Clarias-culture

Considering that Clarias is a carnivorous fish, feeding aquaculture fits in principle. The first trial was implemented in a pond similar to that of Tilapia culture. (see Table 6-9). Pellet feed sold by SONGHAI that manufacture feed for Tilapias, were first used for the first culture trial, but the production capacity of SONGHAI having proved later inadequate, they supplemented with pellet feed from an fingerling- producing farm in Avrankou

Table 6-9. Outline of the first culture trial (Lalo, from November 30, 2007)

Facilities	Species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	Weight (g)	Number		
Pond 3 (500m^2)	Clarias	5	4,5	2.500	With pellet compound based-feeding	Sometimes with fertilization

∗The supplier of fingerlings is M. Dominique, private producer of fingerlings in Avrankou.

And in the second trial, a culture trial was implemented in a pond in small net called hapanet coming from Indonesia (see Table 6-10)

Table 6-10. Outline of the second culture trial of Clarias (Lalo, from June 9, 2008)

Facilities	species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	weight (g)	Number		
Hapa 1 ($3m^3$)	Clarias	47	24.6	140	With feeding in using compound or local staff	Sorting by size once a month.
Hapa 2 ($3m^3$)	Clarias	111	15.2	334		
Hapa 3 ($2m^3$)	Clarias	319	5.2	638		
Pond 3 500m^2	Clarias	(culture up to a size of 500g)				The fingerlings reared up to 100g and beyond are transfered into the pond 3.

∗The vendor of fingerlings is Mr Marius, private producer of fingerlings in Sakété

The size of a hapanet is 2x3x1.5m (effective volume considering the water depth is 3 m^3) and 2x1.5x1.5m (effective volume given the water depth is 2 m^3). In South-East Asia, as for Clarias culture in hapanet, the fish are reared and marketed at a size ranging from 100g to 150g by selecting according to growth, but in Benin, the size at which Clarias is sold exceeds 500g. Accordingly, after being raised to a size of more than 100g in hapanet, fish were transferred to a pond one after another for being bred up to market size. (see Fig. 6-3)

During the second culture trial, a technical training was given, as in Covè and Zangnanado, to use pellet feed made from local ingredients and "gari" as binder with manual meat chopper. The composition of this feed is fish meal 2: maize bran 1: rice bran 1 with putting more fish meal than Tilapia feed. The unit price of this feed is worth 148 FCFA/kg

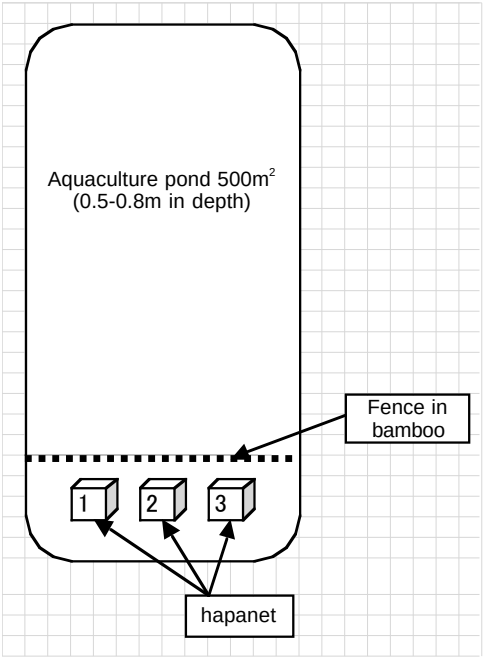


Fig.6-3. Setting of hapa net

v) Forage crops growing
Seeds of taro as pig feed were bought in order to plant next to the pigsty.

vi) Rice growing and aquaculture combination
Part of Tilapia (approximately 60g/individual) produced by the above mentioned culture trial were stocken in a part of rice field on the site, so as to experiment the rice-fish culture. (See Table 6-11). The variety of rice used was NERICA rice (L14, L20, L506) supplied by PACODER

Table 6-11. Outline of rice-fish culture (Lalo)

	Area	Transplanting	Variety of rice	Stocking of fingerling
Rice field 1	310 m^2	May 9, 2008	L-14	May 26, 2008, 200 fingerlings (Average weight : 56.8g)
Rice field 2	480 m^2	April 28,2008	L-20	May 26,2008, 304 fingerlings (Average weight : 60.4g)
Rice field 3	570 m^2	April 16,2008	L-20	May 26,2008, 304 fingerlings (Average weight : 60.4g)
Rice field 4	640 m^2	April 28,2008	L-56	No fingerling what soever (blank area)
Rice field 5	640 m^2	May 23, 2008	L-56	No fingerling what soever (blank area)

4) Village of Penessoulou, Commune of Bassila
The group of farmers targeted by this pilot project is the unique group engaged in aquaculture in the commune of Bassila. Although there isn't any profit to share yet, this group keeps carrying on proudly aquaculture as pionners. Through this pilot project, the profitability of aquaculture associated with farming and animal culture was verified.

i) Chicken farming
The input of the project together with the supply of part of the stuff by the group of farmers, made possible the construction of a hen-roost and the implementation of two (2) series of broiler farming. The chicks were every time supplied by the company whose corporate name is (Ouidah king's chicks) (Les Poussins du Roi de Ouidah), on the basis of 100 chicks per farming.

ii) Sheep and goat farming

The input of the project along with the supply by the group of farmers of local wood for building the boarding of the pasture-lands made possible the construction of a fence Covèring some 400 m^2. In January 2007, 10 femalle goats and two (2) male goats were purchased and the culture was under way. These goats are of short height and referred to as "Western Africa Dwarf Goat". They weigh from 9 to 21kg on purchase. Their age vary from 7 month old to 3.6 year old. Unit purchasing price was from 6,000 to 11,000 FCFA.

iii) Tilapia culture

The outline of the first and the second culture trial is shown in the Tables 6-12 and 6-13.

Table 6-12. Outline of the first culture trial (Bassila, from December 24, 2007/January 16, 2008)

Ponds	Species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	Weight (g)	Number		
No.1 (200m^2)	Tilapia	3	25.7	600	With fertilization by manure pit, without feeding.	Use of dungs of cow collected outside the farm and dung of goat as well as dung of broilers reared in the farm.
No.2 (200m^2)	Tilapia	3	20.5	600		
No.3 (200m^2)	Tilapia	3	31.4	600		
No.4 (200m^2)	(no used)					

*The fingerlings are those who were cultured in the pond.

Table 6-13. Outline of the second culture trial (Bassila, from June 25, 2008)

Ponds	Species	Fingerlings			Type of culture	Remarks
		Density (fish/m^2)	Weight (g)	Number		
No.1 (200m^2)	Tilapia	5	19.2	1 000	With feeding in parallel with fertilization (Fingerlings from Center of Tohonou)	Stocking fingerlings (8g) of Clarias in the ponds on June 23 approximately 65 fish per pond
No.2 (200m^2)	(no used)					
No.3 (200m^2)	Tilapia	5	8.9	812	Like above (fingerlings bred in the farm)	
No.4 (200m^2)	Tilapia	5	19.2	1 000	Like above (Fingerlings from Center of Tohonou)	

*The vendor of the fingerlings regarding ponds 1 and 4 is Tohonou seed production center. In pond 3, as witness are the fingerlings bred in the farm of the site were used.

An extensive aquaculture with manure-pit method was attempted during the first culture trial as on other sites. However, the present site being a Moslem village, pig farming cannot be associted. Some goats and poultry were therefore introduced instead. In case that animal dejection is insufficient, dungs of cow were collected. There are five (5) ponds on the present site, wihich include the three (3) ponds used culture trial of the pilot project. The Tilapia bred on the site was made use of as fingerlings.

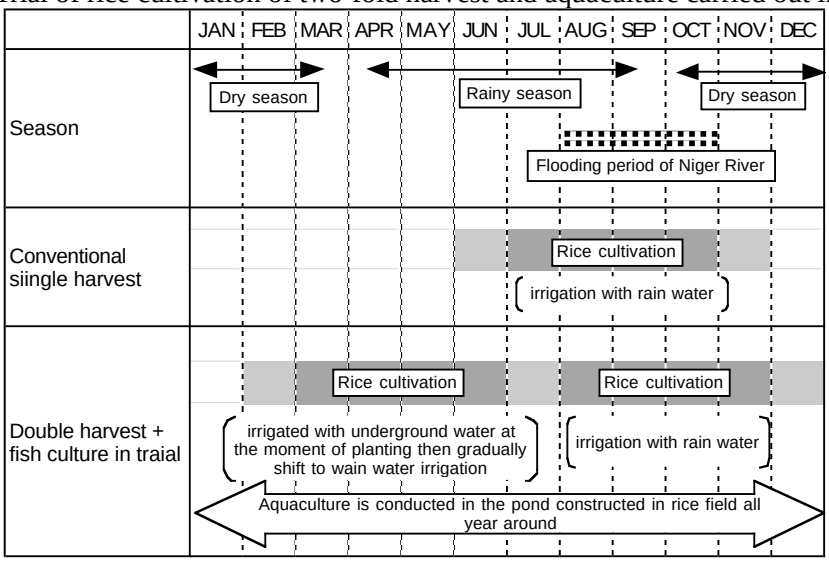
During the second culture trial, a feeding aquaculture was carried out, not only concerning the fingerlings produced on the site, which were expected to suffer from a genetic impoverishment, but also Tilapia fingerlings purchased from a fingerlings producer. Since the procurement of feed near the village of Pénéssoulou was juged to be difficult, a pre-mixed compound feed recommended by the Department of Fisheries was purchased in Cotonou. A manual meat chopper was delivered, like Covè and Zagnanado, and the technique of preparing pellet feed from said compound was transferred to the group members. And Clarias fingerling are also released in the pond to repress the breeding of Tilapia in ponds.

iv) Cultivation of forage crops
The cultivation of forage crops is compulsory for goats farming. Among the forage crops that can grow in dry regions, following three (3) species were planted such as Panicum, Pennisetum and Gliricidia.

5) Village of Monkassa, Commune of Malanville
On the site of Monkassa, the single periode rice cultivation with rain water has been carried on so far, but in referring to irrigation with underground water for vegetable cultivations, the feasibility of rice-fish culture combining the double periode rice cultivation and fish culture was verified. It was the very first time that the two-fold rice cultivation in irrigation with underground water practiced in Benin. The trial of the combination of rice-growing and aquaculture was implemented according to the schedule stated in Table 6-14.

Concerning agriculture and livestock production, a pilot project relating to sheep-fattening (pig farming is impossible since this site is a village where most of the inhabitants are Moslems, like the village of Pénéssoulou, Commune of Bassila) and chicken farming (broiliers) were carried out. Moreover technical guidances were provided concerning the cultivation of forage crops and rice cropping.

Table 6-14. Trial of rice cultivation of two-fold harvest and aquaculture carried out in Malanville



i) Combination of rice-growing and aquaculture
Over a part of the exsting rice-fields, small fish-culture ponds were dug and trials relating to the combination of rice cultivation and aquaculture were worked out. Over the surface area of 2,500 m^2 per unit, 3 fish-culture ponds of 80 m^2 each (depth 1.5m) were dug. During one month from December 2007 to January 2008, the group of farmers built three (3) units of rice plantations and fish-culture ponds with the support of PACODER. The fish-culture ponds are connected to the rice-fields by channels, making up a structure, which enables physically fish to shuttle between ponds and rice-fields.

The outline of the culture trials is indicated in Table 6-15 and 16. The two (2) target species were Clarias and Tilapia and the variety of rice used was the ADNI 11. In the initial plan, the pilot project considered a single stocking with fish, but the occurrence of the theft of the fish intended for culture (described later) led to conduct a second culture trial of Clarias.

Table 6-15 Outline of the first culture trial (Malanville from February 21 and March 14, 2008)

Ponds	Species	Fingerlings			Type of culture	Observations
		Density (fish/m^2)	Weight (g)	Number		
No.1 (80m^2)	Clarias	12,9	96,4	1 035	Rice cultivation and aquaculture combination with feeding.	As regards Tilapia, with fertilization by manure pit.
No.2 (80m^2)	Clarias	13,6	93,3	1 086		
No.3 (80m^2)	Tilapia	6,9	56,2	553		

Note : Clarias fingerlings are natural fish captured in the Niger river or in “whédos”. Whereas Tilapia fingerlings are artificial and were supplied by a fish farm in Malanville

Table 6-16. Outline of the second culture trial (Malanville, from August 9, 2008)

Ponds	Species	Fingerlings			Type of culture	Observations
		Density (fish/m^2)	Weight (g)	Number		
No.1 (80m^2)	Clarias	11.3	35.7	900	Without feeding	Date of stocking of fihs in ponds: August 9
No.2 (80m^2)	Clarias	11.3	35.7	900	Without and with feeding	
No.3 (80m^2)	Continual culture of remaining fish in the pond without bringing in of additional new fish.				Without feeding	

*The vendors of Clarias fingerlings are the same as in the case of the first trial.

ii) Chicken farming

Two (2) broilier-producing operations were achieved in a corner of village. As on the other sites, the hen-house was built from local timber. 100 chicks were bought at the company in Ouidah each time and delivered to Monkassa.

iii) Sheep fattening

Fence to grow sheep was constructed with stems of sorghum that is easily available on the site. The project took advantage of the drop, in February 2008, in sheep prices after Tabaski Feast to procure some lambs at a cheaper rate and to begin its trials. 10 male sheep were bought (with an initial average weight of 17.2kg).

(2) Indicators of assessment

Indicators of assessment are determined on the basis of the animal, fish and farm products introduced in each site. They are recapitulated in Table 6-17

Table 6-17. Indicators of assessment on site basis of the project “Association with agriculture and livestock”

Indicators	Kantègo, Covè	Zonmon, Zagnanado	Tchi-Ahomadégbé, Lalo	Pénessoulou, Bassila	Monkassa, Malanville
Animal					
- Pig: Reproduction, growth, survival, sale and balance	X	X	X		
- Broiler: Growth, survival, sale and balance		X		X	X
- Other animal: Reproduction, growth, survival, sale and balance			X	X	X
Fish					
- Tilapia: Growth, survival, sale and balance	X	X	X	X	
- Clarias: Growth, survival, sale and balance			X		
Agriculture products					
- Yield of rice and fish in rice-fish culture			X		X

(3) Results of the evaluations

1) Village of Kantègo, commune of Covè

i) Pig: Reproduction, growth, survival, sale and balance

Four (4) piglets got birth on May 6 and two (2) others on May 23. Compared to the average number of piglets for the first birth (about six (6) piglets), this figure is low. Despite enough sexual maturity of these sows in terms of age, their weight was insufficient. And the timing for copulation wasn't proper, which accounts mostly for this result.

These piglets weaned 45 days after their birth, then subject to cramming. Their growth reached ranging from 25 to 26 kg within three (3) months, which correspond to a daily gain weight ranging from 130 to 255 g (see Table 6-18). This growth speed is less than half of European breed pig. Identical data are however possessed by the state owned farm in Kpinnou, which seems to point out that such a growth speed is standard in Benin. The pureness of the breed brought forth from the hybridation between "Landrace" and "Large white" decreased and the "crosbreed advantage" seems not work any more.

Table 6-18. Growth of piglets

Saw	Piglet		Weighing (May 29)		Weighing (August 13)		Growth (kg)	Growth per day (g)
	Birth	Sex	Weight (kg)	Age (days)	Weight (kg)	Age (days)		
1	May 23	Male	2.3	6	13	82	10.7	140
1		Male	2.4	6	17	82	14.6	192
1		Male	2.3	6	14	82	11.7	153
1		Female	2.1	6	12	82	9.9	130
2	May 6	Male	7.6	23	27	99	19.4	255
2		Female	6.9	23	25	99	18.6	244

The sale of pork isn't performed in an ordinary market place and is limited. Information on the sale of piglets was thus conveyed through radio broadcast to the vicinity dwellers, so as to seek prospects. A male pig weighing 40kg was sold on October 1st. The price was 40,000 FCFA with the rate of 1,000 FCFA/kg. But, the balance was deficit of 509,374 FCFA considering the costs incurred since the beginning of the reproduction (see Table 6-19). Even though all six pigs under a culture were sold, the balance would be in the red, with a loss amounting to 309,374 FCFA. Such a result could be explained by a small number of piglets per birth per sow, respectively 2 and 4. Another justifying reason might be the surge of unit price of feed from May 2008 (182FCFA per kg). The farm Abada is cultivating currently forage crop maize and has already reaped 700kg thereof. If this home - grown maize is used as an ingredient of feed, it is very likely to curtail considerably the feed cost.

Table 6-19. Balance of pig farming (Covè)

	Quantity	Unit price (FCFA/kg)	Amount (FCFA)
Pigs kept for culture purposes	36kg x 3 pigs	1,500/kg	162,000
Feed for pig Nov.-April	868.5kg	130/kg	112,900
May-Sep.	1,102kg	182/kg	200,564
Oct.-March	1,272kg	182/kg	
Feed for piglet May-September	389kg	190/kg	73,910
Total Expenditure			549,374
Income (Sale of piglets)	40kg/piglet	1000/kg	40,000
Gross profit			- 509,374

ii) Tilapia: Growth, survival, sale and balance

The result of the growth of Tilapia for the first culture trial is shown in Table 6-20. The most satisfactory growth was recorded in pond 1 where diet was supplemented. Weighing of the fish achieved on April 24, 2008, scilicet the fifth month of the culture, showed an average weight of 100g. Nonetheless while harvesting these fish back on June 3, 2008, scilicet the sixth month of the culture, the weight of all 317 market size fish (more than 35g) was 21kg; the average didn't exceed 66.2g.

Such a difference in weighing was observed on the other sites as well. But particulary on the present site, a SPH might have selected begger size fish to measere weight on purpose or not.

No significant mortality was noticed in pond 1 during the culture period, but the survival rate accounted for 74.3% calculated from number of fingerlings stocked in the pond (432 fingerlings). It is estimated that the cause of this poor survival rate resides in the presence of predators such as snakes, lizards, crocodiles, but the magnitude of the harm done by these predators is not clearly assessed.

Table 6-20. Growth of Tilapia (First culture trial in Covè)

Date of measurement	Number of days after the stockingof fingerlings into ponds	Average weight (g)			Observations
		No. 1	No. 2	No. 3	
November 28, 2007	0	29.0	29.0	29.0	
January 22, 2008	55	50.0	31.0	42.1	
February 22, 2008	86	59.0	40.0	40.8	
March 20, 2008	113	61.0	53.1	54.6	2,680 captured fingerlings were apportioned to other farms.
April 24, 2008	148	100.0	68.2	67.2	
ay 29, 2008	183	-	57.1	-	Aproximately 2,500 fingerlings were captured for the second culture trial.
June 3, 2008	188	66.2 (Harvest)	-	46.9 (Harvest)	The average weight were calculatd on the basis of number of captured fish and total weight in ponds 1 and 2.
July 21, 2008	236		61.1		
September 1, 2008	278		50.8 (Resumption with feeding)		Culture without feeding completed .

The sale of harvested fish in Pond 1 is shown in Table 6-21. The sales of fish was performed at the garden of Mr ABADA Roger's house after being announced to neighbouring farmers. This time, the unit price was quoted at 1,000 FCFA/kg, regardless of the size of fish. A trend of customer's buying bigger fish rather than smaller ones was noted.

Table 6-21. Harvest and sale of fish (June 3, 2008)

Clients	Quantity purchased			Sale (FCFA)
	Total weight (kg)	Number of individual	Average weight per invidual (g)	
Sales on June 3, 2008				
Client A	2	23	87	2,000
Client B	2	31	65	2,000
Client C	2	28	71	2,000
Client D	1	13	77	1,000
Client E	1	14	71	1,000
Client F	1	10	100	1,000
Client G	1	11	91	1,000
Client H	1	11	91	1,000
Client I	1	14	71	1,000
Client J	1	17	59	1,000
Client K	0.5	11	45	500
Client L	0.5	8	63	500
Sub-total	14	191	73	14,000
Sales after June 3.	4	60	67	4,000
Household consumption	3	66	45	0
Total	21	317	66	18,000

In Pond 2, a culture without feeding intensively fertilized by dejections of pigs through a manure pit was experimented. But reproduction of the phytoplankton wasn't satisfactory and the growth of the fish was poor. One of the presumed causes is water. The latter sweating from the wall of the pond contains large quantities of turbid substances in colloidal form, which enabled to grasp that the pond was colored grey by this water. These turbid matters do not deposit easily and it is assumed that they impede the photosynthesis of the phytoplankton. Another reason lies in that the pond is situated over a hill and water is permanently replaced owing to the huge volume of spring water (estimation: 10 liter per minute). Fish in pond 2 was reared without feed for mine (9) month. But as the situation doesn't change, the decision was made to resume the trial with feeding.

In pond 3, dungs of cow and goats were used as fertilizing substance and, it seems that they proved less efficient than pig dejections. This pond was also faced up with its water being whitish and water replacement problem. The expected fertilization impact wasn't achieved. Consequently, as in pond 1, the fish was harvested and merchandised sixth month later.

The recapitulation of the balance for the first culture is shown in Table 6-22. The selling price of the first culture in each pond exceeded slightly the purchasing cost of fish. The balance of pond 1 and 3 where feed cost is included is in red. Although the growth of fish proved poor without feeding in pond 2, earnings offset expenses without feed expenses. (As the culture is still under way, the fish haven't heen sold yet). In addition, some fingerlings reproduced naturally in these ponds were allotted to the farms in the vicinity (2,680 fingerlings backon March 20, 2008) as well as utilized for the second culture trial (2,500 fingerlings, in May, 2008 see Table 6-20). If this allotment is counted as a sale (2,680 x 20FCFA/fish = 53,600FCFA), the deficit highlighted in Table 6-22 would be offset.

Table 6-22. Balance of tilapia culture (First culture trial in Covè)

Expenses	Pond 1			Pond 2			Pond 3		
	Quantity	Unit price.	Amount FCFA	Quantity	Unit price.	Amount FCFA	Quantity	Unit price	Amount FCFA
Direct cost (A)									
Fingerlings (fish)	432	40	17,280	900	40	36,000	525	40	21,000
Feed(kg)	137	105	14,385	0	-	0	148	105	15,540
Sale (B)									
Tilapia (kg)	21.0	1000	21,000	45.7	800	36,576	27.5	1000	27,500
Gross profit									
(A) - (B)			-10,665			576			-9,040

Note: The actual figures of pond 1 and 3 related sales; pond 2 related sale is estimated by the result of September 1st, 2008 weighing. Pond 2 related unit price is quoted at 800FCFA per kg because of the small size of fish.

Tilapias growth during the second culture trial is indicated in Table 6-23, and the estimated balance in Table 6-24. Since the second culture trial took place in the cource of the farming high season (April to October) and Mr ABADA suffered from ill-health during this period, the feeding of fingerlings couldn't be fulfilled properly. In ponds 1 and 3 namely the fingerlings definitely were reproduced in large number from breeders left behind of the first trial, which entailed a substantial squandering of feed.

Although the fish cultured during the second trial hasn't been marketed yet, the financial assessment was worked out according to realistic criteria (see Table 6-24). Under the condition that unit price of fingerlings is 20FCFA, survival rate is 80%, feed cost is 162FCFA/kg and price of fish is 1,000FCFA/kg, the cost and income for pond 1 where the growth of fish was relatively good thanks to feeding from the beginning was balanced. The result of pond 3 estimated in a same condition was in red. In case of pond 2 where type of cultue was changed from non-feeding to feeding, under the condition that unit price of fingerling is 40FCFA and survival rate is 100%, the result is a little better than in pond 1, although a large amount of feed was wastes as shown as FCR of 7.3.

Table 6-23. Growth of Tilapia (Second culture trial in Covè)

Date of measurement	Number of days after luanching fishes		Average weight (g)			Observations
	No. 1 et 3	No. 2	No. 1	No. 2	No. 3	
June 10, 2008	0	(Culture resumed)	11.0		6.9	
July 21, 2008	41	236	14.5	61.1	9.1	The stocking of clarias fingerlings in ponds (8g, July 25)
August 19, 2008	70	265	22.2	--	22.1	
September 1, 2008	--	278	--	50.8	--	Start feeding in pond 2
November 4, 2008	147	342	56.0	72.0	27.3	

Table 6-24. Estmated balance of Tilapia culture (Second culture trial in Covè)

	No. 1	No. 2	No. 3	Remarks
Initial				
Fish average weight (g/fish.)	11.0	50.8	6.9	
Number of fingerlings	1,008	900	875	
Biomass (kg)	11.1	45.7	6.0	
Final				
Fish average weight (g/fish)	56.0	72.0	27.3	
Number of fingerlings	806	900	700	*1)
Biomass (kg)	45.2	64.8	19.1	
Culture period (days)	147	64	147	
Amount of feed stuff (kg)	138	140	138	
Daily growth (g)	0.31	0.33	0.14	
Rate of alimentary conservation	4.1	7.3	10.5	
Balance	2.642	6.147	-20.767	*2)

*1) Survival rate: Ponds 1 and 2: 80% ; Pond 2: 100%

*2) Fingerlings costs: Ponds 1 and 3: 20FCFA/fish; Ponds 2: 40 FCFA/fish; Feed cost: 162 FCFA per kg. Selling price of fish: 1,000 FCFA/kg

The daily growth rate of fish during the first and the second trials is summarized in Table 6-25. The growth of fish in the second culture showed better result thanks to the improvement of feed stuff composition and the use of pellet feed. However the daily growth rate of 0.3g/day is far from being satisfactory for feeding Tilapia culture. Consequently, some improvements should be brought in terms of environment (ponds) and feeding methods.

Table 6-25. Comparison of daily growths (Covè)

	No. 1	No. 2	No. 3	Observations
First culture trial	0.20	0.15	0.10	Culture period : 183 – 188 days
Seconde culture trial	0.31	0.33	0.14	Culture period : 64 – 147 days

* First trial in ponds 2 and 3 is non-feeding

2) Village of Zonmon, Commune of Zagnanado

i) Pig: Growth, reproduction, survival, selling and Balance

Pigs (1 boar and 2 sows) copulated back on January 7 and 12, 2008, scilicet approximately six (06) months after their birth. The sows were expected to bring forth at the beginning of May, but one of them passed away before parturition in the mid-April. It bore 8 foetuses. The other sow enjoyed a satisfactory growth, but a shortly before its bringing forth; it was put on a course of drench based product, which ended up into a miscarriage.

Although pig farming hasn't been making headway as expected, Mr Jacques, the owner of the core-farm remains optimistic, and purchased back in May, 2008 from a state-owned farm another sow out of his own pocket, in order to make up for the lost sow and be, as a result, able to continue his pig farming.

ii) Broiler: Growth, survival, selling and balance.
The survival rate of broiler chicks for the first culture was poor: nearly 40% died within two (2) first weeks following their delivery (December 2007). Failure to maintain an appropriate temperature owing to an insufficient number of lamps is reckoned as one of the major causes of such a poor record.
As a matter of fact, the sawdust on the floor was wet due to diarrhea undergone by the weakened chickens and wasn't nevertheless removed as appropriate. In nearly second week after delivery, the devastating mortality was over by commencing to maintain the required temperature with glowing coals on advice from consultants and with the help of tetracycline shots.

Afterward, the growth of survivor chicks evolved normally. The balance- sheet showed thus a loss of 152,000 FCFA. Expenditures totaled up to 328,500 FCFA whereas incomes of the selling total only 104,000 FCFA. As for the non- sold 36 hens kept for culture purposes, their worth in the aggregate is 72,000 FCFA. (see Table 6-26).

The project planned initially the production of broodstock in a same time, to make purchase of chicks easy and cheap. 200 chicks were delivered in totall of which 100 are planned to be served for broodstock. After the selling of the 52 broilers, the 36 hens are set aside and transferred to the hen-roost on the floor, and subject to a controlled diet toward losing weight. The farming of these hens was evolving satisfactorily until the time, 4 mothers later, when the hen- house was ignited and burned down. All the hens were burned to death. The arsonist acknowledged his crime. According to him, the fram owner's father would have suspected him of having thieved some local hens and would have treated him of thief.

On the basis of the outcome of first culture, the second culture was launched back in March, 2008. The 100 chicks place inside a chicken- coop in the mid-March, grew normally, attaining in a two months time individual weights of approximately 1.4 kg. Taking advantage of the lessons drawn from the previous flop, PACODER distributed a thermometer to the core-farmer and advised him to breed chickes of initial stage on the floor where temperature control is easy. Previous cycle was carried out in a hen-house of which the floow was hightened in order to facilitate the collection of dung. But the management of temperature proved to be a failure owing to the many openings. The core-farmer made ready in his house, a room for chicks farming, sticked the thermometer at the wall and maintained the temperature at 35° C required by using glowing coals.

As a result, only 2 chicks died in a course of growth, and a survival rate of 98% was reached. With regard to the objective of 2 kg set as to have fallen, the 1.7 kg weight achieved after two (2) months seemed to have fallen short of the mark. But it is proper to put it under perspective in as much as the afore- started weight was reached with a limited feeding. Therefore such a result should be rather rated a success, for a beginning. In broilers culture, the amount of feed stuff provided is not, in the principle limited (chickens feed as much as they feel like), but with a view to controlling the rate of alimentary requirement, the SPA set the amount of feed to be fed to broilers daily and in so doing, shifted to limited- style feeding. A 1.7 kg weights the market size requirement and give a competitive edge to these broilers compared to hens of focal breed. All of them were sold at a rate of 2,500FCFA each, except 24 kept for eggs collection superposes. If the latter had been sold as well, the profit would have attained 84,275FCFA (see Table 6-26).

The rise of feed price from 210 FCFA to 225 or 240 FCFA can be accounted for by the sowing in cereals price at worldwide level. Table 6-27 indicate the percentage of the various ingredients used for home- made compound as well as their price. As maize and soybean grown in the farm couldn't be reaped in times, these ingredients were bought from the market place. Hence the increase in compound price. But recourse to both self and home grown maize and soybean for manufacturing is very likely to help lower compound, considerably feeds cost.

Table 6-26. Balance of chicken farming (Zagnanado)

	First farming		Second farming	
Number of chicks	200		100	
Survival rate	84/200 =	42%	96/98 =	98%
	Balance（ FCFA）		Balance（ FCFA）	
Purchase of chicks	200 x 750 FCFA =	150,000	100 x 600 FCFA =	60,000
Purchase of feed	850 kg x 210 FCFA =	178,500	49 kg x 240 FCFA = 371 kg x 225 FCFA =	12,250 83,475
Total expenses	150,000 + 178,500 =	328,500	60,000 ＋ 95,725 =	155,725
Sales	52 x 2,000 FCFA = 32 x 2,000 FCFA =	104,000 72,000	72 x 2,500 FCFA = 24 x 2,500 FCFA =	180,000 60,000
Gross profit		-152,500		84,275

Table 6-27 Composition and cost of chicken farming feed

	Initial feed for chicks			Feed for chicks growth		
Stuff	Quantity	Unit price. (FCFA /kg)	Amount (FCFA)	Quantity	Unit price. (FCFA/kg)	Amount (FCFA)
Maize	60 kg	200	12,000	70 kg	200	14,000
Soybean	30 kg	300	9,000	22 kg	300	6,600
Fish meal	7 kg	250	1,750	5 kg	250	1,250
Shells	2.4 kg	75	113	2.4 kg	75	188
Lysine	100 g	2,600	260	100 g	2,600	260
Methionine	100 g	3,000	300	100 g	3,000	300
Vitamine	150 g	1,650	330	150 g	1,650	330
Salt	250 g	110	275	250 g	110	44
Total	100 kg		24,028	100 kg		22,563

iii) Tilapia: Growth, survival, sale and balance.

The data on growth and harvest is showed in Table 6-28. The three (3) ponds on the hill (pond 1, 2 and 3) were fertilized with dejections from the pigsty and reproduction of phytoplankton was stepped up. But its density remained inadequate and the fist growth proved unsatisfactory. The considerable water replacement (approx. 50 liters per minute) and the substantial silt content in the water may bring about an inadequate reproduction of phytoplankton as in Covè.

Table 6-28. Growth of Tilapia (First culture trial in Zagnanado)

Date of measurement	Number of days after the stocking of fingerlings in ponds.	Average weight (g)				Remarks
		Ponds on the hill			Ponds in swampy area	
		No .1	No. 2	No. 3	No. 4	
November 28, 2007	0	29.0	29.0	29.0	29.0	
January 22, 2008	55	40.0	37.7	32.3	38.2	
February 22, 2008	86	45.7	53.8	40.1	51.2	
March 21, 2008	114	46.6	50.0	33.3	53.3	
April 23, 2008	147	46.0	56.6	38.5	55.5	
May 21, 2008	175	48.4	59.4	38.6	57.6	
May 26, 2008	180 (Harvest)	42.3 (265)	53.3 (244)	35.7 (336)	Culture continued	The average weight was reckoned on the basis of the sale and the amount of caught fish.

Taking into account the situation of the site and Growth of tilapia, PACODER inferred that, non-feeding cutlture with fertilization was difficult in three (3) ponds located on the hill and fish were harvested and marketed in the sixth month of the culture. The survival rate obtained in comparing the number of fingerlings stocked in the ponds and that of fingerlings captured and sold, was respectively 88%, 68% and 70% for ponds 1, 2 and 3. No remarkable mortality was registered during the culture and an eventuality of robbery or burglary is barely conceivable. As in Covè's site, predators such as

snakes, lizards or birds might have inflicted harm. By the same token, loss of fish might have been incurred through the overflow- pipe.

The size of the first captured this time was inferior to the standard markeTable size. Nontheless they managed to sell all of them to neighbouring farms by bringing down the selling price to 700FCFA per kg. The average weight, obtained by reserved reckoning on the basis of the sold weight and the amount of fish, was inferior to all estimated figures during the monitoring of growth on May, 21, probably owing to the endeavors made to present customers with bonus supplements while selling to them. The earnings yielded by fish from the three (3) ponds on aggregate worked out to 37kg x 700FCFA/kg=25,900FCFA, an amount inferior to the purshasing price of the fingerlings (1,140 fish x 40FCFA=45,600FCFA). Besides fingerlings used in the second culture trial were reproduced during the first trial and, if this amount is converted into money, income is expected to be 27,000FCFA (1,800 fish in total x 15FCFA). And thus cost and income is balanced.

Regarding pond 4 located in a marshy area, the impact of fertilization that the growth of phytoplankton is accelerated in case that fertilization with chicken manure is carried out, is recognized by farm owner. However, Because of the dysfunctions of the chicken farming, the amount of chicken dung was insufficient. And smooth and sTable reproduction of plankton wasn't demonstrated. Moreover, with the flood which overwhelmed pond 4 occurs in a course of July and the fish were all of a sudden capture (during the absence of the consultant). Flood that overruns ponds is believed to come off approximated once every five years.

It is assumed that it allowed the escape of a large number of fish for the rise in water level. The survivals rate of 73.3% is obtained in comparing the initial number and the total number of caught fish on July, 24 and 29, 2008; 902 fish ; 46.5kg (average weight 51.6kg). As it was suddenly harvested and sold, the unit price ranged from 700 to 800FCFA/kg and the turn over added up to 38,600FCFA (9kg of natural fish inclusive). Considering fingerlings costs totalled (1,230 fingerlings x 40FCFA=49200FCFA), the balance is in the red. Nevertheless the less incurred isn't so substantial and, it would be possible to put in place a "little risk, few earnings" fertilization-based aquaculture. If the fingerlings reproduced in ponds on the hill could be utilized, fingerling cost is alomost zero. Even if half of the fingerling cost of this time is counted, fingerling cost would be of 24,600FCFA. In that case, the direct costs would be incurred even through growth, survival and selling price are unfavourable as in the above-mentioned particular case.

The result of the second culture in the ponds on the hill is stated in Table 6-29. As in Covè, the culture took place during high season of farming work and accordingly pond management was not conducted sufficiently. The highest growth was observed in pond2, where fingerlings attained 80g within 134 days, which is tantamount to an accepTable daily growth rate of 0.53g per day. As it follows from this experience that the average weights of fish at harvest often proves inferior to data measured during the periodical measurements, it will be proper to proceed to more precise investigation. If these results were confirmed, these activities might become economically viable. Reckoned according to criteria identical with those in Covè (fingerling cost: 20FCFA; survival rate: 80%; feed cost: 162FCFA/kg and selling price of fish: 1,000FCFA/kg), the balance highlight a slender profit (6,474FCFA), despite a FCR of 3.7, far from being excellent (see Table 6-30).

Table 6-29. Growth of Tilapia (Second culture trial in Zagnanado)

Date of measurement	Number of days after	Average weight (g)			Observations
		Pond 2	Pond 3	Pond 3b	
June 3, 2008	0	8.7	8.9	3.7	
August 5, 2008	63	30.0	24.0	24.5	The stocking of clarias fingerlings in ponds (8g, july 25)
September2, 2008	91	47.1	44.4	40.0	
October 15, 2008	134	80.0	58.8	25.0	Fish in pond 3b fled because of the collapse of the pond wall.

Table 6-30. Estimated balance of Tilapia culture (Second culture trial in Zagnanado)

	Pond 2	Pond 3	Remarks
Initial			
Fish average weight (g/fish)	8.7	8.9	
Number of fingerlings	600	600	
Biomass (kg)	5.2	5.3	
Final			
Fish average weight (g/fish)	80.0	58.8	
Number of fingerlings	480	480	*1)
Biomass (kg)	38,4	28.2	
Culture period (days)	134	134	
Amount of feed (kg)	123	123	
Daily growth (g)	0.53	0.37	
FCR	3.7	5.4	
Balance	6,474	-3,692	*2)

*1) Survival rate: 80%

*2) Basis of calculation: Fingerling cost: 20 FCFA, Feed cost: 162 FCFA/kg, Selling price of fish: 1,000 FCFA/kg

Clarias reared simultaneously with a view to regulating the amount of tilapia fingerlings enjoyed a good growth in each pond. The fish captured during periodical measurements of weight performed on October 15, possessed an average weight of respectively 90.3g, 108.3g and 63.6g in ponds 2, 3 and 3b. They will yield complementary revenue.

3) Village of Tchi-Ahomadégbé, Commune of Lalo

1) Pig: reproduction, growth, survival, sale and balance

Suckling pigs aged 5 months were bought in November 2007 and raised till adult age. Their copulation was noticed back on January 9 and 16, 2008 scilecet the eight month in the culture. 9 piglets were brought forth on May 3 and another six (6) on May 9. According to the first measurements, the piglets mostly breast milk, recorded a daily increase in weight ranging from 100g to 135g. Since the feed for piglets that is made primariry of breast milk is not available in Benin, there is no choice but rely on breast milk. When aged 4 months, these piglets weight only ranging from 11 to 15kgs scilicet less than half the weight of European breads piglets at the same age. If a repeated reproduction of the same bread (Large White) for culture purposes may be partly blamed for this situation, the main cause originates from the delay in weaning due to the decay of the partitions of the piggery as well as a bad expresure of the animal to the feed provided. Besides, the daily feed in take was determined between 500g and 1kg per animal regardless of the appetite of the piglets. Their growth could be significantly enhanced by starting from the second week, when the amount of breast-milk is dwindling, to feed suiTable feed to the piglets, in stepping up their weaning and in providing them with feed without restriction. Table 6-31 highlights that their growth slow down from the third month and reached 20kg or so only in fifth month. These results are much worse than those achieved by the state-owned farm.

Table 6-31. Growth of piglets

Weighing		June 4		August 13		October 22	
Number.	Sex	Weight (kg)	Daily growth (g)	Weight (kg)	Daily growth (g)	Weight (kg)	Daily growth (g)
Age		32 days		112days		162 days	
1	Female	3.8	127	14	80	18	
2	Female	4.0	125	14	100	19	28 500
3	Female	4.2	135	15	140	22	33 000
4	Female	3.8	115	13	100	18	
5	Female	3.0	100	11	120	17	25 500
6	Female	3,0	100	11	100	15	22 500
Average			117				
Age		26 days		106 days		156 days	
1	Male	3.4	107	12	100	17	20 000
2	Male	3.5	118	13	120	19	
3	Male	3.0	125	13	120	19	
4	Male	5.0	137	16	120	22	33 000
5	Female	4.0	112	13	120	19	20 000
6	Female	4.0	125	14	100	19	
7	Femelle	3.0	100	11	120	17	25 500
8	Female	2.5	131	13	100	18	
9	Female	2.5					
Average			119				
Total sales							208 000

The sale of the Piglets

It is difficult to sell piglets in Tchi-Ahomadégbé and its neighbouring villages. Evev if there is a demand, the quoting of prices doesn't meet criteria of profitability. The intent to sell the piglets was announced to a wider area through a local radio station so as to seek prospects. Thus one boar and four sows were purchased by the company SEPAL, specialized in the reproduction of local bread pigs. Another intended for reproduction was quoted at 1,500FCFA per kg.

Around this period of time, stocks of compound bottomed out and the lack of feed induced the declining of 4 piglets, two of which were to die. The two remaining piglets were sold for consumption at price of 20.000FCFA each.

After the sale of 8 piglets, the balance showed a loss of 549.738FCFA (see Table 6-32). The worth of the remnant sows and piglets is however estimated at 504.000FCFA, which is equivalent to the amount of losses. To makes a profit, increases it and secure a margin of profitability, it is compulsory to shorten the cycle of birth and cut down feed costs by resorting to sell produced feedstock used.

Table 6-32. Balance of pig farming (November 2007)

	Quantity	Unit price (FCFA per kg)	Amount (FCFA)	Observations
Pigs kept for reproduction purpose	4	54, 000	216, 000	
Feed	1, 212 kg	130	157, 560	
	1, 164 kg	182	211, 848	
Feed of piglets	907 kg	190	172 ,330	
Total expense			757, 738	
Earnings from piglets sale	6 (112 kg)	1 ,500	168, 000	
	2	20, 000	40, 000	
Gross profit			-549, 738	

Table 6-33. Cost of compound feed for pig farming

Stuff	Quantity	Unit Price (FCFA per kg)	Amount (FCFA)
Maize	75 kg	150	11, 250
Soybean	15 kg	300	9, 000
Fish meal	7 kg	250	1, 750
Shells	2,4 kg	75	113
Lysine	100 g	2 ,600	260
Methionine	100 g	3 ,000	300
Vitamin	150 g	1 ,650	330
Salt	250 g	110	275
Total	100 kg		232, 775

2) Rabbit: Growth, survival, sale and balance

After the bringing in of breeders in February, young rabbits were brought forth in mid-April. Yet, the furless and helpless infants were assailed by ants and, all 32 newly-born passed away. As the way the parents were managed as well. Feeding as well as shelter manufacturing methods was explained viva voce while introducing the breeders, but these methods wasn't understood. The level of capacities and the standards of technical understanding wasn't achieved, which is the achilles heef of group-based management: discrepancies appeared as to how to handle the culture and resulted in a host of death in the absence of an efficient management. In addition, coconut shells, which is prone to turn up side down, is made use of as drinking and feeding troughs. The possibility cannot be ruled out that, this fact, combined with an efficient less management, could have led to the rabbits having been for saken with neither water nor feed.

The four female-rabbits and the single male remaining when the monitoring took place in May were removed to a room of the warehouse, which provided them with a space where they could saunter freely. During the monitoring carried out in August, PACODER noted that, thanks to this improvement of their culture conditions, one among the femalle rabbits had bred in July 4 young rabbits and that, the two survivors seemed to be growing smoothly. For lack of feeds, these young rabbits were to die later. It seems that the owners, busy going about planting and harvesting for their many crops (which include rice), lacked time to feed them.

iii) Tilapia: Growth, survivals, sale and balance

Pond 1 is manured by pig dejections through the manure pit in concrete. The method applied here consists in the direct injection into the pond after mixing porcine dejection with water everyday with a stirrer. In another words, the manure pit performs as a place for the physical decomposition of dejections rather than a place where organic substances undergo a biological dissolution. Since porcine dejections are soft and scatter easily into water, their immediate injection following stirring in the manure pit doesn't damage the bottom, enhances the manuring-impact. As for the water in the pond, it remains dark green thanks to the steady reproduction of phytoplankton.

Thanks to this method, the non digested residua contained in porcine dejections scatterd into the water in the ponds, permitting that fish could meal there of direct as it was observed. Besides the group of farmers supplemented the feed of the fish by distributing to them the floating algae collected from the culture pond of the clarias on the site.

It appeared from this experiment that tilapia could grow in the environment of pond 1 featured by worthless feed actual cost zero and reach the markeTable size of 150g per individual within 6 months (see Table 6-34). It is fitting to be in hope that this Lalo method will become a model regarding the association of aquaculture with agriculture and livestock. Pond 2, which serves from the beginning as check-pond (the feeding of pellet compounded feed to fingerlings) records results superior to those of pond 1 as concerns fingerlings growth (see Table 6-34).

Table 6-34. Growth of Tilapia (First culture trial in Lalo)

Date de mesure	Number of date after	Average weight (g)		Remarks
		Pond No.1	Pond No. 2	
November 29, 2007	0	29.0	29.0	
January 24, 2008	56	66.5	84.2	
February 25, 2008	88	77.6	101.7	
March 26, 2008	118	94.6	123.0	Fingerlings reproduced in ponds were used for rice-fish culture. May 6, 2008: 616 fish of 60g May 26, 2008: 200 fish of 60g
April 25, 2008	148	106.0	134.4	
May 26, 2008	179	160.5	166.2	

The fish produced in ponds 1 and 2 were gradually caught and marketed from mid-June. Performances are showed in Table 6-35 and 36. As on the other sites the comparaison of the size registred while performing grown periodical measurements to the actual size measured when capturing and selling them disclose a significant gap to the detriment of the latter. This phenomenon is certainly accounted for by the fact that during periodical measurements, big fish are picked in priority and during the sale the size of the fish is under-appraised so as far sold at 500FCFA per kg, the selling price was quoted lower than on the other sites, namely 800FCFA per kg.

Main buyers were villagers from the neighbourhood. Many of them bought in several kgs: some of them purchased more than 10kgs may, up to 54kgs for the biggest buying. The leading purchasers include the staff of the Department of Forestry and civil service employees. (RCPA, etc).

Table 6-35. Result of tilapia sale (Pond1 in Lalo, without feeding)

Date of sale	Number of customers	Number of fish	Weight (kg)	Amount (FCFA)	Quantity of purchase (kg/person)			Average Weight (g/fish)
					Average	Min.	Max.	
July 11, 2008	1	428	54.0	43,200	54.0	-	-	126
July 12, 2008	1	61	12.0	9,600	12.0	-	-	197
July 17, 2008	2	30	4.0	3,200	2.0	1.0	3.0	133
July 23, 2008	3	70	12.0	9,600	4.0	3.0	6.0	171
July 30, 2008	1	115	15.0	12,000	15.0	-	-	130
August 1, 2008	14	278	33.5	26,800	2.4	0.5	6.0	121
August 2, 2008	1	114	15.0	12,000	15.0	-	-	132
Sub-total	23	1 096	145.5	116,400	6.3			133
Till November 2,2008	—	1 508	110.1	88,000				73
Total		2 604	255.6	204,400				98

Table 6-36. Result of Tilapia sale (Pond 2 in Lalo, with feeding)

Date of sale	Number of customers	Number of fish	Weight (kg)	Amount (FCFA)	Quantity of purchase (kg/person)			Average weigt (g/fish)
					Average	Min.	Max.	
June 10, 2008	3	205	33.0	26,400	11.0	1.0	30.0	161
June 13, 2008	2	178	29.0	23,200	14.5	4.0	25.0	163
June 19, 2008	6	93	15.5	12,400	2.6	1.0	7.0	167
June 22,,2008	5	55	8.0	6,400	1.6	1.0	2.0	145
July 5, 2008	9	217	32.0	25,600	3.6	1.0	10.0	147
July 9, 2008	8	216	31.0	24,800	3.9	2.0	10.0	144
July 10, 2008	2	43	6.5	5,200	3.3	2.0	4.5	151
July 23, 2008	3	70	12.0	9,600	4.0	3.0	6.0	171
Sub-total	38	1,077	167.0	133,600	4.4			155
Till November 2,2008	—	131	20.7	16 ,560				158
Total		1,208	187.7	150 ,160				155

The survival rate, reckoned on account of the total number of the sold fish, added up to only 77. 6% as represents pond 1 and 48.3% as concerns pond 2. During periodical measurements as well as final captures, lots of clarias of natural origin were caught, whether in pond 1 or 2 and, their predatory pressure might have been great. Captured clarias, its total weight exceeded 20kg in each pond, were sold as complementary income. The self- consumed portion wasn't reckoned with.

The result is summarized in Table 6-37 in the form of balance sheet. Inspite of the instruction not to feed the fish in pond 1, farmers seem to have used some amount of pellet feed intended for feeding the fish in pond 2. This has been taken into account in Table 6-37, in which the balance was reckoned accordingly. The culture in pond 1 resulted in a gross profit of 45,960 FCFA whereas that of pond 2 resulted in a loss of 281,000FCFA because that fish in pond 2 was not well acclimated to man-made feed and thus excess amount of feed was given.

Table 6-37. Balance of Tilapia culture (First culture trial in Lalo)

Item	Pond 1			Pond 2		
	Quantity	Unit price (FCFA)	Amount (FCFA)	Quantity	Unit price (FCFA)	Amount (FCFA)
Direct costs (A)						
Fingerlings (fish)	3,375	40	135,000	2,500	40	100,000
Feed (kg)	112	210	23,520	1,577	210	331,170
Selling price (B)						
Tilapias (kg)	255.6	800	204,400	187.7	800	150,160
Gross profit						
(A) - (B)			45,960			-281,010

Concerning the result of pond 1, the pilot project suggest a great potential for feed less culture associated with pig farming providing the latter proves successful. It is reasonable to expect a greater profit to bring the following improvements to it: to lower fingerlings cost by producing them in the farm; to cut out feeding cost; to quote the unit selling price of Tilapia at 1,000 FCFA/kg as in other regions. (Had these requirements been met, the gross profit would have risen to 225,600 FCFA).

Concerning the feeding culture in pond 2, because of the fact that pellet feed tends to sink and feeding habitat of fish was difficult to be observed. Besides farmers weren't accustomed to feed. It resulted accordingly in an excess volume of feeding. In this regard, the experience gained so far in Tilapia culture by the Department of Fisheries and advanced fish farmers suggests it is possible to achieve the FCR of 2.5 by improving the fish feeding method. Moreover, as it appeared unequivocally from Covè's experiment, site of the neighboring pilot project, it is relevant to set the selling price of Tilapia at 1.000 FCFA/kg. However this couple of improvement enables to work out only limited gross profits if the survival rate is low as that noticed this time. In the future, it will be compulsory to ensure that feeding cost is reduced through the fertilization of ponds, and that fish-culture related knowledge, namely feeding techniques are enhanced.

iv) Clarias: Growth, survival, sale and balance

The result of growth monitoring is indicated in Table 6-38. It was noted that number of fish sampled in the first growth measurement held on 24 January 2008 was very few, the size of sampled fish was extremely big, some bigger size catfish exceeding 1kg that supposed to be the wild ones were caught as well at the time of sampling. Because of those facts, it was concerned that calibanisme took place soon after the stocking fingerlings in the pond and predation by wild catfish occurred. And then small and medium size fish were killed.

Table 6-38. Growth and survival of Clarias (First culture trial in Lalo)

Date of measurement	Number of days after	No.3 (500m^2)		Observations
		Average weight (g)	Number of fish	
November 29, 2007	0	4.5	2,500	
January 24, 2008	56	113.5		
February 25, 2008	88	342.6		
March 26, 2008	118	-		
April 25, 2008	148	661.48		
May 26, 2008	179	734.0	124	All harvested. Een of the trial

This time the pond was cleaned out with a pump and virtually all were collected on May 26 to wit during the sixth month of the culture. The total number of captured fish, those caught later inclusive worked out to 137 weighing on aggregate 87 kg (635 g in average). The survival rate of the fingerlings was barely 5%. These fish were virtually big sized ones ranging from 500 g to 1 kg – which leads to infer that the predatory assault waged by predators of natural origin as well as calibanisme were rampageous.

The collected Clarias were sold in the village market place at 800 FCFA/kg. The result of the sale is shown in Table 6-39. It took many days to sell out the stock of fish. The demand in Clarias in the neighborhood appears to be lower than in “Ouémé” and “Plateau” prefectures. The number of daily customers ranged to 2 to 10 persons, and the amount of purchase per customer ranged from 1 to 5kg. A trend to sells big fish first was not iceable in spite of a same unit price for all fish.

The total turn over was 69,600 FCFA. But taking into account the cost of fingerlings supplied by the project (100 FCFA per individual x 2,500 fish=250,000 FCFA and the cost of feed (760 kg x 300 FCFA/kg=228,000 FCFA, the total absence of profitability resulting from the use of such a method is vindicated.

Table 6-39. Sales result of Clarias (First culture trial in Lalo)

Date of sale	Number of customers	Number of fish	Weight (kg)	Amount (FCFA)	Sold quantity (kg/pers.)			Average weight (g/fish)
					Average	Min	Max	
May 26, 2008	5	25	18.0	14 400	3.6	1	5	720
May 27, 2008	9	29	22.5	18 000	2.5	1	4	776
May 28, 2008	7	14	9.5	7 600	1.4	1	2	679
May 29, 2008	10	31	19.5	15 600	2.0	1	3	629
June 6, 2008	7	23	11.5	9 200	1.6	1	2	500
June 9, 2008	2	15	6.0	4 800	3.0	2	4	400
Total	40	137	87.0	69 600	2.2	1	5	635

The result of the second culture trial in hapanet is showen in Table 6-40. During the monitoring in June 2008, the consultant supplied ingredients and the manual meat chopper, and provides a training concerning techniques of simplified pellet feed-making. Afterward, the fish feeding seems to have been performed for sometime in conformity with the taught method. But a shortage of feedstock befell in late July and induced an almost complete discontinuity of the fish feeding over several weeks. During discussions held in June, it had been agreed upon that the earnings from the sale of fish bred during the first culture trial would be used to Covèr feed related expenses, but they were instead used otherwise. The group of farmers vindicates such an occurrence that these incomes had already been used for buying of medicine and feed for pig farming. Eventually the supply of supplementary ingredients was achieved only in the mid august when the consultant visited the site again.

Table 6-40. Growth and survival of Clarias (Second culture trial in Lalo)

	Hapa 1	Hapa 2	Hapa 3	(Hapa ->pond)	Pond	Total	Observations
June 9, 2008 (stocking of fingerlings)							
Number of fish	140	334	638			1 112	
Average weight (g)	24.6	15.2	5.2				
Biomass (kg)	3.4	5.1	3.3			11.8	
July 9, 2008 (First measurement of growth)							
Number of fish	40	334	473	20	App. 50	App. 910	Escape of a portion of the fish because of the destruction of hapanet
Average weight (g)	136.3	24.0	8.9	220.0			
Biomass (kg)	5.5	8.0	4.2				
August 14, 2008 (Second measurement of growth)							
Number of fish	16	355	395	28	App. 80	App. 870	
Average weight (g	121.9	32.7	13.7	223.2			Same
Biomass (kg)	2.0	11.6	5.4				
September 17, 2008(Third measurement of growth)							
Number of fish	0	188	426	33	App. 200	App. 850	
Average weight (g)		39.8	20.5	115.0			Same
Biomass (kg)		7.5	8.7				
October 22, 2008 (Fourth measurement of growth)							
Number of fish		214	300	37	App. 200	App. 850	Probable mistake in regard to the number of fish in hapanet
Average weight (g)		56.5	36.2	115.0			
Biomass (kg)		12.1	10.9				
November 17, 2008 (Fifth measurement of growth)							
Number of fish		273	404		153	830	Harvesting and measuring of the all raised fish.
Average weight (g)		47.3	18.2		163.0		
Biomass (kg)		12.9	7.4		24.9	45.2	

In spite of these unforeseen circumstances, Clarias culture according to this procedure secured rather satisfactory results. In the course of the culture, fingerlings were measured in 4 times and selected at each time, and all fish transferred into fish ponds. Finally all the fish were harvested and weighed on November 16 and 17 (156th day of the culture). According to the results of harvest, the total number of fish was then 830 individuals and their weight was 45.2 kg. The survival rate during the culture was 74.6%, which can be rated a satisfactory result. The growth of fish from initial weight of the fingerlings (20-25g) is also good. The selective culture method in hapanet thus proved effective for limiting the initial losses of Clarias fingerlings.

This species is featured by a great disparity in regard to the growth. Table 6-41 provides data about the sales following the harvest as well as about the culture that resumed subsequently. The 185 individuals (in total of 830), which exceeded approximately 100 g (a little bit more than 500g in maximum) were intended for sale (to wit 29.5 kg on aggregate). As respect the smaller fish, they were brought back to culture. Expected earnings were estimated at 23,900 FCFA at the moment when the harvest took place, sales achieved and sale previsions inclusives. The amount of feed used until this date was about 180 kg. (Approximately 35,000 FCFA) which calls for further reflexion as to the enhancement of FCR and profitability.

Table 6-41. Harvest, sale and resumed culture of Clarias (Second culture trial in Lalo)

		Number of fish	Weight (kg)	Unit price	Amount (FCFA)	Average weight (g/fish)
Sale						
	Sale on november 6, 2008	6	1.5	1 000	1 500	250
	Sale on november 7, 2008	23	8	800	6 400	348
	Planned sale	158	20	800	16 000	127
	Sub-total	187	29.5		23 900	158
Resumed culture						
	Nurseries	391	6.4			16.4
	Fish ponds	252	9.2			36.5
	Sub-total	643	15.6			24.3
Total		830	45.1			54.3

v) Yield of rice and fish from rice-fish culture

The trial of rice-fish culture performed on this site didn't result in satisfactory performance owing to lack of preparation of from the project side as well farmers side. Concretely - the ramps surrounding rice-fields weren't sufficiently heightened, which didn't enable get as adequate depth and fingerlings stocked to culture were already too big (60g) (the pricking out of rice as well as the stocking of fish occured in the absence of consultant).

While the amount of grown rice was up to expectations, with regards to the fish, they virtually didn't grow and their number at the moment – when they were captured, was by far inferior to their number at the time of their stocking. As a result, the biomass dropped up to ranging from 60 to 70 % (see Table 6-42).

Some improvements can be contemplated with respect to the rice-fish culture, such as digging a pond in some part oh the rice-fields in pursuance of the method resorted in the village of Monkassa, situate in the commune of Malanville, or using Clarias as target species

Table 6-42. Harvest of fish from rice-fish culture

	Rice-field 1		Rice-field 2		Rice-field 3	
	Stocking of fish	Harvest	Stocking of fish	Harvest	Stocking of fish	Harvest
Date	May 6, 2008	September 10, 2008	May 6, 2008	October 25, 2008	May 6, 2008	October 25, 2008
Number of fish	200	68	304	125	312	177
Biomass (kg)	11.4	3.5	18.4	7.8	18.8	7.8
Average weight (g)	56.8	51.5	60.4	62.4	60.4	44.1
Period of culture (days)	107		172		172	
Survival rate	34%		41%		57%	
Biomass growth	-69%		-58%		-59%	

Since the rice fields were overwhelmed with 2m-high grasses at the beginning, the degree of preparation of different rice fields varied much from one field to another, hence tremendous gaps between them as respects of growth and harvest. Rice-field 1 enjoyed a normal growth, which resulted in a 2.9 tons crop of rice per unit of surface area (See Table 6-43). This rice-field was, as a matter of fact relatively well prepared and weeds were few over it. Rice-field 2 prepared and made ready, on the contrary, by mowing of 2m-high weeds, ploughing and leveling of the plot and land, was nonetheless still strewed with weeds while being used. In this plot, young rice plants were pricked out too deeply because of the grasses bed preventing it. Consequently their initial growth was slowed down. In addition, weeds mushroomed, hence a sparse growth of the rice. This situation brought about a 0.6 ton crop. Owing to the weak crop density, the weight of one thousand grains (PMG in French), to wit 31 g was however, the highest. The crop is very likely to be enhanced by a better preparation of the plot. Like rice-field 2, rice-field 4, prepared and made ready as a result of mowing of a plot strewn with

weeds, yield a crop of only 1.3 tons per unit of surface area because of the many weeds. Owing to the low crop density, the related weight of one Thousand Grains (PMG in French) was also high (30 g), which allow a crop improvement if a better preparation is carried out.

Table 6-43. Cultivation of NERICA rice

	Surface (m^2)	Variety of rice	Harvest (kg)	Unit harvest (ton)	PMG (g)
Rice-field 1	310	L-14	92	2.9	26
Rice-field 2	480	L-20	27	0.6	31
Rice-field 4	640	L-56	89	1.3	30

Looking at the earning of rice cultivation (see Table 6-44), since the cultivator was used for plot preparation works, ploughing and leveling, the cost piled up. Besides, as contracts of exploitation of rice-fields considered plot as a unit, the yield in term of expenses was bad over small parcels. During this trial, the most remunerative parcel yielded as earnings only750 FCFA with in the frame work of a contract-based exploitation. In the hypothesis of a family work, it would be however possible to secure profits amounting to 6,750 FCFA with the smallest plots. (310m^2).

Table 6-44. Profit and cost of rice growing in Lalo

	Use of manpower			Family work		
	Unit price	Quantity	Amount (FCFA)	Unit price	Quantity	Amount (FCFA)
Seeds	1,000 FCFA /kg	2kg	2,000	1,000 FCFA /kg	2 kg	2,000
Grubbing	3,500FCFA /parcel	0.5 parcel	1,750			
Sowing	1,000FCFA /parcel		1,000			
Ploughing, Levelling	4,750FCFA /parcel	0.5 parcel	2,750	4750FCFA /parcel	0.5 parcel	2,750
Transplantatio, weeding	3,500FCFA /parcel	0.5 parcel	1,750			
Crop	3,000FCFA /parcel	0.5 parcel	1,500			
Total expenses			10,750			4,750
Sales of rice	125 FCFA /kg	92 kg	11,500			11,500
Gross profit			750			6,750

4) Village of Pénéssoulou, Commune of Bassila

i) Broiler: Growth, Survival, Sale and Balance.

100 broiler chicks were bought back on November 29, 2007 and delivered to Bassila. Preparations for their reception were completed in Bassila, but there had been a trouble due to lack of heating and accordingly the chicks caught chill nightly. As a result, 18 chicks died within the first two weeks. On advice from the SPA (livestock extension staff of CeCPA), heating was provided with firewood during night to get a temperature of 30 degree, which healed the sick chicks that are enjoying since then a troubleless growth. Thereafter, within three (3) weeks (scilicet when they were aged 8 weeks), their weight shifted to ranging from 2.3 to 2.5 kg. Further to a delay in feed delivery due to bad communications, 18 adult broilers died from malnutrition. Adding 3 chickens unmarketable owing to malformation, only 61 chickens were eventually sold. The balance thus incurred loss of 70,000FCFA as showen in Table 6-45.

During the second production process of broilers, home-made compound was used as feed. In June the requisite ingredients to wit 100 kg of maize and 70 kg of soybean were purchased at the market place. They were weighed by farmers at the village who were subsequently trained to prepare compound namely to the crushing of maize, the heating of soybean and to crunching method. The chicks were delivered in July, and the sale started at the beginning of September. Growth rate of the chicks, which reached 87% improved tremendously. Broilers could be sold at a price of 2,500 FCFA each, which permitted to generate a profit of 47,100 FCFA.

Table 6-45 Balance of chicken farming (Bassila)

	First production		Seconde production	
Input of chicks	100		100	
Survival rate	61/100 =	61%	87/100 =	87%
	Balance (FCFA)		Balance (FCFA)	
Chicks	100 x 600 FCFA =	60,000	100 x 600 FCFA =	60,000
Feed	600 kg x 210 FCFA =	126,000	460 kg x 240 FCFA =	110,400
Total expenitures	60 000+126 000 =	186,000	60 000+110 400 =	170,400
Sales	61 x 2 000 FCFA =	122,000	87 x 2 500 FCFA =	217,500
Gross profit		-64,000		47,100

ii) Goats: growth, survivals, sale and balance

Despite their small size and their short legs, the goats showed a high-standard culture capacity. Most of the young goats were twins. (See Table 6-46). Whereas the interval between two births was usually 8 month one among these goats littered for the second time seven (7) months after the first bringing forth, which constitutes an outstanding yield.

Table 6-46. Reproduction of goats

Number.	Goats			Number.	Young goats weight (kg)			
	Number of Litter	Sex, feature	Date of bringing fourth		Birth	May 31	August 14	October 31
1	2	Male, black	February 21	1	0.5	1	2	
		Female, brown		2	0.4	1	2	4
2	2	Female, brown	April .	3		7	8	8
		Female, brown		4		6.8	8	8
	1	Female, black and white	October 26.	5				1.5
3	1	Male	Avril 12.	6	1.6	5.9	7	
4	2	Female, black and white	May 11	7	1.5	2.2	8	7
		Female, black and white		8	1.5	2.4	7	7
5	2	Male white and brown	May 31	9	1.3		5	7
		Female brown		10	1.0		4	6
6	1	Male	June 6	11	1.1		4	6
7	2	Female		12		6.8		8
		Female, black		13		7.0		8
8	2	Male, black and white	October 24.	14	1.0			
		Female, black and white		15	1.0			

Out of 10 purchased goats, one passed away choked by plastic bag and the other from bite of snake. 8 month later, the 8 remaining femalle goats had brought forth a price of 105,000 FCFA in total; the sale of young goats already yielded 42,000 FCFA (see Table 6-47). The goats were fed on grass, it is not necessary to buy feed. Hence the sale of young goats in per sei is gross profit. Since the culture site was located far from dwellings, it would be easy to mow grasses and shrubs used as feed, but increase in number of goats would makes it difficult to manage the culture

Table 6-47. Purchase of adult goats for reproduction and sale of young goats

Purchase of adult goats for reproduction				Sale of young goats			
Sex, Number.	Age	Weight (kg)	Price (FCFA)	Sex, Number.	Age	Weight (kg)	Price (FCFA)
Female1	7 months	9	8,000	Female1	5 months	6	8,000
Female 2	1 year	10	9,500	Female 2	5 months	6	8,000
Female 3	1 year	Dead	10,000	Male 1	5 months	7	12,000
Female 4	1 year	12	10,000	Male 2	5 months	8	14,000
Female 5	1 year	13	10,000				
Female 6	1 year	15	10,500				
Female 7	2 years	16	10,500				
Female 8	3 years	18	10,500				
Female 9	3 years	18	11,000				
Male 1	2 years	12	6,000				
Male 2	3 years	14	9,000				
Total			105,000				42,000

iii) Tilapia: growth, survival, sale and balance

Non-feeding aquaculture in fertilization with manure pit was experimented on this site too. Yet, many technical and management problems brought this business to a standstill. These problems categorized appear as follow.

Technical problems

- Inadequate quality and quantity of manure
- Hindrances to photosynthesis because of turbid matters in suspension in the water
- Inadequate growth due to the dwarfishness of fingerlings
- Decrease in the depth of water owing to the drying up of gushing water in particular pond 2 randry in March

Management and maintenance problems

- Members of the group of farmers do not abide by the instructions of the group's head for they don't trust him.

Fish didn't virtually grow because of the above reasons. Consequently the first trial was provisionally discontinued. All fish harvestable on June 2, 2008 scilicet the fourth and fifth month of the trial were captured and marketed (see Table 6-48). The average size of fish was small around 40 g and the unit sale price was 500FCFA. Besides, aquaculture on this site didn't involve virtually direct costs because the type of aquaculture was non-feeding one and fingerlings were self-supplied. The balance shows a plussage.

Table 6-48. Balance of Tilapia culture (First culture trial in Bassila)

	Pond1	Pond 2	Pond 3
Stockingdate	December 24, 2007	December 24, 2007	January 16, 2008
Harvesting date	June 2, 2008	Trial interrupted due to dry of pond	June 2, 2008
Period of culture (days)	161		138
Number of harvested fish	519	0	496
Survival rate (%)	86.5	0	82.7
Total amount harvested (kg)	22.8	0	18.5
Fish average weight (g/fish)	43.9	0	37.3
Unit price (FCFA/kg)	500	0	500
Turnover (FCFA)	11, 400	0	9 ,250

Fish growth with regards to feeding aquaculture in the second trials is shown in Table 6-49. The group of farmers during a meeting in late May renewed their group leader. Management problems seem to have been overcome to a certain existent.

Table 6-49. Growth of Tilapia (Second culture trial in Bassila)

Date of weight	Number of days	Average weight (g)			Observations
		Pond -1	Pond-3	Pond-4	
June 25, 2008	0	19.2	8.9	19.2	
July 23, 2008	28	26.8	12.2	216	Stocking Clarias in pond
		(8.0)	(8.0)	(8.0)	
August 26, 2008	62	47.4	26.7	44.8	
		(30.8)	(40.0)	(35.0)	
September 25, 2008	92	80.6	44.1	74.7	
		(156.3)	(128.6)	(131.3)	
October 24, 2008	121	81.5	46.7	70.1	Inadequate feeding due to lack of feed
		(180.0)	(211.0)	(163.3)	

* ( ) Means weight of Clarias

During the second culture, fingerlings were well accustomed to feeding and began gathering as school whenever somebody approached to feed them which is the sign of good culture conditions. Fertilization of the ponds was also carried out through putting a bag of chicken dung. (Due to above-mentioned water quality problem, the phytoplankton doesn't augment adequately; yet some impact was noticeable). Home-made pellet feed was appreciated by fish, which enjoyed accordingly a satisfactory growth. Comparing the daily growth of Tilapia, those from Tohonou (ponds 1 and 4) enjoyed a growth rate by far better than fingerlings produced on the sit itself (pond 3), which indicates that the latter fell victim to advanced genetical impoverishment due to consanguineous cross culture.

Fish produced during the second trial were still neither captured nor sold in November. The balance was therefore examined of in the some conditions, as in the case of other sites (see Table 6-50). The balance is slightly in the red because of the high cost of feed. The performance of pond 3, which used slow-growing fingerlings produced on the site, proved, contrary to expectations, relatively better than performances of the other ponds. This can be accounted for by an estimation of fingerlings cost at zero and by the hypothesis of a constant unit price of 1,000FCFA per kg whatever is the weight of the fish. It is crucial so as to enhance profitability, while cutting feed costs, to lower fingerlings cost, which calls for, as regards the northen region of Benin where, practically, transport cost comes on top of other charges, the production of healthy fingerlings on the site itself.

The major reason explaining the absence of profit, in spite of good growth of fish, is high cost of feed. The feed used on the site was a mixture recommended by the Department of Fisheries. Now, the cost of this feed sky-rocketed, shifting from approximately 130FCFA/kg in 2006 to 215FCFA/kg. Currently the FCR, which exceeded 5, was bad. From now onward, the group of farmers should manage more rigorously and use cheaper and locally available ingredients such as bran of local beer.

Table 6-50. Estimated balance of Tilapia culture (Second culture in Bassila)

	Pond-1 (Fingerlings supplied by center Tohonou)	Pond -3 (Fingerlings from the farm)	Pond-4 (Fingerlings supplied by Tohonou center)	Remarks
Initial				
Average weight (g)	19.2	8.9	19.2	
Number of fingerlings	1 000	812	1 000	
Biomass (kg)	19.2	72	19.2	
Final				
Average weight (g)	81.5	467	74.7	
Number of fingerlings	800	650	800	*1
Biomass (kg)	65.2	303	59.8	
Period of culture (days)	121	121	121	
Amount of feed (kg)	235	152	235	
Daily growth (g)	0.51	0.31	0.46	
Rate of alimentary conversion	5.1	6.6	5.8	
Balance	-1 800	-64	-7 240	*2

*1: survival rate: 80%

*2: condition for calculation is as follows.

Fingerlings cost: Pond 1 and 4/20FCFA per individual (Tohonou); Pond 3/0 self-produced fingerlings

Feed cost: 200FCFA/kg; sale price of fish: 1,000FCFA/kg

5) Village of Monkassa, Commune of Malanville

i) Broiler: Growth, Survival, Sale and Balance.

At the beginning, as heating wasn't sufficient, 10 chicks died in the first week. Afterward, they were placed in 5 cases, each of which was warmed with kerosene lamps, which enable to reduce the mortality rate to 4 deads in the following week, then to zero in the third week .The chicks which weighed 40g at the beginning reached 115g in the first week, 200g in the second week and 480g in the third week. They reached 780g in the fourth week but eleven (11) passed away, thereafter 34died again in the fifth week and eventually all of them had passed away in the sixth week.

Most of the chicks died as a result of incapacity to regulate the body temperature. The culture within cartons at the arrival of the chickens was planned, but preparations were insufficient. It took some time to warm the cartons and the chicks caught chill meanwhile. Moreover, the journey to Malanville lasted two (2) days, which weakened them. Those who died from the fourth week were struck by poultry sickness which was rampant in all villages at the moment when they should strength then their immunity and they certainly died contaminated.

During the second culture trial, 13chicks passed away on the first day, 11 on the second day, 8 on the third day, 3 on the fourth day, 2 on the fifth day and 1 on the sixth day. The reason of these deaths is not known with certainly, but, based on the circumstances, it seems that these losses originate from a mistake in medicine dosage. Following the flop of the first culture trial on this site, a massive amount of drugs was administered to the chicks as a preventive step, which might explain these symptoms of poisoning.

Drawing lessons from the previous failure, a thermometer was made ready and the chicks should be raised over a flat ground, in an environment permitting to check their temperature. The day to day losses resulted in a drop of the grow rate to 56% which prevented from making a profit. All broilers produced could nevertheless be marketed at the unit price of 2,500 FCFA. The commune of Malanville shelters numerous hotels and it is not difficult to sell the broilers since the flow of goods and persons is very active in Malanville.

Table 6-51. Balance of chicken farming (Monkassa)

	First production	Second production
Input of chicks	100	100
Survival rate	0%	57%
	Balance FCFA	Balance FCFA
Chicks	100 x 600=60,000 FCFA	100 x 600=60 000 FCFA
Feed	600kg x 210FCFA=126,500	100kg x 240 FCFA= 24000 300kg x 225 FCFA=67500
Total expenditure		60,000+91,000=151,500
Sales		56 x 2,500 FCFA= 140,000
Gross profit		11,500

ii) Sheep: growth, survival, sale and balance

One in the ten (10) sheep died after being bitten by a snake, but the remaining 9 grew satisfactorily. Their average weight was 17.2 kg during the weighing performed on February 12, 2008 and reset 26 kg on June 19, 2008. The increase in weight is 8.8kg, which corresponds to a daily increase of 69g. This is a good weight gaining pace as regard sheep from Sahel. However, it is proper to underline that broiler remaining feed was given to the sheep in a proportion of 275g per day, which accounts very probably this satisfactory gain of weight.

The measurements performed during the monitoring carried out in August clearly highlight the quality of the breeders. The progeny of Sahel pure breed sheep had continued to gain ranging from 56 g to 126 g of weight while the growth of local breed sheep has been at a standstill. If, between the fifth and the sixth month following their purchase, their growth was manifest, Sahel breeds sheep kept growing beyond until twelve months.

Two rams were sold to a wholesale dealer at the animal marketplace in Guéné (15 km at the south of Mallanville). The ram weighing 24 kg was bought at 29,000 FCFA and that weighing 32 kg, deemed unhealthy at 28,000 FCFA (See Table 6-52). Fallen sick after being pastured and dead from its sickness, the fattest ram in the livestock was sold to a butcher's shop at 20,000F CFA.

Table 6-52 Sheep fattening

No.	Feature	Sex	February 17		June 11		August 21		Obs.
			Weight (kg)	Growth (g/day)	Weight (kg)	Growth (g/day)	Weight (kg)	Growth (g/day)	
1	Black and white	Male	20.2	112	32	126	41	16	Dead
2	Brown	Male	20.0	76	28	56	32	50	
3	Black and brouwn	Male	17.8	97	28	56	32	0	Sold
4	White and brown	Male	17.0	86	26	84	32	0	
5	White and brouwn	Male	16.8	78	25	84	31	0	
6	Black and brouwn	Male	16.5	81	25	56	29	0	
7	White	Male	16.2	79	25	7	25	0	Sold
8	White and brown	Male	16.0	67	23	0	23	16	
9	White and brouwn	Male	15.5	67	23	0	22	0	
	Average		17.2		26		30		

In farmer's mind, there is a strong belief that the sale of sheep for Tabaski feast purposes yield a big profit. It is true that at this period, sheep are worth twice as high as their standard price. But the results from the present trials have enabled us to grasp that the pace of growth of sheep depended on the latter, and that the growth, swift between weaning and the ninth month, slowed down later. One among Sahel sheep of nearly pure breed kept enjoying a good growth till the twelfth month. The best yield should therefore be attainable in buying sheep aged 5month, 3 or 4 months ahead of Tabaski Feast, so as to cram them.

iii) Yield of rice and fish from rice-fish culture

The first rice crop from rice cultivated in underground water irrigated conditions was remarkable. The

amount of rice reaped over a total area of 0.75 ha was tantamount to 60 bags (to wit 4.8 tons for 80kg/bag, and 6.4 tons per hectare). The rice was marketed at 15,0000F CFA per bag, which enables to secure earnings of 900,000 F CFA. Rice price is high during the rainy season, but plummets at the moment of harvesting, from September or October, down to 12,000F CFA, 10,000F CFA in the worst-case. The second crop is seeded and will be reaped in October or November. The balance of the first crop shows expenditures adding up to 452,500F CFA, incomes totaling 900,000F CFA, and a gross profit totting up to 447,500F CFA (See Table 6-53). It is sizeable revenue in comparison to the area cultivated. (0.75 hectare)

Table 6-53. Balance of rice cultivation

	Unit price	Quanity	Amount (FCFA)
Rice seed ADNI-11	15,000	1 bag (40kg)	7,500
Fertilizer NPK	12,000	3 bags	36,000
Urea	12,000	3 bags	36,000
Sowing	5,000	3 parcels	15,000
First ploughing	5,000	3 parcels	15,000
Second ploughing	5,000	3 parcels	15,000
Smoothing	12,000	3 parcels	36,000
Transplantation	12,000	3 parcels	36,000
Weeding	12,000	3 parcels	36,000
Crop	15,000	3 parcels	45,000
Irrigation	15,000	3 parcels	45,000
Fuel	650	200 liters	130,000
Total expenditures			452,500
Rice sales	15,000	60 bags	900,000
Gross profit			447,500

* 0.25 hectare per plot, unit amount of rice sold: 80 kg/bag

On the contrary, the growth of fish wasn't excellent. At the beginning of rice-fish culture, scilicet till toward May8, Clarias didn't virtually grow. (See Table 6-54). This can be explained by the following causes:

- It was a species of natural origin, not accustomed to be fed.
- During this period of time, underground irrigation waters weren't sufficient, which didn't enable fingerlings to go out and enter rice-fields.
- As it was underground water irrigation, the zooplankton, aquatic insects and earth-worms, which serveas feed to Clarias, didn't appear in sufficient number.

Later these main causes went through improvement, which permitted a better growth of the fish. But on July12 in the evening, the fish were robbed. When the group of farmers resorted to the site, they did notice traces of use of net as well as dead fish scattered on the outskirts of the site. That's why they made up their mind on July 14 as an emergency action, to capture the remaining fish with a view to selling them (see Table 6-54).

Table 6-54. Result of rice-fish culture with Tilapia and Clarias (First culture trial in Malanville)

Date measurement	Number of days		Average weight (g)			Estimated number of fish			Remarks
	Pond1	Pond2, 3	Pond1Cla.	Pond2 Cla.	Pond3 Til	Pond1 Cla.	Pond3 Cla	Pond3 Til.	
Feb 21, 2008	0		96.4			1035 -> 1000			Weakening as a result of transport
March 14, 2008	22	0		93.3	56.2		1086 -> 981	553 -> 364	Weakening as a result of transport
May 8 , 2008	77	55	93.1	101.1	76.9				
June 24 2008	124	102	124.8	128.3	126.3				
	Robbery on July 12, 2008.								
14 juil. 2008	144	122	151.9	180,9	139.3	237	329	56	Emergency culture

The sudden decision to market the fish after the perpetrated theft was made at a moment when supply was limited and demand was high, which permitted to sell out all fish in one week's time. In order to keep fish price at a certain level, the sale was limited to direct consumers, primarily farmers from the neighborhood, and didn't target retailers. The sale wasn't carried out by the weight but by the piece pursuant to the local method, and the prices ranged between 225FCFA per piece for the smallest Clarias (the weight of which is 250g). The price of Tilapias was slightly lower than Clarias ones.

According to data obtained, the quantity of Clarias and Tilapias captured after the robbery was respectively 95.5 kg and 7.8 kg to wit 103.3 kg in total, and the sale amounted to 75,775FCFA. The average sale rate was the therefore 736FCFA per kg (see Table 6-55). The first culture resulted consequently in losses adding up to 225,035 FCFA.

Table 6-55. Balance of rice-fish culture (First culture trial in Malanville)

Entry	Qty	Unit price	Amount	Observations
Direct costs (A)				
Fingerlings of Clarias	2,000	100	200,000	Cost price
Fingerlings of Tilapia	500	50	25,000	Cost price
Feed	361	210	75,810	For the consumed portion
Sale Price (B)				
Clarias (kg)	95.5	-	75,775	Emergency harvest and sale.
Tilapia (kg)	7.8	-		
Gross profit				
(A) - (B)			-225,035	

If the theft hadn't been perpetrated and if the survival rate had reached 80%, the amount of captured fish would have been the following:
2,000 Clarias x 80% x 175g = 280kg
500 Tilapias x 80% x140g = 56kg
Scilicet a total of 336 kg

In this case, the amount of sales would have then reached 247,000FCFA, assuming that the average price was the same as this time, to wit 736FCFA per kg. The balance would have nonetheless shown a deficit (loss of 53,810FCFA), if the buying price of fingerlings and feed are taken into account.

It was intended, at the beginning, to carry out only once thr fice-fish culture within the framework of the present pilot project. But as the performance of rice cultivation proved better than expected, in spite of the disappointing performance with regard to culture, the group of farmers was able to boost his financial resources and his motivation. Consequently, the group has resolved on his own to buy new fingerlings and perform a second culture trial. PACODER agreed to continue his aid.

During the second trial, irrigation was achieved by pumping and with rain water. At the moment when ponds 1 and 2 were stocked with Clarias (on August 9, 2008), the planting out of rice was already completed, and the level of water was adequate to allow fish to swim from ponds to rice-fields. The water was to remaine until around the mid-october, at a maximal level of 30cm approximately and, the presence of Clarias as well as Tilapias fingerlings in the rice-fields was observed. As it was the second harvest, the living organisms which serve as natural feed such as aquatic insects and frogs multiplied, which gets us to hope that the fish would feed on them.

Measurements of growth performed on September 24 shows that the fish were growing satisfactorily, not only in parcels where feed was provided but also in feed less plots.

Table 6-56. Growth of Clarias (Second trial of rice-fish culture in Malanville)

Date measurement	Number of days	Average weight (g)		Observations
		Pond-1 (without feed)	Pond-2 (with feed)	
August 9, 2008	0	35,7	35,7	
September 24, 2008	46	71,6	95,5	Amount of feed: 45.5kg
Since mi-November 2008	90-100	Sale scheduled based on the price of fish		

On October 31, date of the last monitoring fulfilled by the consultant, rice-fields and channels had began running dry and connections between the various ponds and the rice-fields were severed. The group of farmers planned to sell their fish from mid November, when their price would rise.

The preliminary scrutiny of the balance provided the results shown in Table 6-57. The average weight of fish at the moment of the sale was assumed to be 90g as regards parcels where feed was not provided, and 140g as respects feeding plots. Whether in one type of parcel or the other the survival rate was hypothetically set at 70%. But, even in this case, the intended balance with regard to nutrient-based parcels. The major cause of this performance resides in the scared buying price of Clarias fingerlings (70FCFA per fingerling).

Thus the rice-fish culture is not currently profitable yet. This pilot project has nonetheless permitted to show for the first time in Benin, that, as far as rice-fish culture is concerned, Clarias could grow without being fed, by feeding solely on living organism in rice-fields. In addition, in rural areas not engaged in fishery, like the village of Monkassa, the guarantee to have at hand all year long sources of animal proteins, thanks to fish culture can be rated a significant result in country-side. The group of farmers from Monkassa uttered his will to still improve the culture methods in the light of the present results.

Tableau 6-57. Balance of rice-fish culture with Clarias (Second culture trial in Malanville)

	Pond-1 (without feeding)	Pond-2 (with feeding)	Observations
Initial			
Average weight (g)	35.7	35.7	
Number of fingerlings	900	900	
Biomass (kg)	32.1	32.1	
Final			
Average weight (g)	90	140	
Number of fingerlings	630	630	*1
Biomass (kg)	56.7	88.2	
Period of culture (days)	100	100	
Amount of feed (kg)	0	125	Oct 31 : 100 kg
Daily growth (g)	0.54	1.04	
Rate of alimentary conversion	0.0	2.2	
Balance	-6 ,300	200	*2

* Survival rate: 70%

* Condition of calculation: Fingerlings cost: 70FCFA per individual;
Feed cost: 200FCFA/kg, Sale price of fish: 1,000FCFA/kg

(4) Feed-back to Master Plan and Action Plan

1) In a view point of aquaculture

i) Potentialities of non-feeding aquaculture with fertilization

In the village of Tchi-Ahomadégbé in the commune of Lalo, it was demonstrated that by stocking in fish-culture ponds after having stirred them in manure pits, animal dejections from pigsties, it was in principle possible to carry out cost-free aquaculture. While keeping enhancing this fertilization-based aquaculture in acclimatizing it to the situation of Benin and the local peculiarities in order to augment the yield, the showing and the extension of this technique will have to be fulfilled.

In case that this technique hasn't showed all its effects yet, owing to the quality of water and the amount of spring water, and even if tilapias growth wasn't satisfactory, the balance remained virtually balanced because of the absence of feed expenses. Even if some sites are better adapted to a feeding aquaculture, it is essential, as far as the conditions allow it, to utilize animal dejections as free or cheap fertilizers.

ii) Fish-culture techniques adapted to both the quantity and quality of water in non-drainable ponds
It appeared unequivocally that there was substantial difference in regard to the quantity and quality of water in non-drainable spring water ponds. Generally, the spring water ponds in the southern region of Benin (Mono, Couffo, Atlantique, etc…) were deemed favourable fertilization because of their great limpidity. On the contrary, Zou has scarcely benefitted from fertilization. Manuring and aquaculture techniques in spring water ponds are not laid down and it is necessary to adapt them with suppleness by proceeding to a through scrutiny of the aquatic environment or by altering the fish-culture methods in accordance with the specific characteristic of the sites.

iii) The Dependence of fertilization-based aquaculture up on pig farming and chicken farming
Fertilization-based aquaculture needs animals dejections provided by piggeries or chicken farming.
Therefore these culture activities are to be profitable and lasting. For these micro-farms and group of farmers, who lack practical experience, to engage in such activities, it is indispensable that they get support and that they could benefit from an adequate length of time so as to stabilize their newly engaged activities. Thus, the promotion of fertilization-based aquaculture should target in priority already existing farms engaged in pig farming and interested in aquaculture.

iv) The complexity of fertilization-based aquaculture performed with cow and goat dungs.
There are few labor-oriented oxen in Benin and the culture is often entrusted to third persons like shepherds from the Peulh ethnic group. Accordingly, it is impossible to procure fresh dungs of cow steadily. Besides, dungs dried outdoors and deprived of ammonia, have a lesser fertilizing impact.

In addition dungs of sheep, goats and rabbits are available only in limited quantity. Although these animal dejections are worth being used as fertilizers, farmers must think of them just as supplement for fish-culture ponds.

v) Necessity to evolve appropriate feed for aquaculture
The development of cheap feed is fundamental and general issue for feeding aquaculture. This issue is important in Benin as there is no purchasable suitable feed for fish. The thinkable of cheap feedstuffs are agriculture by-products exploitable by farms (scilicet, according to the specificity of farms, rice bran, bran of solgum beer, oil palm cake, etc…), culture wastes such as blood flour, floating algae referred to as "Azolla" and forage crops cultivated in these farms.

Thus, the first step is to seek in the neighbourhood which alimentary ingredients are available. It is nevertheless important evolve good-yield feed, even if they are slightly more costly. This will permit to curtail considerably transport and storage costs as well as the man power needed for feeding the fish.
As respects feeding, feed-related expenses account normally for ranging from 50 to 60% of the sale price. On this basis, feed, of which the FCR is 1.5, will remain profitable up to a unit price of 400FCFA per kg.

vi) Potentialities of Clarias in rice-fish cultue
Clarias in rice-fish culture has yielded relatively good results on the site of Malanville and opens technical outlooks for feeding plots as well as non-feeding parcels. Owing to the high cost of Clarias fingerlings, this technique is deemed difficultly profitable when it comes to growth rates such as these obtained this time, even in regard to a non-feeding culture. It has nonetheless an unquestionable social benefit in rural areas where source of animal proteins is insufficient, and future technical improvements are hopeful. The various envisageable orientations are hereafter: to reduce the size of the fingerlings stocked in order to lower costs, to enhance the survival rate by resorting for example in

hapanets, to combine skillfully non-feeding and feeding aquacultures, etc…

vii) Improvements of the sale techniques of fish
Benin suffers from chronic shortage of fish and the gross demand in reared fish is high. The practice has nonetheless shown that it was difficult to fix a high sale rate because of the low buying power of rural communities and that the selling out of the whole stock of harvested fish took sometimes several days. The Covè's partner farm managed nevertheless to market its small Tilapia at a stable price of 1,000FCFA per kg.

In the future, it will be necessary to ponder sale methods adapted to raised fish, while providing to fish culture farms with market related information.

viii) Self-production of Tilapia fingerlings in northern rural areas
It is proven that the anarchic conditions of reproductions may lead to the genetic impoverishment of Tilapia through consanguineous cross-cultures. In South East Asia, for example, fingerlings are generally renewed for each newly launched culture. But in the northern region of Benin particularly, centers for producing healthy fingerlings and stocking them are rare. Hence, the self-production of fingerlings by farms themselves appears to be realistic and economical from transport cost and time point of view.

In this case, it is indispensable to provide farms with technical guidance's about the necessity to capture all fish from fish-producing ponds so as to diminish the impact of consanguine cross-culture; to clearly identify reproduction ponds and to differentiate the final culture from the production of fingerlings; and to steadily feed in order to produce healthy and homogeneously sized fingerlings.

ix) Efficiency of the use of small-sized fish-culture equipment
In Benin, where aquaculture is not widespread yet, it is difficult to procure small equipment and aquaculture requisites, which explain why the work is often inefficient. Within the framework of this project, small-size scoop nets (made in Japan, cheap model for pleasure fishing) as well as hapanets (made in Indonesia) were embraced so as to measure the fish growth, sort fingerlings and perform aquaculture trials, which permitted a sensible improvement of yield.

It would be advisable to manufacture these devices with locally available stuff. But given the quality of local materials, the equipment manufactured from them is very likely to be a "poor imitation". Marketed in Japan and South-East Asia at a reachable price for farmers from Benin, these apparatuses might be, more realistic solution, be indented by sea.

2) In a viewpoint of agriculture and livestock
i) Improvement of pig quality
The performance of pigs kept for culture purposes is very bad. The speed of growth is less than half of that of European and Japanese pigs. The costs of feeds are very high. It is consequently advisable that the state owned farm in Kpinnou engages in that culture in order to enhance the number of piglets per litter as well as the yield of the meat out put. It is namely essential to introduce a pure breed in the cross culture between Landrace breed and Large-White breed, and think also of adding local breed blood for a better adaptation to the environment.

ii) The laying down of the foundation of broilers production
Regarding the production of broilers, the supply system for chicks and compound is faced up with important problems. There is currently in Benin only one chicks-producing company and in such a monopoly situation, the rate of these chicks' amounts up to 600FCFA each. As respects, northern regions, this concern is too much remote, hence a difficult and costly transport. It is accordingly necessary to put in place, in the various regions, chicks and compound-producing centers.

iii) Contribution of goats farming to the improvement of poor farms' revenue. Goat farming can, as a matter of fact, be started with reduced monies.

iv) Promotion of soybean-growing
Since soybean is sold on the market at a less costly price than “niébé”, its growing isn’t widespread. The cropping of soybean should be nevertheless boosted as forage crop. Niébé grows horizontally whereas soybean growns vertically. Consequently these two plants do not compete each other in the space. Their growing and harvesting cycle is also different; the growing cycle of niébé is shorter. These two plants night be reaped well in a mixed cultivation.

v) Rabbit culture must be spurred as means of improving farms management.

6.5.2 Farmer to farmer type extension

(1) Outline of activities
In order to support the extension of techniques in favor of other farmers as well as aquaculture related activities, the present project promote “farmer to farmer” style technical training in rural communities by appointing as trainer farmers who have excellen fish farming techniques and management skills. The program was planed to train 60 person per year from November 2007, gathering 12 farmers per training for five annual training in each of two communities of Tori-bossito and Avrankou.

1) Outline of each target commune
i) Commune of Tori-Bossito
The culture of Tilapias, target species, in spring water ponds is the most popular type of aquaculture in the southern region where Tori-Bossito is situated. But fish farmers lack technical and financial knowledge and have little profitable ponds. Besides there are some farmers having their wish to resume fish culture activities or to engage in aquaculture through JICA training for exemple. This pilot project is to verify the impact of extension through practical and effective training integrating the practical experience of small-scale but independent fish farmers (core farmers) and a systematic knowledges of the Department of Fisheries.

ii) Commune of Avrankou
Production of fingerlings and commercial size of Clarias is developing at a few advanced fish farmers in the Prefecture of Ouémé and Plateau to export to neighbouring Nigeria. As the production of Clarias fingerlings requires the mastery of techniques on culture of quality broodstock and spawing by hormon injection, it is ideal that steady supply of fingerlings by core farmers and increase of fish farmers through extension of aquaculture techniques are implemented so as to reflect each other. The project studied the effectiveness of the extension method carried out by a core farmer in favor of ordinary farmers.

2) Selection of core farmers
The trainers are core farmers in the project site and the work achieved by this farmer can be considered as an important factor to the success of the project. The selection process was assigned priority criteria. The emphasis was put on the excellence of fish culture techniques, management successes having resulted in both profitable and lasting fish-culture, appreciation among local populations and high motivation toward the aquaculture extension work in the communitiy. The consultants along with the Department of Fisheries and the SPH paid several visits there and carried out investigations through conversations with local people. At the end of the screening process, they eventually designated a fish farmer in each of two target-commune as a trainer.

i) Commune of Tori-Bossito
Mr TOZE, a Tilapia farmer was selected as a trainer. Originally he was a local fisherman. Now he is a professional fish farmer to work not only for his farm operation but also for contracted business related aquaculture such as construction of pond and harvest of fish in pond. And he owns the biggest fish-culture facility in Tori-Bossito. He also sells fingerlings at any time and is also tremendously trusted by local population, namely as a result of his availability to spontaneously give, on request from neighbours, aquaculture-related advise.

ii) Commune of Avrankou

KPOSSOU Dominique, Clarias farmer was selected as trainers. Big and influential farmer in his village, Mr Dominique is engaged at one and widely in farming, livestock and aquaculture. He is a pioneer in Clarias culture, which is at its inception in Benin and is a model farmer who longs to broaden his knowledge, seeking for instance, actively to introduce new techniques. In his capacity as a chairman of Avrankou's fish farmers association, not only he furnishes other farmers with fingerlings and technical support but also he gives them advice as to how to better manage their farms.

3) Preparations of training

In order to clarify the goal of the training and exchange between involved persons, as well as to make ready the training curriculum, schedule and material, a one week-long workshop was first held as shown in Table 6-58, gathering the core farmer selected as trainers and the SPH. During this workshorp, after the collection of information on aquaculture situation in the commune, the target-group was identified. In favor of target group in solving the problems they have practically, the training program and publicity approach was discussed. And the training program and materials were prepared in the sense of discussion.

Table 6-58. Content of workshop to prepare training

Day	Hours	Content	Moderator
1er day (Monday)	09:00-09:30	Explanation of the program of workshop	PACODER
	09:30-11:00	Explanation on aquaculture situation in target-commune (Tori-Bossito/Avrankou)	SPH
	11:00-12:30	Explanation on aquaculture and fingerling production situation in core forms and problems Lunch	Core farmers
	14:00-16:00	Achievement of a community map (location of fish farms, suitable sites for aquaculture) Achievement of a flow chart of aquaculture works	All participants
2e day (Tuesday)	09:00-10:30	Explanation of main points on the extension of aquaculture target-species. Introduction of a sample of handbook Presentation of examples of the small scale aquaculture extension in other countries (Asia)	PACODER
	10:30-12:30	Drafting of a handbook and achievement of training material, study for confirmation on the spot. Study of publicity systems such as radio and others	All participants
3e day (Wednesday)	09:00-16:30	Achievement of the schedule, curriculum and training material, common reading of the schedule and curriculum of the lectures.	All participants
4e day (Thursday)	09:00-16:30	Drafting of the manual and achievement of training material	All participants
5e day (Friday)	09:00-16:30	Drafting of the manual and achievement of training material, rehearsal of the training.	all participants

i) Commune of Tori Bossito

Before first training, five-day-long workshop was help from November 12 to November 16. The selected trainer, Mr Tozé, three (3) consultants, the counterparts from the Department of Fisheries and seven (7) SPH took part in it. During the worksho, SPHs expllained about the topographic feature of Tori Bossito, the situation of lands appropriate for aquaculture and current situation of fish farmers. Mr. Tozé explained the history of aquaculture and the current exploitation conditions. These information and data were put in order, and an aquaculture map of Tori Bossito and a plan of Mr Tozé's aquaculture ponds were sketched. Then essential topics to be included were selected and its curriculum was drafted. The training material and the data to be used in each curriculum were listed, the training material was drafted and the equipements was made ready. The probations were arranged five (5) times according to the program hereafter (see Table 6-59).

Table 6-59. Training program for farmers in Tori-Bossito

Date	Time	Content
Days 1 (Tuesday)	08 : 30 – 09 : 00	Reception and seating of participants
	09 : 00 – 09 : 15	Introduction, explanation of the training program
	09 : 15 – 10 : 00	Outline of aquaculture in Tori-Bossito and Mr Tozé's aquaculture farm
	10 : 00 – 10 : 30	Introduction of small-scale aquaculture in rural areas
	10 : 30 – 11 : 30	Biology of Tilapia (I)
	11 : 30 – 12 : 30	Selection of site and construction of a pond (pratice)
		Lunch
	14 : 00 – 16 : 00	Selection of site and construction of a pond. (practice)
Day 2 (Wednesday)	09 : 00 – 12 : 30	Fertilization and feed (lecture and practice)
	14 : 00 – 16 : 00	Technique on harvest of fish from the pond (practice)
Day 3 (Thursday)	09 : 00 – 10 : 00	Hygien management of fish ponds (lecture/visite in the farm)
	10 : 00 – 10 : 30	Impact of aquaculture on environment
	10 : 30 – 11 : 00	Favourable and non favourable fish in association with Tilapia
	11 : 30 – 12 : 30	Biology of Tilapia (2) (practice)
		Lunch
	14 : 00 – 16 : 00	Aquaculture business management and case study (lecture)
Day 4 (Friday)	09 : 00 – 11 : 00	Preparation and feeding of feed (practice)
	11 : 00 – 11 : 30	Water quality management
	11 : 30 – 12 : 30	Synthesis and prospect
		Lunch
	14 : 00 – 14 : 30	Evaluation of training
	14 : 30 – 15 : 00	Closing celemony

ii) Commune of Avrankou

Before the first training, a five-day workshop was help from November 19 to November 2007. The trainer Mr Dominique, three (3) consultants, the counterparts from the Department of Fisheries and three (3) SPH participated in it. After the presentation by the SPH at the beginning of workshop about the situation of aquaculture and fish farmers in Avrankou, Mr Dominique explained the history and the current situation of his aquaculture. Subsequently, an aquaculture map of Avrankou was sketched according to the information and data received from a CeCPA's study. Mr Dominique conducts a planned production such as management of broodstock, production of fingerlings, sorting and grading by size, etc. In order to clearly indicate the flux of series of aquaculture activities (from the production of fingerlings to the harvesting), PACODER drew a plan of the farm SENA's ponds and graphs of aquaculture activities. Consultants offer their knowledges and topics related to culture techniques of Clarias in Asia, its market and feed and deepened the discussion on the feasibility of applied techniques such as feed and mixed culture species in Benin. Then, they prepared the training program (see Table 6-60) by putting these informations and prepared the training materials.

Table 6-60. Training program for farmers in Avrankou

Date	Time	Content
Days 1 (Tuesday)	08 : 30 – 09 : 00	Reception and seating of participants
	09 : 00 – 09 : 30	Introduction, explanation of the training program
	09 : 30 – 10 : 30	Outline of aquaculture in Avrankou
	10 : 30 – 11 : 30	Mr Dominique's aquaculture farm (history and activity of SENA farm)
	11 : 30 – 12 : 30	Selection of site and construction of a pond (1) (lecture/pratice)
		Lunch
	14 : 00 – 16 : 00	Selection of site and construction of a pond (2) (lecture/practice)
Day 2 (Wednesday)	09 : 00 – 10 : 00	Fertilization and pond water preparation (lecture and practice)
	10 : 00 – 11 : 00	Biology of Clarias (lecture/practice)
	11 : 00 – 12 : 00	Handling of fingerlings (lecture/practice)
	12 : 00 – 12 : 30	Mixed culture of Tilapia and Clarias (lecture)
		Lunch
	14 : 00 – 16 : 00	Plastic sheet tank culture (lecture/practice)
Day 3 (Thursday)	09 : 00 – 10 : 00	Feed (preparation of pellet feed) (lecture/practice)
	10 : 00 – 12 : 30	Feed (preparation of paste feed, maggot culture and feeding method) (lecture/practice)
		Lunch
	14 : 00 – 16 : 00	Aquaculture business management and case study (lecture/practice)
		Transportation and concervation of fish
Day 4 (Friday)	09 : 00 – 10 : 00	Measure against predators (practice)
	10 : 00 – 11 : 00	Business management (lecture)
	11 : 00 – 11 : 30	Association of fish farmers (lecture)
	11 : 30 – 12 : 00	Aquaculture and environmental consideration
	12 : 00 – 12 : 30	Distribution of fingerlings and feed and guidance on the system of subsidy
		Lunch
	14 : 00 – 15 : 00	Question and answer (general comments)
	15 : 00 – 16 : 00	Evaluation and Closing celemony

4) Publicity

In order to convey information relating to farmers training to all concerned regions, publicitys were carried out through a various media since 2 weeks befor the first training in each communes. In addition, the achievement and the broadcast of reports on the trainings were fulfilled through local radio stations with a view to training general public and acquainting the latter with PACODER's activities. As PACODER foresaw a difference in term of the effectiveness of the advertising means resorted to, from one commune to another radiophonic reports and advertising banners were used from the second training session, taking into consideration the amount of registrations of participants recorded and the audience's reaction.

i) Commune of Tori Bossito

An information as well as an advertising campaign toward arousing the registration of prospective participants were launched as afore-indicated, from 2 weeks before the beginning of first training.

Table 6-61. Media used to advertise the trainings held in Tori-Bossito

Media	Method
Radio communique	Before the first training: Broacast of information relating to the training three times a day through LAMA Radio station (from November 15 to november 21: during 7 days).
Radio report	First training: Making of a reportage program (1 hour) intended for showing PACODER's activities as well as publicizing widely about the objective and the beneficiaries of "farmer to farmer" style trainings. A program recorded in the form of an interview of SPH performed by a host, and broacast on Radio LAMA on November 20, 2007. Second training: Radio Kpasse evolved a report about the training, and thereasfter broadcast it in two languages: Fon and French. (February 16 to February 19, 2008) Third Training: Radio LAMA came and made a report. On May 22, 2008, this report describing the training and conveying participants' sentiments- with interviews from Mr TOZE, the SPH and the trainees- was broacast in French and in Fon.
Banner	First training: Making of banners (1x4m) bearing the denomination of the training, the dates and hours, and the manner of application- filing Propagation among the public at large by deploying the banners in three (3) spots in the commune; at the crossroads in front of the market of Tori-Bossito, in front of CeCPA and at the path shaped like a T at the entrance of the fish farm of Mr TOZE during five (5) days until the closing day. Second-Fifth trainings: Making of banners that the denomination of the training, the dates and hours were printed and putting them in front of CeCPA and at the entry of Mr TOZE's fish farm

ii) Commune of Avrankou

Before the first training, the advertisement was carried out to spread the training related information inside the whole target-region and to appeal to intending participants. This initial advertising campaign yielded as impact an unexpectedly high number of applicants, exceeding widely the annual prevision of registration for the training. The planned second and following advertising campaign were as a result called off and a report showing Clarias-culture activities carried out by PACODER was broadcoast.

Table 6-62. Media used to advertise trainings held in Avrankou

Media	Method
Radio communiqué	First training: Content of the training, its date and a way of subscription was broadcasted by Radio WEKE three times a day during seven (7) day (November 23 to November 29) in three (3) languages: French, Goun and Tori.
Radio Report	First training: A program of 1-hour reportage in the form of an interview to SPH to inform the activity of PACODER as well as aquaculture training was made and broadcasted. (November 26 on Radio WEKE) After the fourth training: A program of interview to SPH and core farmer, Mr. Dominique was made and broadcasted to advertise the Clarias culture by Radio WEKE (June 3, 2008) Second training: A journalist at Radio WEKE reported on the conditions of the training and interview directely to trainees and trainer. This report was achieved and broadcasted in five (5) languages-Fon-Gun-Tori-Yoruba and French during 15 minutes in the course of transmission of evening news, on the following day, February 9. Fourth training: A journalist at the local Radio station WEKE came and reported at the venue of the training on the first day (May 27, 2008) and the last one (May 30, 2008) of the fourth training. Moreover the description of the training, interviews to traineers and trainees was broadcasted on the same days in the course of the transmission of evening news.
Banners	First training: Banners (1 m x 4 m) indicating the theme, the venue and the date of the training as well as the manner of subscription, were worked out and deployed at three crossroads in the commune (in front of CeCPA, at the entrance of the farm of Mr Dominique and at intersection in the commune). Second-fifth training: Making of banners bearing the denomination of training, its dates and hours at the entrance of the farm of Mr. Dominique and at intersection in the commune.
Megaphone	Before the First training: Use of a traditional local means to advertise that consists in toring villages with a motorbike equipped with a megaphone. The advertising campaign was conducted in touring all fifty (50) villages in the commune for four (4) days. (From November 23 to November 27).

(2) Indicators of assessment

In order to evaluate the effectiveness of “farmer to farmer” style extension, diverse indicators for assessments were embraced: grasp of the content of the trainings; exercise of aquaculture activities after the trainings, improvement/perennity of producive activities, impact of aquaculture activities over the social life (see Table 6-63).

The Table hereafter shows the indicators, targets, data and methods of evaluation. The assessment of Indicator 1 included all participants. The assessment of indicator 2 concerned all farms having benefitted from the aid toward purchasing fingerlings so that they could carry on aquaculture activities after the training. (Farm wishful of engaging in such activities and meeting a certain requirements were indeed encouraged in either concerned commune, with a subsidy of fingerlings purchasing charges). As regards the assessment of Indicator 3 (sustainability of aquaculture activities) and Indicator 4 (aquaculture activities and impact over social life), surveys the target group of which include persons having engaged in their aquaculture activities since more than three (3) months, were conducted, so as to peruse the situation of these activities after the passing of a given length of time of exercising as well as the willingness of these persons to keep carrying on aquaculture and the effects of this activity in their life in general.

Table 6-63. Indicators, targets, data and method of assessment

Indicators	Target	Data	Methods
(Indicator 1) Grasp of «farmer to farmer » style trainings	All participants	Comprehension of the content of trainings	Questionnaires at the end of training Dialogue and observation of sites on visit.
(Indicator 2) Exercise of aquaculture activities	New farms (including those who had suspended their activities)	Percentage of farms having started of aquaculture activities. Application of the learnt techniques.	Monitoring survey of participants (once per month)
	Aquaculture farms in existence	Application of the learnt techniques. Enhancement of aquaculture activities (technique, gestion)	
(Indicator 3) Perennity of aquaculture activities	Persons engaged in aquaculture after the training	Sustainability of aquaculture activities and prospects	Monitoring of activities. Viva voce inquiries
(Indicator 4) Aquaculture activities and impact over social life.	Persons engaged in aquaculture for a certain length of time (after the trainings)	Intent to keep exercising aquaculture. Shift of mentality and transformation of social life	

* New farms and aquaculture farms in existence are those that benefitted from the apportionment of fingerlings by the Project.

(3) Results of assessment

1) Number of participants in the trainings

Between November 2007 and November of the following year, five (5) sessions of training were arranged in the commune of Tori-Bossito and Avrankou. The initial goal was to offer within the year five (5) sessions of training including twelve (12) persons each, which works out to a total number of sixty (60) participants. Since trainings related advertising campaign proved tremendously successful, the amount of applicants exceeded the prevision, with 102 applicants in Tori-Bossito and 134 in Avrankou.

So as to meet the wishes of the CeCPAs and the applicants, the number of participants was risen, with the consent of the Core farmers in charge of the training, to 20 persons per session. The amount of participants surged accordingly to 81 (79% of the total amount of applications) in Tori-Bossito, and to 94 (70% of the whole number of applicants) in Avrankou (see Table 6-64).

Table 6-64. Number of sessions and number of participants in the training

Session	Tori-Bossito			Avrankou		
	From	To	Participants	From	To	Participants
First	Nov. 27, 2007	Nov. 30, 2007	12	Dec. 4, 2007	Dec. 7, 2007	12
Second	Feb. 12, 2008	Fév. 15, 2008	11	Feb. 5, 2008	Feb. 8, 2008	20
Third	May 20, 2008	May 23, 2008	16	May 13, 2008	May 16, 2008	20
Fourth	Aug. 19, 2008	Aug. 22, 2008	18	May 27, 2008	May 30, 2008	21
Fifth	Oct. 21, 2008	Oct. 24, 2008	24	Aug. 26, 2008	Aug. 29, 2008	21
	Total		81	Total		94

2) Subsidizied Farms (Fingerlings purchasing cost, feed buying expenses, supply of chicken dungs)

The pilot project had put in place a system allowing farmers who met certain requirements (preparation of ponds, fitting of manure pit designed for fertilization, etc.) to benefit, after the end of the trainings, from the subsidy of half the fingerlings of Tilapia purchasing cost (up to 500 fingerlings) as well as the furnishing of five (5) bags of chicken dungs in Tori-Bossito on the one hand and the subsidy of half the fingerlings of Clarias purchasing charges (up to 500 fingerlings) as well as half the

expenses of feed buying charge (up to 50kg) in Avrankou on the other hand. In Tori-Bossito, 14 persons benefitted from this system of relief after the training in order to engage in aquaculture, and 53 in Avrankou. These persons were used for the assessment of indicators 2 and 3.

3) Verification of Indicator 1 (Grasp of " farmer to farmer" style trainings)
In the end of each session, all participants were requested to indicate their degree of satisfaction (three standards of satisfaction) with regard to each of the theoretical and practical lectures taught during the 4 days of training.

Table 6-65. Degree of satisfaction of trainees in Tori-Bossito

	Topics of lecture and practice	First training			Second training			Third training			Fourth training		
		○	△	×	○	△	×	○	△	×	○	△	×
First day	Outline of aquaculture in Tori-Bossito and Mr Tozé's aquaculture farm	12			11			16			18		
	Small scale aquaculture in farms	9	2	1	11			16			16		
	Biology of Tilapia (I) (lecture)	11			11			16			15	1	
	Selection of site and construction of ponds (practice).	11	1		11			16			14	2	
Second day	Fertilization and feed (lecture and practice)	11		1	10	1		16			15	1	
	Techniques on harvest of fish from the pond (practice)	12			6	3	2	16			15	1	
Third day	Hygien mangement (lecture/visit)	12			9	2		16			16		
	Impact of aquaculture on environment	12			11			16			16		
	Mixed culture with Tilapia	10	1	1	9	1	1	16			16		
	Biology of Tilapia (2) (practice)	12			11			16			13	3	
	Aquaculture business management and case study (lecture)	11		1	10	1		16			12	3	1
Fourth day	Preparation and feeding of feed (practice)	12			11			16			16		
	Water quality management	12			11			16			16		

○: Useful △: Doesn't know ×: No satisfactory

Table 6-66. Degree of satisfaction of trainees in Avrankou

	Topics of lecture and practice	First training			Third training			Fouth training			Fifth training		
		○	△	×	○	△	×	○	△	×	○	△	×
First day	Outline of aquaculture in Avrankou	10			20			18	1	1	21		
	Mr Dominique's aquaculture farm (history and activity of SENA farm)	12			20			19			20	1	
	Selection of site (lecture/practice)	11			20			19		1	21		
	Construction of ponds (lecture/practice)	11			20			20			20	1	
Second day	Fertilization and pond water preparation (lecture and practice)	11			20			19	1		21		
	Biology of Clarias (lecture/practice)	11	1		20			19		1	21		
	Handling of fingerlings (lecture/practice)	12			20			19		1	20		1
	Mixed culture of Tilapia and Clarias (lecture)	10	1		20			19	1		21		
	Plastic sheet tank culture (lecture/practice)	10			19	1		19		1	20	1	
Third day	Feed (preparation of pellet feed, maggot culture and feeding method) (lecture/practice)	12			20			19		1	20	1	
	Aquaculture business management (lecture/practice)	11			20			18	2		21		
	Transportion and conservation of fish	12			20			19		1	19	2	
Fourth day	Measure against predators (practice)	12			20			20			21		
	Business management (lecture)	12			19		1	19	1		21		
	Association of fish farmers (lecture)	12			20			18	1	1	18	2	1
	Aquaculture and environmental consideration	12			20			20			21		

○: Useful △: Doesn't know ×: No satisfactory

In Tori-Bossito, lectures relating to "Aquaculture business management and case study (lecture)", to "Technique on harvest of fish from the pond" (practice) and "Mixed culture of Tilapias and Clarias" went down relatively less satisfied than other lectures in Avrankou. The lecture entitled "Association of fish farmers" (lecture) was also less satisfied. In these two communes, nearly all lectures were very well appreciated during each training session. Some classes were delivered in the local language and it is assumable that the content of lectures as well as practices was grasped. Besides, it was advised to take note the questions presented by participants during "Questions and Answers" sessions organized after the end of each training. The SPHs thus kept a written record from the second training. Observations thus recorded will be taken advantage of so as to improve next trainings and in so doing, add a qualitative betterment. In addition, the participants individually questioned during visits in aquaculture farms amounted after trainings, confessed everytime, that these trainings were instructive. During training session, much time was devoted to questions and the core farmer in charge of the training answered each question. Questions raised by participants already experienced in aquaculture often related to practically encountered problems. Hence, these "farmer to farmer" style trainings didn't only permitted to participants to acquire knowledge about aquaculture; Definitely, they allow too the participants to build up their capacity to figure out their troubles. Indicator 1 secured a very good assessment.

4) Verification of Indicator 2 (Exercise of aquaculture activities after trainings)

In order to induce farmers to engage in or resume aquaculture activities after their participation in trainings, the project awarded aids for the buying of fingerlings as well as the supply of fertilizers (chicken dungs) to farmers meeting the following requirements: "Having fitted up ponds and be improving the quality of water through cleansing and fertilization". Since the maiden training session, 14 in the 81 participants in Tori-Bossito (17%), and 53 in the 94 participants in Avrankou (56%) benefitted from this scheme to engage in Tilapias aquaculture as concerns the former and Clarias aquaculture as respects the latter.

i) Tori-Bossito

As shown in Table 6-67, only 17% out of 81 participants in Tori-Bossito reacted positively and engaged in aquaculture, which is few. The number of newly engaged among less-experienced fish farmers is particulary low (5%, to wit 2 participants in 44), which is supposed that it is not easy for a beginner who doesn't own a pound to engage, within little time, in aquaculture. On the contrary, 30% of farms that discontinued their aquaculture, (to which 7 participants in 23) resumed the activities which is worth being appreciated.

Table 6-67. State of implementation of aquaculture by participants in Tori-Bossito

Aquaculture experience of participants before training		-> After training			
In operation	14	->	Technical improvement	5	36%
Activity discontinued	23	->	Resumption of activity	7	30%
Newly engaged in fish farmers	44	->	Newly launched aquaculture activity	2	5%
Number of participants in all 5 trainings	81	->	Positif shift	14	17%

The 14 persons who reacted positively bought a total 19,510 fingerlings of Tilapias (see Table 6-68). The amount of fingerlings purchased per person, ranged, in most cases, between 500 and 1,000 fingerlings (weighing ranging from 10 to 20 g), but some, after their first purchase thanks to the granted subsidy, bought subsequently extra fingerlings from their own pocket. 2 of these 14 persons thus procured approximately 6,000 fingerlings each. In addition, if at the moment of purchasing fingerlings, the awarding of a subsidy by the Project, obligated the beneficiary to Covèr half of the charges, more than half of the recipients, scilicet 9 persons, paid in fact only 20% of these expenses. As for farmers who never achieved good performance in aquaculture, the Covèrage of half of the charges relating to the purchase of fingerlings seems to spark somewhat of a reluctancy. On the contrary, 5 persons Covèred 90% of the cost relating to their purchase of fingerlings. It means that some farmers who have positive ideas on aquaculture business as well as rich financial resource buy fingerlings and begin aquaculture regardless the subsidy.

Table 6-68. Fish farmers who purchased fingerlings and engaged in aquaculture after the training.

Fish farmer's name	Situation before training	Participation	Tilapia fingerlings		Date of purchase	Funds for the buying	Rate of charges
			Size	Quantity			
BOCO Samuel	In operation	First	10g	700	Feb.14	PACODER's subsidy	43%
			10g	3,500	April 11	Own funds	100%
			10g	1,160	April 28	Own funds	100%
			20-40g	490	June 13	Own funds	100%
AMOUSSOU Gildas	Interrumpted	First	10g	500	Feb. 28	PACODER's subsidy	20%
AVOUGNANSOU Claude	Discontinued	First	15g	1,000	March 20	PACODER's subsidy	60%
			10g	500	March 28	Own funds	100%
BELOGOUN Erick	Interrumpted	First	15g	500	March 20	PACODER's subsidy	20%
da MATHA Marc Santana	Beginner	First	10g	500	April 4	PACODER's subsidy	20%
AGBO Janvier	Discontinued	First	20-40g	500	June 13	PACODER's subsidy	20%
SODIKPIN Rosaline	Interrumpted	Second	15-20g	500	June 19	PACODER's subsidy	20%
SOHENOU Ebénézer	Discontinued	Forth	20-70g	2,560	June 19	Own funds	100%
			17g	1,300	June 15	Own funds	100%
			20g	800	Aug. 7	Own funds	100%
			13g	280	Sep. 12	Own funds	100%
			20g	1,020	Sep. 29	PACODER's subsidy	61%
AGUENON Ayékossan	Interrumpted	Fourth	15g	500	Aug. 7	Own funds	100%
ZANNOU Edward	In operation	Third	20g	500	Aug. 7	PACODER's subsidy	20%
DAl Oké	In operation	Third	13g	500	Sep. 12	PACODER's subsidy	20%
METOGNON Félicien	In operation	Third	13g	500	Sep. 12	PACODER's subsidy	20%
LEFO Virginie	In operation	Third	13g	500	Sep. 12	PACODER's subsidy	20%
Houngbe Gerard	Beginner	Third	20g	1,200	Sep. 29	Own funds	100%
Total				19,510			

From the viewpoint of aquaculture techniques application, the seven (7) farmers who had discontinued for several years their aquaculture activities enlarged, after the training, the ponds, which they had forsaken, dredged these ponds and resumed their activities with purchased fingerlings. The two participants without aquaculture experience dug new ponds equipped with manure pit on their swampy plots, and engaged in aquaculture. The whole body of the 14 recipients of the subsidy granted for buying of fingerlings, and 5 persons who carried on aquaculture before the training, put in place manure pit and traps against predators, applying in so doing techniques learnt during trainings. Some farmers also procure some cast-nets after the training so as to practice net-casting and perfect their fishing technique.

ii) Avrankou

56% in the 94 participants in trainings (to wit 53 persons) showed off a positive change; some improve their aquaculture activities; others resumed their suspended aquaculture activities; still others engaged newly in aquaculture (see Table 6-69). 40% in 47 participants without aquaculture experience, to wit 19 persons, bought fingerlings of Clarias and started off aquaculture activities. If this number was relatively lower than that of farms in operation and farms at a standstill, this can be explained by the fact that, in a context of limitation of the supplied number of Clarias fingerlings and of reduced monitoring of SPH, the aid awarded to aquaculture farms in existence toward the introduction of Clarias-culture was pushed ahead in priority, and by the fact that preparations for the fitting up of ponds and aquaculture tanks by the newly engaged in fish farmers were delayed. An increasing number of participants in trainings should nonetheless engage in aquaculture. In the commune of Avrankou, it is appreciated that the practice level is high.

Table 6-69. State of aquaculture by participants in Avrankou

Aquaculture expérience of participants before training		->	After training		
In operation	31	->	Technical training	25	81%
Discontinued activity	16	->	Resumption of activity	9	56%
Newly engaged in fish farmers	47	->	Newly launched aquaculture activity	19	40%
Total Number of participants in the 5 trainings.	94	->	Positif shift	53	56%

The 53 participants in trainings who shifted positively bought each ranging from 250 to 450 fingerlings, to wit14, 300 fingerlings on aggregate. In these 53 persons, only 5 were already experienced in Clarias-culture before commencing the training. The 48 remaining persons, who were less-experienced, engaged in aquaculture as a result of their participation in trainings. 15 persons carry on pondless aquaculture, over canvases installed in wooden frame or in small-sized garden cisterns, in pursuance of what they were taught during trainings. Besides, 7 persons procured on their own, in excess of Clarias fingerlings, Tilapia fingerlings and experimented a mixed culture.

5) Verification of Indicator 3: (sustainability of aquaculture activities)

i) Tori-Bossito

14 persons who purchased Tilapia fingerlings in order to engage in aquaculture are steadily followed up by SPH. The assessment of the sustainability of aquaculture activities was conducted with 7 persons among those who had started aquaculture before June 2008 (at least 4 months have elapsed since the floating of their aquaculture activities).

The seven persons keep carrying on till today their aquaculture activities. Many began to use agricultural by-products and home-made compound owing to the slow growth of fingerlings although they started non-feeding aquaculture with fertilization. One in these 7 persons delegates the work to workers, and two are assisted by their children. Two persons started partly to sell their fish, thus earned money. But, due to poor growth of fish, and one in them is forsaking his aquaculture activities because of a growth inferior to expectations. Although aquaculture activities are still currently

proceeding, it is therefore indispensable, in order to let these seven (07) persons to keep their aquaculture activities and proceed in the future, that the SPH and the Department of Fisheries support them in offering some additional supplementary trainings on development of feeds, the elimination of useless fry or the selection of fingerlings for culture.

ii) Avrankou
Requiring in principle a feeding of fingerlings, calarias-culture calls for a certain management including the buying of cheap and good quality feed and the day-to-day feeding. In order to proceed the technical monitoring and conduct follow-up surveys in the farmers who got fingerlings, inquiry forms concerning the culture, namely the day-to-day feeding and the state of the fish, were drawn up, and the SPH carried out every month a monitoring of aquaculture activities under the guidance of the consultant.

So far, 53 farms purchased fingerlings and engaged in Clarias-culture, only 18 in these farms, that started their aquaculture activities before August 2008, were picked for the monitoring of their aquaculture activities with a view to evaluate the sustainability of their activities.

At the present time, the whole body of the 18 persons proceeds, somehow, with their aquaculture activities, which argues the "farmer to farmer" style extension to be a success. From the aquaculture activities perspective, it is proper to notice nonetheless that performances vary from one farm to another. Wholly 8 persons apply successfully the know-how learnt from trainings whereas 10 fail to achieve satisfactory performances because of some hindrances, although they apply partly what they were taught. Considering aquaculture per type, 6 persons got good results versus 3 wit poor results as respects aquaculture in pond, and 2 persons worked out good performances there's four with bad performances as concerns out of pondless aquaculture (over plastic sheet tank or in garden cistern). The pondless cultures, which requires little room and enables beginners to engage in aquaculture without possessing pond, was deemed relatively facile to put in place, it proved less easy than thought.

6) Verification of Indicator 4 (Aquaculture activities and impact over social life)
i) Tori-Bossito
Viva voce surveys through questionnaire were achieved, after trainings, with 11 persons who purchased Tilapia fingerlings and started aquaculture before September 2008. These inquiries aimed at knowing of their sentiment about aquaculture and the changes that aquaculture had brought in their life. When queried: "which were your expectations from aquaculture?", the majority answered : "Diversification of sustenance " followed of "income in cash originating from the sale of fish" (Fig. 6-4). Those who answered: " in order to be able to eat fish at home " are rare, which indicates that aquaculture is considered a means to supplement household's income with additional revenue in cash originating from the sale of fish.

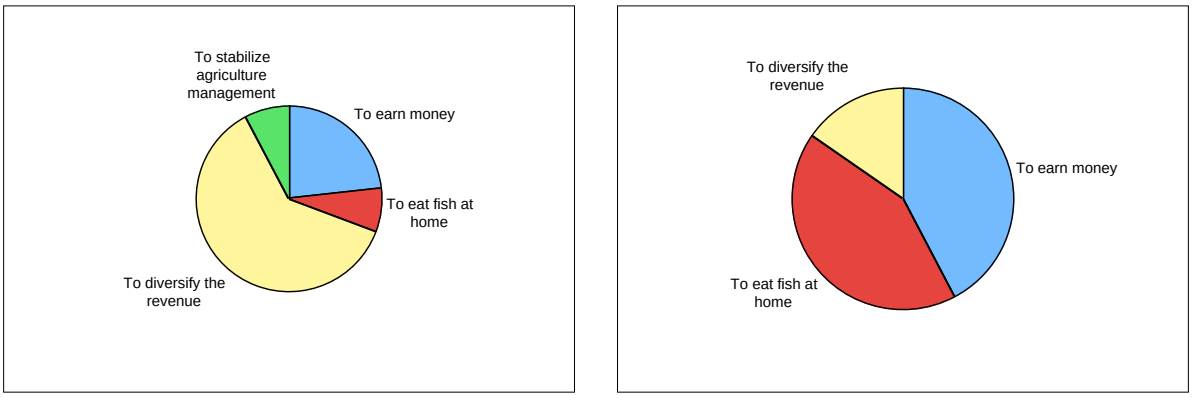
The reason which induced them to engage in aquaculture was for most of them, a piece of advice given by other persons or the fact of seeing people carrying on aquaculture in their vicinity. The first half of these advisors were "CeCPA's specialist" and the second half "inhabitants of the surroundings, friends ". This shows that, in villages, information and hearsay from neighbours or kith as well as near by examples is the trigger of engagement in aquaculture. When questioned concerning their intent to proceed or not with aquaculture, 3 in the questioned persons answered they considered suspending their aquaculture activities because of the lack of time, lack of money or technical problems. The eight (8) other queried persons intend to proceed with their aquaculture activities. 2 in these 8 persons uttered their willingness too "proceed because this activities yield a profit" and the six others answered they intend to "proceed because they expected a profit in the future. "

Another questionnary with 14 other themes previousl set: the period of the work, saving, patrimony, communication within the local community, or the family, etc. was prepared. Concerning the changes appeared in their daily life since the start of aquaculture activities, approximately half of the questioned persons answered eating more frequently fish than before (see Fig. 6-5). Althogh the working time of husbund, wife and children appear to increase, no influence on the time for

agriculture and livestock is observed.

As respects saving and debts, several persons answered that “their saving increased while their debt decreased”, but as their aquaculture activities is still recent, it is difficult to know whether this situation is or not an offshoot of aquaculture. The same holds true for personal and real property, the evolution of which can difficulty be rated as an impact of aquaculture and probably originates from other causes.

As respects the changes occurred as to communication with the surroundings, 100% questioned persons answered that rows within the household (or the family) had diminished, and that communication with dwellers in the vicinity had increased.



Tori-Bossito Avrankou

Fig. 6-4. Expectations from aquaculture

ii) Avrankou

Viva voce surveys through questionnaire were conducted after trainings, with 14 persons who bought fingerlings and started Clarias-culture before June 2008 (see Fig.6-4).

When asked the question: “which were your expectations from aquaculture? “, the majority of queried persons gave, in equal proportion, two answers: “cash income stemming from the sale of raised fish “; as for others, the second half, they answered: “self-consumption of reared fish”, which contrast with answers given in Tori-Bossito (Fig. 6-4). If this divides between the two sites results partly from differences relating to the manner of consumption and marketing of Tilapias and Clarias, it seems that, in Avrankou, the expectation of direct profit from the sale of bred fish is higher. As concerns the reason that induced them to engage in aquaculture, a high percentage of questioned persons, answered “ the fact of seeing persons carrying on aquaculture “, which can be interpreted as a positive attitude consisting in emulating beneficial undertakings. Among the advised persons, most were counseled by inhabitants in their neighborhood and friends rather than by CeCPA’s specialists. Due to the existence of the Association of Avrankou’s Fish farmers, the flowing of information from a aquaculture farm to another is certainly active.

When queried as to their intent to proceed or not with aquaculture, all questioned persons uttered their willingness to proceed. The fact that so far only 2 from among them have already made a profit argues the others to be confident and hopeful. There is no doubt that the existence of the Association of Avrankou’s Fish farmers weighed in the giving of such an answer. But besides, the occurrence of several so to speak aquaculture success stories in the surroundings (- successful cases that exemplify the profitability of aquaculture – was undoubtedly an additional source of motivation.

In regard to the 14 questions relating to the shifts appeared in their day-to-day life, more than half of the queried persons confessed they fed more often on fish in comparison with before. While the period of the length of time allocated by the husband to his work rose, that of the wife and the children didn’t shift in most cases. Moreover while, in Tori-Bossito, farming works including aquaculture are often

family tasks in Avrankou, the division of labor between the various families is more frequent, and the husband deals often willingly with aquaculture activities.

The start of aquaculture activities had virtually no impact over other tasks, farming works or livestock. Several persons answered that their equipment (Agricultural machines and fishing equipment) had augmented. But it is difficult to find out whether this stems from aquaculture activities. If "conversation and rows within the household (couple or family) remains unchanged, the quasi-totality of the queried persons declared, as in Tori-Bossito, that communication with neighbors had improved. The individual launching of new activities like aquaculture, thanks to the technical guidance provided through "farmer to farmer" style trainings might thus contribute to revive villages and ensure law and order".

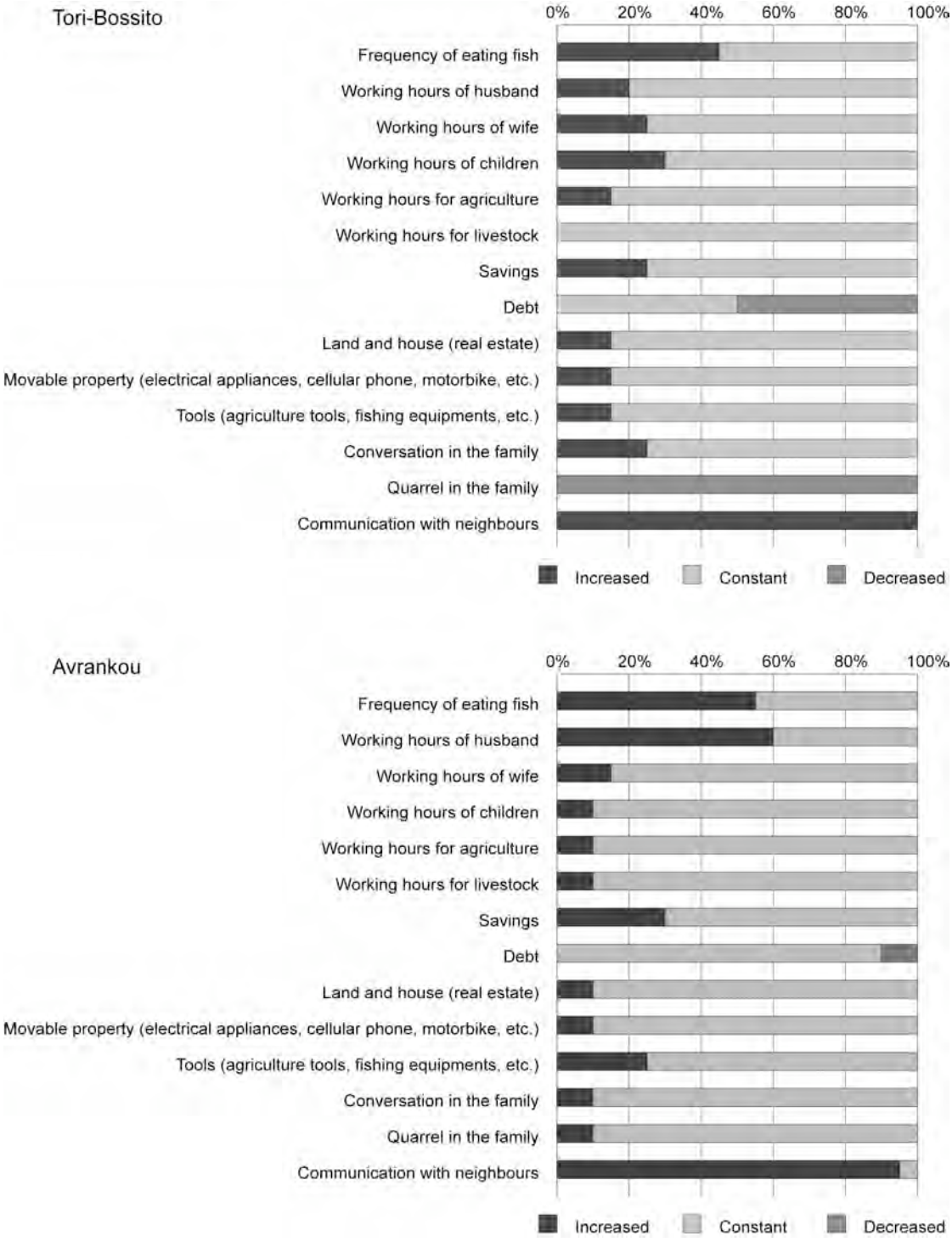


Fig.6-5. Change in life from the start aquaculture

(4) Feed-back to Master Plan and Action Plan

1) Application to technical extension method

After “farmer to farmer” style trainings, it was noted that farms engaged in aquaculture endeavored to apply the techniques learnt during trainings. The technical guidance then provided by core farmers, that constitute the fundament of this model of extension, thus proved effective to a certain extent. It will be possible to utilize this “farmer to farmer “ style method of technical extension in other sites featured by a similar context.

2) Input support in consideration with local feature of fish farmers

The scheme of subsidy toward the purchase of fingerlings and feed established with a view to boosting the start of aquaculture activities did not contributed a rise of the number of fish farmers who practice aquaculture. This is partly because that the supply of fingerlings was not conducted in time but also it is necessary to combinate the proper selection of trainees and input subsidy of fingerlings and feed.

3) Priority granted to the revival of ponds in pause

For the time being, it seems realistic to promote aquaculture, not in helping non-experienced farmers, but rather in boosting experienced farmers who have aquaculture ponds in pause to resume their activities through the training and supply of fingerlings.

4) Feasibility of Clarias-culture through small-size operations

Some pondless and landless farmers are able to start, after the preparation of some extent, Clarias-culture in plastic sheet tank or backyard tank. The absence of land or pond seems thus not to constitute a major obstacle to the start of Clarias-culture.

(5) Profile of participating farmers of training on aquaculture

As for training participants in 2 target communes, 81 farmers participated in training from among 102 applicants in Tori-Bossito, 94 farmers participated in training from among 134 applicants in Avrankou. In order to analyze profile of participating farmers, survey interview was implemented in each training course on the basis of questionnaire form.

1) Tori-Bossito

i) Experience of aquaculture and home village

Experience and present aquaculture condition of 81 training participants are shown in table 6-70.

Table 6-70. Aquaculture condition of training participants in Tori-Bossito

Training Course	In operation	Abandonment (out of production)	Inexperienced	Total
1st	2	7	3	12
2nd	5	3	3	11
3rd	6	1	9	16
4th	1	5	12	18
5th	0	7	17	24
Total	14	23	44	81
Ratio	17%	28%	54%	

17% of participants are operating aquaculture at present, 28% of participants had experience of aquaculture but not in operation now. 54% (44 out of 81 participants) had no experience of aquaculture.

The training during initial phases would be planned for individual target group consisted of farmers at homogeneous level by dividing into 3 groups depending on experience or farmer’s background however it was difficult to make up group of 12 homogeneous farmers. Consequently participants on every training course were mixed at various levels and backgrounds, as it turns out, there was no remarkable difference regarding basic knowledge of aquaculture among participants, thus it was not obstacle factor for training lecture and practice. Inexperienced farmer participated mostly in 4th and 5th

training in the later phases.

Table 6-71. Number of training participants each village in Tori-Bossito

Training Course	Tori-Cada	Tori-Gare	Avamè	Tori-Bossito	Others	Total
1st	11	0	0	1	-	12
2nd	6	0	3	2	-	11
3rd	2	1	6	7	-	16
4th	11	1	4	0	2	18
5th	13	0	9	2	-	24
Total	43	2	22	12	2	81
Ratio	53%	2%	27%	15%	2%	

As for number of participants in each village, almost participants are from only 3 villages, Tori-Cada, Avamè and Tori-Bossito. Although Tori-Bossito commune is consisted of 6 villages, there is few aquaculture potential in other villages such as Azohoue-Aliho, Azohoue-Cada, because no water supplies. There was no positive response from inhabitant, even though SPH (regional extension officer) encouraged them to join the training.

ii) Age, Tribe, Religion, Educational background

As for age of participants, the average age is 40.8 years old (min. 15, max. 70). Tribe Tori and Tribe Fon are majority tribe of participants which accounts for 76% (58 people out of 76 respondents). Major religion is Catholic which makes up 72% (51 out of 71 respondents) of participants, followed by traditional religion with 24% (17 out of 71 respondents) As for educational background, 43% (7 out of 51 respondents) have not been educated even in elementary school.

Table 6-72. Age composition of training participants in Tori-Bossito (76 respondents)

10's	20's	30's	40's	50's	60's	70's
3	13	16	25	9	8	2
(4%)	(17%)	(21%)	(33%)	(12%)	(11%)	(3%)

Table 6-73. Tribe of training participants in Tori-Bossito (76 respondents)

Fon	Tori	Yoruba	Gun	Adja	Toffin	Aïzô	Pedah
20	38	4	5	3	4	1	1
(26%)	(50%)	(5%)	(7%)	(4%)	(5%)	(1%)	(1%)

Table 6-74. Religion of participants (71 respondents)

Christian	Muslim	Traditional
51	3	17
(72%)	(4%)	(24%)

Table 6-75. Educational background of participants (74 respondents)

Non	Elementary	Junior high	University	Others
32	16	20	3	3
(43%)	(22%)	(27%)	(4%)	(4%)

(Others includes carpenter, military and theological school)

iii) Marriage, Household composition, Dependent family member and Transportation device

63 participants are married and 57 persons are householders among 72 respondents. Householders have 1 to 15 dependent family members as shown Fig6-6 with 7.7 on average. 46% (36 persons out of 74 respondents) use motorcycle or car as daily basis transportation device. On the other hand 52% (40 persons out of 74 respondents) use only bicycle or on foot, who guessingly does not own motorcycle.

Fig.6-6. Number of dependent family member of 57 householders in Tori-Bossito

Table 6-76. Transportation device of training participants (74 respondents)

On foot	+ Bycycle	+ Motorcycle	+ Car	Pirogue
20	20	35	1	2
(26%)	(26%)	(45%)	(1%)	(3%)

iv) Management -1（income source, employment, land area）

36 persons replied that agriculture is a major income source. 4 persons gain major income from livestock and 3 person gain major income from aquaculture among 62 respondents. Other 14 persons earn major income from various occupations such plasterer, home teacher, tailor, tour guide, pond construction, mechanic, etc. Consequently 22 out of 60 respondents bring in additional income from livestock, followed by agriculture, commerce and aquaculture. 10 persons make extra money by smothery, mechanic, moto-taxi and pension.

As for employment, 41 persons out of 53 respondents have employed labour in some way or another. 12 persons use 1 to 8 labours (average is 2.1 labours) on a full-time basis. Other 29 persons employ temporary worker only for busy season. As for number of temporary employee, 1 to 25 labours (average 6.4) are employed per year. 67% (32 out of 48 respondents) employ less than 5 labours moreover 85% (41 out of 48 respondents) employ less than 10 labours.

Table 6-77. Income source of training participants

<Main> (62 respondents)

Agriculture	Livestock	Aquaculture	Agriculture/Livestock /Aquaculture	Others
36	4	3	5	14

<Extra> (60 respondents)

Agriculture	Livestock	Aquaculture	Commerce	Agriculture+ Livestock/Aquaculture	Aquaculture+ Commerce/ Salary	Others
11	22	4	6	4	3	10

Table 6-78. Employment condition (61 respondents)

Yes	49	12 employers	full-time	1 to 8 labours (average 2.1)
		29 employers	part-time (for busy season)	1 to 25 labours (average 6.4)
No	12			

Average land area of 53 respondents is 2.8ha per person. 3 persons who exceptionally possess 10-

30ha boost average. 84% of respondents have land less than 3ha, 70% own land less than 2ha furthermore 40% (21 persons out of 53 respondents) possess less than 1ha.

Table 6-79. Land area of training participants (53 respondents)

Smaller than 1ha	1.5ha	2ha	2.5ha	3ha	4ha	5-7ha	10-30ha
21	8	8	1	7	3	2	3

v) Management -2(kind of product, planting area, annual income)

Amount of crop and product sales on individual activities such as agriculture, livestock and aquaculture were surveyed.

Agriculture

50 persons out of 81 participants produce any of 20 kinds of agriculture products as shown in Table 6-80. 34 respondents answered also amount of sales. According to their reply, they earn 276,000FCFA by agriculture crop sales in 2007 on an average, while lowest is 28,000FCFA and highest is 1,580,000FCFA. Excluding 2 exceptional persons who gain more than 1,000,000FCAF per year, nearly 60% of respondents earn less than 200,000FCFA per year. As for kinds of crops, 40 persons out of 50 respondents cultivate maize that is the most popular products, followed with manioc and pineapple.

Table 6-80. Kind of crops in Tori-Bossito (50 respondents, multiple answers allowed)

Kind of crops or products	Num.of producers
Pineapple	12
Grounnut	4
Banana	3
Cucumber	1
Haricot	5
Vegetable	5
Maize	40
Manioc	21
Cowpea	2
Eggplant	1
Oilpalm	3
Watermelon	1
Potate	2
Pepper	1
Paprika	1
Soybean	1
Sorghum	1
Taro	1
Tomate	3
Palm wine	1

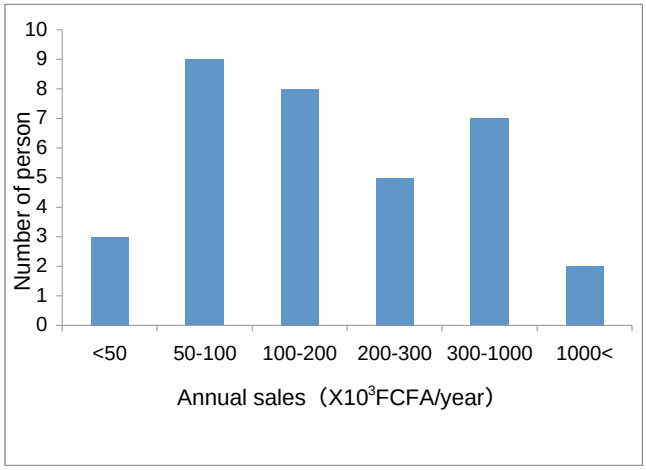


Fig.6-7. Annual sales of agriculture crop of 34 training participants in Tori-Bossito（2007）

Livestock

40 persons out of 81 participants rear some kind of animal. The most popular species are chicken (poultry) followed with sheep, goat, pig, rabbit and cattle in order. 30 persons out of 40 respondents earn cash income by sales. Total income amount by livestock of 30 persons is 3.24million FCFA, while sales income by agriculture crop of 34 persons is 9.38 million FCFA. The scale of livestock is quite small; it is about a third of agriculture. On an average, respondents earn 108,000FCFA per year by sales of live stock in 2007 while lowest is 2,200FCFA and highest is 685,000FCFA. Although 10% (3persons out of 30 producers) earn more than 300,000FCFA, sales income of nearly half producers (14persons out of 30 producers) does not reach to even 50,000FCFA.

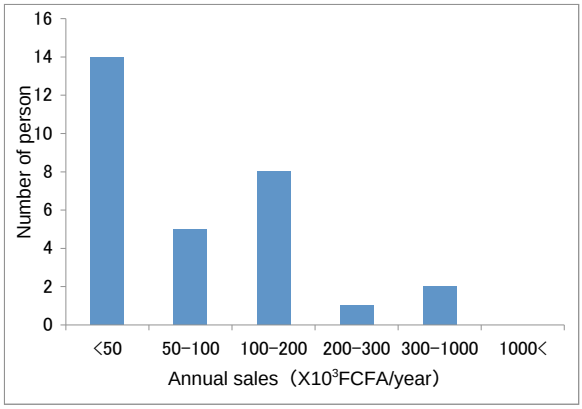


Fig. 6-8. Annual sales of livestock of 30 training participants in Tori-Bossito（2007）

Table 6-81 Kind of livestock in Tori-Bossito (40 respondents, multiple answers allowed)

Kind of livestock		Num.of producers
Bœuf,Bovin	Cattle	3
Cabris,Caprin,Chèvre	Goat	9
Lapin	Rabbit	3
Mouton	Sheep	13
Petit ruminant	Ruminant	3
Porc,Cochon	Pig	9
Poulet	Chicken	11
Volaille	Poultry	16

Aquaculture

33 persons out of those training participants have own fish pond. 22 persons have only one fish pond while 11 persons have more than 2 ponds. 10 persons get some aquaculture harvest in 2007, 9 people of them produce only tilapia. 4 persons have sold fish and gained 10,000～20,000FCFA cash income per year. Other 6 persons consumed all harvest fishes only in the house.

iv) Profile of average training participants in Tori-Bossito

Estimating personal profile of average training participants in Tori-Bossito from the results of these survey i) to v), a participant lives in any of 3 villages, Tori-Cada, Avamè or Tori-Bossito, the age is 40's, ethnic group is tribe Fon or tribe Tori, Religion is Christian. He rarely has been educated even in elementary school. He is householder having about 8 dependent families. At transportation he uses bicycle or on foot because no having motorcycle. Cultivating maize, manioc and pineapple in smaller agricultural land than 2ha, he earns cash income fewer than 200,000FCFA per year. Also he gain less than 100,000FCFA per year by sales of livestock such as chicken (including poultry), sheep, goat, pig. He sometimes employs temporary labours for busy season but the number is below 10 labours per year. Although he has a fish pond, he rarely harvests and sells fish.

2) Avrankou

i) Experience of aquaculture and home village

Experience and present aquaculture condition of 94 training participants are shown in table 6-82. 33% (31 out of 94 participants) are operating aquaculture at present, 17% (16 out of 94 participants) of participants had experience of aquaculture before but not in operation now due to individual reason. Half of participants have no experience of aquaculture. Experience and background of training applicants were considered when the trainees were selected in each training course so that training program could work effectively.

Table 6-82 Aquaculture condition of training participants in Avrankou

Training Course	In operation	Abandonment (out of production)	Inexperienced	Total
1st	12	0	0	12
2nd	1	0	19	20
3rd	14	1	5	20
4th	2	11	8	21
5th	2	4	15	21
Total	31	16	47	94
Ratio	33%	17%	50%	

Experienced active fish farmer participated in 1st and 3rd training, inexperienced or abandonment farmers participated in 2nd and 4th training and inexperienced beginner farmer joined the 5th training respectively. Consequently the contents of lecture and practice were arranged, technical and

administrative subject were included focusing on the majority target.

Number of training participants in each village of Avrankou commune is shown in table 6-83.
The majority of applicants are from Atchoukpa village and Avrankou village which account for half of all. However training participants were selected proportionally depending on number of applicants each village considering a sense of unfairness among applicants.

Table 6-83. Number of training participants in each village of Avrankou

Training Course	Sado	Avrankou	Atchoukpa	Gbozounme	Kouti	Djomon	Ouanho	Total
1st	3	0	3	2	2	2	0	12
2nd	3	6	4	0	2	4	1	20
3rd	3	4	3	1	4	5	0	20
4th	3	3	9	2	2	2	0	21
5th	4	6	6	0	2	2	1	21
Total	16	19	25	5	12	15	2	94
Ratio	17%	20%	27%	5%	13%	16%	2%	

Number of applicants for training in each village

Sado	Avrankou	Atchoukpa	Gbozounme	Kouti	Djomon	Ouanho	Total
21	28	30	5	14	20	5	123
(19%)	(25%)	(27%)	(4%)	(13%)	(18%)	(4%)	

(Number of applicants was 134 including 11persons out of Avrankou)

ii) Age, Tribe, Religion, Educational background

The average age of participants is 44.7 years old while youngest is 18 and oldest is 70years old. Majority generations are 40's and 50's. Majority ethnic groups are Tribe Tori and Tribe Gun, former tribe accounts for 56%(50 of 90 participants)and latter tribe accounts for 41%(37 of 90 participants). Major religion is Catholic which makes up about 80% of all. As for educational background, 18% (16 out of 88respondents) have not been educated even in elementary school. It is much lower rate than Tori-Bossito with 43%. 6 persons have been trained as carpenter, military and in theological school. In addition 4 persons have been trained in SONGHAI.

Table 6-84. Age composition of training participants in Avrankou(90 respondents)

10's	20's	30's	40's	50's	60's	70's
1	11	16	25	25	11	1
(1%)	(12%)	(18%)	(28%)	(28%)	(12%)	(1%)

Table 6-85. Tribe of training participants (90 respondents)

Fon	Tori	Yoruba	Gun
1	50	2	37
(1%)	(56%)	(2%)	(41%)

Table 6-86. Religion of participants (92 respondents)

Christian	Muslim	Traditional
73	2	17
(79%)	(2%)	(18%)

Table 6-87. Educational background of participants (88 respondents)

Non	Elementary	Junior high	University	Others
16	29	34	3	6
(18%)	(33%)	(39%)	(3%)	(7%)

(Others includes carpenter, military and theological school)

iii) Marriage, Household condition, Dependent family member and Transportation device

86 persons are married and 84 persons are householders among 92 respondents. 67 householders replied that they have 1 to 22 dependent family members as shown Fig 6-7 with 8.2 on average. 70% of all have more than 6 dependent family members.

While more than half of respondents use bicycle or on foot as daily basis transportation device in Tori-Bossito, only 25% (22 out of 88 respondents) use it in Avrankou. 72% (63 out of 88 respondents) use motorcycles in Avrankou. Motorcycle ownership rate in Avrankou is estimated 1.6 times higher than in Tori-Bossito.

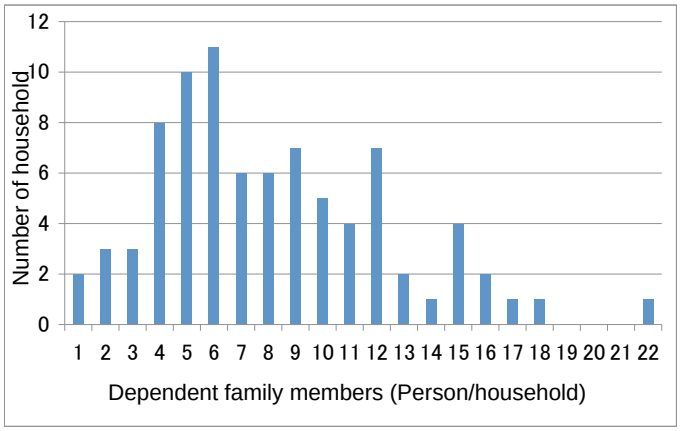


Fig. 6-9. Number of dependent family member

Table 6-88. Transportation device of training participants (88 respondents)

On foot	+ Bycycle	+ Motorcycle	+ Car
14	8	63	3
(16%)	(9%)	(72%)	(3%)

iv) Management -1（income source, employment, land area）
33 persons out of 69 respondents answered that agriculture is a major income source followed with others and livestock. Others include various occupations such as mechanic, electrical engineering technician, carpenter, food processing (oil palm), well-digging, voodooist (traditional remedy), plumber, smithy, printing plant, moto-taxi etc. Including commerce and salary, more than 40% of respondents earn major income not from farm activities such agriculture, livestock and aquaculture. They earn extra income also from various businesses combining agriculture, livestock, aquaculture with commerce such as at-home sales, direct marketing selling, welder, saltimbanco, brickmaking, retailers of jewellery, tailor, baker, moto-taxi etc. There is more variety kind of job in Avrankou comparing with condition in Tori-Bossito.

Table 6-89. Income source of training participants

<main>					(90 respondents)	
Agriculture	Livestock	Aquaculture	Commerce	Salary	Agriculture/Aquaculture /Commerce	Others
33	16	1	6	7	2	25
<extra>					(82 respondents)	
Agriculture	Livestock	Aquaculture	Commerce	Salary	Agriculture+livestock /Aquaculture/Commerce	Others
25	13	9	8	1	14	12

As for employment, 16 persons do not employ any labour but 73 persons employ labour in some way or another for busy season. Average number to employ is 13.4 employees per year while the minimum is 2 and maximum is 150. It differs depending on scale of business. Though slightly more than 20% (17 persons) employ more than 18 employees per year, in almost cases fewer than 15 employees are

employed per year. Moreover more than half employer uses less than 8 employees per year.

Table 6-90. Employment condition

Yes	73	full-time part-time (for busy season)	– 2 to 150 labours (average 13.4)
No	16		

Table 6-91. Number of part-time labours employed per year

Number of labours	2-5	6-8	10-15	18-50	50 or more
Employer	26	16	14	14	3
	(36%)	(22%)	(19%)	(19%)	(4%)

As for property of land, 59 out of 78 respondents are land owner. Average land area is 1.84ha while the largest is 25ha and smallest is 0.04ha. More than half (43 out of 59 land owner) have less than 1ha. Land area per person is relatively smaller than Tori-Bossito. It correlates with income source and occupations of training participants in Avrankou.

Table 6-92. Land area of training participants (78 respondents)

Smaller than 0.5ha	1ha	2ha	4ha	7ha	25ha
26	17	17	13	4	1

v) Management –2 (kind of product, planting area, annual income)

Amount of crop and product sales in 2007 at individual farm activities such as agriculture, livestock and aquaculture were surveyed by interview.

Agriculture

78 persons out of 93 respondents cultivate several agriculture crops as shown in Table 6-93. As for kinds of crops, maize and manioc are the most popular which are cultivated by more than 70% of producers. Ground nut and oil palm are also popular agriculture crops in Avrankou while those crops are cultivated by fewer farmers in Tori-Bossito. 67 persons among 78 producers earn 277,500FCFA per year as an average income by selling agriculture products, while lowest is 8,500FCFA and highest is 3,600,000FCFA. Excluding 5 exceptional persons who gain more than 1,000,000FCAF per year, 90% (60 out of 67 producers) earn less than 400,000FCFA. Furthermore nearly 70% (45 out of 67 producers) earn below 200,000FCAF per year.

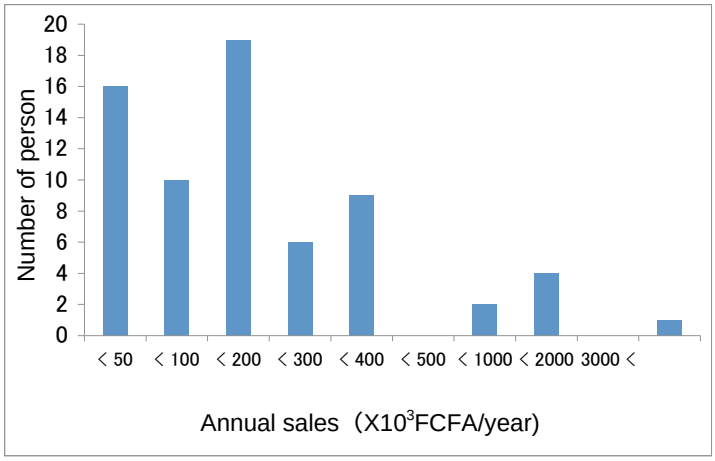


Fig. 6-10. Annual sales of agriculture crop of training participants in Avrankou（2007）

Table 6-93. Kind of crops in Avrankou

Kind of crops or products	Num.of producers	Ratio
Grounnut	30	38%
Banana	2	3%
Firewood	1	1%
Ginger	1	1%
Maize	59	76%
Manioc	56	72%
Cowpea	22	28%
Coconut	2	3%
Oilpalm	28	36%
Potate	14	18%
Pepper	2	3%
Taro	2	3%
Tomate	4	5%
oil press	1	1%
Palm wine	1	1%
Bambara bean	1	1%

Livestock

56 persons rear some kind of animal. The most popular rearing species are chicken (poultry) and pig while former livestock is reared by 66% (37 out of 56 stock farmers) and latter livestock is reared by 54% (30 of out 56 stock farmers) followed with goat and rabbit. 52 persons out of 56 stock farmers earn cash income by selling livestocks. Average sales income per person is 317,000FCFA per year while minimum is 8,000FCAF and maximum is 3,665,000FCFA. It is remarkably higher than sales income of agriculture. Excluding 3 persons who earn more than 1 million FCFA per year, 80% (42 out of 52 respondents) earn fewer than 300,000FCFA per year. While sales amount of agriculture by 67 respondents is 18.59million FCFA, sales amount of live stock by 52 respondents is 16.51million FCFA, indicating similar level. Animal husbandly in Avrankou is livelier comparing with Tori-Bossito.

Table 6-94. Kind of livestock in Avrankou
(56 respondents, multiple answers allowed)

Kind of livestock	Num.of producers
Chicken	8
Poultry	29
Pig	30
Ruminant	5
Sheep	1
Rabbit	14
Goat	19
Cattle	13
Sheep	1
Aulacode	3

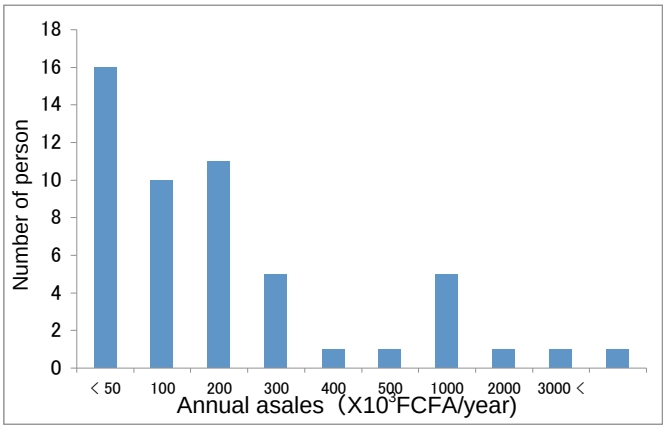


Fig. 6-11. Annual sales of livestock of training participants in Avrankou（2007）

Aquaculture

46 out of 93 respondents have aquaculture pond including inactive farmers. While 35 out of 46 respondents have 1 or 2 ponds, a quarter (11 out of 46 respondents) possess 3 pond or more. 38 out of 46 pond owners harvested fish for the last one year. While the harvest fish species is only tilapia in almost case, 8 persons harvest tilapia with clarias also. In addition 24 out of 38 farmers who have harvested fish earn income by selling fishes, which average sales income is 88,500FCFA while highest is 770,000FCFA and lowest is 5,400FCFA. One farmer earns 770,000FCFA, 4 farmers earn 200,000 to

400,000FCFA and then 80% (19 persons) earn less than 60,000FCAF per year among 24 persons who have sold fishes.

Table 6-95. Number of pond of training participants in Avrankou (93 respondents)

nothing	1 pond	2 ponds	3 ponds	4 ponds	5 ponds
47	22	13	5	3	3

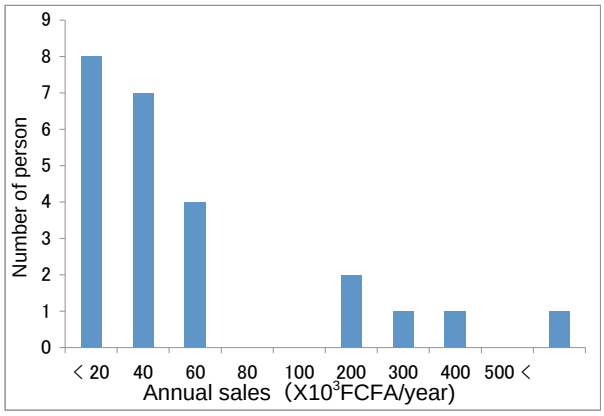


Fig.6-12. Annual sales of aquaculture in Avrankou

vi) Profile of average training participants in Avrankou

Estimating profile of average training participants in Avrankou from the results of the survey i) to v), training participant is age 40's with tribe Tori or tribe Gun. Besides majority is educated in elementary school; person educated in junior high school is not a few. He normally has motorcycle using for daily transportation. He is married and householder living with 8 dependent families. Having smaller land than 1ha, he cultivates maize, manioc, ground nut and oil palm. Although he recognizes that agriculture is major income source, he actually gains same level of income also by livestock sales such as poultry, chicken and pig. For busy season he employs 15 temporary labours per year. Half of participants have aquaculture pond and rear tilapia. Aquaculture product is harvested for house consumption as well as for sales. Still few people rear Clarias.

6.5.3 Utilization of reservoir dams

(1) Outline of activities

Benin has built mainly in the northern region many reservoir dams dedicated to serve as water sources for nomads cattle. But there is no practically aquaculture activities utilizing these water reservoirs. This pilot project has studied the possibility to practice an aquaculture associated to the Agriculture and culture on the sites allowing water supplying in down stream of reservoir dams. This pilot project has also studied a global utilization method of these reservoir dams by bringing in parallel way a support to floating cages simplified aquaculture and to the strengthen of the fishing on these reservoir dams.

The reservoir dam of Tchakalakou in the commune of Toucountouna selected as site in suitable conditions: equipped by a pipe in siphon type which convey water from which rise over the water bank and extended to the up stream, and the inhabitants live around. The main activities are as follows.

Table 6-96. Activities for the utilization of reservoir dams

Field	Outline of activity	Contributions	
		Facility / Equipments	Others
Aquaculture in pond	The culture of the Tilapias works out in the fish pool built at the down stream of the water bank	3 fish ponds (250 m^2/pond) and 2 manure pits	Fingerlings of Tilapia
Pig farming	Upstream of the pond above the pig rearing plot generates profit, and the dejections are used as fertilizer for the pond.	1 piggery	Adult pigs and compound feed
Aquaculture in floating net cages	The floating net cages which can be made with locals materials are introduce for Tilapias culture	4 floating net cages (3.5 x 3.5 x 2 m, 20 m^2/cage of effective capacity)	Fingerlings of Tilapia, compound (pellet) feed
Fishing	Advices are giving for about method of breed fishes captures in aquaculture ponds	2 canoes, gillnet net (4 lots), cast net (2 lots, net mending material, basket trap.	Training of fishing for the groups of farmers

The meeting of awareness of the pilot project was held on November 07, 2007. In reply, the member of management committee of the reservoir dams communicated with farmers during many meetings and studied the formulation of farmers' group that should participate to the different activities. The participation of three farmers' groups to the activities of the pilot project was decided.

- Group of aquaculture farmers/fishers:12 persons
- Group of pigs raisers: 12 persons
- Group of materials management: 12 persons

The Department of Fishery has already conducted some floating net cage culture trial in Tchakalakou, and 2 persons of each of three groups was former members of the aquaculture team at that time, to get advantage from this experience. The composition of groups was changed later, which details are mentioned in the Chapter "capacity building of farmers' organizations". The activities by scopes presented in the Table 6-97 are explained in a concrete manner as follow.

i) Aquaculture in Pond

The input of the project allows the building of new fish ponds in the down stream of the reservoir dam. The pond construction took place during the period of December 2007 and March 2008, with the participation of farmers in Tchakalakou.

The trials of Tilapia culture started after the completion of the ponds, from April 2008, according to the indicated method in the table 6-97.

Table 6-97. Outline of the aquaculture trial in pond (Tchakalakou, from April 2008)

Cage	Species	Fingerling			Types of culture	Remarks
		Density (Fish/m^2)	Size (g)	Number of individual		
Pond-1 (250 m^2)	Tilapia	5	2	1,250	Culture feed and fertilized with manure	Using of dejections of pigs as organic manure
Pond-2 (250 m^2)	Tilapia	5	2	1,250		
Pond-3 (250 m^2)	Tilapia	5	2	1,250		

ii) Pig farming

A boar and three sows were transferred to Tchakalakou on December 2007 for culture, the pilot project started by building a piggery with a financial support from the project. In term of a variety of pigs, it is the same as on the other sites, « Landrace » and « Large white ». The fertility of the landrace and the health and the good meat of large white have been combined.

iii) Aquaculture in floating net cages.

Small floating net cages were built and installed. Materials of the cages were fish nets, frames of woods, plastic tanks of 20 litres as floats, those are all available around except fish nets. The dimensions of the cages were 3.5 x 3.5 x 2 m (useful capacity: 20 m^3) and the cost of materials was about 100.000 F CFA. 2 trials of Tilapia culture were conducted wit the cages (Table 6-98 and 99).

Table 6-98. Outline of 1st trial of culture in floating net cages (Tchakalakou from December 07, 2007)

Cages	Species	Fingerling			Type of culture	Remarks
		Density (fish/m^3)	Seize (g)	Number of individual		
Cage 1 (20 m^3)	Tilapia	65	28.7	1,300	Culture with pellet feed	Dimension of Cage is 3.5 x 3.5 x 2 m^3)
Cage 2 (20m^3)	Tilapia	65	28.7	1,300		
Cage 3 (20m^3)	Tilapia	65	28.7	1,300		
Cage 4 (20m^3)	Tilapia	65	28.7	1,300		

*The fingerlings were supplied from the farmers of Gnangri village, Djougou – the sizes of the fingerling were not homogenous. The feed was procured mainly at SONGHAÏ Center

Table 6-99. Outline of the 2nd trial of culture in floating net cages (Tchakalakou from June 26, 2008)

Cages	Species	Fingerling			Type of culture	Remarks
		Density (fish/m^3)	Size (g)	Number of individual		
Cage 1 (20 m^3)	Tilapia	42,5	15	850	Culture with pellet feed	Dimension of Cage is 3.5 x 3.5 x 2 m^3) capacity 20 m^3)
Cage 2 (20m^3)	Tilapia	42,5	15	850		
Cage 3 (20m^3)	Tilapia	42,5	15	850		
Cage 4 (20m ^{3})	Tilapia	42,5	15	850		

*The fingerling and feed were procured at Mr. Hilary, private aquaculture farm in Parakou

iv) Fishing

The fabrication of canoes and fishing nets introduced in this pilot project was sub-contracted to the Donga fishers association (APD). The materials were prepared from January 2008 to the beginning of February 2008 and delivered to the site.

A leader of (APD) trained twice the fishing group of the area to fishing techniques. The training schedule is presented in the table 6-100 below.

Table 6-100. Fishing training program

	Duration	Participants	Contents
1st training	February 18 – 27, 2008 (10 days)	12 members of the group	Manufacturing of fishing net, canoe navigation, swimming, cast net, gill net, net mending
2nd training	August 30 - September 03, 2008 (5 days)	6 members of the group	Fishing with basket traps and net mending

(2) Indicators of assessment

The indicators are as follows.

1) Tilapia in pond: Growth, survival, sale and balance
2) Pigs: Reproduction and growth, sale and balance
3) Tilapia in cages: Growth, survival, sale and balance
4) Volume of captures and sale

(3) Results of assessment

1) Tilapia in ponds growth, survival, sale and balance

The Table 6-101 indicates the result of the growth of Tilapia in ponds.

Table 6-101. Growth of Tilapia (1st trial in ponds at Tchakalakou)

Date	Number of days	Average weight (g)			Remarks
		Pond – 1	Pond - 2	Pond – 3	
3rd July 2008	0	2.0	2.0	2.0	Much of frogs and tad poles were observation in 3 pond Ponds -1 and 2 harvested and sold
3rd June 2008	61	52.0	55.0	30.0	
4th July 2008	92	46.7	60.0	45.0	
8th August 2008	127	65.0	86.0	63.0	
16th September 2008	166	91.5	112.5	90.1	
6th November 2008	217	126.4	139.9	(culture continuing)	

Since these experimental ponds were newly constructed for this particular purpose, the water captivity of ponds were not well assured in April that fish was stocked. But the level of water was gradually stabilized later. The fertilization of ponds 1 and 2 by bringing pig dejection from manure pit allowed to speed up multiplication of phytoplankton in these ponds. The initial growth of fingerlings has, therefore, been good till the month of June.

However, the observation made during the monitoring of August 2008, showed that the feeding of fingerling were not satisfied. Fish approached to feed, but they seemed afraid about something. It might be pointed out that fish were taken by fishing net provided for training in the pond.

The corrective measures were examined with RCPA of CeCPA Toucountouna, and it was decided to use the car (pick up truck) of CeCPA to make an observation visit wit the farmers and the SPH to the site of Bassila, and teach them the reality of “fish accustomed to feeding”. Organised on September 5th, this visit of demonstration had important impacts. The group of farmers have finally understood the meaning of “fishes accustomed to feeding” so the care of fishes became quite better than before. During the monitoring of October, it is noted that banks of fish gathered together when somebody approached.

The ponds 1 and 2 have been harvested on November 6th and 7thand sold on the site as well as in Natitingou (Table 6-102). In June the floating net cages, Tilapias was sold at the prince of 800 F CFA/kg (see below), fish was entirely sold at 1,000FCFA according to the selling plan elaborated under the supervision of specialist from CeRPA. The fingerling in the pond 3, which born in the pond 1 and 2 were transferred in the meantime and shortly captured for sale.

Table 6-102. Harvest and sales of Tilapia (1st culture in pond at Tchacalakou)

Date	Ponds	Number of individual	Total weight (kg)	Average Weight (g/fish)	Division (kg)		Sale price (FCFA / kg)	Amount (FCFA)
					Sale	Self consumption		
November 6th 2008	N° 1	564	71.3	126.4	67.5	3.8	1,000	67,500
November 7th 2008	N° 2	677	94.7	139.9	88.0	6.7	1,000	88,000
	Total	1,241	166	133.8	155.5	10.5	1,000	155,500

The analysis of the balance – sheet provide results indicated in the Table bellow. Although the daily rate of growth calculated from the above were acceptable (0.57 – 0.64 / g), and that the fish could be sold at the price of 1000 FCFA / kg, the balance –sheet reveal a deficit. The reason of this deficit is comeing from a low survival rate (45.1 – 54.2 %) and high rate of feeding conversion (5.92 – 5.94). The weakness of the survival rate can be explained partially by the loss caused by the wild predators (birds etc.)

Table 6-103. Balance of Tilapia culture (1st trial in ponds at Tchakalakou)

Item	Pond- 1			Pond- 2		
	Quantity	Unit price	Amount (FCFA)	Quantity	Unit price	Amount (FCFA)
Directs costs (A)						
Fingerling	1,250	20	25,000	1,250	20	25,000
Feeding (kg)	408	220	89,900	546	220	120,000
Sales (B)	-	-	-	-	-	-
Tilapia (kg)	71.3	1,000	71,300	94.7	1,000	94,700
Gross profit						
(A) – (B)			-43,600			-50,300

2) Pig reproduction, growth, sale and balance

The sows was normally developed until the time that one of them was assaulted by boar just before the delivery, consequently that provoked a bad delivery and the lost of 8 piglets. Another pig was attacked by “tse-tse fry”, and got worse day by day till the monitoring of May. As there was no hope that the pig would be reCovèred, the farmers consulted to sell and replace by a local pig with consultant, then this proposal was accepted. But in fact, all the pigs of reproduction (foreigner, race) were sold and substituted by local pig with the fund collected.

The selling price of 4 pigs was 114,000 F CFA, then the balance - sheet revealed the loss of 268,140 FCFA due to feeding cost (Table 6-104). The selling fund was used to buy 3 local pigs of reproduction in 63,000 FCFA, as well as two males pigs, of local variety, dedicated for slaughtering which cost 10.000 FCFA each.

During the monitoring of October, one of the sows was sick and moved from the piggery near the pond to the village. The piggery is not clean and well cared, so the dejections accumulated on the floor and sanitary status was critical. The substitution of the former pigs by local ones has no impact. The lack of ability to manage effectively the farming, the hygiene and sanitation aspects was the main cause of disease of pigs. In October, either two months after their purchase, one of two piglets dedicated for slaughtering didn’t shown any sign of growth, and other took only 2kg, in another word 23 g/day. The growth is slow.

Table 6-104. Balance of pig farming at Tchakalakou

Purchase cost of pigs for reproduction				Feed cost		Sale of sick pigs		
No.	Sex	Weight (kg)	Price (FCFA)	Quantity (kg)	Cost (FCFA)	Weight (kg)	Price (FCFA)	Balance (FCFA)
1	F	35	52,500	332	43,160	60	22,500	73,160
2	F	35	52,500	332	43,160	70	29,500	-66,660
3	F	35	52,500	332	43,160	70	24,000	-71,660
4	f	35	52,500	332	43,160	90	39,000	-56,660
TOTAL			210,000		172,640		114,500	-268,140

3) Floating net cage culture of Tilapia: growth, survival, sale and balance

The results of growing, and the harvest during the first trial of culture are indicated in the Table 6-105 and 106.

Table 6-105. Growth of Tilapia (First trial in floating net cages at Tchakalakou)

Date	Number of dates	Average weight (g)				Remarks
		Cage 1	Cage 2	Cage 3	Cage 4	
December 07, 2007	0	28.7	28.7	28.7	28.7	The trial of cage 2 has been interrupted because of break of net (March 2008)
February 20, 2008	75	54.4	50.8	44.8	47.1	
April 03, 2008	118	96.4	(inter-rupted)	47.6	67.4	
June 06, 2008	182	111.1		96.2	88.9	

Table 6-106. Result of harvest of fish in floating net cages (1st trial at Tchakalakou)

	Cages 1	Cages 2	Cage 3	Cage 4	Total
Number of fishes harvested	540	Interrupted Because of damage of net	1,009	1250	2,804
Rate of survival (%)	41.5		77.6	96.2	
Total quantity (kg)	60.0		97.0	111.5	268.5
Individual average weight (g)	111		96	89	96
Quantity sold (kg)	56		94	103	254
Domestic consumption (kg)	4		3	8	15
Unit price (FCFA/kg)	800		800	800	800
Sale (FCFA)	44,800		75,200	82,400	202,400

The duration of culture is 6 months. The harvest was made on June 6, 2008 for the cage – 1 and 2 and on June 7, 2008 for cage – 3.

The growth of Tilapias was slowed for a feeding culture (0.45g/day at maximum). That can be explained by the reasons mentioned below. Also, the net of the cage-2 was partially affected on March, and almost the whole fishes escaped. Consequently the trial was stopped. Few large sized fish remained in the net (20 Tilapia, 25kg) were transferred in cage-1. The damage of the net was about 10 cm. It may be caused by a nail during the periodic fish weighting work or attack of crocodiles.

a. Bad management of feeding

The SPH and the group of farmers have very limited experience in fishing. They introduced mechanically feeding in the cage according to the feeding quantity estimated from biomass and the feeding rate without considering the behaviour of the fish. Consequently feed was not eaten by fish and deposited on the bottom of net cages.

The inappropriate management of feeding caused the huge wasted of feeds. Hypothesis may give possibility to say that the fish was not really attracted by the feeding and the period of feed absorption was very short. It was also noticed that the deterioration of the water quality of reservoir dam caused by the feeding stagnant can be a factor of growth constraint of fish.

b. Low water temperature

Mostly in the northern zone of Benin, the temperatures of water and the air decrease during the “harmattan” (a period of down temperature combined by violent wind). The water temperature of the reservoir dam of Tchakalakou in February was 23°-24°C that is 4-5°C lower than in the South (27-28° C).

c. Existence of predators

In the reservoir dam of Tchakalakou there are predators such as wild bird like heron and crocodile. It may be possible that the fish in the cages is stressed because of the crocodiles and the wild birds, as matter of fact these factors can influence their growth.

d. Bad growth due to the quality of fingerling.

The fingerlings of this site were provided by the aquaculture farmers association of Gnangri village in Djougou (following the principle of supplying the surrounding). Since no new genitor has been brought in many years as in the case of Bassila, it seems to be a genetic impoverishment.

The report of cage 4, of which the result was the best and the survival rate was the highest, is presented in Table 6-107. Although this table doesn’t count the depreciation, the floating cage maintenance fees, the feed transport and its materials fees, the result was extreme red. The most important cause of the results are linked with the mediocrity of the growth and feed conversion rate which is 6.3 (targeted rate less than 2.5) caused by an important feed loss.

The very cheap selling price was also one of the difficulties. They called people of Toucoutounan so as

to finish up the stock, the fish has been sold off all at once at 800FCFA per kg; this unit price was not profitable.

Table 6-107. Result of Tilapia culture (cage 4 of the first trial at Tchakalakou)

Item	Quantity	Unit price	Amount (FCFA)
Direct expenses			
Fingerling	1 300	40	52 000
Feed (kg)	472	225	160 200
Sale of Tilapia (kg)	103	800	82 400
Gross profit (A) - (B)			-75 800

Based upon the results of this first experimentation, the good quality fingerlings were ordered at the aquaculture farmer in Parakou in order to start the second trial in floating net cages. But since this farmer knew very little about the package and transport of fingerlings, more than 30% of them, mostly the bigger ones died or were about dying when they were brought on the site. The farm trail was made as planned, but the growth rate was again lower than the first trail.

Table 6-108. Result of fish culture in floating net cage (Second trail at Tchakalakou)

Date	Numbers of day	Average weight (g)				Remarks
		Cage-1	Cage-2	Cage-3	Cage-4	
June 26, 2008	0	15.0	15.0	15.0	15.0	Do not include the number of Fingerlings which died at stocking
August 20 2008	55	23.9	18.4	19.7	13.5	
October 24 2008	120	49.6	48.3	Tear	44.4	The net of the cage 3 was torn on September 25 2008; the fishes escaped from the net to the reservoir dam environment.

4) Catch and sales

The gill net fishing organized during the first training caught 20 to 30 kg per day of Tilapia and Clarias. This fishing method has proved to be technically acceptable. It however happened that the crocodiles crowding in the water were caught into the nets, causing important damages. Part of the fishing products were sold on the road-side, but the largest part was self consumed. Based on the result of the training, the farmers group might continue, afterwards to practice the fishing by net, but the crocodile might have been caught many times in the net and during the monitoring in August 2008, the nets have not been repaired. Although, the farmers group were trained on how to repair the nets, it's not very likely that those farmers who lacked experience in the fishing domain and do not practice it as main job continue practicing gill net fishing in the future. On thre contrary of this, it seems that cast net has been used since the training. But the cast net is a form of fishing, which is practiced individually and seems not be appropriate for collective activities. The quantity of fish was not registered in the book. In these conditions, fishing by basket trap has been envisioned to replace the fishing by gill net and a second training in fishing sector has been organized with the purpose of bringing in this method.

The basket trap is made of wire fence, 40 cm in diameter and 80 cm in length from a roll wire fence. It has an opening in shell-hole form, what prevents the fish once inside the basket trap from easily getting out. This simple method of fishing, which does not use special baits, consists in setting up the basket trap at spots where the fish are likely to gather themselves, near immerged wood for example and withdrawing them the next day.

The fishing trial made during the practical training have amounted hauls of 78 kg in volume for 19 basket traps. The main captured fish were natural tilapia (*Tilapia zilli* and *T. guinienesis*) also mixed up with some Clarias. After the training, the fishing group tried themselves this method. The results is indicated in the following table. There is not precise data on the species or the number of captured fish, but the main hauls were natural tilapias weighing from 30 to 300g. Some artificial fingerlings of Tilapia (*Oreachromis niloticus*) were released in Tchakalakou (5,000 fingerlings in 1996 by the

Department of Fishery, 5,000 fingerlings in 2005 by PADPPA and 3,000 in March-April of 2008 by PADPPA). However they never have been captured till now.

Table 6-109. Result of the basket trap fishing (Tchakalakou)

	Number of exit	Number of operations	Total captures (kg)	Dispatching (kg)		Selling price (FCFA/kg)	Amount (FCFA)
				Sale	Auto consumption.		
September 2008	23	16	53	50.0	3.0	800	40 000
October 2008	15	7	12	11.0	1.0	800	8 800
Total	38	13	166	61.0	4.0	800	48 800

The fishing by basket trap puts into the framework of this project, could be set up as a new way of support in Tchakalakou. It might be in fact possible that after the pilot project, the farmers in the surroundings of the reservoir dam in Boukoumbe might have heard about the fishing activities of Tchakalakou and have dashed into the fishing by basket trap themselves.

(4) Feed-back to Master Plan and Action Plan.
1) Important remarks concerning promoting the artificial reservoir dams.
Two new approaches, aquaculture and fishing, have been brought in the artificial reservoir dams in the north region of Benin so as to analysis their potentials. The technical feasibility of aquaculture in the ponds constructed in downstream side of the dike was proved and fish was cultured to the market size and sold. That aquaculture not being profitable for the time being, it is however seems important to improve the aquaculture techniques of the farmers, to analyze and adopt some cheap local feeds and reduce the feed expenses by fertilizing the ponds with animal shits.

Aquaculture in simplified floating net cage set up in this project, has aroused more problems than that in ponds. For example the risk that fish might run away through the torn part of the nets or to suffer the material damages of predators such as crocodiles. As the PACODER has judged according to the current results, it seems difficult to spread it in artificial reservoir dams in north of Benin.

As for fishing, some fishing methods introduced in this project such as gill net, cast net, basket trap have proved to be technically acceptable. It however seems difficult for the farmers to take care of the torn nets by the crocodiles. The most efficient way of fishing is baskets using called “ basket trap”. The basket trap at cheap price should be spread into the north artificial dams.

2) Public aid adapted to the promotion of aquaculture in the north.
The pilot project helped to realize that the socio-economics conditions are extremely different in the south of Benin very populated and the north less developed. In general, conditions of aquaculture’s profit are more difficult in the region of north Benin than the south. In the north, the level of education is in fact very low, cost of fingerling and feed transportation is very high and local agriculture products are cheap. Other problems come up: Aquaculture facility often being far from the houses, the risk of theft is higher. Roughly it is then seems difficult to set up an economically durable aquaculture farms in those regions, except the bordering towns like Parakou.

Right now, the promotion of aquaculture in the north regions needs an appropriate public aid in the domains such as the feed and fingerling transportation, or the sale of farmed fish.

6.5.4 Brackish water aquaculture

(1) Overview of the activities
Aheme Lake (brackish water lake), which extends on the Atlantic and Mono prefecture is surrounded by many aquaculture ponds (spring water ponds) exploited thanks to the main support of NGOs. Some ponds developed for aquaculture in fresh water become salty because of the influence of lake water and most of them are now abandoned, since no promising species has been disCovèred. The participants of those aquaculture projects are farmers-fishermen and craftsmen who are very poor, and

to create a means of support in replacement is crucial problem. This pilot project has tested the farming of Chrysichthys and *Sarotherodon* considered as adapted species of brackish water aquaculture as well as tilapia; targeting species for aquaculture. It is also to verify the possibility of developing that aquaculture by analyzing the survival rate, the growth rate and the feed impact on the fish.

Put under the charge of the local NGO CREDI, this pilot project was realized in the brackish water ponds of Couffonou village, in the commune of Kpomasse. On the basis of information provided by the SPH of CeCPA in Kpomasse, "toward December it is easy to find natural fingerling of *Chrysichthys* and *Sarotherodon* in the region of Aheme lake", the culture trial should start in January 2008. But the start was delayed due to difficulties to supply fingerlings, the optimum scheme, lack of knowledge of NGO about transport and choice of natural fingerlings.

Later, with the assistance of PACODER, following information was collected that natural fingerlings of *Chrysichthys* and *Saratherodon* could be captured in Accaja of Nokoué lake and naturally reproduced fingerlings are available in the faculty of Agriculture of the University of Abomey-calavi. Based on the above information, the fingerlings were procured as mentioned in the table below.

Table 6-110. Suppliying source of fingerlings used for the culture trial.

Species	Supplying source
Chrysichthys nigrodigitatus	- Natural fingerlings captured with plot (Accadja) in Sô-Ava, Nokoue lake (99%) - Natural fingerlings captured with plot at Aho Channel, south of Aheme lake
Sarotherodon melanotheron	- Fingerlings reproduce naturally in ponds of Abomey-Calavi University (70%) - Natural fingerlings captured in the fish pond of this site - Natural fingerlings captured with plot (Accadja) in Sô-Ava, Nokoue lake - Natural fingerlings captured at Aho Channel, south of Ahémé lake
Oreochromis niloticus	- Artificial fingerling of Tohonou aquaculture center (55%) - Artificial fingerling of Adounmè farm, 3km from the site (45%)

As far as natural fingerling transportation is concerned, namely the one of *Chrysichthys*, at the beginning, CREDI tried to use polyethylene tank for fingerlings transportation and caused mass mortality. Based on the PACODER advice, they left fingerlings in the fish pond for several days before transportation, packed them in a plastic bag with oxygen and transported them early in the morning. Thus they succeeded to reduce the mortality of fingerlings during transport.

The infrastructure used for experimental fingerling culture is of three abandoned aquaculture ponds (400m^2 per pond) divided into two parts by the nets before stocking of fingerling in Fig. 6-13. Number of fingerlings, size and stocking date is shown in Table 6-111.

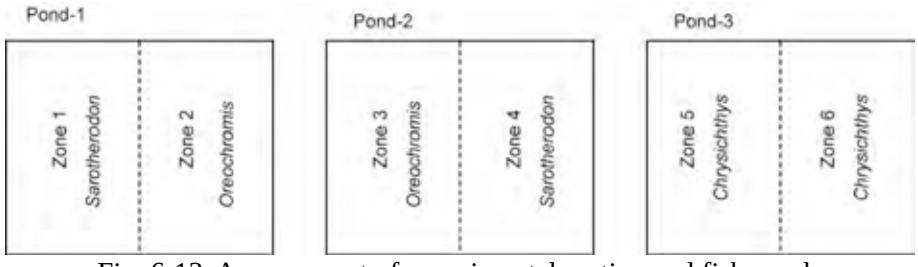


Fig. 6-13. Arrangement of experimental section and fish ponds

Table 6-111. Number and size of fingerlings

Zone	species	Number of fingerlings	Stocking date	Average weight (g/fish)	Density (fish/m^2)
Zone 1	*Sarotherodon*	784	January 24- March 08, 2008	29.0	3.9
Zone 2	*Oreochromis*	1,000	February 29, 2008	20.5	5.0
Zone 3	*Oreochromis*	847	January 25, 2008	49.0	4.2
Zone 4	*Sarotherodon*	984	March 7- March 18 2008	25.0	4.9
Zone 5	*Chrysichthys*	680	January 24- February 22, 2008	27.5	3.4
Zone 6	*Chrysichthys*	1,000	February 22, 2008	27.5	5.0

The aquaculture ponds of the site are flooded during raining season, experimental farming was put under the responsibility of the NGO and implemented till August before the floods.

(2) Indicators for evaluation
The indicators are: growth, survival and balance of three species.

(3) Results of evaluation
1) Salinity and water level in the ponds
The salinity evolving in the different ponds used for the experience of farming and fish culture is recorded in Fig.6-14. The salinity gradually increased from February and reaches the level of 8 to 13 per mille by end of May that means 1/3 of sea water. It is possible that the salt, which has been dropped on the surface of ground during dry season is likely to be dissolved and drained by water during heavy rain season from May to June. Later the salinity tends to decrease gradually during flooding period of Couffo River till July to August.

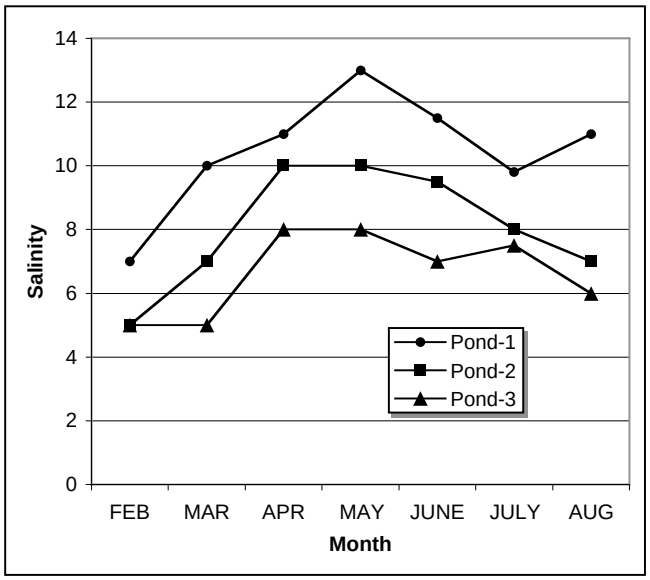


Fig. 6-14. Evolution of salinity (Kpomassè)

The water level of the ponds, which was very low in March-April, started moving up gradually to reach a maximum depth of 2m in August at the harvest of fish. Also, the surroundings of ponds got swampy due to the flooding water of Couffo River. So it was necessary to use canoe to reach the trial site. Consequently, the harvest of fish was carried out by pumping the pond's water.

2) Growth and survival
The growth of three target species is shown in Fig. 6-15. Tilapias grew better than *Chrysichthys* and *Sarotherodon* which were however, promising for brackish water culture. This situation can be explained not only by differences between resistance and acclimatization to the salinity, but also adaptation to the farm relevancy during those experiences, the later factors seems to have more impact.
In fact natural fingerling of *Chrysichthys* and *Sarotherodon* did not show active feeding behavior to compound feed.

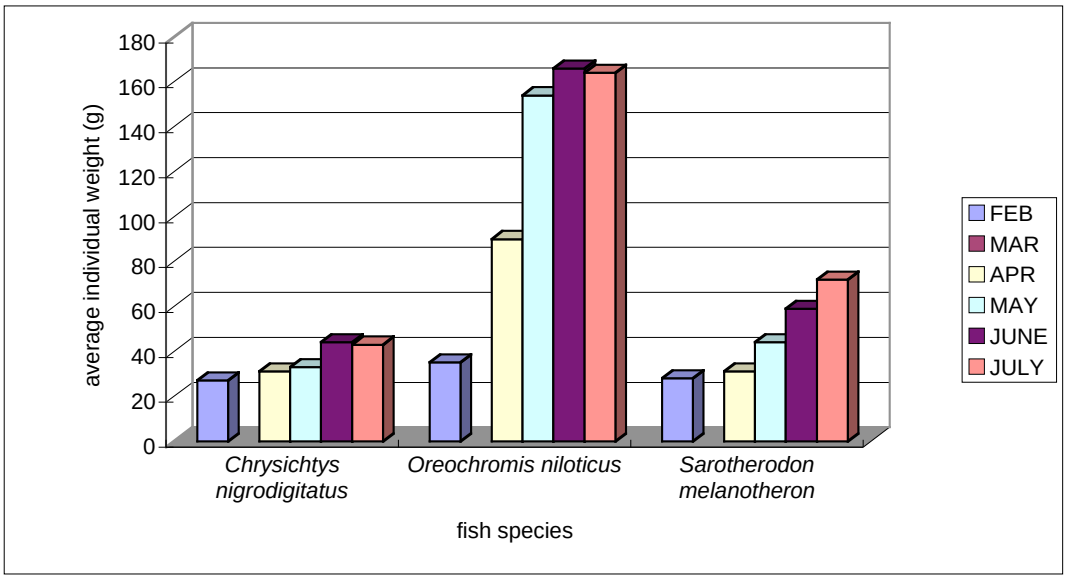


Fig. 6-15. Growth of 3 target species for brackish water aquaculture
Source: Final Report of CREDI

The Table 6-112 shows up the growth, survival and daily growth rate in each zone. The result of total harvest of Tilapia and *Sarotherodon* revealed important gaps in survival rates (30.1-73.3). The harvest was done during flooding period, it may be possible that numerous fish have escaped or predated by beast of prey (snakes, lizards; birds, etc…). Besides, it is undeniable that some robberies have taken place. The Tilapia of zone 3 apparently showing lower survival rate, which is virtually the best resulted zone, and therefore, fish was stolen in concentration. Unfortunately, workers in that domain recognized having consumed part of those fish.

As it is showed further up, Tilapias of zone 3 presented a higher daily growth rate up to 0.99 a figure goes beyond the one of zone 2 (0.45). Many explanations may be possible indeed, that fingerling of each zone was supplied from different source. Fingerling of zone 3 (coming from a private fingerling) might be better than that of zone 2 (from Tohonou aquaculture center). Or fingerling of zone 3 is bigger and adapted more smoothly the salinity.

The daily growth rate of Chrysichthhys and *Sarotherodon* was low (0.11-0.28), so that the aquaculture method used this time was not profitable.

Table 6-112. Result of experimental brackish water aquaculture

	Zone 1 Saro.	Zone 2 Oreo.	Zone 3 Oreo.	Zone 4 Saro.	Zone 5 Chry.	Zone 6 Chry.
Number of fingerling empoisoned	784	1000	847	984	680	1000
Initial weigh average (g/indiv.)	29	20.5	49	25	27.5	27.5
Initial biomass (kg)	22.7	20.5	41.5	24.6	18.7	27.5
Total weight (kg)	17.8	56.1	60.9	30.3	N.A.	N.A.
Average of final weight (g/indiv.)	44.5	95.5	239	42	72	N.A.
Number of fish captured (estimation)	400	587	255	721	N.A.	N.A.
Survival rate (%)	51.0	58.7	30.1	73.3	N.A.	N.A.
Period duration (day)	141	166	191	141	158	N.A.
Daily growth (g/jour)	0.11	0.45	0.99	0.12	0.28	N.A.

Source: Final report of CREDI
* Date of harvest: August 2008
* NA: No data available

3) Balance of aquaculture

The FCR figure out, if survival rate is 100 %, was 4.1 for Tilapias (4.8 and 4.2 for *Sarotherodon* and *Chrysichthys* respectively). This figure has been used to assess the financial status of zone 2 and 3. The survival rate was fixed to 70% and 80% in this estimation. The Tilapia selling price of zone 3 which presented the total weight of 200g was fixed at 1,200FCFA per kg. The balance was calculated to be in red in zone 2 and slightly positive in zone 3. Even if high growth rate is registered like zone 3, aquaculture is still not financially attractive because of the high purchase price of fingerling, feed and the high FCR.

Tableau 6-113. Balance of Tilapia culture in brackish water ponds

Office	Zone 2			Zone 3		
	Quantity	Unit price	Amount (FCFA)	Quantity	Unit price	Amount (FCFA)
Direct cost (A)						
Fingerlings	1 000	40	40 000	1000	60	60 000
Feed (kg)	169	225	38 053	446	225	100 368
Sale (B)						
Tilapia (kg)	61.3	1000	61 250	158.8	1200	190 560
Gross gain						
(A) - (B)			-16 803			30 192

Note: Condition of calculation is as follows.

	Fingerling weight (g)	Daily growth (g/day)	Survival rate (%)	Number of culture day	Final weight of the fish (g)	FCR
Zone 2	20	0.45	70	150	87.5	4.1
Zone 3	50	0.99	80	150	198.5	4.1

(4) Feedback to Master Plan and Action Plan

1) Brackish water species for aquaculture

Among the 3 species used during the present experience, the Tilapias showed the highest growth rate among those of *Sarotherodon* and Chrysichthy, though considered as potential species of brackish water aquaculture. Even the ordinary specie of Tilapia (*Oreachromis niloticus*) developed without problem in a salinity of 10-15 per mille and rather better than in fresh water. Although there is a room to study more about the appropriate culture condition for each species, for the time being, it seems reasonable to use Tilapia in priority for species of brackish water of this kind.

As for *Chrysichthys*, the growth is slow in its initial stage and it is difficult to handle them because of the presence of spines on dorsal fin and pectoral fins. On the other hand, the selling price of that species is 20 to 30% higher than Tilapia and Clarias. There is a potential to study more as a target culture species in brackish water.

2) Problems of abandoned aquaculture ponds

Every year between August and January of the following year, ponds and the area around them are turned into swampy ground because the level of the water increases. Reaching the ponds need a canoe which makes the ponds management difficult during these periods. So that seasonable flood certainly represent very serious handicap for the region than the problem of salinity.

For the time being it appears useful to use abandon aquaculture ponds as artificial whédo for an efficient capture of natural fish. It is possible, like whédo in Malanville or Ouémé region, to practice aquaculture in dry season but this requires being permanently aware of the risk of theft or sudden flood.

3) Lack of competent local organizations (NGO)

The NGO commissioned this project already has aquaculture facility, a fact that made us thinking that it has technical competence and accept PACODER’s contract of agreement signature. But in reality

this NGO has very little experience in this type of aquaculture implementation. This fact has led to the failure of the fingerling transportation and errors committed on feed procurement (where there were no more feed, they would not send for). The NGO also did not possess enough capacity in experience data processing.

The capacity of NGOs in Benin would develop from now on. But for the time being, it is realistic to precise more concretely the content of the requested services and to use the NGOs on the pattern closer to a direct management.

6.5.5 Aquaculture in whédo

(1) Outline of activity

Whédo fshing which takes advantage on the national flood condition because of the increasing level of water and the entrance of fish in the holes dig, the practice developed in the banks areas of lower part of Ouémé River commonly called Ouémé valley. Whédo can be considered as a fishing method but after withdrawing of the natural fish when the water drops in level, it is possible to use them as a pond until the level increase. (Reference study of Abomey-Calavi University)

In this pilot project, Clarias culture was experimented in the whédos during a drop in the water level in order to check the possibilities of developing fish culture and analyzing the survival and growth rate and the feeding output. The project site is the village of Gangban in the commune of Adjohoun and its implementation has been commissioned to the Professor Emile Fiogbe, professor at the Zoology and genetics department in the faculty of science and technique of the University of Abomey-Calavi, an experienced man in the field. The culture period is five months (from December 2007 to May 2008).

It was planed in the framework of this pilot project to use claria fingerling produced by the fish culture site of the University of Abomey-calavi. The gearing up has started in October 2007. The artificial fertilizing and the first growth in size went on very well but by the end of the month of November, during the absence of Prof Fiogbe, water was cut off and provoked the death of many fingerling. Prof Fiogbe immediately took emergency measure in order to purchase some fingerling from private farmers. The weight and quantity of the fingerling for the experience was fixed as in the following table.

Table 6-114. Program of Clarias culture in whédos

Culture pond (whédos)	Number of fingerlings	Culture density (fish / m^2)	Size of fingerlings
Whédo-1 (200 $m^{2)}$	2 000	10	Less than 15g
Whédo-2 (200 $m^{2)}$	Same as above	Same as above	15-20g
Whédo-3 (200 $m^{2)}$	Same as above	Same as above	More than 20g

(2) Indicators of assessment

The indicators are, growth and survival of Clarias and balance of Clarias culture.

(3) Result of assessment

i) Growth and survival

The number and the growth of the Clarias living in three whédos (200 m^2 each) used for the test are indicated in the Table 6-115, their survival rate as well as daily growth are mentioned in the Table 6-116. During the 162 days, the survival rate reached respectively 43%, 63% and 46.6% in the whédos 1, 2 and 3. The daily growth over the whole period was between 0.40g and 0.45g per day. Those figures are inferior to the rate generally presented in aquaculture with feed support to the Clarias in ponds (survival rate superior to 80% daily growth superior to 1g per day; the cause are examined farther.

Table 6-115. Growth and survival of Clarias in whédos

Date	Culture days	Number of fish			Average weight (g)			Biomass (kg)		
		whédo - 1	whédo - 2	whédo - 3	whédo - 1	whédo - 2	whédo - 3	whédo - 1	whédo - 2	whédo - 3
Dec 12th 2008	0	2 000	2 000	2 000	9.3	13.5	21.3	18.5	27.0	42.5
March 1st 2008	80	-	-	-	55.4	61.3	70.7	-	-	-
May 22nd 2008	162	872	1 239	931	79.7	85.8	85.9	69.5	106.3	80.0

Table 6-116. Survival rate and daily growth rate of Clarias

	whédo-1	whédo-2	whédo-3
Survival rate (%)	43.6	62.0	46.6
Daily growth (g/day)			
First 80 days	0.58	0.60	0.62
Second 80 days	0.30	0.30	0.19
Total timing	0.43	0.45	0.40

2) Balance

The Clarias was sold by the farmers group. The selling price was fixed to 800FCFA per kg because of the small size of the fishes. The calculation of the costs and sale is summarized in Table 6-117. The growth and survival of fish being weaker than foreseen, the total balance ended by a gross loss.

Table 6-117. Balance of aquaculture trial in whédos

Whédo-1

Name	Quantity	Unit Price	Amount
Expense			
Fingerlings	2,000 fishes	100 FCFA/fish	200,000 FCFA
Feed	643 kg	300 FCFA/kg	192,900 FCFA
Working force	5 Men-months	10,000 FCFA /men-day	50,000 FCFA
Consumption materials	1	10,000 FCFA	10,000 FCFA
Total (A)			452,900 FCFA
Income			
Sale of Clarias	69.5 kg	800 FCFA/kg	55,600 FCFA
Sale of other fishes	5 kg	300 FCFA/kg	1,500 FCFA
Total (B)			57,100 FCFA
Gross profit (B) – (A)			-395,800 FCFA

Whédo-2

Name	Quantity	Unit price	Amount
Expense			
Fingerlings	2,000 fishes	100 FCFA/fish	200,000 FCFA
Feed	663 kg	300 FCFA/kg	198,900 FCFA
Work force	5 Men-month	10,000 FCFA /men-day	50,000 FCFA
Consumption materials	1	10,000 FCFA	10,000 FCFA
Total (A)			458,900 FCFA
Income			
Sale of Clarias	106.3 kg	800 FCFA/kg	85,040 FCFA
Sale of other fishes	9 kg	300 FCFA/kg	2,700 FCFA
Total (B)			87,740 FCFA
Gross profit (B) – (A)			-371,160 FCFA

Whédo-3

Name	Quantity	Unit Price	Amount
Expense			
Fingerlings	2,000 fishes	150 FCFA/fish	300,000 FCFA
Feed	745 kg	300 FCFA/kg	223,500 FCFA
Work force	5 Men-months	10,000 FCFA /men-day	50,000 FCFA
Consumption materials	1	10,000 FCFA	10,000 FCFA
Total (A)			583,500 FCFA
Income			
Sale of Clarias	80 kg	800 FCFA/kg	64,000 FCFA
Sale of other fishes	3 kg	300 FCFA/kg	900 FCFA
Total (B)			64,900 FCFA
Gross profit (B) – (A)			-518,600 FCFA

Source: Final report achieved by the professor FIOGBE (June 2008)

The target of these experiences of fish culture was to check in practice, the result of the researches, which have been made so far by Prof Fiogbe in the field of fishing by whédo system.
Diverse technical problem have shown up however during the experience, the result was that it is not possible to get satisfying result. Some technical problems are related to the three big following points.

i) Quality of the fingerlings
During the past test, which was done in small whédo ($10m^2$), the fingerlinges were all produced in the university at the fingerling production center, hence a homogeneity, unity of age and size. But due to electricity breaking down in the center, this experience has been done with fingerlinges of different size from different private fingerlinges farmers.

ii) Abnormal dry season
During the past tests, the experimental sites were dredged but since the water of the whédo have never dried up along the dry season, no periodical dredging has been done this time. But the dry season lasted long particularly this time (November to May) and many whédo dried up during the experience. The dry surfaces reached 1/3 to 2/3 of the whédos and we assume the fishe have probably not growth up during that period. In fact, after a normal growth in the course of the first half (0.58-0.62)g per day, the growth rate of the fingerling highly decreased over the second half (0.19-0.30)g per day see table 6-116.

iii) Basic feeding techniques
According to the statistic data, the FCR was abnormally high (6.0-9.0). This shows us that feed was always added following the will of farmers to feed the fish, regardless the fingerling appetite and the type of feed which is dropped into whédos, and was not much consumed by the fish. Although, it is believed that Clarias eat the feed dropped in the water, the bottom of the whédos was Covèred with thick mud and that made things more difficult for them.

(4) Comments on the Master Plan and the Action Plan
Despite the natural potential favorable to aquaculture, the whédos located in Ouémé fluvial basin present some fundamental problems, which are prior to the aquaculture technique. Most of the whédos are far away from the houses, which make the surveillance against the thieves and its daily management more difficult. And also the fact that they are subjected to the uncontrollable influence of the water (river) it is impossible to prevent completely, the natural predators. Right now, it is impossible to transform those whédos into intensive aquaculture site.

6.5.6 Capacities building of farmers' organizations

(1) Outline of activities

A building up of capacities and follow up were carried out for those specialized in farmers organization (referred to as "SOP" in French) and for groups of farmers in the village of Tchi-Ahomadégbé in the commune of Lalo; the village of Pénessoulou in the commune of Bassila; the village of Tchakalakou in the commune of Toucountouna and the village of Monkassa in the commune of Malanville with a view to verifying the effectiveness of the method of building up of the capacities of farmers organizations through specialists in farmers organizations (SOP) appointed at Commune centers for Agriculture Promotion (CeCPA). (See Table 6-118).

Table 6-118. Activities, period and frequency of capacity building of farmers group

No.	Activities			Period	Frequency
	Who	For whom	What		
1	Consultants Counterpart	SOP	Training of improvement of capacities of supervising of farmers.	October, November 2007 February, May and August 2008	5 times in total
2	SOP	Group of farmers	Basic training for farmers' organization	In required time	Average 2 to 4 times per month
3	SOP	Group of farmers	Activity monitoring and guidance	In required time	Average one a week
4	Consultants Counterpart	SOP Group of farmers	Activity monitoring and guidance	October, November 2007 February, May and August 2008	5 times in total

Trainings toward the improvement of SOP's guidance providing capacities performed by consultants and counterparts during Activity 1 were roughly speaking were of three (3) types in number. (See tables 6-120 and 6-121 relating to the themes of trainings.)

1) Trainings having objectives that SOPs themselves understand the contents of training intended for villagers and operate them.
2) Trainings toward the enhancement of the guidance providing capacities of SOPs trainer of illiterate villagers.
3) Trainings toward the efficient implementation of day-to-day activities of the project.

In addition to the afore-mentioned three (3) types of trainings, the building up of SOP's capacities took place either through advice given directly at requisite location or indirectly through telephone or e-mail as in 4).

As for Activity 2, the basic training for farmers organization intended to group of farmers by SOP, provided the 21 essentials for efficient and steady group activities such as the division of labor in the group, the method of use of management tools and that of financial resources. These trainings were held in average from twice to 4 times a month in reckoning with local occurrences such as farming work season, traditional ceremonies and Ramadan. The furnishing of training report and participants list signed by trainees was compulsorily required from SOPs.

As regards the periodical follow up and guidance performed by SOPs involved in Activity 3 with respect to inhabitants' activities, slight differences appeared as to the frequency for follow up and the extend of guidance from one site to another. But it is proper to state that they were conducted virtually periodically outside sick furloughs and business periods of CeCPA's and CeRPA's staff. SOPs assessed the state of organization in the end of each month and delivered an activity report every three months. It sometimes befell that SOPs sought advice from consultants counseled SOPs through phone call or mobile phone messages.

Groups of farmers achieved as well within the framework of the project the activities hereafter.

Table 6-119. Activities of farmers group

Activities	Frequency
Participation to the training courses of capacity building of farmers' organization set up by the SOP	From 2 to 4 times per month
Participation in production activities centered on aquaculture in accordance with group	Training service: practically every day Group's activities: in average one time per week
Participation to the meetings in accordance with group	Difference between groups according to periods. In average once per week.
Practical application of training courses learning. Introduction to responsibility system. Introduction and marking in management book, organization of periodic meetings correct maintenance of equipments and materials	Degree of application and status of using variable as regards the group.

The trainings were held at a free space inside the village, ranging from twice to four (4) times a month, reckoning with ceremonies and the season of farming work in the village, to wit over the estate of one member of the group in the village of Monkassa, at a public place in the village of Tchakalakou in the commune of Toucountouna, in a spare room at the primary school inside the village of Tchi-Ahomadégbé and at the small hut intended for training constructed by members of the group in the village of Pénessoulou in the commune of Bassila. Chalk and blackboard were furnished by PACODER and managed by every group as common property. There are many themes on management on the training. The application of what they learnt was carried out with the leadership of president, secretary and accountant. And the training also focused on the building up of the sentiment of being a member of the group in order to avoid that group's activities will be overwhelmingly controlled by just a portion of executives.

(2) Indicators of assessment

1) Self-assessment by groups' members

Number of members uttering & shift of activities in the group, frequency of economic activities in the group, frequency of meetings or debates, statement of financial management, statement of common material management, number of participants in activities, etc.

2) Shift in groups 'activities

Average amount of participants in economic activities, in meetings and debates as well as in trainings.

3) Extent of inclusion and use of a duty apportioning system.

4) Extent of inclusion and use of management books and tools.

5) Appraisal of SOPs activities.

(3) Results of assessment

1) Self-evaluation by group members

Results of the self – appraisal by groups' members (performed every three (3) months in February, May, August and November 2008) showed in all villages epitomizing activities during the survey period; Answers like "very much", " a little more" and "same" were many and answers "a little less " and "very less" were few. (See tables 6-123, 126, 129, 132, 135, 137 and 139).

In case of the occurrence of troubles such as death of cattle or the delay in the supply of stuffs, the frequency of activities and the number of participants dropped as well as frequency of meetings. In extreme cases, the whole group felt deterred and quitted his activities. On the contrary, when they were overwhelmed with the fulfillment productive activities, the frequency of activities and the number of participants rose even in case of troubles; the frequency of meetings increased as well. As occasions for pooling information concerning division of labor and financial matters augment due to meetings, it makes it easier to ensure the transparency of management, which tends to reinforce mutual trust between members.

Some psychological causes other than the effect of activities related vicissitudes were observed too. In the village of Pénessoulou within the commune of Bassila, there were periods that group activities

were unsteady although production related activities ran smoothly. This stems from the fact that a portion of the whole body of members deemed other economic activities essential and the remaining portion of members bewared thinking that others were neglecting the group's activities; Dissatisfaction got higher because some members settled the fine inflicted by the group and other members didn't. These happenings led to a decrease in the frequency of meetings and a vicious circle where the absence of exchange of views resulted in a further increase of mistrust. In the village of Tchi-Ahomadégbé within the commune of Lalo, mistrust between the group's members gained magnitude because of lack of transparency in financial management. In the cases, the trouble was figured out by restructuring the group, following the fixing of the problem through the calling of general meeting held in presence of the SOP.

Besides, in the village of Monkassa in the commune of Malanville and the village of Tchakalakou in the commune of Toucountouna, some members didn't surrender officially their membership although their will to participate in the group's activities had been weakening as time was elapsing and they had been missing activities steadily. No official restructuring of groups was worked out, but in fact, there was a change in members. Distrust and dissatisfaction concerning absentees didn't appear clearly in the two villages, and those who dropped membership were not loaded within rebukes; since activities were proceeded with inexorably by remaining members, these memberships giving up didn't hamper the fulfillment of group activities.

2) Change of group activity
A combination of the study relating to executives' awaking to consciousness (Study conducted every three (3) months in February, May, August and October 2008; see Tables 6-124, 127, 130, 133, 136, 138, 140), the monthly study carried out by SOPs (every end of month) and reports on inhabitants' trainings made by SOP disclosed that the number of villagers participating in trainings, productive activities as well as meetings gradually dropped in all villages and eventually stagnated to a certain number. This originates from the fact that those who joined the group with knowing of his objectives, rather by curiosity or because they hoped to benefit from a grant quitted while actually interested persons who affiliated to the group knowingly stayed. The induced modification seems to be detrimental in so far as it stems from a decrease in the number of participant. But, in reality, this shrinking has paradoxically led to a remaining group made up of members fully aware of the objectives and dutiful and, as a result to a group equipped with a high capacity of organization. In addition this shrinking of the number of participants in activities originated from the fact that daily feeding and cleaning that don't need the participation of all is carried out by a rotation work of a small group of 2 to 3 members. As the division of labor was established following the learning by all members of the same techniques, activities were performed in a better organized manner despite the apparent drop in number.

In exemplification of the afore-said notice, activities dealt with the aquaculture group in the village of Monkassa, which used till a recent past to be performed only three (3) months a year, are now fulfilled twice a week all year-long along with periodical meetings. (see Table 6-128). Likewise, the individual activities of the women's group were concentrated at a single location while activities relating to the supply of processing equipment and the grubbing of cassava fields were better organized (Tables 6-122, 125, 128, 131 and 134 show the amount activities carried out in each village).

3) Extent of the introduction and the use of duty – apportioning
The establishment of a duty-assigning system was dealt with as a heading necessary for the fulfillment of planned group activities during the first half of trainings delivered by SOPs in favor of the inhabitants and especially during the second training through the heading: "Division of labor in groups". This system was applied by all groups. All group members don't hold a position of responsible person; nonetheless compared to what was noticeable at the beginning of this pilot project, an responsible person is appointed for each activity so as to prevent a single influential person to concentrate within his hands much too duties and accordingly much too power. And as new activities (aquaculture and animal-rearing) were added, new duties scilicet new positions of responsible person were set up accordingly. Thus, for example, were established and appointed among other position of

responsible persons, a aquaculture responsible person, a livestock responsible person, the person in charge of buying and stocking of the new products and a sales responsible person apportioned with the duty of marketing crops, which contributed to reinforce their awaking to consciousness.

When the project started, there was neither a system aiming at assigning duties to members nor even a well kept register in the village of Tchi-Ahomadégbé. The cause of the lack of improvement in terms of management was reported in the study relating to groups 'members awaking to consciousness (see Table 6-123); looking at the assessment of the use of the system based on the apportionment of duties to members and the use of management tools (see Table 6-122), it can be said objectively that the group' s capacity was raised in comparison to the start of the project.

The result of the study relating to the consciousness of core members and duty-assigned members in each village, as well as reports on activities and the results of the follow up performed by SOPs made it possible to realize that eleven (11) months after the start of the project groups' members - from among the whole body of members – who participate steadily in activities are known. Thus, when it came to the dredging of ponds back in November 2007 in the village of Tchi-Ahomadégbé, all 22 members of the group participated in activities everyday, but as time was going by this number shrank and decreased to eleven (11) members attending steadily the group activities. In the village of Tchakalakou too, the project started with a sizeable group comprised of 39 members but in the meantime (November 2008), this number dropped down to ranging from 12 to 13 members attending activities steadily. As a result of the decrease in the number of members, the roles and the duties of each member grew clearer; moreover, the sentiment of membership and the coherence of the group as organization proved strengthened. However, failure by the appointed accountant in the village of Tchi-Ahomadégbé to keep the accounts properly and report on it, a problem that was an item on the agenda of a meeting held in October 2008, brought into prominence that in spite of the introduction of the duty-apportionment-based system, these duties are yet to be fully discharged. Tables 6-122,125, 128, 131 and 134 show the assessment of the use of system.

4) Extent of introduction and use of management books and tools
The account book and activity book are relatively properly kept in all villages. These two management tools connected with the financial management of the group and the apportionment of profit to members fall within the scope of treasurer and the secretary who are literate. During the follow ups carried out in February, May, August and November 2008, instructions were given for auditing management books and tools in every village. In the village of Monkassa, the entries posted in the account books were improved and headway such as the drawing up of proceedings, not made out so far, was made. Yet one among the management tools – the visit book – was unused due to a lack of comprehension from the SOP. In the village of Tchakalakou, the sub-group aquaculture and the sub-group pig farming that are subordinate to the management committee of reservoir dams record as appropriate daily data. Although there is a delay of several days, items relating to cash inflows and cash out flows are properly posted in the account book. This delay resulted from the fact that, during each meeting, the group's members verify earnings and expenditures before their recording. In the village of Tchi-Ahomadégbé a delay was noted as to the introduction of management tools, which is due to the fact that, until the reorganization of the group in February 2008, in interim responsible persons contented themselves with just jotting down data in a provisional book rather than making use of the full-fledged management tools repeatedly while the group was being reorganized, gave instructions and, management tools were introduced as of March 2008. The extent of use of the tools is inadequate, but the chairman and the secretary keeps each a copy of the ticking off note-book the content of which is the basis for reckoning the amount of profit to be allotted to each member, and strive to ensure transparency in order to prevent forgery. In the village of Pénessoulou, all management, books are relatively properly kept.

In all villages, the recording of data in management tools as well as the frequency of money deposits in and money drawing out from bank account, rose, in the course of the implementation of the pilot project which argues groups funds to be managed as appropriate. A register of activities is also kept in each village, but it occurs that minutes are not draw up or indications are inadequate. The reason of

this problem lies in that registers of activities can be simply filled with figures and ciphers. Moreover if the secretaries whose duties consist inter alias to make out the proceedings was absent. No body would be able to replace him. Such an eventuality is unavoidable since the rate of illiterately of the inhabitants is high. Tables 6-122, 125, 128, 131 and 134 indicate the current extent of introduction and use of management books and tools in each village.

5) Assessment of SOPs' activities
The 21 Topics were virtually all taught by SOPs during trainings intended for the inhabitants in each village. (Themes indicated in Table 6-120).

A remarkable improvement of SOPs' ability to deliver training was observed. At the beginning of the project, training was delivered by SOP's as follows. At first SOPs wrote the main themes down on the blackboard in French and next they explained. Such a method was a little much too academic for an illiterate audience hence some participation drowsed and slept during training. Moreover the amount of hours allotted was inadequate and it was difficult for trainees to read what was written on the board and classes took place without clock. But after being initiated into basic teaching techniques trough trainings designed to SOPs, their manner of using the black board and allotting hours, their use of audiovisual didactic material voice and gesture went through a dazing improvement. It was observed that trainees were better concentrated and their face blossomed when the SOP commenced resorting to pictures, plans or gestures.

Trainings involving exchanges between trainees and SOP, and the apportionment of and adequate amount of hours increased and appreciated by trainees. The appraisal of trainings by trainees was conducted on the basis of 5 standards in terms of the standard of grasp and the standard of satisfaction anonymously in the end of every training. As for the standard of satisfactions it ranged from 4 to 5 during each appraisal in all villages; it is proper to state that 5 was the most frequent answer. As the standard of comprehension varied from one trainee to another, results of comprehension varied from one trainee to another, results of the assessment ranged from 3 to 5. Since the three (3) SOPs didn't talk local language, they turned to the secretary of the group as their interpreters, which nevertheless didn't help attain a satisfactory utterance and conveyance of the tuition.

Significant changes appeared in the periodical follow up of the inhabitants' activities by SOPs. At the beginning of the project, as they didn't know and understand the objectives of the study, they botched the filling in of the study related forms; it was frequent to see on these forms incoherent digits and codes but the manner of filling up the forms got better as instructions given toward improvement and in proportion as the number of studies augmented. In other words as sops were in touch with groups' members in order to collect exact information and data, their understanding of groups' inner operation deepened and gradually comments concerning activities described in reports ceased being commonplace. Besides instructions relating to the use of management tools haven't always been detailed and it has often befallen that while visiting the site, consultants and their counterparts instructed both groups and SOPs.

On a whole, it is noticeable that SOPs capability to provide guidance to groups was enhanced during the implementation of the project. In particular, regarding the manner in which SOPs related to groups' member, that was a one direction – oriented relation consisting in SOPs teaching trainees, a shift was noticed. As matter of fact SOPs were at times observed in addition, application of adapted guidance providing and support method by SOPs was remarked.

In the villages of Tchakalakou and Tchi- Ahomadégbé especially, senior RCPAs and specialists have appreciated progress made by the SOPs involved in the project.

(4) Feed back to Master Plan and Action Plan
1) Strengthening of the farmers' organization through the capacity building and capacity improvement of the SOP, CeCPA has been judges having effect.
2) Though, new groups will not be formed to benefit and, but jobless groups won't be woken up. The

groups presently in activities will have help.

3) Some training courses of encouragement in registration activities and attendance, the financial management and profit distribution rules should be fully carried out in order not to provoke the members' mistrust and complain. The tools to assure the transparency and the management of financial resources and their use, as well as the profits distribution, the detailed explanations will be given with didactic materiel so as to allow inhabitants to understand.
4) If the capacities and degree of understanding or RCPA are insufficient, the SOP cannot devote them to the project, are jealous by other extension agents. Training courses or workshop will be made by the RCPA and SOP as to assure sufficient understanding.
5) As the basic knowledge and the capacities of supervising of SOP have directly a big influence on the farmer's organizations, training courses will be widely completed for SOP. Though there are some individual differences, the training courses will be adjusted to SOP of low level the basic knowledge and the supervising techniques will be deepened by practical and varied works use stimulation test of training
6) Instruction will be given to SOP in order to restitute correctly to inhabitant what they have learnt during the training courses. The training courses in function to level of SOP being practically all copied as such a method of supervising adapted to inhabitant's level, it is important to guide them to modify what they should teach them corresponding to the level of trainees.
7) In the training courses concerning SOP of rural zone depends on illiterates, the academic courses centered on theories will be avoided and the tests and practices widely used.
8) The frequency of visits having directly a big influence on the farmers' organization, a transport mean will be assured to them.
9) Per training course for the inhabitants, the trainers will have to present an execution's report; the participants list, an assessment chart of training course, which will reinforce his self-assessment and their capacity of thinking.
10) After an observational visit in the model village, the participants will have to present a report.
11) The SOP will make period visits, to cease the management status of groups, in particular, the financial management and will have to make a written report to the project part will give advice through SOP.

Table 6-120. Themes of training courses for SOP

	Theme	Date
1	Why a group? Inconvenient an advantages of a groups	Octobre 30-31, 2007
2	Organization of work in the activities in group	
3	Principles and terms of a group	
4	Management in a group's life	
5	Requirements in group's management	
6	Management's tools Transparency's tools, programming's tools, Accountant' tools, assets tools	February 4-5, 2008
7	Installation's management + materials and reduction of women work	
8	Financial resources and their use	
9	Distribution of excess inside the groups	
10	Saving and loan in the groups activities	
11	Profitable conditions of income generating activities	
12	Time management	
13	Conflict management	May 15-16, 2008
14	Meetings of a group	
15	Process of decision making	
16	Quality of a Leader	
17	Calculation of cost price and sale price	
18	Commercialization of group products	August 18-19, 2008
19	Rights and obligation of groups' members	
20	Study of management case / status and regulations	
21	Importance of status and regulations in activities	

Table 6-121. Technical training to organize training

	Theme	Date
1	Planning of good training and efficient use of visual aids What is good training Planning for performing of good training Visual materials effects Advantages and inconvenient of visual materials	November 28, 2007 August 19, 2008
2	Analysis of present situation and using of PCM methodology	November 29, 2007 February 5, 2008
3	Dispatching and assessment	November 29, 2007 February 5 and May 16, 2008
4	Dispatching and Presentation	August 19, 2008

Table 6-122. Change of farmer's organization at Tchi- Ahomadégbé

	November 2007	October 2008
Name of Group	BETHESDA	AFOYOYO
Year of creation		
Number	Total 22	Total 22
	Men 21	Men 21
	Women 01	Women 01
Main activity	Aquaculture/rice cultivation	Aquaculture/rice cultivation
Secondary activiy	Pig farming	Pig farming/rice cultivation
Contribution	1500 F CFA/Men	0FCFAI/man
Number of productive activities	3/week	1/week
Number of meetings	2/month	4/month
Responsability	President (provisional) (M)	president
	Vice-president and treasurer (provisional) (M)	Secretary (M)
	In charge of stock (provisional) (F)	Assistant secratry (M)
		Treasures (M)
		Responsible of culture group (M)
		Responsible of aquaculture group (M)
		Responsible of rice cultivation group (M)
		Sales manager (M)
		Stock manager (M)
		4 audits (M.F)
Use of management tools	Account book/ treasurer (M)	Account book/ Treasurer (M)
		Sales book / Sales manager
		2 participation books/Secretary and President
		Member book/Secretary
		Feeds stock/Stock manager
		Meeting participation book /secretary

Table 6-123. Consciousness of the group members of Tchi-Ahomadégbé

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	4	0	11	13	0	3	0	1	0	0
2	Frequency of meeting	0	0	0	0	12	10	3	4	0	3
3	Financial management	0	0	0	0	1	3	14	6	0	8
4	Organizational management	14	0	1	0	0	8	0	8	0	1
5	Management of goods (equipments)	15	0	0	0	0	17	0	0	0	0
6	Particpants number to activities	1	0	12	0	0	0	2	15	0	2

- 1 : achieved February 8, 2008, concerned people : 15/22 group members
- 2 : achieved on October 24 2008, concerned people : 17/22 group members
- 3 : As members expressing a great positive change during the intermediary survey (February – may – August), at the final investigation achieved in October, the number of members expressing this change decreased except that concerning indicator « frequency of economic activities » PACODER suspect as causes, tat members don't have positive perspectives in the latest phase of the project, thinking that the activities won't generate profit and that they are unhappy to invest money in feeding and medical treatment for pig.

Table 6-124. Consciousness of core members of Tchi-Ahomadégbé

N°	Indicators	Total		Men		Women	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Average number of participants to the economic activities	11	11	9	11	1	0
2	Average number of participants to the economic activities	10	11	9	11	1	0
3	Average number of participants to the economic activities	15	11	14	11	1	0

- 1 : Achieved Feb 8,2008, concerning people : 3 provisional workers of group
- 2 : Achieved Oct 24, 2008, concerning people : 3 workers of group

Table 6-125. Change of farmer's organization of Penessoulou

	February 2008	November 2008
Name of group	Alibarika	Alibarika
Year of creation	March, 2003	March 2003
Number	Total 14	Total (since the month of may 2008)
	Men 14	Men 14
	Women 0	Women 0
Main activity	Aquaculture	Aquaculture
Secondary activity	Agriculture	Agriculture, cattle and poultry culture
Contribution	One hundred/week/man	Zero francs/week/man
Number of productive activities	4 week	4 week Work of every body from Monday to thursqay, the third and fourth four turning service
Number of meetings	One month	One month
Responsibility	President	President
	Vice-president	Secretary
	Secretary	Treasurer
	Acting Secretary	Responsible for recording activities
	Treasurer	Information manager
	Acting secretary	
	Technical adviser 1	
	Technical adviser 2	
Use of management tools	Activity's book	Activity's book/responsible for activities cheek in
	Accountant book/Treasurer	Accountant book/Treasurer
	Sales book/Treasurer	Sales book/Treasurer
	Visit book /Secretary	Visit book /Secretary
	Installation book of management /Secretary	General assembly reports/Secretary
		Members book /Secretary
		Training courses book /Secretary

Table 6-126 Consciousness of the group members of Penessoulou

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	11	0	0	9	1	0	0	0	0	0
2	Frequency of meeting	0	7	0	1	9	1	2	0	1	0
3	Financial management	9	9	1	0	2	0	0	0	0	0
4	Organisational management	10	9	2	0	0	0	0	0	0	0
5	Management of maternals (equipment)	2	5	8	4	0	0	2	0	0	0
6	Particpants number involved in activities	0	0	7	0	3	9	2	0	0	0

- 1 : achieved February 13th 2008, concerned people : 12/14 members of group
- 2 : achieved November 3rd 2008, concerned people : 9/9 members of group

Table 6-127. Consciousness of core members of Penessoulou

N°	Indicators	Total		Man		Woman	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Average number of participants to economical activities	12	8	12	8	0	0
2	Average number of participants to meetings	7	9	7	9	0	0
3	Average number of participants to training courses	12	7	12	7	0	0

- 1 achieved February 13th 2008, concerned people : three junior workers of group
- 2: achieved November 3rd 2008, concerned three junior workers of group
- 3: before the setting up of the new crew, some members were always absent, but presently almost every member participates to economical activities (A part from one person under medical treatment). The problem of lack of communication among the members after the decreasing of participant's number at meetings has decreased, but in reality the participation rate has increased because the total number has deceased.

Table 6-128. Change of aquaculture group of Monkassa

	November 2007	November 2008
Name of group	Club 4 "D" Mixte	Club 4 "D" Mixte
Year of creation	March 1996	March 1996
Number	Total 41	Total 44
	Men 11	Men 13
	Women 30	Women 31
Main activity	Riziculture	Riziculture
Secondary activity	Truck farming	Riziculture
Contribution	None regular contribution	None regular contribution
Number of productive activities	High season : Every day individually Low season No activity	Twice per week
Number of meetings	Once /week	Once/ week
Responsibility	President (M)	President (M)
	Vice-president (M)	Vice-president (M)
	Secretary (M)	Secretary (M)
	Acting Secretary (M)	Acting Secretary (M)
	Treasurer (M)	Treasurer (M)
	Acting Treasurer	Responsible to organization (M)
	Responsible of organization (M)	
	Acting Responsible to organization (F)	Acting Responsible to productive activity (F)
	Responsible to productive activity (M)	Responsible to productive activity (M)
	Acting responsible to prodctive activity	Acting responsible to prodctive activity
	Equipement responsible (M)	Responsible to equipment (M)
	Responsible to alphabet learning and training (M)	Responsible to alphabet learning and training (M)
	Responsible de woman activity (F)	Responsible to women activity (F)
Use of management tools	Accountant book/ Treasurer (M)	Accountant book / Treaurer
	Member's book / Secretary (M)	Members book / Secretary (M)
	No other book	Visitor book/Secretary (M)
		Book on common property /Secretary
		Activity book/Secretary (M)
		Participation book/Secretary (M)
		Report / Secretary (M)

Table 6-129. Consciousness of aquaculture group members of Monkassa

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	34	0	0	2	0	21	0	0	0	0
2	Frequency of meeting	34	23	0	0	0	0	0	0	0	0
3	Financial management	34	23	0	0	0	0	0	0	0	0
4	Organisational management	34	6	0	4	0	13	0	0	0	0
5	Management of maternals (equipment)	34	4	0	3	0	16	0	0	0	0
6	Particpants number involved in activities	34	23	0	0	0	0	0	0	0	0

- 1 : Realised 12 feb 2008, concerned people 32/42 group members
- 2 : Realised 1st November 2008, concerned people : 23/44 group members.

Table 6-130. Consciousness of core members of aquaculture group of Monkassa

N°	Indicators	Total		Men		Women	
		Feb	Oct	Feb	Oct	Feb	Oct
1	average number of participants involved in economical activities	37	34	12	12	23	22
2	average number of participants involved in economical activities	37	27	12	12	25	15
3	average number of participants involved in economical activities	25	23	12	11	13	12

- 1 : achieved on February 12, 2008, concerned people : 3 workers of group
- 2 : achieved on November 1st 2008, concerned people : 23/44 members of group

Table 6-131. Change of women organization at Monkassa

	February 2008	November 2008
Name of group	ANFANI	ANFANI
Year of creation	Non identified (2002)	Non identified (2002 ?)
Number	Total 20	Total 27
	Man 0 / Woman 20	Man 7 / Woman 20
Main activity	Transformation of agriculture products	Cassava culture, transformation of agriculture products (17 people)
Secondary activity	No secondary activity (truck farming or cereals production in family	No secondary activity (Truck farming or cereal production in family)
Contribution	0 FCFA / Person	0 FCFA / Person
Number of productive activity	3/week	Work everyday
Number of meeting	Irregular	Irregular
Responsibility	President	President
	Vice president	Vice president
	Treasurer	Secretary
		Treasurer
Use of management tools	No management tools	Account book/Secretary (F)
		Activity book/Secretary (F)
		Report / Secretary

Since it creation, this organization which members practiced economic activities haven't had management tools. Presently, the group becomes a managing some processing equipments.

Table 6-132. Consciousness of women group members of Monkassa

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	17	0	3	17	0	0	0	0	0	0
2	Frequency of meeting	19	0	1	0	0	17	0	0	0	0
3	Financial management	20	17	0	0	0	6	0	0	0	0
4	Organizational management	20	5	0	12	0	0	0	0	0	0
5	Management of goods (equipments)	20	2	0	6	5	0	0	0	0	0
6	Particpants number to activities	20	15	0	2	0	0	0	0	0	0

- 1 : achieved on February 12, 2008, concerned people : 20/20 members of group
- 2: achieved on November 1st 2008, concerned people: 17/27 members of group.

Table 6-133: Consciousness of core members of women group of Monkassa

N°	Indicators	Total		Man		Woman	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Average number of participants involved in economical activities	17	22	0	7	17	15
2	Average number of participants involved in economical activities	20	22	0	7	20	15
3	Average number of participants involved in economical activities	15	20	0	5	15	15

- 1 :achieved on February 12, 2008, concerned : 3 workers of group
- 2: achieved on November 1st 2008, concerned people: 3 workers of group.

Table 6-134. Change of farmers' organization at Tchakalakou

	February 2008	November 2008
Name of group	Roadlock management committee of FAWARATA at Tchakalakou	Road lock management committee of FAWARATA at Tchakalokou
Sub-group		Sub group of aquaculture Sub group of aquaculture Sub group of Material management
Year of creation	March 1993	March 1993
Number	Total 13	Total 43
	Men	Men
	Women	Women
Main activity	Riziculture	Riziculture
Secondary activity	Truck farming	Truck farming
Tertiary activity		Aquaculture
Contribution	None regularly contribution	None regularly contribution
Number of productive activity	3/month 7 / year	6 times /week
Number of meeting	2/months	2/months
Responsibility	President (M)	President (M)
	Vice President (F)	Vice President (F)
	Secretary M	Secretary M
	Acting secretary (F)	Acting secretary (F)
	Treasurer (M)	Treasurer (M)
	Acting treasurer (M)	Acting treasurer (M)
Use of management's tools	Accountant book/treasurer (M)	Accountant book/Treasurer (M)
	Invoice book/ Treasurer (M)	Invoice book/ Treasurer (M)
	Activity book / Secretary (M)	Activity book / Secretary (M)
	Supervising and activities book/ Secretary (M)	Supervising and activities book/ Secretary (M)
	Meeting book and training courses/Secretary	Meeting book and training courses/Secretary
	Participation book /Secretary	Participation book /Secretary
		Member book/Secretary
		Cash book /Treasurer (M)

Table 6-135. Consciousness of members of management committee of Tchakalakou reservoir dam

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	0	0	9	0	0	4	0	0	0	0
2	Frequency of meeting	9	0	0	4	0	0	0	0	0	0
3	Financial management	9	0	0	0	0	4	0	0	0	0
4	Organizational management	9	4	0	0	0	0	0	0	0	0
5	Management of goods (equipments)	9	0	0	0	0	4	0	3	0	0
6	Particpants number to activities	1	0	8	0	0	0	0	0	0	0

- 1: achieved on February 15, 2008, concerned people : 9/13 members of group
- 2: achieved on November 3 2008, concerned people: 4/13 members of group.

Table 6-136 Consciousness of core members of management committee of Tchakalakou reservoir dam

N°	Indicators	Total		Man		Woman	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Average number of participants involved in economical activities	10-11	3	7-8	3	3	0
2	Average number of participants involved in economical activities	13	6	10	6	3	0
3	Average number of participants involved in economical activities courses	13	3	10	3	5	0

Table 6-137. Consciousness of aquaculture sub group members of Tchakalakou

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	0	2	7	0	0	0	0	0	0	0
2	Frequency of meeting	7	0	0	0	0	2	0	0	0	0
3	Financial management	0	2	7	0	0	0	0	0	0	0
4	Organizational management	7	0	0	2	0	0	0	0	0	0
5	Management of goods (equipments)	7	0	0	2	0	0	0	0	0	0
6	Particpants number to activities	7	0	0	0	0	0	0	2	0	0

- 1 : achieved on February 15, 2008, concerned people : 7/11 workers of group
- 2 : achieved on November 3, 2008, concerned people : 3/13 workers of group

Table 6-138. Consciousness of core members of aquaculture sub group of Tchakalakou

N°	Indicators	Total		Man		Woman	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Mean number of participants to economical activities	10-11	3	7-8	3	3	0
2	mean number of participants to meetings	13	6	10	6	3	0
3	Mean number of participants to training courses	13	3	10	3	5	6

- 1 : achieved on February 15, 2008, concerned : 3 workers of group
- 2 : realized November 3, 2008, concerned people : 2 workers of group

Table 6-139. Consciousness of livestock sub group members of Tchakalakou

N°	Indicators	Very much		A little more		Same		A little less		Very less	
		Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct
1	Frequency of economic activities	0	9	9	0	0	0	0	0	0	0
2	Frequency of meeting	4	9	5	0	0	0	0	0	0	0
3	Financial management	0	8	9	0	0	1	0	0	0	0
4	Organizational management	9	8	0	0	0	1	0	0	0	0
5	Management of goods (equipments)	9	0	0	0	0	6	0	0	0	0
6	Particpants number to activities	3	0	6	1	0	8	0	0	0	0

- 1 : achieved on February 15, 2008, concerned people : 9/13 members of group
- 2: achieved on November 3, 2008, concerned: 9/11 members of group.

Table 6-140. Consciousness of core members of livestock sub group of Tchakalakou

N°	Indicators	Total		Man		Woman	
		Feb	Oct	Feb	Oct	Feb	Oct
1	Mean number of participants to economical activities	10	4	3	1	7	3
2	mean number of participants to meetings	12	9	5	4	7	5
3	Mean number of participants to training courses	12	8	5	3	7	5

- 1 : achieved on February 5,2008, concerned people : 3 Workers of group
- 2: achieved on November 3, 2008, concerned: 3 Workers of group.

6.5.7 Reduction of women's work load

(1) Outline of activities

At the beginning of the pilot project in November 2008, the main activities of women of Monkassa was the cassava processing. Processing equipments were granted to the women group ANFANI (a cassava rough, pressing machine, a pothole of heating) in order to reduce the burden of those women, consequently they can optimize their time and be able to attend aquaculture training. 4 improved cooking tools were manufactured by the group of women the day of delivery of the materials granted.

In December 2007, the group bought cassava and began processing. As the work time was going over, women decided on agreement to work once per week. A deficit occurred due to the increase of cassava price. They were obliged to interrupt their activity. In substitution, they meet one another once per week for the collecting of cultivated maize individually.

As the group stopped processing cassava, the members did not participated in the capacity building training course.

But the group of women plan to produce cassava. They acquired 2.5 ha of land at the border of the village and also get involved in the capacity building training course. Cassava producing is in pending the November of 2008.

The rental of grater and press machine to other groups was planned and publically announced. But the lack row materiel cause the interruption of processing at the borders of Monkossa village and the rental is not effective up to now. Some people of the village and surroundings started again cassava culture. At the harvest season of cassava, a paying service is also planned apart from the group's members. The main activities and period linked to the reduction of women's work load are following in the table 6-141.

Table 6-141. Contents and period of the activity of reduction of women's work load

	Activities	Time
1	Introduction of material contributing to reduction of work load	December 2007
2	Training course, use of grater machine and squeezer	
3	Training course on maintenance of grater machine and squeezer	
4	Appointment of a common materiel administrator	
5	Training on group activities	November to December 2007 June to October 2008
6	Processing Cassava.	December 2007 January March 2008
7	Cassava cultivation	In pending since June

(2) Indicators of assessment

1) Change of labor hours: Modification of required time for cassava processing

2) Change of work load: Modification of physic and moral charge in cassava transformation.

3) Correct maintenance activities

(3) Result of assessment

1) Change of working hours: change of required time for cassava processing

After the introduction of processing materiel, the required time for cassava processing decreased and the group activities of women changed. The manual of cassava processing, which was made twice per week has been completed every Monday by every members of the gathered grouping. As the gathered work of cassava required in average 2 hours per day was reduced to 5 minutes, the work time decreased to 1/24 (the grater machine allow to reduce the work time to 1/90 theoretically according to the manual) This reduced time can be devoted to other processing works such as drying roasting and passage to sieve etc. The total time of cassava's processing activities was reduced to 1/3. The activities executed up to here in 3 days per week are reduced in one day.

But from December 2007, the shortage and the increase of the price of raw materials (cassava) impact the activities non profitable, and the activities of processing was provisionally stopped after the fourth operation. The main causes of this increase are the low production observed in 2007, and the fact that the buyers, hearing of the project, increased the price of cassava. The SOP tried to negotiate the price with the union of cassava producers and to supply cassava from the program of development of roots and tubers (PDRT). But both are failed due to lack of product. Then the women of group decided to cultivate themselves cassava. At the setting of PDRT, practically all the farmers of Monkossa cultivated cassava and had an important production; the cultivation of cassava didn't cause any problem. After having for 2.5 hectares at the border of the village, the group asked for assistance to PACODER for the plants, their request was accepted. After ploughing and the planting in June 2008 the main activity of the group was the production of cassava. At the beginning of the cultivation, some former male members of the group came back, and the group became mixed one. Men and women do farming, but the women go back earlier to prepare the dinner. As the production of cassava takes from 9 to 12 months, the harvest and the processing will start in March 2009.

2) Change of work load: improvement of physical and moral burden of process of cassava

The change in the physical and moral burden in cassava processing is indicated in the Table 6-143. According to the study in November 2007, women expressed their physical burden in 10 levels (1 very hard, 5 none of them, 10 very easy) and the average of 17 people interviewed was 3.35. This result revealed an important physical burden. But in spite of this, the average of moral one was 8.40, a positive number, consequently women doesn't hate hard work (1every hard boring 5 none of them 10 very good).

One month after the introduction of processing equipments, a study achieved in January 2008 after three operations revealed that physical burden of seventeen (17) women considerably decreased to 8.41. The moral one was 8.70, an improvement was a little though. The women doesn't detest a hard work, but light physical charge reduces also the moral charge.

3) Good Maintenance Activities

In October 2008, the register of management was established, and the material of processing supplied was kept in a secured warehouse. Assessment at the end of the pilot project indicated that the group acquired good maintenance methods, but it took long time, and the state of maintenance during the period of the project was not very good. The improvement observed during the final assessment gave a strong impression that it was prepared in a hurry to be in time rather than it was as a result of long-term effort.

In November 2008, the two management notebooks such as account notebook and the reports were finally presented. The writing was not of the secretary of the group, but that of the secretary of aquaculture group. Only the secretary is literate in the group. She is a leader-like woman of the village, being a member of students' parents association of the primary school of the village as well apart from the group. This woman knows only how to write alphabet, the numbers and the codes, can not make a report that requires more skill in term of effective text writing. The registrations in the notebooks of group were insufficient, but presently it is acceptable

Table 6-142. Change of average time for cassava processing (unit: time)

Type of work	Gratering time per day		Gratering time per week		Squeezing time per day		Squeezing time per week	
Monitoring	Nov	Jan	Nov	Jan	Nov	Jan	Nov	Jan
Average working time	2.1	0.1	6.2	0.1	2.0	0.1	6.0	0.1

Table 6-143. Change of physical and moral burden of cassava processing

Study month	Physical burden <Hard Easy>										Moral burden <Hard Easy>									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Nov 2007			3.35															8.40		
Nov 2008								8.41										8.70		

(4) Feed back to Master Plan and Action Plan

1) The project should help only existing group not form new group
2) A group having a leader who is capable to read, write and calculate is desirable for help
3) In case of agriculture product processing, it is desirable that the target group can control the supply of raw material. (Raw material is self supplied or assured in the future)
4) The activity of SOP depends upon the capacity and understanding of RCPH. Their sufficient understanding should be assured at the training course of RCPA
5) As basic knowledge and the supervising capacities of SOP bring an impact in straight manner on the farmers' organization, some training course should be widely completed for the SOP.
6) The frequency of visits of SOP has an impact directly on farmers' organizations, a mean of transport should be assured.
7) At the end of each training course, the trainers should present a report and the participants' list.
8) In the farmers training courses, considering illiterates, the exercises and the practice should be widely used.
9) An Alphabetisation training course should be made to reinforce the farmer' capacities
10) The status of farmers group management, in particular the financial management status should be grasped by the SOP and reported periodically as a written report to the project.

Chapter 7

Recommendation

Chapter 7 Recommendation

Strengthening of logistics for fishery extension officers
CeRPA and CeCPA play an important role for the development of aquaculture and rural development in general. According to the socio-economic survey of June 2007, 56% of fish farmers receive technical advise from fishery extension officer. Recruited large number of extension officers in 2007, they are deployed in 72 communes out of 77 and their total number amounts to 229. Since the number of agriculture household is 569,672 (RGPH 3, 2002), an extension officer serves for approx. 2,500 households in calculation. Most of them are equipped with motorcycle. A service vehicle is also deployed at CeCPA from 2008. Thus the personnel and equipment of the Government are being disposed for rural development. The effort paid by the MAEP and the Government to set up this structure under the difficult financial situation is truly appreciated. However, the supply of fuel for motorcycle is not enough and that may lead to the reduced frequency of visit. It is recommended to continue strengthening of logistics to support activities of extension officers.

Strengthening of the personnel of Department of Fisheries
There are 3 technical staffs in the division of inland fishery and aquaculture. The number of technical officers may decrease due to retirement. An effort is needed to maintain the number of technical officers as well as knowledge and technical level through new recruitment or exchange personnel and practical training on them.

Partial responsibility of cost of beneficiaries
The farmers in the south who accustomed to have project assistance tend to think that equipment and material should be given with free of charge and per diem should be given to participate the training. But this way of thinking should be modified. The success of project needs a motivation and self-effort of farmers. In order to fix the ownership of the project, it is recommended that a part of cost is beard by farmers.

Public assistance toward construction of water sources related facilities
In order to construct drainable aquaculture pond, the water source related facility that is apt to the specific topographic feature of the site is required. It corresponds the water source pond in swamp valley, flowing well and artificial reservoir dam. Considering that these facilities need a certain amount of money and serve as public aquaculture infrastructures, it is recommended that the government or commune construct them for private fish farmers. Besides, regarding artificial reservoir dams constructed in large number in northern region, siphon system is recommended to be installed with public assistance to supply water to down stream side of dike and fully exploit the area. If there are some artificial reservoir dams in planning stage, water supply pipe is desirable to be included in the plan.

Agriculture production and aquaculture
Aquaculture in rural area of Benin depends on agriculture like livestock. Thinking of aquaculture as an secondary activity, it is important that enough amount of agriculture production is assured and agriculture by-products are supplied in large quantity and in cheep price. The aquaculture should be promoted in the area where agriculture and livestock is fully developed.

Expansion of workers in aquaculture sector
Aquaculture is exercised only in 0.39% of total agriculture household. It is hardly recognized at general farmers household level and its related industry like feed production plant is not developed yet.
Due to limited demand of the sector, the competition principle does not work and the price of materials remains high as a result. In this situation, the aquaculture is not very feasible and expected to develop further more. First of all, it is important to transmit proper technique in appropriate extension approach like “farmer to farmer” to many farmers and increase those who work in aquaculture sector.

Loose coordination if organization is necessary
It is difficult to share and manage the common benefit in more than one person. There are plenty of

people's groups who fail to manage it. In the northern regions where the natural resource is limited, people tend to be grouped naturally to use it in common. On the other hand, there is no necessity that people make group in the south where the natural resource is abundant and everywhere. Even if the group is organized, they don't succeed in general to manage the benefit in common with enough transparency. But, a group of loose coordination may work well even in the south. The management of property remains at individual level and members use in common the necessary services. For instance, a group purchase necessary material in common and large quantity, thus reduce the unit price for members. This type of group or association may work and should be promoted in the south as well.

Learn from the experience of aquaculture-advanced developing countries

Some of the South-East Asian countries like Indonesia, Thailand, Vietnam and Cambodia are still developing countries in economical point of view but aquaculture is well developed in there. Although social and historical background is not the same between South-East Asian countries and Benin, there are many similar points in economic and natural conditions and points to refer. It is important to analyze the case inland aquaculture in South-East Asian countries, China and India not only in Japan and apply them in the country.

Promotion of middle and large-scale fish farmers

Since this study aims at developing small scale aquaculture in principle that is practicable by artisanal farmers in viewpoints of rural development, the commercial aquaculture with large capital is not studied well. Actually, some advanced private fish farms exercise integrated fish farming with agriculture and livestock by using effectively several workers. One of these fish farms performs a complete aquaculture of catfish from seed production to growth of commercial size fish, and finally seeks a chance to export fish to the European market.

It is difficult for poor farmers with limited technique and fund to exercise large-scale aquaculture. But it will be possible to find potential middle and large-scale fish farmers and raise them, through encouragement of new participation to aquaculture sector from large-scale agriculture or non-agriculture sector, supply of modern aquaculture technique to highly motivated investors and arrangement of aquaculture potential sites in northern region. Although middle and large-scale aquaculture accompanies the risk of certain level, it may contribute to create a job opportunity and a base of technology transfer, and thus enhance the local activities.