Improve integrated farming in costal area of central Vietnam

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Introduction and objectives

A typical integrated farming system encompassing gardening, fish pond and livestock pen (under Vietnamese acronym VAC) is the most popular practice in the rural communities of Vietnam. Usually, in the VAC system, the fish pond ecosystem utilizes either raw animal manure or compost to improve the natural primary and secondary productivity for carp and tilapia aquaculture. Animal manure is also used in gardens mainly for vegetable cultivation. Such a system produces fish and vegetables for family consumption and surplus income. However, the productivity of the pond is quite low ranging from few hundred kilograms to an average 1,500-1,700 kg per ha per year (0,015-0,017 kg/m^2.year). Vegetables produced are mainly for subsistence. The coastal communities are always faced with the limitation of land for such an extensive system on one hand and low economic efficiency on the other. To address this issue, the proposed project aims to improve the traditional VAC system through the application of new technology and cultivation of higher value species. This aim is expected to be achieved by meeting following three objectives: (i) by providing an alternative income and ensure food security for the poor farmers and/or fishers; (ii) by improving technological and extension capacity for the stakeholders; and (iii) by minimizing the negative impacts of aquaculture on environment and animal husbandry through the reuse of discharged water and proper use of organic manure, other agricultural wastes and weeds.

The work is under progress and this paper highlights some of the results of the project. The project has three phases: a) analysis of the current status of household aquaculture practices and the identification of incentives and constraints for improved VAC implementation; b) development of appropriate improved VAC guidelines and manuals for household aquaculture through participation on farm and community trials and; c) building capacity for VAC implementation and opening dialogues with traders and processors to explore market incentives for the promotion of improved VAC products.

Materials and Methods

The modified VAC system includes establishing a new system into the existing VAC framework. The new system includes, 30-40m^3 of water in plastic tanks or pond (20m^2 of the tank), livestock pen with space of 50-60m^2 which can produce manure for cultivation of earth worm as a feed for fish and earthworm manure as a fertilizer for a vegetable garden of 70-80m^2. It is expected that 150-170 kg of valuable aquatic species (eel, grouper or goby fish etc.) and few hundred kilograms of vegetables can be harvested. The diagrammatic presentation of this modification is shown in Figure 1.

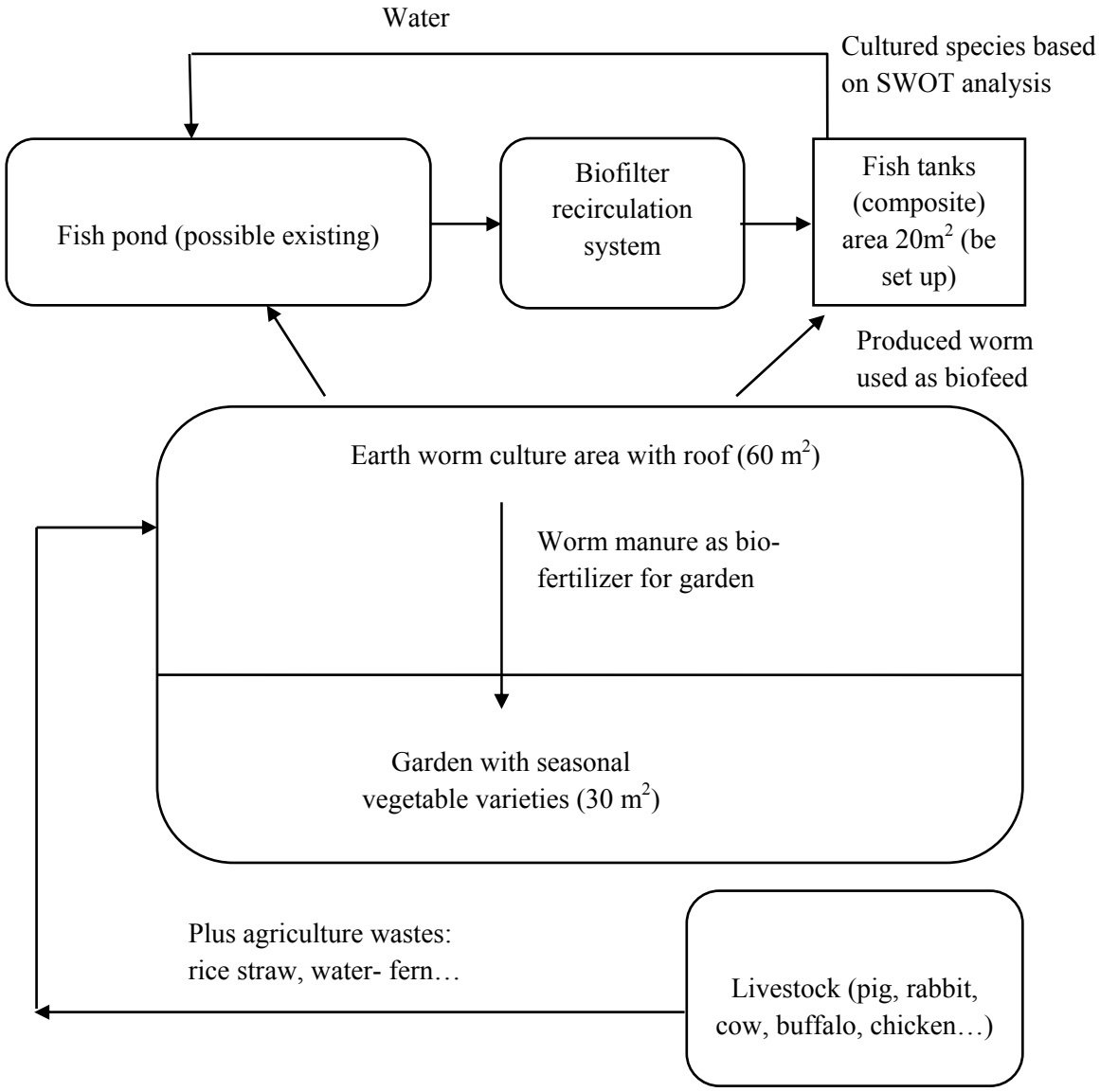

Figure 1: Principle of modification in improved integrated system (VAC)

During the first phase, which is complete now, SWOT analysis based on the analysis of initial data was used to select three (3) demonstration farms in two provinces, namely Quang Tri and Nghe An. These demonstration households had common characteristics of being small but existing intensive farming practices, willingness and ability to adapt a new technology based on the culture of high-value species. These householders were also well respected and had assumed leadership roles in their local communities. The SWOT analysis was also employed to select the new high-value species for these households. During this initial phase, extensive discussions were held among all stakeholders as an exercise for capacity building.

The second phase commenced with the establishment of the proposed modifications in the VAC system, introduction of the high-value species and actual operation of these modified VAC systems. A further of seventeen (17) new VAC households were selected in order to incorporate the wider ranges of existing VAC practices which was based on the "lessons learned" approach from the initial three (3) adapted VAC households. Currently, a new set of modifications are getting implemented in those additional VAC households and relevant extension materials is getting prepared. The third phase will disseminate the technologies to secondary beneficiaries through extensive extension and dissemination process and document the benefits. During this phase, findings of the initial two phases will be used by demonstration farmers and extension workers to develop suitable VAC guidelines and training manuals for targeted farmers and extension workers, which will be disseminated through communication channels to build capacity for concerned stakeholders at all levels.

Results and Discussion

Assessment of current status of integrated system in costal area of the North Central Vietnam

Species used in VAC (Aquaculture and Horticulture)

In Vietnam, traditional VAC is widely practice in rural areas including coastline. This integration consists of gardening, horticulture and aquaculture. The level of integration varies from household to household but integration in terms of human resource is a common practice. The species used for traditional VAC is shown in Table 1.

Organic fertilizer from pigs, chicken, cow or buffalo is getting recycled in almost all integrated systems. The fertilizers are used for gardening and aquaculture as nutrient source for plants and

for direct consumption for fish species. Majority of the raw organic manure contributes in the heavy suspended organic load eutrophication of fish ponds.

Another source of material which enters the VAC system in costal areas is trash fish which comes as a daily catch from the sea. The trash fish is used as a feed for chicken, fish, dogs or cats.

Table 1: Various species are practiced in integrated farming in the costal area of North - Centre

Gardening	Horticulture	Aquaculture
Sweet potato buds	Pig	Common carp
Maize	Chicken	Grass carp
Soybean	Dogs	Silver carp
Peanut	Cat	Rohu
Grass	Cow	Mrigal
		Tilapia

(data based on 15 questionnaires)

Income source from VAC

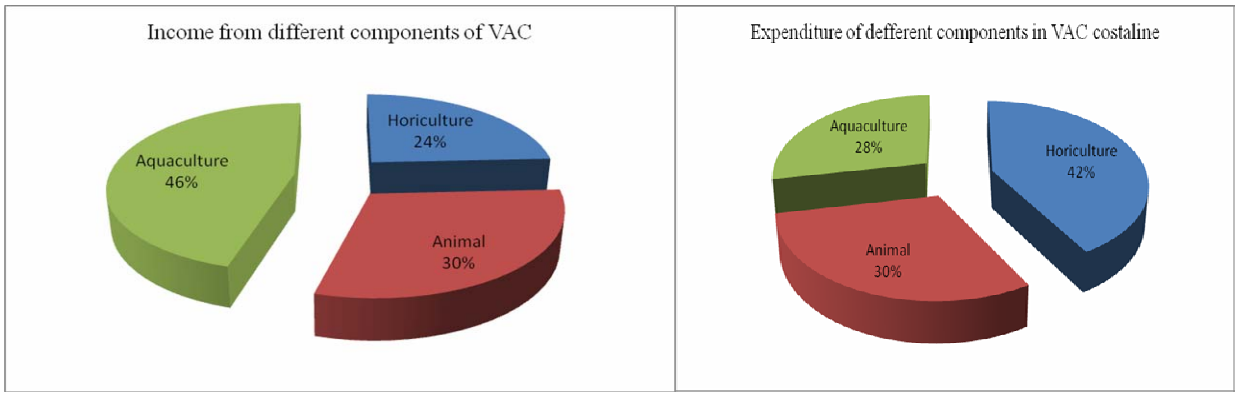

Figure 2: Income and expenditure in VAC. The date is analyzed from 15 household surveys.

Aquaculture plays a large role in contributing the income for families in North Centre of Vietnam even though expenditure for this component is less than animal or horticulture operations.

Contribution of VAC on livelihood

The main income for costal household is from fishing whereas cultivation occupied a small proportion of income. However, under high pressure, pollution and overfishing, fish production

through catching has reduced. Further, the quality and value of the wild fish is getting progressively low as more small and invaluable species are fished. Therefore, the alternative livelihood income is from gardening, cultivation of animal and aquaculture is getting more important. More than 90% households from survey are now highly dependant on the income from VAC operations.

Current issues and constrains

Advantages of VAC coastline

- Local materials and byproducts such as fertilizers, straw, grass are easily available and are cheap
- Trash fish is still a cheap source of feed for fish or animal (VND 3000 – 6000/kg in summer)
- Labor is also cheap and readily available.
- Power is not expensive as is subsidized by the Government.

Disadvantages of VAC coastline

- Farming is based on traditional technology and yields productivity.
- Low valued species in aquaculture are used. (also see in Table 1)
- Lack of skilled farmers.
- Availability of land for efficient farming is getting smaller..
- Trash fish is available but is expected to be less available as other commercial uses of trash fish are increasing. Further, collection of trash fish for animal protein production is not considered to be sustainable.

Demonstration models of modification

Earth Worm production

Modification which incorporated facilities to produce earth worm is assisting in both generation of income as the production of the worm can sell at VND 30.000/kg and reducing the potential risk of water pollution creating from direct discharge of animal wastes into the fish pond.. Furthermore, the soil after nursing worms can be recycled and used for the gardening.

Table 2: Earth worm culture in five project provinces

Household name	Location	Sock area (m^2).	Density Kg/m²	Current area (m^2).	Estimate increase production (kg)	Day of culture
Lê Sinh	Quang Tri	15	1	25	10	50
Lê thanh Tùng	Nghe An	30	1	40	200	300
Trần văn Thiệu	Quang Tri	15	2	20	180	300
Huy	Ha Tinh	20	1.5	40	80	50
Dũng	Quang Binh	15	1	15	70	50
Trực	Hue	15	1	15	80	50

Note: Density: 1kg = 8000 – 10000 con

There are 7 (Table 2) out of 20 demonstrations VAC households set up for earth worm production facilities.. The area for earth worm ranges from 10 – 20 m², depending on geography, land-availability and estimated food requirement. The initial results from trials have shown potential trend to alter the feed source for fish or cultured animals including chicken and duck.

Table 3: Analysis of income from the earth worm productions

Costs (VND)	Mr. Huy (20 m²)	Mr. Thieu (15 m²)
Payment for house	*6,050,000.00*	*3,330,000.00*
Monthly Estimated	1,344,444.44	1,110,000.00
Fertilizer (for 8 months)	1,800,000.00	1,500,000.00
Labor cost (for 8 months)	8,000,000.00	6,000,000.00
Land fee 12 months	250,000.00	
Total costs	11,394,444.44	8,610,000.00
Gross Profit	14,400,000.00	12,000,000.00
Net income	3,005,555.56	3,390,000.00
ROI	26.4	39.4

Though, the returns are low, the significance of this model has profound advantages in terms of the recycling of the animal wastes and the utilization of the existing by-products from horticultural activities.

The eels

Water environment for eel culture should be good enough to maintain stocking high density. Feeding with trash fish or worm every day creates a high level of nitrogen waste concentration which is very serious for the eels. In order to address this problem, recirculation system to maintain the water quality is designed (Figure 3)

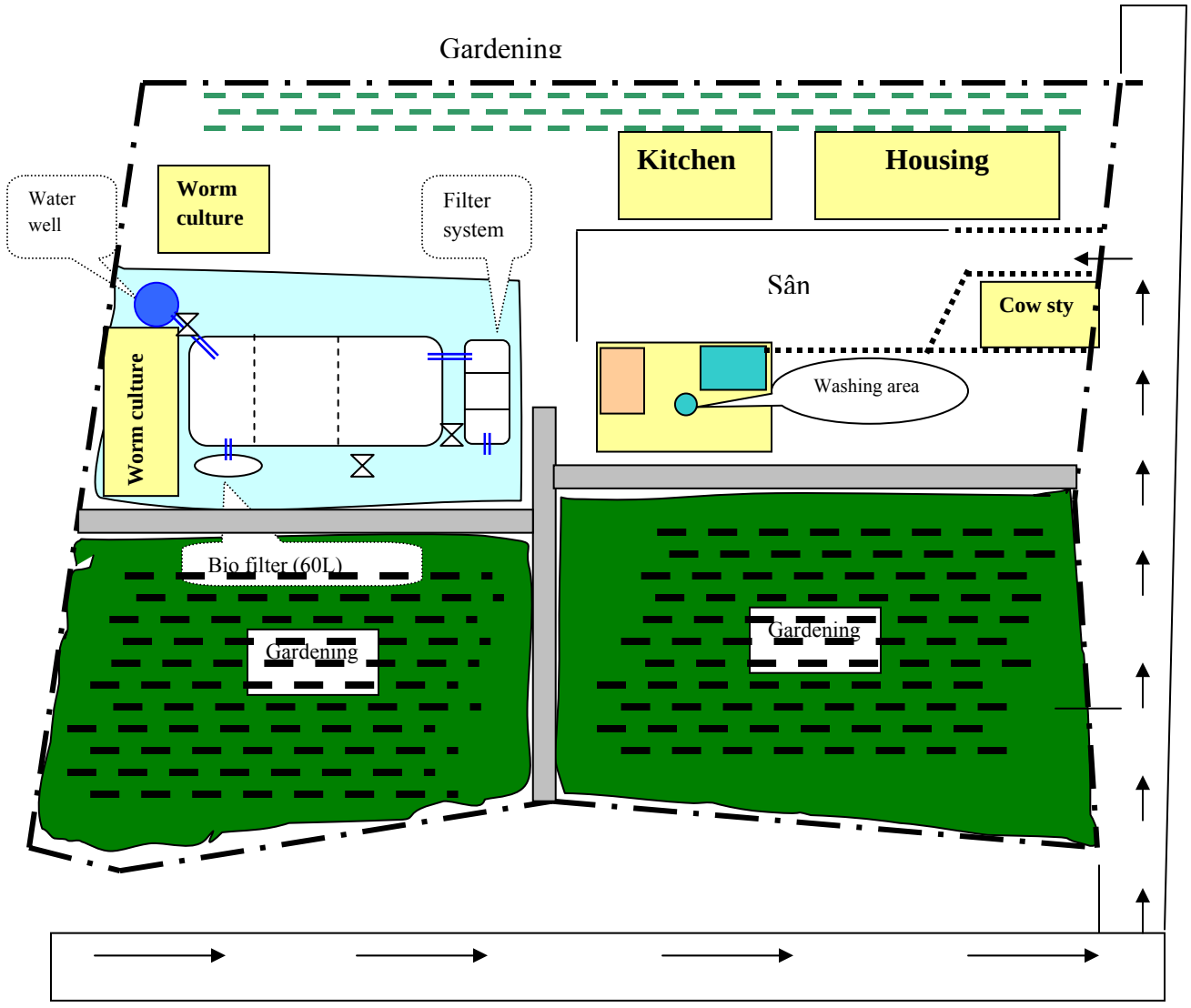

Figure 3: Diagram of recirculation system in an integrated farming (Mr. Tung)

Snake head (*Channa channa*)

Snake head is proposed to part-replace traditional species. This species is suitable for both ponds and tanks of in which traditional carp and tilapia species struggle to survive.. For families without pond, tanks for snake head are very practical and efficient. In the absence of trashfish, earthworms are expected to replace this food source for snake heads. Snake head can be cultured up to density 70 fish/m², giving a maximum capacity of 70 kg/m². This capacity is even better than cage aquaculture. However, to be safe, a density of 35 fish/m² is highly recommended.

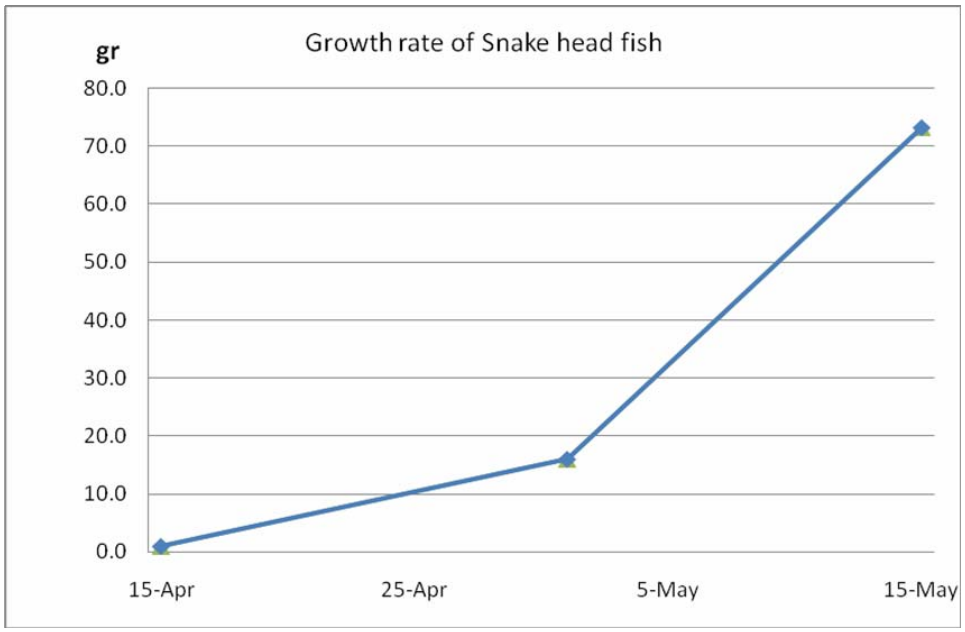

Figure 4: Growth of Snake head fish in tank in Ha Tinh

Table 4: Economic analysis of Snake head

Cost	Amount (VND)
Tanks (2 tanks x 20 m² each) with depreciation	1,000,000.00
Pumping	300,000.00
Fingerling cost (2000 ind.)	2,000,000.00
Feed (trash fish)	19,800,000.00
Labor cost (for 4 months)	3,600,000.00
Sub total	26,700,000.00
Gross profit	36,000,000.00
Net profit	9,300,000.00
ROI	34.83

from the Table 4 shows that the main input cost for snake head culture is from feed, occupying 74% of the total cost.. However, even with high input for feed, the net profit is very acceptable with VND 232.500/m² land used. ROI also shows high returns within 4 months of cultivation.

It is expected that introduction of earthworms as a replacement of trash fish will increase the production cycles of snakeheads to 2.5 per year. Simultaneously, , the investment can be reduced from VND million 26.7 to million 6.9.

Frogs (*Rana rugulosa*)

As advantages of frog production facilities are yet to be established in the project, it is expected that frog culture will have many advantages:

Low input costs and low land requirements as existing water bodies can be used.;

Production cycle is short, about 3 months, and thus reduces risks;

Markets are existing as the frogs have traditional uses in Vietnamese culture

Frog production is considered to be sustainable and environmentally safe as no effluents are generated.

Table 5: Economic analysis of frog cage aquaculture

Cost	Amount (VND)
Nets	250,000.00
Cages (7 m³) and labor	180,000.00
Fingerling	400,000.00
Feed	1,680,000.00
Labor cost	900,000.00
Other	100,000.00
Sub total	3,510,000.00
Gross profit	6,300,000.00
Net profit	2,790,000.00
ROI	79.49

Frogs are considered as added income which utilizes the pond surface only. It is economically good as it provides a higher ROI (Table 5).

Expected outcomes

Higher return -Preliminary results have indicated that the income generated by the households of demonstration sites of the project have started to improve.

Better nutrient cycling – Better utilization of the existing waste through efficient nutrient cycling between the various components of the VAC farming has resulted in less water pollution and improved sustainability of the entire VAC operations. .

Value adding and product diversity - The addition of new species like, eels, snakeheads, earthworms and frogs will help in diversifying the markets and reducing production risks.