RURAL LIVELIHOOD SUPPORT THROUGH IAA IN KIGALI (RWANDA)

Developed by:

Mahassin Ahmed Ibrahim
Francis SR Phiri
Eileen Nkondola
Phillip K Ruto
Stephanie Kamondo

(ABBASSA-WFC TRAINED EXPERTS GROUP)

This project is the outcome of a group efforts to who credit and technical responsibility go. This project is based on an assignment which was given to course participants and supervised by Dr. Abdel Rahman El Gamal as a part of "Warm Water Fish Production" Training course". This course is organized by the Egyptian International Centre for Agriculture - (EICA) in cooperation with Japan International Cooperation Agency (JICA) . Names of the team members are shown above.

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PROPOSAL SUMMARY

- Integrated fish farming, is the practice of growing fish and other agricultural enterprises together, has a number of advantages over other farming systems, ensuring a well organised waste and by-product recycle for permaculture, as well as diversified income.
- The project will be piloted in Kigali - Rwanda, by integrating Oreochromis niloticus, with ducks and other horticultural crops like tomato, cabbage etc
- The project plans to establish a manageable integrated fish farm model for adoption by the people of Rwanda, thereby contributing towards sustainable economic growth as agriculture remains a top-priority economic tool in the country and the African region as a whole.
- Expected production is 2.4 tons of fish per year.

INTRODUCTION

- Aquaculture has for sometime not thoroughly suited to the needs and resources of small holder farmers in Sub-Saharan Africa i.e. food and income demands.
- Farmers are generally reluctant to abandon their more traditional farming enterprises in order to undertake an enterprise with which they are unfamiliar and which will require a large investment in terms of costs of labour.
- For these reasons aquaculture which forms an integral (and usually minor) part of other farming practices is often more suited to the needs of resource-limited smallholder farmers.
- This approach has been referred to as "Integrated Resources Management" (IRM) and the farming systems are known as Integrated Agriculture-Aquaculture (IAA) systems.
- IAA systems promote species diversification and nutrient recycling so they are more environmentally sustainable than most traditional farming practices which have resulted in widespread soil erosion and desertification in Africa.
- Success of the systems must however depend ultimately on their profitability: if they are not profitable, then farmers will not adopt them.
- The concepts behind IAA is that household wastes and by-products generated from one form of agriculture are used as inputs for other components in the system.

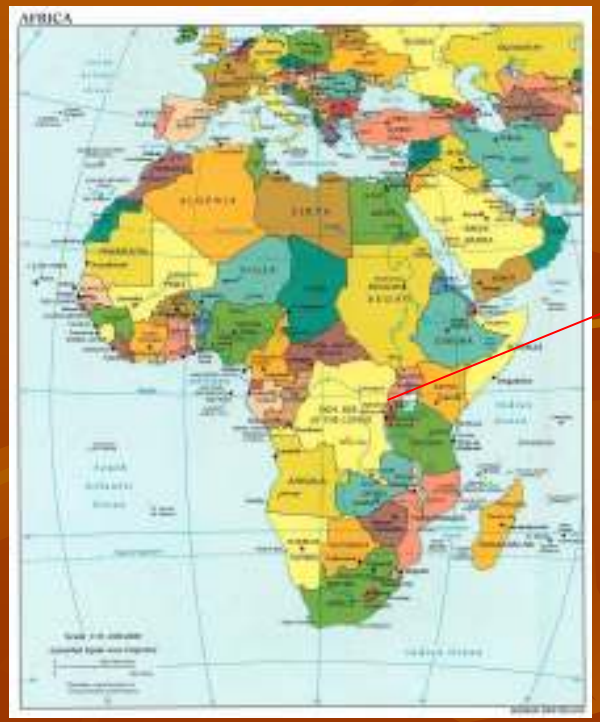
AIM OF PROJECT

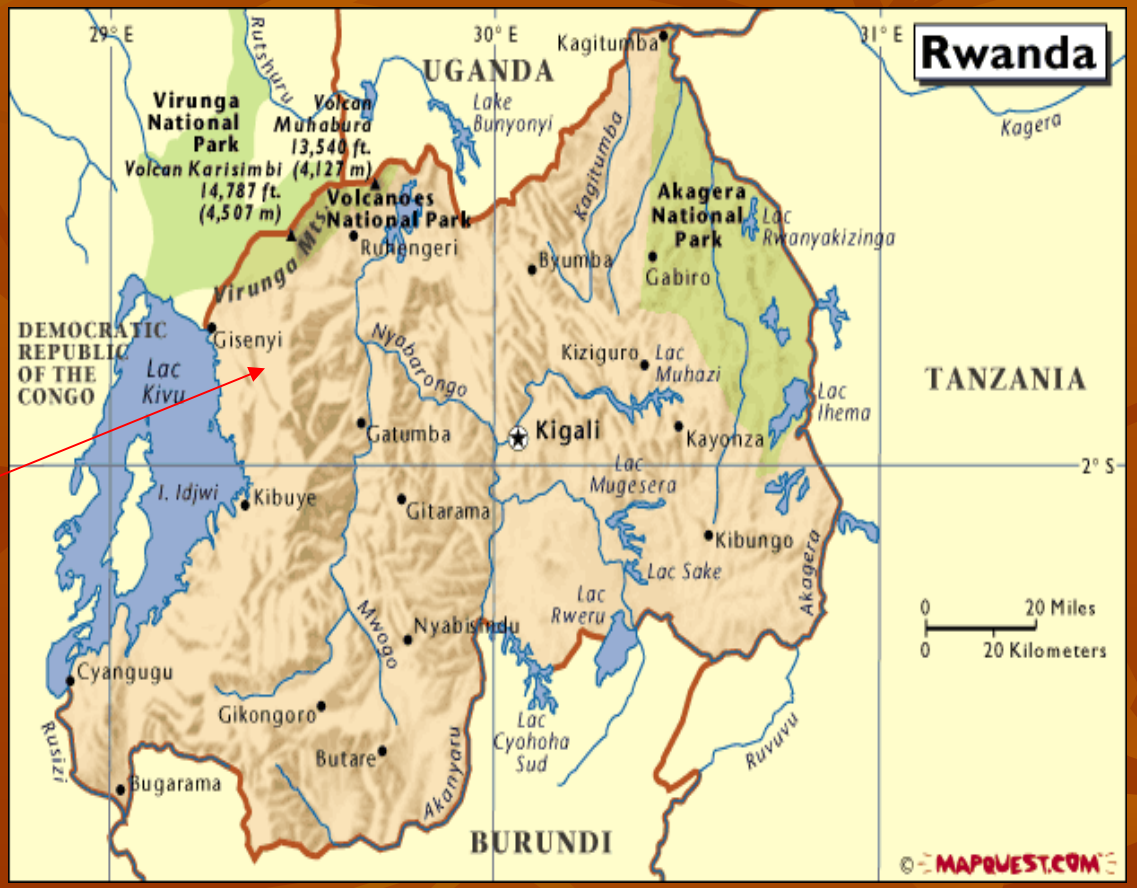
- to establish a model for economically viable fish farms under the IAA theme with better local available resources utilisation to ensure augmented food and income base.

PROJECT OBJECTIVES

- promote income diversification and nutrient recycling so that fish farms are more environmentally sustainable than most traditional farming practices which have resulted in widespread soil erosion and desertification in Africa.
- establish a demonstration model for adoption on how integrated agriculture / aquaculture works based on local conditions and locally available resources.

MAPS OF AFRICA AND RWANDA





LOCATION AND JUSTIFICATION

- The project will be implemented in Rwanda.
  - deficiency in the IAA system as well as the countries' low fish uptake which is largely attributed to low inland fish production.
- Fish production in Rwanda is so low in that the country has a production of 7100 tons of fish from both the natural and aquaculture fisheries.
  - 1239 is consumed within the country with a per capita consumption of 0.3kg.
- The small consumption rate is based on the existing variations in meat – fish preference due to abundance as well as price variation and this has a bearing on fish uptake.
- This project is deemed at increasing fish production levels by:-
  - ensuring that retention levels of potential farmers is improving by keeping the practice in continued closeness with the usual farming systems that are common to local farmers.
  - ensuring increased economic returns if compared with other farming practices.
- The project will also address one of the pillars for country's sustainable economic growth as stipulated in the growth strategy (The Vision 2020), where fish production is expected to go to 17,365 tons by 2010 and 24,560 tons by 2020 and assume per capita consumption of 1 and 2 kg respectively.

ADVANTAGES OF INTEGRATED FISH FARMING

IAA production system ensures:-

- creation of micro-economic systems that recycles resources thereby reducing organic pollution.
- increased food supply by enhancing use of manure and minimising the dependency on formulated feed which is more costly and not economically viable in a rural setting by making conscious use of land, water, pond silt and livestock waste to increase food supply.
- with due respect to the above, reduced input costs as the farm will produce its own fertilizers and feeds thereby reducing operational costs which are a cause to disappointing and disheartening results in most fish farms in developing countries.
- enhanced employment opportunities due to the diverse economic activities that are synonymous to IAA.
- improved overall income by supplementing capital income from all-fish culture with poultry and vegetable investment.
- enhanced food sustainability with emphasis in nutritional stability which enhances a self-reliance culture.

ASSUMPTIONS FOR PROJECT SUCCESS

Enhanced socio-economic benefits of the project will depend on the following assumptions:-

- low fish mortality from fry to fingerling stage as this is the most critical point in the farming process, since the farm will depend on on-farm fingerling production as there is a deficiency in fingerling production in the whole of Rwanda.
- stability of prices as unconscious price adjustments will have diverse effects on the project results i-e rise in prices of materials will cause panic in the implementation process as can be the case with downward adjustments in selling prices of fish which will affect the economic returns of the farm.
- no occurrence of draught hence an ensured continue water supply for the fish ponds.

CULTURE TYPE

Mono-culture of tilapia.

- The culture system will be mono-culture, which is the rearing of one species per rearing unit. This culture system has advantages over polyculture in that in the existing conditions:-
- It is relatively less costly
- It is easier in operation and can be readily applied under rural conditions
- It can be easily copied by rural farmers as compared to poly culture.

CULTURE TYPE cont'd

Why tilapia?

- The choice of tilapia was based on the:-
- high consumer preference in Africa as a whole and higher preference in Rwanda.
- enjoys wide range of temperature systems.
- easiness to spawn in relatively simple facilities.
- feeds on wide range of feed stuffs including natural food which provides higher flexibility towards economic production.
- its high resistance to diseases.
- its higher market price as compared to other species i.e catfish.
- its success stories around the African region in diverse aquaculture systems.

Why and how to produce all-male tilapia?

To ensure maxim returns, only male tilapia will be cultured. The choice of this system is based on:-

- High productivity (ABW) in male fish than in females based on average growth rate and size at first maturity.
- To minimise unnecessary propagation that taxes on energy requirements that is essential for growth as well as control the increased biomass that affect a farm's carrying capacity.

All-male tilapia will be obtained through hand sexing (the use of hormone in sex reversal is banned in Rwanda)

PRODUCTION SYSTEM

- The production system will be semi-intensive
- This system will enhance the abundance of natural food by making sure that pond water is always rich in nutrients to boost primary productivity {phytoplankton (microscopic plants), zooplankton (microscopic animals)}.
- Fertilization of ponds will increase their abundance.

ADVANTAGES OF DUCKS

- Duck droppings will fertilize the pond.
- Ducks will keep water plants in check.
- Ducks will loosen the pond bottom with their dabbling and help in release of nutrients from the soil, which will increase pond productivity.
- Ducks will be aerating the water while swimming.

ADVANTAGES OF HORTICULTURE

- provision of additional income from growing fruits and vegetables on the pond embankment that normally lies fallow.
- diversify farm income.
- nutrient-rich pond effluent will fertilizer horticulture crops, thereby reducing the need/cost of fertilizers (mineral/organic).
- fruit/vegetable by-products could be incorporated in fish feeding whether directly as well as in composted form.
- plants on the embankment will strengthen the dikes.

PROJECT ELEMENTS

- SITE SELECTION
  - Availability of permanent source of water.
  - Good soil type (with high water retention) preferably loamy clay soils.
  - A good gentle slope to enhance filling and draining of ponds by gravity as well as avoiding ponds wash away due to runoff water.
  - Nearness and easy accessibility to the site to ensure conscious management and security against predators as successful pond management is the basis of profitable fish culture.
  - Availability of management and skilled labour.

POND ELEMENTS

1. Site selection.

A suitable site will be selected for the construction of the farm in consideration of the following factors:-

- Availability of permanent source of water.
- Good soil type (with high water retention) preferably loamy clay soils.
- A good gentle slope to enhance filling and draining of ponds by gravity as well as avoiding ponds wash away due to runoff water.
- Nearness and easy accessibility to the site to ensure conscious management and security against predators as successful pond management is the basis of profitable fish culture.
- Availability of management and skilled labour.

POND ELEMENTS cont'd

The farm will be designed and laid out in a way that, there will be:

- 20 ponds of 500m² each with the following specifications:-
- depth 1.5m
- length 25m
- width 20m
- dyke 2m
- inside slope 1:2
- outside slope 1:3
- freeboard 30cm
- harvest basin (3x3)m

Duck facilities

20 duck houses of 7m² (3.5x2)

A 56m² -farm house will be needed: (14 m x 4 m)

POND CONSTRUCTION

The project will have three types of ponds

- Brood stock ponds
- Nursery ponds
- Rearing ponds

Note: manual labor will be used in the construction of ponds, farm, duck houses, fence etc.

Water supply system

- Water supply and drainage into/from the ponds will be by gravity.
- Pond filling will be done by a network of PVC pipes (4inches) which will draw water from the canal that will be constructed from the lake.
- The ponds will subsequently be drained by drainage pipes (4inches PVC) into a drainage canal that will be used for irrigating horticultural crops.

FARM OPERATIONS

Acquisition of brood stock

- The farm will be stocked using fingerlings produced right there at the farm. This will require acquisition of brood stock. The brood will be collected from Lake Muhazi
- The brood fish will be captured using fish traps and taken live to the farm in a plastic tank with considerable aeration to ease oxygen deficiency.

FRY PRODUCTION

- 28 brood fish (21 females and 7 males) will be stocked in 2 (200m³) and conditioned for 15 days to make them ready for spawning in hapas of (4x7)m at a stocking density of 3 females to 1 male (each pond will host 4 hapas).
- The brood fish will be fed once a day with a 25% protein feed at a rate of 2% body weight.
- Fry will be collected at an interval of 23 days to have fry of 100mg average body weight. The collected fry will be transferred to earthen ponds for rearing to fingering ponds, where they will be reared until reaching 3-5grams.
- In the rearing ponds, the fry will be fed to a feed with 30-40% protein at a feeding rate of 10% of total body weight. However the feed will be fed in 6 rations at a feeding rate/frequency of 2hrs.

GROW OUT

- When the fingerlings are ready for stocking in grow-out ponds, they will be transferred to the grow-out ponds
- Will be stocked at a stocking rate of 6 fish per m^3.
- Fish will feed on natural food (planktons) which will be guaranteed be the continuous fertilisation of the ponds by the effects of proximity of ducks to the ponds.
- Since natural foods are not always available in sufficient quantity to provide adequate nutrition for fish growth; supplementary feed will be given to the fish at regular intervals. The feed will be given at various rates in regards average body weight. As outlined in the table below.
- There will be sampling of the stock every month to establish fish growth rate as well as to assist in adjustment of feeding rate and to understand fish condition during the culture period.
- Harvesting of market size fish (400-500g) will be done after a culture period of 6 months.

PROGRESS INDICATORS

- To ensure smooth running of the project towards achieving the project objectives, there will be conscious checks and balances on the progress the project will be making. The indicators that the project will use to measure its success will be:-

(Refer to Microsoft word table on Progress indicators)

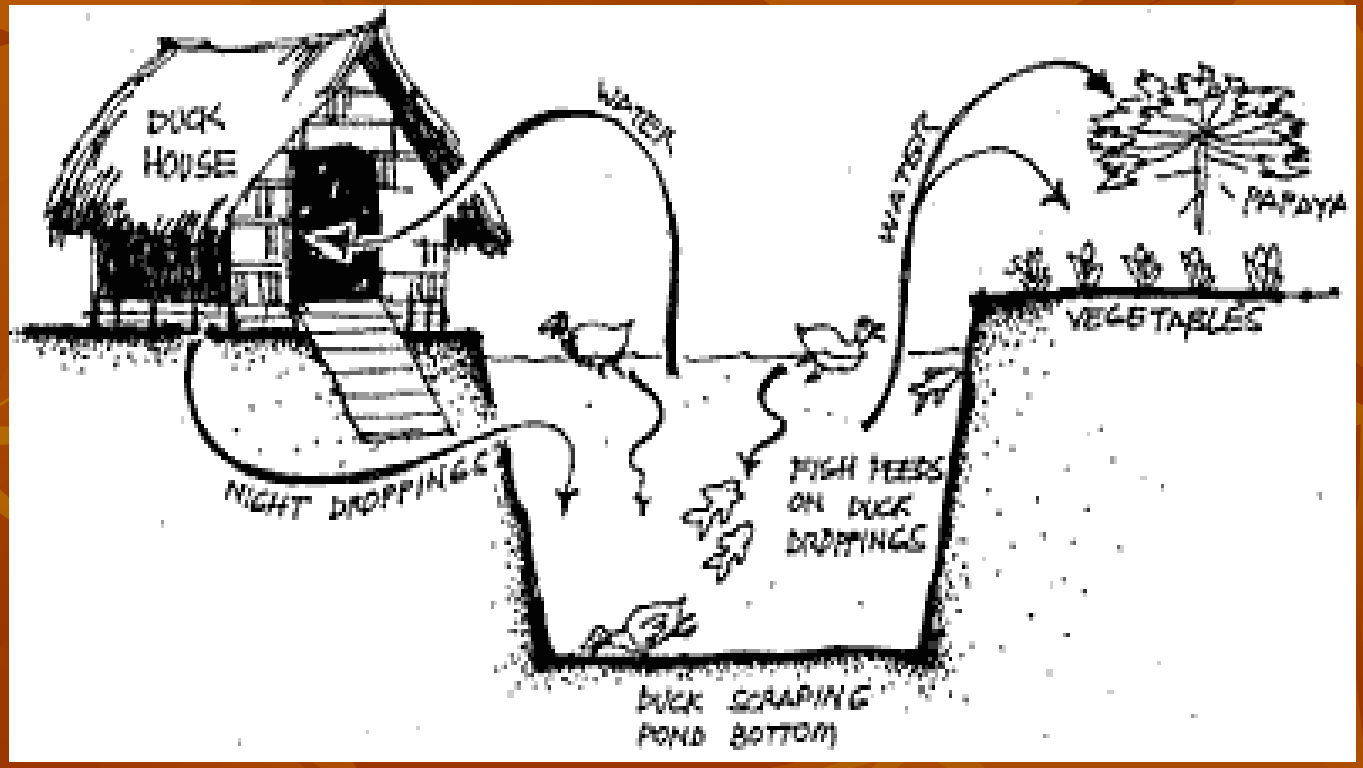
FERTILIZATION

Duck farming

- 15 (12-16 month old) ducks will be stocked in a duck house built over the pond surface (500m²). This number will ensure sufficient fertilization of the pond.

- When ducks are let swimming on pond surface, they will feed on natural food from the pond with only very little supplementary feed which can come from household wastes, such as kitchen leftovers, maize husks, rice bran, broken rice and spoiled cereals, at a feeding rate of 50g/bird/day.

FISH-DUCK FARMING MATERIAL FLOW



- SHUKRAN (Sudan)
- ZIKOMO (Malawi)
- ASANTE (Tanzania)
- MURAKODZE (Rwanda)