Summary:
Fish farming in Egypt is not formally recognized as an agricultural activity, so aquaculture cannot use water from irrigation canals. However, fish are raised as primary or secondary crops in combination with fruit and other plant crops. A study by the WorldFish Center found farms could efficiently use well water to intensively raise tilapia in aerated tanks and use the effluent to irrigate fruit trees, vegetables and flowers. Two other farms used water from nearly Nile irrigation canals to fill water storage reservoirs stocked with tilapia. Crops and fruit were the main source of revenue for these farms, and fish reflected a minor secondary crop.

With annual production of 705,000 mt in 2009, Egypt is by far the largest producer of farmed fish in Africa. Aquaculture provides 65% of the fish consumed in Egypt. Nile tilapia make up 55% of the farmed fish production methods and fall in two categories. The first category uses underground water sources and applies intensive fish production techniques involving concrete basins, aeration and high fish densities. The method of obtaining from the Nile drainage is used to irrigate crops and fruits. The second category consists of primarily agriculture farms that grow an additional fish crop in reservoirs that were built to store Nile water for irrigating crops and trees during periods when the local irrigation canal does not contain sufficient water. Double use of water seems to make sense, especially in a country where freshwater resources are limited. But are farms that combine different production systems indeed benefiting from the integration of fish with crops or fruit trees?

Quantitative data on water use at Egyptian fish farms, especially integrated fish farms, are scarce. To obtain such data and assess the impacts of fish farming in integrated systems, the water use and fish production of four farms were studied in 2010 by scientists of the WorldFish Center, an international research institute based in Abbassa, Egypt. This study was financed by the Netherlands Ministry of Economic Affairs, Agriculture and Innovation.

Research Study
Four commercial farms based in the Sharkia, North Sinai and Behera Governorates were visited monthly between May and December 2010 by researchers who collected data on farm design, water use and farm production. Also, samples of the water source and the water in the ponds were analyzed in the WorldFish Center laboratory.

Integrated Farms
About a dozen commercial farms have integrated aquaculture and agricultural practices. Such farms use semi-intensive or intensive fish production methods and fall in two categories. The first category uses underground water sources and applies intensive fish production techniques involving concrete basins, aeration and high fish densities. The method of obtaining from the Nile drainage is used to irrigate crops and fruits. The second category consists of primarily agriculture farms that grow an additional fish crop in reservoirs that were built to store Nile water for irrigating crops and trees during periods when the local irrigation canal does not contain sufficient water. Double use of water seems to make sense, especially in a country where freshwater resources are limited. But are farms that combine different production systems indeed benefiting from the integration of fish with crops or fruit trees?

Quantitative data on water use at Egyptian fish farms, especially integrated fish farms, are scarce. To obtain such data and assess the impacts of fish farming in integrated systems, the water use and fish production of four farms were studied in 2010 by scientists of the WorldFish Center, an international research institute based in Abbassa, Egypt. This study was financed by the Netherlands Ministry of Economic Affairs, Agriculture and Innovation.
from nearby Nile irrigation canals to fill water storage reservoirs. The reservoirs were stocked with tilapia. To avoid blockages of the drip irrigation systems, the water passed through sand filters before entering the irrigation tubes and hoses.

Young banana plants are irrigated via a drip system with effluent from an intensive tilapia farm.

The authors estimated the fertilizer savings in two ways. First, they compared the cost of the amount of fertilizer applied with the cost of the amount recommended by the Horticulture Research Institute under Ministry of Agriculture and Land Reform. Second, they referenced the water quality analyses of the samples taken monthly at the farms.

With data on the total volume of water that passed through the fish basins and reservoirs, and the difference between the source water and pond drainage water with regard to average total nitrogen, available phosphorus and potassium content, the amounts of these plant nutrients added to the irrigation water as a result of the fish farming could be estimated. The estimates are summarized in Table 2.

It is known that especially phosphate tends to attach itself to sediments. A sand filter placed between the fish culture component and the orchards and fields removed sediments from the water, and as a result, an unknown but possibly large part of the phosphate excreted with the fish feces may not have reached the crops.

The two farms that used crops as a major source of income were already well established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.

The two farms that used crops as a major source of income already had well-established and had gross revenue of EGP 2.36 and 2.46/m\(^3\) (U.S. $0.41 and 0.43/m\(^3\)) of water used. However, no data on the costs were collected in this study, and hence, no conclusion about the profitability of the farms could be drawn.

For one farm, the volume of water available in the storage basins would allow a greater number of fingerlings to be stocked and higher fish production without any extra water use or extra aeration. Farm 4 had delayed the harvest of the fish due to the low prices paid for tilapia at the time. Hence, this farm had no income from the sale of fish to report.