



Increasing fish farm profitability through aquaculture best management practice training in Egypt



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ABSTRACT

Egyptian aquaculture production has grown rapidly to over one million tons per year so that it now provides most of the country's fish supply. However, Egyptian fish farmers have received little extension advice or training. An intervention starting in 2012 aimed to address this gap by providing best management practice (BMP) training for pondbased tilapia monoculture and tilapia-mullet polyculture fish farmers. A series of field-based training modules were developed and designed with the participation of leading fish farmers and delivered through private sector farmer-trainers to over 2400 fish farm owners and managers. This paper reports on the results of an impact assessment survey carried out in 2015 comparing fish farm performance, production and profitability in randomly selected farms where the manager had received and was applying the principles of BMP training (BMP) and farms where the manager had not received IEIDEAS project training (control). The results show that although the two groups were very similar in terms of general farm characteristics, BMP farms were more likely to practice tilapia-mullet polyculture than monoculture of tilapia. The main BMP training messages apparent in the results were improved feed and fertilizer management. This resulted in more efficient food conversion ratios in BMP farms compared to control farms. Average fish yields and values were similar between the two groups, although BMP farms produced less small-sized tilapia and more mullet than the control farms. Lower feed costs resulted in significantly lower operating costs in BMP farms compared to control farms, whereas fixed costs were similar for the two groups. Average net profits were significantly higher in BMP farms compared to control farms equivalent to additional profits of over \$15,000 for an average farm size of 7.5 hectares. Taking into account the number of farmers trained and BMP adoption rates suggests that \$18.9 million additional profits were generated through the intervention in 2014. The results demonstrate that fish farms in mature aquaculture systems can benefit significantly from the adoption of improved farm management practices suggesting that similar approaches, including field-based BMP training and the use of private sector farmer-trainers should be used to accelerate the development of nascent aquaculture sectors in other parts of Africa.

Statement of relevance: While it is often assumed that training will benefit fish farmers the true economic benefits have rarely been documented. This research demonstrates clear improvements in the profitability of Egyptian fish farmers following best management practice training.

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1. Introduction

Aquaculture production has risen rapidly in Egypt since the early 1980's when it was made a priority sector for development by the government. Large areas of land were set aside for aquaculture development on the southern edges of the Nile Delta lakes, Manzala, Burullus Mariout and Edku as well as the inland Lake Quaron. Feed mills, hatcheries and research farms were established along with an institutional framework including a new commercially focused agency, the General

Authority for Fisheries Resources Development under the Ministry of Agriculture and Land Reclamation, while key staff were trained in pond aquaculture techniques in the United States (El-Gayar, 2003). Pond-based aquaculture of tilapia and mullet was highly profitable which resulted in private-sector investment, and total aquaculture production grew from only 19 thousand tons per year (t/yr) in 1980 to 340 thousand t/yr in 2000, reaching an estimated total of 1.137 million t/yr in 2014. Aquaculture represented 77% of total Egyptian fish production in 2014 compared to only 54% in 2004 (GAFRD, 2016). Eighty-five percent of aquaculture production comes from ponds, concentrated in discrete aquaculture zones covering 115,000 ha close to the Nile Delta lakes where land is leased to, or is owned by fish farms, supplied with water from canals draining from agricultural irrigation systems while

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the remaining 15% comes from fish cages, rice fields and intensive farms (Nasr-Allah et al., 2012).

Although the Egyptian aquaculture sector has developed over several decades, many fish farmers have received little extension advice or training. This was recognized as a problem during a value chain analysis (VCA) of Egyptian aquaculture carried out in 2011 (Macfadyen et al., 2012) which found that fish farmers complained about declining profitability due to increasing production costs and static or declining selling prices for their fish. The VCA study recommended to increase fish farm profits by introducing the genetically improved Abbassa strain of Nile tilapia and designing and delivering best management practice training for the fish farmers. It was assumed that these actions would lead to increased aquaculture production and employment as the VCA suggested that each 100 t/yr of production resulted in 14 full-time jobs along the aquaculture value chain.

The adoption of best or better management practices (BMPs) has been widely promoted from the point of view of improving the environmental performance of fish farms and is often aligned with the introduction of certification schemes such as GlobalGAP or Aquaculture Stewardship Council (Frimpong et al., 2014). However, this approach can suffer from low adoption rates because it is viewed as an additional burden for the fish farmer, particularly when there is no obvious market advantage to participation in such schemes (Boyd et al., 2013).

In the current study, the introduction of best management practice training was designed from the start to concentrate on improving overall farm performance which was also expected to result in additional environmental benefits through improved feed efficiencies.

This approach has been supported by several authors who suggest that strategies integrating profitability and efficiency are an important factor affecting the adoption of aquaculture BMPs (Engle et al., 2005; Engle and Valderrama, 2004; Frimpong et al., 2014). Demonstrating profitability of better management practices will encourage their adoption by fish farmers, which will both further increase farm profits and protect the environment (Ansah and Frimpong, 2015; Poot-López et al., 2014). The positive outcomes of BMPs adoption include increased tilapia production, lower fish feed costs, and reduce impact of aquaculture on surrounding environment (Ansah et al., 2013; Ansah and Frimpong 2015; Klinger and Naylor, 2012; Poot-López et al., 2014).

The BMP training system applied in Egypt followed a field survey to document the dominant aquaculture practices in the main fish farming zones. A group of expert, mainly private-sector Egyptian fish farmers then participated in a planning workshop to define Egyptian aquaculture BMPs and helped to design a series of ten, short, field-based, practical training modules covering subjects from pond construction and preparation through to post-harvest handling. Some of these experts, along with other private-sector fish farmers and consultants went on to become BMP trainers, delivering field-based training in short sessions, usually delivered at the pond-side as each training module included practical demonstration of a skill. In each session they would cover two or three of the modules with a group of around ten fish farmers. The trainers were paid a small allowance to deliver the training and were encouraged to make sure that, where possible, fish farmers completed the entire course. The course evolved into 15 individual topics meaning that each fish farmer attended around five training sessions over a period of time. After a three-year implementation period, ending in December 2014, more than 3000 training sessions had been delivered across five governorates, while over 2400 fish farmers and fish farm managers had completed the 15 module BMP training course (Fig. 1; Table 1).

An impact assessment was carried out in 2015 covering the BMP training carried out in four governorates: Behera, Fayoum, Kafr El Sheikh and Sharkia. While the study focused on impacts from use of the Abbassa improved strain of Nile tilapia as well as the adoption of BMPs by fish farmers, this paper is concerned with the adoption and impacts of BMPs on fish farm incomes, production and profits only.



Fig. 1. Location of study governorates.

2. Methodology

2.1. Study methodology and approach

A farmer and fish farm database was compiled using data collected during the BMP training as well as using sales records from hatcheries disseminating seed of the Abbassa improved strain. Additional data came from databases held by the General Authority for Fish Resources Development (GAFRD) on licensed fish farms and farms that have been fined for operating without a license. The total number in the database stood at 3715 farms. The total number of fish farms in Egypt is unknown but has been estimated at between 6000 and 12,000.

A stratified random sampling framework was established with the aim of comparing results from the interventions. The groups used for comparison were as follows: (1) farms where the fish farm operator had received best management practice training (BMP or treatment) and the practices were being applied; and (2) a control group of fish farms that had no involvement with the training (control).

Farmers in the BMP group were pre-qualified for selection through a BMP adoption survey where fish farmers were asked if they had changed their practices. However, it should be noted that it was not possible to physically verify whether they had actually applied the

Table 1
Number of training sessions delivered in each governorate.

Governorate	Number of training sessions
Kafr El Sheikh	1340
Sharkia	886
Fayoum	635
Behera	382
Mineya	44

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