Integrated MultiTrophic Aquaculture (IMTA) is based on an ecosystem approach framework, where the foraging of aquaculture species from different trophic levels with complementary ecosystem functions allows one species' unmet need for waste and nutrients and by-products (in particulate and dissolved forms) to be converted and converted into feed. waste; feed and energy for the other species, taking advantage of synergistic interaction between species. Moreover, the combination of IMTA with hydroponics allows to minimize water consumption, avoids the discharge of effluents enriched in dissolved nitrogen (N) and phosphorus (P) from IMTA into ground or surface water, and decreases the need of using crop fertilizers of mineral origin made from depleting natural resources by recovering the nutrients from wastewater (converting fish excreta into high-value products for plants).

The present study, conducted in the frame of HortiMED Hasso PRIMA Project (Grant Number 1145) was part of an effort to be evaluated at the feasibility of combining Integrated MultiTrophic Aquaculture (IMTA) including the production of Nile tilapia (Oreochromis niloticus), mullus (Liza marina), carp/lake bream (Cyprinus carpio), and hydrilla verticillata and hyacinth (Vallisneria americana). The main purpose of this project is to produce fish, vegetables, and ornamental plants in an integrated aquaponics system that is sustainable, cost-effective, and environmentally friendly.

**MATERIALS AND METHODS**

The study was conducted at the fish-research station, El-Kanare El-Khayara, of HortiMED (Zulayqa Governorate, Egypt). The experimental project area consists of three plastic greenhouses with a semi-artificial metal structure: (i) Greenhouse A: A greenhouse of 496 m² (33 × 15) with a NFT hydroponics units and a FRS (Feed Recycling System) a hydroponics systems, (ii) Greenhouse B: A greenhouse of 272 m² (20 × 14) with siphon hydroponics systems, and (iii) Greenhouse C: A greenhouse of 228 m² (17 × 13) with a concrete pond of 144 m³ for the production of different aquatic species.

**SYSTEM SETUP & OPERATION:** The system relies on five water pumps and manual ball valves to manage the water flow within the system. The fresh water is pumped from the well water source by a submersible pump (Pump No. 1) to two water tanks at a flow rate of 12 m³/h. Then it flows by gravity into the greenhouse (Pump No. 2) and moves to the remaining aquaponics units by means of a series of pipes. The inlet and outlet manual valves of Greenhouse C are only for emergency use. The sedimentation pond acts as a mechanical filter where a significant part of the solid waste is captured. The water from the sedimentation pond is pumped to a large biological filter of 65 m³ where ammonium is oxidized to nitrate. After the biological filter, the water goes through a sand filter, and then it is pumped either to the Greenhouse C (Pump No.3) or to the Greenhouse B (Pump No.4). Pump No.1 & Pump No.3 can work simultaneously, but normally only Pump No.4 works continuously to provide a continuous water flow in the water recycling system (Aquaponic Units – FRS & FTS units of Greenhouse C – Aquatic Ponds). Within the hydroponic units, the water moves by gravity through the FTS & NFT units at a mass flow of around 1.75 m³/h for each FTS unit and around 2.15 m³/h for each NFT unit. The water exits in a pump pond of 17 m³ (P.N) used for sedimentation and a 3.15 m³ acting as biolife (growth) pond to reduce the total amount of organic matter and sedimentation through reduction and if necessary, to add some additional ammonia. Inside the greenhouse C, the water is diverted to the FTS in the traditional Soil Culture (TSC) units via manual valves, and finally goes to an aerator pond of 70 m³ through an outlet drain. A closed air circulation network distributes air through air nozzles and nano-dose nozzles to the different units of the system. The aeration network relies on air blowers (Siemens & SCHMALZ) that operate one by one alternatively with an interval of 30 minutes by means of automatic timers (24 h/day).

**RESULTS:**

Aquaducts: Nile tilapia fingerlings with an initial weight of 16 ± 1.2 g were placed in the first aquatic pond on 1 May 2021. Day 60, the polyculture of carp/lake bream (mullus) with an initial body weight of 16.49 ± 1.7 g and mullus fingerling with an initial body weight of 1.49 ± 0.25 g was started in the second aquatic pond. Day 60, Liza marina with an initial weight of 3.40 ± 0.99 g were introduced in the fourth aquatic pond (sedimentation pond) to prevent the proliferation of algae. On day 90, 25 freshwater crayfish were distributed in the third pond. Aquatic animals were stocked in ponds according to the availability of their feed. The only aquatic species artificially feed was the Nile tilapia. Tilapia were fed with experimental diet (36% crude protein, 5% lipid and 16% L-Methionine gross energy) at approximately 5% of body weight 6-dm3 per week, three days a day (72, 12 and 10 ± 0.10). Feeding rate based on tilapia biomass was corrected every three weeks by taking a random sample of at least 25% of tilapia and weighing it.

**CONCLUSIONS:**

In IMTA, the combination of aquaponics systems significantly improves its performance because new NUE has been recorded in NUE and water in NUE, aquatic biomass production and FCR, compared to traditional horticulture or aquatic monoculture systems. These results indicate that IMTA aquaponics as an eco-integrated food production system not only has a significant contribution to the aquaculture and crop production systems but also has a methodological strategy for converting nutritive and water.