IMPLEMENTING COMMERCIAL AQUAPONICS IN EUROPE – FIRST RESULTS FROM THE ECOINNOVATION PROJECT ECOPONICS

R. I. Thorarinsdottir

University of Iceland, VR-2, Hjardarhaga 2-6, 107 Reykjavik (Iceland)
E-mail: rith@hi.is

Introduction

Aquaponics is receiving increased interest globally as a sustainable food production method. The commercially available systems are mainly based on the research carried out by Rakocy and his coworkers at the University of Virgin Islands (Rakocy, 1999a,b, 2002, 2009, Rakocy et al., 2001, 2004, 2006, 2009), however, most aquaponics systems so far are small hobby systems well described by Bernstein (Bernstein, 2011). In 2013 the three SMEs BREEN in Spain, IGFF in Denmark and SVINNA in Iceland joined forces together with the University of Iceland and started the EcoInnovation funded project EcoFood from AquaPonics – EcoPonics. The objective is to work towards implementation of commercial aquaponics in Europe introducing pilot plants in these three countries. In Spain the focus is on closing the nutrient cycles, in Denmark urban farming is the main topic and in Iceland the main aim is to increase sustainable food production with direct use of geothermal energy and link the production to experience and educational tourism. The interest for landbased farming of warm water species using the abundant geothermal energy in Iceland has been growing and the warm water species tilapia (Dalsgaard et al., 2013), Senegal sole, sea cucumber, abalone and European lobster have been imported lately. This provides opportunities for developing integrated multitrophic farming methods as aquaponics. In this paper the Icelandic part of the EcoPonics project is presented.

Materials and methods

Tests have been carried out in hybride systems, each consisting of a fish tank, a deep water culture (raft) and a grow bed. Hekla pumice and clay balls, respectively, have been used as the grow media and as biofilter media. Each system consists of a 600 L fish tank, a 2.0x0.6x0.4 m^3 grow bed and a raft system of same size. The plants tested so far are mainly basilica, salad, cucumbers tomatoes, peppers and strawberries. Nile tilapia, *Oreochromis niloticus* was imported to Iceland from Fishgen in UK. The juveniles had an average weight of 7 grams at the start of the experiments. The temperature is maintained at 27°C and the oxygen level is secured with aerators both in the fish tanks and in the raft system. The daily feeding has been on average 4% of the biomass. pH is kept at 7 +/- 0.4 by addition of $CaCO_3$, KOH, $Ca(OH)_2$ and $Mg(OH)_2$. Moreover iron is added as Fe-DTPA.

The first test units were set up in the Iceland Ocean Cluster in Reykjavik and have been open for visitors.

Results

The start-up of the nitrogen cycle building up the necessary microflora of *Nitrosomonas* and *Nitrospira* took appr. 3 weeks. During the activation of the biofilter water exchange was carried out to decrease the levels of ammonia and nitrite. pH, temperature and ammonia is followed with on-line monitoring. The temperature and ammonia levels remain stable, but the pH value drops constantly due to the nitrification process. As the plant biomass increases the pH drop decreases. Also the pH dropped less in the systems with Hekla pumice compared to the system with clay balls.

The first results show that leafy greens, e.g. salad and basilica grow extremely well in the systems. Flowering plants require much higher nutrient levels and thus, the fruits are taking much longer time to form than in conventional systems.

The tilapia has remained in good condition.

The aquaponics set up has received a lot of interest from visitors of all age groups and from many different nations.

Discussion and conclusion

The first results show that production of leafy greens and tilapia provide excellent synergy effects. However, the co-production of flowering plants needs more research. The Hekla pumice is an excellent grow media for the systems and provides better pH stabilisation than the clayball material.

Biomass calculations will be carried out in the summer 2014 and further comparison tests will be done on the growth rate and quality of different plant species. Moreover, alternative ways for pH stabilisation will be tested.

The next steps will also include economic calculations on the production part as well as on including experience and educational tourism to the business idea.

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