

A New Aquaponics Training Program for Stellenbosch University

Henk Stander

Aquaculture, Department of Animal Science, Faculty of AgriSciences,
University of Stellenbosch

Aquaponics is the combination of aquaculture and hydroponic technology to grow both fish and plants together in a closed-loop system. While aquaponics can play a role in increasing food security, it may also be a potential educational tool because of its interdisciplinary nature and required technological skill set. With aquaponics, students could conduct hands-on activities involving chemistry, physics, and biology to solidify their understanding of a range of theories. Beyond standard science, technology, engineering and mathematic principles, aquaponics may be related to projects on sustainability, environmental science, agriculture, the food system, health, economics, business, and marketing. The interdisciplinary nature of aquaponics may make it an appealing tool for education, yet that same aspect may also make an aquaponics system challenging to implement and manage. Educators require appropriate training materials and training courses for their educational settings. The endeavours of the Aquaculture unit at Stellenbosch University and its Industry Partners aim to develop digital and interactive aquaponics study programmes for South Africa and across the SADC region by way of a hybrid teaching approach comprising of pre-academic online courses, scientific graduate studies, live practical training workshops and accompanying formats such as virtual workshops.

Aim of the Aquaponics Training Program:

Staff members from the Aquaculture unit at Stellenbosch University are busy developing an entire new study program for Aquaponics Teaching and Training. A MOU was recently signed with two Industry Partners, Desertfoods International in Germany, and Integrated Aquaculture in Gauteng. It is the firm belief of the parties that aquaponics will play an essential role in supplying the planet, semi-arid and arid areas, with healthy and safe fresh produce and that aquaponics farming is less harmful to the environment than conventional agriculture. The parties are convinced that people make companies with the cooperation inspired and committed to helping all stakeholders of the evolving aquaponics industry to develop their highest potentials. With the right knowledge of modern aquaponics growing techniques and business practices, local aquaponics farmers will function as catalyst in the exponentially growing local food economy. The purpose of the cooperation is to educate and empower them to make that happen. The parties agree that the study programme shall comply with the UN development goals, global climate protection ideals as well as the ethical standards of the countries of intervention. Special importance shall also be given to water conservation, animal protection, waste-stream reduction, and the year-round supply of nutritious, protein-rich, and organically grown fresh produce sourced from local aquaponics food production facilities requiring



substantially less land than conventional farming practices.

The aim of the cooperation is to establish a world-class study programme for a vast number of outstanding young academic talents, and/or conventional smallholder farmers and farm workers in South Africa and across the Southern African Development Community (“SADC”) to develop scientific and practical skills in the new-age of sustainable food production methodology called aquaponics. Aquaponics as a technology is representing an innovative and utmost land-efficient and water-saving form of agriculture that combines raising fish (recirculating aquaculture) with soil-less plant culture (hydroponics).

Teaching Media:

The main teaching media for the study programme will be digital tools such as cell phones, tablet PCs, notebooks, and desktop PCs. As far as possible, teaching didactics shall use any form of visualization. This includes video, audio, graphics, animation, virtual reality, best-practice scenarios, e-scripts, guides, checklists, and other tools. Sole teaching language of the study programme shall be English with teaching formats comprising of online or hybrid courses as well as virtual events. The parties are hundred percent aligned that a well-balanced split between theory and practice is essential with

the ‘train with purpose approach’ representing the core of criteria for all courses, studies, and events to be deployed under the study programme. Students are expected to spend a minimum number of practical hours on aquaponics farms either operated as demonstration, R&D and competence facility or commercial at-scale food production facility. Practical hours can count towards temporary or full-time placement and shall facilitate employment. Practical and vocational training shall be considered as part of mentoring and tracking student progress to meaning employment or business development. To impart cutting-edge know-how and technology the farms shall meet certain standards both system and design-wise. The profile of the scientists and practitioners acting as virtual lecturers and/or on-site trainers shall also meet certain pre-requisites with criteria catalogue to be jointly defined by the Parties.

Target Market:

The course attendees of the study programme shall comprise of a socially diverse student population representing a key component of the accomplishments the parties are jointly aiming to achieve with the cooperation. To provide access to the study programme and secure a more diverse range of students, the parties jointly intend to provide financial assistance to individuals originating from an underprivileged group and/or (previous) disadvantaged community. Students with outstanding records of academic and/or



practical achievements shall be given special consideration and encouraged to apply for e.g., a scholarship.

The cooperation aims to empower below mentioned stakeholders to pursue powerful work in the growing local food economy:

- Young farmers who want to specialize in innovative technologies
- Farmers who are already affected by climate change and therefore need to adapt
- Prospective farmers who cannot raise the capital for a large farm
- Already active hydroponic, aquaculture or aquaponic farmers
- “Alternative eco-farmers” who want to produce uncontaminated, organically cultivated food
- Village communities and cooperatives that want to produce food independently
- “Urban farmers” who also want to produce food on urban brownfield land
- Communities in townships
- Graduates of agricultural faculties of universities and agricultural colleges
- Independent religious communities
- Large hotel businesses
- Independent organisations such as ATKV
- Women’s groups
- Schools, universities, technikons, gated communities

Accreditation:

Providing excellence in scientific and vocational education is the core mission of

the cooperation. The study programme shall be guided by career orientation and practical relevance and comprise of exceptional courses all meeting the highest quality standards both content and learning experience wise. Each graduate programme of the higher-education studies shall receive the accreditation from the Department of Higher Education and Training of South Africa as main competent authority with the parties in the medium to long-term also striving to be appreciated by the specialized or programmatic accreditation seal of e.g., European Foundation for Management Development (EFMD-EQUIS). Both online courses and live practical training workshops shall be awarded by quality seals to be issued by e.g., the South African Qualifications Authority (‘SAQA’).

A Pipeline of Training Options:

Since a flying-start from “zero to 100” is not possible for a multitude of varied reasons but mainly accreditation related, the introduction of the study programme shall be carried out on different levels and by way of a staggered course design (pipeline in development) and roll-out schedule to be guided by the framework as set out below:

1. Imparting of basic pre-academic aquaponics knowledge – no university enrolment required.
2. Academic aquaponics studies with the obtaining of a university degree:
 - 2.1. Post-graduate online aquaponics supplement course.
 - 2.2. Under and post-graduate hybrid aquaponics study degree course on a tertiary level.
 - 2.3. Hybrid PhD programme.



2.4. Hybrid MBA programme.

3. Accompanying formats:

- 3.1. Virtual aquaponics workshops.
- 3.2. Virtual aquaponics conventions and physical tradeshow.
- 3.3. Special online courses.

4. Dual aquaponics training programme.

Overall Learning Outcomes:

The Aquaponics curriculum has been designed using student-centred teaching methods such as problem based learning and peer learning to enable tertiary level students to acquire expert knowledge as well as the skills desired by employers. The didactic techniques employed, such as workshops, wikis, discussion forums and social bookmarking, are intended to encourage a mixture of student dialogue and collaboration, autonomy, critical thinking, and creativity. Instructional scaffolding has been used to build up student knowledge as they progress through each module, with different Moodle tools used to address various levels of Bloom's revised taxonomy: remember (glossary), understand (wiki), apply (database), analyse (workshop), evaluate (workshop, forum), and create (e-portfolio).

The overall learning outcomes are:

- Acquisition of the skills necessary to conduct inquiry and research and show independence in learning.
- Development of transversal skills such as digital skills and the use of appropriate terminology in relevant professional areas (aquaculture, horticulture. etc.)

- Acquisition of in-depth knowledge and development of understanding across a range of disciplines.

Conclusion:

Aquaponics promotes scientific literacy and provides a useful tool for teaching the natural sciences at all levels, from primary through to tertiary education. An aquaponics classroom model system provides multiple ways of enriching classes in Science, Technology, Engineering and Mathematics (STEM). The day-to-day maintenance of an aquaponics system also enables experiential learning, which is the process of learning through physical experience, and more precisely the 'meaning making' process of an individual's direct experience. Aquaponics can thus become an enjoyable and effective way for learners to study STEM content. It can also be used for teaching subjects such as business and economics, and for addressing issues like sustainable development, environmental science, agriculture, food systems and health. There are many types of aquaponic systems available on the internet which can either be purchased as a kit, or a complete system can be delivered and installed. However, building an aquaponics system is a valuable educational experience. A basic aquaponics system can also be built easily and inexpensively from reclaimed materials. Even a micro system (1.5 m²) can mimic a full-scale unit in terms of water quality and water consumption, thus making it an effective teaching tool. However, implementing aquaponics in classrooms is not without its challenges. Technical difficulties, lack of experience and knowledge, and maintenance



over holiday periods can all pose significant barriers to teachers using aquaponics, and disinterest on the teacher's part may also be a crucial factor. However, other studies revealed that many educators are willing to incorporate aquaponics in the classroom, particularly when it provides an opportunity for experiential learning. Teachers strongly agreed that bringing an aquaponics unit into the classroom is inspiring for the students and led to greater interaction between students and teachers, thereby contributing to a dialogue about science. A survey of the use of aquaponics in education in the USA found that in primary and secondary schools it tends to be project oriented and used for teaching

single discipline subjects such as chemistry or biology, while college and university aquaponics systems were used for teaching interdisciplinary subjects such as food systems and environmental sciences. In vocational and technical schools aquaponics systems are rarely used to teach subjects other than aquaponics.

The online Introductory Aquaponics Course will be alive from April 2022 and the first two Postgraduate Diploma Aquaponics Hybrid Modules will be available in the beginning of 2023 and the complete Aquaponics Postgraduate Diploma Program in 2024. Contact the author: hbs@sun.ac.za

