AQUAVET

INTRODUCING AQUAPONIC IN VET:
TOOLS, TEACHING UNITS AND TEACHER TRAINING

Result 12

Module guide for AQUAPONICS teaching material

Lifelong Learning Programme

Cross borders
Gather experience
Enhance knowledge

Stiftung für eidgenössische Zusammenarbeit
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Didactical Guidelines

Introduction

Water is our most precious resource. It moves through earth's systems in many ways, beginning with its evaporation from the oceans into the atmosphere. In modern society man has interfered with nature in a large-scale way and most fish farms and agricultural farms are highly industrialized and contribute severely to the pollution of natural water resources. In agriculture a lot of chemicals are used in combating pests (pesticides, herbicides) and to increase yield (fertilizers). Conventional aquaculture discharges high concentrations of nutrients into the environment, due to fish excrements and fish food residues in the effluent.

One solution to these problems is Aquaponics, which combines fish farming (AQUAculture) and crop plants grown soil-less (hydroPONIC) which are cultivated in the recirculation water of the fish tank. In aquaponics water and nutrients are recycled. The aquaculture effluent runs through planted beds where it is treated by the combined action of plants and bacteria. The treated water then flows back into the fish tanks. Thus, waste is converted into useful plant biomass – vegetables, herbs and ornamental plants. This way, the water doesn't need to be exchanged except for the water lost through evaporation, and there is no harmful wastewater leaving the system. Use of pesticides in aquaponics in not allowed, because they can harm the fish. Also, use of antibiotics is not allowed because they can harm the plants. Therefore, aquaponics is an environmentally friendly and sustainable way of food growing.

To achieve this, there is a need to educate professionals in the field of aquaponics. Within this module, presentations and worksheets on introduction to aquaponics, living organisms (fish, plants and bacteria) and water analysis are included. In addition, presentation on how to construct a simple aquaponic system is provided. The goal is to give students the knowledge to be able to work with aquaponics or even start their own production system. Complete knowledge (basic and advanced) of aquaculture and hydroponics, which is essential for understanding of aquaponics, is provided within AQUA-VET Results 6 and 10.

Audience

VET students, VET teachers, VET schools and other institutions

Overview

This package contains the presentations for the lectures of the module “Aquaponics” as well as some work sheets with exercises. Below you will find a description of the units that are part of the lectures. For each lecture learning outcomes are identified and teaching methods proposed. Each description mentions all the teaching material that corresponds to the particular unit.

Overview of available material in R12

R12: Teaching material for AQUAPONICS	Languages				
	EN	DE	SL	IT	FR
BASIC UNITS					
Basic Unit 1 presentation: Introduction to Aquaponics	✓	✓	✓	✓	✓
work sheet 1	✓	✓	✓	✓	
Handout: Introduction to Aquaponics	✓	✓	✓	✓	
Basic Unit 2 presentation: Living Organisms Aquaponics	✓	✓	✓	✓	✓
work sheet 2	✓	✓	✓	✓	
work sheet 3	✓	✓	✓	✓	
work sheet 4	✓	✓	✓	✓	
Basic Unit 3 presentation: Water Analyses Aquaponics	✓	✓	✓	✓	✓
work sheet 5	✓	✓	✓	✓	
ADVANCED UNITS					
Advanced Unit 1 presentation: Design Construction Aquaponics	✓		✓		
SUPPLEMENTARY MATERIAL					
Supplementary presentation: Aquaponic Balancing (incl. Excel file)	✓	✓			

General objectives

Students will:

- know the vocabulary of aquaponics,
- obtain and demonstrate technological knowledge and understanding of aquaponic systems,
- be able to grow fish and vegetables in aquaponics,
- assess the value of aquaponics in terms of ecological, social and economic importance,
- be able to design and construct a simple aquaponic unit.

Basic Units and Objectives

Basic Unit 1:	Introduction to Aquaponics
Learning Outcome	Students will • be able to give definition of aquaponics • be able to list components of aquaponic system and explain their function • be able to explain how aquaponic system works • recognize advantages and disadvantages of aquaponic production • recognize the ecological, social and economic value of aquaponic production
Teaching methods	Teacher-centred instruction, exercises, *practical task*
Teaching material	Presentation 'Introduction to Aquaponics' work sheet 1 on introduction to Aquaponics Handout Introduction to Aquaponics

Basic Unit 2:	Living organisms in Aquaponics
Learning Outcome	Students will • be able to illustrate fish and plant species that can be used in aquaponics • be able to distinguish between potential fish and plant species and their advantages and disadvantages • be able to plan the feeding regime for fish • be able to calculate fish stock density • be able to know different types of plant beds used in aquaponics • be able to explain when to introduce fish and plants into the system • be able to explain the processes of nitrification and denitrification • be able to explain how to establish a biofilter • be able to describe how fish, plants and nitrifying bacteria affect each other in an aquaponic system
Teaching methods	Teacher-centred instruction, exercises, practical task
Teaching material	Presentation 'Living Organisms Aquaponics' work sheet 2 to 4 on living organisms in Aquaponics

Basic Unit 3:	Water analyses in Aquaponics
Learning Outcome	Students will • know which water parameters are important in aquaponic system and how they affect living organisms • be able to perform measurement of water parameters • know the threshold values for the most important parameters • be able to react appropriately if parameters are exceeding threshold values
Teaching methods	Teacher-centred instruction, exercise, practical task
Teaching material	Presentation 'Water Analyses Aquaponics' work sheet 5 on water analyses in Aquaponics

Advanced Units and Objectives

Advanced Unit 1:	Designing and constructing a simple Aquaponics
Learning Outcome	Students will • know basic equations and parameters for designing a simple aquaponic unit • know basic equipment for constructing a simple aquaponic unit • be able to explain what is the function of individual components and why are they constructed in a certain way • be able to use at least some recycled materials when constructing a simple aquaponic unit • know basic instructions on how to start a new aquaponic

	system
Teaching methods	Teacher-centred instruction, exercise, practical task
Teaching material	Presentation 'Design Construction Aquaponics'

Basic Units

Teaching Material Basic Unit 1

Presentation 1 – Introduction to Aquaponics

Worksheet 1 – Introduction to Aquaponics

Handout – Introduction to Aquaponics

Teaching Material Basic Unit 2

Presentation 2 – Living Organisms Aquaponics

Worksheet 2 – Living organisms in Aquaponics – Fish

Worksheet 3 – Living organisms in Aquaponics – Plants

Worksheet 4 – Living organisms in Aquaponics – Bacteria

Teaching Material Basic Unit 3

Presentation 3 – Water Analyses Aquaponics

Worksheet 5 – Water analyses in Aquaponics

Advanced Units

Teaching Material Advanced Unit 1

Presentation 1 – Design Construction Aquaponics

Supplementary Material

Supplementary presentation – Aquaponic Balancing (incl. Excel file)