

# Becoming more self-sufficient

By Helen Smith

There are a number of reasons why a small farmer might want to consider aquaponics. One is shortage of space and another is shortage of water. A third reason could be the desire to become as self-sufficient as possible while producing fresh food, and a fourth might be a lack of time or interest to weed, water, fertilise and tend a full sized vegetable garden.

It may seem odd to think that a farmer might be short of space, but if your property is, say, four hectares and you want a reasonable orchard, a good sized shed, a small dam, to run a few sheep or cattle and maybe a pony for the children, it could be a crush to provide enough land for a decent sized vegetable patch. Added to that, small farm or not, shortage of water is a common problem for many farmers.

As the name suggests, aquaponics combines both aquaculture and hydroponics, with the combination bringing greater benefits than can be derived from each of the components operated separately. Put simply, the water in a fish tank is pumped through soil-less growbeds before being returned to the tank, purified by bacteria in the growing medium of the growbeds. The plants benefit from the water made nutrient-rich by the fish, who benefit from the cleaned and oxygenated water returned from the growbeds. With a basically closed system, there is almost no waste and both fish and vegetables grow faster than if they were produced conventionally. Reports state that

both fish and vegetables taste better too.

Joel Malcolm stumbled upon aquaponics in 2000 while searching the internet for different ways to grow plants. Inspired by a pioneering American couple, he began experimenting with a small makeshift aquaponics system in his own back-yard. The possibilities soon became evident and he continued to develop systems that are now so successful his hobby has turned into a business and he has recently opened a display centre at Jandakot near Perth - the only aquaponics shop in the world, Joel claims.

'There are three main elements essential for success,' he says, 'fish, plants and bacteria. Fish expel ammonia through their gills, and while plants have no use for ammonia, two types of naturally occurring bacteria (Nitrosomonas and Nitrobacter) in the growing medium break it down in the water, first into nitrites and then into nitrates which the plants can use, at the same time cleaning and aerating the water before it is returned to the fish tank.'

Other nutrients essential for plant growth such as potassium, phosphorous and magnesium, are supplied from the food fed to the fish and dissolved in the water. In addition, fish faeces break down to provide other essential nutrients for the plants.

In conventional aquaculture, the problem of keeping the water fresh would require 10 percent to be pumped out daily to rid the tank of solids. For a 2000 litre tank that amounts to 200 litres of water usage every 24 hours. Even if it were pumped onto



These plants are growing in blue metal which is a cheap growing medium but, because it is heavier than most, needs strong support.



Up to 100 fish can be raised from 50 gram fingerlings to plate size (500 grams) over a six month period in a 3000 litre tank.

# AQUAPONICS - Combining hydroponics & aquaculture

a conventional garden, it is more than many farmers could afford to use. Water usage in an aquaponics system is far less and amounts to no more than replacing water lost through evaporation and transpiration.

So what does an aquaponics system look like? First of all, it is surprisingly compact. A system that can provide 50 kilogram of fish and over 100 kilograms of vegetables in six months - enough to feed a small family - will easily fit under a carport roof. The size of the fish tank/pond/dam and growbeds can suit individual needs, with some options small enough to fit onto a balcony. However, a family-sized system would need a fish tank of 2000 - 3000 litres, plus three or four growbeds. These need to sit higher than the fish tank, either by raising the growbeds or sinking the tank, to allow the water to gravity feed back to a small drain tank that can double as a fingerling nursery until the mature fish are harvested. From there the water is aerated and pumped back to the fish tank. Raising the growbeds also reduces the risk of garden pests such as snails. Further refinements can include a battery backup for the pump or a worm farm to consume vegetable scraps, with worms fed to the fish. A 65 watt solar panel can reduce or even eliminate the already reasonable power costs

Once each hour the growbeds are flooded with water pumped up from the fish tank. The pump stops when the tank water drops to a level determined by a float switch and the water drains back into the tank within the hour before being pumped up again.

The shape of growbeds is usually circular or rectangular but should facilitate easy harvesting. They are filled to



a depth of 30 centimetres with a growing medium that can be virtually any inert material. Pea gravel, blue metal, diatomite or expanded clay 'pebbles' are commonly used.

'Expanded clay is probably the best medium, but it is more expensive than the others,' Joel explains. 'Blue metal is cheaper but heavy and hard on the hands when working in the growbeds.'

Normal reticulation pipe and fittings, a small 200 watt pump and a couple of aerators complete the system.

'The tanks and growbeds don't have to be purpose-built,' Joel explains. 'Old baths or recycled food-grade plastic barrels halved vertically are quite suitable.'

The type of fish chosen depends on the climate and

In a symbiotic relationship this rainbow trout has assisted in the growth of the lettuces behind it, while the lettuces have helped clean the water in the fish tank. There is very little wastage from either product.



The water is aerated as it is returned to the tank. The level drops when the pump is operating, but is raised when the water returns to the tank as the growbed drains.

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personal preference. Joel grows trout in the cooler months, but Perth is too hot for them in the summer, so he then switches to barramundi.

'Six months is all that is needed to produce a 500 gram fish from a 50 gram fingerling,' says Joel. 'Fish have a great food conversion rate: because they are cold-blooded, and because they are suspended in water, they don't have to support their own weight. Trout have a 1.2:1 ratio.'

A 3000 litre tank will carry up to 100 fish in this system. Some people prefer to keep ornamentals, such as goldfish or koi, while others choose silver perch, black bream, yabbies or eels.

'Ethel Creek Station near Newman in the Pilbara region of WA have installed a large aquaponics system,' Joel says. 'It's an ideal way for them to have a constant supply of fresh vegetables during the dry season. Overseas there are aquaponics systems in Alaska, as well as the desert regions of the USA.'

Apart from cleaning out the reticulation before replanting to remove roots that may have grown into the growbed pipes, Joel spends just minutes each day to keep his system working.

'It takes less than five minutes to feed the fish and check that it's all working OK,' says Joel, 'and they can last without food for a couple of days if I go away.'



Commercial growers are now beginning to see the benefits of aquaponics on a large scale and Joel has recently installed a system of perforated foam rafts floating on two 20 metre x 2.5-metre channels that will bring to maturity a continual harvest of 500 lettuces per week. Grown conventionally they would take more land, water, labour, and time to mature.

As Joel says, aquaponics just makes so much sense. ■

■ Backyard Aquaponics, telephone 08 9414 9334 or [www.backyardaquaponics.com](http://www.backyardaquaponics.com)

Black soldier flies occur naturally in the Perth region. Their larvae live in compost and are self-harvesting when appropriately housed. They make an excellent organic food for the fish as do the casualties of 'bug-zappers' mounted over the tank.



This compact unit houses a complete aquaponics system with fish in the bottom chamber (opening on the other side) and a single growbed on the top. It would easily fit on a balcony, patio or courtyard.

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