

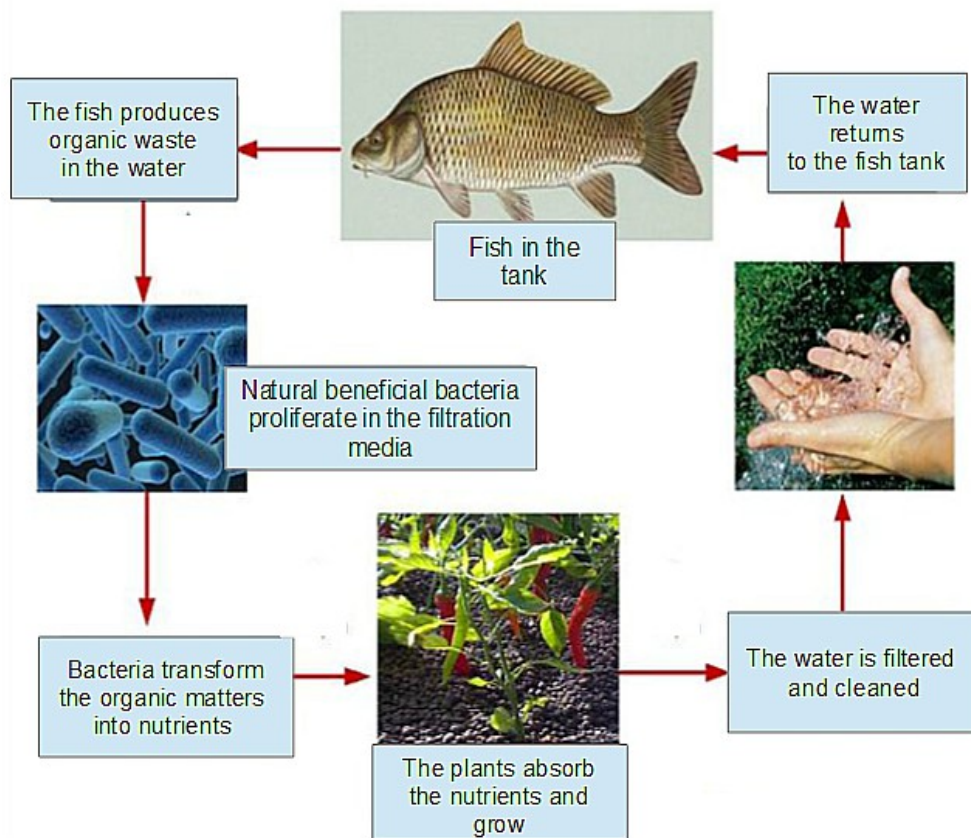
AQUAPONICS HISTORY AND BENEFITS

Aquaponics is an innovative completely organic sustainable productive method that merges the Aquaculture (the rearing of aquatic species) with the Hydroponics (the cultivation of vegetables without the soil). It is the perfect marriage between two well-tested food productive methods that integrate in a natural symbiotic relationship, maximizing their individual qualities in this way.

Schematically an aquaponic system uses the water in the tank, which contains for example fish, in order to irrigate the special soilless grow beds, where the plants are cultivated without the need for additional artificial fertilizers.

The water is rich in nutritious substances coming from the waste produced by fish, that can be used by the vegetables for their growth thanks to the beneficial bacterial populations, cultivated in the filtering media, that transform its natural chemical substances, toxic for the fish, into important nutrients absorbed by the roots of the plants and used for their growth.

It is a beautiful form of natural organic water treatment that achieves the filtration and purification of water returned without toxic substances to the fish tank for a new plant watering cycle.



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HISTORICAL FACTS



Aquaponics principle was established more than 600 years ago when in Mexico the Aztecs decided to settle along the marshy shores of the Lake of Texcoco, where they built the capital of their Empire, Tenochtitlán (that is the actual Mexico City).

Since the marshlands and the surrounding rough soil didn't allow the development of enough agricultural farming to feed the population, Aztecs invented the “*Chinampas*”, artificial floating gardens made from reeds and covered by mud coming from the bottom of the lake. On these islands the farmed plants could thrive thanks to the skill of seeping into the soil, going through its thickness to get the lake water that was rich in nutritious substances, produced by the aquatic organisms.

This method of farming primitively anticipated the ecological principle that was rediscovered by the culturists of aquatic organisms during the age we live in when they began to experiment with new methods in order to reduce the need for soil, water and energy availability. Traditionally for example Aquaculture (the rearing of freshwater and marine aquatic species that range from fish to shellfish and algae) requires significant volumes of clean water and capacious water basins available for use, especially when it is carried out on the ground.

In the last decades the research and the technology have allowed the reduction of the amount of indispensable land space and water thanks to the development of water recirculating systems (named R.A.S. that is *Recirculating Aquaculture Systems*) that allows the farming of a higher density of animals in a lower portion of aquatic space than that one required by traditional methods of breeding. But the use of R.A.S. requires skilled and experienced workers who should understand well the biological needs of the farmed living organisms. They should also be able to face quickly and with self-confidence some occurrences of imbalances of environmental aquatic parameters that can take place in the tank when it stores many individuals.

Besides there are some disadvantages that can be summed up in two main phenomenons:

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1. The increase of polluted water caused by the waste substances produced by the decomposition of unconsumed feeds and in the form of excrements and urine coming from the farmed animals;
2. Higher exposure and sensitivity of breded aquatic organisms to illness and stress when they are kept at high density. This requires the use of antibiotics and other chemical substances to protect the farmed animals.

Since the 70's some fish farmers have been experimenting with the use of aquatic and terrestrial plants in order to verify the possibility that their natural absorptive action of nutritious substances from the water (indispensable for their growth) was effective in purifying it. In this way there was no longer a need to drain periodically a partial amount of water from the tank, needed to keep under control the continuously increasing concentration of dissolved waste substances that tend to become toxic for the breded animals beyond a certain level.

In order to find a possible solution some experiments were begun by individual entrepreneurs and lovers of sustainability in private aquatic farming systems that obtained important results that successfully have been involved universities and public research centres too.

In the last decades all these experiences have led to the birth of aquaponic commercial farms that are able to organically produce huge amounts of vegetables and aquatic animals (especially fish) throughout the whole year.

Today aquaponic commercial systems are installed for example in:

- Unites States of America
- Australia
- United Arab Emirates
- Singapore
- Mexico
- Canada
- Vietnam
- Great Britain
- Germany
- Switzerland

In Italy the first commercial systems have been installed for the production of high-value ornamental fish species (like Koi carp), edible fish and crustaceans (as Tilapia and freshwater crayfish species) and the cultivation of Saffron and Hot Peppers of interesting commercial value.

THE ADVANTAGES

Aquaponic systems are good because:

1. **Minimal water consumption**, with a saving up to 90% of the whole volume of water in the system;
2. **Lower dependence on the water**. In conventional agriculture the water is daily dispersed in the soil and from here it is lost for evaporation and percolation;
3. **Absence of the need for manure and artificial fertilizers**. The nutrients for the vegetables are provided by the breeding tank and indirectly by the animal feeds;
4. **Lower labor in the plant cultivation**. The opportunity of cultivating without soil reduces all the traditional heavy works in agriculture limiting them to the transplanting and the harvest of the crop;
5. **Organic pest control**. The system is maintained preferably within a covered structure like a greenhouse for maintaining a steady temperature inside too. The control of the environmental and aquatic parameters and the use of soilless cultivation allows to avoid the negative presence of pest and pathogens into the aquaponic system;
6. **Economic saving**. The cut of the costs for the purchase of pesticides, fertilizers, fuel for the tractor and other traditional agricultural machinery makes this new kind of food production very attractive;
7. **Production of natural organic food**. It meets the constantly increasing demand from a market that is interested in genuine traceable products because more consumers are tired of being subject to adulterated or food of unknown origin that plays a leading role in recurring food scandals;
8. **Easy management**. The system can be operated by a person who doesn't need to have technical university training; it needs to have a basic knowledge of breeding aquatic animals and plants and taking care of them;
9. **Easy ecological balance**. It can be kept with a minimal supply of external energy in the form of power supply for the pumps and the aerators and the addition of feed for the growth of the farmed animals;
10. **Wide range of farmed aquatic animal species**. In freshwater for example: Tilapia, Trout, Catfish, Eel, Carp, Crayfish and ornamental species like Koi Carp and Goldfish; in saltwater Sea bass and Sea bream (using Marine Aquaponics);
11. **Wide range of cultivated vegetable species**. For example: Lettuce, Carrot, Basil, Celery, Tomato, Pea, Spinach, Aubergines, Chard, Savoy, Cabbage, Hot Pepper, Cauliflowers, Bean, Cucumber, some flowering plants, Saffron and Strawberries;
12. **Village Aquaponics**. It allows the construction of systems that can be shared by groups and associations interested in obtaining an organically cultivated food source without the need to use large spaces of land, respecting the environment and its natural sources. Some similar systems are present in Wisconsin and in Massachusetts (U.S.A.) and provide food for the local communities;
13. **Education**. Aquaponics is also used in school to teach for example: biology, ecology, physics and natural sciences. In many schools in the U.S.A. and in Australia there are working didactic aquaponic modules with which students of secondary schools and high schools can be trained and understand in a better way the relevant bioecological processes;

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14. **Food security.** FAO ([Food and Agriculture Organization of the United Nations](http://www.fao.org)) has showed great attention towards Aquaponics with specific programs since 2010. In 2015 our company has organized with FAO the first international workshop on Aquaponics: “*Technical training workshop on advancing aquaponics: an efficient use of limited resources*”. This event took place in Osimo, Marche Region, Italy and participants coming from 10 countries from North Africa to Arabia Saudita has followed it.
15. **In the Space.** Aquaponics is considered a good source of fresh food for the astronauts in the future NASA missions in the space and on Mars.



**Saffron plants cultivated in Aquaponics
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