The Art of Aquaponics

My film:
The Art of Aquaponics, is an informational, animated short film, aimed at teaching people the basics of aquaponic production. The content is meant to help the viewer understand how it works, and also why it is something that I believe should be implemented on a larger scale in the US. The film covers production, science, and pros and cons. My goal is to get more people interested in aquaponics, so there can be a larger base of people pushing for it to be used regularly.

Part 1
What is aquaponics?
Aqua- ponics
Aqua refers to the practice of aquaculture, or raising fish for commercial purposes, while ponics refers to growing plants in a system that is not the outer crust of the earth, usually associated with growth in water

So what actually is it
Aquaponics is the combination of raising fish for commercial use, and also growing plants in water. The plants filter the waste of the fish, creating clean water for the fish while utilizing them for the nutrients that is required to grow.

Part 2
Now time for some quick science
The reason that all of this works is because of something called the nitrogen cycle
If you just put plants in water with fish waste, their roots would burn up and the plants would die
The key to an aquaponic system are the bacteria
After the fish eat... they poop which releases ammonia into the water, which is toxic to fish
Luckily there are nitrifying bacteria present, that convert this bacteria to nitrite, which is also high toxic to fish
Lastly there are niter bacteria that convert this nitrite into nitrate, which still guesses what.. Is toxic to fish however less so than the nitrite and ammonia,
But don't worry, now that nitrates are in the water, the plants can utilize these for fertilizers in order to grow. They absorb these nitrates, leading to clean, non toxic water for the the fish
This is why you can simply grow plants in water in an aquaponic system, there needs to be some form of substrate, commonly expanded clay pellets, or a biofilter where the bacteria live.

Part 3
But.. what does this all look like
There are three main types of aquaponic systems, nutrient film, deep water culture, and the media bed system

The nutrient film technique uses slanted tubes with plants growing into those tubes with limited substrate. The water constantly runs over the roots in a small stream or “film”. The water runs

either into a second sump tank or straight back into the main fish tank. The fish tank water is led to a mechanical and biofilter, because of the lack of substrate where it is lastly pumped back to the plants.

The second technique is the DWC system. The plants are grown on a float raft, so their roots are always suspended in water. The tank where the plants are grown in a separate tank, where the water is then fed to the fish tank, then from there through a biofilter, mechanical filter and then back to the plants.

The last popular form of aquaponics is the media bed or flood and drain system. A solid bed of media, usually expanded clay pellets or lava rock because their porous structure allows for extensive bacterial load, is where the plants are grown. Periodically the bned is flooded and drained, with the nutrient rich water from the fishes. This does not usually require a bio filter because the bacteria live in the substrate with the plants. A mechanical filter can be used to filter out the large waste particles.

Part 4
Now that you know how it works, we can go through what you can raise and grow. Starting with crops, most any crops except root vegetables can be grown. The issue with root vegetables is that they need soft substrate to grow into a consistently shaped crop that consumers want. Usually high value crops are grown such as, strawberries, tomatoes, cannabis or crops that can be grown extremely fast such as lettuce

On the other side for fish there are a few options. Goldfish and koi are good for aquaponics because they have an extremely high nutrient load and are hardy fish. Commercially they can be sold for ornamental purposes, or just kept around. If edible fish are utilized, which is most common, tilapia, jade perch, silver perch and barramundi are recommended for warmer temperatures. While trout and salmon can be grown in colder temperatures however are more sensitive to water quality and temperature changes. Fish like catfish and bass can be grown in a wider range of temperatures. Catfish specifically are hardy fish that can thrive in very low oxygen levels however take a long time to grow to harvest size. The most used fish is tilapia, simply due to the low time to reach maturity as well as hardiness.

Part 5
But why go through all this effort?
The problem with conventional aquaculture is that it is often a highly polluting activity. The fish are kept over one spot where their waste accumulates, they are kept in scraped conditions where pests and diseases thrive. To combat this produces pump antibiotics and toxic pesticides onto the fish, which is terrible for the consumer and the environment. This is one of the reasons that tilapia is often branded as an unhealthy fish, because of the toxins often used in east asian aquaculture systems. While in reality, when grown correctly they are extremely healthy. In addition to this, most comercial cropping systems degrade, erode and salute the soil with tillage, fertilizers and pesticides. The pesticides are bad for the environment and consumer, as well as

the fertilizers which can runoff into local waterways and cause algal bloom, killing much of the marine life.

Aquaponics goes around all of this. There is no soil to degrade, no need to pump pesticides and antibiotics, as the water is not made toxic by unfiltered fish waste. In addition aquaponics can use up to 90% less water than irrigating which in drought climates is favorable. In addition plants in aquaponic systems grow up to 2 times faster than conventional systems, leading to high yields in small spaces. This allows food to be grown in urban areas, which can assist local communities.

Part 6

But what are the cons of aquaponics?

The main problems with aquaponics are electricity costs. Many aquaponic growth operations require electricity for supplemental lighting and or heating, which drives up costs and if not gotten from a sustainable source contributes to global warming and burning fossil fuels. Water needs to be pumped against gravity at some point, aeration is sometimes needed and other electricity costs are also a deterrent for producers. Set up costs are also high as tanks and infrastructure can cost a lot of money.

Part 7

The issues facing aquaponics are ones that can be solved, with further change in our energy production systems and by creating more energy efficient systems to complement aquaponics. Though there are some issues. Integrating aquaponics into mainstream agriculture is a step in the right direction, in order to create a more sustainable food production system.