Description

Title of invention: WangFY Aquaponic System

WangFY Aquaponic System relates to Aquaponic, a food production system that combines aquaculture which is farming of fish and hydroponics which is growing of vegetable in a soil-less medium.

WangFY Aquaponic System is an existing system which has been in operations in Singapore over two years with 20 modular paired-units at the time the application for Grant of Patent is filed.

The present invention uses these two systems in a symbiotic combination where the nutrient-rich water from the fish unit (Fig. 1) is pump into the grow bed (Fig. 2) to be used as a natural fertilizer for the hydroponically grown crops. In return the crops and the grow bed which also function as a bio-filter bed, help to filter the water that goes back to the fish unit after absorbing the nutrients from the fertilizer for the crop's growth. The water filtered by the grow bed also contains other nutrients that are beneficial for the fish. Furthermore the CO_2 exhaled by the fish is also absorbed by the plants – thus greatly increasing the crop productivity.

The present invention relates to an outdoor system that relies on the natural resources – the sunlight and rainfalls.

Brief description of drawings

Fig. 1

Depicts the Fish Unit of the WangFY Aquaponic System. The Fish Unit houses the monitoring sensors, pumping system for efficient re-circulation of the water in order to facilitate the high density stocking for the fishes. The fish unit also facilitate a Vertical in the form of trellis to support vine growing crops such as luffa.

Fig. 2

Depicts the Grow Bed of the WangFY Aquaponic System. The Grow Bed uses gravel and clay pebbles as the growing medium for crop (vegetable) farming. It houses a sump to filter the water and a pumping system to re-circulate the filtered water back to the Fish Unit. Like the Fish Unit, it also facilitate a Vertical to support vine growing crop like luffa.

Fig. 3

Depicts the Customized IOT Solutions employed in the WangFY Aquaponic System to Monitor and Collect Real-Time Data, Predict Abnormalities in the water of the fish Unit in order to efficiently altered the environment to reduce potential loss of yield. The IOT uses Mobile and Desktop applications over wireless network.

In **Fig. 1 and Fig. 2**, the present invention is depicted in accordance to the full view of the paired design at **Section on AA**. The fish unit (Fig.1) and the grow bed (Fig.2) is built with concrete to reach a volume of 20 sqm and at a depth of 1m for the fish unit and at least 0.6m for the grow bed. The ratio of the surface area of the fish unit and the grow media bed is 1:1. The 1:1 pairing ensures modular scalability with sufficient ease. The modular paring also helps mitigate yield loss in the event of water contamination.

The fish unit is coated with epoxy to improve the unit's surface smoothness to mitigate abrasion to the fishes and for easy cleaning. The base of the fish unit is lined in such a way that the level is sloping towards the center of the paired-units at Section on AA. While the grow bed is sloped towards the far side of the paired-unit. This is done to position the pump and the discharge valve.

A discharge drain is constructed below the paired-units for discharge of the water with a Discharge valve each at the fish unit and the grow bed. The water is discharged in the event the water in with the fish unit or the grow bed is breached. By breach, it means the water is contaminated and need to be discharged and replaced with clean water.

This system has to work in pairs with the fish unit pairing besides the grow bed to achieve the maximum yield for the fish and the crop. With this pairing, the yields of both the crop and fish are enhance greatly compared to traditional soil-based crop and fish farming.

The fish unit is for housing 1 type of aquatic fish species, such as Tilapia. The present invention relates to the high stocking density for the fish farming in one fish unit, fishes of harvest-able size of 500gm to 600gm.
Water aeration is provide for with air pumps to the fish unit, a process of increasing or maintaining the oxygen saturation of water in the fish unit.

No synthetic fertilizers or chemicals are used in the present invention.

In order to preserve the quality of water in the fish unit, a multi-parameters monitoring sensor or individual monitoring sensor is place in the fish unit for monitoring the parameters in the water that are crucial to the success of the WangFY Aquaponic System.. The parameters are:

A. Water PH level - is a way of measuring whether the water in the fish unit is acidic or basic (alkaline). Maintaining the right pH in the fish is important to fishes, but it is especially vital if the fishes are collected in the wild, like the empurau (from Indonesia lake). Sudden changes in pH can be harmful, or even fatal, if the change is too drastic or happens suddenly. Most of the freshwater farmed fish do best between 6.8 and 7.8;

B. Water DO, Dissolved Oxygen level - All life needs oxygen, including the life present in the water in the present invention. The concentration of DO in water is important for optimal fish and plant growth, as well as for beneficial bacteria that convert toxic ammonia to usable nitrate for plant growth.

C. Water EC, Electrical Conductivity - The electrical conductivity of water provides an assessment of the total concentration of dissolved ions in water, and is an important property of water frequently measured in aquaculture systems.

D. Water Temperature - Water temperature in the present invention will influence not only what type of fish can be farmed but also plant growth and the performance of the bio filter. The key is to find a temperature that falls within the acceptable range for all three components of the present invention.

E. Water TDS, Total Dissolved Solids - Dissolved solids are different minerals dissolved in water, higher levels of total dissolved solids often harm aquatic species.

F. Water Turbidity - Turbidity is a measure of how clear the water is. Unlike 'hardness', the greater the total dissolved solids' content is, the lower the turbidity of the water.

G. Water Ammonia Level - Ammonia is excreted as the primary waste product of protein metabolism by fish from the gills and in urine. Too much Ammonia in an aquatic system becomes toxic. Therefore a balanced ammonia based on changing pH and temperature of the water is paramount to the health of the fishes in the fish unit.

H. Water Nitrate Level - Fish will feel the impact of high nitrate levels particularly if these levels persist. The resulting stress leaves fish more susceptible to disease and inhibits their ability to reproduce. High nitrate

levels are especially harmful to fry and young fish and will negatively affect their growth.

These sensors can be integrated as 1 unit or as individual sensors depending on the availability and viability of the sensors to be integrated with the WIFI module or 5G SIM card. They are placed in the water to monitor these various parameter's level.

These monitoring sensors are paramount to the success of fish farming with high density stocking in the present invention.

Fig. 3 depicts the monitoring unit that is hooked up via a wireless module and is connected to a host gateway via WIFI or 5G SIM card to store in a cloud server and a software adapted in a desktop can be used to monitor the levels or via a mobile app.

The data captured are in real time. With any abnormality captured from the sensor(s), an alert will be triggered via desktop software or mobile app. By using this technology, automation of the system is ensured for the quality of the water for the fish unit, and thereby the quality of the crop produce in the grow bed. This automation also ensure the better deployment of manpower, especially in labor-crunch country like Singapore.

The grow bed uses gravels as the primary grow media and clay pebbles as the secondary grow media. The gravels are place up to 0.4m and the top is layed with a layer about 0.15m of clay pebbles. The choice of using clay pebbles is such that it helps with the high crop planting density in the grow bed; while the crop roots can take hold on the gravels for growth

stability. Both the gravels and the clay pebbles makes a superb filtering medium to ensure the water is cleaned before returning to the fish unit and it also acts as a bio-filter to help break down the ammonia into nitrates which the crops need for growth, due to their combine huge surface area.

The huge surface area enhances the natural occurring biological waste digesting unit formed by bacterias, helps digest and produce the nutrients for the plants farm in the grow bed. The grow bed is for farming up to 2 types of leafy crop species, such as the Brazil Spinach and Luffa, a vine growing plant.

A sump unit (Fig. 2) is constructed at the grow bed at the far end to act as an infiltration basin used to manage surface runoff water and to collect often undesirable matters from the grow bed filtration.

A discharge valve is fixed at the lower portion of both the fish unit and grow media bed to discharge contaminated water either at the fish unit or the grow bed.

Submersible pumps are used each at the fish unit and the grow bed. At the fish unit the pump is placed at the lowest space near the discharge Valve to pump the ammonia rich waste into the grow bed. At the grow bed the pump is housed in the sump area near to the Discharge Valve to pump the filtered clean water back to the fish unit.

The arrows depicted in Fig. 1 and Fig. 2, gave a better perspectives of the re-circulating system in the present invention. This system can also be addressed as Recirculating Aquaculture System or RAS, as the water

from the grow bed is pump back to the fish unit after filtering. It significantly reduces the usage of water for crops in the grow bed by up to 95%.

To further maintain the stability and quality of the water in the fish unit, regular partial water exchanges are also done to remove pollutants and replenish minerals that naturally buffer pH and keep it stable.

The present invention employs the Vertical concept to produce another crop yield by Growing Up instead of just Growing Horizontal.

Only One (1) level of vertical for the present invention is built on both the fish unit and the grow bed (Fig. 1 and Fig. 2), this is to ensure adequate sunlight for all the crops in the grow bed as well as on the Vertical.

The Vertical is to farm vine growing plants, like the luffa. The luffa is planted at the extreme end row in the grow bed to ensure the proper climbing of the vines and they do not obstruct the other crop in the grow bed.

The Vertical also serves other benefits to the present invention, the fully grown luffa will provide a shade for the fish units and the grow bed, thereby lowering the ambient temperature and also mitigates the production of algae in the water.

Algae is known to be toxic to fishes in aquaculture.

The present invention allows a near zero-emission, contributes to solving the issue of sustainable food security, water security and land scarcity especially for a country like Singapore.

The present invention is adaptable to local conditions.

This present invention is a Scalable, Sustainable and an Automated EcoFarm using technology to provide Wholesome Fish & Organic Crop produces.

Claims

1. WangFY Aquaponic system relates to a modular paired unit consisting of one fish unit and one grow bed wherein the modular paired unit can be easily scale when necessary and helps mitigate yield loss when one unit quality is compromised thus enabling WangFY Aquaponic system to start off with 4 paired units and quickly scaled to its current 20 paired modular units in 3 months.

2. WangFY Aquaponic system comprising of one fish unit and one grow bed wherein the fish unit is for housing only one type of aquatic fishes and the grow bed is for farming up to only two types of crops species growing in an aqueous environment thus enabling this combination to work ideally with the maximum productivity yield and negligible yield loss.

3. The grow bed of the WangFY Aquaponic system uses two type of mediums namely the primary being gravels at the bottom and the secondary top layer is clay pebbles wherein both the medium offers an excellent filtering media, excellent for crop to take roots as well as an excellent bio-filter to break down nutrients for plant growth.

4. WangFY Aquaponic system employs monitoring sensors in the fish unit wherein the monitoring sensors are paramount in maintaining the quality of the water in the fish unit to support high density stocking in order to produce an optimal nutrient for the plant's growth.

5. WangFY Aquaponic system introduces a vertical (one level) to both its fish unit and grow bed wherein the vertical acts as a trellis to support a vine-growing crop like the luffa to grow on it thus enabling this growth to provide a shade for both the fish unit and the grow bed thereby lowering the temperature in the system and restricts algae growing.