SUBMISSION ON WATER USE IN AQUAPONICS

***Aquaponics is the world's most productive food system in terms of water use efficiency*.**

That can be expected to be a political ace for aquaponics science and technology as the world's fresh water supplies come under increasing pressure. It is also a point worth noting well by governments wishing to encourage more productive use of rural water. by rural industry.

Depending on where it is practiced, much aquaponics currently takes only about half the volume of water to produce $100 worth of food in the form of fresh fish and fresh vegetables or fruit – whatever the currency – than inorganic hydroponics.

The accompanying table uses Australian figuring. It shows just how badly other food production systems perform in water use. Inorganic hydroponics is the only close contender for the title of "Most Miserly Water User".

TABLE: COMPARISONS OF WATER USE FOR FOOD PRODUCTION

The first section of figures in the table below were reported at the International Conference and Exhibition on Soilless Culture in Singapore in September 2005 by Graeme Smith,President - Australian Hydroponic & Greenhouse Association. He said he obtained the figures from Dr Derek Eamus (University of Sydney) who was keynote speaker at the AHGA conference in Melbourne in 2003. Mr Smith said the figures were checked with Australian Government sources.
The 600 litres figure he quoted for hydroponics was based on lettuce in a simple NFT system. No figures have been done for other hydroponic crops. However, Mr. Smith believes they would not be much different.

Litres of water per A$100 of output:

Rice	**470,000**
Cotton	**160,000**
Milk	**147,000**
Sugar	**123,900**
Beef cattle	**81,200**
Vegetables and fruit (soil grown)	**37,900**
Wheat	**24,500**
Hydroponic crops	**600**

Here's estimates of the general water use for Australan aquaponics in the tropics and sub-tropics:

Aquaponics -- fish and lettuce	***500***
Aquaponics --fish and basil	***173***

Temperate climate evapo-transpiration water loss in aquaponics has been cut to around 0.15% a day. This means that top up of water each year is about 55% of the total water volume in the system. For every tonne of fish produced each year, the fish wastes can produce about seven tonnes of salad vegetables or herbs. About one tonne of fish and seven tonnes of vegetables or herbs can be grown for every 22 cubic metres (22,000 litres) of water.

Incredibly, this means that temperate-climate aquaponics is currently capable of using a mere ***15 to 20 litres of water to produce food worth $100*** in a barramundi and herb combination, based on current market returns at the farm gate.

Even better results are expected from some combinations of fish and plants plus tourism.. However, the average aquaponics use of between 170 to 500 litres of water to produce $100 worth of fresh fish and vegetables is exciting enough for the moment.

The actual figuring on which this is based came from an article by the author in collaboration with the world's leading researcher on aquaponics, Dr James Rakocy of the University of Virgin Islands. This article is attached..

Other articles on aquaponics by the author are attached, and support the demonstrable fact that aquaponics technology is currently the world's most productive use of rural water for the growing of food, and is the technology most capable of returning rural farmers some of their best returns for a most modest environmental footprint.

The United States, Canada and Australia are leading the world on development of aquaponics technology. It's hobby, educational and professional use is worth encouragement. Of all the food production systems, it is the one most likely to be capable of paying the highest prices for water.

Geoff Wilson,
Convenor,
Aquaponics Network Australia.

February 17, 2006.

GREEN ROOF OPPORTUNITIES ARE KNOCKING:

An aquaponic investment in every small town – and shopping centre?

By Geoff Wilson

Should every small rural town in the world have an aquaponic investment for local food security.?

This is a question raised by California-based aquaponics consultant, John Pade. Who challenged us to think about "Village Aquaponics".

It is also a valid question whether the town or village is in a developed country or in one that is still struggling to become one.

Indeed, as John pointed out, the question even comes down to small groups in suburbs of big cities.

But the small town and village scale aquaponics will be most important to help preserve and foster rural economies that have been jeopardised by what I call "industrialised farming" and "industrialised supermarketing" based upon it.

In my country, Australia, (and I suspect other countries have a similar situation), it is easy to observe that many inland towns "import" the majority of fresh fish, fresh vegetables and fresh flowers from central markets in capital cities – where once they grew their own for local needs.

Often that fresh produce has already travelled a considerable distance at a substantial cost in diesel transport fuel. Indeed, I heard one fresh food economist estimate that 40% of the average cost of a retail lettuce is in transporting it – often up to 1,000 or more kilometres from grower to retailer.

This inefficient practice has been made worse by the recent logistics evolution of the central warehousing system of supermarkets. A punnet of strawberries or a head of lettuce can be consigned to a capital city's central market by a grower 300 to 500 kilometres away. That same grower can then observe (if the product is branded) that his produce has journeyed back the same route to his local town's supermarket.

Similar things happen to flowers. A common complaint by rural town florists is that their supplies from the central city market are often travelled and tired.

With fresh fish exactly the same problem means that eating takeaways from the fish and chip shop in country towns is often a dodgy experience, because the fish freshness necessary for a good eating experience is often very wanting.

What this should indicate to a canny local aquaculture marketer is that there is an opportunity in rural areas, and even in the suburbs, to beat the supermarket system on a local supply basis.

An aquaponic investment in a greenhouse close to or within a town (perhaps with a roadside stall) growing fresh fish, fresh salad vegetables and fresh flowers can compete well. The greenhouse for organic hydroponics can also be on a commercial rooftop, with the heavier aquaculture unit being on the ground or in a basement.

The greenhouse can even be a tourist stop in its own right.

It can operate on minimal water supplies if run well on rainwater harvested from town buildings.

Hydroponics technology is well established in Australia. It uses less than a tenth of the water needed for fresh vegetable production than a field crop. However, in aquaponics, where fish wastes are used to grow fruit and vegetables, water use can be less than a third of that used for hydroponics.

Also, there's great scope with today's advancing technology for the aquaponics water to be recycled from other town uses.

The proposition gets even more interesting if the food for the fish in the aquaponics enterprise comes from local organic wastes via:

- On-site worm farming using restaurant and café food wastes.
- An on-site insectory using out-of-code dry food wastes from supermarkets to convert them into insect pupae.

The local aquaponic investor can then well argue a case for the now-prized "organically-grown" label that have been proven in capital city markets to be worth and extra 10% to 30% on the retail price.

Aquaponics thus has an allure of its own as we try to head towards a sustainable future in our urban living in towns and cities. "Think local" will be an even more important slogan to aquaponic investors prepared to grasp the opportunities now in view for communities world-wide.

Just as important will be the proposition that we should now start to run much of our fresh food production on harvested roofwater from a multiplicity of green roof options now available from Europe and North America as "off-the-shelf" technologies.

John Pade's wise words should also be well heeded by municipal governments in rural areas too – so they can help aquaponic investments with less repressive rules or planning approval delays.

Geoff@nettworx.info *Geoff Wilson is a freelance journalist in Brisbane, Australia, who writes about aquaculture, hydroponics and aquaponics. He edits the newsletter of the Aquaculture Association of Queensland and writes for "Fish Farming International based in London"and "Aquaponics Journal" based in California. He is convenor of Aquaponics Association Australia and Green Roofs for Healthy Australian Cities which operate under the auspices of the Urban Agriculture Network-Western Pacific (a regional office of the Urban Agriculture Network Inc in Washington DC)...*

Climate change evidence hots up the aquaponics imperative

In the last two years climate change modelers around the world have provided further reasons why aquaponics must become a serious food production technology.

Peter Corish, President of the National Farmers Federation in Australia has further underpinned this view in 2004, when he was reported in "The Australian" newspaper as saying that the greatest risk facing Australian farmers was climate change.

He called for a national blueprint on the long-term problems such change meant to Australian farmers. A year ago the NFF was undecided about the climate change issue. It had now changed its mind, and had become convinced about the global warming threat.

The message is now clear for educators and researchers in aquaculture, and to growers – especially greenhouse growers of plant and "fish foods" (including crustaceans and mollusks)..

Rural agriculture is most likely to be less blessed with stable rainfall over the next 50 years. Indeed, in many areas of the world fertile farmland can now expect to be "desertified" as serious rainfall reduction is experienced. "New Scientist" magazine reported on April 10, 2004, that by 2050 cities and towns along the west coast of the United States – from Seattle to Los Angeles -- could face a 30% drop in annual rainfall.

The reason ? Ice melt in the Arctic that could be triggered by global warming currently being predicted as a result of increases in carbon dioxide and methane in the atmosphere. If Arctic meltdown and ocean warming occurs the ultimate action is likely to be the runaway release of vast quantities of methane hydrate currently locked up under pressure in cold, deep oceans. In turn, this will force up the global warming spike that now seems to be inevitable from scientist's observations of both the Amazon rainforest and the analysis of ancient ice and mud cores.

The two scientists who reported the reduced rainfall possibility for the US west coast are Jacob Sewall and Lisa Cirbus Sloan of the University of California at Santa Cruz. The implications of their climate modeling are (a) that the US west coast's traditional agriculture will be seriously jeopardized and (b) that water use for food production will have to change dramatically.

The same kind of problems are expected for many other parts of the world.

In this scenario, convergence of technologies such as organic hydroponics and recirculation aquaculture will become paramount. So will greenhouse growing of food to ensure climate control for plants threatened by new conditions.

This is particularly important with water use.

Hydroponic production of food plants requires only 10% or so of the water needed by field crops; good recirculation aquaponics recycles water continuously, is miserly in actual water use and is non-polluting. .

Both technologies are ideal in urban areas because they take up little ground area, and can, if it is practical, be placed in greenhouses on urban rooftops, to use rainwater collected from those rooftops.
So, while future climate modeling is likely to scare the pants off traditional, rural agriculturalists and wild-catch fishery people, the obverse can be true for aquaculture in both rural and urban areas where recirculation aquaponics is practiced.

Climate change now appears certain. It will accelerate interest in ***aquaponics*** – the combination of hydroponics and recirculation aquaculture, where the wastes of one process become the raw materials of the next. The same water resource and business infrastructure produces food more economically – where it is needed to be consumed, in urban areas. It offers greater food security.

Also important in local food security is Israel's pioneering of ***salt-water aquaponics*** on land is expected to now lead the world. It has certainly triggered important research of benefit to many of Australia's coastal and inland towns and cities with more secure food production in the years ahead.

This logic will soon be inescapable for governments concerned about future food security that will, in many parts of the world, be beyond the traditional agricultural and wild-catch systems to guarantee.

AQUAPONICS INCLUDED IN:

Australasian Aquaculture conference in Adelaide August 27 to 30,2006

A major information-gathering and networking opportunity in aquaculture and aquaponics will be the Australasian Aquaculture-2006 conference and exhibition in Adelaide, South Australia, from August 27 to 30 next year.

For the first time it will feature aquaponics technology.

The conference is the second in a series of international conferences being held every two years near the major aquaculture-producing regions of Australia.

The theme in 2006 is "Innovation in Aquaculture". This theme means more than increasing production; it will also focus on increasing profits from aquaculture, entering new markets, and obtaining skilled labour,

The 2004 conference held in Sydney attracted 1,300 registrations and 60 trade booths and poster displays.

Adelaide is expected to be just as popular, particularly as it will feature:

- ***Inland saline aquaculture*** investment potential in Australia.
- ***Aquaponics and agri-aquaculture***—where the farming of fish is integrated with horticulture in both intensive and extensive systems.
- ***Arid-zone aquaculture***.

Chairing the aquaponics sessions will be the "Aquaculture Journal" contributor, ***Geoff Wilson.***..

The conference and exhibition will be held in the Adelaide Convention Centre. It is being strongly supported by the National Aquaculture Council, the Canberra-based peak body of the Australian aquaculture industry.

Other sponsors are the Asian-Pacific Chapter of the World Aquaculture Society, the South Australian Government, the South Australian Aquaculture Council, and the Fisheries Research and Development Corportaion of the Australian Government

Further information from www.australian-aquacultureportal.com or from Geoff Wilson. Email:Geoff@nettworx.info or phone him in Australia on +61 7 3411 4524.

News item for release in Australia:

Aquaponics
Study Tour
in Australia
next August

An Australian Aquaponics Study Tour is being organised from August 19 to 26, 2006.

It will be the first event of the newly-formed Aquaponics Network Australia, which has seven foundation members (see separate item this issue) and is recruiting others..

Organiser will be Nettworx Publishing Pty Ltd. Geoff and Mary Wilson, the proprietors of Nettworx, who have run eight technical study tours in Australia, the United States, New Zealand, Singapore and China.

Details of the study tour can be obtained at **www.urbanag.info** after March1.2006..

It is expected to include a visit to a project north of Brisbane which is likely to become the world's largest aquaponics farm -- with production of 450 tonnes of fish a year in large sheds, and organic hydroponics using fish wastes with the potential to produce up to 3,000 tonnes of salad vegetables a year.

The study tour will begin with two on-farm visits north of Brisbane and a half-day aquaponics seminar on August 19, 2006. Travelling in a luxury coach the tour party will then make three on-farm visits on the way to Newcastle, in New South Wales. Another half-day aquaponics seminar will be held in Sydney.

After a flight to Melbourne for another aquaponics seminar, and several on-farm visits, the tour party will board another luxury coach to make on-farm visits in Victoria and South Australia before ending the tour at Adelaide, South Australia, on August 26, 2006.

Three of the world's leading authorities on aquaponics (from the United States, Canada and Australia) will be on the study tour, to be speakers at the seminars.

The tour party will then attend the ***Australasia Aquaculture 2006*** conference and exhibition at the Adelaide Convention Centre from August 26 to 30 .

A highlight of the conference will be four sessions on aquaponics investments (aquaponics being on the program for the first time).

The three world experts on aquaponics will provide analysis of the investment case studies of aquaponics for production of:

- About five tonnes of fish and around 35 tonnes of food plants.
- About 25 tonnes of fish and around 175 tonnes of food plants.
- From 200 to 450 tonnes of fish and around 1,400 to 3,000 tonnes of food plants.
- Revenue potential from aquaponics tourism and education projects.

In Adelaide the conference sessions and exhibitions on aquaponics are expected to draw in many intensive hydroponic-horticulture investors with green houses and shade houses that can have an intensive aquaculture retrofit.

The reverse applies to many investors in intensive, recirculating aquaculture systems. They can study the possibilities of an organic hydroponic retrofit.

Both then enjoy two revenue streams with no wastes, plus miserly use of fresh water (see story this issue)..

The conference case studies will be composites of actual aquaponics investments. It will be the first time such comprehensive investment analysis will be presented on the innovative aquaponics technology – which began to be studied in the United States in the early 1980s.

CAPTIONS:

Dr James Rakocy (US).

Dr Nick Savidov (Canada),.

Rebecca Nelson (US)

John Pade (US)..

Wilson Lennard (Australia)

A map of Australia showing the route of the Australian Aquaponics Study Tour from Brisbane to Adelaide from August 18 to 26, 2006.

<u>Canadian R&D will be a catalyst for change as …</u>

Greenhouse aquaponics proves superior to inorganic hydroponics

By Geoff Wilson

Aquaponics technology for growing food plants in greenhouses is significantly superior to inorganic hydroponics.

This is the startling conclusion reported at the International Conference and Exhibition for Soilless Culture-2005 in Singapore from September 5 to 8.

I expect it to trigger a cascade of global interest in the aquaponics technology.

The report was made by Dr Nick Savidov, of the Crop Diversification Centre South, Alberta Agriculture Food and Rural Development at Brooks, Alberta, Canada.

It followed two years research at Brooks comparing greenhouse growing of plants under both aquaponic and inorganic hydroponic regimes (see report in "Aquaponics Journal", 2^{nd} Quarter, 2005).

A major collaborator in the project was Dr James Rakocy of the Agriculture Experiment Station of the University of Virgin Islands, who is the acknowledged world leader in freshwater aquaponics science and technology..

The accompanying bar charts well sum up Dr Savidov's report to the Singapore conference.

The first shows that aquaponics, before it has fully developed its all-important microbiology to change fish wastes to plant food, is not as productive in greenhouse growing of food plants as inorganic hydroponics.

But when the aquaponic system is fully operational after six months, it leaps ahead of inorganic hydroponics. This leads to earlier maturity of greenhouse crops under aquaponics, and much heavier cropping.

The result is expected to be a massive revenue advantage for greenhouse growers in temperate or cold climates taking up aquaponics to gain higher prices from early markets for seasonal fresh produce. At present they face heavy competition in this from growers in warmer climates.

The economics of investment in expensive greenhouses in colder climates will also be improved from the greater productivity.

A very real bonus will be additional revenues from sales of fish.

Dr Savidov's report at the Singapore conference led to almost heated exchanges with fellow scientists specialising in inorganic hydroponics.

They even questioned his inorganic nutrient choices, and tried to undermine aquaponics as a possible problem technology from human disease transfer or as a snail parasite source (one of the major points in favour of inorganic hydroponics in some countries is that it breaks the water-borne disease or parasite cycle).

On all counts Dr Savidov, and other aquaponic experts at the Singapore conference, made effective rebuttals.

Dr Savidov, a researcher for 20 years in inorganic hydroponics, said he, too, was surprised by the results of the aquaponic-hydroponic comparison. It has led him to double-check the hydroponic nutrients used, and the data.

Dr James Rakocy from the University of Virgin Islands, testified that, in 25 years of UVI aquaponic production using fish wastes to grow fresh vegetables for local consumption, not one disease or parasite incident had occurred. In either case it was a groundless fear if precautions were adequate.

I was also able to testify that Australia's seven-year experience with aquaponics production had not revealed any human disease or parasite problems. Indeed, the aquaponic growers had the advantage of the healthy "organic" cachet for their produce.

Dr Savidov said the "unknown growth factor" in aquaponic production was worthy of further research – not only to better understand aquaponics technology, but also to see if use of the "unknown growth factor" could be applied to improve inorganic hydroponics production in greenhouses.

More than 60 different food crops and varieties were tested in the Alberta greenhouse, and 24 were chosen for trials on production levels. Five were greenhouse vegetables and 19 were herbs. The accompanying pictures tell the story better than any words.

An economic feasibility was now under way, Dr Savidov said.

It can be expected to be of major interest to the world's growers of greenhouse plants – not just because of the likely revenue benefits, but also because aquaponics solves one of the major problems of inorganic hydroponics in greenhouse production.

This is disposal of waste waters still containing plant nutrients. It has become a rising cost that has bedevilled greenhouse growers in Europe and North America, where increasingly-stringent waste disposal regulations are being applied.
In aquaponics there is only sludge residue for disposal from the fish wastes as they pass through to organic hydroponic growing of plants.

The plant-growing cleans the water so it can be returned for re-use in fish tanks.

In this way the aquaponics technology is an even more miserly water user than inorganic hydroponics – a point which will become increasingly important in a world where climate change problems may make traditional food production technologies in soil either uneconomic or difficult.

Also, most relevant is the rising cost of inorganic nutrients for hydroponics, because many are wedded to heavy use of petroleum energy – whereas fish farming (especially when using herbivorous or omnivorous fish species) is able to take advantage of most desirable recycling of urban and rural organic matter (via worm farming).

Of course, as Dr Rakocy rightly points out: “Fish feed is very well formulated and contains corn, soybeans, fish meal, vitamins and minerals. An aquaponic system using urban and rural organic matter would currently not lead to good fish growth and may not generate adequate nutrients for plants.”

That is a direction for future research into the refinement of the aquaponic technology.

Thus, economic and environmental advantages of aquaponics (now mostly a partly-organic system that can be improved upon to become totally organic) over inorganic hydroponics can be seen as having just begun to be revealed by the recent greenhouse research in Canada and the continuing development of the technology in the United States and Australia.

The next major step for aquaponics research, in my view, is to demonstrate its urban agriculture and urban aquaculture variations that put food production close to where it is needed – without transport cost and all that means in reduced use of fossil fuels and air pollution.

The Canadian greenhouse research milestone is, therefore, likely to be an important global catalyst for many kinds of changes in our food production paradigms.

CONCLUSIONS REPORTED BY DR SAVIDOV IN SINGAPORE:

1. The study demonstrated that the Rakocy (UVI) aquaponics model developed for outdoor conditions can be successfully adapted for greenhouse operations in Canada
2. The same yields of vegetables as in hydroponics are achievable using aquaponics technology
3. The rate of fish biomass production in aquaponics is comparable with conventional aquaculture operations
4. The aquaponics system has an intrinsic capacity of self-regulation and balancing nutrients in the solution.
5. The nutrient balance necessary for optimal crop production can be reached within six months of operation or earlier.
6. Biological control is an essential tool for success of aquaponics operations
7. Staggered crop and fish production and maintenance schedules prevented spikes in nutrient concentrations.
8. Economic analysis is under way. However, a preliminary estimation indicates that aquaponic operations are economically feasible when growing high value crops like basil

Canada's R&D should trigger aquaponics for greenhouse retrofits

*By Geoff Wilson**

One of the great things about advances of knowledge from research is that a discovery in one field can have significant benefits in another.

I believe that this is the case with Canadian aquaponics research that was spring-boarded from aquaponics research by Dr James Rakocy at the University of Virgin Islands.

The Canadian aquaponics research led by Dr Nick Savidov (see "Aquaponics Journal, 3rd quarter 2005) has shown clearly that it may pay many inorganic hydroponics growers to change over to aquaponics. They can do this reasonably easily, using existing greenhouses or shadehouses, but adding an aquaculture front end to provide organically-based nutrients.

In Australia some 1,665 commerical hydroponics farmers could ask themselves whether or not their long-term futures lies in inorganic hydroponics or in the aquaculture and organic hydroponics of aquaponics.

The majority of them operate in temperate climates where winters demand use of greenhouses for crop protection.

Their answers will vary greatly, but I predict that many Australian inorganic hydroponic growers will try aquaponics because of the financial advantage proved for it in Canada's research greenhouses in Alberta (see accompanying graph which compares inorganic hydroponic plant growth with aquaponics plant growth in cold-climate greenhouses).

No doubt a number of the "early innovators" in Australia will be shining examples for others to follow. I will certainly write them up as they succeed.

Also, I have no doubt that the good word about aquaponics over inorganic hydroponics will spread throughout the world where food and flower crops are grown in greenhouses.

Fortunately, the entrance barrier to a change-over from inorganic hydroponics to aquaponics need not be high in terms of cost or the acquisition of knowledge. The major acquisition is intensive aquaculture know-how – something which is now commonly available via academic study, short courses and serious reading.

The minor (but very important) acquisition is a hobby or educational aquaponics unit that can provide an inorganic hydroponics grower with the hands-on experience so necessary ***before contemplating an investment in an intensive aquaculture "front-end"*** and a re-jigging of the way food plants are grown under organic hydroponics using fish wastes.

Such a slow-but-sure approach to aquaponics by inorganic hydroponics growers will be highly desirable, in my view, to effect the most painless transition.

The aquaponics technology can work brilliantly in competent hands. I would hate to see the dog given a bad name from incautious experiences of “instant enthusiasts” who fail because of imperfect mastery of the business of managing three crops in unison, namely:

1. The fish crop.
2. The microbial crop converting fish wastes to plant food.
3. The plant crop.

In Canada the climate for adoption of aquaponics technology appears to be good. The Alberta aquaponics/hydroponics research project is now being strengthened considerably to delve much more into two important points.

One is the question of the “unknown growth factor” that Dr Savidov’s team described in the aquaponics process. This gives aquaponics big advantages in earlier and faster plant crop production from cold-climate greenhouses, to capture more profitable early markets. If that growth factor can be better understood (and more widely applied) it can be expected to greatly enhance both aquaponics and inorganic hydroponics – and perhaps even soil growing of food plants.

The other important point is the economic research Dr Savidov’s team has now started in cold-climate aquaponics using greenhouses.

Bean counters with investment funds in inorganic hydroponics will be most influenced if the financial figuring clearly shows a great differential between the profits to be made from inorganic hydroponics and aquaponics.

Aquaponics might mean a stepped-up investment, but it is one that creates another revenue stream (from fish) linked with more profitable plant production. That means greater financial resiliency for a business -- and maximising dollar returns to shareholders can be a very powerful force for rapid change.

In addition, I regard Canada as ripe for urban rooftop production of food using intensive aquaculture in basements and organic hydroponics in rooftop greenhouses. Toronto is perhaps the most likely start point for this because of its world leadership in green roof development.

Cr Joe Pantalone, Deputy Mayor of The City of Toronto has just sent me 170 pages of several key reports whose titles give a clue to what is about to happen in this environmentally-conscious city. The are:

- ***“Making Green Roofs Happen.”***
- ***“Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto***.”

Together they give deep insights into how municipal governments in cities around the globe are likely to supercede slothful national governments when it comes to encouraging individuals and corporations to change their ways so that there can be a winnable fight against climate change brought about by human factors.

Aquaponics will, I’m sure, be part of the Toronto effort when Cr Pantalone and Dr Savidov get to meet to talk about the huge potential Canada now has for application of knowledge developed in rural Alberta.

The ripples will spread outwards from Toronto to many cities.

I take great pride in reporting that the City of Brisbane, my home town, will be one of the early responders to the Toronto green roofs initiative.

So will the tropical city of Singapore. To see why, go to ***www.greenroofs.com*** to read my guest editorial titled **“Food from the Roof”**.

Then, when you have what I call “The Obligation of Knowledge” you might be motivated to start chewing the ears of your own municipal government about the new potential of aquaponics – especially on rooftops..

**** NEXT ISSUE: “Yet another trump card for aquaponics” investment.***

*Freelance journalist Geoff Wilson has just launched “UrbanAg Online”, a news and information service on 29 different topics in urban agriculture – including aquaponics. Go to **www.urbanag.info** Geoff is convenor of Aquaponics Network Australia. Write to **geoff@nettworx.info***

Captions:

Dr Nick Savidov.

Cr Joe Pantalone.

A green roof on the Schwab Rehabilitation Hospital in Chicago, where patients enjoy flowers, water, birds and fish. It is a system for improved health care that will morph into aquaponics.

Aquaponics is world's best food system in miserly water use

*By Geoff Wilson**

***Aquaponics appears to be the world's most productive food system in terms of water use efficiency*.**

That can be expected to be a political ace for aquaponics science and technology as the world's fresh water supplies come under increasing pressure.

Depending on where it is practiced, much aquaponics takes only about half the volume of water to produce $100 worth of food in the form of fresh fish and fresh vegetables or fruit – whatever the currency – than inorganic hydroponics.

The accompanying table uses Australian figuring. It shows just how badly other food production systems perform. Inorganic hydroponics is the only close contender for the title of "Most Miserly Water User".

The best Recirculating Aquaculture Systems (RAS) generally use around 700 to 800 litres of water for about $100 worth of food (with American, Canadian and Australian currency comparisons being roughly the same).

But add organic hydroponics as a "back-end" to grow food plants from fish wastes, and there's an immediate reduction in water use as waters from fish tanks are cleaned and recycled back to these tanks. This is the key to why aquaponics is such an efficient system.

It is "Mother Nature" at work – where, over countless millennia, the wastes of one process have become the raw materials of the next. Bumbling humans are only just discovering the great good sense of linked polycultures such as those in aquaponics – instead of using monocultures that gobble up water, fossil-fuel energy and nutrient resources (mostly created from, or using, fossil energy).

I predict that, with increasing awareness of the advantages of aquaponics and hydroponics in political circles, where the painful economics of water use allocations are being thrashed out in many countries, there will be a very logical favouring of aquaponics and hydroponics development.

My other prediction is that this miserly water use, combined with small space needs in cities, ***will make urban aquaponics and hydroponics the dominant food security technologies that will emerge from this century of humankind's development.***

Small signs of this can be seen already among intensive aquaculture producers who are able to harvest fish wastes for additional profit rather than send them down drains at a cost -- or not at all as environment protection laws continue to tighten. Further signs are evident in the advances being made in hydroponics, especially close to city markets, or within cities.

I asked the world's leading aquaponics scientist, Dr James Rakocy, to come up with his aquaponics water use figures in US dollars from his 25 or more years of experiments and practical running of aquaponics at the University of Virgin Islands. Here's what he said of his situation at St Croix in the Virgin Islands:

"For tilapia/lettuce it is 210 litres per US$100, and for tilapia/basil it is 85litres per US$100.

He explained: "I took the total revenue generated from the tilapia/lettuce and tilapia/basil enterprise budgets and divided this by US$100 to the get the total number of US$100 units.

"I then took the initial system volume (110 cubic metres) plus the annual daily makeup water (0.015 x 110,000 litres x 365 days). This came out to 712,250 litres. I then divided this by the number of US$100 units.

"The total annual revenues from tilapia/lettuce were US$333,855 or 3338.55 US$100 units and from tilapia/basil were US$840,375 or 8403.75 US$100 units.

Dr Rakocy said: "This is based on the economics in the Virgin Islands where the price for fish and lettuce is very high. This is also based on gross revenue, not profits," Dr Rakocy said.

But even a most conservative figuring of water use to revenue earned comes up with figures that are as impressive as the best inorganic hydroponics.

My back-of-the envelope figuring based on the UVI aquaponics production figures translated to Australian prices and fish species indicates that Dr Rakocy's aquaponic unit, if it were transported to Australia, would have a water use efficiency of less than 500 litres per A$100 of output.

The Australian pricing of the UVI unit's production is thus:

- Fish output value - 5 tonnes x $11/kg = A$55,000.
- Lettuce output value - average of 35,000 heads by A$1/head = $35,000.
- Basil - five tonnes - A$10/kg = A$50,000.
- Okra - two tonnes - A$3/kg = A$6,000.

Estimated total value of output = A$146,000   Divided into 700,000 litres of water used each year this is about 479 litres of water used per A$100 of production.

But if I chose to grow basil only, and was able to achieve A$10/kg from the 35 or so tonnes it would be possible to grow from the barramundi wastes, then the situation changes dramatically:

- Fish output value – 5 tonnes x $11/kg = A$55,000.
- Basil – 35 tonnes x $10/kg = A$350,000.

Estimated total value of output is then A$405,000 -- which represents water use efficiency of around 173 litres/A$100 of production..

This compares very favourably with the Australian commercial
hydroponics figure of 600 litres of water used per A$100 of production.

But, in comparison to fairly static figures for hydroponics, the aquaponics figures are extremely variable and will fluctuate wildly according to species of fish and food plants chosen.

All that can really be said is that aquaponics can be expected to be the most miserly user of water to grow food in most practical circumstances. Hydroponics is nearly as good – and is well proven.

That is surely enough at the moment.

Obvious questions to Dr Rakocy were:

Does the UVI unit produce year round ? Can its water-use productivity be increased ? How much water comes from (a) the plastic catchment and (b) rooftop runoff?

Dr Rakocy answered: "Yes, we produce year round. Yes, water-use efficiency during washing of the filter tanks could be increased. We could recycle all the water in these tanks. However, I have not included cleaning water, so maybe this should be left alone. All the water comes from rainwater catchment, so we are not depleting any current water supplies.

"If I can remember correctly from a paper we did on a 3-year lettuce trial, about half of the 1.5% daily make-up water replaces water lost to splashing, evaporation and transpiration while the other half replaces water lost during sludge removal, Dr Rakocy said.

I plan to go into the water use experience of other aquaponics growers next issue.

In the meantime, the preceding figuring will give many growers who use water to grow food, an incentive to think a little more deeply about the aquaponics directions they could be taking to better use the world's water – and to become the owners of a better business.

Freelance journalist Geoff Wilson has just launched "UrbanAg Online", a news and information service on 29 different topics in urban agriculture – including aquaponics. Go to ***www.urbanag.info***
Geoff is convenor of Aquaponics Network Australia. Write to ***geoff@nettworx.info***

CAPTIONS:

The University of Virgin Islands' aquaponics farm for which the figuring in this article is based.

Dr James Rakoci.