
The Future of sustainable Agriculture is in the Now

Prompted by the sporadic representation of innovative ways of farming in South Africa, this article explores the massive contribution of emergent smart farming, particularly symbiotic inclined technologies and innovations that could lead to an ultimate agricultural overhaul. Focalsing mainly on the least but crucial aspects of the Agricultural component of South Africa. As an emerging business within the sector, innovations such as Hydroponics, Aquaponics and Aeroponics appear to be the much needed innovation to sustain a growing population.

What you need to know about Aeroponics, Aquaponics and Hydroponics

Aeroponics, Aquaponics and Hydroponics are variants of the revolutionary vertical indoor farming systems that innovatively complement traditional outdoor large scale horizontal agriculture. These three systems are largely indoor water based farming approaches that rely on ICT implements, foreshadowing a futuristic way towards farming that may help dispel hunger and poverty in South Africa. While these implements are still experimental here in South Africa, global economic giants like the United States, Singapore and the United Kingdom have championed these implements for many decades, using them for large scale farming in small spaces such as roof tops, inside unused buildings and alleyways. Aeroponics is, according to some sources, a method where plants are suspended in the air with water solutions sprayed directly onto them. The process is an indoor method with conditions closely monitored to optimise the production of crops.

Aquaponics is a fusion of aquaculture and hydroponics in a system that cyclically breeds fish and grows plants simultaneously. The plants suspended in the air vertically or horizontally in pipes, derive nutrients from the fish waste water passing along the pipes. The plants in turn, use up the nutrients in the water cleansing the water in the process. The water is passed through the pipes along the roots of the plants, back into the fish tanks. The temperatures and conditions in the fish tanks have to be monitored at all times.

It is a needful exercise to perhaps explain aquaculture, as a side note, given that it plays a great role in aquaponics farming. Aquaculture has been defined as a controlled system of “rearing of aquatic fish or aquatic plants for food”. In South Africa, there are quite a number of aquaculture farms of note, Alan Fleming’s Philippi Village in Cape Town and Rikalize Reinecke of Pretoria. These two entrepreneurs are championing new ways of farming in urban South Africa. While Flemming’s village is centred mainly on fish farming in shipping containers, Reinecke’s business acumen cuts across two divides; aquaculture and aquaponics, giving her maximum advantages to fish and plant production.

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Hydroponics is a complex but balanced method of growing plants without the use of soil. Monitoring the processes in this method is essential as balancing of nutrient solutions and oxygen is paramount to the growth of the plants. High precision technology is essential in this method, as the growth of the plants is dependent on the right balance of the nutrient infused water and temperatures. While there are many forms of hydroponics farming, an important aspect to this type of farming is the technology that goes behind it. In South Africa, hydroponics is perhaps the most widely adopted modern technology based farming, especially on rooftops and skyscrapers of Johannesburg.

Traditional Horizontal Farms

Horizontal farming is farming the way we know it today. Using large areas of land to cultivate crops, to do animal husbandry and many other soil based forms of growing plants are the basis of what forms traditional agriculture. This type of farming is heavily dependent on the use of soil as the main ingredient to plant cultivation and/or growing grass to feed livestock or the rearing of farm animals. This form of farming uses large areas of land and is exposed to weather elements. Drought, shortage of rain water, exceptional high temperatures or extremely cold temperatures leave plants at the mercy of unpredictable conditions. With this in mind, traditional farming requires extremely close management to avoid crop loss. This may be a costly exercise for farmers.

While there have been efforts to curb damages to crops by unpredictable natural weather conditions through fertilisers, the use of technologies to monitor weather conditions and soil improving implements, challenges still remain high in this form of farming, hence there has been a general interest in newer forms of agriculture such as vertical farming. “Belgium Campus held a Smart Farming International Week where students collaborated with international students from the Penn State University to find innovative solutions to challenges farmers face in farming. The students focused on both traditional ways of farming as well as the newer forms of farming, particularly aquaponics and hydroponics”.

In a generalised comment about the growth of the human population, Emeritus Professor Despommier of Public Health at Columbia University, notes that there is a stunted growth in the traditional “horizontal” agrarian way of farming and gaps in knowledge about the sustainability of the growing population. The “godfather of vertical farming” proposes vertical farming systems as a solution to the challenges of land farming.

Professor Despommier posits that “we have failed at biomimicry at an agricultural level”. This reality paints a picture that foretells a thwarting of efforts that seek to address the current high levels of global food security for the growing population, if not addressed. He reasons that this should prompt a much needed “third agricultural revolution”. Emeritus Professor Despommier

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is globally renowned for his conception of “vertical farming”, an innovation that upsets old ways of farming.

What is Vertical Farming?

Dozens of sources attribute Vertical farming to Emeritus Professor Dickson Despommier of the University of Columbia. According to some sources, as early as 1997, Despommier together with a group of students experimented with vertical farming after realising that the population of New York was rapidly growing. Their experiment of finding ways to produce food for large populations of people gave birth to vertical farming inside buildings.

Despommier came up with ways of farming indoors and under controlled environments at a much faster rate than traditional farming. This method of farming proved to be quick and efficient, reduced production costs while increasing yield and profits. Unlike in traditional farming where external unpredictable conditions may affect crop growing, vertical farming is solely dependent on the ICT based control systems employed to produce conducive conditions for the fast and efficient plant production. Vertical farming does away with the use of soil. Plants get nutrients directly from produced controlled solutions, monitored by sensors for accuracy as per need. The roots of the plants are held in place by

The persistence of drought continues to increase the vulnerability of people living in arid to semi-arid lands, vertical farming seems to be the logical step to take to bring relief through not only through employment creation but in providing accessibility to affordable food stuff at local levels. With little or no use for soil, the plants grown in this way mature quicker than plants grown using the traditional way. At the moment, risks that go into this type of farming pose as the major challenge faced by farmers engaging in it. Therefore, complementarity between the two forms of farming can go a long way in feeding the nation at large. With technologies that can optimise food production between traditional farming and vertical farming, costs may be cut by a large margin.

The Third Agricultural Revolution

The face of agriculture has changed since humans discovered that we could farm to sustain ourselves. Large scale farming, which has now become known as traditional farming, has been the major form of farming known to men for centuries. However, as challenges of climate change, plant and animal disease and other calamities that are synonymous with natural weather conditions, newer ways of farming have emerged.

According to Despommier, the first green revolution happened “10 to 15 000 years” when humans discovered that they could farm grains like “corn, wheat, millet and other grains” using

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crude technologies implements.

Second green revolution happened around 1932 where hydroponics was introduced but never really particularly tapped into. This is the stage where farmers started selection of grains to farm. This all happened on traditional soil based farms. Also occurring during this revolution, scientists developed ways to genetically manipulate plants into desired species of plants to grow. Finally, Despommier reckons we are on the brink of a third agricultural revolution where the optimum use of ICT implements will be the future of smart farming. Smart farming is basically the use of ICT implements to improve the growth of plants and crops under controlled environments.

Locally, while South Africa grapples with feeding the growing population, through largely traditional ways of farming, newer and innovative ways of vertical farming are emerging. Technologies are being developed and improved, not only for the traditional ways of farming, but also for the versatile vertical farming efforts. Aquaponics and aquaculture take precedence and is making waves in the agricultural sector in South Africa. With efforts resonating with Despommier's vertical farming concept, there has been a surge of local farmers adopting this innovative and futuristic way of farming.

While vertical farming seems to be an expensive exercise, in its outlook, farmers who use this ecosystem type of farming stand to unanimously yield better rewards with a far more reaching result compared to existing traditional ways of farming.

Vertical Farming; The Double-Barrelled Solution to South Africa's Food Crisis

Successive years of drought have left South Africa wallowing in food shortages and hunger crises in some parts of the country, which government effort alone cannot address. Three provinces have been declared disaster provinces because of the lack of rainfall in those areas. Water shortages in the mentioned provinces leave those areas arid to semi-arid, leaving the land useless for farming. As water shortages continue to haunt the three provinces most hit by drought; Northern Cape, Western Cape and the Eastern Cape, implements like vertical farming could champion the much needed relief to the food shortage threat. Designed to consume 90% less water compared to traditional irrigation, vertical soilless farming may be the innovative way to usher in the third green revolution.

Vertical farming is still a relatively new approach to farming that is proving to be a double-barrel solution to the drought solution in South Africa. Aquaponics, hydroponics, drip irrigation and aquaculture are a few of the innovative ways some South African farmers have adopted to tackle the food crisis resulting from the drought.

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All these water based farming innovations grounded in ICT, breathe fresh air into food production in a place where drought is on a high rise and where space challenges are persistent. With its unique ecosystemic type of framework, this form of farming, may; in the long run, be a low cost solution to food shortages while at the same time alleviating poverty through increased employment.

Could Complementarity of Traditional Farming and Vertical Farming offer a sustainable solutions to South African Drought Problem?

It is a general consensus that in its entirety, the South African Agricultural sector is in dire need of a technological revamp. Taking into cognisance that food security is congruently linked to this sector, complementarity of traditional and vertical farming could be the much needed answer to looming food scarcity woes. The need to feed the growing population, should not be taken lightly.

Farmers need to take advantage of the technology that is currently available on the one hand to ensure sustainability through traditional farming. On the other hand, the use of innovative newer ways of farming, that is; vertical farming, should be optimised and exploited to increase food production for the growing population.

Vertical farming foreshadows the future of agriculture in terms of large scale food production in small spaces. With the projection of population growth to more than 60 million people living in South Africa by 2030, maximum use of small spaces to produce food in a fast and efficient way will go a long way in curbing food shortages. This symbiotic relationship between the innovative vertical indoor farming and the traditional farming in the now, may seamlessly usher in the impending third agricultural revolution, if it not already in motion. A mastery of the technology used now, both in traditional farming and in the newer ways of farming is sure to keep food shortages asunder.

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