

# HYDROPONICS: PRACTISING TROUGH CULTURE

**Worldwide plants are increasingly grown commercially using hydroponics methods and have become an important source of fresh vegetables supply. Growers employing the hydroponics technique make use of a simple equation: Investment in crop production vs. yield figures and marketable crop percentage.**

Hydroponics is not an inexpensive growing method, therefore growers are constantly searching for solutions that can decrease financial input but increase output production. Terms such as: density per sq/m, kg/plant yield, etc., are continuously capturing the mind of the hydroponics grower because he depends on high productivity to make his operation viable.

The industry has used various techniques during the last 30-40 years trying to develop the ultimate practical method to fulfill the above criteria.

According to M. S. Sweat, G. J. Hochmuth in their publication "Production Systems - Florida Greenhouse Vegetable Production" (Publication #HS785), they state: Individual production systems are not necessarily crop specific. All of the major greenhouse vegetable crops can be grown successfully in most systems. No single system is superior to the others. The cost of each system is comparable and the production from all systems is high when the system is managed properly. Research studies have shown that there was no significant difference in tomato yield among rockwool, bag, and hydroponics NFT systems. However, the study found that all of these systems produced higher yields than ground culture....." The major differences would be in the irrigation and nutrient delivery methods and controls ".

The question is; what can be considered as more important for the individual grower? The answer for that is a system

that can reduce input cost while increasing or at least produce adequate results. The running cost of a hydroponics business from the grower's point of view concerns labour, nutrients, pest management, seeds/seedlings basically. Those factors will never change or might slightly change due to crop variations etc.

What can change (and drastically so) is the financial input required for growing medium, water/nutrients cost per growing cycle and the growing method employed (growing system and the labour associated with it)

Plants grown in hydroponics depend entirely on consistent supply of nutrients dissolved in water via the irrigation mechanism. The water supply is the main source of oxygen to the root system and therefore if these dynamics are not in place, the roots will be deprived of oxygen and will cause irreversible damage. More than that stunted roots will affect the

ratio between roots and shooting which is the main balance between growth development and roots development. In a hydroponics crop this means that an under developed root system will result in poor vegetative growth and later poor fruit production.

Roots development as stated by ; A.J. Both, L.D. Albright, S.S. Scholl, R.W. Langhans in "ISHS Acta Horticulturae 507: Third

International Workshop on Models for Plant Growth and Control of the Shoot and Root Environments in Greenhouses"

"Plants growth and development are directly influenced by root-shoot relationship; Plants need to balance the rate of photosynthesis with the rate of uptake of water and nutrients in order to stay healthy".

Plant development in hydroponics culture depends on the available area that support root growth and development\*; if limited (as in bag culture) it will balance itself accordingly, i.e. the roots will develop during the vegetative stage and occupy most or all of the growing area, further development become slow and become a problem when the plant becomes productive and need more nutrients and water. At this stage the plant will struggle to cope with the stress and will compromise its production and further growth.



Overview of peppers in ground troughs with perlite



Peppers in ground perlite troughs

The solution is to allow room for root expansion that can be achieved for instance in the TROUGH system.

Hydroponics practice in advanced countries spend huge sums of money on ultimate hydroponics structures which are fully computerized to control climate conditions, nutrients input and even harvesting done by advanced mechanism ( the link will show a 50 million dollars development in USA : [http://www.kubo.nl/kubo\\_tv.php?lang=en&sub=4](http://www.kubo.nl/kubo_tv.php?lang=en&sub=4) (future tomato cultivation).

South Africa is not in this league yet as the South African grower is living with a different economic reality and very few and far between has managed to create structures on a different level (glasshouses at Dube TradePort project next to King Shaka Airport, Durban and others).

The majority need to improve production with what they can afford to make work as hydroponics business - that is TRYING TO

IMPROVE the growing method with limited expense, improve growing medium that lasts longer and support better nutrients uptake and root oxygen supply.

The TROUGH system has been in use for a long time in various applications; it can be gutters, raised troughs etc. - but considering the above statement of keeping the cost low, ground troughs are probably the most practical avenue. W.H. Schnitzler, H. Heuberger stated in their research (ISHS Acta Horticulturae 548: International Symposium on Growing Media and Hydroponics) "Depending on local conditions, the simplest hydroponics system with continuous flow of nutrient solution in self constructed troughs could well prove most cost attractive." And for good reason, since digging a trench (trough) in a tunnel's ground will provide the required troughs with minimum labour. Stretching a double side plastic sheet layer (white -up) will provide the trough base.

Consider using the most supportive growing medium: i.e. that allows water flow down the trough while pulling oxygen along the plants' roots and allow easy nutrients uptake, perlite is a perfect solution. Others such as sawdust, mostly block the water mobility and slowing it down while less supporting oxygen reach the roots. Vermiculite is a better option, but requires very careful irrigation to avoid the trough becoming soggy and blocked. Coir will not support the trough culture unless it is very carefully monitored.

From the above medium options, perlite is the only one that can be used for several growing cycles without being too concerned about its structural properties.

Using a medium like perlite will improve not only the DO (Dissolved Oxygen) levels at root zone but will also allow smooth water/nutrients dynamics throughout the trough. Being inert and with considerably

good water holding capacity(WHC), it can support the growth with less water and nutrients during the cycle.

The main benefit of a trough system is that it allows the root zone to expand according to the plant's natural requirement of keeping the root-shoot ratio intact. The trough system in its simplest version is a method that can keep the hydroponics structure more profitable, at least in the South African economic reality.

In conclusion: In very advanced hydroponics structures the root zone ratio to shoot is less dramatic, since with sophisticated monitoring/measuring technology the plant is compensated all the time with optimal balanced nutrient/oxygen/CO2 input that keep the ratio intact.



Italian peppers seedlings in perlite gutter