

# Hydroponics Agriculture: Its Status, Scope and Limitations in Pakistan



Research and Publication Unit, Planning and Research Department

**Zarai Taraqati Bank Limited**



**ZTBL**

<b>Table of Contents</b>		
<b>S.No</b>	<b>Title</b>	<b>Page</b>
	<b>ACKNOWLEDGEMENT</b>	03
1	<b>INTRODUCTION</b>	04
1.1	WHAT IS HYDROPONICS	04
1.2	BENEFITS OF HYDROPONICS	05
1.3	TYPES OF HYDROPONICS	06
2	<b>REVIEW OF LITERATURE</b>	09
3	<b>NEED FOR THE STUDY</b>	10
4	<b>EXPECTED OUTCOMES OF THE STUDY</b>	10
5	<b>RESEARCH METHODOLOGY</b>	11
6	<b>RESULTS &amp; DISCUSSION</b>	11
7	<b>LIMITATIONS OF HYDROPONICS</b>	13
8	<b>ROLE OF ZTBL</b>	14
9	<b>CONCLUSIONS</b>	16
10	<b>REFERENCES</b>	17
11	<b>RESEARCH INSTRUMENT</b>	18

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## **INTRODUCTION**

Pakistan's agriculture sector assumes a focal part in the economy as it contributes 19% to the GDP (GDP) and retains 42% of the workforce. The economy has been burdened with ever increasing Food imports Bills of the agribusiness based country. With the monetary hardships, for example, increasing financial needs, devaluation of Rupee, high tax collection rates, high import bill, lower income etc. and mismanagement of resources including deficiency of developed land because of Real Estate Boom, water shortage, and so on, Pakistan needs to move concentration to local harvests to substitute imports and achieve self-sustenance.

Due to the Worldwide economic crisis led by Covid-19, further triggered by Russia-Ukraine War, it is need of the hour for apex level policy makers to review prevailing agri-policies and put efforts for the advancement of self-food in horticulture, proficient utilization of existing resources, promotion of local produce and less dependence on worldwide commodity price fluctuations, in order to guarantee food security and sustainability in the country.

The purpose can either be achieved through enhancing the yield of existing landscape (72% cultivated area of the total agricultural land) available for cultivation through different government incentives, modern technology and financial assistance to the farming community or by diversifying the agri-potential with new emerging techniques such as hydroponics, aquaponics, vertical farming, tissue culture, monoculture, drones and genetically modified (GM) crops, are just few latest agri-tech models.

Due to its greater yields and soilless nature, hydroponics and its variants can be found across the globe. Tons of high quality, high profit fruits and vegetables like cucumber, different types of leafy vegetables, eggplant, tomatoes, capsicum, melons, strawberry etc are produced by Saudi Arabia, Japan, South Australia, UAE and many other contries using different types of latest soilless agri technologies.

## **WHAT IS HYDROPONICS:**

Basically, Hydroponics is a Greek term, made from two words - *Hydro* means water and

*Ponos* means labor. Thus its true meaning is "working water". Hydroponics is a type of Horticulture which implies growing plants using mineral nutrient solutions, in water, without soil enhancing productivity multiple times as compared to conventional agriculture. It is principally based on controlled environment agriculture where influence of Nature has been ruled out. Hydroponics is usually grown indoors or in a greenhouse. This means cultivators will supervise the environment carefully - temperature, climate, lights, ventilation, nutrients and so on.

### **BENEFITS OF HYDROPONICS**

Hydroponics is now an established branch of agronomical science. It has been proved that hydroponics is thoroughly practical and it has very definite advantages over conventional methods of agriculture/horticulture. Some of the advantages of Hydroponics are listed below:

- **SOILLESS CULTIVATION**

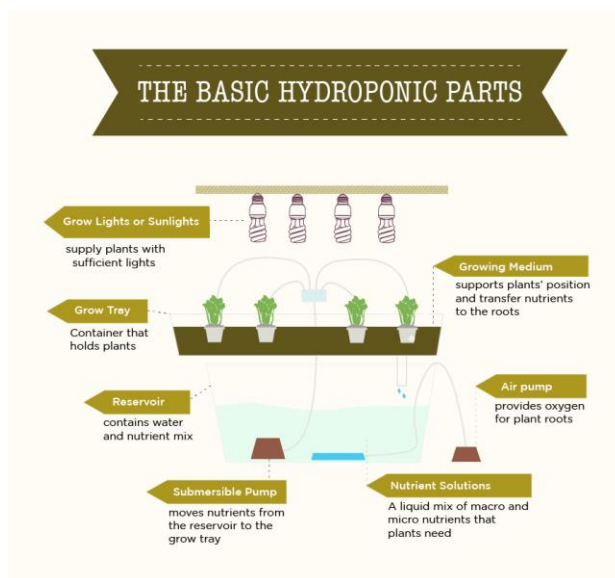
One of the basic advantages of hydroponics is its soilless nature i-e it has made agriculture/gardening possible where one could not even think of it. Hydroponics setups are principally controlled environment systems that can be set up in deserts, mountainous and harsh climate areas as well.

- **HIGHER CROP YIELDS**

Hydroponics produces much higher crop yields as compared to conventional agriculture. For example, average yield of hydroponic tomatoes was found to be  $161.8 \pm 6.6$  ton per hectare as against  $10.07 \pm 0.4$  in open field. Lesser space is required to produce same amount of crop as compared to that grown in the field.

- **LESS GROWTH TIME**

In hydroponics, less growing time is required. Growth of plant is faster as there is no mechanical impediment to the roots and all the nutrient elements are available to the plant in plenty. Further, to increase plant growth, lighting systems such as metalhalide or high pressure sodium lamps are used to lengthen the day or to supplement natural sunshine.



- **LESS LABOUR REQUIREMENT**

As hydroponics is a controlled environment, the Labour and garden maintenance is reduced. The intercultural operation is often absent or is very less, fertilization and irrigation is automated and no hard manual work is required.

- **WATER CONSERVATION**

Hydroponics saves an incredible amount of water since it uses as little as 1/20<sup>th</sup> the amount as a regular farm would to produce the same amount of food. Water conservation is the biggest advantage especially in countries like Pakistan where water availability is already at alarming stage. By using this technique, Waterlogging never occurs.

- **COST SAVINGS IN WORKING CAPITAL**

Initially hydroponics systems are capital intensive but save money by recycling nutrients and water eventually. The nutrient is recycled in case of closed system of hydroponics, thereby preventing loss of nutrient elements and preventing soil pollution. Large amounts of water can be recycled not used by the plant, after being aerated and eliminating anoxic conditions.

- **LESS PEST AND DISEASE PROBLEMS**

Plants grown hydroponically avoid soil borne pests. Moreover, Pest and disease problems can be controlled easily. The existence of weed is practically impossible in Hydroponics. The produce is dirt and smell free, making it attractive choice of consumers.

- **MORE CONTROL OVER PLANT**

With the use of controlled systems in Hydroponics, there is more control over the plants rooting environment as the root zone's temperature, humidity, darkness, etc. can be easily manipulated. It also helps in quick identification of problems in plants growth and remedial measures can be taken timely to avoid major losses.

- **HIGHER RETURNS**

Higher yields can be obtained since the number of plants per unit is higher compared to conventional agriculture and produce can be obtained over an extended period of cropping. This will ultimately result in higher returns. Some out of season plants can also be raised which fetch higher income to the farmers.

- **ENVIRONMENT FRIENDLY AGRICULTURE**

Hydroponics is environment friendly as this type of gardening practically wipes out the requirement for herbicides and pesticides.

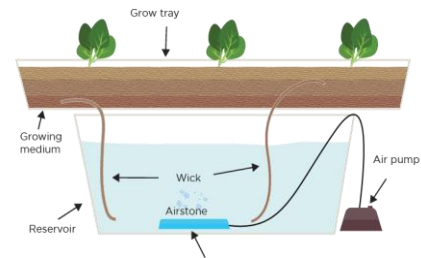
## TYPES OF HYDROPONICS

Every plant needs different type of soil for its growth. Some heavy water requiring plants need clay soil, some need sandy soil where standing water can get easily drained out. This demand automatically restricts the diversification of cultivation i.e. only limited amount and limited type of crop can be produced in an area. So, the situation where this varietal need of soil type can be eliminated even without compromising on the crop's need of nutrients, minerals water etc. can be described as Hydroponics.

Hydroponics farming in Pakistan is in its rising stage. Now-a-days, the progressively thinking farmers of Pakistan are adopting this innovative farming technique. To adopt this technology, we should know that the plants are totally depended upon the artificially created system which can be categorized in 6 basic types; Wick, Water Culture, Ebb and Flow (Flood & Drain), Drip (recovery or non- recovery), N.F.T. (Nutrient Film Technique) and Aeroponics.

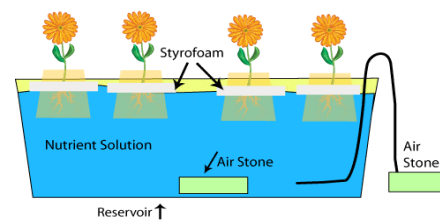
### 1. WICK SYSTEM:

It is a simple type of system where there are no moving parts. In this system, the wick is used to draw the nutrient into the growing medium from the reservoir solution. Vermiculite, Perlite, Pro-Mix and Coconut Fiber are commonly used growing mediums in this system.



### 2. WATER CULTURE:

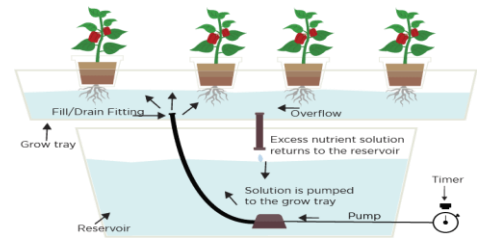
In hydroponics method, the water culture system is the simplest of all active systems. To hold the plants directly on the nutrient solution, a floating platform (usually made of Styrofoam) is used. The oxygen is supplied to the roots of the plants. An air pump is used to pump air to the air stone so that bubbles are formed in the nutrient solution. This system is ideal for fast growing water loving plants like lettuce.



### 3. EBB & FLOW – (FLOOD AND DRAIN):

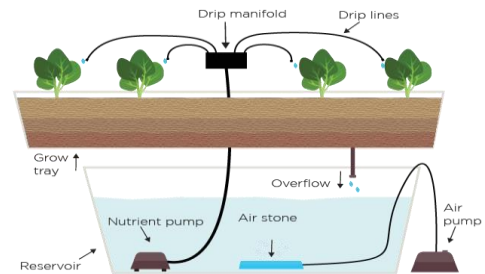
In EBB & FLOW system, the growing tray is flooded with the nutrient solution and then drained back into the reservoir. A submerged pump with timer is used for this action. The timer is used to turn the pump on so that the nutrient solution reaches to the grow tray. When

the timer shuts the pump down, the solution comes back into the reservoir. It depends on the type and size of plants that how many times the timer will be functional in a day. Temperature, humidity and the type of growing medium are other factors too.



#### 4. DRIP SYSTEMS - RECOVERY / NON-RECOVERY:

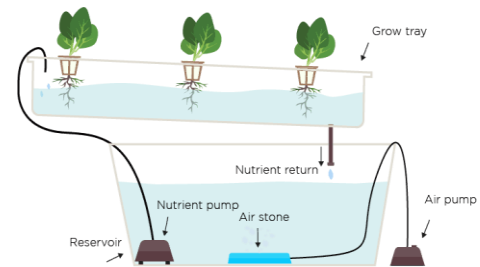
The most widely used system of hydroponics is the Drip system. A submersed pump, controlled by a timer, drips the nutrient solution onto the base of each plant by a small drip line. In a Recovery Drip System, the excess solution comes back in the reservoir for using again.



The non-recovery system needs proper timer as watering cycles should be adjusted to give the plants enough nutrient solution and the runoff is minimum.

#### 5. N.F.T (NUTRIENT FILM TECHNIQUE):

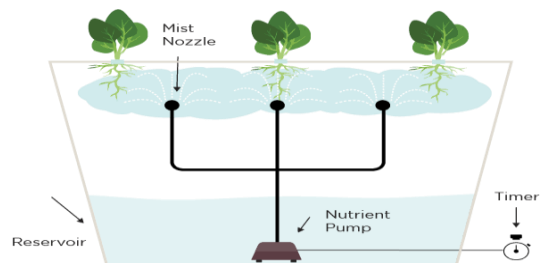
In N.F.T. systems, the submersible pump is not connected with any timer as this system ensures constant flow of nutrient solution. The growing tray (usually a tube) is filled with the nutrient solution through the pump and the solution flows over the plant roots. Then collected back into the reservoir.



Usually, the air is used as growing medium to save the extra cost of replacing the medium after every crop. However, a small plastic basket is used to support where the roots droop into the nutrient solution.

#### 6. AEROPONIC:

A high-tech type hydroponic system in which air is primarily used as growing medium is known as Aeroponics. The plant roots hang in the air and are misted with nutrient solution. It is very risky as if the misting cycles are interrupted, the roots would dry up because they are exposed in the air. In this system, a short cycle timer is required where the pump is run every couple of minutes for few seconds.





## REVIEW OF LITERATURE

The study of crop nutrition began thousands of years ago. According to the ancient history, various experiments were undertaken by Theophrastus (372-287 B.C.) while several writings of Dioscorides on botany dated from the first century A.D. are still in existence (Douglas & James, 1975). The classic work on growing terrestrial plants without soil was published by Sir Francis Bacon in 1627, the book named '*Sylva Sylvarum*'. After Bacon's work, water culture became a popular research technique. In 1699, John Woodward published his water culture experiments with spearmint. He observed that plants grew better in less pure water sources than plants in distilled water. Experiments of German botanists, Julius von Sachs and Wilhelm Knop (1859-65) resulted in a development of the technique of soilless cultivation. It was Professor William Frederick Gericke (1937), who finally introduced the term *hydroponics* and wrote the book named '*Complete Guide to Soilless Gardening*'. Two other plant nutritionists, Dennis R. Hoagland and Daniel I. Arnon, at the University of California wrote a classic in 1938 in agricultural bulletin, *The Water Culture Method for Growing Plants without Soil*. These two researchers developed several formulas for mineral nutrient solutions, known as Hoagland solutions. Modified Hoagland solutions are still used today.

One of the early successes of hydroponics occurred in 1930s on Wake Island where it was used to grow vegetables for the passengers of Pan American Airlines. Since the inception of hydroponics, research to refine the methodology has continued. In the late 1960s researchers at the Glasshouse Crops Research Institute (GCRI), Littlehampton, England developed the nutrient film technique along with a number of subsequent refinements (Graves, 1983). This research gave rise to the hydroponic systems used today. Jensen and Collins (1985) published a complete review of hydroponics highlighting many new cultural systems developed in Europe and the United States. In recent decades, NASA has done extensive hydroponic research for their 'Controlled Ecological Life Support System' (CELSS). Hydroponics intended to take place on Mars are using LED lighting to grow in different color spectrum with much less heat. Hydroponics is a successful and rapidly expanding industry in the world over ([Carruthus, 2002](#)) and is developed manifold in developed countries like four to five folds in last decade in Australia ([Hassall and Associates Pvt. Ltd. 2001](#)). Hydroponic technology is a capital-intensive

technology involving development of infrastructure which has positive impact on productivity and growth ([Imran, 2011](#)). US department of labor classify food crops grown under cover as 0182 sub-head of major Agriculture production as 01 ([USDL, 2014](#)).

Farmers Market Pvt. Ltd. (FMP), a company registered in Pakistan with Security and Exchange Commission of Pakistan (SECP) under company's ordinance 1984 during 2003, is the main body in this study. The company is incorporated for production of horticultural crops in high tech. system with independent Board of Directors and management staff. In March 2009, company has been transferred to Pir Mehr Ali Shah Arid Agriculture University Rawalpindi (PMAS-AAUR) on the basis of board resolution. This company is pioneered in production of hydroponics horticultural crops in the country.

Economical production of hydroponics tomato improves the productivity and farmers profitability. Benefit cost ratio of tomato production under drip irrigation in net houses was found to be 5.19 with the application of farm yard manure. Payback period of investment in net houses using drip irrigation was calculated as one and half years ([Dunage, 2010](#)).

## **NEED FOR THE STUDY**

The population of the world is increasing day by day, especially in the third world countries like Pakistan where there is already scarcity/ mis-utilization of available resources. If this trend in population raise continues, it will become very difficult to meet the food requirements of the growing population. Due to limited availability of cultivable land, urbanization, climate change and many other factors, food and agriculture scientists have come up with different innovative technologies in order to meet the food demands of growing population. Out of these technologies, hydroponics has gained unusual momentum and a lot of research has been conducted across the globe on different aspects of this method. However, in Pakistan very limited or no research on hydroponics has been carried so far.

Therefore, there is a dire need to conduct the research on hydroponics covering different aspects of hydroponics, its status, scope and limitations in Pakistan.

## **EXPECTED OUTCOMES OF THE STUDY**

It is hoped that ZTBL, being specialized Agriculture Development Financial Institution, will be

benefitted from the study by exploring the need of hydroponic among the farming community of Pakistan which is already facing difficulties in agriculture due to Climate Change, increasing input costs of the farmers and huge post-harvest losses. The Credit Division may launch financing scheme for hydroponic agriculture if found feasible/ affordable for the farmers as well as the bank. The study result will also be shared with Agriculture Technology Department in order to add Hydroponics as an innovative Technology in Farmers training Calendar for capacity building of the farmers.

## **RESEARCH METHODOLOGY**

For the purpose of conducting research on Hydroponics, the data has been gathered by primary as well as secondary sources. For the purpose of data collection a questionnaire has been designed. A questionnaire (ANNEX-I) was designed and filled by different experts of hydroponics, in order to get insight view on adoption and effectiveness of hydroponics system in Pakistan. Based on this questionnaire, conclusions have been drawn using qualitative and quantitative statistical measures. The data has been collected from experience Hydroponic researchers/scientists from PMAS- Arid Agriculture University Rawalpindi. The secondary data has been collected from different Research papers, websites and Research Journals. The collected data has been analyzed, conclusion has been drawn and suggestions have been made.

### **Aspects covered in Research Study:**

Hydroponics is a vast field and it is not possible to cover it entirely in single research study, however, following aspects of hydroponics are covered here:

- basics of hydroponics
- Global Status & Current status in Pakistan
- Estimated Cost
- Limitations
- Suggestions for ZTBL as Agriculture Development Financial Institution

## **RESULTS & DISCUSSION**

On the basis of data gathered and analyzed, some of the aspects of hydroponics in Pakistan are described below:

- **Technical expertise required for hydroponics and their availability in Pakistan**

Hydroponics is a complex system where expertise is required covering multiple aspects

including nutrients requirements, light temperature and humidity control, growth monitoring and disease/pest observation. The expertise is available in Pakistan however; most of the local masses are unaware of such facilities. Diploma/ post graduate Diploma in Hydroponics agriculture has been started in different agriculture universities of Pakistan.

- **Water efficiency**

Hydroponics system has greater level of water efficiency and this system is ideal for a country like Pakistan that has drastically been affected by the impacts of Climate Change and water scarcity issues. Hydroponic systems are 80% more water efficient as compared to conventional farming.

- **Impact on Farmers' income and Yield**

As hydroponics system is basically used for growing high value crops, it increases the income of farmers almost 20 times as compared to conventional farming. It enhances the yield of various crops multiple times as shown in table. There is no difference in nutritional values and shelf life of the products, therefore, marketing and transportation of the produce does not require extra efforts.

S. No	Crops/Fruits /Vegetables	Estimated production in Traditional farming practices (per acre)	Estimated Production in hydroponic system (per acre)
1	Tomatoes	04 Tons	70 Tons
2	Cucumber	10 Tons	60 Tons
3	Cherry tomatoes	02 Tons	30 Tons
4	Capsicum (Coloured)	04 Tons	35 Tons

- **Viability of Hydroponics System**

Due to higher initial cost of setup and lack of awareness, most of the farmers are reluctant to invest in this technology. However, once set up is built, it increases production level and hence farmers' income increases, making it viable for small/subsistence farmers also. An estimated cost breakup of small, medium and large scale Hydroponics system has been given in the table:

S.No	Items	Cost of Small Scale Structure (Millions)	Cost of Medium Scale Structure (Millions)	Cost of Large Scale Structure (Millions)

1	Hydroponic structure	2	5	50
2	Seeds	0.1	0.2	0.5
3	Irrigation	0.2	0.3	0.8
4	Nutrient Management	0.3	0.5	1.2
5	Farm Labor	Self employed	0.6	0.85
6	Harvesting	Self employed	0.2	0.7
7	Packaging & Marketing	0.2	0.4	1.2
8	Miscellaneous	0.7	1.1	1.6
<b>TOTAL</b>		<b>3.5</b>	<b>7.5</b>	<b>55.3</b>

- **Adoption of Hydroponics by Small/ Marginalized Farmers**

Hydroponics seems lucrative opportunity for progressive farmers who have sufficient resources to invest in capital-intensive farming technologies. However, small and medium scale farmers can also multiply their income multifold if Banks/DFIs provide them finances for adopting Hydroponics. For banks/DFIs, promotion of hydroponic systems not only creates business but will also add to common interest as a nation. As production of farmers will increase, risk of losses on account of repayment will also be minimal.

## **LIMITATIONS OF HYDROPONICS**

Hydroponics is well-rewarding opportunity for agriculturists with minimal requirements; however, there are some limitations to be considered before shifting to this form of agriculture:

- **Higher set up cost**

Hydroponics require huge capital investment initially as setup consisting of growing containers, pumps, nutrient solutions, appropriate lighting and other materials must be purchased. For small/ medium farmers, it is nearly impossible to set hydroponic units.

- **Lack of Technical Knowledge**

Hydroponic systems require technical knowledge in addition to basic gardening knowledge. The system is based on some principles of engineering to work out efficiently. Moreover, if

you want to reduce your cost of premade nutrient solutions, you have to be aware of some chemistry and biology rules for making such solutions yourself. The skills and knowledge is also required to maintain optimum production in commercial applications.

- **Maintenance**

Due to complexity of the hydroponic setup, maintenance also becomes challenging. Cleaning the tanks often and mixing solutions could be time consuming.

- **Power outages**

Hydroponic systems mainly rely on pumps and artificial lighting, power outages can cause problems. In Pakistan, where electricity breakouts are quite often and the price of electricity is constantly increasing, it is not easy to set up hydroponic units. The Plants in hydroponic system continuously need water pumping and they must be watered by hand if the pumps are not functional.

- **More Pest/ Disease Attacks**

In hydroponics system, each plant is sharing the same nutrients; it is more susceptible that pests, diseases etc. can easily affect each plant.

- **Higher risk of Crop loss**

Plants react faster to fluctuations in the environment whether favorable or otherwise. If this change is for the worst, plants will quickly react to it; showing signs of deficiency or trouble. This may result in limited production and loss of crops.

- **Lack of awareness among public**

Hydroponics is need of an hour as climate change in Pakistan and external economic factors has raised concerns over food security. There is lack of awareness among general masses about outcomes of this technology. Government may initiate media and social campaigns to create awareness and promote latest farming technologies like hydroponics, vertical gardening, rooftop gardening etc. where thousands of tons of vegetables can be grown. Such incentives will make country self-sufficient in food production and will earn foreign exchange through exports.

## **ROLE OF ZTBL**

Zarai Taraqati Bank Limited is an agriculture development financial institution geared towards prosperity of small/marginalized farmers by increasing their income and reducing poverty. The bank has always served farmers by introducing new and innovative agriculture technologies and

believed in agriculture revolution through promotion of mechanization in the country. Keeping in view the role of ZTBL in agriculture sector, following suggestion/recommendations have been drawn in context of Hydroponics technology:

➤ **INSTALLATION OF MODEL HYDROPONICS UNITS**

ZTBL promotes new and innovative technologies in agriculture sector by demonstrating them to farmers. For this purpose, ZTBL may set up small hydroponics units at provincial level for awareness of farmers/general public. These display centres may provide basic training and technical knowledge of Hydroponics to intended farmers.

➤ **CAPACITY BUILDING OF EMPLOYEES/FARMERS**

ZTBL serves community not only in financial terms but also believes in capacity building of its employees/farmers for promotion of agriculture. ZTBL may involve Agri. Graduates working in the bank for Diplomas/ certifications in Hydroponics introduced by different educational institutes on “TRAIN THE TRAINERS” concept. These employees will further deliver their knowledge to farmers and peer group as CRPs (Community Resource Personnel) for promotion/awareness of hydroponics systems. Training and Development of the Bank may provide calendar wise plan of trainings in hydroponics to be held in different areas.

➤ **STRENGTHEN LINKAGES**

ZTBL may develop linkages with well-reputed hydroponic consultancy firms, personnel involved in local based low cost setup manufacturers, specialists in hydroponics in different universities and research centres and supply chain managers of the produce for promoting this technology effectively in the community. The concerns of intended farmers at various stages may be addressed for adoption of hydroponics in the country.

➤ **CREATING PUBLIC AWARENESS**

The success or failure of any new product depends upon the way its benefits are communicated to the society. In order to achieve maximum benefits of this technology, ZTBL may start awareness campaign among farming community by printing brochures, booklets or through social/print media.

➤ **DEVELOP LENDING PRODUCTS FOR HYDROPONICS**

ZTBL may design new lending product for hydroponics. Undoubtedly, it is capital intensive method of cultivation; lending for different purposes (financing for setup, working capital, financing for automated equipments etc.) may be bifurcated in different identifiable products.

Group lending for multiple borrowers may also be considered.

ZTBL may reconsider its Credit policy as agri. land is preferably accepted as Security against loan. Hydroponics is dire need in current situation and landless borrowers having recognized technical experience in hydroponics field may become entitled for loan against personal belongings (Gold, Plot, House etc.) or Guarantee.

- **ELIGIBILITY CRITERIA**

ZTBL may finance on hydroponics to only those borrowers who have gained technical knowledge and attended field based trainings of the subject. Preference should be given to Diploma holders in hydroponics from recognized agri. Institutes/Universities.

- **INVESTMENT IN RESEARCH & DEVELOPMENT**

ZTBL may benefit farming community by obtaining services of experts in the field of hydroponics. These persons will research on the technology as per best hydroponic practices available in the world and develop low-cost base setup structures, nutrients, seeds, equipments etc. for farmers.

## **CONCLUSION**

For making an informed decision and reducing the risk of failure, it is important to understand the advantages and disadvantages of hydroponics. This technology allows for growing where no one has grown before, be it underground, or above, in space or under the oceans this technology will allow humanity to live where humanity chooses. If used for our own survival, hydroponics is and will be a major part of our collective future (Winterborne 2005).

From decades vegetable productivity is stagnant in Pakistan forcing Pakistan to import. Climate change, and extreme climatic conditions are further threatening agriculture production and hence food security. Food security through productivity enhancement is the major thrust of most of the national and international development agendas. This coupled with increasing population are driving up global food demand thus putting upward pressure on Agricultural productivity. Technological development via Hydroponics can be the potential solution to this issue. Hydroponics will benefit country in micro as well as macro level. The increase in production of fruits and vegetables using hydroponics, use of less land for cultivation, with more water efficiency and so on shows an overall positive impact on Pakistan's real GDP, sectoral exports and imports, improves terms of trade and reducing the local market price of fruits and vegetables in Pakistan.



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**Interview Schedule**  
**HYDROPONIC AGRICULTURE: ITS STATUS, SCOPE AND LIMITATIONS IN**  
**PAKISTAN**

1. **Name** \_\_\_\_\_
2. **Qualification** \_\_\_\_\_
3. **Years of Experience in Hydroponics** \_\_\_\_\_
4. Do you think technical expertise require to manage hydroponic farm? Do such expertise available in Pakistan?
  - a. Yes
  - b. No
5. Which agricultural crops, fruits and vegetables can be grown in hydroponic technology in Pakistan? Expected yield in hydroponic system as compared to conventional agriculture.

S.No	Crops/Fruits/Vegetables	Traditional farming practices (per acre)	Production in hydroponic system (per acre)
1	Tomatoes		
2	Chilies		
3	Cucumber		
4	Cherry tomatoes		
5	Cabbage		
6	Cauliflower		
7	Water melons		
8	Musk melons		
	Any other (Please Specify)		

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6. Please give your feedback on the efficiency of yield increase in comparison to the traditional method?
    - a) 25%
    - b) 25-50%
    - c) 50-75%
    - d) 75-100%
    - e) Above 100% \_\_\_\_\_ (specify % age)

7. Please specify the water efficiency in hydroponic system (% age)?
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8. Specify the level of marketing of Hydroponic products?

- a. Very easy
- b. Easy
- c. Normal
- d. Difficult
- e. Very difficult

9. How much is the cost of hydroponic structure at different farmers' level (small/ medium & large scale)?

Small Structure			Medium Structure			Large Structure		
S. No	Item	Cost	S. No	Item	Cost	S. No	Item	Cost
1	Hydroponic structure		1	Hydroponic structure		1	Hydroponic structure	
2	Seeds		2	Seeds		2	Seeds	
3.	Irrigation		3.	Irrigation		3.	Irrigation	
4	Nutrient Management		4	Nutrient Management		4	Nutrient Management	
5	Weeds Control		5	Weeds Control		5	Weeds Control	
6	Pests and Disease Management		6	Pests and Disease Management		6	Pests and Disease Management	
7	Farm Labor		7	Farm Labor		7	Farm Labor	
8	Harvesting		8	Harvesting		8	Harvesting	
9	Packaging & Marketing		9	Packaging & Marketing		9	Packaging & Marketing	
10	Miscellaneous		10	Miscellaneous		10	Miscellaneous	
11	Any other		11	Any other		11	Any other	

10. Do equipments required in hydroponics system easily available in the market? Please provide names of some suppliers/vendors if available.

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11. By adopting hydroponics, how much additional income does a farmer earn?

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12. Is it viable for small farmers to adopt hydroponics?

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13. Please specify the reasons why hydroponic technology is not being adopted by local farmers?

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14. Please mention your feedback how this technology can be adopted in the country in near future?

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15. What do you think do small/medium levels of farmers will adopt this technology if hydroponic is being financed by financial institutions? What difficulties farmers face even after financial aid? Please elaborate your response in detail.

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16. How can ZTBL benefit its employees/ customers for their capacity building in hydroponics in collaboration with PMAS-AAUR?

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17. Are there some Govt. Supported initiatives regarding Adoption of Hydroponics in the country to be communicated/informed to the potential farmers?

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Mr. Asad Ullah Habib  
Mr. Nadeem Akhtar Malik  
Mr. Muhammad Fakhar Imam  
Mr. Ahmed Hussain Khan  
Ms. Aamna Imtiaz (OG-II)  
Ms. Humma Nisar (OG-III)

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