

# Pre-Feasibility Study

## OFF-SEASON VEGETABLE FARMING (High Tunnel)



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## 1 EXECUTIVE SUMMARY

The proposed project is a medium size off-season vegetable farming unit, spreading over a land area of 9 acres on the outskirts of Lahore. Off-season vegetables are proposed to be cultivated in this project using high tunnel technology. The three vegetables assumed to be cultivated in this particular project are tomato, sweet pepper and cucumber. The approximate total time from land preparation to harvesting time is around 8 months.

There is great demand of vegetables all year round and the price is high at the start of the season and at the end of the season. If modern techniques are applied to grow off season vegetable, high prices can be fetched. Vegetables can be cultivated in off-season, with the induction of an artificial technique like tunnel technology, in which temperature and moisture is controlled for specific growth of vegetables. The production of vegetables all around the year enables the growers to fully utilize their resources and supplement income from vegetable growing as compared to other normal agricultural crops. As the landholding power of farmers is decreasing, they need to increase the productivity of their available land, off-season vegetable farming is a measure through which they can attain higher profit margins from the crop.

Tunnel farming is gaining popularity, and being practiced in many areas of Punjab like, Faisalabad, Mamokanjan, Gujranwala, Okara, Sahiwal. But still their cultivation is not at a level to be exported. Farmers are also unaware of their potential. Awareness programmes are helpful as Punjab government is already doing its effort to introduce this technology.

The total initial cost for setting up the high tunnel farm is estimated at Rs. 3.229 million. The project is proposed to be financed through 50% debt and 50% equity. The project NPV is projected around Rs. 6.317 million, with an IRR of 42% and a payback period of 3.19 years. The legal business status of this project is proposed as 'Sole Proprietorship'.

The estimated yield potential of the farm varies according to the selected type of vegetable. The proposed vegetable mix is tomato, sweat pepper and cucumber each cultivated on 3 acres of land. The quantity of seeds sown each year on 9 acres of land is 45,000 number of tomato seeds, 600 grams of sweet pepper seeds and 1,500 grams of cucumber seeds. The estimated produce would be 102 tonnes of tomato, 64 tonnes sweet pepper and 127 tonnes of cucumber excluding 15% wastage.

## **2 INTRODUCTION TO SMEDA**

The Small and Medium Enterprises Development Authority (SMEDA) was established with an objective to provide fresh impetus to the economy through the launch of an aggressive SME support program.

Since its inception in October 1998, SMEDA had adopted a sectoral SME development approach. A few priority sectors were selected on the criterion of SME presence. In depth research was conducted and comprehensive development plans were formulated after identification of impediments and retardants. The all-encompassing sectoral development strategy involved recommending changes in the regulatory environment by taking into consideration other important aspects including finance, marketing, technology and human resource development.

SMEDA has so far successfully formulated strategies for industries such as horticulture, including export of fruits and vegetables, marble and granite, gems and jewellery, marine fisheries, leather and footwear, textiles, surgical instruments, transport, dairy etc. Whereas the task of SME development at a broader scale still requires more coverage and enhanced reach in terms of SMEDA's areas of operation.

Along with the sectoral focus a broad spectrum of business development services is also offered to the SMEs by SMEDA. These services include identification of viable business opportunities for potential SME investors. In order to facilitate these investors, SMEDA provides business guidance through its help desk services as well as development of project specific documents. These documents consist of information required to make well-researched investment decisions. Pre-feasibility studies and business plan development are some of the services provided to enhance the capacity of individual SMEs to exploit viable business opportunities in a better way.

This document is in continuation of this effort to enable potential investors to make well-informed investment decisions.

## **3 PURPOSE OF THE DOCUMENT**

The objective of this pre-feasibility study is primarily to facilitate potential entrepreneurs in project identification for investment. This pre-feasibility may form the basis of an important investment decision and in order to serve this objective, the document/study covers various aspects of project concept development, start-up, and production, marketing, finance and business management. The document also provides sector information and international scenario, which have some bearing on the project itself.

The purpose of this document is to facilitate potential investors of High Tunnel Farming by providing them a macro and micro view of the business with the hope that the information provided herein will aid potential investors in crucial investment decisions.

This report is based on the information obtained from industry sources as well as discussions with businessmen. In the financial model, since forecast/projections relate to the future periods, actual results are likely to differ because of events and circumstances that do not occur as expected.

## 4 PROJECT PROFILE

### 4.1 Opportunity Rationale

Importance of vegetables in human diet cannot be ignored as they provide vitamins and minerals and are a major source of roughage that is helpful for digestion process. Vegetables also help to control cholesterol in our body. Many vegetables are famous for their low-caloric value being used by diet conscious people.

With increased health awareness in the general public and changing dietary patterns vegetables are now becoming an integral part of average household's daily meals. Additionally, high population growth rate (1.6%)<sup>1</sup> and availability of packaged vegetables, has generated a year round high demand for vegetables in the country.

In natural season local vegetables flood the markets bringing down the prices substantially. The demand of vegetables is high all year round and the price is high at the start of the season and at the end of the season. If modern techniques are applied to grow off season vegetable, high prices can be fetched. Increasing population of the world and shortage of land for agricultural use coined the idea of producing vegetables in tunnels. Vegetables can be cultivated in off-season, with the induction of this artificial technique, in which temperature and moisture is controlled for specific growth of vegetables. The production of vegetables all around the year enables the growers to fully utilize their resources and supplement income from vegetable growing as compared to other normal agricultural crops. As the landholding power of farmers is decreasing, they need to increase the productivity of their available land, off-season vegetable farming is a measure through which they can attain higher profit margins from the crop as compared to traditional farming.

Lack of developed vegetable processing and storage facility robs farmers from their due share of profit margins. In the absence of storage infrastructure and vegetable processing industry in the country, off-season vegetables farming is one of the most viable options that can add value to the farmer's produce.

### 4.2 Project Brief

The proposed project is designed as a medium sized off-season vegetable farming unit, spreading over a land area of 9 acres. Off-season vegetables, such as, tomatoes, chillies/hot pepper, cucumber, brinjal, sweet peppers, ridge-gourd (teendi) and bitter-gourd (krela) can be cultivated using high tunnel technology. However for the purpose of this pre-feasibility three crops have been proposed, namely: tomato, sweet pepper and cucumber.

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<sup>1</sup> [http://en.wikipedia.org/wiki/Demographics\\_of\\_Pakistan](http://en.wikipedia.org/wiki/Demographics_of_Pakistan)

The land can be utilized for green manuring during the idle period to maintain the fertility of soil. Apart from green manuring, the land can also be utilized for growing seasonal vegetables in the idle period.

The estimated yield potential of the farm varies according to the selected type of vegetable. For this project a mix of three proposed vegetables is listed below. For this vegetable mix it is estimated that a 9 acre farm unit will yield a total of 293,250 kg per season excluding 15% wastage.

### 4.3 Proposed Business Legal Status

The business legal status of the proposed project can either be sole proprietorship or partnership. Additionally, it can also be registered under the Companies Ordinance, 1984 with the Securities & Exchange Commission of Pakistan. The selection depends upon the choice of the Entrepreneur. This Pre-feasibility assumes the legal status to be Sole Proprietorship.

### 4.4 Proposed Capacity

The estimated yield potential of the farm varies according to the selected type of vegetable. The proposed vegetable mix is tomato, sweet pepper and cucumber each cultivated on 3 acres of land. The quantity of seeds sown each year on 9 acres of land is 45,000 watermelon seeds, 600 grams of sweet pepper seeds and 1,500 grams of cucumber seeds. The estimated produce would be 102 tonnes of tomato, 63.75 tonnes sweet pepper and 127.5 tonnes of cucumber excluding 15% wastage.

**Table 4-1 Total Production Capacity on the basis of high tunnel technology**

Vegetables	Area (acres)	Seeds sown	Total Production Quantity (kg)
Tomato	3	45,000 (no. of seeds)	102,000
Sweet pepper	3	600 (grams)	63,750
Cucumber	3	1,500 (grams)	127,500

### 4.5 Advantages

Benefits from year-round production include year-round income, retention of old customers, gain in new customers, and higher prices at times of the year when other local growers (who have only unprotected field crops) can not deliver vegetable produce. Other potential benefits of season extension technologies are higher yields and better quality. In winters for off season vegetables cultivation, high quality indeterminate seed is easily available in the markets. This indeterminate seed grows upwards with provided support. Therefore tunnel farming has increased the production of plants in even smaller areas. Farmers with small cultivating area can get benefits from plastic tunnel farming and can increase their income.

In plastic tunnel farming, problems due to less supply of water are alleviated by using drip system irrigation.



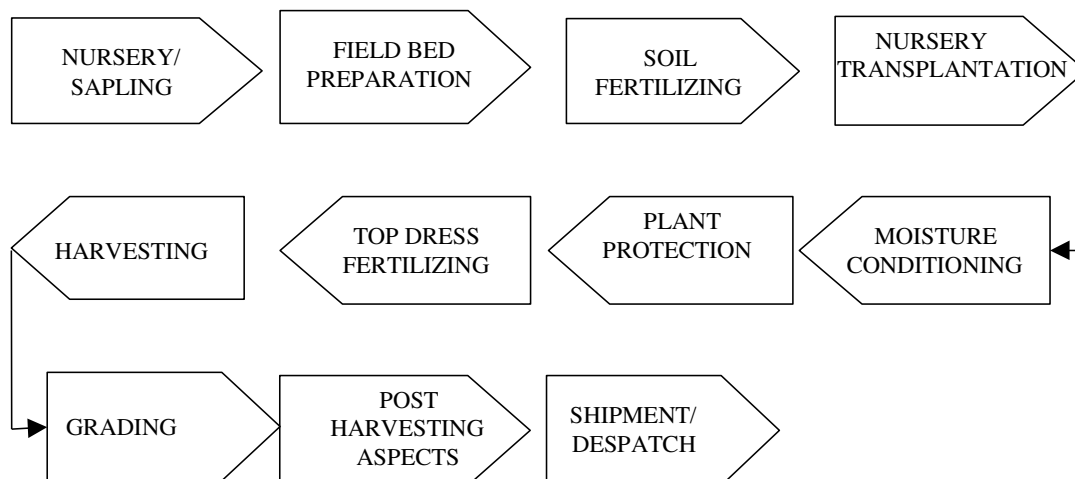
In addition, with year-round production you can provide extended or year-round employment for skilled employees whom you might otherwise lose to other jobs at the end of the outdoor growing season. Disadvantages include no break in the yearly work schedule, increased management demands, higher production costs, and plastic disposal problems.

#### 4.6 Viable Economic Farm Size

The proposed project is based on leased land of 9 acres, however the distance of the farm from the market will determine the feasible size of the project. Near large markets like Lahore, projects with smaller land holdings can be a viable option, and large land holdings are recommended for projects that are planned away from large markets.

#### 4.7 Process Flow Chart

**Figure 4-1 Production flow of off- season vegetables (transplanting)**



#### 4.8 Production Flow of off-season vegetables

The production flow varies slightly for different vegetables. The following production flow is based on the production of tomato:

- i. Sowing of seeds in a separate plot of land for nursery.
- ii. Preparation of seed beds in the field for cultivation of vegetables.
- iii. Transplantation of nursery in the soil or sowing of seeds directly in the soil.
- iv. Using fertilizer in the soil to maintain its fertility.
- v. Covering the furrows with black polyethylene as mulch to protect weeding.
- vi. Sowing of seeds directly in the soil.
- vii. Maintaining level of moisture in the soil.
- viii. Protection from the pests, diseases and other wild growths by using

- pesticides/sprays of chemicals, and trimming.
- ix. Using fertilizer of different varieties for the smooth growth of plantation.
  - x. Picking/harvesting at various times as per nature/requirement of the plantation.
  - xi. Grading of crop on the basis of quality and other standards.
  - xii. Application of post harvesting technology for picking and storing the products.
  - xiii. Transportation to the sale points in local or export markets.

## **5 CURRENT INDUSTRY STRUCTURE**

### **5.1 Off season vegetable growers**

At present, the tunnel technology is being used at the following places/farms.

- i. Mian Shadi Agri Farm, Mamonkangan, district Faisalabad
- ii. Haji Sons, Chiniot, Jhang
- iii. Ayub Agricultural Research Center, Faisalabad
- iv. National Agriculture Research Center (NARC) Chak Shahzad, Islamabad
- v. Jalandhar Vegetable Farm, Rahim Yar Khan
- vi. University of the Punjab, Lahore
- vii. Sindhu Farm, Kamalia, district T.T Singh
- viii. Sitara Farm, at Sitara Chemicals, Shah Kot, district Faisalabad

### **5.2 Vegetables Suitable for Tunnel Farming**

Growing under plastic is more competitive in today's vegetable market, it gives superior yields and early spring production. Few high value vegetables, which can be grown in off-season and provide significant increase in earnings, are as follows:

- Muskmelon
- Tomato
- Pepper
- Chillies
- Cucumber
- Bitter Gourds
- Squashes
- Pumpkin
- Watermelon

- Brinjal

### 5.3 Present Production of Vegetables

According to Agriculture Marketing Information Service, Govt. of Punjab 2008-09, the production statistics of various vegetables are shown in table below:

**Table 5-1 Production of various vegetables during the year 2008-09 (tonnes)**

Item	Punjab	Sindh	KPK	Balochistan	Pakistan
Tomato	72,475	100,921	161,828	226,667	561,891
Onion	300,515	660,171	136,442	607,015	1,704,143
Garlic	24,870	14,309	22,030	5,995	67,204
Chillies	8,590	172,171	749	6,182	187,692
Turmeric	33,640	170	2,343	--	36,153
Potato	2,782,683	3,026	121,005	34,606	2,941,320

### 5.4 Clusters of off-season vegetable production

As per the information gathered from Agriculture Department, Government of Punjab, and National Agricultural Research Center, Islamabad, following are the areas which could be identified as major existing clusters of off-season vegetable production:

Mamonkangan, Nankana Sahib, Faisalabad, Kamalia in Toba Tek Singh, Rahim Yar Khan, Chack Shahzad, Islamabad, Swat, Tarnab, Mardan, Khairabad, Mirpur Khas, Chiniot, etc.

## 6 TECHNICAL ANALYSIS

### 6.1 Plantation and Growth Essentials

There are 15 essential requirements for healthy growth of a plant. The requirement and their respective sources are provided in the following table:

**Table 6-1 Plantation growth essentials**

SOURCE	REQUIREMENT
Air & Water	Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus and Potash
Land	Calcium, Magnesium, Sulphur Iron, Copper, Zinc, Boron, Molybdenum, Manganese and Chlorine

### 6.2 Fertilizers on Production

By using fertilizers containing Nitrogen, Phosphorus and Potash the yield of the crop can be maximized. Good quality and appropriate quantity of fertilizer plays a great role in the production and quality of vegetables ultimately affecting overall cost of production.

### 6.3 Sowing and Picking period of off-season vegetables

Following are sowing and picking periods of selected off-season vegetables in their respective normal growing seasons:

**Table 6-2 Sowing and Picking period for the selected off-season vegetables**

Vegetables	Sowing Period	Picking Period
Tomato	<ul style="list-style-type: none"> <li>▪ October (Nursery)</li> <li>▪ November (transplantation)</li> </ul>	<ul style="list-style-type: none"> <li>▪ February-May</li> </ul>
Watermelon	<ul style="list-style-type: none"> <li>▪ 10<sup>th</sup>-20<sup>th</sup> November</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mid March to May</li> </ul>
Pumpkin	<ul style="list-style-type: none"> <li>▪ 20<sup>th</sup> October - 10<sup>th</sup> November</li> </ul>	<ul style="list-style-type: none"> <li>▪ 2nd week of February to May</li> </ul>
Cucumber	<ul style="list-style-type: none"> <li>▪ End of October to end of December (direct seeding)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mid January to May</li> </ul>
Sweet pepper/ Hot pepper	<ul style="list-style-type: none"> <li>▪ Mid of September to 1<sup>st</sup> week of October</li> <li>▪ End of October to 1<sup>st</sup> week of November (Transplantation)</li> </ul>	<ul style="list-style-type: none"> <li>▪ End of January to September</li> </ul>

### 6.4 Off-season cultivation methods

There are number of ways and methods to cultivate vegetables during the off-season. Some of the methods are explained as under:

#### 6.4.1 Natural method by selection of appropriate area

Off-season vegetables are grown in areas where climatic conditions are moderate for both normal and off-season vegetables. Winter vegetables are grown in summer on hilly/semi-hilly areas where climatic conditions are favourable for a particular vegetable. In the same way, summer vegetables are grown in winter season in the valleys and across the sea areas.

The production cost of vegetables under given conditions is very high due to transportation of crop to the markets. Moreover, the transportation of crop over long distance markets causes post-harvest losses. These drawbacks lead to adoption of artificial methods of cultivation in off-season, and cultivation nearer to markets to tackle heavy transportation cost and to reduce post-harvest losses.

#### 6.4.2 Artificial Methods

Vegetables can be grown in off-season through artificial methods; the detail of these methods is given below:

- **Growing Beneath the Sarkanda<sup>2</sup>**

This is an old method and is usually adopted near the big cities. The main vegetables grown under this method are tomato, chilli, cucumber, and bottle gourd. The nursery of these vegetables is planted in October/November and a wall of Sarkanda is affixed in the direction of North South, which protects plants from cold winds and mist. This method of cultivation is not beneficial because the growth of the plant tends to be slow, as the plant does not receive required sunshine and desired humidity.

- **Building of Green Houses**

Through building green houses, the sunshine intensity is controlled. The vegetables under this method are grown mostly in the winter season. Here the temperature, humidity, carbon dioxide, ventilation of air and irrigation etc. is controlled. Green houses can be built of plain glass or of fibreglass material. The main drawback in the usage of this method is heavy capital cost.

- **Plastic Tunnel**

Cultivation by this method is gaining popularity because of low cost and easy usage. Plastic tunnels are transparent which provide required sunshine to the plants, and the plastic also acts as a barrier against the cool air in winter.

## **6.5 Structures**

There are different types of tunnel structures which are used to grow off-season vegetables based on the height of tunnel and material used.

### **6.5.1 Height based structures**

- Low tunnel
- Walk-in tunnel
- High tunnel

### **6.5.2 Material based structures**

- Tunnel made by Bamboo
- Tunnel made by Iron material
- Tunnel made by Plastic pipe (PVC material)

## **6.6 Recommended Tunnel**

In this pre-feasibility study, cultivation is recommended with the use of high tunnels of bamboo structure on the basis of its low construction cost.

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<sup>2</sup> *Sarkanda (Saccharum spontaneum)* is a tall, straight, grass, growing in clumps, having height up to 6 meters.

It is the cheapest among the available options of high tunnel structural materials. The tunnels are suitable for bitter gourds, tomato, cucumber, chilli/peppers, etc. The crop yield in this type of tunnel is the highest compared to other types considering best management practices. All calculations are done on the basis of high tunnel technology. The specifications of high tunnel are given in the following table:

**Table 6-3 Specifications of High Tunnel**

<b>Material Specification</b>	Material	Plastic pipe (Bamboo material)
	Plastic pipe (Bamboo material)	Diameter 2-3 inch Length 8.5-20 ft (Different lengths)
	Plastic	0.06 mm thick
<b>Tunnel Specification</b>	Height	10 ft
	Width	30-32 ft
	Length	200 ft
	No. of tunnels	6 per acre

The cost of such tunnel amount to Rs. 134,040 per acre excluding the cost related to plastic used as a shield (Cover) and mulch.

**Figure 6-1 High Plastic Tunnel**



### 6.6.1 Support Structure

Each tunnel will be 200 feet long, 10 feet high and 30-32 feet wide. The tunnel is built by 2-3 inch diameter (different thickness) bamboo having 8.5-20 feet length (different lengths). The bamboos are put at regular intervals of approximately 10 -15 feet. Each tunnel structure will then be covered by 0.06 mm thick plastic sheet. Approximately 6 tunnels can be constructed on an acre of land depending on the type of vegetable, i.e. tomato, sweet pepper and cucumber.

## 6.7 Seed and its importance

For tunnel cultivation, F1 hybrid seed is used, because they have the ability to resist multiple diseases. These hybrid seeds cost more than the ordinary seeds. The productivity and quality of the crop is ensured from quality of these seeds. Hybrid seeds have above 90% germination capacity as compared to that of ordinary one. The ordinary seed is produced from the crop itself whereas hybrid seed is produced through a special process. For every crop, new hybrid seed needs to be purchased / sown.

The crop yield achieved from hybrid seeds is 3 to 4 times higher than the ordinary seeds and is also less prone to diseases.

## 6.8 Practical Tips for off-season vegetable farming

- Any person who is planning to adopt this technology should have some practical knowledge about agriculture and farming.
- Land that is being utilized for off-season vegetable farming should be tested which will help in determining the quality of soil for vegetable production.
- Farmer should ensure that the plants they are planning to grow must have the ability to self-pollinate under the plastic sheet.
- Selection of the seed is most important factor because the quality of seed determines the productivity of the crop.
- Vegetables, which are in demand should be cultivated, this will help in earning higher profit margins.
- Timing of cultivation of vegetables has to be done accurately. The farmer should have knowledge about the benefits of an early crop and he should gather data about the prices of these early crops.

## 7 LAND UTILIZATION

### 7.1 Soil Preparation and Sowing

- Laser levelling or with any precise method soil should be properly levelled
- Deep ploughing and harrowing.
- Apply well decomposed FYM 10 tonne per acre or green manuring is recommended at least 60 days before sowing.
- Apply basal dose chemical fertilizer one month before sowing followed by irrigation.
- Prepare soil, complete bed preparation and mulching one week before sowing.
- Make holes on mulch (plastic sheet) before seeding.
- Irrigate the field after seeding in such a way that moisture should reach the seed place.

- The next day, light irrigation should be repeated to assure proper moisture at seed place.

## 7.2 Material Availability

- Tunnel material i.e. Plastic Sheet, Iron Wire, Bamboo, etc. is available locally from different suppliers.
- Mian Shadi Agricultural Material Company, Syngenta Pakistan Ltd. and Haji Sons are the major suppliers of hybrid seeds.
- Fertilizers of all kinds are available locally.
- Pesticides of different kinds are also available locally.
- Water is available from canal or can be used from tube wells.

## 7.3 Expected Production and Sale price

Expected production and sale prices of some vegetables are given in table below:

**Table 7-1 Expected Production and Land Utilization**

Vegetable	Land Utilization (Acres)	Production Quantity incl. Wastage (Kg/ Acre)	Production Quantity excl. Wastage (Kg)	Sale Price (Rs./ Kg )
Tomato	3	40,000	102,000	20
Sweet pepper	3	25,000	63,750	20
Cucumber	3	50,000	127,500	15

The prices of vegetables in normal season are around one-third of the prices of vegetables grown in off-seasons.

## 8 HUMAN RESOURCE REQUIREMENT

### 8.1 Number of Staff Required

Permanent staff required for the project is given in the table below.

**Table 8-1 Permanent staff requirement**

Description	Number	Monthly Salary per person (Rs.)	Annual Salary (Rs)
Farm Owner	1	20,000	160,000
Permanent Labour	6	8,000	384,000
<b>Total Salary</b>			<b>544,000</b>

Part time workers would be required during the picking season of three months. Five pickings per month are assumed with an average rate of Rs. 220 per picking. Following table shows the criteria for temporary labour salary:



**Table 8-2 Part-time staff requirement**

Description	Number	Salary (Rs. per picking)	Seasonal Salary (Rs)
Temporary Labour	11	Male: 220 Female: 220	326,700

## 9 MACHINERY AND TOOLS

Plant and machinery required for an off-season vegetable farm can be purchased or leased by paying on hourly basis. In this particular pre-feasibility we have assumed machinery for hoeing and land preparation would be leased and spray machine and some tools would be purchased.

**Table 9-1 Machinery and Tools purchased**

Description	Number	Cost per Unit (in Rs.)	Total Cost (in Rs.)
Farm Tools	1	20,000	20,000
Spray Machines	3	5,000	15,000
<b>Total cost of tools and equipment</b>			<b>35,000</b>

## 10 FURNITURE AND FIXTURE

Table 10-1 shows the furniture requirement of the project and table 10-2 below represents the Tunnel equipment required for construction of tunnels:

**Table 10-1 Office Furniture and Fixtures**

Description	Unit	Unit Cost (Rs.)	Total Amount (Rs.)
Chairs	8	1,500	12,000

**Table 10-2 Requirement for high tunnel**

Description	Unit /Acre	Units for 9 acres	Unit Cost (Rs.)	Total Amount (Rs.)
Bamboos (No. / Acre)	1080	9,720	110	1,069,200
Wire (G. Iron) (Kg / Acre)	40	360	106	38,160
Wire stretchers (No. / Acre)	100	900	30	27,000
Structure installation cost			8000	72,000
Plastic (white) Cost (Kg / Acre)	250	2,250	192	432,000
Plastic Mulch (black)	30	270	207	55,890
<b>Total Cost</b>				<b>1,694,250</b>

## 11 LAND AND BUILDING

### 11.1 Land and Building requirement

Keeping in mind the weather conditions and population base, “off-season” vegetable farming project can be located near the big cities on fertile land. Big cities have adequate consumption of various vegetables. The project may be located on the outskirts of Lahore, Faisalabad, Sahiwal, Mardan, and Quetta.

For setting up a tunnel farm, land can either be purchased or rented out. In this pre-feasibility 9 acres of land is assumed to be rented for a season of 8 months.

### 11.2 Utilities Required

- Water
- Telephone (mobile)

## 12 PROJECT ECONOMICS

The total project cost is estimated around Rs. 3.229 million. The capital cost is estimated around Rs. 1.741 million and working capital of Rs. 1.487 million. The total cost, project returns and financial plan are given in the tables below:

**Table 12-1 Total Project Cost**

Account Head	Total Cost (Rs.)
Capital Cost	1,741,250
Working Capital Cost	1,487,273
<b>Total Project Cost</b>	<b>3,228,523</b>

**Table 12-2 Project Returns**

NPV (Rs.)	6,316,560
IRR	42%
Payback Period (Years)	3.19

**Table 12-3 Financing Plan**

Financing	Ratio	Rs.
Equity	50%	1,614,261
Debt	50%	1,614,261

## 13 KEY SUCCESS FACTORS

The commercial viability of the project depends upon the regular and consistent supply of good quality hybrid seeds and fertilizers. The other important aspect is the need for strong linkages with the local markets.

### **13.1 Guidelines for successful cultivation**

Following principles need to be pursued for the best productivity of vegetables:

- Proper soil analysis for determining soil nutritional level.
- Use of high quality hybrid seeds.
- Fertile land and its maintenance within the tunnel during the period of cultivation.
- Selection of profitable vegetables on the basis of best analysis of cost and revenues for a given season. Cost efficiency through better management.
- Timely control of pests, diseases and exercise of preventive measures.
- Maintenance and control of internal temperature and humidity of the tunnel.
- Timely irrigation and fertilization.
- Timely training and grading of plantation.
- Fertilization should be done at the soil bed preparation stage. The second fertilization, after 3 weeks interval, the third after 6 weeks and finally during the harvesting period.
- Post harvest includes protection from direct sunlight and speedy transport to the market.

## **14 THREATS FOR THE BUSINESS**

- Crop failure in any year.
- Effect of change in the government regulations.
- Absence of crop insurance.

## **15 OPPORTUNITIES FOR THE BUSINESS**

- Hybrid seeds that provide higher yield can lead to lower unit cost.
- Off-season cultivation of high value vegetables will fetch better price and provide continuous supply to the processing industries.
- Higher prices can be obtained by producing the right crops, at the right times and of better quality. They may also depend on negotiating skills and targeting high price buyers.

## 16 FINANCIAL ANALYSIS

### 16.1 Project Cost

<b>Initial Investment</b>		
<b>Capital Investment</b>	<b>Rs. in actuals</b>	
Machinery & equipment	35,000	
Furniture & fixtures	1,218,360	
Tunnel equipment	487,890	
<b>Total Capital Costs</b>	<b>1,741,250</b>	
<b>Working Capital</b>	<b>Rs. in actuals</b>	
Raw material inventory	812,460	
Upfront land rent	300,000	
Cash	374,813	
<b>Total Working Capital</b>	<b>1,487,273</b>	
<b>Total Investment</b>	<b>3,228,523</b>	
<b>Initial Financing</b>	<b>Rs. in actuals</b>	
Debt	1,614,261	
Equity	1,614,261	
<b>Project Returns</b>		
	<b>EQUITY</b>	<b>PROJECT</b>
Net Present Value (Rs.)	3,943,485	6,316,560
Internal Rate of Return	56%	42%
Payback Period (Yrs)	2.45	3.19

## 16.2 Raw material calculations

Raw material costs										
Total cost of seeds	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10
Tomato Seed	110,160	121,176	133,294	146,623	161,285	177,414	195,155	214,671	236,138	259,752
Sweet pepper Seed	120,000	132,000	145,200	159,720	175,692	193,261	212,587	233,846	257,231	282,954
Cucumber Seed	135,000	148,500	163,350	179,685	197,654	217,419	239,161	263,077	289,384	318,323
<b>Total</b>	<b>365,160</b>	<b>401,676</b>	<b>441,844</b>	<b>486,028</b>	<b>534,631</b>	<b>588,094</b>	<b>646,903</b>	<b>711,594</b>	<b>782,753</b>	<b>861,028</b>
Total cost of fertilizer	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10
Calcium Amonium Nitrate	25,200	27,720	30,492	33,541	36,895	40,585	44,643	49,108	54,018	59,420
Nitrophos	93,600	102,960	113,256	124,582	137,040	150,744	165,818	182,400	200,640	220,704
DAP	75,600	83,160	91,476	100,624	110,686	121,755	133,930	147,323	162,055	178,261
SOP	72,900	80,190	88,209	97,030	106,733	117,406	129,147	142,061	156,268	171,894
<b>Total</b>	<b>267,300</b>	<b>294,030</b>	<b>323,433</b>	<b>355,776</b>	<b>391,354</b>	<b>430,489</b>	<b>473,538</b>	<b>520,892</b>	<b>572,981</b>	<b>630,279</b>

## 16.3 Packing calculations

Packing Expense										
	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10
Tomato	136,000	66,938	70,284	73,799	77,489	81,363	85,431	89,703	94,188	98,897
Sweet pepper	63,750	66,938	70,284	73,799	77,489	81,363	85,431	89,703	94,188	98,897
Cucumber	76,500	80,325	84,341	88,558	92,986	97,636	102,517	107,643	113,025	118,677
<b>Total Packing expense</b>	<b>276,250</b>	<b>214,200</b>	<b>224,910</b>	<b>236,156</b>	<b>247,963</b>	<b>260,361</b>	<b>273,380</b>	<b>287,048</b>	<b>301,401</b>	<b>316,471</b>



## 16.4 Revenue calculations

<b>Sales Revenue</b>										
	<b>Year-1</b>	<b>Year-2</b>	<b>Year-3</b>	<b>Year-4</b>	<b>Year-5</b>	<b>Year-6</b>	<b>Year-7</b>	<b>Year-8</b>	<b>Year-9</b>	<b>Year-10</b>
<b>No. of Kgs per acre</b>										
Tomato	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Sweet pepper	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Cucumber	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
<b>Total Production in Kgs (excl. wastage)</b>										
Tomato	102,000	102,000	102,000	102,000	102,000	102,000	102,000	102,000	102,000	102,000
Sweet pepper	63,750	63,750	63,750	63,750	63,750	63,750	63,750	63,750	63,750	63,750
Cucumber	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500
	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>	<b>293,250</b>
<b>Sales Price per kg</b>										
Tomato	20	22	24	27	29	32	35	39	43	47
Sweet pepper	20	22	24	27	29	32	35	39	43	47
Cucumber	15	17	18	20	22	24	27	29	32	35
<b>Sales Revenue</b>										
Tomato	2,040,000	2,244,000	2,468,400	2,715,240	2,986,764	3,285,440	3,613,984	3,975,383	4,372,921	4,810,213
Sweet pepper	1,275,000	1,402,500	1,542,750	1,697,025	1,866,728	2,053,400	2,258,740	2,484,614	2,733,076	3,006,383
Cucumber	1,912,500	2,103,750	2,314,125	2,545,538	2,800,091	3,080,100	3,388,110	3,726,921	4,099,614	4,509,575
Sale of empty bags of fertilizer	900	990	1,089	1,198	1,318	1,449	1,594	1,754	1,929	2,122
<b>Total sales Revenue</b>	<b>5,228,400</b>	<b>5,751,240</b>	<b>6,326,364</b>	<b>6,959,000</b>	<b>7,654,900</b>	<b>8,420,390</b>	<b>9,262,430</b>	<b>10,188,672</b>	<b>11,207,540</b>	<b>12,328,294</b>

## 16.5 Projected Income Statement

Income Statement										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue	5,228,400	5,751,240	6,326,364	6,959,000	7,654,900	8,420,390	9,262,430	10,188,672	11,207,540	12,328,294
<i>Cost of sales</i>										
Seeds expense	365,160	401,676	441,844	486,028	534,631	588,094	646,903	711,594	782,753	861,028
Fertilizer expense	267,300	294,030	323,433	355,776	391,354	430,489	473,538	520,892	572,981	630,279
Pesticide expense	180,000	198,000	217,800	239,580	263,538	289,892	318,881	350,769	385,846	424,431
Green Manuring and Land Preparation	95,400	104,940	115,434	126,977	139,675	153,643	169,007	185,908	204,498	224,948
Weeding	27,000	29,700	32,670	35,937	39,531	43,484	47,832	52,615	57,877	63,665
Irrigation expense	36,000	36,720	37,454	38,203	38,968	39,747	40,542	41,353	42,180	43,023
Direct labor	710,700	674,548	740,223	812,292	891,378	978,164	1,073,399	1,177,907	1,292,590	1,418,438
Transportation Cost from Farm to Market	219,938	241,931	266,124	292,737	322,010	354,212	389,633	428,596	471,456	518,601
Packing expense	276,250	214,200	224,910	236,156	247,963	260,361	273,380	287,048	301,401	316,471
Total cost of sales	2,177,748	2,195,745	2,399,892	2,623,687	2,869,048	3,138,085	3,433,115	3,756,682	4,111,581	4,500,884
Gross Profit	3,050,653	3,555,495	3,926,472	4,335,314	4,785,853	5,282,305	5,829,315	6,431,991	7,095,958	7,827,409
<i>General administration &amp; selling expenses</i>										
Administration expense	160,000	131,683	144,504	158,573	174,012	190,954	209,546	229,948	252,336	276,903
Land rental expense	300,000	330,000	363,000	399,300	439,230	483,153	531,468	584,615	643,077	707,384
Travelling expense	30,000	31,500	33,075	34,729	36,465	38,288	40,203	42,213	44,324	46,540
Communications expense (phone, fax, mail, internet, etc.)	18,000	18,900	19,845	20,837	21,879	22,973	24,122	25,328	26,594	27,924
Misc. expenses	9,600	7,901	8,670	9,514	10,441	11,457	12,573	13,797	15,140	16,614
Vegetable marketing expense	365,988	402,587	442,845	487,130	535,843	589,427	648,370	713,207	784,528	862,981
Depreciation expense	613,226	637,621	663,235	690,130	718,369	752,488	783,622	816,313	850,639	886,681
Subtotal	1,496,814	1,560,192	1,675,175	1,800,213	1,936,240	2,088,742	2,249,904	2,425,421	2,616,637	2,825,027
Operating Income	1,553,839	1,995,303	2,251,297	2,535,100	2,849,613	3,193,564	3,579,411	4,006,570	4,479,322	5,002,382
Other income (interest on cash)	19,422	12,223	89,200	213,000	337,042	498,819	706,117	952,048	1,243,625	1,772,015
Earnings Before Interest & Taxes	1,573,260	2,007,526	2,340,496	2,748,100	3,186,654	3,692,383	4,285,528	4,958,618	5,722,947	6,774,398
Interest expense on long term debt (Project Loan)	148,006	138,591	156,801	148,000	100,445	44,806	25,969	7,583	-	-
Interest expense on long term debt (Working Capital Loan)	66,013	-	-	-	-	-	-	-	-	-
Subtotal	214,019	138,591	156,801	148,000	100,445	44,806	25,969	7,583	-	-
Earnings Before Tax	1,359,241	1,868,935	2,183,695	2,600,100	3,086,209	3,647,577	4,259,559	4,951,035	5,722,947	6,774,398
Tax	339,810	467,234	545,924	650,025	771,552	911,894	1,064,890	1,237,759	1,430,737	1,693,599
<b>NET PROFIT/(LOSS) AFTER TAX</b>	<b>1,019,431</b>	<b>1,401,702</b>	<b>1,637,771</b>	<b>1,950,075</b>	<b>2,314,657</b>	<b>2,735,683</b>	<b>3,194,669</b>	<b>3,713,276</b>	<b>4,292,210</b>	<b>5,080,798</b>

## 16.6 Projected Cash Flow Statement

<b>Cash Flow Statement</b>											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<i>Operating activities</i>											
Net profit		1,019,431	1,401,702	1,637,771	1,950,075	2,314,657	2,735,683	3,194,669	3,713,276	4,292,210	5,080,798
Add: depreciation expense		613,226	637,621	663,235	690,130	718,369	752,488	783,622	816,313	850,639	886,681
Deferred income tax		(210,304)	(299,030)	(349,391)	(416,016)	(493,793)	(575,890)	(682,964)	(793,601)	(917,107)	(1,085,339)
Accounts receivable		(429,732)	(21,487)	(45,122)	(49,634)	(54,597)	(60,057)	(66,063)	(72,669)	(79,936)	(87,930)
Raw material inventory	(812,460)	(81,246)	(89,371)	(98,308)	(108,138)	(118,952)	(130,847)	(143,932)	(158,325)	(174,158)	1,915,738
Pre-paid building rent	(300,000)	(30,000)	(33,000)	(36,300)	(39,930)	(43,923)	(48,315)	(53,147)	(58,462)	(64,308)	707,384
Cash provided by operations	(1,112,460)	881,376	1,596,435	1,771,885	2,026,486	2,321,760	2,673,061	3,032,185	3,446,533	3,907,341	7,417,333
<i>Financing activities</i>											
Project Loan - principal repayment		(124,120)	(155,019)	(218,744)	(279,735)	(327,290)	(110,803)	(108,155)	(44,606)	-	-
Working Capital Loan - principal repayment		(743,636)	-	-	-	-	-	-	-	-	-
Additions to Project Loan	870,625	68,736	262,139	166,972	-	-	-	-	-	-	-
Additions to Working Capital Loan	743,636	-	-	-	-	-	-	-	-	-	-
Issuance of shares	1,614,261	68,736	262,139	166,972	-	-	-	-	-	-	-
Cash provided by / (used for) financing activities	3,228,523	(730,284)	369,260	115,200	(279,735)	(327,290)	(110,803)	(108,155)	(44,606)	-	-
<i>Investing activities</i>											
Capital expenditure	(1,741,250)	(512,285)	(537,899)	(564,794)	(593,033)	(667,355)	(653,819)	(686,510)	(720,836)	(756,878)	-
Cash (used for) / provided by investing activities	(1,741,250)	(512,285)	(537,899)	(564,794)	(593,033)	(667,355)	(653,819)	(686,510)	(720,836)	(756,878)	-
<b>NET CASH</b>	<b>374,813</b>	<b>(361,193)</b>	<b>1,427,796</b>	<b>1,322,291</b>	<b>1,153,718</b>	<b>1,327,116</b>	<b>1,908,439</b>	<b>2,237,519</b>	<b>2,681,090</b>	<b>3,150,463</b>	<b>7,417,333</b>



## 16.7 Projected Balance Sheet

<b>Balance Sheet</b>											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Assets</b>											
<i>Current assets</i>											
Cash & Bank	374,813	13,620	230,850	1,553,141	2,706,859	4,033,975	5,942,413	8,179,933	10,861,023	14,011,486	21,428,819
Accounts receivable		429,732	451,218	496,340	545,974	600,571	660,628	726,691	799,360	879,296	967,226
Raw material inventory	812,460	893,706	983,077	1,081,384	1,189,523	1,308,475	1,439,322	1,583,255	1,741,580	1,915,738	-
Pre-paid building rent	300,000	330,000	363,000	399,300	439,230	483,153	531,468	584,615	643,077	707,384	-
<b>Total Current Assets</b>	<b>1,487,273</b>	<b>1,667,057</b>	<b>2,028,144</b>	<b>3,530,165</b>	<b>4,881,586</b>	<b>6,426,174</b>	<b>8,573,833</b>	<b>11,074,494</b>	<b>14,045,040</b>	<b>17,513,905</b>	<b>22,396,045</b>
<i>Fixed assets</i>											
Machinery & equipment	35,000	31,500	28,000	24,500	21,000	62,170	54,203	46,236	38,269	30,302	22,335
Furniture & fixtures	1,218,360	1,096,524	974,688	852,852	731,016	609,180	487,344	365,508	243,672	121,836	-
Office equipment	487,890	512,285	537,899	564,794	593,033	622,685	653,819	686,510	720,836	756,878	-
<b>Total Fixed Assets</b>	<b>1,741,250</b>	<b>1,640,309</b>	<b>1,540,587</b>	<b>1,442,146</b>	<b>1,345,049</b>	<b>1,294,035</b>	<b>1,195,366</b>	<b>1,098,254</b>	<b>1,002,777</b>	<b>909,015</b>	<b>22,335</b>
<i>Intangible assets</i>											
Total Intangible Assets	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL ASSETS</b>	<b>3,228,523</b>	<b>3,307,366</b>	<b>3,568,731</b>	<b>4,972,311</b>	<b>6,226,635</b>	<b>7,720,209</b>	<b>9,769,199</b>	<b>12,172,748</b>	<b>15,047,817</b>	<b>18,422,921</b>	<b>22,418,380</b>
<b>Liabilities &amp; Shareholders' Equity</b>											
<i>Current liabilities</i>											
Total Current Liabilities	-	-	-	-	-	-	-	-	-	-	-
<i>Other liabilities</i>											
Deferred tax		(210,304)	(509,333)	(858,724)	(1,274,740)	(1,768,534)	(2,344,424)	(3,027,388)	(3,820,989)	(4,738,095)	(5,823,434)
Long term debt (Project Loan)	870,625	815,241	922,362	870,589	590,854	263,565	152,762	44,606	-	-	-
Long term debt (Working Capital Loan)	743,636	-	-	-	-	-	-	-	-	-	-
<b>Total Long Term Liabilities</b>	<b>1,614,261</b>	<b>604,938</b>	<b>413,028</b>	<b>11,865</b>	<b>(683,886)</b>	<b>(1,504,969)</b>	<b>(2,191,662)</b>	<b>(2,982,782)</b>	<b>(3,820,989)</b>	<b>(4,738,095)</b>	<b>(5,823,434)</b>
<i>Shareholders' equity</i>											
Paid-up capital	1,614,261	1,682,997	1,945,137	2,112,109	2,112,109	2,112,109	2,112,109	2,112,109	2,112,109	2,112,109	2,112,109
Retained earnings		1,019,431	1,210,566	2,848,337	4,798,413	7,113,069	9,848,752	13,043,421	16,756,697	21,048,907	26,129,706
<b>Total Equity</b>	<b>1,614,261</b>	<b>2,702,428</b>	<b>3,155,703</b>	<b>4,960,446</b>	<b>6,910,521</b>	<b>9,225,178</b>	<b>11,960,861</b>	<b>15,155,530</b>	<b>18,868,806</b>	<b>23,161,016</b>	<b>28,241,814</b>
<b>TOTAL CAPITAL AND LIABILITIES</b>	<b>3,228,523</b>	<b>3,307,366</b>	<b>3,568,731</b>	<b>4,972,311</b>	<b>6,226,635</b>	<b>7,720,209</b>	<b>9,769,199</b>	<b>12,172,748</b>	<b>15,047,817</b>	<b>18,422,921</b>	<b>22,418,380</b>

## 17 KEY ASSUMPTIONS

**Table 17-1: Revenue Assumptions**

<b>Annual Production per Acre</b>	
Tomato (kg)	40,000
Sweet pepper (kg)	25,000
Cucumber (kg)	50,000
<b>Sales price per kg</b>	
Tomato (Rs.)	20
Sweet pepper (Rs.)	20
Cucumber (Rs.)	15
Sales price growth rate	10%
Percentage wastage	15%
Production capacity utilization year 1 - 10	100%

**Table 17-2: COGS Assumptions**

<b>Cost of seed</b>	
Tomato (Rs. per seed )	2.45
Sweet pepper (Rs. per gram)	200
Cucumber (Rs. per gram)	90
<b>Quantity of seeds per Acre</b>	
Tomato (no.)	15,000
Sweet pepper (gram)	200
Cucumber (gram)	500
<b>Cost of Fertilizer per bag</b>	
Calcium Ammonium Nitrate (Rs.)	1,400
Nitrophos (Rs.)	2,600
DAP (Rs.)	4,200
SOP (Rs.)	4,050
<b>Quantity of Fertilizer per Acre</b>	
Calcium Ammonium Nitrate (bags)	2
Nitrophos (bags)	4
DAP (bags)	2
SOP (bags)	2
Pesticides expense per Acre per season (Rs.)	20,000
<b>Water expense</b>	
Number of months for irrigation	8
Total number of irrigations per season	10
Cost per irrigation per acre (Rs.)	400
Total cost of green manuring, land prep and sowing per acre (Rs.)	10,600

Total cost of Mechanical Hoeing – twice per season per acre (Rs.)	1,500
Average packing expense per kg (Rs.)	0.98
<b>Commercial Transportation of farm produce</b>	
Cost per kilometre (Rs.)	20
Farm to market distance (km)	75
Per trip cost (Rs.)	1,500
Load per trip (tonnes)	2
No. of trips	147

**Table 17-3 Expense Assumptions**

COGS growth rate	10%	
Operating costs growth rate	5%	
Vegetable market expense	7%	% of revenue
Travelling expense	Rs. 30,000 per annum	
Communication expense	Rs. 18,000 per annum	
Office expenses	6%	% of admin expense
Promotional expense growth rate	1%	% of revenue
Tools and machinery depreciation rate	10	% of machinery & equip. cost
Tunnel equipment depreciation rate	100%	% of tunnel equipment cost
Furniture & Fixtures depreciation rate	10%	% of furniture & fixture cost

**Table 17-4 Economy Related Assumptions**

Inflation rate	10%
Electricity growth rate	10%
Water price growth rate	2%
Gas price growth rate	10%
Wage growth rate	10%

**Table 17-5: Cash Flow Assumptions**

Time period per season (months)	8
Accounts receivable in days	30
Accounts payable in days	0
Raw material inventory (months)	6

**Table 17-6 Financial Assumptions**

Project life (Years)	10
Debt	50%
Equity	50%
Interest rate on long-term debt (KIBOR + 5%)	17%

Interest rate on short-term debt	16%
Interest on cash in bank	10%
Debt tenure (Years)	5
Debt payments per year	1

## 18 ANNEXURE

### 18.1 Tax deduction income slabs

Income Slabs	Tax Rate
	0.00%
100,000 – 110,000	0.50%
110,000 – 125,000	1.00%
125,000 – 150,000	2.00%
150,000 – 175,000	3.00%
175,000 – 200,000	4.00%
200,000 – 300,000	5.00%
300,000 – 400,000	7.50%
400,000 – 500,000	10.00%
500,000 – 600,000	12.50%
600,000 – 800,000	15.00%
800,000 – 1,000,000	17.50%
1,000,000 – 1,300,000	21.00%
1,300,000 and above	25.00%