

# **Specifications of Hitech Hydroponic Laboratory under RKVY sponsored Project entitled “Establishment of Poly-housed Hydroponic Facility for Soilless farming system and skill development of farmers in Prayagraj region”**

## **NFT structure and essential components**

- Total covered Area: 20 x 28 = 560 m<sup>2</sup>
- Center height of structure 4.5 mts
- Side height of structure 4 mt
- Foundation elevation 3’ above the ground level.
- Floor Foundation 2’ height.
- Side Path of 1 mt interlocking passage outside of the structure.
- Structure should be made protected with wired fencing.
- Structure floor should be covered with anti-skid non slip tiles (10 mm)
- Provision of entrance with double door entry to make the plants in greenhouse free of any pest and diseases.
- LED top-lighting (Philips or any comparable brand) specifically designed to last longer for such facilities.
- Hydroponic control room: 15 x 15 feet<sup>2</sup> (adjacent to main hydroponic facility) Full furnished with office furniture and with standard electrical supplies AC, fan and LED lights. Floor should be covered with standard double charged vitrified tiles.

## **Material**

- Structure should be covered fully with heavy duty, multiwall, UV resistant, clear (white) polycarbonate sheet (10 mm thickness). The polycarbonate sheet should be certified for greenhouse roofing and siding. Second Layer of Alumtex 50 % to reduce temperature by 2-3 °C
- The system should be based on Nutrient film Technique (NFT) system based.
- NFT Channels (2mm thick) for hydroponic growing systems with detachable lid should be made of high grade material (preferably food grade plastic) NFT shape A: Suitable for leafy crop (vegetables, herbs, decorative) production rest on G.I. support frames. Total of 40 NFT A frames, 40 Flat beds. NFT system can be sufficient to grow 10000 – 12000 Plants per cycle
- All the iron material shall be of standard HSS (square shaped), galvanized, rust proof, long life and should be of minimum thickness of 2 mm, except for foundation (3 mm). The pipes shall be either of Hisar or Jindal make.

## **Air Ventilation and circulation specifications:**

- Inside Air circulation Fan - 06 Nos
- Air Flow Fan 50"3 Phase - 06 Nos
- Algae free and changeable cooling pads and filters with automated ventilation 5' x 4.5' for maintain temperature - 06 Nos.

## **Water and Nutrient flow facilities:**

- A boring of 6” about 200 mts with 1.5 hp submersible pump shall be done for independent water availability and supply.
- Pump for fresh water (2.5HP or 0.5 HP x 5)
- Nutrient tank with dedicated pump for fertigation with minimum capacity 2000 litre
- Dedicated pump for pad cooling system with minimum capacity 2000 litre
- Dedicated pump for fogger system with minimum capacity 2000 litre
- One dedicated R. O. system for TDS control with minimum capacity of 1000 lts/Hr.
- Automatic Four Tank precise nutrient adjustable mixing system (Three for nutrients (EC) and one for Acid/Alkaline (pH).
- Automated drip irrigation system with fogging and misting facility
- Nutrient ready to mix (100 kg)
- Water Recycling: Water Reservoir (minimum 5000 ltr tank) and with recycle plumbing piping and connections
- 120-150 GSM weeding mat to eliminate weeds and provide infection free growing of vegetables
- Nursery tray holder of 2.5’ X 1.5’. Nursery trays could be placed on top of these or Oasis cube could directly be placed on this.

## **Sensors and Pro- Controllers (Make Bluelab International)**

### **Automated sensors to control real time pH, DC, DO, temperature and nutrient concentration.**

Root-zone environmental factors such as nutrient concentration, pH, electrical conductivity, dissolved oxygen and temperature directly affect the growth of hydroponically grown plants. For real-time measurement of these factors, corresponding sensors should be supplied and fixed with the hydroponic facility with following prerequisites:

- Sensors and controllers should Monitor and automate nutrient and pH dosing in reservoirs and paired with PeriPod dosers.
- They must have in-built safety lockouts prevent excessive dosing.
- They must have auto-resume dosing after power loss.
- They must indicate reservoir parameters on mobile phone.
- They must have multi-part nutrient dosing possible with multiple PeriPods and Connect software.
- They must have controls pH in the up (alkali) or down (acid) direction.
- They must have high and low alarms to alert you when parameters are out of range.
- They must have dosing routine to allow for effective mixing before next dose.
- They must have 2-metre/6-ft cable lengths for best positioning and viewing.
- They must have flexible mounting options for walls, posts and racks.
- They must have super precision portable sensors for measurement and calibration of EC and pH included in Automation.

## Sensor for Leaf spectral analysis/Spectrometer (CID Spectra Agritech Model CI 710s)

A spectroscopic analytical system is essentially required for non-destructive, rapid measurement of plant stress & pigments to study the effects of different nutrient applications, to evaluate environmental changes on plant stress, for different spectral measurement of plant leaves, changes in pigments levels.

Measured parameters : Chlorophyll A ( $\mu\text{g}/\text{cm}^3$ ), Chlorophyll B ( $\mu\text{g}/\text{cm}^3$ ), Chlorophyll Total ( $\mu\text{g}/\text{cm}^3$ ), Soil-Plant Analysis Development, Anthocyanin Reflectance Index, Flavonols Reflectance Index, Normalized Difference Vegetation Index (NDVI), Chlorophyll Normalized Difference Vegetation Index (CNDVI), Carotenoid Reflectance Index, Photochemical Reflectance Index (PRI), Plant Senescence Reflectance Index, Water Band Index(Water Potential System), Carter Index, Gitelson and Merzlyak Index, Lichtenthaler Index, Modified Chlorophyll Absorption Ratio Index, Modified Edge Simple Ratio Index, Normalized Pigment Chlorophyll Index, Normalized Phaeophytinization Index, Edge Normalized Difference Vegetation Index, Structure Intensive Pigment Index, Simple Ratio Pigment Index, Transformed CAR Index, Triangular Vegetation Index, Vogelmann Edge Index, ZarcoTejada & Miller Index, Modified DATT Index, Chlorophyll Content Index, Absorbance Difference Index etc.

Hydroponic facility should be equipped with powerful but portable spectrometer paired with a leaf probe attachment, on-board operating software, and display screen to measure reflectance, transmittance and absorbance. It should work within a wide range of wavelengths that cover visible and Near Infra-Red (NIR) light. Two broadband light sources should be attached inside the device. One is positioned in the leaf clamp for transmissive measurements, and one is placed inside the case for reflective measurements. The spectrometer module takes the light from the leaf probe attachment and projects the wavelength dispersed light onto a CCD array. Each pixel of the CCD array thus corresponds to a specific wavelength of light. The operating software displays the light intensity of each pixel of the CCD array.

Some of the basic features required are as follows:

- Should have Wide range spectrum (360-1100 nm)
- Should have On-board analysis software
- Should have minimum 7" 1024 x 600 display
- Should have High resolution and real-time high speed scanning
- Should have Very high sensitivity; ideal for fluorescence and other low light level applications
- Should have USB interface
- Should be GPS enabled
- Enabled for In-field analysis
- Should have Simultaneous measurement of absorbance, reflectance and transmittance
- Should have Integrating time = 3.8 ms - 10 seconds
- Should have Lightweight and fully portable

### Detector Specifications

**Detector:** CMOS Linear Array; **Pixels:** 2048 pixels; **Pixel Size:** 14  $\mu\text{m}$  x 200  $\mu\text{m}$ ; **Pixel Well Depth:** 100,000 electrons; **Signal-To-Noise Ratio:** 330:1 (at full signal); **Dark Noise:** 16 counts; **Corrected Linearity:** >99.8%; **Sensitivity:** 337.500; **Wavelength Data Increment:** 0.55 - 0.7 nm

### Spectroscopic Specifications

**Grating:** 300 lines/mm, Slit = 55  $\mu\text{m}$ ; **Optical Resolution:** 2.4 FWHM in nm; **Integration Time:** 30  $\mu\text{s}$  – 60 seconds; **Dynamic Range:** 3300:1; **Stray Light:** 0.2 – 1.0%

### **Electronics Specifications**

**Power Supply:** Two 18650 batteries and USB-C port power enabled **Battery life:** 3 - 4 hours; **Trigger Modes:** Automatic & Manual

### **Other Essentials**

1. CCTV 360° Vision Camera (Mi brand) setup 4 Nos. with 2.0 megapixel, 1080p resolution and wide dynamic range (Mi or any other standard brand)
2. 4 Nos. of 100 Watt LED lights outside of the main structure
3. Horticultural lighting 10 Nos.

### **Conditions:**

- The contractor should take acceptance for the maintenance of this facility for 2 years from the date of handing over.
- He should grow one crop cycle.
- The time frame to complete the structure will be 4-5 months
- All civil work shall be as per PWD norms.

### **Eligibility:**

- The contractor must have previous experience of minimum 2-3 years of developing such big facility with in the minimum area of 500 m<sup>2</sup>