FATE Facility at CRIDA, Hyderabad, India

Establishment of Free air temperature and CO_2 elevation (FATE) facility consisting of nine rings with 8m diameter at elevated surface (vegetation and/or soil) temperature (ambient + 3°C) and CO_2 (550ppm) level.

The following issues are mandatory and should be submitted

1. A conceptual design and layout of components of facility.
2. List of material (sensors, equipments and other accessories) with make, model along with supplementary literature/ information.
3. List of brochures indicating the commissioning of similar facilities by the firm elsewhere
4. The simple reporting of 'complied' on any specification of the facility will be treated as 'not responding' or 'no information'. Hence the firm has to submit information on 1, 2, 3 items mentioned above very clearly.
5. List of experts with their names and details who monitor and supervise the facility during and after commissioning the facility.

The total controls of the facility need to be housed in a control room. Standard signal cable needs to be provided for connecting sensors to the PLC/SCADA system in control room. They should be of standard make and ISI certified. There should not be any signal loss in the wires while connecting from source to the SCADA. It should have ferrules and identifiers for easy identification in the field and maintenance.

1	Fabrication of nine FATE rings of 8 m diameter with detachable arrangement along with height adjustment with respect to crop height. Three rings each for maintaining the conditions of i) ambient crop canopy temperature + 3°C ±0.5°C ii) ambient crop canopy temperature + 3°C ±0.5°C and 550ppm ±50ppm CO_2 iii) ambient control with all structural fittings for temperature and CO_2 elevation
2	Heating system for maintaining elevated crop canopy temperature of ambient + 3°C ±0.5°C with infrared heaters of 230V at one metre above canopy with a provision to manual and motorized mechanical height adjustment. The supportive structures should be of high quality material to with stand rugged open field weather conditions. Canopy height will vary from 0 m at the beginning of a growing season to 3 m at mid-season. Heating should provided through 24 infrared heater with 5000 watt capacity of I.S. make with weather proof arrangements to maintain the set elevated temperature in 8m dia. plots under open-field conditions at least 90% of the time. The coefficient of the spatial variation of the infrared radiation impinging on the vegetation across the 8-m-diameter plot must be less than 10%. To assure that the heating system provides warming only with no photo-morphogenic effects, there must be no significant radiation emitted at wave lengths shorter than 850 nm.

3	CO_2 supply system consisting CO_2 tank of minimum 20 Kilo litres capacity with all necessary accessories to maintain the pressure and with safety certificates from authorized agencies. CO_2 tank should meet the I.S. code 2825 (1969). Supply line of PU tubing with appropriate diameter to bear 5 kg/cm2 pressure should produce a flow rate of approximately 25 kg/hr with appropriate vapourizer and pressure regulatory system. CO_2 supply lines from CO_2 tank to rings (Approximate distance from the supply to ring ~ 75mts) and sampling lines.
4	Temperature and CO_2 controlling and monitoring system along with data storage and accessible unit. CO_2 monitoring by microprocessor based CO_2 analyzer with non-dispersive infrared absorption (NDIR) measuring method. The repeatability of the CO_2 analyzer within ± 0.5% of full scale and response time of 1-3 seconds; Within ± 1% of linearity; ± 0.5% of noise of full scale; With in-built temperature and relative humidity measurement facility; With Auto calibration and Barometric pressure compensation and must have sampler selector. A dedicated CO_2 analyzer with pump need to be provided for each CO_2 ring with a sampling point at the central point for monitoring and controlling the set CO_2 concentration through PLC. A dedicated CO_2 analyzer with pump need to be provided with 4 sampling points in each ring for monitoring and mapping CO_2 concentration of all the three CO_2 rings - totaling 12 samples. Before air sample enters the analyzer it should pass from the moisture removal device to safe guard the analyzer from excess humidity. Temperature control in each ring should be done by monitoring at 6 ponts with sensor accuracy of 0.1°C. The heating system must sense canopy temperatures (with corrections for reflected infrared radiation from the heaters if appropriate) and use a proportional-integral-derivative (PID) feedback system to maintain the heating treatment. The program should enable to enhance the canopy temperature from +1.0 to +3.0°C ±0.5°C for different durations. All the process data of temperature and CO2 concentration should be controlled through PLC and SCADA. The data should be logged continuously and output should be compatible with MS Excel. The program should enable to shut the heating system and CO_2 supply where ever it is applicable if wind velocity is very high or in storm conditions. An in-built alarm system for different trouble shooting events.
5	Data management system for SCADA and PLC DELL Monitor 21.5" LED, TFT with red eye protection; windows 7 professional with licensed key and original CD, Intel coreTM i7 processor with suitable chipset and high processor speed (15M Cache, up to 3.90GHz), 64GB DDR3 ram, 64 bit, 4 DIMM sockets for memory slots, 4 nos bays (2 nos 5.25” for optical media drives and 2 nos, 3.5” for hard disk

	drives), 500 GB SATA hard disk drive (7200 rpm), Super multi SATA DVD writer, MS office 2007, 6 USB ports of highest version and compatible to all connecting devices, audio ports, head phones and microphone ports in front, standard key board with all provisions, optical two button scroller mouse, network interface integrated 10/100/1000 baseT network interface, 3 year onsite warranty, antivirus: kaspersky with original CD. Multimedia graphic card.
6	HP Laser color printer high quality proper software: print speed 8ppm on A4, 600 x 600 dpi, in line color laser printing, direct to page printing, duty cycle 35,000 pages, standard memory 16 MB, processor speed 264 MHz, host based standard languages, 2 standard paper trays, 250 sheets, 125 sheets output bin, manual duplex print options, media sizes A4,A5 and B5, sheet fed finished output handling, standard connectivity with USB and Ethernet, compatible to windows 7 professional
7	Weather station including solar radiation, air temperature, relative humidity, rainfall, wind direction and wind speed. The specifications include Air Temperature (Range : -40°C to +60°C; Accuracy ; ± 0.3 °C or better (with radiation shield); Resolution : + 0.1 °C; Sensor Type ; Resistance / Thermistor; Response Time : 10 sec) Relative Humidity (Range: 0 to 100% RH; Accuracy: ± 2%; Resolution: 1%; Sensor Type: Capacitive / Solid-state; Response Time: 10 sec.) Solar Radiation (Range : 0 to ~ 1750 W/m^2; Operating Temperature : -10°C to +60°C; Resolution: 1 W/m^2; Accuracy: 1 W/m2) Rainfall (Range : 0 to 500 mm per hour; Accuracy : ± 2 %; Resolution : 0.2 mm; Sensor Type : Tipping bucket rain gauge or other suitable sensor) Wind Speed (Range (operation) : 0 to 50 m/sec or 0 to 180 km/hr; Accuracy : ± 0.5 m/s; Resolution : 0.1 m/s or 0.36 km/hr; Threshold : 0.2 m/sec) Wind Direction (Range: 0 to 359°; Accuracy: ± 5°; Resolution: 1°) The weather station data should be interfaced with PLC and SCADA for monitoring CO2 supply and temperature control.
8	One set of soil moisture and soil temperature monitoring at depths of 15cm, 30cm, 45cm and 60cm in each ring with data logging at one hour interval. The probe or sensor should measure soil moisture and temperature simultaneously and logged into the Data management system. The probe should measure the soil moisture as volume percentage by applying the frequency/time domain technique based on the dielectric constant of soil or any media. The soil temperature sensor should have ▪ measuring range of –40°C till +60°C ▪ Accuracy 0.2°C. The measuring range for soil moisture probe should be ▪ very dry (1-2% soil moisture) to wet conditions (100% moisture) ▪ Operating temperature 0-60°C. Accuracy: ± 3% or better.

9	Electric console (1 x 1 x 0.8 m) S type with standard gauge for electrical application, housing of signal cables, PLC, Data management system with SCADA, keyboard slider with mouse and printer. It should be corrosion free MS steel with 6mm thick, smart look painted outside with lock and key provision with support legs at both ends. It should be installed in a control room on rised CC platform of size 2 x 1.5 x 0.3 m. A printer table along with standard and ergonomic computer chair, revolving type suiting to the height of console.
10	UPS system with 5 KVA capacity of APC or equivalent make to support all control and monitoring units with 2hr backups (but not the heaters or the vaporizer for the CO_2 tank).
11	The cost of two year on-site maintenance charges after one year mandatory period need to be quoted separately.
12	The details of technical expertise and man power to set up and maintain the facility. The brochures with technical details of proposed components need to be attached.
13	Proof of experience in establishing the facility or similar facilities if any with satisfactory working report or certificate from the PI/Institute of not less than six months prior to this advertisement.

The decision of the duly constituted technical committee of CRIDA is final in evaluation of technical bids on its suitability/ qualification. This decision cannot be challenged by the bidder and no correspondence will be entertained further.