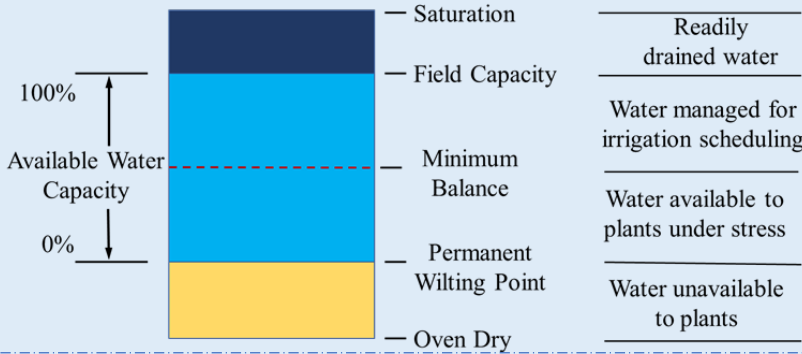
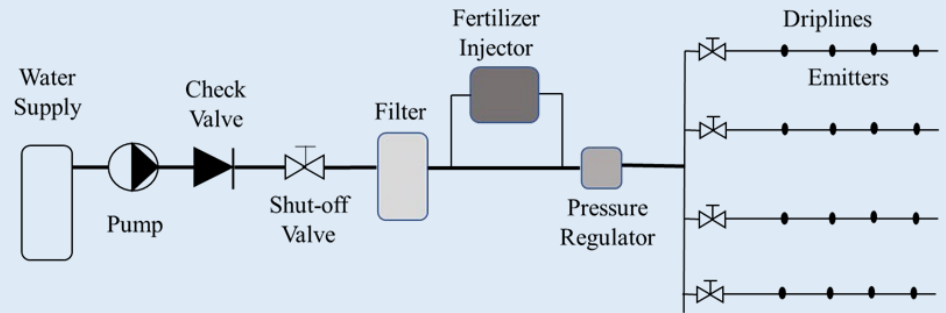


# Sensor-Based Irrigation Strategies and Wireless Network Systems for Automated Irrigation

## Drip Irrigation System

- Widely used for PA vegetable crops
- Micro-irrigation with slow drip
- High water use efficiency (~90%)
- Including: water source, pump, valves, pipeline, emitters, and etc.



## Important Terms -Soil Water Status

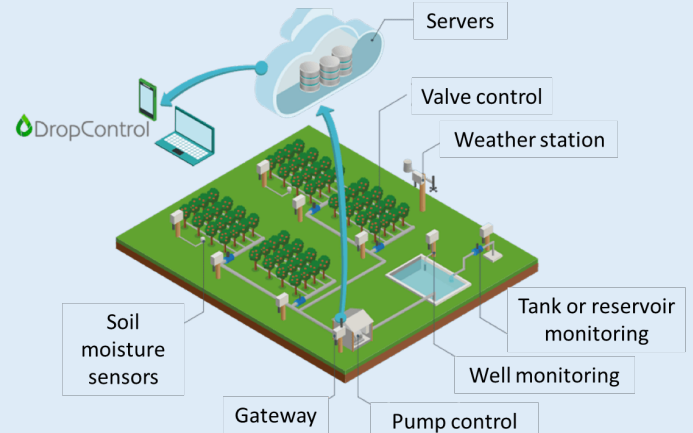
- Field Capacity** – Water remains in the soil after ~ 24 hours of draining from saturation
- Permanent Wilting Point** – No available water for plant in the soil
- Minimum Balance** – Soil moisture level when plant starts to experience stress
- Available Water Capacity** – Amount of water can be extracted by plant

## Soil Moisture Status and Sensors

- Soil Water Content**– The mass of water per mass of dry soil (Gravimetric water content) or the volume of liquid water per volume of soil (Volumetric water content)
- Soil Water Potential**– Expression of the energy state of water in the soil for plant to uptake



## Cloud-Based Sensing and Control Network Systems



(Cited from [fruitworldddedia.com](http://fruitworldddedia.com))

- Lora-based (Long range) communication
- Cellular-based communication

## Examples of Sensing and Automated Irrigation System

### Cellular-based sensor system (ZL-6 Data logger)

- TEROS 10 (Soil water content)
- TEROS 12 (Soil water content + EC)
- TEROS 21 (Soil water potential)
- ZL-6 (Cloud-based datalogger)
- Cloud service (season pass)



### Lora-based sensor system (Vinduino)

- Watermark 200 SS (Soil water potential)
- Vinduino R3 sensor station
- eOchard software for monitoring
- Lora wireless communication



### Automated valve control

- Solenoid valve
- Vinduino valve controller
- Lora wireless communication
- Real-time control

