**Lecture 25 Automation**

**25.1 Introduction**

Automation of micro irrigation system refers to operation of the irrigation system with minimum or without manual intervention. A well-controlled irrigation system is one which controls the spatial and temporal distribution of soil moisture to achieve maximum crop yield and benefit cost ratio. The adoption of automated new micro irrigation makes possible to grow advanced high value cropping system with new technologies which are difficult to grow by conventional means. Using automation one can control the irrigation valves, pump and fertigation equipment.

Some of the specific features of automation irrigation are stated below:

i) It eliminates the manual opening and closing of valves.

ii) It starts and stops pump exactly as and when required thus optimizing the

energy requirement.

iii) Irrigation system can be started at any desired time. One need not worry to visit farm during odd time (night). This is specially in Indian condition,  where power supply is available for agricultural operation during night time.

iv) Possibility to change frequency of irrigation and fertilizer application as per the crop need.

v) Use of water from different sources and increased water and fertilizer use efficiency.

**25.2  The Need for Automation of Irrigation**

The consumption of energy and water is quite high for agricultural production. Both of these are scare national resources. It is therefore in the national interest to adopt newer technologies to reduce their wastage. Automation of irrigation system is one way of doing it as the same helps in optimal utilization of energy and water resources. The micro irrigation system possesses all qualities to introduce automation in this irrigation system. Micro irrigation includes drip surface and sub-surface, bubblers, mini and micro sprinklers and jet that offers the means to maintain soil water nearly at constant levels and minimizes the water stress. However, with frequent irrigation the control of the soil water root environment is critically dependent upon the irrigation regardless whether it is manually or computer controlled. Any disturbance is the irrigation schedule quickly creates detrimental water or oxygen stress on the crop. On the control of high frequency micro-irrigation systems must be automatic, redundant and capable of responding to small and rapid changes in soil water. Hence automation of micro irrigation meets these requirements. To meet the increasing food demand for growing population it is the need of the hour to increase agricultural production with minimum expenditure and loss of resources. Automation of drip and micro irrigation will serve as basic tool to achieve this. Although initial cost of drip and along with automation unit is high. However, the long term benefits in saving water, labour, energy, and fertilizer and also increase in agricultural produce as well as quality definitely covers up the high initial cost in a less pay back period.

**25.3 Merits and Demerits of Automation**

**A) Merits**

An automated micro irrigation system increases crop yield, save water and energy and labor costs as compared with the manual system. The automated irrigation system starts watering just at the predetermined level of moisture content and stops irrigation as the desired soil moisture content or field capacity is attained. The system accounts for effective rainfall to schedule irrigation, eliminates the need to visit the farm frequently and ensures optimum soil water condition in the root zone. This prevents leaching of minerals and nutrients vital for the plant’s healthy growth and eliminates the long term ill-effects of over irrigation that leads to development of the salinity. The system is useful for both arid and humid areas where unpredictable and unevenly distributed rainfall disrupts a fixed irrigation schedule. This system also facilitates high frequency and low volume irrigation.

Automation results in higher production, increased productivity, better quality, improved safety, shorter workweeks for labour. Higher output and increased productivity. Automated systems typically perform the irrigation process with less variability than human workers, resulting in greater control and consistency. Also, increased process control makes more efficient use of irrigation water, resulting in less water consumption or high water use efficiency.

i) Reduced labour

As the irrigator is not required to constantly monitor the progress of irrigation, the irrigator is available to perform other tasks uninterrupted.

ii) Improved life style

The irrigator is not required to constantly check the progress of water down the bays being irrigated. The irrigator is able to be away from the farm, relax with the family and sleep during night.

iii) More timely irrigation

Irrigators with automation are more inclined to irrigate when the plants need water, not when it suits the irrigator.

 iv) Assists in the management of higher flow rates

Many irrigators are looking to increase the irrigation flow rates they receive through installing bigger channels and bay outlets. Such flow rates generally require an increase in labour as the time taken to irrigate a bay is reduced thus requiring more frequent change over. Automation allows for these higher flows to be managed without an increase in the amount of labour.

v) More accurate cut-off

Automation of the irrigation system allows cut-off of water at the appropriate point in the bay. This is usually more accurate than manual checking because mistakes can occur if the operator is too late or too early in making a change of water flow.

vi) Reduced runoff of water and nutrients

Automation can help keep fertiliser on farm by effectively reducing runoff from the farm. Retaining fertiliser on farm has both economic and environmental benefits.

vii) Reduced costs for vehicles used for irrigation

As the irrigator is not required to constantly check progress of irrigation, motor bikes, four wheelers and other vehicles are used less. This reduces the running costs of these vehicles and they require less frequent replacement.

**B) Demerits**

Automated irrigation system requires high capital expenditure to invest in automation.

i) Cost

There are costs in purchasing, installing and maintaining automatic equipment.

ii) Reliability

Can the irrigator trust an automatic system to work correctly every time? Sometimes failure will occur. Often these failures are because of human error in setting and maintaining the systems. A reuse system is good insurance to collect any excess runoff when failures occur.

ii) Increased channel maintenance

There is a need to increase maintenance of channels and equipment to ensure the system works correctly. Channels should be fenced to protect the automatic units from stock damage.

**25.4 Semiautomatic and Fully Automatic Systems of Automation**

i) Semiautomatic

Semiautomatic systems and controls require manual attention at each irrigation and are usually simpler and less costlier than the fully automatic systems. Most semi-automated systems use mechanical or electronic timers to activate control structures at predetermined times. The irrigator usually determines when to begin irrigation and its duration and manually resets or returns the devices to their original positions or moves them from one location to another before the next irrigation. The parts of given system may be automatic while other parts are semiautomatic or manually operated. Such systems require communication between the controller and system components located in the field. Communication may be by direct interconnecting electrical wires, by hydraulic or pneumatic conduits or by radio telemetry.

ii) Fully Automatic

Fully automatic systems normally operate without operator attention except for periodic inspections and routine maintenance. The irrigator may determine when and how long to irrigate and turn water into the system or start programmed controllers to initiate the automated functions. Fully automatic systems may use soil moisture sensors, such as tensiometers or electrical resistance blocks to activate electrical controls when soil water is depleted to predetermined levels. Meteorological data using climate based sensors can also be used to predict when to irrigate and the output from a microprocessor controller can automatically begin irrigation. Once irrigation has been started water is diverted into the farm distribution system and irrigation is completed without operator intervention. Irrigation duration may be controlled by programmed timers, soil moisture sensors or surface water sensors. Fully automatic systems require a water supply available on demand such as from wells or farm reservoirs. Most farm systems however do not have the flexibility required for complete automation (Hart et al., 1980).

**25.5 Automatic Controllers**

Micro irrigation system use automatic controller, which can be simply mechanical clocks that open/close a single valve on a pre-set time schedule to microcomputers. These can be programmed to interrogate with soil moisture and/or climate sensors, decide when to start and stop irrigation, start/stop pumps and open/close valves to accomplish the irrigation and to apply exact amount of water and fertilizer to each block within the field.

A timer type controller uses a clock (either solid state or motor driven electric) and programmed for starting and to sequence the irrigation. The controller’s supplies electrical or hydraulic power to activate remote solenoid valves located on individual laterals or sub-mains (manifolds). Electrical cables wires, hydraulic or pneumatic conduit or radio telemetry are used for communication between controller and valves.

Microprocessor/microcomputer-based controllers can be programmed to control pumps, fertilizer injection equipment, filters, etc., as well as activate/deactivate solenoid valves using data from tensiometers, pyranometers, evaporation pans, thermocouple, humidity meters, anemometers, flow meters, pressure transducers, and other sensors. These controllers pull soil and/or climate sensors data according to a schedule specified by the irrigator. The controller is programmed to use these data to determine the need for irrigation in each field and block. It then operates the pumps, filters, injection equipment, and valves needed to accomplish the irrigation. Data from flow meters and pressure sensors are used to determine the need for such things as flushing and to detect system malfunctions.

Some controllers are also able to diagnose system malfunctions and take corrective action. Some even turn the system off during rain storms and then restarts the system when the storm ends (James, 1988).