



High Efficient Irrigation System



Vegetables

Basic Knowledge

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Irrigation

- Irrigation is the application of controlled amounts of water to plants at needed intervals.
- Irrigation helps to grow agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of less than average rainfall.
- Irrigation also has other uses in crop production, including frost protection, suppressing weed growth in grain fields and preventing soil consolidation.



Surface Irrigation



Irrigation



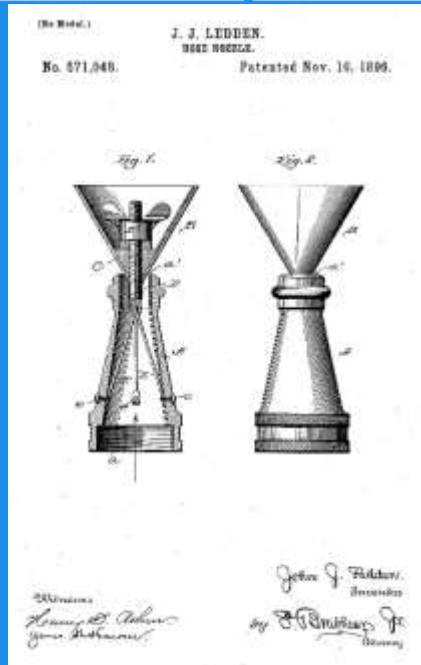
HEIS





Outside China

Garden Hose Nozzle



John J. Ledden



Year: 1896

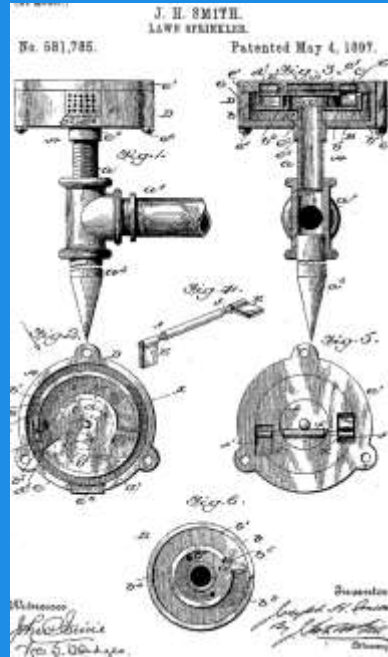
Manufacturer: Patent

Type: Garden Hose Nozzle

Typical use: Agriculture, Commercial, Residential

This patent by John J. Ledden of Baltimore, Maryland, USA, was issued on November 10, 1896. It is not known if it went into production.

Sprinkler Patent



Joseph H. Smith



Year: 1897

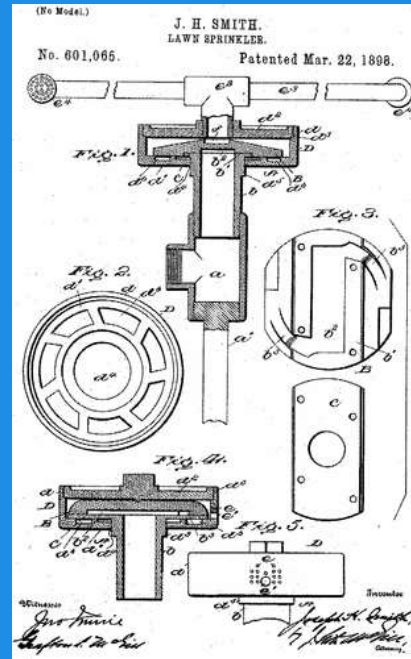
Manufacturer: Joseph H. Smith
Washington D.C.

Type: Sprinkler

Typical use: Agriculture, Commercial,
Residential

This patent from Joseph H. Smith,
shows a new type of lawn sprinkler.
The patent date is May 4, 1897.

Sprinkler Patent



Joseph H. Smith



Year: 1898

Manufacturer: Joseph H. Smith

Washington D.C.

Type: Sprinkler

Typical use: Agriculture, Commercial, Residential

Here's another Joseph H. Smith sprinkler patent and this one is dated, March 22, 1898.

Canvas Irrigation Hose



Agriculture

Year: 1903

Manufacturer: Unknown

Type: Irrigation Canvas Hose

Typical use: Agriculture

Distributing water from a 12-inch
canvas hose in Stevens Point,
Wisconsin, USA



Sprinkler



Oscillating Sprinkler

Year: 1935

Manufacturer: White Showers

Model: ?

Type: Oscillating Sprinkler

Typical use: Agriculture, Commercial, Residential

The White Shower sprinklers are an oscillating type of sprinkler. They are attached to the water source by a hose.



Impact Sprinkler



Skinner Irrigation



Year: 1938

Manufacturer: Skinner Irrigation

Troy, Ohio

Model: SAU

Type: Impact sprinkler

Typical use: Agriculture, Commercial

This impact sprinkler would be used on a stand or portable irrigation pipe.

Impact Sprinkler Factory



Buckner



Year: 1948

Manufacturer: Buckner Irrigation
Fresno, California

Type: Impact Sprinkler

Typical use: Agriculture, Commercial,
Residential

This photo shows how impact sprinklers
were made at Buckner Irrigation in Fresno,
California, USA in 1948.

Germany, Australia

Cost less Harvest more



Modern drip irrigation

When researchers began experimenting with subsurface irrigation using clay pipe to create combination irrigation and drainage systems



Hannis Thill



Year: in 1860, 1920s

Manufacturer: Drip Irrigation

Type:

Typical use: Agriculture

Research was later expanded in the 1920s to include the application of perforated pipe systems. The usage of plastic to hold and distribute water in drip irrigation was later developed in Australia by Hannis Thill.

Israel

Plastic emitter in drip irrigation

Instead of releasing water through tiny holes easily clogging by tiny particles, water was released through larger and longer passageways by using velocity to slow water inside a plastic emitter.



Simcha Blass and his son Yeshayahu



Year: 1959

Manufacturer: Israel with Kibbutz Hatzerim

Type: Drip Irrigation

Typical use: Agriculture, The first experimental system of this type was established in 1959 by Blass who partnered later (1964).

Drip Irrigation Agriculture



Chapin Irrigation



Year: 1964

Manufacturer: Chapin Watermatics

Water Town, New York

Model: Unknown

Type: Drip Irrigation

Typical use: Agriculture

This photo shows Professor Norman Smith, Nassau County Agriculture Agent in Old West Bury Gardens, New York, USA. He is inspecting a crop of cantaloupe grown with drip irrigation developed by Dick Chapin in August 1964.

Sprinkler Irrigation Association Convention Locations 1953 - 1972

San Diego, CA 1953
Boca Raton, FL 1954
Colorado Springs, CO 1955
Washington D.C. 1956
Phoenix, AZ 1957

Phoenix, AZ 1958
Phoenix, AZ 1959
Point Clear, AL 1960
San Francisco, CA 1961
Scottsdale, AZ 1962



Broadmoor Hotel
Colorado Springs, Colorado USA
1955



Tampa, FL 1963
Phoenix, AZ 1964
Phoenix, AZ 1965
Corpus Christi, TX 1966
Scottsdale, AZ 1967



in China

Primitive drip irrigation

汜勝之書以三斗瓦甕埋著科中央，令甕口上與地平。盛水甕中，令滿。



Bainbridge, David A (June 2001). "Buried clay pot irrigation: a little known but very efficient traditional method of irrigation". *Agricultural Water Management*. 48 (2): 79–88. doi:10.1016/S0378-3774(00)00119-0. Retrieved 23 October 2013.

Fan Sheng-Chih Shu



Year: First century BC

Manufacturer:

Model:

Type: Clay pots

Typical use: Agriculture, the use of buried, unglazed clay pots filled with water as a means of irrigation.

China

Cost less Harvest more



Sprinkler Irrigation



In the early 1950s, the sprinkler irrigation was introduced into China, and the high income crops and vegetables were applied in the suburbs of the big cities. Sprinkler irrigation technology has been initially applied to agricultural cultivation, such as vegetables, field crops, nursery and so on. Now it is widely used in landscaping, such as lawn, football field, golf course, courtyard, park and so on.

Micro Irrigation



Since 1974, the micro irrigation technology, it has experienced three stages:

1. introduction, digestion and trial production (1974 to 1980),
2. depth research and stable development (1980 to 1990)
3. rapid development (1990 later).

At present, China has developed and improved drip irrigation equipment, micro sprinkler irrigation equipment, drip pipe (tube), emitter, compensating emitter and the rotary micro nozzles, the establishment of a number of new experimental demonstration base, and the development of a number of micro irrigation equipment enterprises.

China

Drip irrigation equipment



In 1974, three sets of drip irrigation equipment were given to China as a present by the government of Mexico to introduce drip irrigation technology

Mexico



Year: 1974

Drip irrigation equipment as a present give China by the government of Mexico



National Sprinkler Information Network



In May 1975, the national sprinkler science and technology information network was approved by the Ministry of Water Resources.

Wuhan University



Year: 1975

Managed by sprinkler irrigation group of water conservancy teaching and research team of Wuhan University

China

Cost less Harvest more



National Sprinkler Information Network

In 1975 by the China Academy of Sciences, Ministry of Science and Technology and a number of relevant ministries involved, in Tongliao, Qixian and Luoyang, during the year held irrigation technology conference, for three times within one year, cross sectoral and cross discipline under the promotion of water-saving irrigation, industry ushered in the golden period of development.

Ministries Commissions



Year: 1975
the China Academy of Sciences, Ministry of Science and Technology and a number of ministries and commissions



中华人民共和国
科学技术部



中华人民共和国
水利部

National Sprinkler Information Network



September 1976, the internal exchange Journal of the national sprinkler technology and information network -- the first publish of the "Sprinkler Technology" magazine

Wuhan University



Year: 1976

Management of sprinkler irrigation group of water conservancy teaching and research team of Wuhan University

Micro Irrigation Group



In June 1, 1990, the Ministry of Water Resources of Institute of Irrigation in Xinxiang, Henan, held a meeting of micro irrigation.

Wuhan University



Year: June 1, 1990

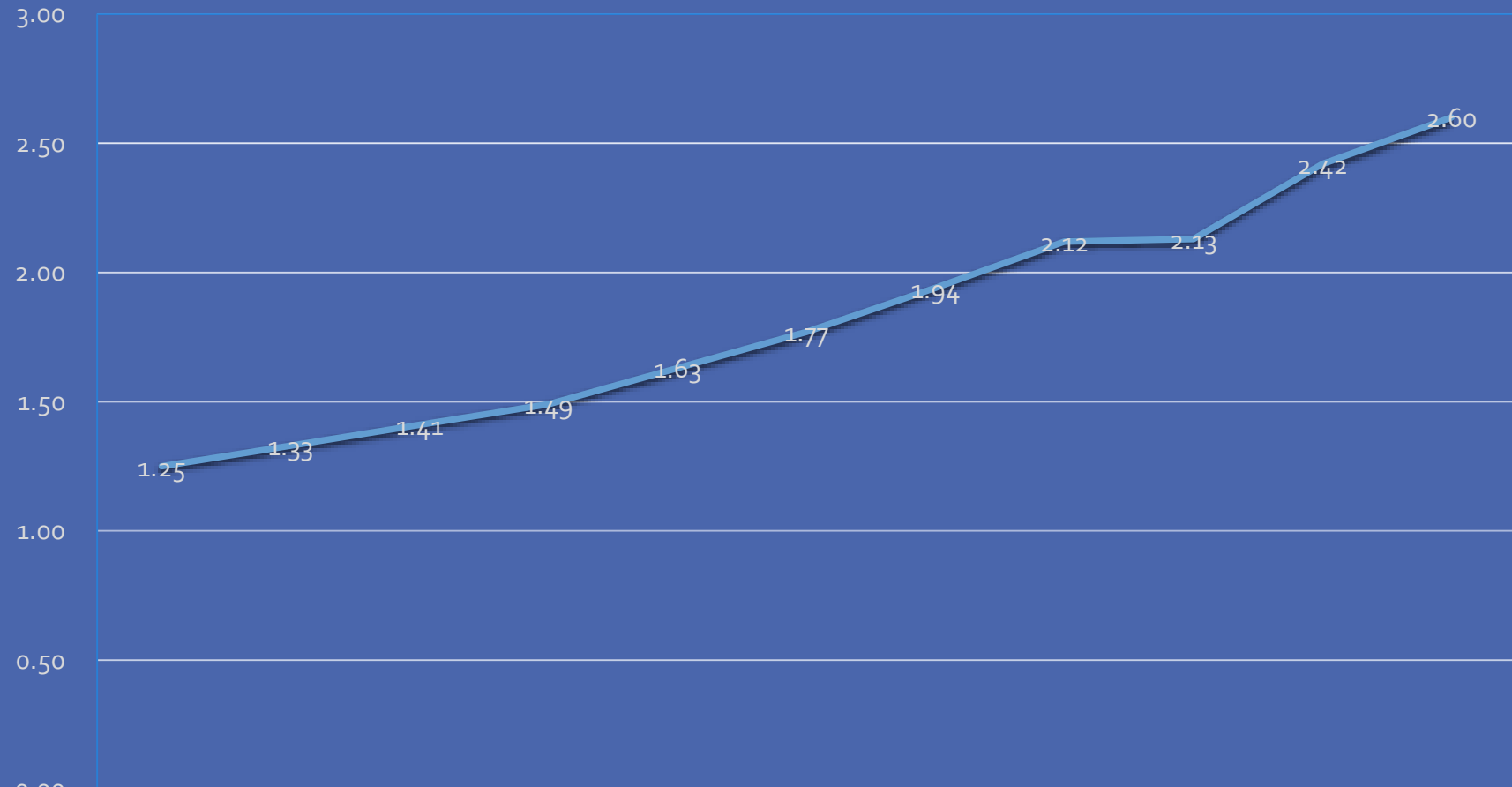
At the meeting of Agricultural Water Conservancy Specialized Committee officially announce to establishment Micro Irrigation Research Team.

High Efficiency Irrigation Area

Cost less Harvest more



China's HEIA Irrigation Area (100*Million mu)



Irrigation Area (10⁸ mu)

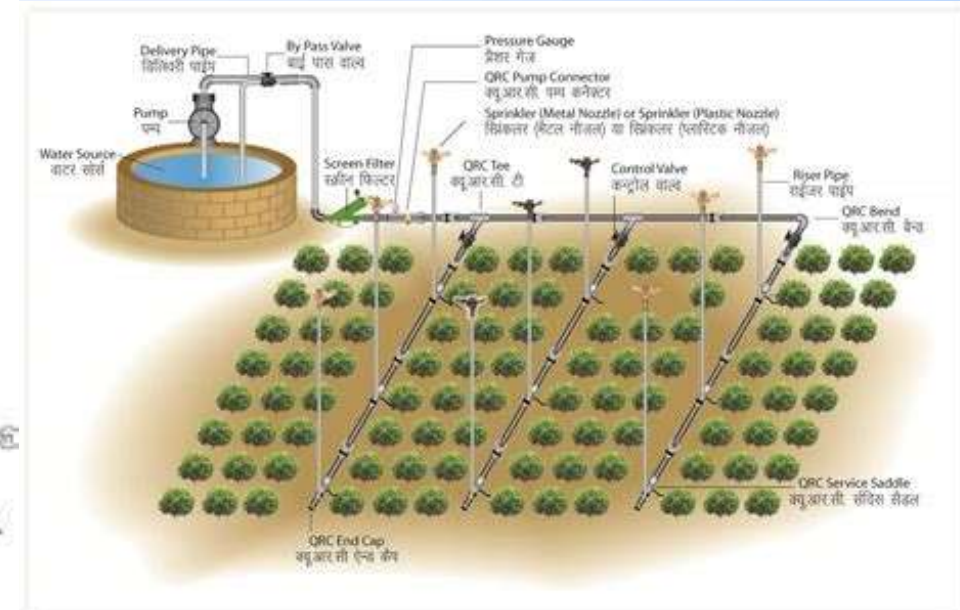
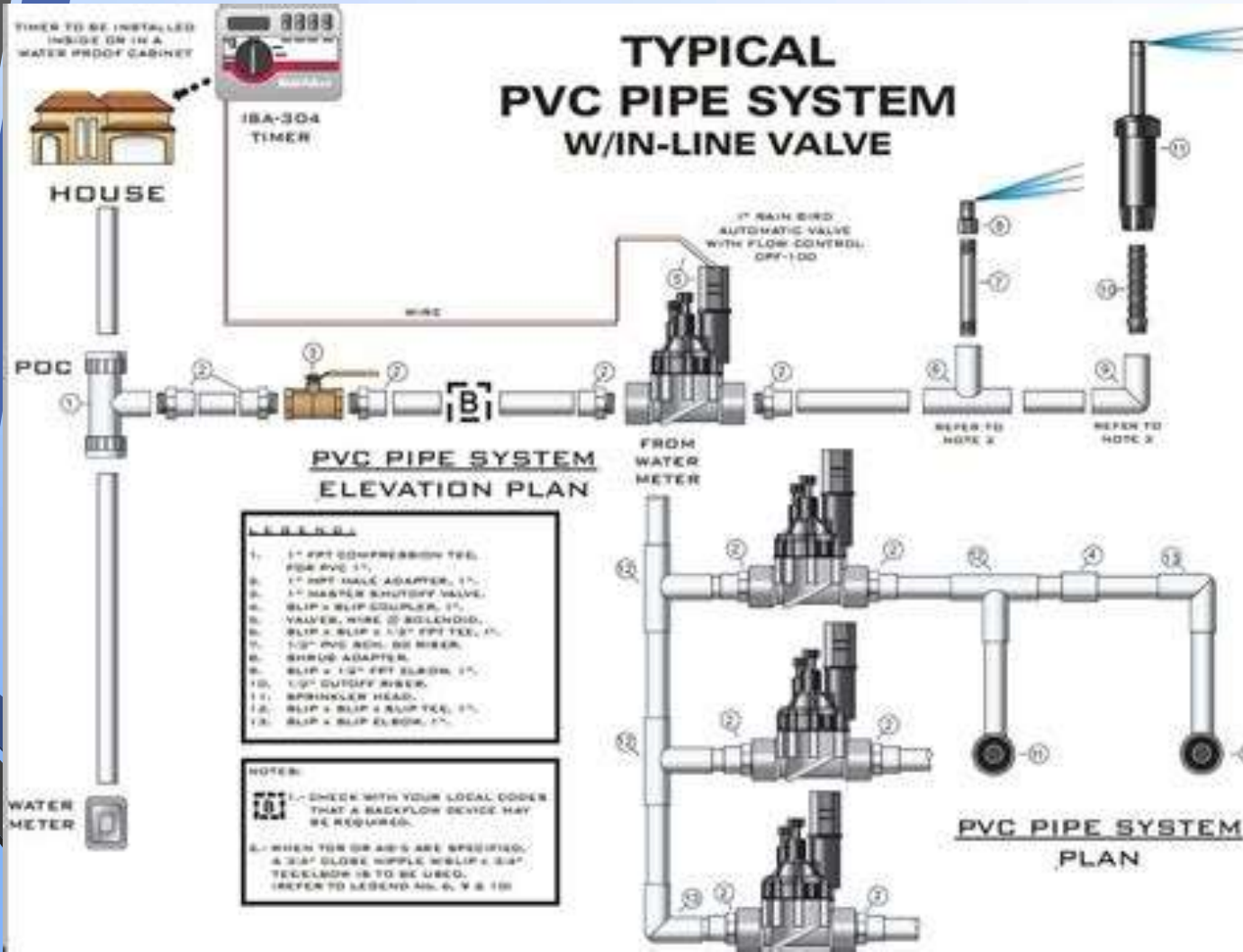
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Irrigation Area (10 ⁸ mu)	1.25	1.33	1.41	1.49	1.63	1.77	1.94	2.12	2.13	2.42	2.60



High Efficient Irrigation and Fertilization Model



Sprinkler Irrigation



Layout of Sprinkler Irrigation System (फिदकन सिंपाई प्रणाली का रेखाचित्र)

Sprinkler Irrigation

- In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system using sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a solid-set irrigation system. Higher pressure sprinklers that rotate are called rotors and are driven by a ball drive, gear drive, or impact mechanism.



Sprinkler Irrigation

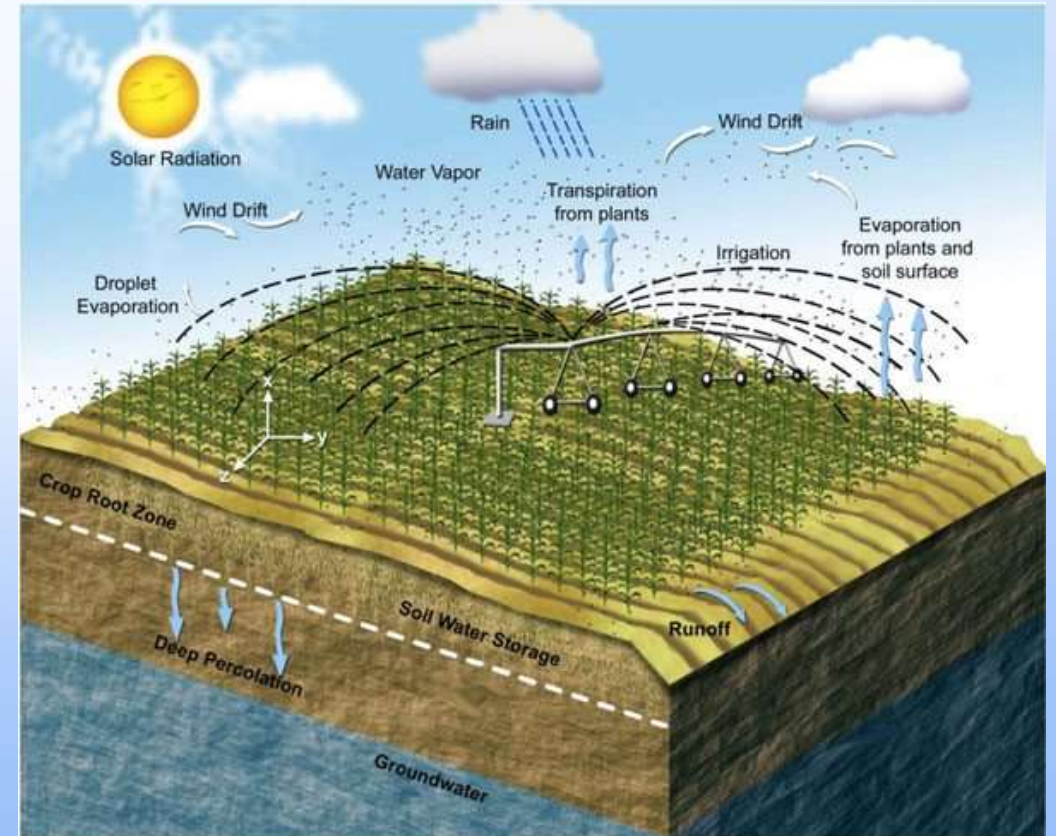


Figure 4. Components of the water cycle for a center pivot irrigated field as it relates to water application efficiency (E_a) [Adapted from Irmak (2009)].

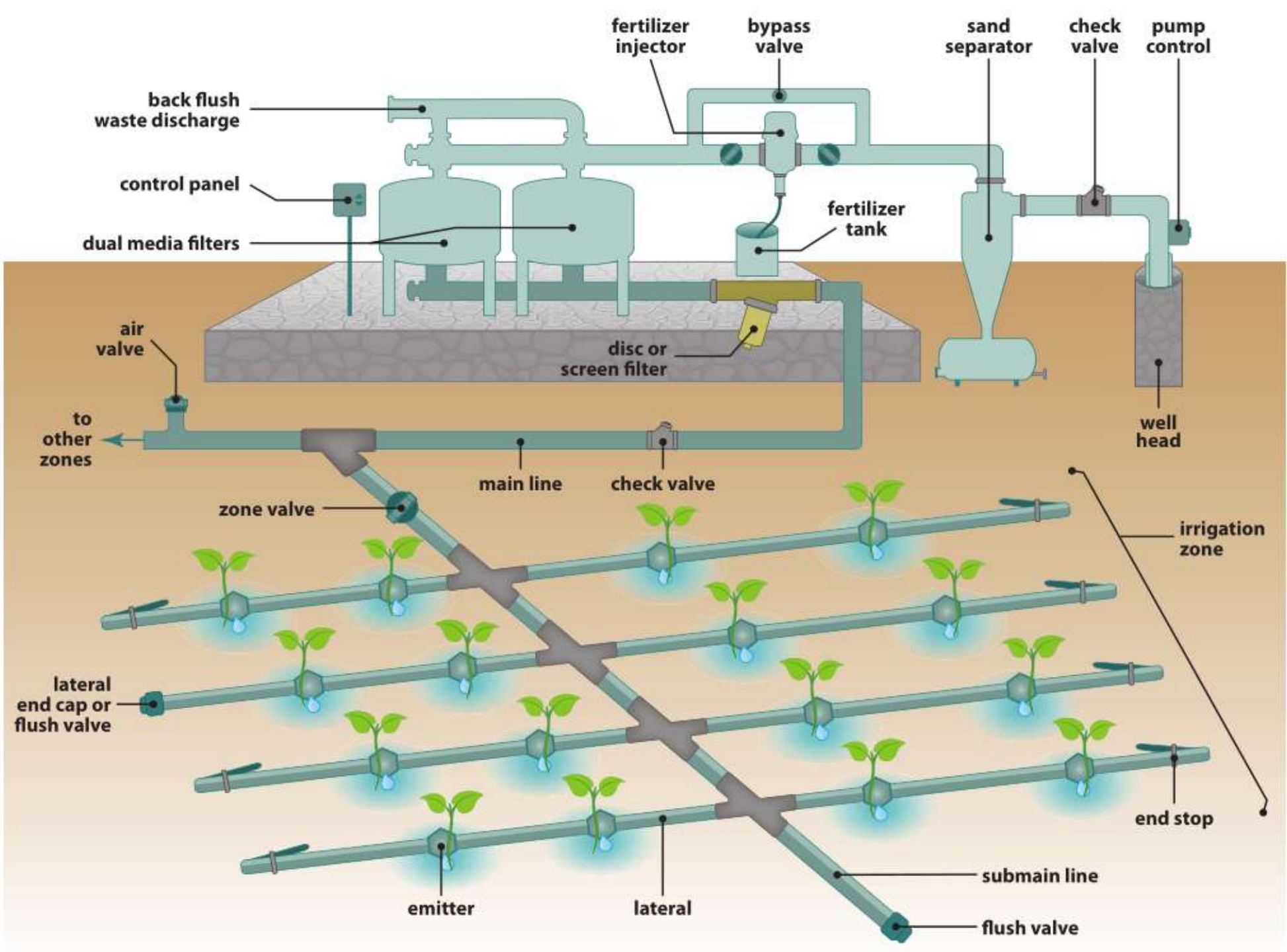
Basics of Micro Irrigation

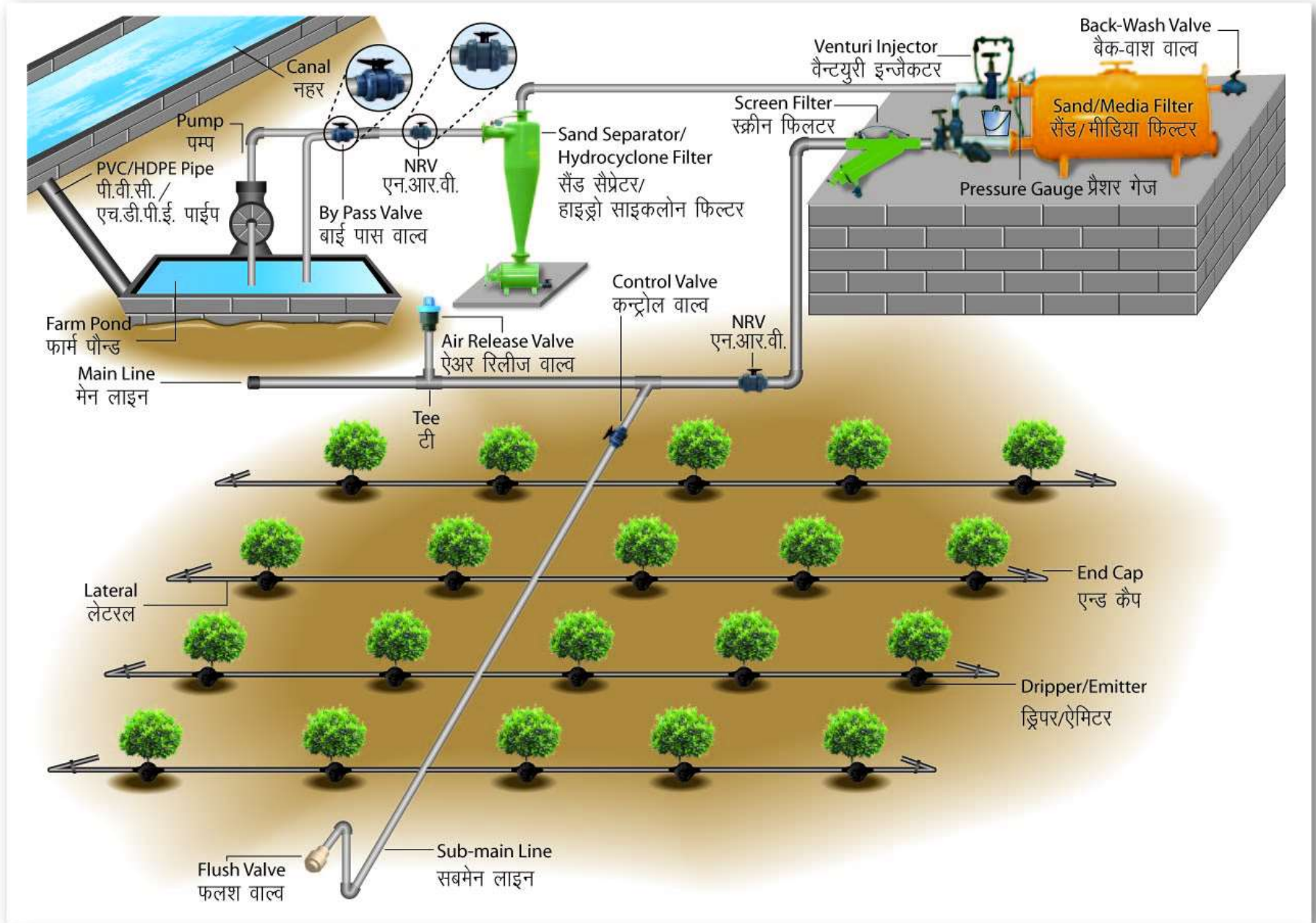


Micro Irrigation

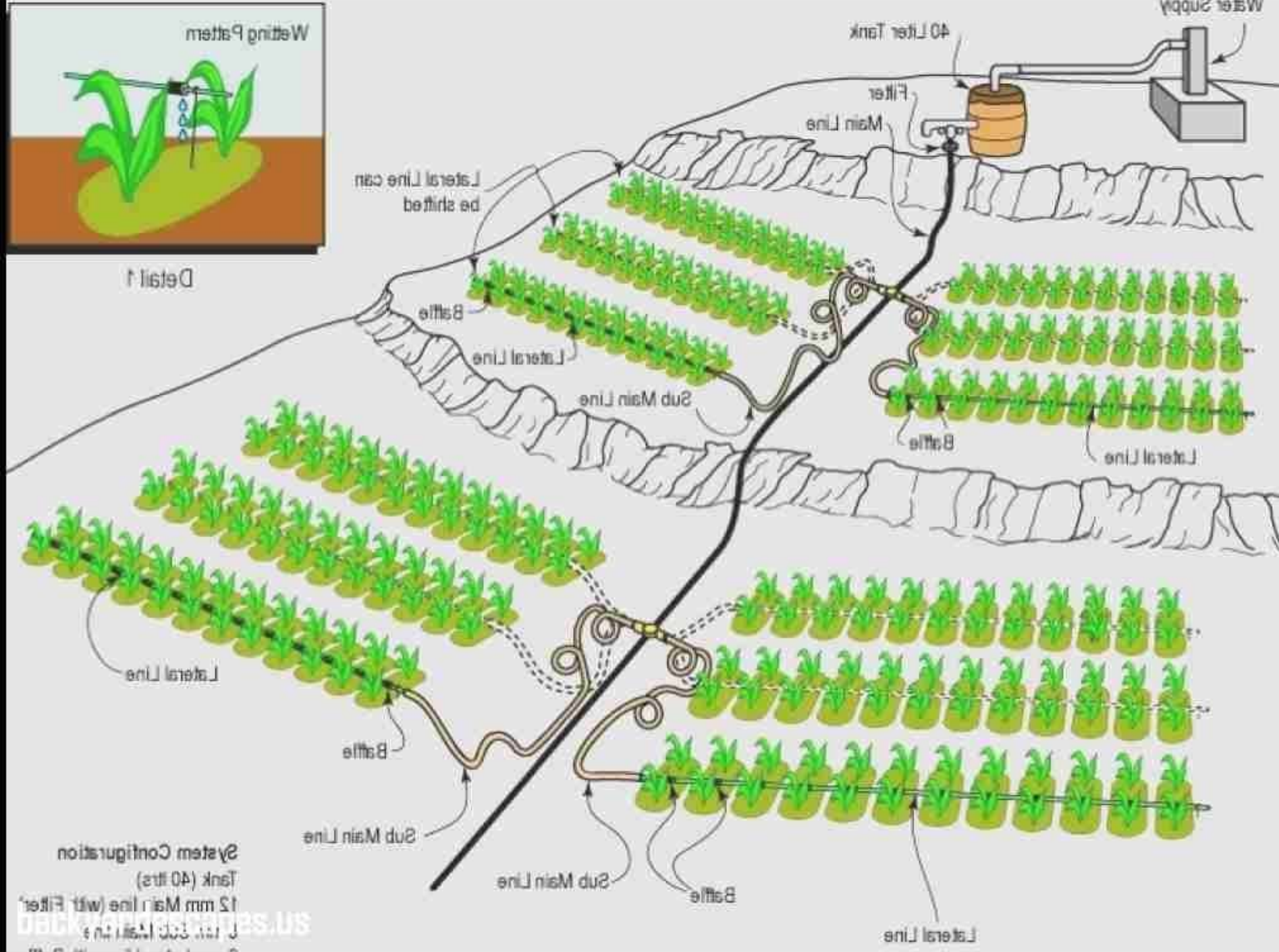
- Micro-irrigation, sometimes called localized irrigation, low volume irrigation, or trickle irrigation is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each plant or adjacent to it.
- Traditional drip irrigation using individual emitters, subsurface drip irrigation (SDI), micro-spray or micro-sprinkler irrigation, and mini-bubbler irrigation all belong to this category of irrigation methods.







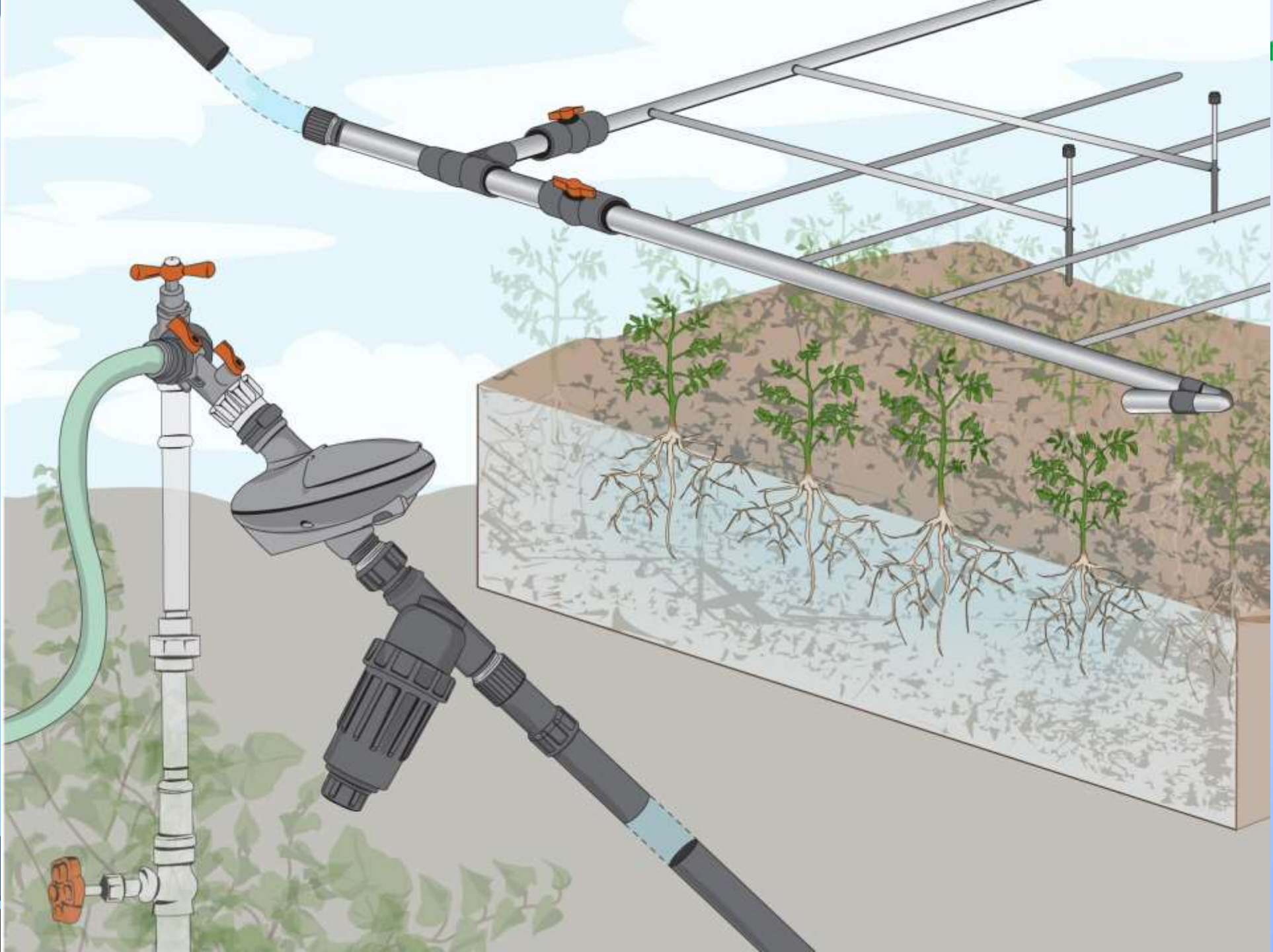
Layout of Drip Irrigation System (ड्रिप सिंचाई पद्धति का रेखाचित्र)



System Configuration
 Tank (40 ltrs)
 12 mm Main line (w/ Filter)
 16 mm Lateral Lines



more

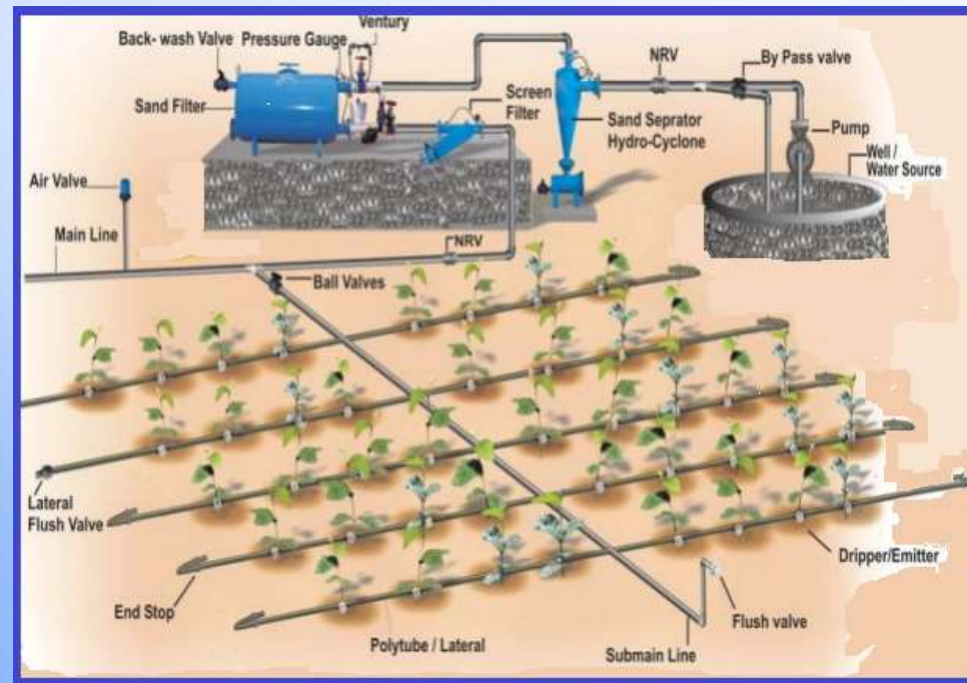


Micro Irrigation

- Micro irrigation system consists of valves, pipes, tubing, and emitters that slowly dispense water near the plant root zone.
- There are several types of micro irrigation. Drip irrigation, also called trickle irrigation, delivers one water droplet at a time or a very small stream of water to plants.
- Micro spray irrigation delivers small amounts of water in a fine mist, in a stream of water, or by means of a micro sprinkler.



Head System of Micro Irrigation



Water Resource



Water Resource



Head system



Pump

Water tank

Filter

Fertilizer equipment

Controller

Water Source

Steel tank with anti-leakage film

- Light weight, competitive cost
- Volume can be customized
- Standard parts, easy for installing, maintains
- Prevent algae
- Long using life

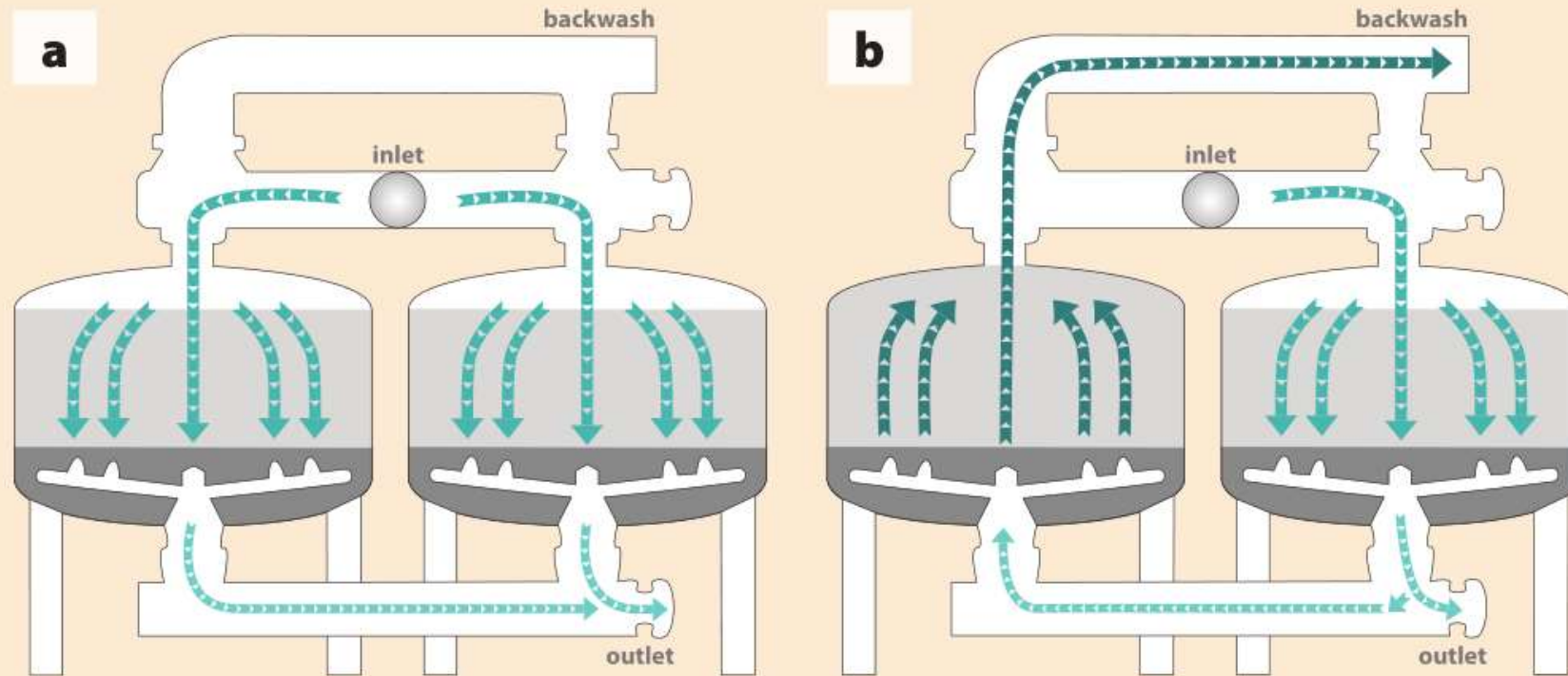


(1) Media filter: organic impurity

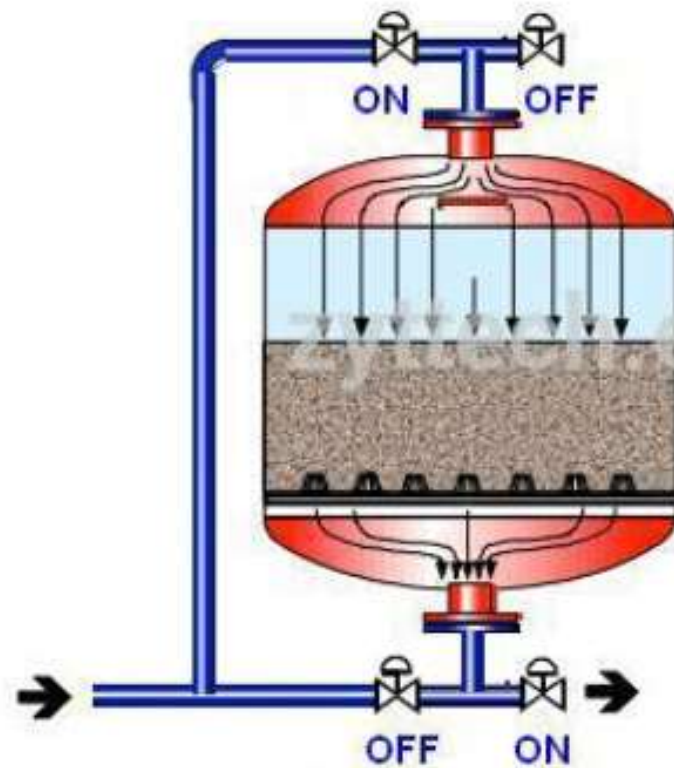


Media filters (also called sand filters), similar to swimming pool filters, are effective for removal of suspended

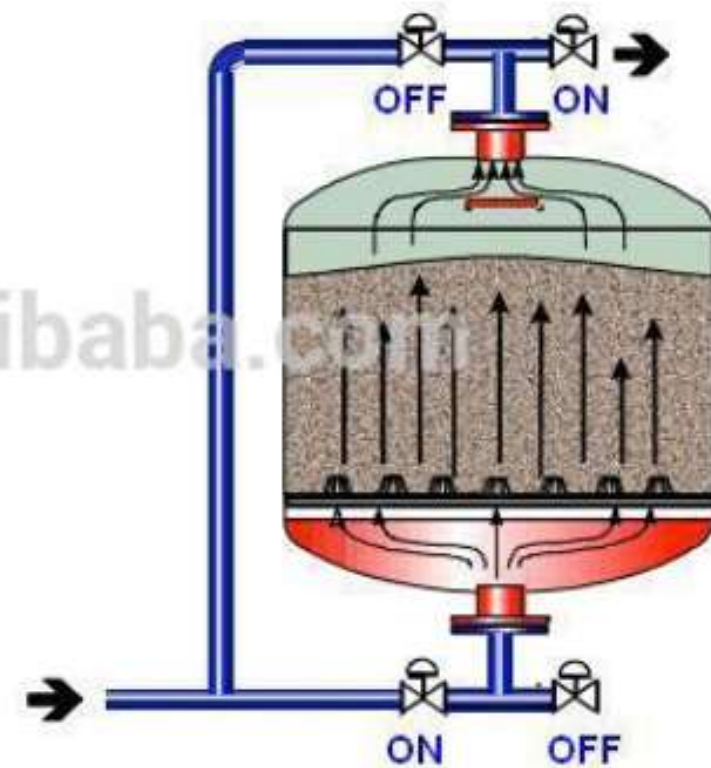
FIGURE 21. Backwashing of a media filter: (a) both vessels in filtration mode; (b) one vessel in backwash mode and one vessel in filtration mode.



Blackflush



FILTERING PROCESS



BACKFLUSH

(2) Separator filter: inorganic impurity



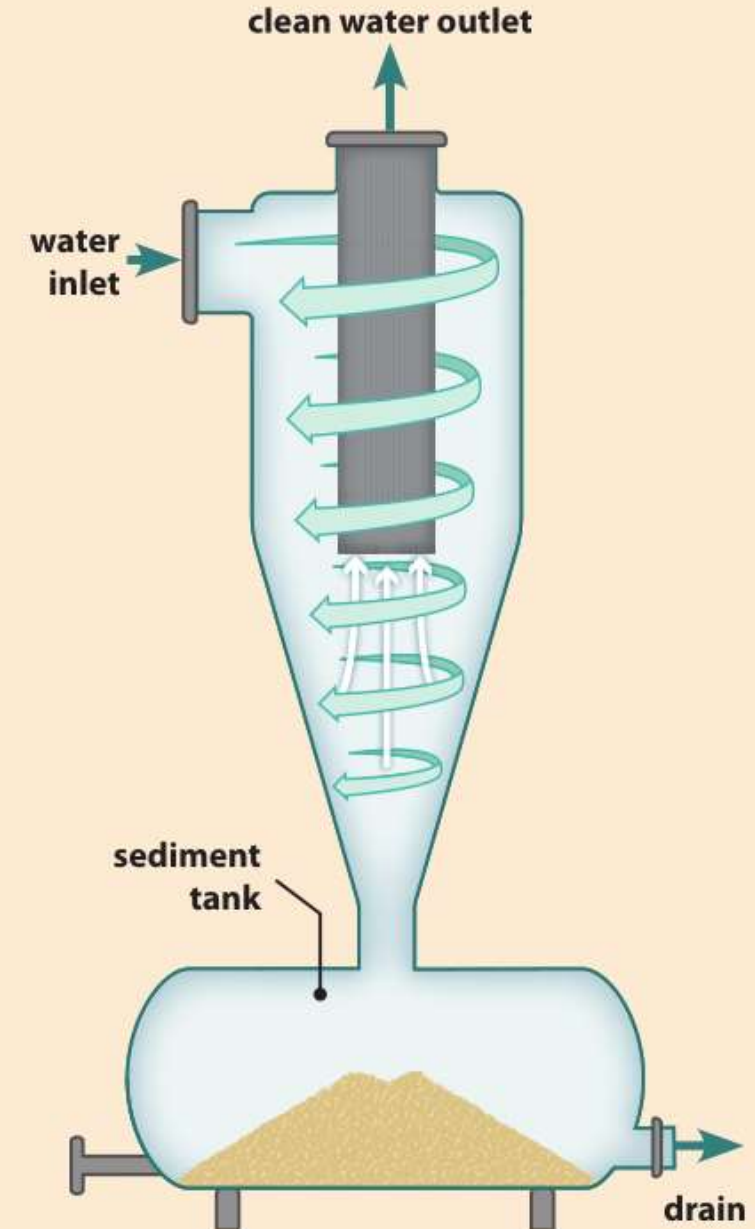
- Separator filters make use of centrifugal force to separate particles from the water.
- They work well for removal of sand and particles that are heavier than water.
- They are not effective for removing organic matter and particles that are less dense than water.

FIGURE 22. Separator/cyclone filter.

(Courtesy of Netafim USA.)



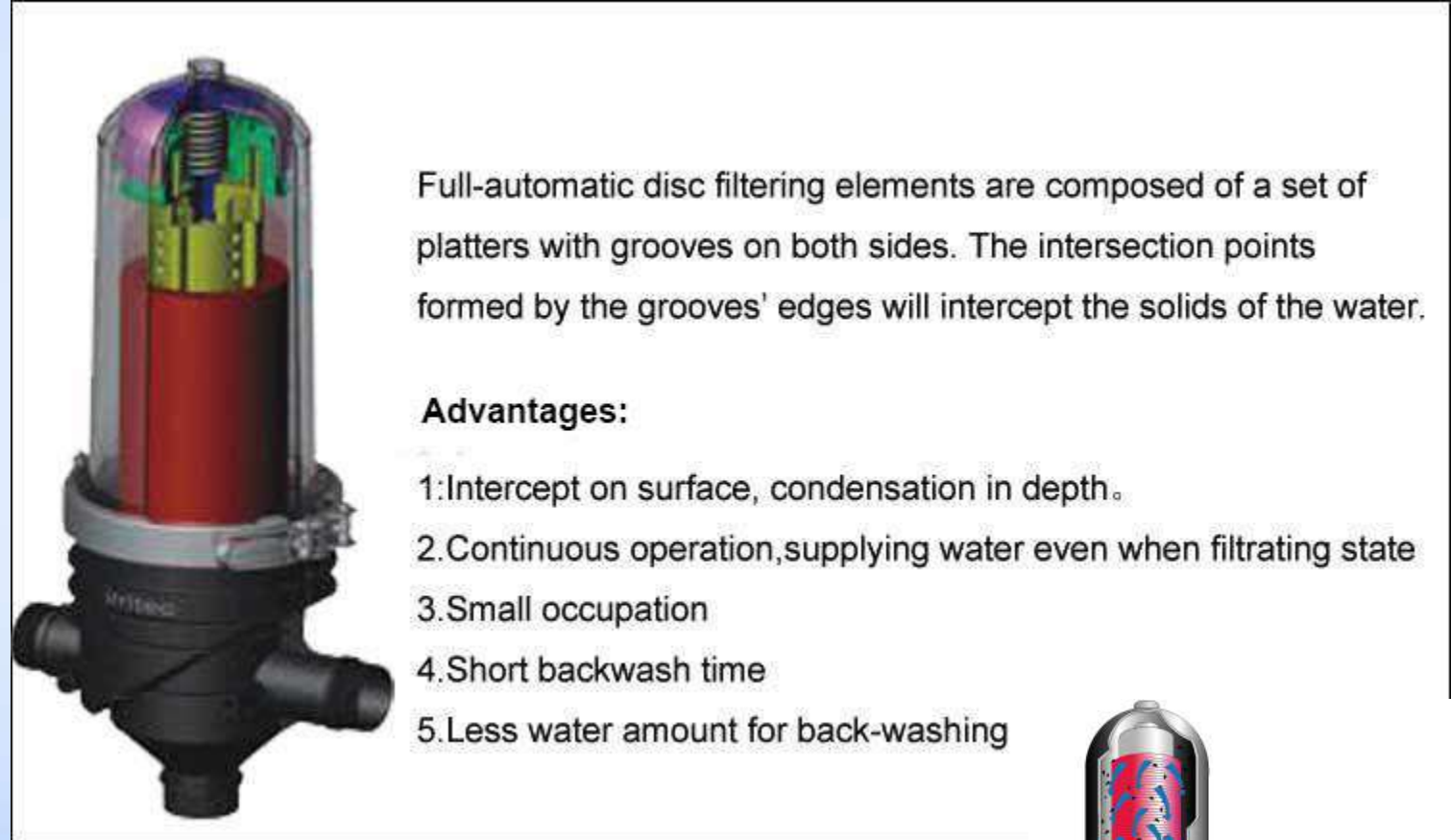
FIGURE 23. Separator flows.



(3) Disc filter: second stage filtration



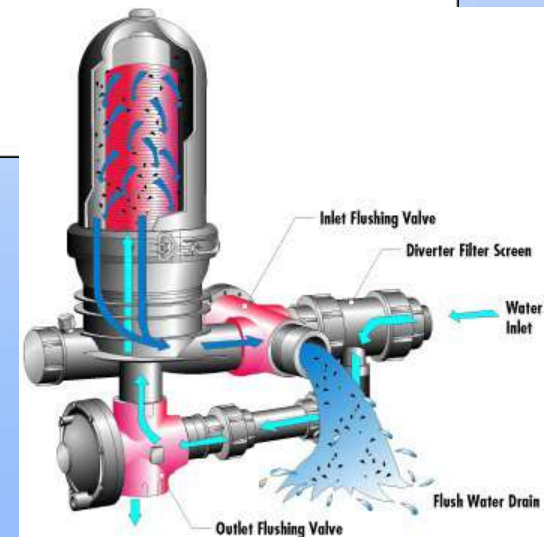
- Disk filters use a stack of thin doughnut-shaped filter material.
- These are often used to remove organic matter and small particles after the water goes through a media or separator filter, but they can also be used on small systems to avoid the expense of a media filter.



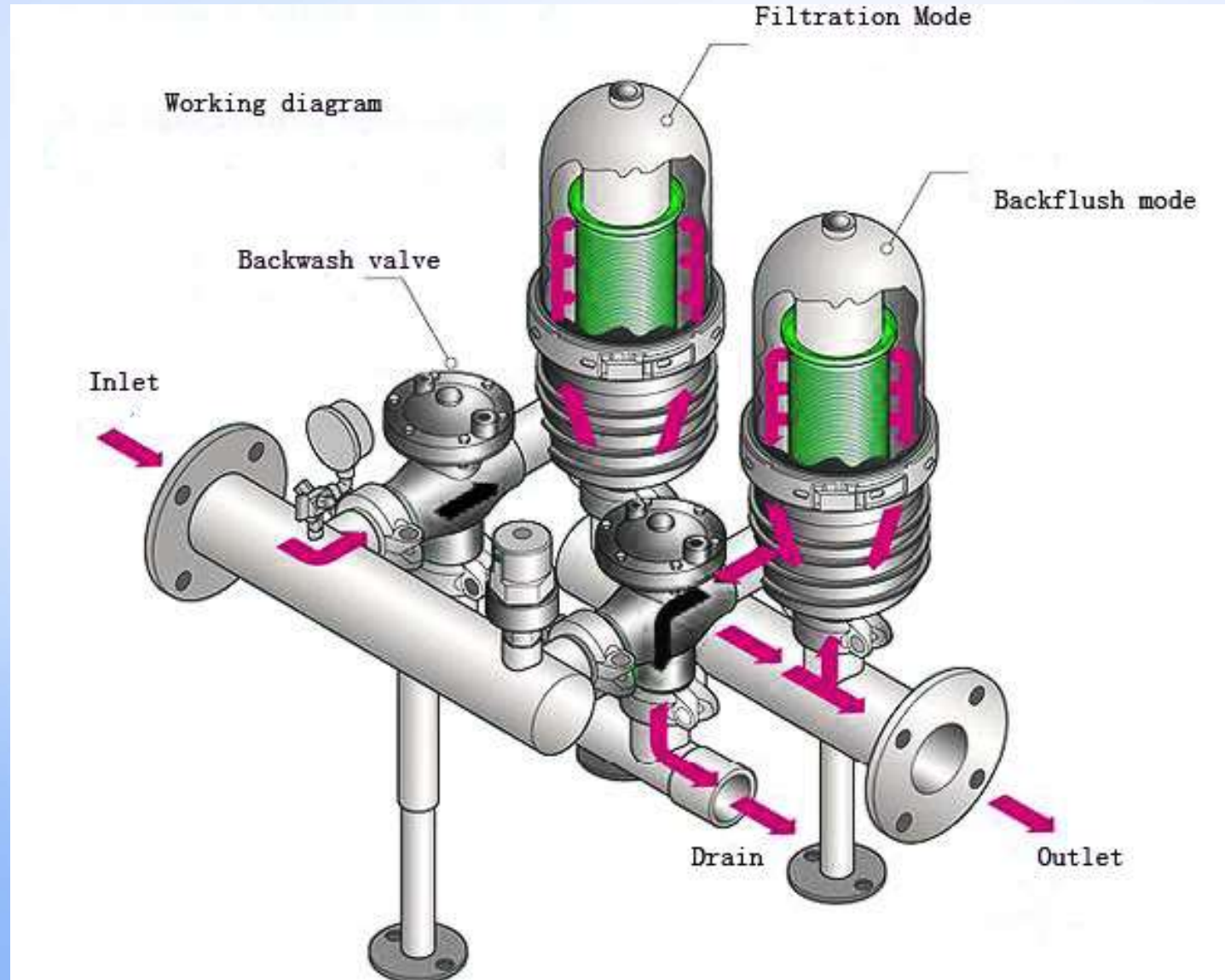
Full-automatic disc filtering elements are composed of a set of platters with grooves on both sides. The intersection points formed by the grooves' edges will intercept the solids of the water.

Advantages:

1. Intercept on surface, condensation in depth.
2. Continuous operation, supplying water even when filtrating state
3. Small occupation
4. Short backwash time
5. Less water amount for back-washing



Auto Blackflush



(4) Screen filter



(5) On field disc filter & screen filter



(6). PIPE SERIES & PIPE FITTINGS



LDPE pipe fittings



GREENHOUSE SPRINKLER MACHINE

MICRO SPRAYER

(7). IRRIGATION EQUIPMENT/SYSTEMS



(1) Irrigation based— 5429 rotating micro sprayer



IRRIGATION SPRINKLER SERIES

	<p>3018</p> <p>Size: 3/4" male thread Work pressure: 2.0-4.0 bar Range: 7.0-12.0m Flow rate: 0.95-1.3m³/hr</p>		<p>3130/3131</p> <p>Size: 3/4" male thread / female thread Work pressure: 2.0-4.0 bar Range: 10.0-16.0 m Flow rate: 1.12-2.45 m³/hr</p>
	<p>5983</p> <p>Size: 1/2" male thread Work pressure: 2.0-3.5 bar Range: 8.0-12.0 m Flow rate: 0.68-1.10 m³/hr</p>		<p>3811</p> <p>Size: 1" female thread Work pressure: 2.5-4.0 bar Range: 15.0-21.0 m Flow rate: 3.12-4.13 m³/hr</p>

Drip Irrigation



Drip irrigation



Drip pipe



Drip tape



Dripper



Drip arrow

1. Drip irrigation system

What is “Drip” ?

Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface.



Dripline or Drip pipe

- Key part: inside cylinder dripper + anti-uv appearance
- Key process: uniformity + durable
- Feature: many flow rate & dripper space
- application: row planting



Application



Drip tape

- Normally $\Phi 16$ mm, thickness 0.3mm
- Double blue line design
- Application: row planting





Dripper

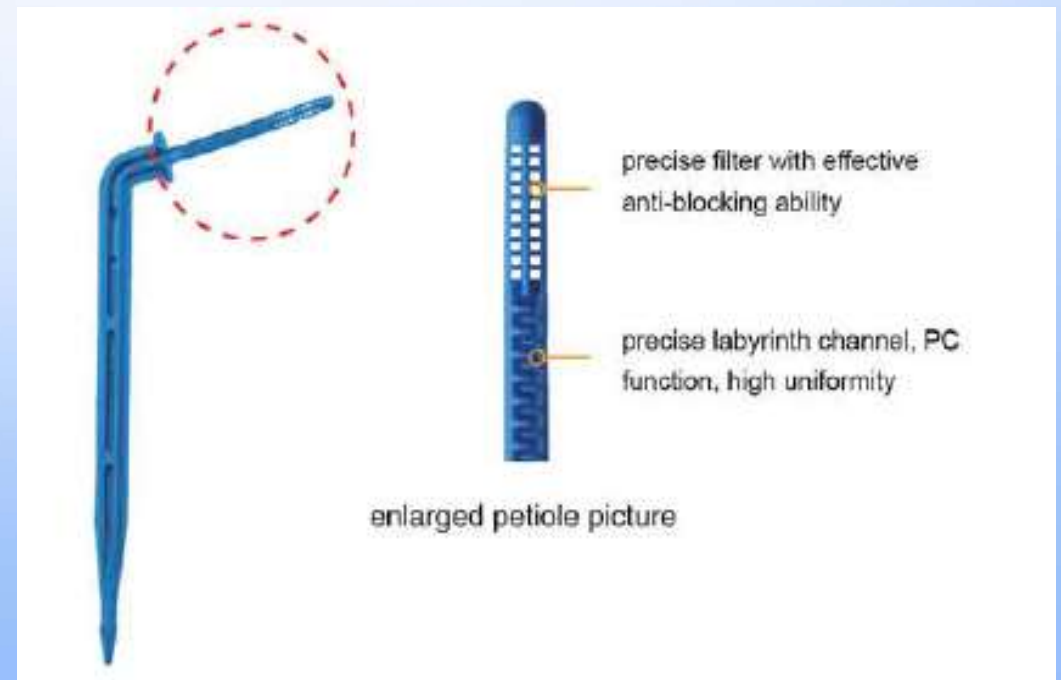
- Easy to install
- According to crop location
- Application: tree, fruit, orchard





Drip arrow

- Irrigation uniformity, accuracy, adjustable location installation
- Soft pipe+filter, labyrinth channel



- Application: row planting, bag cultivation, potted plants, seedlings, film mulching cultivation







Hanging garden irrigation system

Key components:

**Drip arrow + extra liquid
recycle + split type pot**



Cost less Harvest more



How to Select



How to choose?

- Drip pipe /drip tape: most row planting with small space between two crops
- Dripper: big distance or irregular space
- Drip with arrow: bag cultivation, potted plants, vertical cultivation
- Price: drip tape < drip pipe < dripper < dripper + drip arrow

2. Micro spray irrigation system

Irrigation emitter



Micro sprayer installation



(1) Irrigation based— 5429 rotating micro sprayer



(2) Cooling humidifying seeding—5428 flat spray model



Cost less Harvest more



(3) 5427 mist micro sprayer



- small flow rate, no high pressure, good performance of fog
- height no less than 1.5m, distance between 1.2-2m,
- Livestock farm cooling

(4) 5410 series for fruit tree

support projects by National Science and Technology Innovation Fund

patent No. : 201220113405.2



Cost less Harvest more



(5) Micro spray tape



3. Impulse sprinkler irrigation system

- Sprinkler, sprinkler gun, irrigation machine
- Application: vegetable, nursery stock or open field crops



How to Select



How to choose?

- Dripline /drip tape: most row planting with small space between two crops
- Dripper: big distance or irregular space
- Drip with arrow: bag cultivation, potted plants, vertical cultivation
- Micro spray: orchard, tea, fruit tree
- Sprinkler: open field farming, large scale irrigation

Irrigation Solution Questionnaires

- 1. What is your irrigation area type, open field, greenhouse, landscape or others
- 2. How many Hectares will need irrigation, please specify its length and width in meters if possible.
- 3. Is the land area flat, ramp or hill-land ? Can you provide scheme drawing with details for it ?
- 4. What crops will you plant, did you divide the field for different crops? please specify it.

Irrigation Solution Questionnaires

- 5. What's the row spacing?
- 6. what's the crops spacing ?
- 7. Please describe the water conditions. Is the water from Lake, River, Well , Spring, or others ?
- 8. How far from water source to Irrigation-land ?
- 9. What's the altitude difference between your land and water source?

Irrigation Solution Questionnaires

- 11. Do you need automatic Controlled irrigation system or manual controlled ones ?
- 12. Please describe the weather conditions, like sunshine, temperature range, humidity.
- 13. Please describe the soil conditions.
- 14. We supply high-precision dosing fertilizer tanks, and advanced irrigation machine. Will you need it ?
- 15. For electricity, do you have 3 phase 380V/50HZ stable electricity or single phase 220V around your land?

Calculation of Emitter Number and Total Lateral



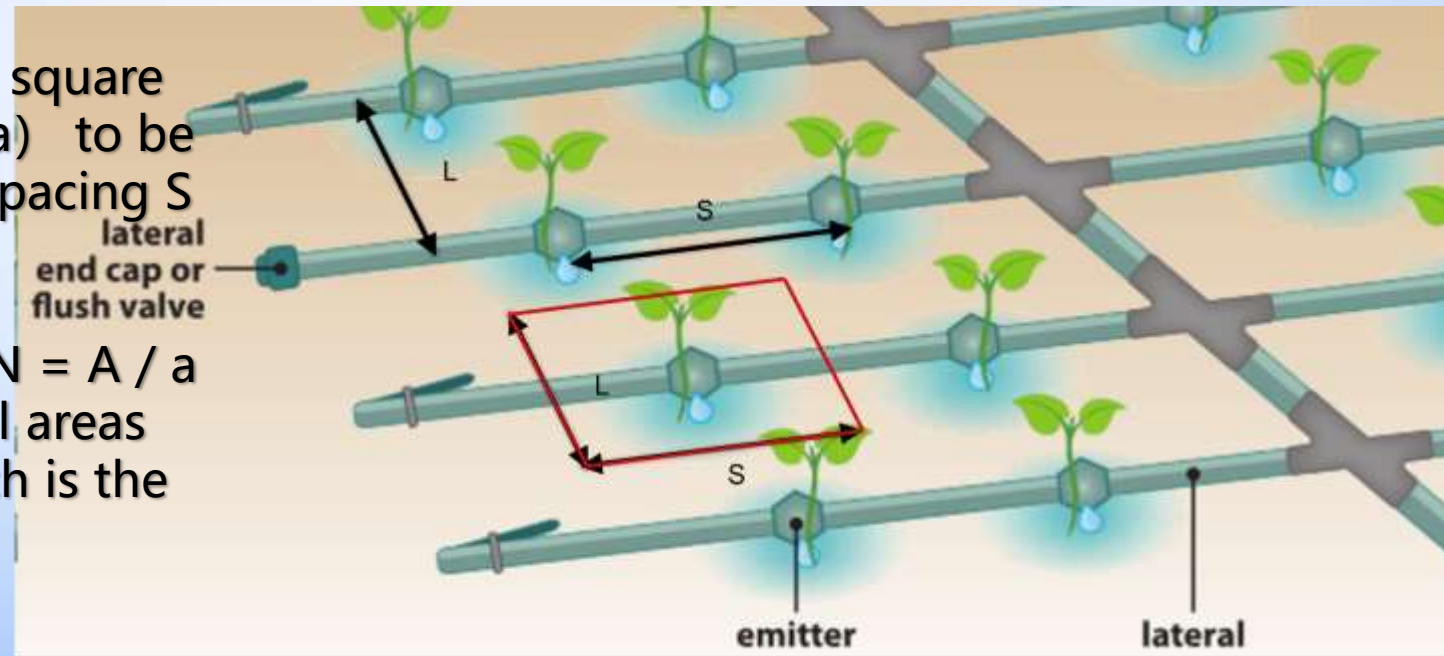
http://m.guangaidashi.com/col.jsp?id=115&_sc

Row spacing L of the spacing S of emitters

Assuming that his irrigation area is A square metres, the irrigation control area (a) to be installed is the row spacing L of the spacing S of emitters, that is:

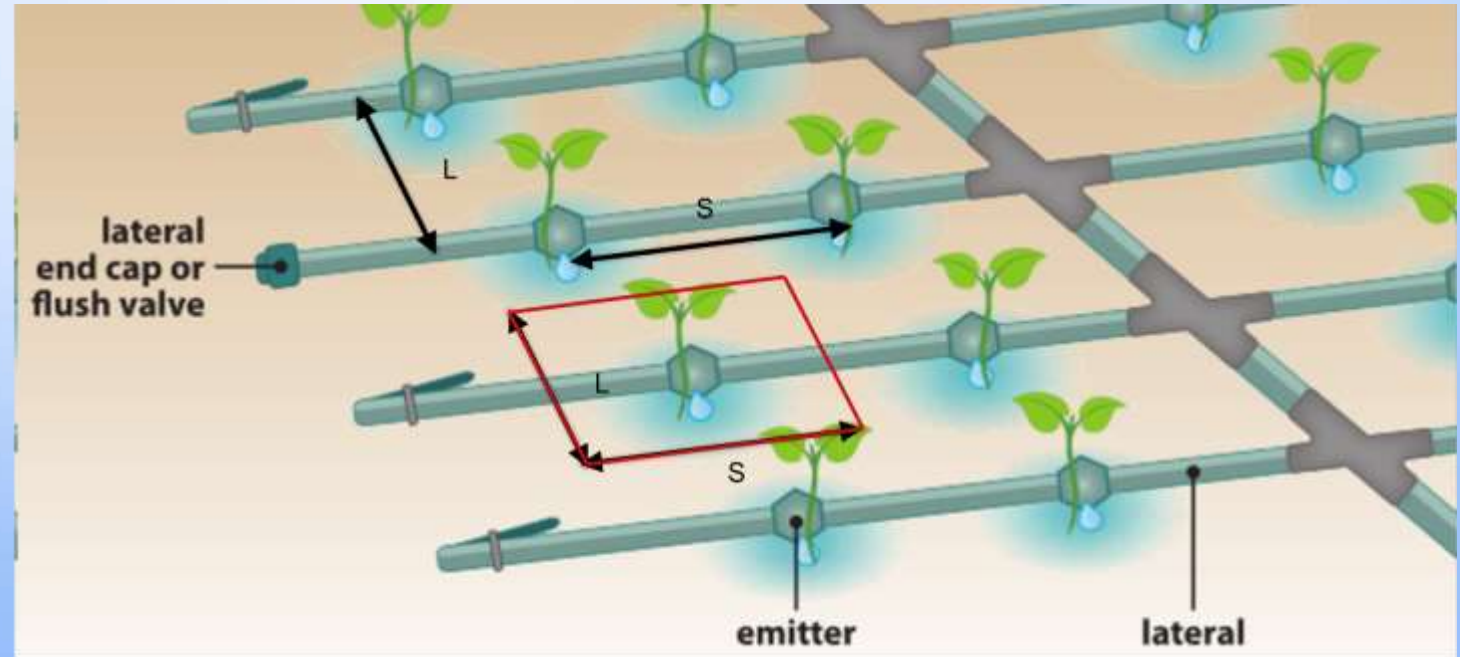
$$a = S \times L$$

The number of irrigators required is $N = A / a = A / (S \times L)$, and how many a control areas (SXL) are on his irrigation area, which is the number of emitters needed.



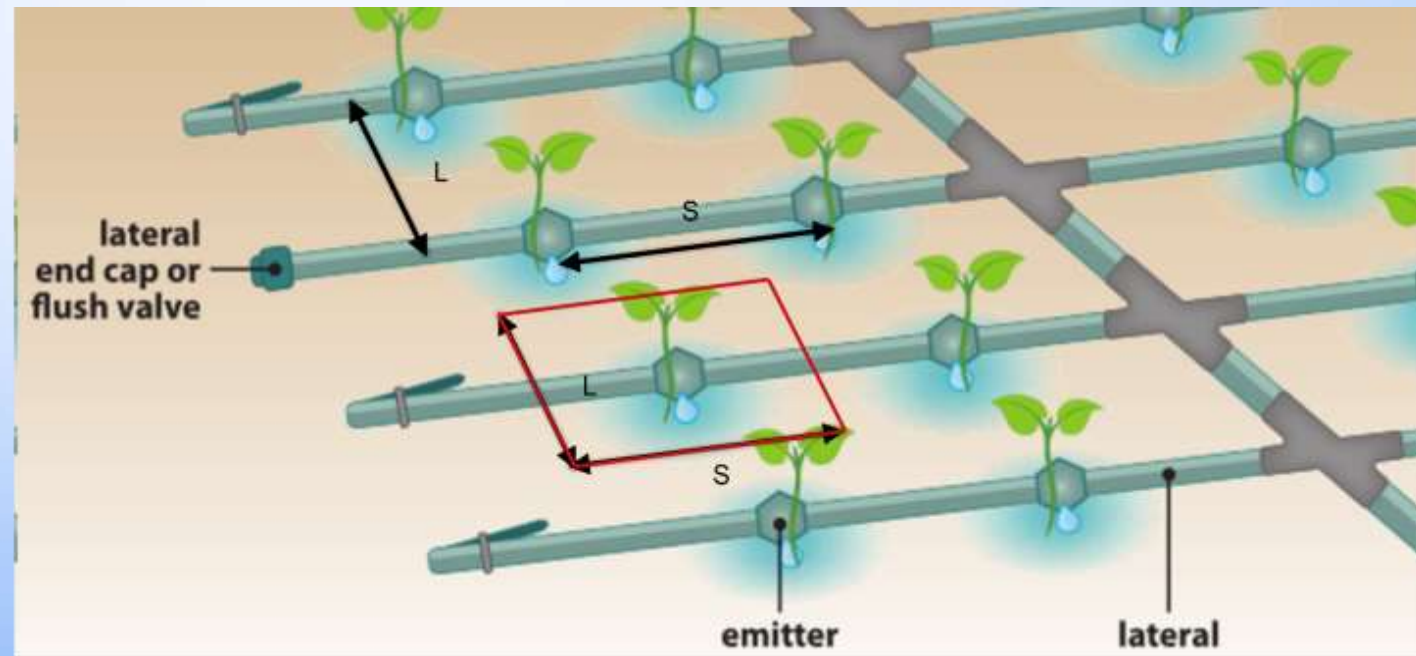
Number of irrigators required

- $N = A / a = A / (SXL)$, and how many a control areas (SXL) are on his irrigation area, which is the number of emitters needed.



Area and Total Lateral Length

- First of all, the distance between pipe lines is given to, if the answer is 4 meters. So,
- Irrigated area: 20 ha = 20000 square meters;
- The number of drip pipes is calculated:
 $L_{sum} = A/L = 20000/4 = 5000$ meters.



Known irrigation area A, calculation of irrigation flow Q.

- Irrigation flow $Q = \text{water quantity } m_1 * A / \text{irrigation efficiency } W_n / \text{irrigation work time } t \text{ of the system for a day.}$
- $Q = m_1 * A / W_n / t / 1000.$



http://m.guangaidashi.com/col.jsp?id=116&_sc

Estimating irrigation pump lift

- http://m.guangaidashi.com/col.jsp?id=117&_sc



Thank You!



Question?