AV-9041

Department of Rural Technology and Social Development, GGU, Bilaspur (C.G.)

Odd Semester Examination 2015-16: B. Sc. (Hon's) Vst Semester

RT-504 (Agricultural Equipments and Crop Production)

Time : 03 hours **Max. Marks: 30**

Section-A

Q.1. Objective Type Questions (Attempt all): **1×10 = 10 Marks**

i. Botanical name of Fox tail millet is _____.

c. *Setaria italica*

ii._____ is the tillage operation in which only isolated bands of soil are tilled.

a. Strip tillage

iii. Harrow is a_____tillage implement.

b. Secondary

iv. _____consist of dropping the seeds in furrow line in a continuous stream and covering them with soil.

b. Drilling

v. Sprayers can be used to apply_____.

d. All the three chemicals

vi. Common wheat is _____.

c. Triticum aestivum

vii. _____mimics the rice crop.

c. Echinochloa colonum

viii. _____is partial root parasite on millets.

a. *Striga spp*

ix. _____ tractors are used for land clearing and land leveling works.

b. Crawler tractors

x. Recommended seed rate for green gram is _____kg/ha

b. 20

Section-B

Short Answer Type Questions (Attempt any four): **2.5×04 = 10 Marks**

Q.2. What is a mower? Explain different types of mowers.

Mower is a machine to cut herbage crops and leave them in a swath. Animal drawn and tractor operated mowers are available. According to the cutting tool mowers are classified in to the following types such as: a) Cylinder mower b) Reciprocating mower c) Horizontal rotary mower d) Gang mover and e) Flail mower.

a) Cylinder mower: It has rotating helical blades arranged in cylindrical form. With the rotation of blades, forage or grasses are cut continuously. It is used for trimming grass in lawns, golf grounds etc.

b) Reciprocating mower: It is a mower with a knife made of several serrated triangular sections that reciprocate against stationary fingers. The knife cuts the crop by its reciprocating action. It is the most common type of mower used for harvesting forage crops and food grain crops like paddy and wheat.

c) Horizontal rotary mower: It is a mower with high speed knife rotating in the horizontal plane. Due to rotation of knife, the grass and forage are cut uniformly. Used for trimming lawns, golf grounds etc.

d) Gang mower: It is an assembly of two or more ground driven cylinder mowers. It is used for trimming grass in lawns, golf grounds etc.

e) Flail mower: It is a mower with high speed swinging knives, operating either in the horizontal plane or in the vertical plane. Used to cut herbaceous weeds like parthenium.

Q. 3. Define agronomy and explain its extent in agriculture.

Agronomy: It is defined as an agricultural science deals with principles and practices of crop production and field management.

Scope of Agronomy

Agronomy is a dynamic discipline with the advancement of knowledge and better understanding of planet, environment and agriculture. Agronomy science becomes imperative in Agriculture in the following areas.

- ✓ Identification of proper season for cultivation of wide range of crops is needed which could be made possible only by Agronomy science.
- ✓ Proper methods of cultivation are needed to reduce the cost of cultivation and maximize the yield and economic returns.
- ✓ Availability and application of chemical fertilizers has necessitated the generation of knowledge to reduce the ill-effects due to excess application and yield losses due to the unscientific manner of application.
- ✓ Availability of herbicides for control of weeds has led to development for a vast knowledge about selectivity, time & method of its application.
- ✓ Water management practices play greater role in present day crisis of water demand and Agronomy science answer to the questions 'how much to apply?' and 'when to apply?'.
- ✓ Intensive cropping is the need of the day and proper time and space intensification not only increase the production but also reduces the environmental hazards.
- ✓ New technology to overcome the effect of moisture stress under dry land condition is explored by Agronomy and future agriculture is depends on dry land agriculture.
- ✓ Packages of practices to explore full potential of new varieties of crops are the most important aspects in crop production which could be made possible only by Agronomy science.
- ✓ Keeping farm implements in good shape and utilizing efficient manner to nullify the present day labour crisis is further broadening the scope of agronomy.
- ✓ Maintaining the ecological balance through efficient management of crops, livestock and their feedings in a rational manner is possible only by knowing agronomic principles.

Q. 4. Short notes (All compulsory)

i. Rocker sprayer: This type of sprayer consists of a lever operated pump assembly which rests on a wooden platform. Suction hose with a strainer is immersed in a separate container containing the spray liquid. Delivery system consists of a separate pressure chamber, a flexible hose, spray lance, and a spray nozzle. The lever attached to the pump is operated by the rocking- forward and backward movement of the handle. Pressure is developed in the pressure chamber, which may attain pressure of 14-18 kg/cm2. Such sprayers are used for spraying tall plants like coconut and areca nut trees, and sugar cane plants. Uniform spraying can be done if sufficient pressure is maintained in the pressure chamber. It needs two persons to operate the sprayer, one for operating the pumping system and another for the application of spray liquid.

ii. Water use efficiency:

Water use efficiencies:

Consumptive Use Efficiency: It is measure of the water that has been actually used by the crop from the total water depleted from root zone. It includes water used for metabolic processes also besides ET.

$$Consumptive\ use\ efficiency = \frac{Consumptive\ use\ of\ water\ by\ crop\ (Wcu)}{Water\ depleted\ from\ root\ zone\ (Wd)} \times 100$$

Water Use Efficiency: It relates crop yield to water use. It is the ratio between marketable crop yield and water used in evapotranspiration.

$$Water\ use\ efficiency = \frac{Marketable\ crop\ yeild\ (Y)}{Evapotranspiration\ (ET)}$$

Field Water Use Efficiency:

It is the ratio of crop yield to the amount of water used in the field, which include ET, deep percolation and that used in plant metabolic processes. Since water used in metabolic processes is very small, field water use efficiency (FWUE) is the ratio between marketable yield and water used in ET plus deep percolation (DP) losses.

$$FWUE = \frac{Y}{ET + DP}$$

Q.5. Write down the classification of weeds according to nature of stem and association.

Classification based on nature of stem

Depending upon development of bark tissue on their stems and branches weeds are classified into woody, semi-woody and herbaceous weeds.

a. Woody weeds: Weeds include shrubs and under shrubs and are collectively called brush weeds. *Lantana camera, Prosopis juliflora* (mesquite) *Zizyphus rotundifolia* (wild plum) are examples for brush weeds.

b. Semi-woody weeds: *Croton sparsiflorus* is semi woody weed.

c. Herbaceous weeds: Weeds have green, succulent stems are of most common occurrence around us. e.g. *Amaranthus viridis and Chenopodium album*.

Classification based on association

When two plants are living together i.e called association. Based on association they are season bound weeds, crop bound weeds and crop associated weeds.

Season bound weeds: They are seen in that particular season irrespective of crop. These are either summer annuals or winter annuals. *Sorghum halepans* (Perennial) is a summer perennial and *Circium arvense is* **winter perennial.** *Phalaris minor and Avena fatua* are winter season annuals.

Crop bound weeds: Weeds which usually parasite the host crop partially or fully for their nourishment i.e parasitism also called as parasitic weeds. Those parasites which attackroots are termed as root parasites and those which attack shoot of other plants are called as stem parasites

1 Root parasites

a. complete root parasite e.g. *Orobanche* (broom rape)in tobacco

b. partial root parasite e.g. *Striga* spp (witch weed) on millets

2. Stem parasites a complete stem parasite e.g. *cuscuta* (dodder) in lucern & burseem

b. partial stem parasite e.g. *Loranthus* in fruit crops

Crop associated weeds: These are also crop specific due to mimicry, need for specific micro climate and ready contamination with the crops.

Mimicry

If weeds look exactly like crops morphologically & complete their life cycle, *Echinochloa colonum* (Jungle rice) mimic the rice crop. *Avena fatuva (wild oat)* and *Phalaris minor* (canary grass) both mimic the wheat and *Loranthus* in tea gardens. For example *Avena fatua* (wild oats) tends to grow to the height of winter grains and adjusts its ripening period to the crop over a wide varietal range and this type of mimicry is called phenotypic mimicry.

Need for specific micro climate

C*ichorium intybus* (chicory) and *Coronopus didymus*(swinecress) requires shady, moist & cool micro climate for their growth and development and which is available in lucerne and berseem crops.

Ready contamination with the crops

If the crop seed mature at the same time & same height of the crop, then it contaminates the crop (also morphologically same) easily e. g. little seed canary grass (*Phalaris minor) and* wild onion, wild garlic (*Allium spp).*

Q.6. Describe Seed drill.

Seed drill is a machine used for placing the seeds in a continuous stream in furrows at uniform rate and at controlled depth with an arrangement of covering the seeds with soil.

According to the power source used, seed drills may be classified in to

(i) Bullock drawn seed drills
(ii) Tractor drawn seed drills

According to the type of seed metering done animal drawn seed drills may be classified into

i) Manually metered seed drills and
ii) Mechanically metered seed drill

In manually metered seed drills a person drops the seeds in the furrows, in mechanically metered seed drills a mechanical device called seed metering mechanism is used to meter the seeds. There are many designs of bullock drawn seed drills and tractor drawn seed drills which are used for sowing.

Functions of a seed drill:

Seed drill performs the following functions

i) To carry the seeds.
ii) To open furrows at uniform depths
iii) To meter the seeds
iv) To deposite the seeds in furrows in an acceptable pattern
v) To cover the seeds and compact the soil around the seed

Q.7. Enlist different sowing methods and explain any two.

Sowing methods

(i) Broadcasting (ii) Dibbling (iii) Drilling (iv) Seed dropping behind the plough (v) Transplanting (vi) Hill dropping (vii) Check row planting.

(i) Broadcasting

Broadcasting is the method of random scattering of seeds on the surface of seedbed. It can be done manually or mechanically. When broadcasting is done manually, uniformity of seed placement depends upon the skill of the man scattering the seeds. Soon after broadcasting the seeds are covered by planking or some other devices. Usually higher seed rate is obtained in this system. Mechanical broadcasters are used for large-scale sowing. The device scatters the seeds on the surface of the seedbed at controlled rates.

(ii) Dibbling

Dibbling is the process of placing seeds in holes made in the seedbed and closing the seed with soil. In this method, seeds are placed in holes made at definite depth at fixed spacing. The equipment used for dibbling is called *dibbler*. It is a conical shape instrument used to make proper holes in the field. This is very time consuming process, so it is not suitable for small seeds. Mostly vegetables are sown in this way.

(iii) Seed dropping behind the plough

It is a very common method of sowing followed by farmers in villages. This method is used for seeds like maize, gram, peas, wheat and barley. A woman/ man walk behind a plough ploughing the land and drop the seeds in the furrows made by the plough. Sowing behind the plough can be done by a device. It consists of a bamboo tube provided with a funnel shaped mouth. It is fitted to the handle of the plough. One man drops the seeds through the funnel and other man handles the plough and the bullocks. This method is a slow and laborious method.

(iv) Drilling

Drilling consists of dropping the seeds in furrow lines in a continuous stream and covering them with soil. The spacing between the seeds is not uniform. Seed metering may be done either manually or mechanically. The number of rows planted may be one or more (Figs.2-5). This method is very helpful in achieving proper depth of sowing, proper spacing between seeds and proper seed rate. Drilling can be done by using seed drills of tractor drawn and animal drawn types.

(v) Transplanting

Transplanting consists of rising the seedlings in a nursery bed and then planting the seedlings in another field (main field). It is commonly done for paddy, vegetable and flowers. It is a time consuming operation. Equipment used for planting the seedlings in the main field is called *transplanter*.

(vi) Hill dropping

In this method, few seeds are dropped as a hill at a fixed place and not in a continuous stream. The spacing between hill to hill in a row is constant The equipments are called planters

(vii) Check row planting

It is a method of planting, in which row-to-row and plant-to-plant distance is uniform. In this method, seeds are planted precisely along straight parallel furrows. The rows are always in two perpendicular directions. A machine used for check row planting is called check row planter.

Section-C

Long Answer Type Questions (Attempt any two): 5×02 = 10 Marks

Q.8. Define weed management. Enlist different principles of weed management and explain 'preventive measures'.

Prevention

It encompasses all measures taken to prevent the introduction and/or establishment and spread of weeds. Such areas may be local, regional or national in size. No weed control programme is successful if adequate preventive measures are not taken to reduce weed infestation. It is a long term planning so that the weeds could be controlled or managed more effectively and economically than is possible where these are allowed to disperse freely.

Arresting the movement and denying the entry in uninfested area. Crop hygiene can also be considered as prevention. Weeds producing seeds in current season are the inoculum for next season. If some how they do not produce seeds in current season, this is also one of the preventive measures. Thus controlling weeds at flowering stage, which will prevent contamination in other season, is also a preventive measure.

Important weed prevention practices are

1. Use clean crop seeds/ weed free crop seed

The prevention of weeds that disperse with crop seed can be achieved in two ways by the production of weed free crop seed at govt. farms or at farmer's fields and cleaning of the crop seeds before storage and at the time of sowing In seed production plots weeds are removed before flowering.

2. Avoid feeding of screenings, grain or hey containing weed seeds to live stock without destroying their viability by grinding, cooking and ensiling.

Use well rotten\decomposed organic manure Avoid reaching of weed seeds into the compost pit. A composting temperature of 65 to 90 ^{O}C should be maintained for 4-5 months. Treat the FYM with chemicals like acrocyanamide, SMDC (metham), DMTT (mylone) and ammonium thiocyanate or uramon (synthetic urea).

3. Prevent movement of weeds with other farm resources i.e don't permit live stock from weed infested area to clean areas. Clean the harvesters, seed cleaners, hey balers and other farm implements before moving them from infested area. Avoid use of gravel, sand and soil from weed infested area. Inspection of nursery stock for presence of weed seeds, tubers, rhizomes of perennial weeds

4. Keep non crop area clean

Keep irrigation & drainage channel, fence lines, road sides, fence corners and all other non cropped areas free from weeds. Prevent the dissemination of mature seeds to the main land

5. Use vigilance

A farmer should inspect his farm periodically for strange looking new weed. Farmer knows the weed flora in his field. So when a new weed spp is seen then prevent its establishment. So that it does not add to existing weed flora.

6. Follow legal & quarantine measures: Quarantine measures should be strict. Legal measures are necessary to check inter state and inter country movement of noxious weeds.

Important seed cleaning methods

Sieving: Most common method of separating weed seeds in seed houses is screening. Vibrating sieves various mesh sizes and shapes are used for this purpose.

Salt solution: Dipping crop seeds in 5-10% common salt solution. Light weight seeds float on the surface of the water. Crop seeds will settle down.

Winnowing: Lighter seeds can be separated

Specific gravity pneumatic and aspirator separators: Remove the weed seeds having different specific gravity than the crop seeds, irrespective of their shape and size

Velvet rollers: Seed surfaces differ in their texture if the weed seeds to be removed are of rough surface they are caught on the velvet while the crop seeds fall below as they have smooth surface.

Conveyer belts: They are working on the same principle as the velvet rollers.

Magnetic separators: Iron powder is added which will stick to rough surface of weed seeds & they can be separated by magnets.

Electrical separators: Seeds differ in their ability to conduct electricity or to hold a surface charge. When thin layer of weed seeds trough a high voltage electric field, the low surface charge seeds fall off and high surface charge seeds continue on the conveyer belts.

Dented plates: weed seeds separated by passing the seed mixture over dents made on discs, cylinders or metallic sheets. The dent shape and size can varied to each specific weed seeds.

Photo tubes: It is used in USA to separate beans and peas it assess the colour of different kinds of seeds in the admixture and eject them in to separate chambers.

Q.9. Write down the functions of mould board, enlist different types of mould board and explain them.

Function of mould board plough:

1) cutting the furrow slice
2) lifting the soil
3) turning the furrow slice and
4) pulverising the soil.

Moulds boards:

Different types of moulds boards are named below:

1. **General purpose:** It is the best for all round general farm use to give through pulverization.
2. **Stubble:** It is adopted for ploughing an old ground where good pulverization is desired. It has relatively short and broad mould board. Its curvature is not gradual but it is abrupt along the top edge. This causes the furrow slice to be thrown off quickly, pulverizing it much better than other types of mould board. This is best suited to work in stubble soil that is under cultivation for years together. Stubble soil is that soil in which stubble of the plants from the previous crop is still left on the land at the time of ploughing.
3. **Sod or Breaker:** the breaker bottom is used in tough sod (grass land) where it is desired to turn the furrow slice completely so that the grass may not continue to grow.
4. **Slat:** It is a mould board whose surface is made of slats placed along the length of the mould board, so that there are gaps between the slats. This type of mould board is often used, where the soil is sticky, because the solid mould board does not scour well in sticky soils.
5. **High speed:** Most of the high speed bottoms are used on tractor plough for general farm use.

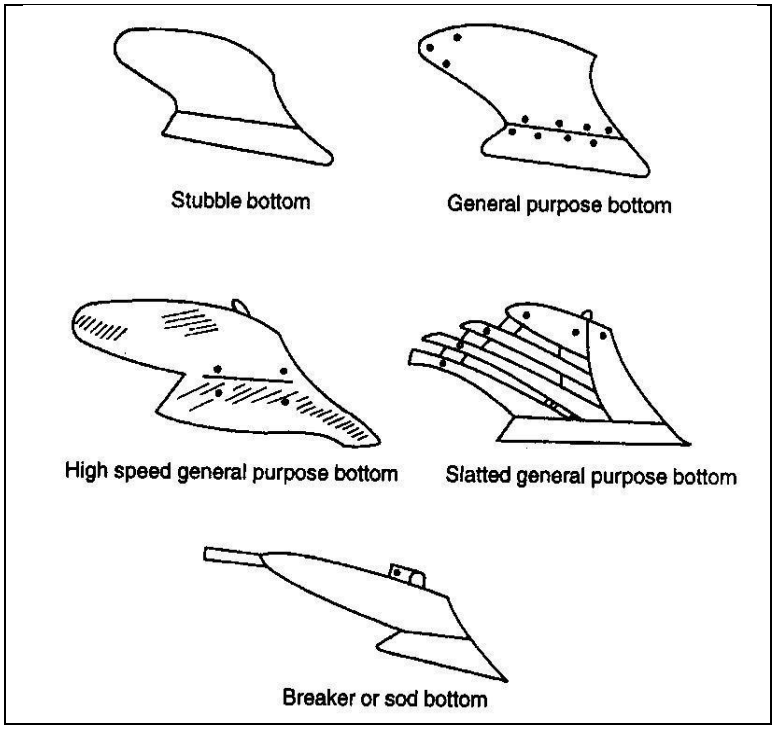

Fig. A few commonly used mould boards

Q.10. How rice is cultivated using SRI method?

Components of System of Rice Intensification (SRI)

1. Young Seedling (14 days old)
2. Single Seedling/hill
3. Square Planting
4. Weeding by Cono Weeder
5. Alternate Wetting & Drying
6. LCC based 'N' Management

System of Rice Intensification (SRI) Cultivation

- Season: Dry season with assured irrigation is more suitable.
- Varieties: Hybrids and varieties with heavy tillering

Nursery

- Seed Rate: 7- 8 kg for single seedling per hill
- Preparation of Nursery Area: Prepare 100 m2 nurseries to plant 1 ha. Select a levelled area near the water source. Spread a plastic sheet or used polythene gunny bags on the shallow raised bed to prevent roots growing deep into soil.
- Preparation of Soil Mixture: Four (4) m^3 of soil mix is needed for each 100 m^2 of nursery. Mix 70% soil + 20% well-decomposed pressmud / bio-gas slurry / FYM + 10% rice hull. Incorporate in the soil mixture 1.5 kg of powdered di -ammonium phosphate or 2 kg 17-17-17 NPK fertilizer.
- Blending Soil Mixture: Filling in soil mixture: Place a wooden frame of 0.5 m long, 1 m wide and 4 cm deep divided into 4 equal segments on the plastic sheet or banana leaves. Fill the rame almost to the top with the soil mixture.
- Pre-germinating the seeds 2 days before sowing: Soak the seeds for 24 h, drain and incubate the soaked seeds for 24 h, sow when the seeds sprout and radical (seed root) grows to 2-3 mm long.
- Sowing: Sow the pre-germinated seeds weighing 90 -100 g / m-2 (100g dry seed may weigh 130g after sprouting) uniformly and cover them with dry soil to a hickness of 5mm. Sprinkle water immediately using rose can to soak the bed and remove the wooden frame and continue the process until the required area is completed.

- Watering: Water the nursery with rose can as and when needed (twice or thrice a day) to keep the soil moist. Protect the nursery from heavy rains for the first 5 DAS. At 6 DAS, maintain thin film of water all around the seedling mats. Drain the water 2 days before removing the seedling mats for transplanting.
- Spraying fertilizer solution (optional): If seedling growth is slow, sprinkle 0.5% urea + 0.5% zinc sulfate solution at 8-10 DAS.
- Lifting seedling mats: Seedlings reach sufficient height for planting at 15 days. Lift the seedling mats and transport them to main field.

Main Field Preparation:

- Puddled lowland prepared as described in transplanted section
- Perfect leveling is a pre-requisite for the water management proposed hereunder

Transplanting

- Single seedling of 15 days old.
- Square planting of 25 x 25 cm.
- Fill up the gaps between 7th and 10th DAT.
- Transplant within 30 minutes of pulling out of seedlings.

Irrigation Management

- Irrigation only to moist the soil in the early period of 10 days
- Restoring irrigation to a maximum depth of 2.5cm after development of hairline cracks in the soil until panicle initiation
- Increasing irrigation depth to 5.0cm after PI one day after disappearance of ponded water

Weed Management

- Using rotary weeder / Cono weeder
- Moving the weeder with forward and backward motion to bury the weeds and as well to aerate the soil at 7-10 days interval from 10-15 days after planting on either direction of the rows and column.
- Manual weeding is also essential to remove the weeds closer to rice root zone.

Nutrient Managements

- As per transplanted rice.
- Use of LCC has more advantage in N management.

Nutrient Management through Leaf Color Chart (LCC)

- Time of application is decided by LCC score
- Take observations from 14 DAT in transplanted rice or 21 DAS in direct seeded rice.
- Repeat the observations at weekly intervals up to heading
- Observe the leaf colour in the fully opened third leaf from the top as index leaf.
- Match the leaf color with the colours in the chart during morning hours (8-10 am).
- Take observation in 10 places.
- When 6/10 observations show less than the critical colour value, N can be applied @ 35kg N/ha in dry season and 30kg N/ha in wet season per application per ha.
- Green manure and farm yard manure application will enhance the growth and yield of rice in this system approach.

Q.11. Enlist different methods of irrigation and explain drip irrigation.

Methods of irrigation:

a. Surface irrigation

b. Sprinkler irrigation

c. Drip irrigation

Drip irrigation

It can be defined as the process of slow application of water in the form of discrete, continuous drops, tiny stream or miniature sprays through mechanical devices called emitters or applicators located at selected points along water delivery lines. Fertilizer and other chemical amendments can be effectively applied to individual or several plants using drip irrigation.

Trickle irrigation will not fit for every crop, specific site or objective. Presently, trickle system has greatest potential where water is expensive or scarce, soil are sandy, rocky or difficult to level and high value crop are produced. Principal crops under trickle irrigation are avocado, citrus, stone fruits, grapes, strawberry, sugarcane and tomato.

Surface trickle irrigation: In this system, the lateral lines are laid on the surface. It is most popular application method, particularly for widely spaced crops. Advantages of this system include the ease of installing, inspecting and changing and cleaning emitters. However, surface drip lines interfere with cultural operations.

Sub-surface trickle irrigation: These system with lateral lines buried below soil surface are gaining importance as problems with clogging have been reduced. Advantages of this system include freedom from necessity of anchoring of tubing at the beginning and removing at the end of growing season, little interference with cultural operation and longer economic life.

Advantages:

- Increase beneficial use of available water
- Enhanced plant growth and yield
- Reduced salinity hazards to plants
- Improved fertilizers and other chemical applications
- Limited weed growth
- Reduced operational labour
- Decreased energy requirement
- Improved cultural practices

Disadvantages:

- Persistence maintenance requirement
- Salt accumulation near plants
- Restricted soil water distribution and plant root development
- Economic and technical limitations

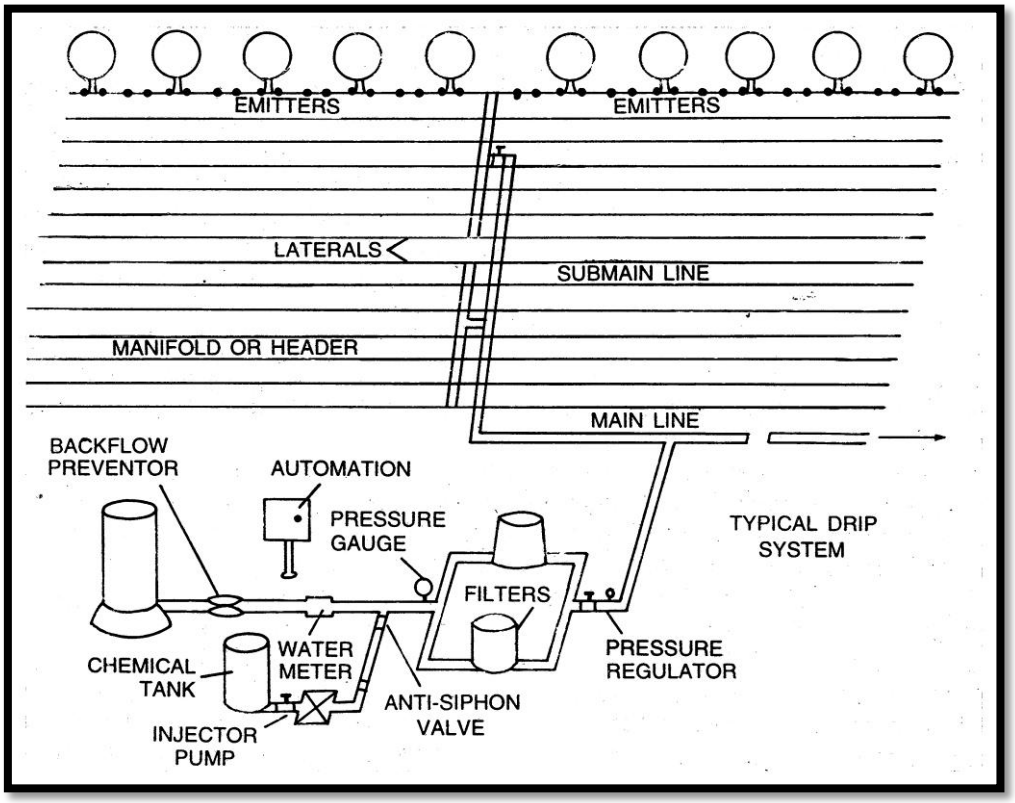

Fig. Drip irrigation system