

CHAPTER SEVEN

MANAGEMENT OF VEGETABLE FARM

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7.1 Cultivation

1. Cultivation/Hoeing

- Consists in moving the surface layer of the soil *without turning it*.

It is an important cultural operation for the following reasons:

- ✓ *Results in the destruction of weeds thereby avoid competition*
- ✓ *Decrease or the cease of the capillary flow*
- ✓ *Favoring better aeration,*
- ✓ *Favors in raising the temperature of the soil*
 - ✓ *favors nitrification and aids other chemical changes in the soil. Increasing the absorption and retention of heat.*

2. Earthing up

- ✓ It is collecting of earth (soil) around the base of plants, which gives them more *resistance* against wind (sweet corn) and *stimulates the growth* of new roots, in turn, extra plant growth.
- ✓ In some plants like *asparagus* and leek earthing up is done with the object of *blanching* a certain part of the plant and thus improving its eating quality and commercial value.
- ✓ In the case of *potatoes* this operation supplements the *planting depth, favors root development, inhibits the greening* of tubers and *protects* them from the attacks of *mildew and tuber moth*. One must be careful to *carry it out* progressively according to the growth of the plants and after having tested its effect on a few of them.

Cont.

- ✓ Unless the earthing up is performed correctly crop losses could be encountered for several reasons. These are:
 - **Damage to the root system**
 - **Injuries to the plant, or**
 - **Development of diseases on the stems of plants.**
- ✓ The work may be carried out by hand hoe, or on sandy soils, even by rake.
- ✓ On larger areas, the ridging plough is usually employed.

7.2 Mulching

. 4. Mulching

- ✓ Many kinds of materials are used to some extent as mulch for weed control and other purposes.
 - Leaves, straw, hay, saw dust, peat moss, paper, polythene sheet, and other degradable films.
- ✓ All the materials except paper, polythene sheet and degradable films, have some value in supplying the soil with organic matter when incorporated with the soil.

Cont.

- The mulching material could be applied in different methods viz;
 - *For individual plants*
 - *Covering of inter rows*
 - *Covering the intra rows and*
 - *Even complete covering of the field.*
- The usual practice is *spread the material evenly over the surface of the soil b/n the rows and around plants.*
- The *thickness of the mulching material depends on the kind of material and the cost.*
- When straw and grass mulches are the available resources, 5cm thick layer is enough to serve the purpose.
- With almost all organic materials nitrogen deficiency is likely to develop since the organisms that cause decomposition of the organic matter consume nitrogen.

Con't

- *Inorganic mulch* materials such as *paper, polythene sheet and degradable films will keep the product off the ground*
 - ❖ Which is a considerable importance with some crops such as tomatoes, eggplant and melons under certain conditions.
- Such mulching materials are also *expensive and labor demanding in for their applications.*
- Furthermore, paper and plastic mulches are known to result compaction of the soil when repeatedly used.

Con't

Mulches have the following importance in vegetable growing

- *Allow early growing (planting) of some vegetables,*
- *Improve and speedup seedling emergence in direct seeded plants,*
- *Protect soil surfaces from erosion,*
- *Shorten the growing seasons or promote crop maturity,*
- *Conserve soil moisture,*

7.3 Irrigation

- Water is an essential environmental factor which should be *controlled by drainage, storage, diversion, and irrigation*
- An **optimum supply** of soil water is essential for **maximum root development**
- **Well developed roots** in turn *absorb optimal quantities of water and nutrients, producing healthy top growth and higher yields.*
- **Excess water**, on the other hand, causes unhealthy roots due to poor soil aeration

7.3 Irrigation..

- There are four types of irrigation methods in common use, viz;
 - ✓ *Overhead irrigation*
 - ✓ *Surface irrigation*
 - ✓ *Drip irrigation*
 - ✓ *Subsurface irrigation.*
- Of these four methods, **surface** and **drip** irrigation are the chief irrigation methods for vegetable crops.

7.3 Irrigation..

Surface irrigation

- This method requires level or nearly level land with a slope of 0.1- 0.4%,
- and for this reason it is little used where soils are shallow and leveling should be necessary.
- Two methods of surface irrigation are **furrow and flooding** irrigation.
- Advantage of surface irrigation over others is low cost of equipment.

7.3 Irrigation..

- The main disadvantages of surface irrigation are,
- uneven distribution of water,
- Loss of water in open porous soils,
- Paddling and baking of the soil in the furrows,
- Cost of labor in the distribution of water
- ***Subsurface irrigation***
- This method consists in delivering the water to the plant from below.
- The advantages claimed for sub-irrigation are as follows
- The water supply is constant

7.3 Irrigation..

- The surface soil is kept dry which prevents rapid evaporation
- The surface does not puddle
- The main disadvantage is the large quantity of water required

7.3 Irrigation...

Spray Irrigation(sprinkler): In this method the water is applied in the form of spray or mist some what similar to a gentle rain.

•**Some of the advantages of spray irrigation are:-**

- It can be used on land too uneven for other types
- It can be used on soils that are too porous for other methods*
- It distribute water more uniformly than any other type of irrigation
- The rate of application can be so adjusted that little or no erosion occurs

7.3 Irrigation

- Light application of water can be made on soils or low water holding capacity and shallow depth and for shallow-rooted crops thus avoiding loss of water and soluble nutrients
- In this method, ditches and borders required for surface irrigation are eliminated, thus making more land available for crop production.

The disadvantages of spray irrigation are:-

- Initial cost of equipment is high
- Operation cost is high owing to necessity of supplying water under pressure
- Labor cost is high where movable lines are used

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.
- ❖ The goal is to place water directly into the root zone and minimize evaporation.
- ❖ Drip irrigation systems distribute water through a network of valves, pipes, tubing, and emitters.
- ❖ Depending on how well designed, installed, maintained, and operated it is, a drip irrigation system can be more efficient than other types of irrigation systems, such as surface irrigation or sprinkler irrigation.

Con't

- ❖ The choice of any method depends primarily on the:
 - ✓ *Cost of equipment and operation,*
 - ✓ *Efficiency of water use,*
 - ✓ *Simplicity of layout,*
 - ✓ *Quality of the water available*
 - ✓ *Type of soil and dangers of its erosion*
 - ✓ *The species of vegetables to be grown.*
 - ✓ *Field shape, topography, power supply and availability of labor should also affect the type of irrigation we choose*

7.4 Fertilization

- ❖ There are 20 essential chemical elements (plant nutrients) known to be required for normal vegetable growth.
- ❖ These elements can be supplied by either organic or commercial inorganic fertilizers.
- ❖ Carbon, hydrogen, and oxygen from air and water, and Nitrogen from organic and inorganic sources are four plant nutrients which make up 95 percent of plant dry matter.
- ❖ The other 16 essential elements: iron, calcium, phosphorus, potassium, copper, sulfur, magnesium, manganese, zinc, boron, chlorine, molybdenum, cobalt, sodium, silicon and vanadium are supplied to plants by the soil.

7.4 Fertilization

- Fertilization concerns on improving the *physical, chemical, and biological properties of the soil*
 - *So as to improve the growing conditions for the crops thus obtain higher yields and better quality.*
- A constant optimum yield requires the availability of essential elements and the content of organic matter in the soil.
- *The content of plant nutrients and OM will change according to climate, cultural method, etc.*

fertilization

- Thus the gardener has to **maintain the content of plant nutrients** and organic matter at a level sufficient for vegetable crops by applying mineral and/or organic fertilizers.
- **7.4.1 Organic Fertilizer:**
- The word organic applied to fertilizers simply means that the nutrients contained in the product are derived solely **from the remains or a by-product of a once-living organism.**

7.4.1 Organic fertilizer....

1. *Manures*

- It is one of the most valuable humus forming materials and some form of organic matter is necessary to keep the soil in a good condition for crop growth.
- The OM improves heavy soils by making them looser more friable, thus improving their drainage, increasing aeration and making them easier to work.
- It also improves light soils, as sand and sandy loams, by filling the space between the grains with humus their by making them less porous and more retentive of moisture and nutrients.

Important terms

- **Farm yard manure:** Organic matter, excreted by animals, which is used as a soil amendment and fertilizer
- **Green Manure:** The biomass of a crop grown specifically for incorporation in the soil to improve fertility
- **Humus:** A dark-colored organic material that is the product of organic matter breakdown by both microorganisms and chemical reactions

Cont....

- ✓ Heavy application of manure to sandy soils enable vegetable growers to produce *large yields, a result impossible without manure or some other sources of humus.*
- ✓ Manure can serve also as a *carrier for major and minor elements.*
- ❖ The *amount of N, P and in any type of manure* depends up on the
 - ✓ *Kind of manure (source of manure)*
 - ✓ *Method of storage and*
 - ✓ *Final condition of the material.*

Con't

- ✓ Manures are *carrier and promoter* of useful organisms in the soil.
- ✓ Manure, as a result of its nutrients and humus contains organisms which *break down the OM of the manure itself and aids in the decomposition of the humus already in the soil.*
- ✓ In the decomposition of the manure, materials are set free which act on some of the mineral compounds make them more readily available to the growing plants.

Time to apply manure

- The proper time to apply manure depends on *the kind, the stage of its decomposition, the crops to be grown, and the rotation to be followed.*

Con't

- ✓ When cow manure is to be applied, it should be ploughed under as far as in advance of planting as convenient.

Rate and method of application

- ✓ The rate of application of manure should be governed largely by the *economic considerations*.
- ✓ The *supply of manure available, the kind of the crop to be grown, and the character and the richness of the soil should also be considered*.
- ✓ Unless justifiable return is expected from the vegetable field, *heavy application of manures is not recommendable*.
- ✓ The rate of application of hen manure should be lower than that of any of the other kinds that contain less nitrogen.

Soil improving crops

- ✓ Soil improving crops are grown for the purpose of *improving the soil condition for the growth of succeeding crops.*
- ✓ *Green manures* are crops grown especially for the purpose of improving the soil condition and turned under while they are still green or soon after they mature.
- ✓ A green manure crop is grown to be ploughed under into the soil when the plants are young and green ie succulent.
- ✓ Sometimes the green manure crop is cut down or pulled up and then left on the soil surface as a mulch; after some time the plants rot and are taken down into the soil by termites, earthworms etc.

Soil improving crops

- ✓ On the other hand **cover crops** are those which are grown for *protection of the soil as well as for soil improvement through the addition of humus*.
- ✓ They may be turned under while the plants are still green or left until they are dead.

Con't

The importance of soil improving crops

- ✓ To conserve soluble nutrients in the soil,
- ✓ To add nitrogen to the soil in the case of legumes
- ✓ To transfer nutrients from the subsoil to the surface soil,
To affect favorably the growth of beneficial organisms
in the soil,
- ✓ To increase the carbon-dioxide content of the soil and
air. To improve the condition of the subsoil,
- ✓ To render mineral nutrients available, and
- ✓ To aid in the control of erosion.

Con't

Selection of soil improving crops

- ✓ *Adaptation of the crop to the climate and soil of the area*
- ✓ *Quantity of OM produced in the time available*
- ✓ *Character of root growth*
- ✓ *Ease of incorporating the plant material with the soil*
- ✓ *The time crop is to be planted*
- ✓ *Whether the crop is to be turned under while green or as dead material.*

Con't

Turning under soil improving crops:

- ❖ *The best time to turn under soil improving crops depends on*
 - ✓ *The time the succeeding crop is to be planted,*
 - ✓ *The kind of soil improving crop,*
 - ✓ *The season of the year when the crop is grown,*
 - ✓ *The condition of the soil, and*
 - ✓ *The climatic conditions*

7.4.2 Mineral/commercial fertilizer

✓ The role of plant nutrients in vegetable crops

- Most soils are endowed with sufficient amount of trace elements and thus, there is hardly any need for their application to vegetable fields.
- An adequate supply of nutritive elements in the soil in a readily assailable form is essential when
 - ❑ *The growth cycle of the crop is generally short duration and*
 - ❑ *The yields obtainable are substantial*

Types of fertilizers

- *Complete vs incomplete fertilizers*
- A fertilizer is said to be complete when it contains the major nutrients, nitrogen, phosphorus and potassium.
- An incomplete fertilizer will be missing one of the major nutrients.

Importance of commercial fertilization

- The demand and use of commercial fertilizers in vegetable growing is *increasing every time*.
- This is due to the ever *decreasing number of cattle*,
 - *There is shortage of animal manure,*
 - *There is increase in the awareness of the growers about the value of commercial fertilizers,*

Cont..

- ✓ Most growers have understood that commercial fertilizers could be applied in a balanced way unlike the manure where P is especially deficient,
- ✓ The price of manure around urban areas is getting extremely expensive, that individual farmers optionally buy commercial fertilizers.

In discussing about fertilizer use, the f/f terms are important to know

A. Fertilizer Analysis (Grade): is the statement of percentage of N, P, and K contained in a complete fertilizer

✓

Con't

- ✓ This statement is printed in tag of on the bag and is required by law. **Example:** *the analysis, 15-20-15 represent a complete fertilizer with 15% N, 20% P, and 15% K, respectively.*
- ✓ **Fertilizer formula:** is the recipe showing the kind of materials and the quantity of each ingredient mixed together to make up a ton of fertilizer.

The fertilizer formula is important *b/c it will indicate the extent of availability, of the source and the effect on soil reaction.*

Fertilizer ratio: It is simply the grade reduced its simplest terms.

Cont..

- Ratio is the proportion of the three principal nutrients in a mixed fertilizer the quantitative relation they bear to each other
- The term **FR** has come into use *b/c of the large number of possible analyses with the same proportion of nutrients.*
- It is not simpler to base fertilizer practices on **FR** than on analyses.
- ✓ Ex: the analyses 4-8-4, 5-10-5, 6-12-6 and 10-20-10 represent the same fertilizer ratio of 1-2-1.
- ✓ So anyone can select the appropriate ratio considering the rate of application and on the crop to be grown

Cont.

- ✓ The different ratios given for different crops are:
 - ✓ Leafy Vegetables 2:1:1,
 - ✓ Root crops 1:2:1,
 - ✓ Legume crops 0:1:2, and
 - ✓ general crops 1:1:1.
- **C. Rate of application of fertilizers**
- The correct fertilization depends on the interaction of numerous factors which are generally insufficiently understood and in these circumstances it is very difficult to prescribe the formula perfectly adapted to a particular soil and crop.

C. Rate of application of fertilizers

- ✓ The grower must rely on available information and experience and, if need be, should experiment with different *dosages, to establish the best possible formula for his crop, soil, climate and other conditions.*
- ✓ The plant removes considerable quantities of nutritive elements from the soil and numerous studies have been made to evaluate the quantities removed by vegetable crops.
- ✓ These demands vary according to the *yield, the variety, duration and season, of the crop and the soil character, climatic conditions, type of irrigation and cultural techniques.*

Fertilizer application methods

- **Broadcasting on the surface before plowing**
- Broadcasting on the surface after planting and mixing with the surface soil by disking or harrowing.
- Applying fertilizer in bands in the bottom of the furrow applying fertilizers 2 -3 inches from the row.
- **Applying fertilizers with a drill** below the surface of the soil before the crop is planted.
- **Foliage application of fertilizers:** In some areas minor elements are supplied to vegetables as a foliage spray

7.5 Pests and their control in vegetable production

- **7.5.1 Insect and disease pest**

- ✓ Understanding crop protection measures for the important diseases and insect pests is essential for successful vegetable production because of the increased results from such agents.
- ✓ **Importance of controlling pests:** Insect pests and plant diseases cause *losses to the vegetable grower in quality and quantity terms.*
- ✓ This *increase the cost of production due to the incurring costs of controlling the diseases and insect pests.*

Cont..

- ❖ For instance growing of tomatoes in the rainy season is not profitable due to a serious attack from blight.
- ❖ As in the case of damage by insect and other pests, the development of diseases in a growing crop may result in both *lower yields and reduced quality*.

Means Of Controlling Insects And Diseases,

- 1. Field Sanitation:** this is essential to reduce the insect population or inoculum of pathogens.
 - Measures adopted for field sanitation include
 - (a) **Destruction of residue and plants harboring insects and diseases**

Many insects pass winter period in the residue left on the field.

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Means of controlling insects and diseases..

- If this is ploughed under, most the insects are killed.
- But diseases that live through the winter on the plant remains are not destroyed by sloughing.
- The weed harbors the insects and pathogen in the off seasons when appropriate host plants are not available
- Therefore, cleaning up and destruction of weed is important.

b. Eradication of affected plant parts and plants

- Roughening of infected plants in the early stages constitutes important measures for the control of potato virus and the production of certified tubers.

Means of controlling insects and diseases....

- Removal of affected plant parts may also reduce inoculum.
- Systemic destruction of the affected plant or parts in the manner to keep down the populations resorted to, to reduce the damage caused by fruit flies infestation cucurbits and many tissue borers of plants.
- **Tillage:** summer plowing and up turning of the top layer of soil exposes the soil to the summer heat with the result that the considerable extent.
- **Crop rotation:** Rotation in cropping is effective in controlling those insects which feed on only one crop and are unable to move long distance. In planning a rotation for insects control one should follow a crop which has been known not to be attacked by the same insect

Cont.

- ✓ The term crop rotation is defined as a systematic arrangement for the growing of different crops in a more or less regular sequence on the same land.
- ✓ Systematic crop growing is important in vegetable growing and should be planned and followed as systematic as feasible.

The benefits derived from crop rotations are:

- ❖ Better uses of resources
- ❖ To reduces the accumulation of disease and insects, such as Club Root in brassicas, Brown Streak virus in cassava, Take-all in cereals, Eelworm (nematodes) etc.;
- ❖ reduces the accumulation of weeds;
- ❖ maintains or improves soil fertility;

Cont.

Many explanations have been given to account for the divergent effect of crop plants on those that follow.

- Difference in uptake of nutrients from the soil
- Difference in effect on soil reaction especially the greater removal of bases by some crops than others
- Difference in quantity of organic matter left in the soil
- Difference in effect on pathogenic organisms in the soil
- Difference in toxic materials produced on the soil decomposition of the plant remains
- Difference in extent and distribution of the root system

Rotation as a factor of crop protection

- Many serious diseases can be controlled in a practical way by a systematic rotation in which the host plant is grown on the same land not oftener than once in 3 or 4 years
- Rotation is effective in disease control mainly with those spores or other propagating parts which live only for 1 or 2 years
- Rotation is of value in the control of some kinds of insect especially of species which feed on only one crop and which are unable to move very far.
- If the host plants are not near at hand when the insect emerge, many will perish before reaching them

Means of controlling insects and diseases....

- **Use of clean planting materials:** Use of insects and disease free planting material is an important prerequisite for clean cultivation,
- as many pathogens and some insects are carried over in the seeds and planting materials.
- In virus diseases, the most important practical measures is the use of virus free planting materials.
- The use of clean and disease free seed eliminates the need for seed treatment in some cases.

Means of controlling insects and diseases....

- **Adjustment in sowing or planting:**
- Many plants are susceptible to attack by pests during a limited period in their life and
- serious attacks will result if the population or inoculum build up takes place during that period which is again conditioned by ecological factors.
- Adjustment to the date of sowing may be profitable practices to avoid attack by pests by avoiding the peak period attack.
- Okra planted during march- April suffers more severe damage from fruit and likewise, potatoes planted during early December in late September or early January.

Means of controlling insects and diseases....

- **Growing Resistant Varieties:**
- The most practical means of controlling some of plant diseases is the growing of resistant varieties.
- In some cases this is the only feasible means of controlling certain diseases such as cabbage yellow, verticellium, bacterial wilts of tomatoes and black rot of cauliflower.
- **Seed treatment to control diseases and insects:**
- Seed treatment with certain insecticides such as aldrin , inderne, and chlordane prevents serious damage from certain insect pests. Potato tubers seed treated with the insecticides, aldrin or linden prevents damage form potato tuber moth both in storage and field

Means of controlling insects and diseases....

- Likewise seed treatment with fungicides can be done to prevent seed rots, damping off and certain seed borne disease.

Control by soil treatment: Control of many soil insects is possible by applying insecticides to the soil before planting the crop.

- The insecticide is applied at the same time of ploughing either as dust or sprays and mixed with the soil.
- The insecticides such as Dorsban (Chloropyriphos), Malathion, aldrin and chlordane can be used to control wire worms, cut worms and grubs which attack many vegetable crop, Control of seed rot diseases is carried out by soil drenching by fungicide like Bavistin, captan.

Con't

- **Viruses, bacteria and fungi** can all cause serious crop losses although the *later group are more diverse and represent the most serious threat to vegetable production.*
- **Bacterial diseases** are more frequently associated with rotting during storage but they can also present a problem in growing crops, *particularly under very wet conditions.*
- Bacterial diseases may be soil borne and can enter roots and tubers through *lenticels or wounds.*
- *Both rain and irrigation can also spread bacterial diseases from plant to plant or from field to field.*

Cont.

- ✓ The **fungal diseases** of economic significance generally have the characteristics of rapid rates of multiplication given the appropriate environmental conditions and efficient methods of dissemination.
- ✓ Rain, irrigation water and wind play a great role in the **transmission**, built up and subsequent germination of spores produced at the reproductive stage of fungi.

7.5.2Weeds

The control of weeds

- ✓ Loss of yield worldwide due to weeds has been estimated at **287.5 million tons or 11.5% of all plant production.**

7.5.2 Weeds..

- ✓ In agriculture, losses caused by weeds is **not only loss of yield**. In heavily infested fields, high yielding varieties and hybrids loose their potential and the beneficial effects of fertilizers.

Negative influences of weed

- ✓ *Reduce crop yield*
- ✓ *Reduce crop quality*
- ✓ *Delay harvesting/interfere with harvesting*
- ✓ *Interfere with animal feeding*
- ✓ *Cause poisoning*
- ✓ *Taint animal products*
- ✓ *Act as plant parasites*

Cont.

- ✓ *Reduce crop health Reduce animal (and human) health*
- ✓ *Are a safety hazard*
- ✓ *Reduce wool quality*
- ✓ *Prevent water flow*
- ✓ *Exhibit allelopathy*
- ✓ *Impact on crop establishmen*

7.5.4 Nematodes

- + Cause disease in different crops
- + Could be seed or soil born
 - ✓ *Anguinia tritici*---affect the curnel of wheat
 - ✓ *Pratelynychus goodei*---affect enset
 - ✓ Root knot nematode on beans & vegetables
- + Root-knot caused by a group of nematodes
 - Genus: Meloidogyne, Hetrodera & Globodera
- + The life cycle: Egg ➡ Larvae (4-juveniles) ➡ AdultThe adult and juveniles infect the plants and they feed by their stylet & inject toxin to the plant
- Symptoms
 - ☐ Dwarfism
 - ☐ Formation of galls (hyperplasia) & formation of excessive branching of roots ➡ typical symptoms of the disease
 - ☐ Galls of Rhizobia Vs Nematode galls

Cont....

- ✓ **Rhizobia galls have pink color w/n the galls are dissected & they are simply attached to the roots**
- ✓ **Nematode galls it appears rotted & contain nematode in it and the galls are an outgrowth of the roots**