COFFEE CULTIVATION

According to Alfred it is not enough to simply to grow crops but they must be produced as to yield a profit on the capital invested. Greater economic returns are possible through rich soil, good climate and ideal landform. In plantation farming optimum yield can be exploited not only through those geographical factors but also by technological innovations, intensive use of land, greater use of fertilizers, adequate supply of water through irrigation and scientific method of cultivation. This is particularly so in the case of coffee.

CONDITIONS FOR GROWTH:- Coffee is a plantation crop and takes 5 to 6 years to come to full bearing. It bears fruit for 30 years. Any mistake committed in the beginning will result in poor and un-economic production. Coffee, for its cultivation, requires many conditions. However, the distribution of coffee plant is mainly governed by soil and influenced by climate.

1. Coffee soils should be deep, friable, open textured; rich in plant foods with plenty of humus and of a near neutral reaction. Coffee soils are of varying geological origin, laterites in Brazil, volcanic ash soils in Colombia, Central America, Kenya and Tanzania, soils originating from lava rocks as in Hawaii and soils derived from granite and gneiss as in India. Generally, the soils in India are highly leached low in available phosphorus, acidic in reaction with PH even as low as 4 - 5 and
fairly supplied with variable potassium. The organic status is good. The soils also vary in texture ranging from sandy loam to clayey loam with colour from gray to deep red. Rad-ferruginous clays prevail occur in tracts like sababudangiri in Karnataka and Hilgiri in Tamilnadu.

2. Climate and environmental factors have great influence on coffee production. A well distributed rainfall between 1700 and 2000 mm annually may be sufficient for its cultivation. The rainfall in the traditional coffee areas of Karnataka, Tamilnadu and Kerala ranges from 1370 to 3800 mm. Definite wet and dry seasons are essential to have a well marked cycle of flowering; vegetative growth and maturity of fruits. Coffee needs a good shower after a dry period for successful blossom. (vide photograph - 1) A backing shower 2 to 3 weeks after blossom is considered essential for good development of the crop. Coffee is generally tolerant to short dry periods. Yield is known to go down if moisture supply is inadequate. Just as inadequate supplies of water limit crop production, so does excess.

Coffee can stand periods of cold weather but is severely damaged by frost. Robusta coffee requires a warm and humid climate.

1. COFFEE BLOSSOM IN ITS WHITE GLORY.
3. Coffee generally comes up well at elevations ranging from 750 to 2000 metres above sea level. Arabica is found thriving well between elevations ranging from 750 to 1350 metres above sea level with an optimum in the neighbourhood of 900 to 1050 metres where climate and soil conditions are congenial though it can also be grown in the higher elevations. Robusta, on the other hand, comes up well between 450 to 900 metres above sea level, but can also be grown in elevations lower than 300 metres where the influence of the sea is available.

4. A large supply of cheap human labour, for picking the fruit and preparing the product for the market, is required. (see Appendix 4).

5. Transport facilities are essential to transport the produce to the nearest curing works of coffee depot and to bring in manure, chemicals, provisions etc., required for the estate and

6. Thickly wooded jungle, bamboo forests and similar vegetative covers are suitable for opening new areas. (see Appendix 5) Before opening a new plantation one must make sure whether the area is in the general coffee growing tract. He will be subject to loss risks in choosing a site for a plantation where coffee is already growing and the experience of planters can guide him in the venture. It is not advisable to grow coffee in marginal lands or grasslands.
SPECIES: Coffee belongs to the family Rubiacae. Although over seventy species have been recognised in coffee, six are known to be under cultivation. These are C. Arabica, C. Canephora, C. Liberica, C. Abeokuta, C. Dewsirei, and C. Racemosa. Apart from these cultivated species, some wild species are noticed in South India.

Coffee grown in various countries differ by types and kinds as well as by grades. In the parlance of the trade, the terms "BRAZIL" "MILD" and "ROBUSTA" are used to describe the three major types of coffee. Brazil applies generally to coffees grown in Brazil. All those grown elsewhere in central and south America and most of those grown in Asia and Oceania are called "MILDS". Most of the "BRAZILS" and "MILDS" are produced by the C. Arabica species of tree. The C. Robusta species which produces robusta coffee is a native of Congo and is more resistant to disease than the C. Arabica. However, the beverage produced by C. Robusta is regarded as inferior to C. Arabica. Arabica is renowned for its superior flavour of the beverage made from its beans. C. Arabica contributes over 75 percent of the world's commercial coffee while 15 percent to 20 percent is contributed by C. Canephora. Hence, attention has been given for improvement of Arabica and Robusta plant material in various countries according

to commercial value of these species. Extensive work on arabica has been reported from the Americas, Portugal, Angola, Congo, Uganda, Kenya, Tansania and Philippines while on robusta it is mostly in Congo, Ivory Coast, Angola, Uganda, Indonesia and Tansania. India is engaged in improvement of both C. Arabica and C. Canephora since the two species occupy about 60 percent and 40 percent respectively of the total area under coffee. C. Liberica has been tried only in a few estates of Karnataka. Because of its susceptibility to leaf diseases, it has never become popular in India. It is gas not good in quality. It also yields less. Therefore, it is mostly used for blends. C. Obockute, C. Racemosa and C. Deavurei were also tried in some countries of the world. But, they have not served the purpose.

HYBRIDS: Plant improvement by breeding is being practiced in all coffee growing countries. However, the objectives of breeding has varied according to requirements of countries growing it. Breedings is essential for good production and quality, resistance to leaf rust, coffee berry disease, specific ecological conditions etc. With these objectives, research has been carried on in various countries. Gene bank established a Central Coffee Research Institute comprising of 21 species of coffee and varieties of Arabica and robusta as well as various intra and inter-specific hybrids. It provides ample material and scope for improvement of the coffee plant.
At first, hybrids like 'netravonda', 'Jacksons', 'Chondrapore' and Kents were evolved by enterprising planters. All these hybrids were taken up under trial plantings. Amongst these, Kents proved vigorous and productive and was used for large scale cultivation in all the coffee tracts in India. However, after a few years of its introduction 'Kents' also succumbed to leaf rust. Selection S.288 and S.795 were introduced by the C.C.R.I. Of the two selections S.795 rapidly gained favour with the planting community on account of its vigorous growth and sustained production. At present, the selections are estimated to occupy over 50% of the total acreage under Arabica in India as new clearings and replantings.

Among robusta collections S.274 and 270 have recorded better yield performance. S.274 is generally bold fruited and has recorded 960 Kg/ha on the mean of 34 years with over 1000 Kg/ha in 15 out of 34 years and a maximum of 2020 Kg/ha during its 15th year. S.270 has recorded 990 Kg/ha on the mean of 31 years with over 1000 Kg/ha in 14 out of 31 years and a maximum of 2335 Kg/ha during its 24th year.

'Chik Arabica' a native of Chikmagalur was popular as a high yielding variety for quite a long period in Coorg. But its susceptibility to borer attack in later years, has reduced the area. In 1870, a Hysore planter Mr. Stanley Jupp replaced the

1. Office of the Senior Liaison Officer, India Coffee Board, Madikeri.
‘Chik’ with ‘Coorg’ which were taken from the plantings of chik at Salknad in Coorg. Kent is the most popular type grown at present in the State. It is reported to have been selected from plantings of Coorgs in the region between Madigere and Chikmagalur. It is more resistant to leaf-blight than the ‘Coorgs’. Its leaves are a long and of dark green colour. Fruits are borne in thin clusters. It is more resistant to borer attacks.

Coffee from Nursery to Field: The success or failure of any planting depends on the successful raising of seedlings and their establishments in the field. Absolute care has to be bestowed on choice of site, selection of seed material, preparation of germination beds, sowing of seeds and transplanting of seedlings.

Gently sloping piece of sheltered land is a best site for nursery. Nursery site must be free from large trees. A water source near to nursery is essential. The soil should be light to medium loam. Beds raised to a height of about 15 cm usually about 1 metre width and of any convenient length are prepared. Thorough preparation of seed bed with four baskets (about 2 for lits) of well rotted cattle manures or compost, about 2 Kg. of finely sieved agricultural lime and 400 gram of rock phosphate is necessary to ensure conditions for optimum germination. Healthy and well developed fruits of normal size and appearance three quarters to fully ripe, are harvested from specially selected coffee plants for use as seed bearers. The sound fruits thus
collected are pulped and then mixed with sieved wood ash. After about fifth day, excess ash is rubbed off. Prior to sowing the seeds are preferably treated with a seed desser eg. Agrosan at 20 per boxlet seeds are placed on the bed about 1.5 - 2.5 cm apart with the flat side downwards in regular rows. Seeds germinate in about 45 days. Seedlings are transplanted to secondary nursery beds for raising bell plants. Then coffee seedlings are transplanted to polythene bags which have adequate number of holes in the bottom. The bags are filled with a prepared mixture containing jungle soil, farmyard manure and sand.

The seedlings from the germination beds are planted to secondary nursery beds prepared in the same way as the germination beds. Transplanting is done after the first pair of leaves has developed. They are planted 30 cm apart. If the tap root is bent or grown too long, it is ripped off while transplanting. The beds are mulched and watered regularly depending on needs. Adequate plant protection measures should be taken against nursery diseases and pests.

Since coffee is a perennial plant any initial set back will exert a lasting influence on its subsequent growth. Careful planting of good quality seedlings at the right time and in fertile soil is therefore most important.
CHOICE OF FIELD :- In choosing the field for coffee plantation, altitude, temperature, rainfall, exposure to winds and transport facilities should all receive due consideration.

Good forest land is an asset for raising a successful plantation. Deep soils with good drainage but with moisture retaining qualities are desirable. Coffee is an evergreen plant and as such needs to have sufficient soil moisture particularly during dry months. A gentle slope is the most suitable lie of land. Steep slopes require adoption of measures to prevent soil erosion. Flat land necessitates provision of good drainage to carry away excess water during the monsoon months. Land having northern aspect is considered to be the best. This is said to give comparatively more equable temperature conditions. A thicker shade is required to provide shelter against the afternoon sun, high winds and to build up heavy mulch status to protect the soil from insolation and diurnal variations of temperature. It is essential to raise wind belts on land exposed to such high winds. These wind belts may consist of tall and stout trees that can withstand high winds eg, Silver Oak, Eucalyptus etc.

PREPARATION OF FIELD :- Clean felling is not advocated when the land is cleared for planting coffee. Selective training may be done retaining a number of desirable shade trees. All undergrowth
is slashed and left to rot in the soil. Orally climbers and thorny bushes are cut and burnt. Then the land is divided into blocks of convenient size, with foot paths and roads laid out. Terracing in steeper areas and contour planting across the slope may be adopted.

Pits for planting coffee seedlings are generally dug well in advance of the planting season so that the soil may be weathered. Pits may be of any size. But, the size should be about 45 cm cube. While closing the pits the top soil which is more fertile must be returned to its original position.

**PATTERN OF PLANTING**

The main emphasis on pattern of planting is to utilise properly the available land and to put it to the best use by not only cultivating coffee intensively but the other crops as well in a more systematic manner.

There are two ways in which coffee may be planted. They are "Square" (vide Fig. 4.A) and "Contour" (vide Fig. 4.B). Square planting is an old fashioned system in which every tree is in a straight line. Contour planting is better than the square because the lines of trees follow the curves of the slopes and the curving lines of trees are placed at proper distance from another. Therefore, yield in this type of planting is generally more. These two systems are practised in all the coffee growing districts of Karnataka state. In addition to these, two more
PATTERNS OF PLANTING OF COFFEE IN KARNATAKA

A

SQUARE METHOD

B

CONTOUR METHOD

C

TRIANGULAR METHOD

D

RECTANGULAR METHOD

SCALE 1 cm = 2"

Coffee Plant =

Shade tree =

Fig. 4
systems via 'Triangular' and 'Rectangular' (vide Fig. 4.C and D) plantings are also practised in certain places. Generally, square planting is adopted for a small orchard of a few acres especially where the land is almost flat. Contour planting system, however, is adopted for a larger plantation.

**Strip Pattern** Strip pattern of cultivation offers a good line of planting system. Each strip is separated from the other by an intervening belt of silver oak trees. As a result, maximum yield is noticed under this pattern. This pattern is being tried in Coorg (Buthanahadlu 'J' block of Mallur Emax Estate) in ten strips along with orange under different shade trees.

**Spacing** Generally spacing depends upon the type of coffee grown. Spacing of 2 × 2.25 m for arabica coffee and 2.5 × 4 m for robusta (eitherway) is considered to be best on flat lands and under square system of planting. Close planting at 1 × 1.5 m in either way and reducing the plant population to half after harvesting 1 to 2 crops may be advantageous. Close planting enables coverage of the grounds quickly and thus helps a great deal in reducing soil erosion and weeding. Planting on contour terraces is desirable on slopes. Successive terraces may be 3–4 m apart in arabica and 4 m in robusta. The spacing in the rows may be 1⅔ × 2 m for arabica and 2 × 3½ m for robusta.
PLANTING IN THE FIELD

Only healthy seedlings are selected for planting and planted at the commencement of the monsoon. The seedlings by then would be 15 to 18 months old. These seedlings are brought to site after carefully removing from the nursery and are placed in the hole with tap root. The hole is filled in and the soil around the seedlings is packed evenly. The area around the plant is mulched. Then, the seedlings are planted in the hole. The hole is covered with soil and the plant firmly fixed as in the case of ball plants.

SOIL MANAGEMENT

A fertile and productive soil has the potential to produce good crops. Soil management practices are aimed at achieving this. Soil cultivation in the plantation is chiefly directed at control of weeds and maintenance of soil conducive for vigorous plant growth. Deep cultivation practices may have no place except in the early stages of establishing the plants. Such operations in established coffee plants could injure the roots and cause packing of soil; cultivation practices are also inter-mixed with soil conservation practices. The common operations in vogue are: digging, scuffing, trenching, mulching, weeding, irrigation etc.

A well distributed rainfall goes a long way for healthy maintenance of coffee. Continued maintenance of adequate soil moisture is essential. In this connection, sprinkler irrigation may be considered. Ground irrigation has been in vogue for coffee
In Yemen for centuries, Kenya and Tanzania are using sprinkler irrigation for keeping up soil moisture status. The growth pattern of coffee is influenced by many factors including climatic conditions, soil fertility and moisture status. However, irrigation promotes vigorous and uniform growth.

**PLANT TRAINING** :- Training of the bush is essentially to control the natural growth habit of the plant to enable to build up a frame work of the desired shape and form. 'Single stem', 'multiple stem' and 'free growth' are in vogue in the various coffee growing countries. In India, coffee plants are trained on single stem to form an umbrella shape bush.

**PRUNING (PLANT SHAPING)** :- Pruning includes operation for maintenance of the plant for optimum growth and crop production. Removal of dead and diseased branches cleaning up the bush, removal of unwanted bean and lanky shoots to prevent formation of matty growth. Systematic pruning enables operations like spraying against pests and diseases to be more effective.

**STEM SYSTEMS** :- Stem systems are of two types - 'Single' and 'Multiple'. During the first 3 or 4 years after planting, every effort is made to develop a strong trunk with a number of primary branches. If the primary branches are lost, the entire frame work will be lost. Hence, as soon as the plants reach a height of 75 cm in the case of arabica and 105 to 120 cm in the case of robusta,
they are topped i.e. the growing tip of the stem is nipped off. It is known as ‘single stem system’.

Multiple stem system is practised in Kenya, Tanzania and frequently in Latin American countries. In recent years, some plantations allow coffee to grow on multiple stem as a stop-gap arrangement. When old coffee is to be gradually replaced and converted into multiple stem to give crop until the new plants grow up.

SHADE FOR COFFEE: Objects of maintaining shade trees is to give filtered light, free passage of free air and to minimise variations in day and night temperatures. They protect coffee plants from the scorching sun and strong winds. They also protect plants from the onslaught of heavy monsoon rains and hail storms. They improve the fertility status of the soil, weed growth is suppressed considerably, shade can prolong the economic life of coffee.

Coffee in Asia is grown under shade cover. Plantations in Brazil, the Cameroons, and Kenya have either very little shade or no shade. Higher yields are reported from plants in the open provided the soil was properly fertilised, mulched and protected from weed competition. In tropical areas of high rainfall and light intensities and warmth, the plants in the open trend to over bear quickly resulting in debility.
malformation and even death of plants. Hence, shade is essential for coffee to get crop regularly. However, the intensity of shade varies from region to region. Therefore, a balance between protection to the crop plant, production levels and intensity of shade is essential.

Trees with light and thin foliage are preferable as they give light feathery shade. The trees which have spreading habit and loose their leaves regularly provide good shade. They also add mulch to the soil and enrich it. It is better to plant mixed shade so that coffee underneath will have some protection or other throughout the year. In addition, shade trees must be quick growing, possess a deep root system and branches strong enough to withstand heavy winds. It should grow fast with a spreading habit to allow a uniform filtered light. The root system should be deep so that it does not compete with coffee for plant foods and moisture. The trees should be able to regenerate quickly after loppings. However, no single species offers all the desired qualities. A mixed pattern of shade consisting of species suitable for each region is advocated.

The introduction of a primary canopy of a temporary shade is a useful practice and is increasingly becoming common. The most important temporary shade tree is Erythrina lithosperma (dodop palvan, haivan). The most popular permanent shade trees are
Atti (Ficus glomerata) Nitti (Ficus racemosa) Malagaragathi (Ficus nervosa) and Bilimbi (Ficus sierra). They give good pattern of light and shade and deposit large quantities of mulch.

Shade trees are generally planted 12-14 metres apart. The trees have to be regulated in such a way that in course of time, they have their canopy about 10-14 metres above the coffee. Shade trees require constant attention by way of pruning and lopping to provide the required shade. Coffee, especially arabica has been grown under heavy shade with the object of minimising the incidence of leaf disease and the white stem borer. In case of robusta, the usual practice is to grow it under shade conditions lighter than that in vogue for arabicas. The trees generally preferred are the hagges (Albizzia) dadap and silver oak.

MANAGEMENT - Managing is one of the established intensive cultivation practices to enable to grow larger crops per unit area. Application of balanced fertilisers is equally important and in most economical in the long run for higher and sustained production of quality coffee. When coffee is harvested, processed and sold, plant nutrients are removed from the soil permanently. Thus, year after year such removals take place and in course of time lead to impoverishment of the soil and reduction in crop yields. It is, therefore necessary to replace the nutrients thus lost and those depleted through leaching and immobilisation. Results of experiments carried out over a number of years at Central Coffee Research
Institute, and in various coffee growing zones indicate that it is necessary to supply all the three macro-nutrients N, P, and K (Nitrogen, Phosphorus, and Potassium).

At least fifteen chemical elements are considered essential for plant growth. They are Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Sulphur, Magnesium, Iron, Manganese, Molybdenum, Copper, Zinc, and Boron. The first three elements are derived from the atmosphere and water; the rest are absorbed through the roots from the soil. Out of the other twelve, Nitrogen, Potassium, Phosphorus and Calcium are termed as major nutrients as deficiency of one or the other leads to a low crop yield. The other elements are termed ‘Micro’ nutrients as only very small quantities are required in the soil for good plant growth. Some other elements such as Sodium, Choline, and Silicon, though not essential, are beneficial to certain plants.

Time and frequency of fertilizer applications also have considered effects on yield and growth. For an efficient and effective use of fertilizers, they should be applied at times when they are most needed by the plant. Foliar analysis studies have indicated that the peak periods of demand for nutrients are at times of flowering, fruit setting and development and maturation.
of the crop. A continuous supply of nitrogen in the soil is however, very necessary throughout the period of active growth.

**METHOD OF APPLICATION** - Due to the immobility of some of the fertilizers, they have to be placed properly so that the roots will have easy access to them. The most common and efficient method of application is by placement in the drip circle. The leaf mulch beneath the coffee is swept towards the base and the fertilizers are applied in a broad circular band about 30 cm away from the stem. They are then incorporated into the soil with a fork or stick and covered by mulch.

**PREPARATION OF COFFEE FOR THE MARKET** - The preparation of coffee offers a considerable field for investigation and is closely linked with the question of quality. Quality is a summative index of many characteristics of coffee such as its appearance in the raw and roast and liquor qualities comprising of factors like aroma, body and acidity. Quality can be influenced by nutritional factors and adverse weather conditions during development and maturity stages of the beans. But it may be possible to overcome the influence of these by adopting improved technological practices in cultivation. The processing techniques are by far the most important where deterioration in quality could be minimised. Coffee is prepared for the market in two ways Viz., the 'plantation' or 'parchment process' and the 'cherry process'
Plantation coffee prepared by the wet method is generally favoured by the market. Cherry coffee is usually associated with a characteristic flavour known as 'fruity' flavour. Hence it is desirable to process the largest quantity possible by the wet method particularly so in the case of arabica.

**Harvesting** - For the preparation of both parchment and cherry, picking of the right type of fruits forms an essential part of processing coffee fruits should be picked as and when they become ripe. Coffee is just ripe when on gently squeezing the fruit, the bean inside pops out easily.

Under ripe and over ripe fruits cause deterioration in quality, the former tending to produce 'immature beans' and the latter 'foxy' coffee. The over and under ripe fruits should be sorted out before using them for pulping. They may be dried separately as cherry. Bags in which fertilizers, pesticides and fungicides are stored should never be used for collecting the harvested fruits.

**Methods of Processing** - Coffee may be prepared by either a 'dry' or a 'wash' process. In the 'dry' process, the coffee cherries are thoroughly rinsed in water and then spread out on cement patios in the open air and sun to dry. After drying, the coffee is repeatedly run through sacking and hulling machines to remove the hull, dried pulp and parchment and then is subjected to
further cleaning by machines that remove portions of the silver skin.

The wash process is quite different. The cherries are first put through a pulping machine that breaks them open. Then the beans go into large tanks where they are left for about 24 hours. Slight fermentation takes place in the jelly-like substance which the coffee grower calls 'honey'. This fermentation loosens the honey so it can be removed easily by thorough washing back. After washing, the coffee is spread out in patios to dry. It takes two or three weeks in the sun for the coffee to become thoroughly dried.

In the case of the highest quality coffee, there is then a careful hand inspection, to remove imperfect beans which is the final step before packing the coffee in bags for shipment to the coffee ports of the world.

TASTE TESTING: Generally, importers of coffee used to make their purchase largely on the basis of the size, colour and other physical characteristics of the beans. In the U.S.A. a more selective manner of purchasing was established. Coffees are brought primarily on the basis of cup tests for taste and quality.

Coffee defies all known chemical tests for evaluation of quality and can be evaluated only by the senses of taste and smell. Until coffee is roasted, it has none of the flavour or taste generally associated with coffee. Roasting creates the brown colour and transforms the natural chemical constituents into others that give coffee its splendid aromatic qualities and pleasing taste.

**EXTENSION SERVICE**

The extension service came into being in the post-war years at a time when the expansion of coffee industry was in the early stages. The work of the extension wing has created an awareness on the part of the planters of the existence of this wing for their utilization for intensive cultivation and higher production level. A number of planters to whom the knowledge of the latest scientific findings was a far cry, are today in the forefront, eager to adopt better methods of cultivation and achieve higher standard of living. This has become possible due to the extension service.

**DEFICIENCY SYMPTOMS**

Coffee plant presents a high demand for nutrients. The mineral nutrients are essentially obtained from the soil. The role of each one of these is tuned to the other. Excess of any one could bring in deficiency of the other. Crop production is affected by the absence or inadequacy of any one of these elements. Deficiency of any nutrient element results in the manifestation of characteristic visual deficiency systems on the plant.
DISEASES AND PESTS:

No matter what crop is grown, it is bound to suffer from a disease of one kind or another. Diseases may appear suddenly. They may be very severe or mild and attack only some or all parts of a plant. In accordance with the actual or potential damage they may do, they can be classified as major or minor diseases. As a general rule, coffee is more severely attacked by diseases if the trees are weakened by drought by cold winds, by overbearing or by high temperature.

Among the diseases affecting coffee in South India, leaf rust caused by Hemileia Vastatrix B and Br. and Black rot caused by Koleroga Knoxia Dork are the more important ones, while brown-eye-spot caused by Cercospora Coffeicola B and Cke, Collar rot or damping off, caused by Dik Phizatoria Solani Khun, stump rot or brown root rot caused by Fomes noxius corner, black root-rot caused by Rosellina arenatta petch, brown blight caused by Collectotrichum coffeanum Noack, pink disease caused by Corticium Salmoneicolar B and Br and sooty mould caused by Capnodium braziliense putten are less frequently noticed.

1. LEAF RUST (Hemileia Vastatrix B and Br.) :

Leaf-rust is the most devastating and economically the most ravaging of the diseases that affect Arabica coffee. In South-India leaf-rust caused by Hemileia Vastatrix has been the major limiting sector in successful arabica coffee production. The first appearance of this disease is in Ceylon in 1868 and it later spread throughout the coffee growing tracts. The first report of —->
the disease from India dates back as 1871. Now, it is prevalent throughout the coffee zones. It occurs mostly on the leaves rarely on fruits. Leaf rust is active under conditions of moist weather or when there is enough mist or dew to permit germination of spores usually during the period of April to December. The weather dry weather period between the end of December to the start of the blossom showers is unfavourable for disease development.

The problem of control of this disease has been tackled from two main approaches viz. spraying fungicides.

2. **BLACK-ROT OR KOLEROGA** (Koleroga Knoxia Borrk) :-

   Black-rot caused by Koleroga Knoxia is another serious disease affecting coffee. This disease occurs particularly in the South-West Monsoon Ghats of Coorg where heavy rains and mists are frequent.

   Spraying with one percent Bordeaux mixture during the early parts of the monsoon affords the necessary protection. It is enough if spraying is done to patches where the disease is normally noticed. Shade regulation, centering of the bushes to admit light and air and destruction of affected material also help in minimizing infection.

3. **DIE-BACK** :- Die-back is generally caused as a result of
exhaustion. A previous heavy defoliation due to leaf disease or excessive soil moisture conditions result in the die-back of the twigs. Arabica is more prone to this disease than robusta.

Die-back was first reported during 1957 from some coffee plantations in Sakaleshpur and subsequently in the other South-West monsoon areas. Control measures directed against leaf disease are equally effective against this also. In addition, proper drainage, aeration of the soil and heavier folding of the bushes in years of heavy crop help in the quicker and earlier recovery of the plants.

4. **STUMP-ROT OR BROWN-ROOT-ROT (Fomes noxius Corner):**

Brown-root-rot disease is caused by the fungus *Fomes noxius*. It is a common root disease of mature coffee found commonly in all the coffee growing areas. The disease affects certain shade and jungle trees also. It attacks single tree only not plantation as a whole.

Isolation of infected bushes and digging and burning of roots of affected & coffee and shade trees must be done. This reduces chances of stump rot infection.

5. **COLLAR ROT/DAMPING OFF (Rhizoctonia solani Kühn):**

Nursery collar rot is caused by the fungus *Rhizoctonia sp.*. The stem near or at the ground level get thin and constricted and has a brownish look. Overcrowding and excessive moisture
are conducive for quick spread of the disease.

**Removal of affected seedlings** aeration of the buds by removing mulch and thinning of overhead shade and regulation of watering help in the control of this disease.

**MINOR DISEASES**

Of the minor diseases affecting coffee.

Brown-eye-spot caused by the fungus, cercospora Sp has been reported to be assuming serious proportions in the nursery and on young coffee in new clearings. The disease is also found to be more severe under open exposed conditions than under shade.

Sanitary conditions and avoiding sudden exposure to bright sun help in the control of the disease.

Other diseases are Root-rot-Rosellinaarorata, Sooty mould, capnodium Sp, pink disease, Root parasite-Solanophora index other maladies like Kondli, dry collar, root and ringding of stem occasionally noticed in nurseries.

**PESTS**

The word 'Pests' covers a wide field for mites and aphids, caterpillars, slugs, snails and bugs, rats and monkeys, moths and butterflies, nematodes and beetles are included. Again it is possible to classify them into 'major' and 'minor' pests in accordance with the frequency of their appearance and the damage they do. But it is important to realise that a major pest may become a minor pests or vice-versa on account of a change in the methods of cultivation.
Some pests seem to appear and to strike suddenly and to spread like a fire through a plantation. The most important pests and parasites of coffee at present are white stem-borer, shot-hole, borer beetle, cockchafer, green bug, mealy-bug, root parasitic nematodes, thrips, hairy caterpillars and snails. The white stem borer generally attacks arabica coffee particularly that grown under inadequate shade. However, the shot-hole-borer attacks branches and suckers of robusta coffee. The cockchafer beetles breed mainly on roots of moistured coffee and young plants and is a severe pest on replanted fields particularly under poor shade. Thrips cause only localised mechanical damage to the leaf tissue.

Modern chemicals are certainly efficient as a control but they are sometimes dangerous to use. These new and effective insecticides are - Aldrin, Dieldrin and Endrin. The first is recommended in the form of dust or a spray to control ants, termites, grasshoppers and ants etc. Dieldrin controls wider range including caterpillars. Endrin is expensive but it is more potent for it will deal with aphids. The organophosphorus insecticides parathion, malathion and Diazinon are of special use but are highly poisonous and dangerous.