... first successful gas... tractor was introduced in Iowa. Later on tractors gradually became popular.

Ever since colonial days, agricultural leaders have been interested in increasing the productivity. As land became less available, people became more interested in maintaining soil fertility and increasing crop yields. In 1914 Govt. responded to this need by providing funds for state agricultural extension programme assist farmers in adopting improved farming methods. In 1930s national attention was focussed on the need for soil and water conservation measures to maintain farm productivity. The rich soils produced bountiful crops and between 1870 to 1910 the population of plains states increased by a factor of 10. In response to soil and water conservation programmes, the soil conservation service was established in 1935. In America untill world war II, productivity increased in view of additional demand for food. Conversion of animal power to mechanical power resulted in increased output. Use of fertilizers and pesticides including DDT increased by 50% in between 1940–1944. But in India the productivity was not so, because England ruled India till 1947. The production was not sufficient. Some time we import the food grains and other food materials. After the independance we progressed by giving the facilities to farmers. Farmers didn't have high quality mechanical power, seeds, fertilizers, pesticides etc. For all people were dependent on Govt.

FOOD RESOURCES

We know that only plants can produce food, hence they are called producers. Food, which is necessary for all living organisms consists of proteins, enzymes, carbohydrates, minerals etc. There are various types of animals depend upon the types of food. Herbivores take plants directly as food. Meat eaters are called Carnivores. Animals eat every thing i.e. vegetables or meat called Omnivores. Some animals eat flesh of dead animals are called Scavengers. Thus agriculture and domestic animals are the principal sources of food.

Cereals, pulses, grains, vegetables, fruits etc. we get from agriculture. Domestification of cattle and poultry are necessary for food production from animals. Fish is the another animal source of food. For the last so many years, our food production increased by 50%, at the same time population growth is increased. Still we are not getting production at par with other countries like U.S.A. The 1996 world food summit warmed the countries to reduce the number of undernourished and malnutrition.

The land and water resources are limited, therefore, it is needed to increase the productivity, urgent steps are also needed to reduce the population. Fishes also play an important role to fulfil the world food demand to some an extent. In India, open ocean is under utilised and coastal areas are overexploited for fish industry. Thus fish production from aquatic resources goes high, solving the food problem.

OVERGRAZING

Grazing management is the foundation of grassland based live-stock production since it affects both animal and plant health and productivity. Overgrazing can occur under continuous or rotational grazing. It can be caused by having too many animals on the farm or by not properly controlling their grazing activity. Overgrazing reduces plant leaf areas which reduces interception of sunlight and plant growth. Plants become weakened and have reduced root length and pasture sod weakens. The reduced root length makes the plants more susceptible to death during dry weather. The weakened sod allows weed seeds to germinate and grow. If the weeds are unpalatable or poisonous, major problems can result.

One indicator of overgrazing is that the animals run short of pasture. Under continuous grazing, overgrazed pastures are predominated by short grass species such as blue grass and will be less than 2-3 inches tall in the grazed areas. Soil may be visible between plants in the stand allowing erosion to occur. Under rational grazing overgrazed plants do not have enough time to grow to the proper height between grazing events. The animals are turned in to a paddock before the plants have restored carbohydrate reserves and grown back roots lost after the last defoliation. As the sod thins, weeds encroach in to the pasture. Another indicator is that the livestock run out of pasture, and hay needs to be fed early in the fall. Overgrazing is also indicated in livestock performance and condition.

Overgrazing can increase soil erosion. Reduced soil depth, soil organic matter and soil fertility hurt the land's future productivity. Soil fertility can be corrected by applying the appropriate lime and fertilizers. However the loss of soil depth and organic matter takes years to correct. Their loss is critical in determining the soil's water holding capacity and how well pasture plants do during dry weather.

To prevent overgrazing, match the forage supplement to the herd's requirement. This means that a buffer needs to be in the system to adjust for the last spring growth of cool season forages. One buffer may state producers use is to harvest hay in May and June and allow the cattle to graze the after math in August and September.

Another potential buffer is to plant warm season perennial grasses such as switchgrass, which do not grow early in the session. This reduces the acreage that the live stock can use early in the session, making it easier for them to keep up with the cool season grasses. The animals then use the warm-season grasses during the heat of the summer, and the cool season grasses recover for all grazing.

EFFECTS OF MODERN AGRICULTURE

Between 1950 and 1975 agricultural productivity in American history changed more rapidly. Total farm output increased more than half. This change was due to technological innovations, development of hybrid strains and other genetic improvements and a fourfold increase in the use of pesticides and fertilizers. Not only in America, all over world productivity and means of farming were changed. Thus the agriculture has become more intensive producing higher yields per acre. It also has become more expensive, relying on purchase of machinery and chemicals to replace heavy labour requirements of the past. To remain competitive farmers have been forced to become more efficient.

Although the intensification of agriculture has vastly increased productivity, it also has had a number of potentially detrimental environmental consequences, ranging from rapid erosion of fertile topsoils to contamination of drinking water suppliers by the chemicals used to enhance farmland productivity.

IMPACTS

Damage to Soil. Soil erosion from farmland threatens the productivity of agriculture fields and causes a number of problems elsewhere in the environment. An average of 10 times as much soil erodes from American agricultural fields as is replaced by natural soil formation processes. Because it takes up to 300 years for 1 inch of agricultural topsoil to form, soil that is lost is essentially irreplaceable. The consequences for long-term crop yields have not been adequately quantified. The amount of erosion varies considerably from one field to another, depending on soil type, slope of the field, drainage patterns, and crop management practices; and the effects of

Contamination of Water. In the Northeast water supplies are generally plentiful, but are increasingly becoming threatened by contamination. Farming is one potential source of such contamination. Surface runoff carries manure, fertilizers, and pesticides into streams, lakes, and reservoirs, in some cases causing unacceptable levels of bacteria, nutrients, or synthetic organic compounds. Similarly, water percolating downward through farm fields carries with it dissolved chemicals, which can include nitrate fertilizers and soluble pesticides. In sufficient quantities these can contaminate groundwater supplies.

Fertilizers. Nutrients are lost from agricultural fields through runoff, drainage, or attachment to eroded soil particles. The amounts lost depend on the soil type and organic matter content, the climate, slope of the land, and depth to groundwater, as well as on the amount and type of fertilizer and irrigation used.

The three major nutrients in fertilizers are nitrogen, phosphorus, and potassium. Of these, nitrogen is the most readily lost because of its high solubility in the nitrate form. Leaching of nitrate from agricultural fields can elevate concentrations in underlying groundwater to levels unacceptable for drinking water quality. In the Suffolk County area of Long Island, for example, almost 10 per cent of private wells tested for nitrate exceed the 10 mg/l drinking water standard.

Phosphorus does not leach as readily as nitrate because it is more tightly bound to soil particles. However, it is carried with eroded soils into surface water bodies, where it may cause excessive growth of aquatic plants. If this process proceeds far enough, lakes and reservoirs become choked with decaying mats of algae, which have offensive odour and can cause fish kills from the resulting lack of dissolved oxygen.

Potassium, the third major nutrient in fertilizers, does not cause water quality problems because it is not hazardous in drinking water and is not a limiting nutrient for growth of aquatic plants. It is tightly held by soil particles and so can be removed from fields by erosion, but generally not by leaching.

Pesticides. The trend toward intensive crop production in modern farming has led to increased potential for damage by pests and diseases. Predators that would be present in a mixed biological community are not supported by large fields of a single crop; so farmers, instead, rely on chemical measures for crop protection. Use of pesticides on U.S. farms has risen 10-fold over the past 40 years as agriculture has become more intensive. One drawback to this is that pesticides generally kill not only the pest of concern, but also a wide range of other organisms, including beneficial insects and other pest predators. Once the effect of the pesticide wears off, the pest species is likely to recover more rapidly than its predators because of differences in the available food supply. Previously unimportant species may also become significant crop pests when their natural predators are killed by pesticide applications.

Another drawback to the increasing pesticide use is the development of resistance in pest species. The individual pests that survive pesticide applications continue to breed, gradually producing a population with greater tolerance to the chemicals control pest populations.

Following World War II, DDT and related chlorinated hydrocarbons were introduced as potent new pesticides and were used throughout the world for protection of agricultural crops, as well as control of mosquitoes, lice and other human pests. In 1962 Rachel Carson's book *Silent Spring* brought public attention to the fact that these organic compounds are highly persistent in the environment and accumulate in animal tissues, causing water contamination, fish kills, and decline of some bird populations. DDT was banned for agricultural use in the United States in 1973, and since that time it and similar chlorinated hydrocarbons have been replaced by less persistent, but more acutely toxic, compounds.

In the past couple of decades, awareness has been growing of the many potential problems caused by the heavy use of chemicals in modern agriculture. This, combined with the rapid rise in the cost of fertilizers and pesticides, has led many farmers to seek ways of reducing their reliance on chemical intensive methods of farming. A small but growing percentage of farmers are farming with no synthetic chemicals, and many others are reducing their overall chemical use. Agriculture research has begun to focus on ways of maintaining environmental quality while producing acceptable crop yields. One example is integrated pest management, aimed at controlling pests through a combination of methods that minimize undesirable ecological effects. Continuing research and education need to be conducted on farming practices that produce profitable yields while maintaining environmental quality and the long-term productivity of the land.

WATERLOGGING

Another problem associated with excessive irrigation on poorly demand soils is waterlogging. This occurs (as is common for salinization) in poorly drained soils where water can't penetrate deeply. For example, there may be an impermeable clay layer below the soil. It also occurs on areas that are poorly drained topographically. What happens is that the irrigation water (and/or seepage from canals) eventually raises the water table in the ground – the upper level of the groundwater – from beneath. Growers don't generally realize that waterlogging is happening until it is too late – tests for water in soil are apparently very expensive.

The raised water table results in the soils becoming waterlogged. When soils are water logged, air spaces in the soil are filled with water, and plant roots essentially suffocate – lack oxygen. Waterlogging also damages soil structure.

Worldwide, about 10% of all irrigated land suffers from water logging. This is an area about the size of Idaho. As a result, productivity has fallen about 20% in this area of cropland.

Both waterlogging and salinization could be reduced if the efficiency of irrigation systems could be improved, and more appropriate crops (less water hungry) could be grown in arid and semi-arid regions. In addition, increasing the cost of water to more closely reflect its true value would encourage its conservation, rather than using incentives that essentially encourage wasting water, as some water rights laws in the US do (e.g., the "use it or lose it" approaches discussed above). We can consider excessive irrigation to be another example of humanities' attempt to increase "K" in ways that are unsustainable. For example, one could argue that the Central Valley of CA shouldn't be lush and green; it is one of the most agriculturally productive regions of the world only because of irrigation, which may not be sustainable there.

SALINITY

In many areas of India, crop production is limited because of salinity or alkalinity or both. It is estimated that about 7 million hectares in the country have either gone out of cultivation or this area produces low yield of crops. Three class of saline and alkali soils are recognized. They are—

1. **Saline Soils.** The soils containing toxic concentrations of soluble salts in the root-zone are called saline soils. Electrical conductivity in the saturation extract of such soils taken as a measure of salts is greater than 4.0 mmhos/cm. Exchangeable sodium percentage is less than 15 and the pH is less than 8.5. The soluble salts mainly consist of chlorides and sulphates of sodium, calcium and magnesium. Because of the white encrustation due to salts, the saline soil is also called white alkali.

2. **Non-saline Alkali Or Sodic Soils.** These soils do not contain any large amount of neutral salts and, as such, the electrical conductivity is less than 4 mmhos/cm. The detrimental effect of alkali soil on plants is largely due to toxicity of a high amount of exchangeable sodium and the pH. Alkali soils have an exchangeable sodium percentage of more than 15 and a pH greater than 8.5. Such soils have low infiltration rate and the physical condition is unfavourable. Because of high alkalinity, resulting from sodium carbonate, the surface soil is discoloured and black, and, hence the term black alkali is frequently used to designate the non-saline alkali soil.

3. **Saline-alkali Soils.** This group of soils is both saline and alkali. They have appreciable amounts of soluble salts, as indicated by the electrical conductivity values of more than 4 mmhos/cm. Also, the exchangeable sodium percentage is greater than 15. The pH, however, is likely to be less than 8.5.

The soil salinity or alkalinity or both have many adverse effects, which are summarized below :

1. Causing low yields of crops or crop failure in extreme cases.

2. The limiting of the choice of crops, because some crops are sensitive to salinity or alkalinity or to both.
3. Rendering the quality of fodder poor as, at times, the fodder grown on alkali soils may contain a high amount of molybdenum and a low amount of zinc, causing nutritional imbalance and diseases among live-stock.
4. Creating difficulties in the construction of buildings and roads and their maintenance.
5. Causing excessive run-off and floods owing to low infiltration, resulting in damage to crops in the adjoining areas.

Causes of salinity. In arid and semi-arid areas, salts formed during the weathering of soil minerals are not fully leached. During the periods of higher-than-average rain-fall, the soluble salts are leached from the more permeable high-lying areas to the low-lying areas, where, if the drainage is restricted, salts accumulate on the surface as water evaporates. The excessive irrigation of the uplands containing salts thus results in the accumulation of salts in the valleys. In areas having a salt layer at lower depths in the profile, seasonal irrigation may favour the upward movement of the salts. Salinization is also caused owing to the irrigation of soils with saline water. In all these cases, restricted drainage is usually the main reason. Rise in the water-table within 2 metres of the surface due to irrigation, the obstruction of natural drainage because of developmental activities, e.g. roads and canals, and the siltation of natural drainage may also cause soil salinity. In the coastal areas, the ingress of sea-water induces salinity in the soil. When sodium ions predominate in the soil solution, and carbonates are present, alkali soils are formed.

Reclamation. The salinity or alkalinity depend upon their mode of formation and physiographic position. Since the degree of salinity or alkalinity may vary as such methods of reclamation also differ.

(*i*) If the problem is only of salinity, the salts need to be leached below the root-zone and not allowed to come up. In practice, however, this might be difficult to accomplish, especially in deep and fine-textured soils containing more salts in the lower layers. Under these conditions, a provision of some kind of subsurface drains becomes important. If the soil contains a sandy layer at a lower depth, the leaching of the salts below this layer will check the rise of salts.

(*ii*) The reclamation of alkali soils needs the addition of a soil amendment, containing soluble calcium salts. The commonly used amendment is gypsum. In the course of reclamation, sodium on the exchange complex is replaced by calcium. The sodium salts, thus formed, are leached down.

(*iii*) The number and frequency of leaching, the quantity of gypsum to be added and the techniques involved vary from region to region, depending upon the clay mineralogy of the soils, the intensity of the problem, the subsequent use of the soils, the availability and quality of irrigation water and the economics of these operations. Hence, the state authorities engaged in this work should be consulted to draw a schedule of operations for reclamation.

ENERGY RESOURCES

Energy is needed by all living organisms and vegetations for biochemical reactions of their cells. It is a power which is needed in one form or other for work done. Long before most of the power available to human society was limited to solar energy trapped by green plants which produced organic matter. Biological oxidation of the organic matter provided fuel to muscle power. The fire was the first form of known energy used for cooking, heating purposes. The formation of fossil fuels (coal, oil & natural gas) is also due to photosynthesis carried on by plants which occurred millions of years ago. Now the things are changed drastically. For the developmental activities, energy sources have their own importance. Energy consumption of a nation is usually considered as an index of its development.

GROWING ENERGY NEEDS

Energy is the prime input of a country. It is converted into heat & electricity. For every activity to be performed required energy in the form of heat, light, electricity and even food (in the form of energy) for our body. Food energy is measured in calories. India has fast growing developing economy, with the GDP growth rate exceeding 6% in recent years. Xth plan projected 8% growth rate economy. This growth has been accompanied by a steady increase in energy consumption. Primary commercial energy demand grew at annual rate of 6% upto 2001. It will go more rapidly than in the past as country's reforms process accelerates.

As the economy grows, energy intensity rises following corresponding increase in energy consumption. However, beyond a certain level of per capita income, energy intensity begins to decline. These linkages between energy and economic factors, manifested in energy elasticity and energy intensity are broadly related to—

(*i*) Demographic changes, including a relatively faster growth in urban areas, higher per capita GDP and per Capita gross saving.

(*ii*) Efficient end-use devices.

(*iii*) Technological improvements in conversion equipments.

(*iv*) Inter fuel substitution with more efficient alternatives.

As the world population is growing (@ 6 billion) we need energy much faster rate to meet the industrial, food, residental, transport, agriculture etc. requirements. So it was realised that, energy sources will not meet the requirement last long. In early 70s interest was shown world over to look for other alternatives sources of energy. Therefore, thrust was given for renewable sources of energy like solar, wind, hydro, biomass, tidal, hydrothermal, hydrogen energy etc.

ENERGY CONSUMPTION

India's commercial energy consumption is about one-fourth that of the world average. Therefore, India's consumption of coal, oil, and natural gas is only a small part of total world consumption. The consumption of commercial fuels is steadily rising throughout the country, with coal continuing to be the most prominent energy source. The fuel composition of commercial energy consumption varies significantly from sector to sector. Coal continues to meet over 70 per cent of the industry's energy needs, but petroleum products, especially natural gas and power, are steadily replacing coal. In the field of agriculture, draught animal power continues to be predominantly used in various farming activities, but this use is also not well documented. In transportation, the direct use of coal is virtually nil, following the substitution of steam traction by electric traction. Consequently, the use of electric power has gone up in the Railways sector.

The consumption of petroleum products has significantly increased following a seven-fold increase in registered motor vehicles between 1981 and 1997 (MoST, 1999). While a large part of the household sector continues to depend on traditional fuels for cooking, this data has not been documented formally. There appears to be some substitution of petroleum products by power in the household sector, probably resulting from extensive electrification, whereby kerosene gets replaced by electricity for lighting purposes. But in overall terms, petroleum consumption has grown manyfold and the oil intensity of the Indian economy has been sharply increasing.

LAND RESOURCES

In India, land is generally called as "*MOTHER LAND*". It is because of our life depend on it for food, fibre, fuel and other basic amenities. Therefore, it is the valuable gift of nature to human beings. Top layer of the land is called soil, which is renewable resource and essentail for survival of life. Though it is life support system, but it is overused which causes environmental problems. The existing land use pattern in different regions in India has been evolved as the result of the action and interaction of the various factors i.e. physical characteristics of land, the institutional frame work, the structure of other resources available and the location of the region in relation to other aspects of the economic development *e.g.*, those relating to transport as well as to industry and trade.

Out of the total geographical area of 328 million hectares, the land use statistics are available for roughly 306 million hectares, constituting 93% of the total (1970-71) land available for cultivation is approximately 14 million hectares. But it is reducing day by day. It is due to mismanagement. The earth is made up of three principal layers cores, mantle and crust. Cores are inner most fluid layers. Mantle is the middle layer and crust is the upper most layer.

Till 1949-50, the land area in India was classified into five categories—(*i*) forests (*ii*) area not available for cultivation (*iii*) other uncultivated land (*iv*) fallow land (*v*) the net area sown. But after 1950-51 the new classification was adopted, where, classified in to 9 categories instead of 5. They are (*i*) forests, (*ii*) land put to non-agricultural use (*iii*) barren land unculturable land (*iv*) permanent pastures and other grazing lands (*v*) misc. tree crops and groves (*vi*) culturable waste (*vii*) fallow land (*viii*) current fallow (*ix*) net area sown.

Land-capability classification. Any soil and water-conservation project includes two distinct sets of operations, viz. (1) the mapping of land for classification according to its capability, and (2) planning and executing measures to check erosion, improve land productivity and reclaim wasteland. The farm plans for effective soil and water conservation are based largely on the capability of the land. The land-capability classification map is normally prepared by interpreting a standard soil-survey map.

Land-capability classification is a systematic arrangement of different kinds of land according to those properties that determine the ability of the land to produce crops on a virtually permanent basis.

The factors determining land-capability. These are the major soil characteristics of the land, e.g. the texture of the top soil, its effective depth, permeability of the top soil and subsoil, and associated land features, e.g. the slope of the land, the extent of erosion, the degree of wetness and susceptibility to overflowing and flooding.

The grouping of soils into capability classes is done primarily on the basis of their capability to produce common cultivated crops and pasture plants without deterioration over a long period.

Land-capability classes. The land-capability classes are based on the intensity of hazards and the limitations of use. The land-capability classes range from the best and most easily farmed land to that which has no value for cultivation, grazing or forestry, but which may be suited to wild-life, recreation or for watershed protection. They all fall into 2 broad groups : one suitable for cultivation and other land uses, and the other not suitable for cultivation, but suitable for other land uses.

LAND SUITABLE FOR CULTIVATION AND OTHER USES

There are four class of land which are suitable for cultivation and other purposes. Their details and limitations are as

Class I (Green Colour). Soils in class I have very few or no limitations that restrict their use. This type of land is nearly level and the erosion hazard is low. The soils are deep, well-drained, easily worked, hold water well and are either fairly well supplied with plant nutrients or are highly responsive to the application of fertilizers. The soils are not subject to damage because of overflow. The local climate must be favourable for growing many of the common field crops. In irrigated areas, the soils may be placed in class I, if the limitation of the arid climate has been removed by relatively permanent irrigation works.

These soils need ordinary management practices to maintain productivity. Such practices may include the use of one or more of the following : fertilizers, lime, cover and green-manure crops, conservation of crop residues and crop rotations.

Soils in this class are suited to a wide range of plants, may be used for cultivated crops, pastures, forests and wild life, food and cover.

Class II (Yellow Colour). Soils in class II have some limitations which reduce the choice of plants or require simple conversion practices.

The limitations of soils in class II may result from the effects of one or more of the following factors : (*i*) a gentle slope, (*ii*) a slight susceptibility to erosion, (*iii*) less than ideal soil depth, (*iv*) occasional damaging overflow, (*v*) wetness which can be corrected by drainage, but existing permanently as a moderate limitation, (*vi*) slight to moderate salinity or sodium, easily corrected but likely to recur, and (*vii*) a slight climatic limitation on soil use and management.

They needy terracing, strip-cropping, contour cultivation, water-disposal area, covered with vegetation crop rotation, cover and green-manure crops, stubble mulching, the use of fertilizers, manure and lime. These soils may be used for growing cultivated crops, raising pastures, forests and for wild-life food and cover.

Class III (Red Colour). Soils in class III have moderate limitations which reduce the choice of plants and require special conservation practices.

Limitations of soils in class III may result from the effects of one or more of the following factors : (*i*) moderately sloping land, (*ii*) moderately susceptible to water or wind erosion, (*iii*) frequent overflow accompanied with some crop damage, (*iv*) very slow permeability of the sub-soil, (*v*) wetness or continuing water-logging after drainage, (*vi*) shallow soil depth up to the bed-rock, hard-pan or clay-pan which limits the rooting-zone and the water storage, (*vii*) low moisture-holding capacity, (*viii*) moderate salinity or sodium, and (*ix*) moderate climatic limitation.

The soils can be used for raising cultivated crops, pastures, forests and wild-life food and cover.

Class IV (Blue Colour). Soils in class IV have severe limitations that restrict the choice of plants and require careful management.

The restrictions in the use of these soils are greater than those in class III and the choice of plants is more limited. When these soils are cultivated, very careful management is required and the conservation practices and more difficult to apply and maintain.

The use of these soils for cultivated crops is limited as a result of the effect of one or more permanent features, such as (*i*) steep slopes, (*ii*) severe susceptibility to water and wind erosion, (*iii*) severe effect of past erosion, (*iv*) frequent over-flow accompanied with severe crop damage, (*vii*) excessive wetness with a continuing hazard of water-logging after drainage, (*viii*) severe salinity or sodium, and (*ix*) moderately adverse climate.

These soils can be used for crops, pastueres forests and wild life food and cover.

SOIL

The word "*SOIL*" is derived from the latin word "*SOLUM*" meaning ground. Here, the word soil is used in a strictly scientific sense. To the scientist soil is not merely the product of simple rock decay - the result of both chemical decomposition and mechanical disintegration of rocks, whether igneous or sedimentary, but a reworked natural material having special and definite characteristics of its own.

Soil is defined as a thin layer of earth's crust which serves as a natural medium for the growth of plants. Soil is formed by weathering process of parental material rocks. Soil differ from parental material in the morphological, physical, chemical and biological properties. Generally it is said that, it is a mixture of mineral constituents and of organic matter, which later consists, more or less of the decomposed residues of plant materials and to a lesser extent of animal remains and extreta.

There are various types of soils like red, black, yellow - alluvial etc. Depth of soil is variable and it differ in texture like coarse, fine, soils serve as reservoirs of nutrients and soil's flora. The most characteristic constituents of soil are the colloidal organic matter and colloidal clay. Soil organic matter and particles conserve soil moisture for crops, plantation, soil living organisms. Soil provide even mechanical anchorage and favourable tilth. The components of the soil are mineral material, organic material, water and air the proportion of which vary.

Since, the main interest of soils to MAN is for growing his crops, it is necessary to learn also about the physical and chemical properties of the soils. Because for growing with success particular crop is dependent. In soil studies, the following physical properties are important

(*i*) Specific gravity (*ii*) Pore space (*iii*) Plasticity
(*iv*) Cohesion (*v*) Colour (*vi*) Texture
(*vii*) Soil temperature (*viii*) Permeability.

Soil Forming Materials

Rocks are the chief sources for the parent materials over which soils are developed. There are three main kind of rocks viz (*a*) igneous rocks (*b*) sedimentary rocks (*c*) metamorphic rocks. Soil differs in chemical composition. The main chemicals are

SiO_2, Al_2O_3, Fe_2O_3, MgO, FeO, CaO, Na_2O, K_2O, CO''_3, P_2O_5, MnO, TiO_3 etc. and water moisture.

Weathering, soil formation and development proceed simultaneously. The weathering may be chemical or physical. Physical weathering comprised of — water, temperature, wind, plants/animals, while chemical weathering comprised of solution, hydration, hydrolysis, carbonation, oxidation-reduction.

Soil types and Soil groups

Depending upon weather a particular soil had originated from the direct decomposition of the crystalline rocks or it had been formed from deposits which have already passed through a cycle or cycles of weathering, transport or consolidation, we have respectively the *Primary* and *Secondary soils.*

The important soil groups of the world are the following :

1. Soils of the Podsolic group : They are found in cold to temperate regions under humid conditions. The Pod sols and their congeners are completely leached soils in which Calcium carbonate and Calcium sulphate are present only in very subordinate amounts. Soils of this include the Tunda soils, Podsols, Brown forest soils, Prairie soils and Mountain soils.

2. Tschernosems and their related groups : Such soils develop best in semi and climate. Hence leaching is rather incomplete and generally there is always the development of horizons of