**Difference between agronomy and agriculture . Pramod Bhatta 62**

Agriculture : Agriculture is a broad term encompassing all aspects of crop production,l ivestock farming, forestry etc. Agronomy: It is a branch of agricultural science which deals with principles and practices of soil ,water and crop management. In recent time ,it can also be defined as a branch of agricultural science that deals with methods which provide favorable environment to the crop for higher productivity.The main difference between agronomy and agriculture is pin pointed below:

**Agriculture vs Agronomy**

1. Agriculture is very broad terms aaw. Iencompassing all aspects of crop production ,Livestock farming ,fisheries etc. Whereas Agronomy is a part of agriculture which only deals with production of plants and crop management.

2. Agriculture is art and science of crop cultivation. Whereas Agronomy is art and science of crop cultivation.

3. In simple meaning ,agriculture means process of cultivation of land. Whereas Agronomy is the study of management of land.

4. Agriculture means the practice of farming including cultivation of soil for the growing of crop and rearing of animals to provide food, wool and other products. Whereas Agronomy is the technology of producing and using plants for fuels , food , fibre and land reclamation.

**What is Agronomy and classification of crops? Dipesh R Bist, RN-25**

The term agronomy is derived from Greek words "*agro*" meaning field & "*nomo*" meaning to manage. Agronomy is a branch of agricultural science that deals with the study of crops and the soils in which they grow. The principles of agronomy deal with the production, management of crops and scientific facts in relations to environment in which crop are produced. There are hundreds of crops grown in agriculture sector. These crops are grouped together or classified into various categories based on agronomic classification, seasonal classification, special purpose classification etc. The purpose of these classifications is to learn about the crops more deeply and accurately to judge their characteristics so that best agronomic practices can be applied to get maximum production and yield. In this article we will learn about special purpose classification of crops.**Special Purpose Classification Of Crops**:

This classification is used to refer to plants having special advantages to the farmer himself in relation to his farming practices. In special purpose classification , crops are divided into 11 categories. They are:

1. Catch Crop *(e.g. green gram, black gram etc.)*
2. Cover Crop *(e.g. most of legumes)*
3. Trap Crop *(e.g. sun hemp, marigold etc.)*
4. Silage Crop *(e.g. maize and oat)*
5. Soiling Crop *(e.g. maize when young)*
6. Restorative Crop *(e.g. legumes)*
7. Relay Crop *(e.g. lentil in rice field)*

8. Cash Crop *(e.g. sugarcane, tea etc.)*
9. Green Manuring Crop *(e.g. Egyptian clover, lupine and cowpea)*
10. Ratoon Crop *(e.g. sugarcane, berseem, oats, etc. )*
11. Brake Crop *(e.g. legumes)*

**The 5 of them are briefly explained below:**

**1.Catch or emergency crops**: These crops are used to substitute crops that have failed on account of unfavorable conditions. They are usually quick-growing so that they can be grown in between two major crops to catch the short period between them. They include crops like green gram, black gram, rye, millet, etc.

**2.Cover crops:** These crops are planted to provide a cover for the soil and to prevent erosion. They also improve soil health, enhance water availability, smother weeds and increase biodiversity and the eventually increases yield. They act as cover against splash effect of rain such as legumes, clover, rye etc.

**3.Green manure crops:** These crops are turned under while still green in order to improve the soil properties and increase organic matter content. They improve the physical and chemical properties of soil. They provide large quantities of nitrogen for the soil. Green manure crops also provide generous amounts of high protein fodder for animals as well as food for humans. E.g. Egyptian clover, lupine and cowpea

**4.Silage crops:** The crops that are grown for preparation of silage are called silage crops. Silage is fermented, high-moisture stored fodder which can be fed to cattle, sheep and other such ruminants (cud-chewing animals) or used as a biofuel feedstock for anaerobic digesters. These crops are harvested at very young and are preserved in a succulent condition by partial fermentation in a tight receptacle forming silage .They include corn, sorghum, forage grasses and legumes.

**5.Ratoon Crops**: Ratooning is the agricultural practice of harvesting a monocot crop by cutting most of the above ground portion but leaving the roots and growing shoot apices intact so as to allow the plants to recover and produce a fresh crop in the next season. This practice is widely used in the cultivation of crops such as *rice, sugarcane, banana, and pineapple*. Ratoon crops cannot be perennially renewed, and may be harvested only for a few seasons, as a decline in yields tends to occur due to increased crowding, damage by pests and diseases, and a decline in soil fertility.

**What is special purpose classification of crops ? Explain any five. By Pramod KC**

The process of classification of cros which refers to plants having special advantages to the farmers themself in relation to their farming practices is called special purpose classification. These crops help farmers to safeguard their economic benefits. Under this classification, different crops are included which are listed below.

A. Catch crop: Crops that are grown in between two major crops to catch the short period between them or crops that are grown to catch the remaining season in case of main crop failure are called catch crop. Eg; greengram, blackgram

B. Cover crop: Crops that are grown to prevent the soil from erosion are known as cover crops. These crops act as cover against the splash effect of rain and prevent soil erosion. Eg; most of the legumes

C. Trap crop: Crops that are grown to attract insects towards them and to protect the main crop are termed as trap crop. Eg;Sunhemp attracts nematode, marigold can attract insect pest of several vegetable.

D. Cash crop: Crops that are  grown to earn hard cash are termed as cash crops. These crops are generally not stored but are directly used as raw materials in many industries thus are sold immediately after the harvest. Eg; sugarcane

E. Soiling crop: Crops that are grown to feed the animals are known as soiling crops. Eg maize, when they are young and green, they are cut and fed to the animals.

**Crop Classfication Based On Agronomic Use: Anita Regmi; Roll-4**

There are hundreds of crops grown in agriculture sector.these crops are grouped together or more precisely classified into various categories based on Agronomic classification ,seasonal classification special purpose classification etc.the purpose of these classification is to learn about the agriculture crops more deeply and accurately to judge their characteristics so that best Agronomic practices can be applied to get maximum production and yield in Agronomic classification crop ae divided into10 catagories .a briefly which is given below with example.

**1:cerals crops**: These are the grasses grown for their edible seed
eg.wheat,rice,maize,barley,oat,sorgum,millet,and other.

**2:forage crops:** These are the crops which are cultivate for green chop,hay,silage,or soiling or they are grazed by animal.forage crops belong to the graminae and leguminosae families like clovers and grasses respectively .eg.the crops like sorghum,maize,and other coarse crops when harvested as whole and used to feed animals these are termed as fodder crops.

**3:oilseed crops:** These are crops cultivate specially for the purpose of extracting oils from their seed .eg:mustard,rapessed,canola,soyebean, sunflower,sesame,caster bean,and flax.

**4:fiber crops:** These crops are specially grown to extract fiber .this fiber is used to make clouher,ropes,bags etc.eg:cotton,jute,flax,etc

**5:sugar crops**: Edible sugar is made from the juice extract from these crops.eg:sugarcane,sugarbeet,etc

**6:pulses or grain crops**: These are the member leguminaseae which are cultivate for their edible seed.ex:chickpea,mungbean,lentil,cowpea etc.

**7:root and tuber crops**: These crops are grown for their underground economical part like rhizome,bulb,tuber,corms,and stem tuber.ex:onion,garlic,potato etc.

**8:vegetable or garden crops**: Crops which are grown for their edible leaf,shoot fruit and seed ,eg:cabbage,pumpkin,tomato, cauliflower etc.

**9:condiment crops:** Corriander,mint and chillies are cultivated and used as condiments.

**10:narcotic or drug crops**: Tobacco,poppy,tea,coffee,and pepper-mint are the crops which find theirs use as narcotic or drug crops.

**What is agronomic classification? Explain about 5. Om P Bhandari**

Crop plants which are grown with the intention of obtaining yield or to meet particular purpose . The major agronomic crop are grouped according to their use.

1. Cereal crops: Crops that are grown for their edible grains and belongs to family poaceae are termed as cereal crops. Eg: rice ,wheat

2. Grain legumes: These are the crops that contains protein rich seeds enclosed within the pod and have the capacity of biological nitrogen fixation. Eg: soyabean, pea

3. Fiber crops: Crops that are grown for the extraction of fiber are termed as fiber crops. Eg. Cotton, jute, etc.

4. Sugar crops: crops that are grown for the extraction of sugar are termed as sugar crops. Eg. Sugarcane, sugarbeet.

5. Oilseed crops: crops that are grown for their oil-rich seeds are termed as oilseed crops. The seed of these crops are used for extraction of oil. Eg. Mustard, sunflower.

**Explain about importance of agriculture in Nepal. Enlist 15 points and explain them all. Tarjan Bhandari; Roll No. 94**

Agriculture is the art and science of farming, including cultivation of the soil for growing of crops and the rearing of animals to provide food, wool and other products. In the context of Nepal, which has always been regarded as an agro-based country, agriculture is the backbone of Nepalese economy, means of livelihood for the majority of the population and the main source of income and employment generation. The importance of agriculture is summarized below:

1. **Major source of food**
   Agriculture is the primary source of food products. It provides various kinds of staple food crops, cash crops, fruits, vegetables, meat, milk, etc. Thus, agriculture ensures food security.
2. **Source of clothing material**
   Agriculture provides fiber to make clothes. About 70% of the fibers comes from cotton and other sources are jute, wool, silk, natural fiber, etc. which are also obtained from agriculture.
3. **Major source of national income**
   Agriculture is the major source of national income, which contributes about 33% of the total GDP of Nepal. Agriculture, which significantly contributed in the past, declined due to the gradual development in the industrial and tertiary sectors.
4. **Source of industrial raw materials**
   Various types of industries such as furniture, paper and paper products, textiles, handicrafts, medicine, etc are based on agricultural inputs. Agriculture sector provides raw materials such as raw jute, timber, grass, herbs, cotton, sugarcane, tobacco, etc. for industries.

5. **Source of employment**

   Agriculture provides employment opportunities to about 78% of the working population of Nepal. Since agriculture is highly labour intensive occupation, it generates direct and indirect employment opportunities to unskilled, semi-skilled and skilled manpower such as construction of irrigation schemes, drainage system, etc.

6. **Major source of government revenue**

   Agriculture is the major source of government revenue. Land tax, registration and other payments form part of the government revenue. Modernized agriculture can contribute a large share to the national income.

7. **Significance in foreign trade**

   Major agricultural exports of Nepal are tea, coffee, cardamom and medicinal herbs. If there is smooth development in practice of agriculture, imports are reduced while export increases considerably. This also helps in earning foreign currency.

8. **Overall economic development**

   Since agriculture employs many people, it contributes to economic development. As a result, the national income level as well as people's standard of living is improved. The fast rate of development in agriculture sector offers progressive outlook as well as increased motivation for development. Hence, it aids to create good atmosphere for overall economic development of a country.

9. **Promotes international relation**

   By importing and exporting of agricultural commodities, a country can establish a good relationship with other countries. For example, the relations of Nepal with big countries like India and China due to trade.

10. **Environmental balance**

    Plants liberate $O_2$ and animals liberate $CO_2$ to the atmosphere and thus, the gaseous concentration of the atmosphere is balanced. In addition, the plantation of various crops and trees also helps in reducing the green house effects.

11. **Increase in living standard of rural people**

    Other sectors of the economy i.e. industry, trade and commerce develop with the development of agriculture sector. As a consequence, it helps to increase employment and income opportunities for the people. The more income means the increased standard of living of the people.

12. **Source of food and fodder**

    Agricultural sector provides fodder for domestic animals. Cow provides people with milk which is a form of protective food. Moreover, livestock also meets people's food requirements.

13. **Importance in business**

    There are many businesses dependent on agriculture sector, such as chemical industries, farm equipment industries, etc. The development and advancements in agricultural sector is as a result of the development of these industries.

14. **Market surplus**

    The growth of agricultural sector contributes to marketable surplus. Many people engage in manufacturing, as well as other non- agricultural sector as the nation develops. All these individuals rely on food production that they might meet from the nation's marketable surplus.

As agricultural sector development takes place, production increases and this leads to expansion of marketable surplus.

15. **Aesthetic importance**
    Agriculture promotes natural beauty by increasing the greenery of the surrounding. Flowers, grasses and other ornamental plants are also used for landscaping

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**Define food security. List and explain all 4 pillars of food security. Pramod Sah Roll No.64**

Ans: Food security is defined as the availability of sufficient, safe and nutritious food and have a good access of it. According to World Food Summit of 1996 food security is defined as the "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Food security also includes both physical and economic access to food that can maintain the diets in people and their basic needs.

Four pillars of food security are:

1. Food availability(sufficient food supply)
2. Food accessibility(food must be within the reach of people)
3. Food consumptability or absorption
4. And Food sustainability(there must be the sustainability in all above mentioned sectors)

**Food availability:** In order to maintain food security, food availability is primary things. Sufficient, safe, and nutritious food must be available in order to maintain food security. To make food available the production of food should be in sufficient amount. The starting point of food availability is food production. Food production is determined by a variety of factors including land ownership and use, soil management, crop selection, breeding, management, livestock breeding; and management; and harvesting. These requires thought and consideration to be given to the physical availability of food at farm and in local market. In turn this is predicted on well functioning market infrastructure with adequate road and rail network as well as ensuring adequate storage and processing technology.

**Food accessibility:** Food accessibility refers to the affordability and allocation of food, as well as preferences of individual and households. Access by individuals to adequate resources(entitlements) for acquiring appropriate food for a nutritious diet. Entitlement are defined as the set of all commodity bundle over which a person can establish command given the legal political economics and social arrangement of the community in which they live.

**Food consumptability or Absorption:** It refers to the metabolism of food by individuals. Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all the physiological needs are meet. This brings out the important of non-food input in food security. Food is properly used and many suitable techniques are employed for storage. At the global level, hunger results from political and economic inequality, environmental degradation unjust trade policies, inappropriate technologies and other factor depending on local context. At the local level, the food inequality results by the lack of nutritional education, poor quality of food and from inadequate quantities of the rights kinds of food.

**Food sustainability/stability:** It refers to the ability to obtain food over time. To be food secure, a population, household or individual must have access to adequate food at all times. They should not

risk losing access to food as a consequences of sudden shocks(e.g. an economics or climatic crisis) or cyclical events(e.g. seasonal food insecurity). The concept of stability can therefore refers to both the availability and access dimension of food security.

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**Enlist and explain at least 10 causes of food insecurity in Nepal. Ram janam tharu; Roll no. : 70**

Food insecurity means insufficient condition of food or scarcity of food in any particular areas. The food insecurity is becoming one of the major issues in Nepal. The majority of Nepalese people depend on a smallholder farming for their livelihood. Many households operate in landholding that inadequate to produce enough annual foods for survival. Certain families, particularly those from lower caste groups, manage landholding within the ADHIYA (share cropping) system and obligated to turn over a significant portion of their harvest to the wealthier or higher caste members holding the land.

Poverty and lack of purchasing power limits the poor's ability to assess food. Even poor people are unable to consume enough food and calories required for their body, and lack of micronutrients may compromise their bodies ability to absorb and synthesize nutrients and causes different types of disease. In Nepal, mainly the children from poor or lower caste families died due to malnutrition.

Some causes of food insecurity in Nepal are listed and explained below ;

1. **Geographical topography of Nepal :-** Nepal is biologically and geographically diversified country. Most of the areas of the country are covered by high hills and mountains, and less cultivable land for agricultural practices are available. Due to the topography of land in Nepal, people are unable to produce much crops which causes lack of food in the country.
2. **Population growth :-** Population growth is one of the major problem of food insecurity in Nepal. The population of the country is increasing day by day but the agricultural land remains same which can't fulfill the required food needs of the growing population. And due to increasing population, agricultural fields are used for housing and converting into cities which causes decrease in agricultural land and yield of crops causing food insecurity in Nepal.
3. **Climatic effect :-** Food production and food insecurity is heavily impacted by natural climatic condition of Nepal that includes a prolonged drought, severe flooding, frequent landslide and occasional hailstorm. Rice is one of the more severely affected crops from drought and a late monsoon. Most of the Nepalese farmer depend on rain water for their agriculture.
4. **Impact of migration and mobility :-** Due to large scale migration, directly or indirectly, deteriorates the condition of food security. In case of Nepal, many youth abandoned their village and even their cities and migrate to other countries. This allowed large area of cultivable land to fallow every year. It reduces the labour intensive agricultural business.
5. **Infrastructure destruction**:- There are lack of infrastructure in Nepal. Some parts of the country are deprived of roads which unable to transport food in all part of the country and causes starvation in some parts. They only consume what they grow.
6. **Lack of storage facilities:-** Nepal is a agricultural country so, most of the food items are obtained from agricultural fields. Agricultural products are mostly decaying in nature. They require proper storage facilities for long term use but there is very low storage and processing facilities in Nepal.

7. **Food price :-** Food price is also an important cause of food insecurity in the country. In countries like Nepal, the prices of food items differ according to place. It is not possible for poor to purchase enough food for their consumption. Especially the people from mountain and high hills becomes the victim of high prices.
8. **Lack of technicians and technical knowledge :-** In Nepal, most of the people are engaged in traditional and subsistence agriculture system. Due to lack of technicians and technical knowledge in the country the production is decreasing. Most of the farmers have small land holdings for agriculture which causes less commercial agriculture.
9. **Lack of law implementation and improper market distribution:-** Improper distribution of market causes unequal prices of same commodities according to places. And proper law are not made and implemented in country which causes unavailable of food in all part of the country.
10. **Unemployment and poverty :-** Unemployment and poverty have greatly contributed in food insecurity of Nepal. In Nepal, most of the people are unemployed and they don't have equal economic status. Where, rich get enough food but poor die due to hunger.

**Source : www.foodinsecurityinnepal.com**

**Definition of Food Security and Causes of food insecurity in Nepal. By Asha Mishra**

Food security is a condition related to the availability of food,and individuals. Essentially,food security can be described as a phenomenon relating to individuals. Food security exists when all people, at all times,have physical, social and economic acess to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.

Nepalese agriculture cannot meet the growing food requirements of its exploiding population. Rapidly increasing population which puts pressure on limited land resources causes low land productivity. Low production, distribution, poor acess to food in remote areas and low income are key factors causing food insecurity. We are living in technologically advanced era today when people are aiming to settle in the moon.But there are some harsh realities when it comes to feeding millions of people on the earth. Food security has emerged as a major global challenge today with nearly 800 millions people in the world are facing hunger .Next surprising thing is that about 1.3 billion ton of food is wasted across the world every year.

There is problem of food insecurity not because the country does not produce enough to feed the population. But it emanates from the fact that food produced in one region is not made available in the other areas. Likewise in our country Nepal agricultural equipment are not available for all .Irrigation facility is not improved. Because of not having skilled human resource there is great problem in identifying quality seeds.We aren't being able to use proper land so must of the field are left as free grazing areas.lf we take glance at local areas we see more participation of men at agricultural programs and women are not getting proper ideas, methods and knowledge about new technology which we need to implement in our agricultural land in order to increase our food production.Likewise we are not practising nutrition sensitive agriculture because of this people are not getting balanced diet food.Next problem is that Nepalese people have not proper knowledge about balanced diet food. We people give first priority to rice in order to fulfil our hunger.lf we talk about livestock there is not proper housing, nutrition, and vaccination so they easily get infected.As we know meat,milk and egg are best sources to complete nutrition in our food.But we are not being able

to add these sources properly. Having infected animals meat, milk people are losing their life.Here, government is also not allocating the proper budget for agriculture and agricultural materials which support to enhance better quality production.

According to data of 2018 World Food Programme 4.6 million people are food insecure and 1.4 million pregnant and nursing women are malnourished. If we cannot maintain this situation we have to suffer a lot in our future.To solve the problem of food insecurity we must put pressure on four pillars of food security that are sustainability, availability, accessibility and consumptabillity.Other attributing factors are women's education, women's active participation in agricultural activities, lifestyle, culture,access to health service and basic sanitation among others. These factors are positively correlated with food security. As government known the importance of food security, government should focused in this subject. He must make proper policies for this field.Then we will be able to see some bright change in our future.

**What are the factors that should be considered by the agronomist for reducing yield gaps (between potential and average yield)?- Sweta Adhikari; Roll no. = 93; Pramod**

Agronomist are the scientists who are responsible for maintaining the field and increase the production by reducing the yield gaps. There are different factors which play vital role in reducing the yield gap.

A yield gap is the difference between observed crop yield and those attainable in a given region. Yields of the major crops grown in developing countries are often far below economically feasible and economically sound potential. Enabling farmers to narrow these gaps and stabilize yields in a sustainable manner is a major requirement for achieving long term global food security. Yet the challenge is far from the straightforward .A great deal of progress has been made in developing better methodologies for analyzing yield gaps.For the success of the deal i.e reducing yield gaps , agronomist considered these mentioned factors **:**

**1.<u>Promotion of integrated crop management</u>**

Yield gaps caused by biological,socio-economic and institutional constraints can be effectively sddressed through an integrated crop management (ICM) practices. Transfer of the practices theough extension agents could affectively help farmers minimize yield gaps .Timely planting, irrigation, weeding ,plant protection and timely harvesting could account for more than 20% yield increase .Howecer , input /output prices anfd employment opportunities influence farmers decision on the level of inputs to be applied.And for all these things a qualified agronomist should workout for integrated crop management.

2. **<u>Adequate input and credit supplies</u>**

Inputs play and important role in the productivity of crops and minimizing yield gaps. Farmers need adequate amount of quality inputs at the right time to obtain high yield. It is also important that the fertilizer inputs are integrated with organic manures for balanced use of nutrients Resourse shows that poor small but productive farmers representing more than 80% of farm population are usually unable to purchase required quantities of the inputs for better yield. Therefore,a agronomist should make a appropriate measures to reduce transaction cost , simplifying lending procedures , revise eligibility criteria and strengthen monitoring and supervision mechanism of the credit system.

3.**<u>Reasearch and extension support</u>**

The support of research and extension is necessary for narrowing yield gap. The researcher should understand farmers constraints to high productivity and accordingly develop integrated technological package (appropriate variety,timely planting,fertilizer , irrigation, and pest management) for farmers for specific location to bridge up the gaps.The jujudicious application of inputs from seeding to heading in terms of quality amd timing will significantly contribute to reducing yield gaps and thereby increasing productivity of crops.

4**.Policy support**

As mentioned earlier, socio economic and institutional contraints can cause yield gap significantly .It is thus necessary that the government address the issues seriously and come forward with the solution to the problems to increase productivity by minimizing the yield gaps.so,a qualified agromomist should significant involvement in policy making and following the formulated policy.

Along with these factors to reduce the yield gap these recommendation should be given importance:

1. The government must strengthen efforts to ensure timely supply of adequate quantities of quality inputs to the farmers to enable them to minimize yield gap.
2. Both public and private sectors should play a vital role in producing and distributing the inputs in time.

**A small difference between potential yield and average yield:**

Potential yield is defined as the yield of a crop culivar when grown in environments to which it is adapted with nutrients and water non-limiting and pests and diseases effectively controlled.And average yield is defined as the production with the available nutrients in the field without external addition.

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**What is climate change? Explain at least 10 causes of climate change. Tekendra Bahadur Manni Roll No.- 100**

Ans:- Climate change means the change or variation in weather component ( temperature, humidity, precipitation, cloudiness, radiation etc.) over the comparatively longer period ( according to IPCC-intergovernmental panel on climate change; at least 30 yrs. or more) to larger area ( country, state, zone). climate change is simply change in climate pattern where climate is generalization or summation of weather condition.

**Causes of climate change are following;**

a) Natural cause:- The climate change through natural causes.it include;

1) volcanic eruption:-When a volcano erupts it throws large volume of SO2 gas, H2O vapour, dust and ash mixed into atmosphere that cause climate change.

2) Global warming:- The temperature of earth increase day by day due to global warming which directly climate change.

3)Earthquake:- This cause resent change in surround environment through mixing dust,ash and different gasses.

4) ocean current:- it moves large amount of heat across the earth.

5) Variation in solar radiation receive:- it can't seen short time but change in radiation in longer time period which is major cause of climate cause.

6) Earth orbital change:- The earth makes one full orbit around the sun each year, when it changes, the radiation effect to earth become adverse and change climate.

7) Natural disaster:- Drought, snow fall, storm etc are directly affect climate condition.

b)Human causes:- Human cause means which cased by human that affect climate, these are,

1)De-forestation/ Forest fire:- it means reduce of forest component where tree are help in neutralizaing harmful gases and maintain climate status.

2)Industrialization:- industry are establish more rapidly day to day it produce many waste product that affect climate change. e.g- petrol/ desel industry produce more gasses.

3)Population growth:- de-forestation is mainly caused by population growth.

4)excessive use of chemical:- Now a days chemical are used in every where in agricultural,missile test , industry etc which direct affect climate change.

5) Green house gasses:-Now a days human produce excessive amount of greenhouse gasses. it is main cause of man made where they produce these from industry and different ways these are;

- CO2- carbon dioxide is largest driver of green house effect.
- Methane & NO- These are produce from agricultural field I.e, rice cultivation and animal farming.
- the other green house gasses are CO, NO2, chlorofluorocarbon etc.

These above gasses act as barrier of solar radiation escape from earth and increase atmosphere temperature and affect climate.

- Akikrit krisi gyan @Balaramkrishana Banjade
- www.monstercrawler.com

**List out the causes of climate change**

- Climate change is the change in the statistical distribution of weather patterns when that change
- lasts for an extended period of time. A change in global or regional climate patterns is known
- as climate change. The main causes of climate changes are
- 1) Biotic processes
- 2) Variation in solar radiation received by earth
- 3). Plate tectonics

- 4). Volcanic eruptions
- 5). Global warming
- 6). Forest fire
- 7). Population growth
- 8). Deforestation
- 9). Natural disaster
- 10). Industrialization
- 11). Excessive use of fossil fuels
- 12). Excessive use of chemical
- 13). Erratic rainfall
- 14). Weapon testing/ war
- 15). Increase in carbon dioxide, nitrous oxide, methane etc.

**Climate Change and its impact on Nepalese agriculture. Apil Joshi- Roll no.6**

Climate change is a change in the pattern of wheather and related changes in oceans, lands surface,and ice sheets occuring over timescales. Climate change can have both direct and indiret impact on natural resources i:e agriculture, with regard to agriculture the general consenses is that changes in temperature and precipitation will result in agriculture productivity. Human activity is the main cause of climate change People burns which produces CO2, nitrous oxide and other harmful gaseous. Among them carbon dioxide is the main cause of climate change.

Nepal is traditionally an agrarian country. About two-third of the economically active population is engaged in agriculture and agriculture sector to contributes about one third to GDP. The variablity of agriculture productivity due to climate change may have a significant impact on people depending on this sector, espically poor and small holder farmer.

***Impact of climate change on agriculture:***

In Nepal exponential growth of CO2 and other greenhouse gasses in the atmosphere is causing climate change it effect on Nepalese agriculture directly. Nepal's economy depends on agriculture. Total area of Nepal is 147,181 km2

divided in mountains (35%), hills (42%) and terai (23%). A total of 3091000ha area is cultivated for agriculture, and it accounts for 38.15% of the gross domestic product (GDP). Following are the impacts on neplease agriculture.

1. In nepal every year an average of 0.06c/yea raise in temperature from 1975 to 2006 by1.8°c has been recorded in country.

2. Frequent drought seen everywhere due to raise in temperature which destroy the fertility of soil i.e nitrogen, phosphrous ,potassium and organic matter whichdecrease the crop productivity.

3. People burns biofules which produces co2 nitrogeus oxide and uses unnecessary biofertilizer which decreases the quality of crop.

4. Traditional rainfalls of Jestha and Ashar (mid July) have been shifted in Shrawan and Bhadra in nepal. It has affected negatively in the paddy production.

5.Due to heavy rain fall in shrawan causes land slid, soil erosion which destroy the rainy season Crops and hampers to the poor farmers who mostly depend on it. It means rice is cultivate in the altitude of 300m- 2300m above sea level but due to rainfall he slided land and decrease suitable altitude.

6.As a temperature increases cropping pattern as well as vector born diseases of human and livestock's can be expected to shift in higher eco-zones too.

7. Due to natural calamities like drought, landslide, soil erosion in mountain region .so the People are migrating to the terai lands and People engaged other sectors which decrease the agriculture productiviy in agriculture country like nepal.

In Nepalese agriculture the time has come for the authorities to find out adaptive measures to mitigate the effects to reduce untold natural calamities and miseries due to recent erratic weather pattern. Nepalese farmer are still traditional the climate is also become major problem that hinders the whole development and Productivity of the agriculture in Nepal. So, we have to control these impact on agriculture to get the higher productivity.

**Explain about 10 different measures to reduce the impact of climate change. Saurab Subedi; Roll No.83**

As the world warms, extreme weather events are becoming frequent ,sea levels are rising, prolonged droughts are putting pressure on food crops and many animal and plant species and being driven to extinction. Following measurres can be adopted to reduce the impact of climate change:

- **1. Reduce methane leaks**: Methane is a green house gas that contribute to the progress of climate change. Natural gas and petroleum system are also considered among the main sources of methane emmision. Upgrading the equipment used in transferring, storing and producing oil and gas can limit methane leaks.
- **2. Divest for fossil fuels**: Use of fossil fuels should be controlled. The CO gas from fossil fuels causes global warming and results climate change. So use of fossil fuels should be minimized.
- **3. Making environment green**: Environment should be made green by planting trees. The green environment reduces carbondioxide and helps to reduce climate change. Green environment also reduce pollution and reduces global warming which results to reduce in impact of climate change.
- **4. Wind power:** Wind power is the fastest growing energy resources in the world since 1990. Wind turbine use the wind, a renewable source of energy to generate electricity. It is eco-friendly and reduces impact of climate change.
- **5. Controlling industrialization**: Industrialization and urbanization should be controlled. The chemicals produced and harmful gases from industrialization causes climate change. Pollution due to urbanization also causes climate change.

- **6. Reuse and Recycle:** Recycling of paper, plastic, glass, aluminium, carboards etc. should be done to reduce impact of climate change.
- **7. Reducing uses of fuels:** Fuel emissions associated with motor vehicles should be controlled . The fuels produce smoke also causes climate change . Its use should be reduce.
- **8. Controlling overpopulation and deforestation**:Overpopulation and deforestation are the main causes for change in climate. Population should be controlled and plantation should be done for reducing impact of climate change.
- **9. Minimize green house gases:**Emmisions of green house gases should be checked from different factories and industries. Green house gases are main cause for change in climate.
- **10. Use of renewable resources:** Renewable resources should be used to generate energy. Renewable resources such as solar energy, hydroelectricity does not causes pollution than non- renewable resources. It makes environment clean, healthier and fresh . Hence helps to reduce climate change.
- www.davidsuzuki.org
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- Principles of Agronomy

**Explain the role of agronomist in increasing production and productivity without harming environment. Sushma Regmi; Roll no. : 91**

Agronomist is an expert who consider all the agronomic principles for increasing the production and productivity with the proper land improvement and management practices . An agronomist has to consider following points for the increment in production and productivity of crop production:

- **Agro meteorology**:
  As an agronomist, s/he should study the climate related to agriculture of a particular place in order to reduce the adverse effect of climate change. This help in increasing production.
- **Crop selection/variety selection:**
  An agronomist should suggest the farmer for the proper selection of the crop that are needed to be cultivated . Choice of crop varieties adaptable to the particular agro-climate, land situation, soil fertility, season and method of cultivation and benefitting to the cropping system which helps in increment in production.
- **Quality of seed and seed materials:**
  Quality seed and seed material affects the production. So an agronomist should play an effective role for the proper production and distribution of quality of seed and seed material among the farmers. Provision of quality seed or seed material and maintenance of healthy and uniform seedling favors high production.
- **Proper planning, programming and management design:**
  An agronomist should work on the maximum utilization of land, labor, capital, sunshine, rain-water, temperature, humidity, transport and marketing facilities for increasing production.
- **Cropping system:**
  An agronomist should develop and imparts ideas for the adoption of multiple cropping, also mixed or inter-cropping to ensure harvest even under adverse environment condition for increasing production.
- **Land management and improvement:**

An agronomist should consider for the proper field management and improvement. It is done by developing and adopting appropriate method of tillage, preparing field channels and bunds for irrigation and drainage, checking soil erosion, levelling and adopting other suitable land improvement practices for better production.

- **Water management:**
  An agronomist must develop ideas for proper water management practices with respect to crop, soil and environment through conservation and utilization of soil moisture as well as by water that is available in excess. It also includes time and method of water management practices required for selected crop for better production.
- **Nutrient management:**
  An agronomist must identify various required nutrient for crop and consider farmers for the timely application of proper and balanced nutrient to the crop or crops in sequence , improvement of soil fertility and productivity. It also include correction of bad effect of soil reactions and conditions, increasing soil organic matter through the application of green manure, organic wastes, bio fertilizer and profitable recycling of organic wastes.
- **Weed management:**
  An agronomist must suggest for the better weed management practices to farmers. It includes adoption of adequate, need-based, timely and proper plant protection measures against weeds, insects-pests, pathogens as well as climatic hazards and correction of deficiencies and disorders along with the suitable and proper intercultural operations to get maximum benefit by increasing production.
- **Harvest techniques:**
  An agronomist must develop and better method of harvesting. It also includes time of harvesting of crop to reduce field damage and to release land for succeeding crops along with the efficient utilization of residual moisture, plant nutrient and other management practices for increasing production.
- **Post harvest techniques:**
  An agronomist must develop suitable post harvest technologies such as method of storing, processing, etc. for increasing profit.
  www.agriinfo.in
  www.agrislide.com

**Explain the principle role of agronomist in increasing production and productivity without harming environment .- Aanand sah; Roll no.01**

The major role of agronomist in increasing production and productivity without harming environment are as follows :

- Soil and water conservation
- Soil and tillage
- Dry land agriculture
- Agro meteorology
- Irrigation water management
- Weed mgmt
- Cropping system
- Mineral nutrition manures and Fertilizers
- Pollution control Environment

- Sustainable Agriculture

1. **Soil and water conservation**

We must conserve soil and water because these are the most critical resources .
In this principle we will touch to soil erosion , water erosion , wind erosion ,Soil and water conservation measure .

2. **Soils and tillage**

Soils and tillage are necessary to know how soils should be managed and conserved for sustainable crop production . Under this principle Agronomist can learn physical properties of soil , biological properties of, soil organic matter , salt affected soils and tillage .

3. **Dry land agriculture**

Dry land farming is cultivation of crops in regions with annual rainfall more than 750mm . Under this we need history of dry land agriculture ,problems of dry land agriculture ,monsoon and length of crop growing season , drought , moisture conservation in dry lands water harvesting and protective irrigation , crops and cropping systems , mitigating adverse effect of aberrant weather , alternative land use system watershed mgmt and improved dry land agriculture implements

4. **Agro meteorology**

Agro meteorology is the branch of meteorology which investigates the relationship plants and animals the physical environment. Agro meteorology describes agro meteorological observatory , atmosphere wind , clouds and precipitation , solar radiation , air temperature , soil temperature , humidity and evaporation weather hazards and their mitigation , weather and crop productivity ,weather relations of crops , weather forecasting and classification of climate and agro climate in relation to agriculture .

5. **Irrigation water mgmt**

Irrigation water mgmt is very important for success of agriculture . In irrigation mgmt we need to read irrigation in Nepalese agriculture and globle agriculture , water resourse and their development , system of irrigation , soil water relationship , evapo transpiration , water requirements in crops , measurement of irrigation water , scheduling irrigation , methods of irrigations , irrigations and water use efficiency , irrigation practice for major crops , quality of irrigation water , drainage , cropping pattern in command areas , pricing irrigation water . As an agronomist irrigation systems and water mgmt maintained systematically and that is mostly favoured for the environment.

6. **Weed management**

Weed is a plant grown at place and time which is not desire .Understanding of common weeds , losses and benefits , weed ecology and classification , crop weed association and competition , methods of weed control , classification of herbicides , herbicides formulation , herbicides application , absorption and translocation of herbicides , herbicides combination rotation and interaction , persistence of herbicides in soils , herbicides resistance , chemical weed control in different crops , parasitic and weed control .

7. **Cropping System**

Cropping system is gaining more importance in this day and includes various terminology . Major cropping system are a ) Agronomy of rainfed cropping system b) agronomy of irrigated cropping system c ) Evaluation of cropping system d) Farming system and farming system research .

8. **Minerals nutrition , Manures and fertilizer s**

Nutrient mgmt is one of the most important principles for agronomist which includes essential in plant nutrition ,nutrient uptake by plants ,soil fertility evaluation, manures , fertilizers in Nepal agriculture , nitrogen fertilizers , phosphatic fertilizers potasic fertilizers ,ca ,mg and sulphur ,micronutrients , Mixed fertilizers , Fertilizers applications and environment . We protect from excess use of fertilizers.

9. **POLLUTION CONTROL ENVIRONMENT**

Pollutants can be managed properly in fixed places and to the dumping sites . There is not the use of excess chemical fertilizers like insecticides and pesticides .Polluted materials should be re use and recycled time to time.

**10. SUSTAINABLE AGRICULTURE**

Sustainable agriculture can be defined as the form of agriculture aimed at meeting the food and fuel needs of the present generation without endangering the resource base for the future generations. It includes study of impact of improved crop production technology ,factors affecting ecological , balances evaluation of sustainable agriculture , components of sustainable agriculture , sustainable utilization of land resources ,sustainable utilization of water resources ,sustainable utilization of biodiversity ,integrated nutrient mgmt integrated plant protection ,Enhancing sustainability of dry land agriculture , Enhancing sustainability of integrated agriculture agricultural sustainability and farming system.

***As an Agronomist I can do such types of activities :-***

- Awareness programme should be launched time to time .
- Dry land cab be planted and used properly as an economic points of view .
- Afforestation programme should be done .
- Use of green manures and compost manures is in first priority .
- Use of friendly eco system and use of friend insects against enemy insects Instead of insecticides and pesticides.
- Well experienced agriculturist and expert should be engaged and work without disturbing Envt.
- Use of market properly As the time of excess production .
- Farmers should be directly linked with market and protect from the mediator .
- Crops should be insuranced and free from any tension .
- Sustainability should be maintained
    - Www.Agri info.com
    - Principle of agronomy . By Redy and Reddy

**Role of agronomist in solving food insecurity problems. Rachana chaudhary Roll.no = 66**

Agronomistisaspecializedscientistinagronomy,whichdeals withthescienceofutilizingplantsforfood,fuel, feedandfiber. Agronomist should considered following points in solving food insecurity problems:

11. Agronomist should study the problems of crop productions and develop better ways of producing food, feed and fiber.
12. Agronomist should develop the method of harvesting, time for harvesting etc. The harvest should be done in the appropriate time.
13. Agronomisthastoidentifyvarioustypeofnutrientsrequiredfor crops.
14. Agronomist should develop proper crop planting i.e developing crop sequence or cropping pattern.
15. Agronomist must select a better irrigation management practice.
16. Agronomistmustselectabetterweedmanagementpractice.
17. The agronomist co-operates and co-ordinate with all the disciplines of agriculture, it is essential than an agronomist should have training in other disciplines of agriculture also.
18. To develop efficient method of cultivation ( whether broadcasting, nursery and transplantation or dibbling, etc.) the method may vary according to the germination period and depending upon the crop establishment and what should be the optimum plant population.
19. Decision should be made by agronomist in the farm management

20. Agronomist aims at obtaining maximum production at minimum cost e.g. developing efficient and economic field preparation
21. ,in what season,etc.
22. Agronomist should shoulder the responsibilities of all social, economic,cultural problems inadditiontofieldproblemsforthe effective functioning of the farm in general.
23. Agronomist should exploits the knowledge developed by basic and allied, applied sciences for higher crop production. 13)Agronomist must carry out research on scientific cultivation of crops taking into account the effect of factors like soil, climate and crop varities and adjust production techniques suitably depending on the situation.
24. Agronomist should conduct experiments to develop the best methods for increasing the quality and production of crops.
25. Agronomistshouldconsiderwith productionsoffoodandfiberto meet the needs of the growing population.
26. Agronomist should test the suitability of research finding of others specialists in the field and accept them finally and also judge the reaction of the farming community.
27. Agronomistshouldgivetheknowledgetothefarmeraboutallthe agril disciplines and cordinater of different subject matter specialists.
28. Agronomist should improve the technical re-euipment of sustainable food markets.
29. Agronomist should make improvement in the land relation to make production high.
30. Agronomist should improve the competitiveness of product. \

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**Q.No:77 - List and explain the impacts of climate change on Nepalese agriculture. Roshani Bista – Roll 99**

**Climate Change:** Climate change is a chnage in statical distribution of weather patterns when that change last for extended period of time. Climate change is a phenomenon due to emissions of greenhouse gases from fuel combustion, deforestation, urbanization and industrialization resulting variations in solar energy, temperature and precipitation. Climate change has adverse affect on water resources, agriculture, coastal regions, freshwater habitats, vegetation and forests, snow cover and melting and geological processes such as landslide, desertification and floods, and has long-term affects on food security as well as in human health.

***Impacts of climate change on agriculture sector of nepal are as follows;***

*1- Crop production:* Climate change affects crop production in a number of ways, including through changes in average temperatures, rainfall, and climate extremes. Rice,wheat,maize are the major crops of our country.Tons of these crops are cultivated every year in our country. The climate change has direct as well as indirect effect on production of the crops. For example- the increase in amount of rainfall increases the firtility and production of crops. Similarly, the conditions like adverse increase of temperature or no rainfall leads to decrease in yield of crops.

*2-Soil fertility and water availibility:*

As a natural fertilizer, more food can be grown with increasing $CO_2$. Increase in vigorous growth of food crops due to more availability of $CO_2$ may reduce the nutrients available in soil. Increase in temperature may lead to reduce the level of soil organic carbon, soil micronutrients. Agricultural sectors mainly crops, livestock's and horticulture largely depend on the given water sources in the country. Variability in climate and weather is major reason for change in moisture availability in the soil.

*3-Livestock:*

Livestock is a major component of agriculture. It includes poultry, dairy production and raring animals such as cattle, buffaloes, sheeps, goats and pigs. Climate change can cause adverse effect on livestock. Increase in temperature by 2 degree centigrade would decrease the meat and milk quality, hatchability of poultry and increases the possibility of disease in the livestock. On the other hand, increase of atmospheric $CO_2$ will increase the greenery of the land or fodder and pasture for the livestock's. Increase in amount of green fodder helps to boost up meat and milk production.

*4-Pests and Diseases:*

Climate change parameters: temperature, rainfall pattern and humidity have an impact on the development and distribution of pests and diseases. Increase in temperature and $CO_2$ will lead to an increase in population of pests and severity of diseases. It increases the rate of reproductive cycle of insect and pest. The increase in insect population leads to demand for more use of pesticide, which unknowingly causes lots of harm to ecosystem as well as human society. Incidence of pest and diseases would be most severe in tropical region due to climate change.

*5-Economic impact :*

Nepal is considered to be highly vulnerable to the effects of climate change. Nepal suffers high economic costs due to current climate variability and extremes. There is not a planned and well managed way for agriculture in our country , so we face extreme agriculture loss every year. **By the 2070s, net agricultural losses in Nepal are estimated to be the equivalent per year of around 0.8% of current GDP, or US$140 million/year in current prices.** The impacts were much more severe in years of extreme rainfall variability.

Reference: https://pdfs.semanticscholar.org/210e/788555f0e28a7c78863a5bc51cb35d7c4713.pdf

**Impact of climate change on Nepalese agriculture By Upendra GC (96)**

**Erratic rainfall and unlimited rainfall:**
A large no of rainfall causes flood, landslide and soil erosion .unlimited rainfall cause all the crop productivity. Due to large rainfall a large no of productivity decrease by a lot.

**Temperature increase and decrease :**
Due to increase on temperature the no of insect also increase. Due to large no of increase in no of insect disease will spread out in the country. Farmer will use many insecticides and pesticide to kill the insect and the crop productivity will decrease and drought occurs and people will die from hunger and starvation.

**Ice melt and glacier melt :**
Due to melting of ice from the snow . At the place of apple the orange will grow and at the place of orange the mango will grow. Due to melting of snow the river will reach up and flood
Will occurs and it damage the crop productivity.

**Global sea level:**
Inundation and displacement of wetlands and lowlands;costal region;increased strom flooding And damage;salinisation ;risingwater tables and impeded drainage.

**Sea water temperature:**
Increased coral bleaching;increased algal blooms;northerly migration of costal species ;decrease incidence of sea ice at higher latitudes.

**Precipation intensity:**
Increased flood risk in many place of Nepal.

**Wave climate:**
Changed cross shore and long sediment treansport, and hence pattern of erosion occurs.

**Atmospheric carbondioxide:**
Exponential growth of carbondioxide and other green house gases in the atmosphere is causing Climate change. It affect agriculture,mountain ecosystem ,problems of frequent drought,serve floods,landslides and mixed type of effect in agricultural crops have been experienced in Nepal because of agriculture.

**GREEN REVOLUTION Pros and Cons by Satya Niraula**
Dr. Norman E. Borlaug, in 1940s developed a strain of wheat that could resist diseases, was short, which reduced damage by wind and could produce large seed heads and high yields,which

dramatically changed the file of agriculture is known as Green Revolution. Today, a lot of farmers are practicing modern methods under this revolution. But as this innovation has also some drawbacks,this technology has become a subject of heated debates on whether it can really do good or bad for the society and the environment. Some of the positive and negative impacts of

**Green Revolution are:**

Positive Impacts:

1. It allows agricultural operations on a large scale: The Green Revolution has brought farming to a massive scale operation. Previously in the agricultural sector, crops grown massively require a lot of human inventions in order to grow healthy. And this made farming in large scale difficult and unaffordable to some community. Presently, things are a lot easier,where by,a lot of the crops are grown on a massive scale and even done by smaller farmers.
2. It has the potential to be able to grow any crops anywhere: This innovative farming process has made it possible for agriculture to be done almost everywhere. Though we still cannot grow potatoes on a beach,we will be able to utilize most types of land to grow crops with it.As an irrigation is also one of the vital factor of this revolution, we are also able to grow special types of crops in drier areas with the use of irrigation and other innovative technologies. This shows that farmers do not have to depend on the most fertile lands to plant their crops. Since,this innovative revolution made the planting of crops possible on almost every land.
3. It eradicates the need to fallow lands: This agricultural method has allowed farmers to replant similar crops without fallowing their lands, which is known to be a costly process. Though there are some crops on which soil still needs to be fallowed, the Green Revolution has certainly made farming cost efficiency.
4. Development of Industries: One of the most feasible advantages of Green Revolution is the development of industries. A lot of industries producing chemical fertilizers, pesticides, agriculture machinery, insecticides and so on, have arisen to
meet the rising demand for these products.
5. Increase in crop production: Due to the Green Revolution technology and the beginning of the use of synthetic pesticides and herbicides, chemical fertilizers, High yield crops, and the multiple cropping processes, the agricultural sector was able to provide food in larger qualities globally. This technique helps to reduce cost of production and results in cheaper prices of food in the market. It yields dramatic results nearly doubling wheat production in few years. In 1965-66 production of food grains was 33.89 lakh tonnes whereas in 1980-81 the output became 119 lakh tonnes. This increase in crop productivity not only helps to tackle and handle the ever-rising human population worldwide but also helpful to the environment as it meant that much less natural land and forest needed to be transformed to farmland for providing more food.
6. Scientific Cultivation: One of the most important effects of the Green Revolution is that the traditional agricultural practices and inputs have given way to fresh and scientific practices.As opposed to farm seeds,farmers now make use of 'High Yield Variety' seeds.Also,the traditional fertilizers are changed to chemical fertilizers.As a result,the land use for HYV seeds has increased rapidly.
7. Prosperity to farmers: Green Revolution has brought prosperity to farmers as agriculture is also regarded as a profitable occupation after this period. Standard of living of farmers has gone up in many places.Their quality of life and economic status also improved.
8. Effect on Rural employment: Due to multiple cropping and excessive uses of chemical fertilizers, the demand of labour increased.At sowing and harvesting time,acute shortage of labour is experienced.So,Green Revolution has generated employment. Though,this innovative Revolution had several benefits, there have been also some issues associated with this technology that affected both the society and the environment.

***Negative Impacts***:

1. It can cause Pests and Weeds to develop hazards: This modern method of farming is believed to cause the emergence of poisonous weeds and pests that are difficult to control.Aside from this, there

is also the concern of cross pollination between genetically modified organisms and traditional plants that could result in invasive species.
2. It employs mono-culturing: One of the biggest arguments against this modern technology is that it uses mono-culturing.This practice is known to require large tracts of land,which are not often available, intensive amounts of fertilizers and large volumes of water,bring about difficulties to smaller farmers which helped displace poorer farmers from the land,driving them into urban slums.
3. Toxicity of the Green Revolution: In 2008,researchers at Punjab University discovered DNA damage in 30% of Indian farmers who treated plants with herbicides ans pesticides.An additional study found heavy metals and pesticide chemicals in drinking water. Critics also pointed that the heavy use of fertilizer and irrigation causes long term degradation of the soil and also influenced the environment by increasing pollution and erosion of the top soil.
4. Loss of Genetic Diversity: In traditional, farmers plant a variety of crops that typically have a large supply of unique genotypes. People using Green Revolution techniques, plant fewer crop varieties in favor of those that produce high yields.This type of cultivation causes an undesirable loss in crop genetic diversity.
5. Other side effects:

**Green Revolution [Pros &Cons]: By Upendra GC: RN-96Green Revolution:**

In the mid- and late-20th century a revolution occurred that dramatically changed the field of agriculture, and this revolution was known as the Green Revolution. The **Green Revolution** was a period when the productivity of global agriculture increased drastically as a result of new advances. Under Green Revolution, machinery processes are being used in farming. This modern method is seen as labor intensive, where farmers make use of tractors, instead of oxen and horses, to plow and cultivate their lands, making the process faster and easier. It is a combination of controlling chemicals in the soil, weeds and pests, mechanization of agriculture, and genetic adaptation of plants to suit daily needs.

However, this method has become a subject of some debates on whether it really does good, rather than bad, for all of us. So, let us take a look at some of the pros and cons of Green Revolution to have a clear overview of the matter. **Pros of Green Revolution:**

**1. Agricultural Operations of a Massive Scale.**

Green Revolution has brought agriculture to a massive scale. By looking at the world before this modern method, we can see that crops that were grown on a massive scale are only those that require extensive manual intervention to grow healthy. This means that managing massive scale farms was not that easy. Thanks to Green Revolution, we have identified more ways to make things easier. Most crops, these days, are grown on an industrial scale even by smaller farming communities.

**2. Plants Have Become Resistant to Pests and Herbicides.**

Perhaps the greatest gift Green Revolution has given to us is the ability to give crops resistance to pests and herbicides. In the past, developing economies, which were still adapting to technology

and did not have very high literacy rates, struggled with farming. Now that Green Revolution is here, this has changed, not only leading to more produce, but also making it healthier.

**3. The Need to Fallow Lands Is Eliminated.**

This modern method of farming has allowed farmers to re-plant the same crops without fallowing their lands, which is another significant achievement of the inculcation of technology and knowledge in agriculture. Take note that fallowing used to be costly for farmers. Though there are some crops that still need fallowing, making crops for more profits has been made cost-efficient with Green Revolution.

**4. Automation in the Process of Farming.**

With automation, Green Revolution has made farming more predictable. It is important to note that there is more dependence on resources that are under human control than nature and other external factors. Now, when it comes to studying seeds and soil health, this modern method has given us the convenience to do most of such tricky work in the boardroom, rather than running year-long trials and then failing with massive losses to farmers.

**5. Ability to Grow Any Crop Virtually Anywhere.**

Yes, Green Revolution has made it possible for agriculture to be done almost everywhere. Of course, you still cannot grow potatoes on a plateau or paddy on a beach, but you can use most types of land or terrain to grow crops with this method. Thus, farmers do not have to be at the most fertile river banks to be able to start farming. Agriculture has definitely become more doable everywhere.

**6. More Profitable Farming Industry.**

Truth be told, farmers around the world were mostly poor, unless their families had large tracts of land and numerous farms that grow multiple crops. With Green Revolution, there are richer farmers today.

## Cons of Green Revolution

**1. Mono-Culturing.**

Among the most prominent shortcomings of Green Evolution is mono-culturing. This practice demands large tracts of land, which are not always available, large volumes of water and intensive amounts of fertilizers. These needs poses difficulties for farmers around the world.

**2. Probability of Weeds and Pests to Develop Hazards.**

Green Revolution is speculated to develop poisonous and super weeds and pests that are difficult to control. There is also the concern of cross pollination from genetically modified organisms (GMOs) to other plants in the environment, which could result in invasive species.

**3. Compromise to Crop Health.**

There have been some cases with this modern farming method, where unknown ailments have plagued the health of various crop species. It is always thought of that some new breeds of weed and pests can develop, and they may resist pesticides that are used right now.

**4. Sterile Seeds.**

In most cases, GMOs will generate sterile seeds every year.

**5. Varied Soil Type by Location.**

Green Revolution does not take into consideration the type of soil or its suitability for certain types of crop; it just considers the land area and does what is needed for the cultivation of crops each year. The following year requires fresh procurement of seeds, but nothing is done to ensure that the fertility of the soil is retained or replenished.

**6. High Cost.**

The price of the industrial farming and its equipment under Green Revolution may not be affordable for small farmers.

**7. Shortage of Supply.**

There is a sterner focus on cash crops with this modern method, and innumerable farmers are trying to grow them, which is leading to a shortage of staple food crops.

**8. Environmental Harm.**

All the equipment used in Green Revolution requires burning of fossil fuels that contributes to pollution and global warming. Also, if you make use of petrochemical fertilizers, it requires fossil fuels that tend to be patently and unsustainable.

**Q.Expalin about different factor affecting plant growth and describe each component.**
**SauhardaAdhikari Roll no. 82**

Plant growth factors control or influence plant characteristic or influence plant characteristics as well as adaption. Plant growth factor are classified as follows :

1. **Genetic factor**: The genetic factor is also called internal factor because the basis of plant expression (the gene) is located within the cell. The genotype of plant affects it's growth. For example: selected varies of rice grows rapidly ,maturing within 110 days , whearas others ,in the same environment condition grow more slowly and mature within 155 days.
2. **Environmental factor**: The environmental factor is considered as external factor .Genetic factor determines the characteristic of plant ,but the extent to which this is expressed is influenced by environmental factor. It is classified under biotic and abiotic factors.

a. **Abiotic factors:** It denotes the non-living components of environment.
**i)Topography**: It is generally linked with the layout of land .Slope ,elevation, flatness etc affect the sunlight, water, soil type ,wind and other factors. The altitude of land also affect the growth. The temperature decreases by 1°c for every 100 meters increase in altitude.
**ii) soil**: Physical ,biological and chemical characteristics of soil have distinct effect on plant. The nutrient present in the soil also affect plant and as well the microorganism like fungus , bacteria , algae etc. also affect plant. The soil physical properties include soil texture ,soil structure ,bulk density ,particle density which also affect water retention and ion exchange.
**iii)Humidity:** It generally refers relative humidity. The ideal relative humidity for propagation ranges between 80% to 90% for seeds and cuttings,60% for budding grafting and seed bed method. It also affect leaf growth, photosynthesis and pollination.
**iv) Aeration :** $co_2$ and $o_2$ both are required for photosynthesis and respiration So, proper balance between $co_2$ and $o_2$ is needed.
**v)Light:** Light is essential for photosynthesis ,while light quality which is determined by wavelength of light also influence germination and flowering. long day plant need more light. With no light or inadequate light seedling of poor quality are produced with excessive elongation(etiolation).
**vi)Temperature :**The biochemical reaction is affected by temperature. The biochemical reaction doubles with every 10°c increase in temperature . When light is not limiting photosynthesis is some what affected by temperature. It also affect on uptake of carbondioxide ,enzymatic activity ,growth substance and dry matter production. Grain growth is seen more in 30°c than in 15°c.
**Vii) Water/Rainfall :** water is essential for the various metabolic activities. In drought or water scarcity condition wilting may occur and plant may even die in prolong scarcity.

b. Biotic factor : It is the living component of environment. They can be classified as follows
i)producer: They produce their own food through photosynthesis in presence of sunlight. Plants comes under this class.
ii)Consumer: They depend upon producer for food. They are classified under secondary and tertiary consumer.
iii)Decomposer: They decompose the dead materials into simpler form to add nutrient to the soil which can be again used by plants.

Biotic factor can be better understood by their interactions which is listed below:
1**.Mutualism:** Mutualism is the species to species interactions in which both biotic factor and plant are benifited by the interaction.
Example :Rhizobium bacteria and leguminous plant, birds and insects helps in pollination and seed dispersal.

2.**Herbivory:** Some plant eating rodents ,insects and molluscs and herbivorous animal feed on plant which causes reduced production or destruction of entire plant.

3.**Parasitism:** Some virus ,Bacteria ,Fungus etc. feed or attack plant ultimately destroying them. some insects and other organism act as vector to carry such organism.

4.**Allelopathy:** Plant also inhibit the growth of other plant s by producing toxic materials as well as by physical means like thrones etc. And competition among the densely grown plants also affects both competing plant .

**Abiotic Stress**

Abiotic stress is defined as the negative impact of non-living factors on the living organisms in a specific environment. The non-living variable must influence the environment beyond its normal range of variation to adversely affect the population performance or individual physiology of the organism in a significant way

Plants are more and more affected by environmental stresses, especially by the devastating consequences of desertifi cation and water scarcity which can be seen and felt all over the world. About 3.6 billion of the world's 5.2 billion hectares of dryland used for agriculture have already suffered erosion, soil degradation, and salinization. Desertifi cation can hinder efforts for sustainable development and introduces new threats to human health, ecosystems, and national economies. This problem is catalyzed by global climate change which exacerbates desertifi cation and salinization. Therefore, solutions are desperately needed, such as the improvement of drought and salinity tolerance of crops, which in turn requires a detailed knowledge about tolerance mechanisms in plants. These mechanisms comprise a wide range of responses on molecular, cellular, and whole plant levels, which include amongst others the synthesis of compatible solutes/osmolytes and radical scavenging mechanisms. Regarding global change, elevated atmospheric CO 2 concentrations can enhance salt and drought tolerance because oxidative stress is alleviated and more energy can be provided for energy-dependent tolerance mechanisms such as the synthesis of compatible solutes and antioxidants, thus increasing the suitability of plants as crops in future. A detailed knowledge of the physiological and biochemical basis of drought and salt toleranceand its interaction with elevated CO2 concentration can provide a basis for the cultivation of suitable plants in regions threatened by desertifi cation and water scarcity under sustainable culture conditions. Even the drylands could offer tangible economic and ecological opportunities.

**EXPLAIN ABOUT ABIOTIC STRESS AND DIFFERENT FACTORS CREATING IT.**

Abiotic stress is defined as the negative impact of non-living factors on the living organisms in a specific environment. Abiotic stress factors or stressors are naturally occurring, often intangible and inanimate factors such as intense sunlight, temperature, or wind that may cause harm to the plants and animals in the area affected. Abiotic stress is the most harmful factor concerning the growth and productivity of crops worldwide.

**FACTORS CREATING ABIOTIC STRESS.**

Some factors creating abiotic stress are thoroughly explained below:

1. **Sunlight:-** Sunlight is used for the process of photosynthesis. Although photosynthesis requires sunlight, the very nature of sunlight also has negative impacts on photosynthesis. Visible light and ultraviolet light, inherent parts of sunlight , may cause damage to photosynthetic machinery and other cellular components. Excess light and ultraviolet radiation from sunlight lead to increased production of ROS, which may cause photoxidative damage. Therefore, sunlight is a major factor to create abiotic stress.
2. **TEMPERATURE:-** The reproductive (gametophytic) phase in flowering plants is often highly sensitive to hot or cold temperature stress, with a single hot day or cold night sometimes being fatal to reproductive success. As production is directly affected by temperature on which we have no control, it is a major factor causing abiotic stress.
3. **Wind:-** Wind induses stress in all parts of plant decreasing yield upto 30% for sorghum, 24% for barley and 48% in the marigold due to wind exposure. Wind also causes higher transpiration which reduces leaf temperature and may dehydrate plants. As we can't take control over wind and it significantly decreased the yield, it is also considered to be a factor causing abiotic stress in plant.

What are the biotic & abiotic factors affecting plant growth?Dhan Bahadur and Kumar Gupta

**Biotic factors**

Biotic factors refres to the living organism both macro and micro organism, including tbe various ways in which they affect plant growth and development. The effects of these living factors on plant growth all expressions maybe advantageous and disadvantageous depending on how they interact with the plant. Some biotic factors affecting growth of plant are

1.soil organism

- It includes bacteria,fungi ,earthworm, rodant, termite etc.
- Some bacteria and fungi can cause diseases and some are useful for growth of plant
- Nitrogen fixing bacteria in the root nodules can fix nutrients directly to plant and soil
- Some helps in the decomposition of plant materials to form humus.

2.Plants that cause deterious affects to another plant that is intentionally grown or crops are called weeds. Tolerance to this biotic factora (weed) varies from crop to crop.

3 Parasitism is an interaction between 2 organism in which one organism called parasite is benefitted but causes harm to another called host. Micro organism parasite such as fungi, bacteria and virus suppress the growth of plant by causing disease.

4 Birds, insects and bats serves as vector pollination which are the factors of the plant development phase so they are also included as biotic factors for the growth of plants.

5 Forest and fruit trees and other plants including annual crops associate with microrrhizal fungi which aid in the absorption of water and nutrients such as phosphorus, zinc, nitrogen from the soil which directly affect the plant growth.

**What is microclimate? Explain the causes of microclimate. Satya Niraula; Roll:81**

**Microclimate:** A microclimate is a local atmospheric zone where the climate differs from the surrounding area. The microclimate of a region are defined by the moisture, temperature, and winds of the atmosphere near the ground, the vegetation soil and the latitude, elevation and season, etc. Weather is also influenced by microclimatic conditions.

Microclimate can be found in most places, such as: near bodies of water which may cool the local atmosphere or in heavily urban areas where brick and concrete absorb the sun's energy, heat up, and reradiate that heat to the ambient air, etc.

**Causes of microclimate:**

Microclimate are caused by local differences in the amount of heat or water received or trapped near the surface. Some of the causes of microclimate are explained below:

1. **Vegetation:** The type of vegetation we have selected directly helps in causing microclimate. Many plants helps to lower the temperature which causes a cooler microclimate but some plants (like: maize), increases the temperature of surrounding causing a warmer microclimate. Plants that originate in tropical areas tend to have broad, dark leaves that allows for the maximum absorption of sunlight and the effective transpiration of moisture back into the air which will in return influence the micro climate in the immediate vicinity. The vegetation on permaculture site interacts with the soil and water to affect the microclimate. It not only covers the soil and prevents heat loss and radiation from it but also regulates the temperature of the soil, filters dust and other particles from the air and can act as a windbreak or suntrap.
2. **The artificial structure:** Tall buildings can impact upon microclimate by absorbing heat during the day and releasing it at night by deflecting wind and reflecting sunlight. But other artificial structures can also play a part in modifying microclimates. For instance, courtyard and other paved surfaces like driveways, moderate temperature by absorbing and releasing heat, while fences and walls can give plants protection from wind, shade, and shelter from wind. Even, rocks in the garden will have an impact by storing and releasing heat. We can judiciously place rocks to modify microclimates.
3. **Topography:** The slope of the land is a significant influence on microclimates. Direction that a slope faces will determine how much solar radiation it receives, which in turn impacts upon temperature and shading. In the northern hemisphere, south facing slopes are exposed to more direct sunlight than opposite slopes, as are north facing slopes in the southern hemisphere. This will cast longer shadows on the opposite slope of the slope, which must be taken into account when deciding which species of plant to place there.
4. **Water:** It is not just the moisture level within the soil that can affect a microclimate, the water stored on the surface of the land is also important. Over a region, the presence of lakes and reservoirs can create a more moderate climate, while ponds, streams and other bodies of water on the site will impact upon the temperature of the surrounding areas in the garden. These effects are due to the fact that water gains and loses heat more slowly than the land.

   The water body also sends moisture into the air through evaporation. This atmospheric

moisture captures heat from the sun, making the air around a pond warmer than areas further away.

5. **Soil:** The composition of the soil affects microclimates primarily through how much water it retains or which evaporates from it. A soil that has a large proportion of clay retains more moisture than one that is predominantly sand. The degree to which a soil retains moisture affects the humidity and temperature of the air above it. After heavy rains, the soil can contain a lot of water and modify microclimates much like a body of water such as a lake.

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**How solar radiation (light and temperature)affect plant growth? Seema Lamichhane**

The sun is the primary source of heat to the earth and its atmosphere.solar radiation thus consists of a bundle of rays of radiant energy of different wavelengths from the sun that acts as the driving force for all the atmoshpheric as well as biological process on the earth.
◦ Light
◦ Thermal effect(photothermic effect)

A.Effect of light on the plant can be studided under the four heading
◦ Light intensity
◦ Quality of light
◦ Duration of light
◦ Direction of light

1.light intensity
The variation in the light intensity are always accompanied with change in temperature and relatives humidity.generally,the light intensity falling on the particular place is normally enough for the plant and the physiological Process ie, photosynthesis. In photosynthesis about one percent of light is convert into potential chemical energy. Very low intensity reduces the rate of photosynthesis and may even result in closing of stomata .also that low intensity reduces the vegetative growth like as very high intensity of light increase the rate of respiration and thus disturbs the photosynthesis .respiration balance cause rapid loss of water resulting in the closure of stomata based on the response to light intensity the plant are classified as:
A.sciophytes(shade loving plant): the plant that grow under partially shade (low light) conditions .eg betel vines, buckwheat etc
B.heliophytes(sun loving plants): many species of plants produce maximum dry matter under high intensities when moisture are available at optimum level eg. maize,sorghum,rice etc Expect under glass house or shaded condition intensity of light cannot be controlled

2.Quality of light: Not all the light coming to the earths surface are utilized for photosynthetic process.when light passes the a prism.It dispersed into different colors. This light called as visible part of solar radiation spectrum. This only the radiation o certain wavelength are utilized for photosynthesis term as PAR(photosynthetic active radiation) (400-760nm). As among these light

red light is most favorable light for growth followed by (voilet-blue) .As the uv and shorter wavelength kills the bacteria and many fungi.
3.Duration of light(photoperiodic effect) It is important from the farmers point of view in selecting the variety of crops. The duration of light of or length of day has greater influence than the intensity. The response of plant to the relative length of the day and night is khowns as photoperiodism.
a.long day plant : the plant which develop and produce normally when the photoperiod is greater than the critical minimum( greater than 12 hours)eg.potato,sugarbeets, cereals, wheat ,barlely.
b.short day plant: the plant which develop and produce and when photoperiod short less the critical maximum(less than 12hrs) eg tobacco,soyabean,millet, maize , sugarcan.
c.Day neutral plant:some plants are found to be unaffected by photoperiod as day neutral plant( tomato ,asparagus) The photoperiodism influence the plant characters such as floral initation and development bulb Rizhome production . If a long day plant is grown during shorts days the growths of internodes are shorterned and flower is delayed. Similarly the shorts day plant are grown subjected to long days there will be normal vegetative growth and maynot be foral initiation ie, in rice.

4.Direction of light: The direction of sunlight has a greater effect on the orientation root,shoots, and leaves.In temperature region southern slope show better growth of plants than the northern slopes due to higher contribution of light in southern slide. The orientation leaves caused by light is usually called as phototropism.Eg leaves are oriented at right angle to incidence of light to receive maximum radiation. Direction of light can also causes morphological change in plant due to ultra voilet and violet rays.

B.thermal effect Majority of the solar radiation absorbed by the plants are converted to heat .only the PAR is used for photosynthesis .however,all other radiation play an important role in heat generation which afterwords used in transpiration and temperature exchange with the plants surrounding.

**#How solar radiation (light and temperature) affect plant growth ? Arbin kumar chaudhary; RN-7**

**Ans:**-Solar radiation plays an important role as regulator and controller of growth and development. It also influences assimilation of nutrient and dry matter distribution .It provides energy required for seed germination, leaf expansion ,growth of stem and shoot ,flowering , fruiting and thermal conditions necessary for the physiological functions of the plant. Solar radiation include 2 factors that affect plant growth .they are

**1.Light :**-Light is an essential factor in maintaining plants . The rate of growth and length of time a plant remains active is dependent on the amount of light it receives .Light energy is used in photosynthesis, the plants most basic metabolic process. When determining the effect of light on plant growth there are 3 areas to consider; intensity, duration and quality.

**2.Temperature:-** Temperature also plays an important role in plant growth. Most plants tolerate normal temperature fluctuations . In general , foliage plant grow best between 70f to 80f during the day and between 60f to 68f at night . Most flowering plants prefer the same daytime temperature range but grow best when night time temperature range from 55f to 60f.lower nighttime temperature help the plant recover from moisture loss, intensify flower color and prolong flower

life. Excessive low or high temperatures may cause plant stress ,inhibit growth or promote a spindly appearance and foliage damage or drop. Cool nighttime temperatures are actually more desirable for plant growth than high temperature.

**Effect of temp on plant growth By- Himanshu Giri/Gunjan Giri**

1.Effect of Temperature on plant growth:

Temperature is a measure of intensity of heat energy. Temperature of a certain place is determined by it's distance from the equator(latitude) & the altitude of certain place. The range of most of the agricultural plant is between 15° to 40° but different plants have different temperature tolerance.

2.Effect of Temperature during germination:

Germination increases in higher temperature up to a point but once the seed reach optimum temperature "depending on plants", germination begins to decline. So weather it is extreme hot or cold temperature does not affect plants & their growth.

3.Effect of temperature During Growth:

The most notable effect of temperature is observed in the growing duration of the crops. The crops grown in a higher temperature zone mature faster than in lower temperature zone. Various growth promotions like Auxins, Cytokixius, & gibberellium have increased activity at optimum temperature whereas the activity of growth regulators like Abscissic acid is low thus resulting in increased plant growth.

4.Effect of temperature During Reproductive stages:

Exposure of plants to temperature extremes at reproductive stage has a major impact on fruit or grain production across all species. The effect of increased temperature exhibit a large impact on grain yield than on vegetative growth because of increased minimum temperature.

Then, temperature is a primary factor affecting the rate of plant growth & germination. It also plays role in biochemical process, photosynthesis, respiration, transpiration, growth substance and growth duration.

**How do you enhance the temperature of soil? Arvind Jagat Dhami; Roll.no: 35**

Temperature regulates the rate of chemical reaction. Temperature of soil is the important factor for plants growth. Plants root do not grow below $5^0$c or colder. The optimum temperature for germination is $18^0$c and warmer for most of the crops. Soil temperature can be modified for crop production. To enhance the tempr of soil following methods are applied.

a. Mulching: for the regulation of soil temperature the soil is covered by leguminous cover or easily rotten plants parts which is commonly known as mulching. By applying mulch soil surface can modify its temperature. Light color mulch reflects sunlight whereas dark mulch absorbs it. Pale mulch is used to control weeds. Mulching not only increases

temperature but also reserve moisture and preserve soil from dry.

b. Drainage: Draining a soil enables to warm quickly. By removing the water content the temperature of soil increases due to the less specific capacity of soil than water. Raised beds are used to enhance the tempr of soil by drainage.
c. Poly house: poly house increases the temperature of soil as well as the surrounding inside the poly house. Using black roofed poly house increases the tempr more than other due to its absorbing nature.

Normally these are the major practices for increasing soil temperature. By removing the branches of tree near the field to make proper availability of sunlight also increases the tempr of soil at day time. And helps to evaporate the water presence.

**How to enhance the temperature of soil . Explain. Niranjan Kushwaha**

=> Soil temperature is very important factor that affect the germination of seeds . when the temperature is very cold of soil then the seeds cannot germinate properly . So, in this case we should enhance the temperature of soil by using different techniques and tools .Some of them are ;

1. MULCHING: A mulch is a layers of materials required to the surface of soil in order to trap soil temperature . We can use different types of materials for mulching like hay, straw, leaves, shells, old carpets, plastics, etc. In this process we need to cover the soil surface by these materials so that we can trap the heat of soil and enhance the soil temperature .

2. HEAVING: It is an another process to enhance soil temperature . In this process the inner soils are brought up at surface level so that pores could get blocked and heat could escape from soil .In this process also the inner soil which are cold when brought to the surface then it get exposed to direct sunlight and get warmed and easily transmit heat to the inner soils also.

3. BY USING SOIL HEATING CABLES: It is a 48 feet cable which is placed in ground to increase soil temperature . It is safely encased in a tough water proof PVC coating with orange color for visibility .It is placed 3 to 4 inchs below the surface of soil and it can heat about 12 square feet of space .

4. OTHER PROCESS

=> From an experiment it is discovered that generally sandy soil is around 2°C to 3°C warmer than peat or clay soil. So, laying sand over the surface of soil can also enhance the temperature of soil in colder climates.
=> since sun is ultimate source of energy i.e. heat and temperature .So, it can also enhance the temperature of soil. So, avoid shaded areas of soil . we can also add dark compost to our soil because dark surfaces absorbs more sunlight and increase the soil temperature .
=> We can also enhance the soil temperature by building Green House

since ,it trap heat and donot allow heat to escape.
=> We can also enhance soil temperature by burning unwanted weeds on soil surface.

**What do you mean by soil solarization and heaving? Choodamani Joshi, RN 22; Prabha Khanal**

**Soil solarization** is an environmentally friendly method of using solar power for controlling pest such as soil borne plant pathogens including fungi, bactaria, algae, nematode and insects and mite pests along with the weed seed. It is the method of using solar power for controlling seedling in the soil by mulching the soil and covering it with tarp, usually with a transparent polyethene cover to trap solar energy. It may also describe methods of decontaminating soil using sunlight or solar power. This energy causes physical, chemical, and biological changes in the soil. Soil solarization may be a convenient way for managing some soil pests in home garden or small field sites. For the best results, it should be done in open, unshaded areas during the summer months. If the soil is moist but not waterlogged or muddy, water help to conduct heat, so best result is obtained. By this process soil pest should be reduced for 3-4 months. Soil solarization process is completed in 6 weeks.

Soil solarization is an environmentally friendly method of using solar power for controlling pests such as soil borne plant pathogens including fungi,bacteria,nematodes and insect and mite pestes along with weed seeds and seedling in the soil by mulching the soil and covering it with tarp,usually with a transparent.

**Heaving**

Heaving is defined as the resulting upward movement of an underlying soil layer due to the addition of moisture to an unsaturated expansive soil.when water is added to an expansive soil (such as clay) large volume changes occur.This results in an expansion of the soil in an upward direction.

Heaving is the partial lifting of plants out of ground, as a result of freezing and thawing of the surface soil in winter. Heaving can kill perennial forage crops such as alfalfa.

**Conventional, Frontal and Orographic Rainfall By Ganesh kumar Nepali; RN. 26**

**Conventional Rain**

When the land is heated by solar radiation, it warm up the air and rise up. The air get condensed in the atmosphere and causes rainfall. This types of rain is called conventional rain. In dome of the area having irrigation deficiency; it is the main saorce of water as irrigation. Some terai region of Nepal is also depend upon this rainfall for the planting of rice. In mid-hill reason it is the main source of irrigation water.

When the earth surface gets heated up, the air above it gets warmer and expands. As the temperature increases, the amount of water vapor in the atmosphere also increases (due to evaporation). Warmer air has less relative humidity which means it can hold more water vapor. The warmer less dense air moves up and cool down and hence its relative humidity increases and dew point is reached. At this point, the water vapor condenses and clouds are formed which upon further cooling causes rainfall which is called as convectional rainfall. This occurs moistly in tropical areas where there is abundant of moisture in air.

## Frontal Rainfall

Frontal rainfall which is also called as cyclonic rainfall occurs due to the cyclic activities that occurs at the front of cyclone. It is formed when two masses of air with different humidity, density and temperature ( ie. Warm and cold air mass) collides. When a warm air mass replaces the old air mass, it is also called as warm front. Similarly when a cold air mass replaces warm air mass it is called as cold front.

Difference in temperature triggers the condensation process which leads to rainfall. Cold front causes intense precipitation comparatively small areas, whole the precipitation due to warm front is less intense but is spread over comparatively larger area. Eg. Meeting of moisture laden warm tropical wind with a polar air mass. This rainfall steadily for a few days.

The rainfall which formed after the meeting of different air masses having different humidity, temperature and density called frontal rainfall. It is caused by the cyclonic activity along the front of the cyclone. Cyclone is a large scale air mass that rotates around the strong low atmospheric pressure. The layer that separate different air masses called front; has two part; warm front and cold front. At warm front, warm lighter air rises gently over the cold heavy air which still nearest to the earth surface. As warm air rise up it cools and get condensed to form cloud. Moisture present in it causes rainfall and called frontal rainfall. It is steadily for few hours to few days. For eg. Meeting of warm tropical air with cold polar air mass.

## Orographic Rainfall

Orographic rainfall is rain that produce from the lofting of moist air over a mountain. Orographic rainfall produced when moist air is lofted as it moves over a mountain ranger. As the source of precipitation, most of which falls upwind of the mountain ridge and is sometimes called spillover. In the leeward side of the mountain range rainfall is usually low and the area as said to be a rain shadow. Very heavy precipitation typically occurs upwind of a prominent mountain range.

A mountain range in the path of prevalling wind creats moist condition on windward side and dry condition on the leeward side. Warm air present at the base of the mountain range rise up gradually andd cools to the dew point. The air that is forced upward by the mountain range get condensed and losses its moisture and caused rainfall called Orographic rainfall. Some of the air from windward side passes over the mountain and goes downward in leeward side and become warm gradually the makes some humid environment around there. In case of large water bodies air blow from windward side to leeward side so that windward side become drier and leeward side get moist.

There is more stable humid climate in leeward side as compare to windward side which is suitable for production of drought sensitive crops. Drought tolerable crops can be grown in windward side.

**Explain about the different types of monsoon in Nepal and their importance in Nepal.**

=> A monsoon is a seasonal change in the direction of the prevailing or strongest,winds of a region.Monsoon cause wet and dry seasons throughout much of the tropics.Monsoon are often associated with indian ocean.Monsoon always blow from cold to warm regions.There are two types of monsoon that determine the climate of Nepal.They are:

1.Summer Monsoon

2. Winter Monsoon

- **Summer Monsoon**
- Summer monsoon rainfall variability from June to September over Nepal. Summer monsoon generally arrives in early June characterized by violent lightning and thunderstromes and lasts upto the sept. Sometimes 10% of the total annual precipitation can occur in a single day. Similarly 50% of total annual rainfall can also occur within the 10 days of summer. The wind that flows northwestward from the head of Bay of Bengal transports moisture to the region of Nepal. The influence of summer circulation pattern is unequally distributed over the Himalayan of Nepal with greater rainfall in the central eastern part and less in wettest in the eastern part of Nepal like Dhankuta , Taplejung etc.

- **Winter Monsoon**
  The Himalayas act as a barrier to the cold winds blowing from central Asia in the winter and forms the northern boundary of the monsoon wind patterns which lasts from October to April . Winter monsoon is due to the frontal system which generates more concentrated rainfall in the western part of Nepal and very few in the eastern part of Nepal.Winter Monsoon is less powerful than summer monsoon in Nepal it is because the Himalaya mountain prevent much of the wind and moisture of the monsoon from reaching the coast.Winter Monsoon are sometimes associated with droughts.The rainfall can provide upto (1/5) of the annual total rainfall.Similarly,heavy rainfall in December and November is rare.
  Average temperature and rainfall during the peak summer and winter in three most popular toutist area.

| **Place** | **Summer(may,june,july)** | | | **Winter(dec,jan,feb)** | | |
|---|---|---|---|---|---|---|
| | **Max 0C** | **Min 0C** | **Rain (mm)** | **Max 0C** | **Min 0C** | **Rain (mm)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Kathmandu** | **28.1** | **19.5** | **312** | **19.3** | **3.0** | **15.4** |
| **Pokhara** | **29.7** | **21.3** | **829.7** | **20.3** | **7.7** | **26.3** |
| **Chitwan** | **33.0** | **25.3** | **404.0** | **24.1** | **8.3** | **13.8** |

**Importance of Monsoon in Nepal**

**Importance of summer monsoon**

- **Agricultural Importance**
  Agriculture for example relies on yearly rain . Many areas in our country do not have large irrigations systems,surroundings lakes,rivers are snowmelt areas.Aqufires or suppliers of underground water are shallow. The summer monsoons fills the wells and aquifers for the rest of the year.Rice and tea crops that relay o the summer monsoon.Dairyfarms which help Nepal to supply large amount of milk also depend on the monsoon rains to keep healthy and well fed.
- **Industrial importance**
  Some of the industry in Nepal and southeast asia also relies on the summer monsoon. A great deal of electricity in the region of Nepal is produced by hydroelectricity power plants which are driven by water collected during the monsoons.Electricity powers hospitals,schools and businesses that help to flourish the economic condition of Nepal.

- **Reduces the import of goods from foreign country**

  When the summer monsoon is late or weak ,the regions economy suffers.Fewer people can grow their own food and large agribusiness do not have produce to sell. So,the would be compoltion to import goods from foreign country.So we can say summer monsoon as Nepal's true finance minister.

  **Importance of winter monsoon**

  Precipitation during the winter season has great importance in agriculture,particularly for the Rabi crops.Wheat among them is one of the most important crops which helps to meet Nepal food security problem. In some parts of Nepal there is some dryness after summer monsoon which is wet by rain of winter monsoon.So in that type of place winter rain helps to flourish the agriculture.

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**What happen to the plant if it does not receive sufficient sun light? Pramod Shah**

Ans:- If plant does not receive sun light then following effect can be occur which is listed below :

1 ) Plant cannot survive without the presence of sunlight except sciophytes such as betel vines, buck wheat, turmeric ,etc.

2 ) It decreases the rate of respiration and thus disturb the photosynthesis respiration balance.

3) It disturbs the seed germination; leaf expansion ; growth of stem ; and shoot ;flowering ;fruiting ;and even dormancy.

4) Many species produce maximum dry , matter under high light intensity if water is available in plenty also disturb .

5) Long day plant cannot survive in the absence of sufficient sunlight.

6) Very low intensity of light helps in the closing of stomata and thus transpiration stops .

7) Plant cannot prepare their own food and their food cycle will be disturbed .

**Explain about photorespiration and why it is not considered as good for plants? Niranjan Kumar Kushwaha**

When is hot and dry, plants closes their stomata to prevent water loss. As a result, carbon dioxide levels in the plants cell decreases and oxygen levels rise. This results in photorespiration. Photorespiration is a wasteful chemical process by which plants use oxygen and releases carbon dioxide rather than using carbon dioxide. Photorespiration prevents plants from using their ATP and NADPH to synthesize carbohydrates. Photorespiration also competes with Calvin cycle. Photorespiration is not considered as good for plants because it releases toxic compounds and fixes far less energy than photosynthesis. Photorespiration is a problem faced by many species of plants on hot dry days. When plants photosynthesize normally, two molecules of G3P are produced per reaction. After a series of additional chemical reaction, these G3P molecules are used to produce glucose, which the plants later breaks down for energy. Photorespiration is far less efficient at storing energy than photosynthesis. It produces only one molecule of G3P, along with a toxic phosphoglycolate molecule that the plant must spend energy to convert to a non-toxic substance. So, due to these all reasons photorespiration is not considered as good for plants.

**Explain about photorespiration? Why it is not considered good for higher yield? Narayan Bhusal**

**Photorespiration** (also known as the **oxidative photosynthetic carbon cycle**, or **$C_2$photosynthesis**) refers to a process in plant metabolism where the enzyme RuBisCOoxygenates RuBP, causing some of the energy produced by photosynthesis to be wasted. The desired reaction is the addition of carbon dioxide to RuBP (carboxylation), a key step in the Calvin–Benson cycle, however approximately 25% of reactions by RuBisCO instead add oxygen to RuBP (oxygenation), creating a product that cannot be used within the Calvin–Benson cycle. This process reduces the efficiency of photosynthesis, potentially reducing photosynthetic output by 25% in $C_3$ plants.[1] Photorespiration involves a complex network of

enzyme reactions that exchange metabolites between chloroplasts, leaf peroxisomes and mitochondria.

The oxygenation reaction of RuBisCO is a wasteful process because 3-phosphoglycerate is created at a reduced rate and higher metabolic cost compared with RuBP carboxylase activity. While photorespiratory carbon cycling results in the formation of G3P eventually, there is still a net loss of carbon (around 25% of carbon fixed by photosynthesis is re-released as $CO_2$)[2] and nitrogen, as ammonia. Ammonia must be detoxified at a substantial cost to the cell. Photorespiration also incurs a direct cost of one ATP and one NAD(P)H.

While it is common to refer to the entire process as photorespiration, technically the term refers only to the metabolic network which acts to rescue the products of the oxygenation reaction (phosphoglycolate).

**Explain how can we improve the efficiency of C3 plant for higher productivity? Roll 39 Lokendra Bist**

Ans: The plants which use C3 pathway for carbondioxide assimilation are called C3 plants.C3 plants includes both monocots(eg:barley,wheat,rice and oat) and dicots(eg:soybean,pea, peanut and sunflower).The assimilation process is catalyzed by an enzyme called ribulose 1,5-biphosphate (or simplyRuBP).

In C3 plants at high temperature stomata is closed, so that carbondioxide is not able to diffuse.Then the concentration of carbondioxide in leaf is low, which reduce the rate of photosynthesis in C3 plants and increase the rate of photo- respiration.To improve the efficiency of C3 plants we must have to maintain the carbondioxide concentration,temperature and light by applying green house effect method.In green house effect condition the concentration of green house gases like carbondioxide is high.Then stomata open and able to diffuse carbondioxidr easily.Which results the rate of photosynthesis in C3 plants will increase.Increasing the carbondioxide concentration in the to 0.10% is known to double the rate of photosynthesis in C3 plants by reducing the rate of photorespiration. In this way we can improve the efficiency of C3 plants for higher productivity.

**Why is c4 plant more efficient then c3 plant at high temperature?**

C3 plant is three carbon containing compound called phosphoglycerate. The c3 plant also called calvin cycle. The calvin cycle of photosynthesis in which the first product after $co_2$ fixation are 3 carbon molecule. In c3 pathway of $co_2$ fixation the biochemical reaction involved occur in stroma of the chloroplast. At high temperature leaf stomata close to conserve energy. So, co2 concentration low and co2 from mesophile cell cannot go inside. Here, oxygen bind to rubisco enzyme instead of co2 through a process of photorespiration. Here, ribulose enzyme nature change and it take O2 instead of co2. So, it cannot formed carbon and formed other compound and sufficient amount of sugar cannot formed.

c4 plant is 4 carbon containing molecule called oxaloacetate . c4 plant also called hatch- slack cycle of photosynthesis .In which the first product after carbon fixatation are 4 carbon molecule in which calvin cycle also formed . c4 plant have 2 type of photosynthetic cell i.e. mesophile cell

and bundle sheath cell . mesophyll chloroplast are randomly distributed along cell wall , where as bundle sheath chloroplast are located close to the vascular tissue .At high temperature bundle sheath cell present which carry co2 inside . So sugar formation take place and phoitosynthesis also take place . c4 plant have higher photosynthetic ability than c3 plant because of their high light saturation and temperature. Hence, c4 plant more efficient than C3 plant at high temperature .

**Explain the green house effect. Lokesh Dhami**

The green house effect is warming of the Earth atmosphere through the activities of certain gases that block the re-emittence of solar energy that reachea tha earth. About 85 % of solar radiation reaching the earth is absorbed by water vapour in atmosphere. The remainder is reflected back to the earth is due to accumulation of co2 , methane, chlorophlorocarbon (cfcs) and nitrous oxide, among others. These gases are called green house effect.

There concentration in the atmosphere is fluenced by human activities such as the burning of fossi fuels (that increases carbon dioxide content of the air) .

These gases act as a shield or glass pone that allown light in but reflects radiation back to the earth. This re-radiance is less energetic. Having long wavelength the atmosphere gases filter the harmful short waves during the entry process.

Without greenhouse effect gases, the earth surface temprature would be about -18degree centgrate and thus susvitable for crop production. On the other hand. Excessive heat also has consequences by way of climate production. Some of expected effects include drought that cause crop production in affected regions to be moisture – stressed and less productive. In region where ice occurs and high temperature cause ice to melt raising the see level and causing flooding in lowland.

To reduce these possible effect of global warming from the greenhouse effect ,government may institute legislation to control the emission of greenhouse gases into the atmosphere, law are currectly in place in certain countries to regulate the emission of exhaust fumes of automobiles, the burning of forests, and the use of CFCS. “Green house gases are “ Gases, especially carbon dioxide, that create a barrier in the atmosphere against the re-radiation of heat leading to the greenhouse effect.

**What do you mean by crop growth? Bipana Joshi**

crops growth is the irreversible quantitative increase in size,mass or volume of crops or its parts respond to environmental factors.
It involves the coordination,growth and longevity of new vegetative and reproductive parts. Newly produced cells from the division of meristematic cells undergo change and specialization through differentiation ,a process called morphogenesis. The activities of various meristems produce change in crop growth. The shoot meristem supported by intercalary meristem in the internodes produces enlogation in the crops .Also,axillary meristem in leaf axils produce branches, while lateral meristems produce increase in girth.
Since the fruits and seed are commonly the economic yield of most crops plant,crop producers are especially interested in reproductive development. flowering plants have two phases of

development i.e; vegetative and reproductive. At a certain stage in the development, the shoot apices change from the vegetative phase to the reproductive phase. The environment induces this conversions. The yield of the crop depends on the extent to which the conversion occurs,thus making it critical for a crop to complete its reproductive phase during the growing season and without stress. For high productivity,there has to be a good balance between the two phases. A protracted vegetative phase reduces reproductive functions .So,good vegetative development is needed to support good reproductive development.

**What is wind? How does the wind velocity affect the plant growth..?? Deepak Ojha**
Wind is the flow of gases on a large scale. On the surface of the Earth, wind consists of the bulk movement of air. In outer space, solar wind is the movement of gases or charged particles from the Sun through space, while planetary wind is the outgassing of light chemical elements from a planet's atmosphere into space. Winds are commonly classified by their spatial scale, their speed, the types of forces that cause them, the regions in which they occur, and their effect.

Wind greatly affects plants throughout their growth. When plants are seedlings, slight breezes help them grow more sturdy. Wind at gale force can damage or even break and blow down the strongest tree. The storm damage can occur in winter, summer, fall or early spring. Winter wind is particularly damaging because plants are unable to replace the water they lose and become desiccated. In many areas, wind causes more winter plant desiccation than sun. strong winds occur mainly in late winter. Temperatures then often begin to fluctuate between mild and severe. Mild days, especially several in succession, may lower the cold hardiness of some plants. A **burlap wind break supported with stakes provides protection from winter cold and wind. Or place a ring or wire mesh around each plant and fill it loosely with straw or oak leaves. Any materials placed around plants should be loose enough to allow som**e movement of air.

Plants vulnerable to wind include not only less hardy specimens, but also many hardy plants not adapted to open situations, including forest natives such as hemlock. Wind-whipped plants may suffer broken roots. Fruit trees do not bear when wind tears off the blossoms. Wind retards growth through increased cold, as seen in the "cold bands" on corn leaves when chilling temporarily halts growth, or through reduction of photosynthesis because less leaf s**urface is death ....so wind can** affect many other cause to affect the plant..

**Explain how and why wind velocity and direction affect plant growth? Sanjay Chaudhary; RN.79**

Wind velocity greatly affects throughout their growth.When plants seedlings breezes help them grow more strongly.A very strong wind can damages or break and blow down the strongest tree. Winter wind is particularly damaging because plants are unable to replace the water they lose and become desiccated. This process is similar to an ice making,it will gradually become smaller. Wind causes more plant desiccation than sun.

Persistent strong winds mainly occurs in late winter.

Temperatures begin to fluctuates between mild and severe.

The wind chill factor heightens the effect cold:20° F with a 40 mph wind is as chlling as - 10°F and 5 mph wind.Plant located near the house, particularly on the east get fairly good wind protection. Soil near the do not freeze deeply and the east wall protects from the late afternoon winter sun. The Southside also offers wind protection but excess warming of marginal plants in that location causes damage. North sides of buildings allow some wind damage but the protection from winter sun often enables certain plants to survive quite well.

- **Wind velocity affects plant growth in two ways:**

(1) Physiological impact:

(I) Increases transpiration especially cuticular transpiration than stomatal transpiration.

(ii) Hot wind accelerates the drying of the plants by replacing humid air by dry air in the intercellular spaces.

For example, rice crop during June-July months shows tip drying.

(iii) Wind increases turbulence in the atmosphere and availability of $CO_2$ and there by increased photosynthesis.

(iv) Beyond a certain wind speed the rate of photosynthesis becomes constant.

(2) Mechanical impact on plants:

(i) Strong wind damages the shoots

(ii) Lodging (Paddy, Sugarcane, Banana etc.,)

(iii) Flower and fruit shedding

(iv) Crops and trees with shallow roots are uprooted.

(v) Cold wind causes chilling injuries

(vi) Causes soil erosion

(vii) Soil deposition causes poor aeration in root zone.

- Protection of plants from wind damage:

Shelter belts and wind breaks: Growing of trees and tall crops across the direction of prevailing wind to reduce the physiological and mechanical damage to crops. Wind breaks reduces the wind velocity and creates favourable microclimate.

**What happen when plant don't get sufficient sunlight? Maheshwari Bohara; RN-42**

The process by which light, energy, chlorophyll, water, and carbon dioxide all come together to produce the starch and sugar plants need for survival .All plants require some sunlight,however some require more than others when plants grow tall and spindly , it is because they are stretching in search of more sunlight.

Plant can exhibits other symptoms when they do not receive the require amount of sunlight. yellowing of new foliage or the lower plant leaves is an indication of insufficient light .plants also exhibits other symptoms such as pale colour , small leaves and poor growth in addition to failure to flower and long thin stems. without sufficient light , plant decline and die due to their inability to manufacture food through photosynthesis.

If the plants do not get sunlight , they cannot produce chlorophyll and they will lose their green colour and die too.

When plants do not receive enough sunlight, you might notice them leaning and growing toward window indoors or becoming leggy and weak outdoors.

All the plant need sunlight which is six to eight hours daily,  while others need partial sun , which is three to four hours of direct sunlight . Even shadow loving plants need some sunlight they can manage with only two hours of sunlight daily.  Plants with lower sunlight requirement usually grow slower than sun-loving plants.
Weaking of plants occurs when its stems grow longer and more rapidly than normally because of lack of sunlight. Spindly plants in search of light lose strength, have long internode and few leaves.

**Vernalization By Sweta Adhikari**
Vernalization is derived from Latin word 'vernus' which means 'of the spring'.
It is commonly known as chilling treatment.
There are some plants like wheat which need chilling treatment for flowering and vegetative propagation. Vernalization is the artificial exposure of plants or seeds to low temperature in order to stimulate flowering or to enhance seed production. It is mainly required for temperate zone plants. The knowledge of this process has been used to eliminate the normal two year growth cycle required of winter wheat. Although this chilling treatment is used even for seed germination but the main aim of this is encouraged in fruit propagation and flowering stage. The time this treatment is done is calculated as chilling hours. The typical vernalization temperature is between 5-10°C . Wheat must go through a prolonged period of cold before flowering occurs.

**Vernallization By Basudev**

The induction of flowering of plants by exposure to the prolonged cold of winter or by an artificial equivalent. In another words vernalization can be called yarovization or cold treatment or chilling treatment. Vernalization was first reported in 1857 by Klippart. During vernalization the hypothetical hormone called vernalin gets active in low temperature about 273K-283K which reduces the vegetative period and induces the early flowering. Vernalization increases the resistance for cold as well as fungus infection. By the application of vernalization,biennial varieties can be converted into annual varieties.Similarly vernalization also helps to convert spring variety into winter variety.

(X days)

🔹 ----------》

Seed  Room Temp.  No flower

(X days)

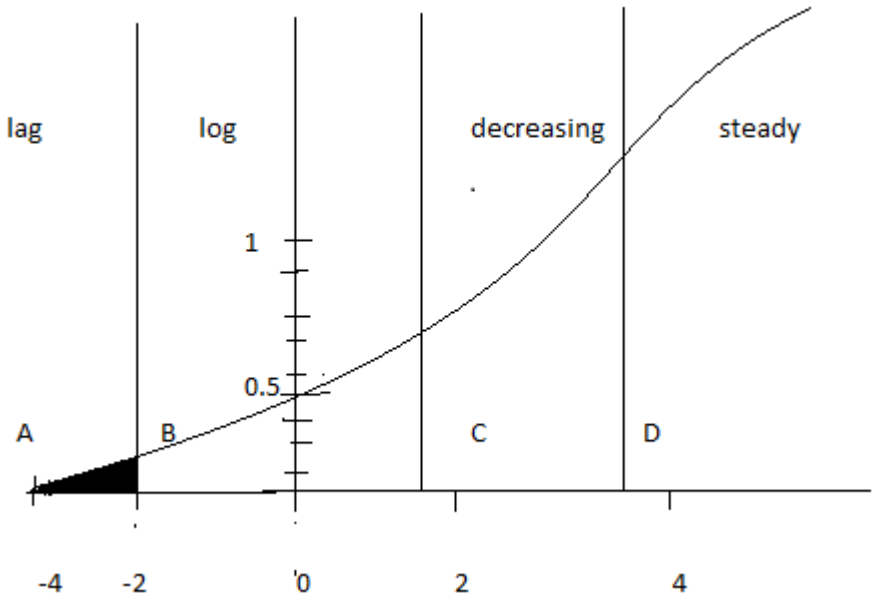
🔹 ----------》

Seed ( 273K-383K) flower

Define growth? Different phases of crop growth. By Louis Rijal
Growth is a progressive and irreversible process that involves three activities - cellular division, enlargement and differentiation.

The different phases of crop growth are as follows

1) **Lag growth phase:** This phase includes activities in preparation for growth. Dormant cells become active; dry tissue imbibes moisture; cells divide and increase in size; the embryo differentiates
2) **Logarithmic growth phase:** During this phase, the plant experiences an ever increasing rate of growth. Events that occur in this phase includes germination and vegetative growth.
3) **Decreasing growth phase:** The decreasing growth phase is characterized by a slowing down of the rate of growth. The plant activities during this period include flowering, fruiting, and seed filing.
4) **Steady growth Phase :** The growth rate either declines or stops during this phase . plant activities in this phase include maturation .



**Explain Sigmoid Curve orS-phase?**

**Sigmoid curve or s -curve By Nabin Oli**

The curve can be shown appearing slowly along the line and stabilizing.

During the initial stage, i.e., during the lag phase, the rate of plant growth is slow.

Rate of growth then increases rapidly during the exponential phase. After some time the growth rate slowly decreases due to limitation of nutrients.

This phase constitutes the stationary phase.

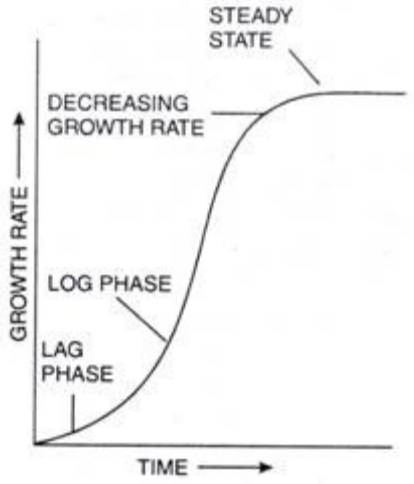



**Fig. 17.1.** Sigmoid curve.

The sigmoid curve represents the integrated sum of the curves for each growing organ and cell and presents the changing size of these parts. Similarly, when dry weight is measured as an index of growth before maturity, the curve takes the well known sigmoid form. Environmental conditions may alter growth rates but not the sigmoid form of the growth curve.

**What do you mean by crop growth? Nischal Pandey**

Crop growth is an important natural phenomenon occurring in plants life.It is the process of increase in the size by cell division and enlargement, including synthesis of new cellular material and organization of sub cellular organelles. It is irreversible and permanent change in mass. Major components for crop growth are ¡) cell division and ¡) cell enlargement. The growth can be measure by increase in fresh weight ,increase in dry weight, volume,length,height,surface area. The ultimate goal of crop growth and production is the yield of an economic plant production. Crop growth is a complex operation . It success depends on both the crop and environmental factors , coupled with socioeconomic and political factors.

Crop growth is very complex phenomenon and a product of a series of complicated interaction of soil ,plant and weather.

Crop growth is less than potential when the uptake of water , oxygen or nutrients is less than the demand of the crop.

**What is minimum, maximum and optimum temperature? Sonu Singh, RN. 87; Avash Bhattarai**

Temperature is a measure of intensity of heat energy. The range of temperature for maximum growth of most of agricultural plans is between 15 & 40 degree centigrade. The temperature of place is largely determined by its distance from equator (latitude) and the altitude.

1] Maximum Temperature:

→It refers to maximum temperature limit above which the growth and development of the plant ceases out. The tolerance capacity to maximum temperature varies widely depending upon the crop species. The maximum temperature range for winter crops lies in range of 30-35˚C whereas this range lies in between 45-50˚C for summer crops.

2] Minimum temperature:

→It refers to minimum threshold temperature below which the plant growth and development ceases. Generally for winter season crops this lies within 0-5˚C whereas in case of summer season crops the range is between 15-20˚C.

3] Optimum temperature:

→The favorable temperature range in which the growth and development of plant is at its best is termed as optimum temperature. For most of winter crops the optimum range lies within is -22˚C whereas for summer season crop, it lies in range of 25-35˚C.

**Cardinal temperature for some of the crops are listed here below:**

| Crop | Temperature(˚C) | | |
|---|---|---|---|
| | Minimum | Maximum | Optimum |
| Wheat | 3-4.5 | 30-32 | 25 |
| Barley | 4.5 | 29-31 | 20 |
| Rice | 10-12 | 36-38 | 30-32 |
| Maize | 8-10 | 40-44 | 32-35 |
| Saghum | 8-10 | 40 | 32-35 |
| Tobacco | 13-14 | 35 | 28 |

**Explain about the abiotic and biotic factor affecting plant growth. Samarpan**

The main abiotic and biotic factor affecting plant growth are as follows:

**Abiotic factors:**

Abiotic factors are the non-living part of the environment which plays an important role in plant growth. It includes water, sunlight,oxygen,soil and temperature.

Water ; Water is a very important abiotic factor.It is often say that,"water is life." Plant needs water for proper growth and photosynthesis.Even plants that live in the desert need a little bit of water to grow.

Sunlight; Sunlight is rhe main sources of energy which is necessary for photosynthesis and formany other function of the plants including seed germination,leaf expansion,growth of stem and shoot, flowering,fruiting and even dormancy.

Oxygen; Oxygen is also an important factor for plant growth. Without oxygen plant cannot live.For proper plant growth plant needs oxygen for respiration.

Soil; soil is often considered as abiotic factor.since it is mostly made up of small partical of rock(sand and clay) mixed with decomposed plants and animals plants used their roots to get water and nutrition from the soil for proper growth of the plant.

Temperature; Various growth promoters like auxins, cytokinins and gibberellins have increased activity at optimum temperature whereas the activity of the growth regulators like abscissic acid is low thus resulting in increased plant growth.

**Biotic factors:**

Biotic factors are all of the living things in an ecosystem. The biltic factors affecting plant growth are as follows:

Producer; All plants,such as grasses and trees are producers.These absorbs the sun energy and convert the energy into food for themselves allowing them to grow larger,make flower and seeds.

Consumer; Consumer depends upon the producer. When they eat the producer the number of producer decreases and affect the plant growth.

Decomposer; These organism break down dead material into soil and return nutrients to the soil so, tgey can be reused by producer for proper growth.

**What is microclimate? And what are the causes of microclimate? Hem Raj Joshi; RN. 33**

**Microclimate**, any climatic condition in a relatively small area, within a few metres or less above and below the Earth's surface and within canopies of vegetation. The term usually applies to the surfaces of terrestrial and glaciated environments, but it could also pertain to the surfaces of oceans and other bodies of water. The term may refer to areas as small as a few square meters or square feet (for example a garden bed or a cave) or as large as many square kilometers or square miles.

Examples of microclimate:  near bodies of water which may cool the local atmosphere, or in heavy urban areas where brick, concrete, and asphalt absorb the sun's energy, heat up, and re-radiate that heat to the ambient air: the resulting urban heat island is a kind of microclimate.

Causes of micoclimate:

1.Microclimates are caused by local differences in the amount of heat or water received or trapped near the surface. A microclimate may differ from its surroundings by receiving more energy, so it is a little warmer than its surroundings. On the other hand, if it is shaded it may be cooler on average, because it does not get the direct heating of the sun. Its humidity may differ; water may have accumulated there making things damper, or there may be less water so that it is drier.

2. Another contributing factor of microclimate is the slope or aspect of an area. South-facing slopes in northern hemisphere and north-facing slopes in southern hemisphere are exposed to direct sunlight than the opposite slopes and are more warmer for longer period of time, causing more warmer microclimate.

3. Vegetation also helps in causing microclimate. The types of vegetation we select directly helps in building a microclimate. Many plants help to lower the temperature which causes a cooler microclimate but some plants like maize increase the surrounding temperature causing a warmer microclimate.

4. The human built large structure also help in creating their own microclimates. Tall buildings create their own microclimate, both by overshadowing a large area and channeling strong winds to ground level, causing a different kind of microclimate.

**Explain about determinant and indeterminate growth with example By Anita Regmi**

Determinant growth:plant growth in which the main stem ends ends in an inflorescene or other reproductive structure and stops continuing to elongate indefinitely with only branches from the main stem having further and similar restricted growth.

Also: growth characterized by sequential flowering from the central or uppermost bud to the lateral or basal buds.

Indeterminate growth:it is the growth that is not terminated in contrast to determinate growth that stops once a genetically pre-determined structure has completely formed.

E.g: determinate tomatoes or bush tomatoes are variety that grow to a compact height (generally 3-4) determinate stops growing when fruit sets on the top bud.....

And indeterminate tomatoes will grow and produce fruit until killed by frost .they can reach heights of up to12 feet . although 6 feet is normal.

**Explain about determinate and indeterminate growth with example. By Prabin Dangi**

DETERMINATE GROWTH:- The process of growth pattern in which the vegetative growth ceases when the apical meristem converts from vegetative growth to reproductive structure is known as determinate growth. Examples for specific organisms are the "leaves" of plant, seeds, flowers, and fruit. The varieties of tomatoes like Roma Celebrity, Rutgers etc. can be taken as the examples of plants which shows determinate growth. The floral meristem is main subject responsible for determinate growth.

When a leaf or any specific organisms stops growing it is due to the production of retardant hormones. The plant releases these hormones to specific sites of the plants (eg:-leaves) causing

them to yield in growth. If these hormones wouldn't be released every organ of the plants would keep growing.

INDETERMINATE GROWTH:- This is the process of a open ended growth pattern in which organisms or organ continues to grow as long as it lives. This behaviour is found in shoots and roots of plant. It is a pattern of bud development associated with continual twig elongation and bud formation until twig growth is stopped.

The shoot apical meristem is one of the main factor responsible for indeterminate growth. It becomes the inflorescence meristem which produces floral meristem until the plant dies.

Root apical meristem also plays an important role in indeterminate growth.it is undifferentiated tissue at the apex of root that gives rise to the organs of 'root'. It also plays a critical steps im setting up dimensions and thickness of the root axis and supply of cells to the zone of elongation.

**What is microclimate? Explain the factors affecting the micro climate.**

**:-** A micro climate is a local set of atmospheric condition that differs from those in the surrounding areas often with a substantial. One the term may refers to areas as small as a few square meters or square feet or as large as many square km or square miles. Microclimate exists for example near bodies of water which may cool the local atmosphere or in heavy urban areas, where brick, concentrate and asphalt absorb the sun's energy heat up and re-radiate that heat to the obient air. The resulting urban heat island is a kind of microclimate.

Another contributing factor of microclimate is the slope or aspect of an area. South facing slopes in the northern hemisphere and the north facing slope in southern hemisphere are exposed to move direct sunlight than opposite slope and are there the fore warm for longer.

**Factors affecting microclimate:**

- **Topography:-**

  The shape of land is a significant influence on microclimates while on a large space weather systems have a certain predictability (related to the rotation of earth and the interplay between land and ocean). These patterns can get disrupted at the local level by topographical features such as aspect and slope.

  The angle of slope in the geographical feature is a major factor in determining the influence of wind and water on a site.
- **Soil:-**

  The composition of the soil affects microclimates primarily through how much water it retains or which evaporates from it. A soil that has a large portion of clay retains more moisture.

  The degree to which a soil retains moisture affects the humidity and temperature of the air above it. After heavy rains, the soils can contain a lot of water and modify microclimates much like a body of water such as a lake.
- **Water:-**

  It is not just the moisture level within the soil that can affect a microclimate, the water stored on the surface of the land is also important. The presence of lakes and reservoirs can

create a more moderate climate while ponds, streams and other bodies of water on our site will impact upon the temperature of the surrounding area in our garden.

- **Vegetation:-**

  Vegetation is naturally adapted to make the most of its climate of origin. So for instance plants that originator in tropical area tend to have broad, dark levels that allows for the maximum absorption of sunlight and the effective transpiration of moisture back into the air, which will in turn influence the microclimate in the immediate vicinity.

- **Artificial structure:-**

  Microclimates are dynamic things as our site changes through maturation of planting, siting of artificial structure and even confouring of the land. So the microclimate will alter the good things that we can directly influence how this happens by our design choices and so make the maximum use of every microclimate niche our property.

**Explain about importance of relative humidity for plant growth ? High humidity and low humidity effect. Srijana chaudhary**

Water is always present in the atmosphere in the form of invisible water vapor, normally known as humidity of the air. Relative humidity is the ratio between the actual humidity present and the saturation humidity possible at that temperature. Humidity is important to make photosynthesis possible. In case of Anthurium, good humidity around the plant is even more important than for most other crops, because the plant can only absorb a reduce amount of humidity and hence has less water evaporation than most plants. If the plants losses too much water, the stomata will close with the result that photosynthesis stops. If this happens, no further $CO_2$ can be absorbed and $CO_2$ is required to keep the photosynthesis going. Effects are:

**High Humidity:**High humidity promote the growth of mold and bacteria that causes plant to die and crop to fail, as well as condition like root or crown rot. It also invite the present of pest such as fungus whose larva feed on plant root and thrive in moist soil. When humidity is too high ,plant cannot make water evaporate or draw nutrients from soil.

**Low humidity:** When the humidity is low a plant may close its stomata to reduce water losses. The stomata also act as a cooling mechanism. When ambient condition are too warm for a plant and it closes its stomata for too long in an effort to conserve water, it has no way to move $CO_2$ and $O_2$ molecules, slowly causing the plants to suffocate an water vapor and its own transpired gases.

**What is green manure? Characteristics of green manure.**

Green manures, although bulk in nature are specially grown for incorporation into the soil for improving the nutrients status of the soil. Usually legumes are popularly used as green manure as they have dual advantages; one they add nutrient into the soil via their decomposition and secondly they have the capacity of biological nitrogen fixation. Eg. Dhaincha, Sun hemp, legumes.

**Characteristics:**

- ❖ Green manure are plants grown on the soil than turned back into the soil.
- ❖ They bring nutrients from an outside and them to the soil.
- ❖ Most of the green manures are leguminous plants.
- ❖ They are of multiple purpose.
- ❖ High nitrogen accumulation rate .
- ❖ They are widely accepted because they do not destroy the soil.

**Explain about important of relative humidity for plants growth?**

- Relative humidity is the ratio between the actual amount of water vapour present in air and the maximum amount of water vapour in air that can hold at a given temperature.

Relative humidity has a direct influence on the physiological process that occurs in the plants. These is direct relation between relative humidity, transpiration, temperature maintenance and photosynthesis. So the correct maintenance of the humidity is necessary. Fluctuation in the RH hampers the normal growth of plant.

I) Effect of RH of transpiration

Transpiration occurs when the humidity in air is low so that the water vapour present in the mesophyll diffuse out i.e( transpiration ). If the humidity is too high than transpiration can't proceeds. Due to excessive accumulation of water within the plant, plant cell can brust and die.

If the humidity is too low then there is excessive loss of water due to high transpiration rate so that the plant get dehydrated.

II) Effect of RH on photosynthesis

AS already discussed, low humidity finally leads to dehydration. This causes the stomata to close due to the change(decreases) in the turgor pressure in the guard cell. Stomatal closer cause the less absorption of CO2, which is needed for photosynthesis. As the photosynthesis is hampered plant growth decline.

III) Effect on the temperature of the plant

- Low humidity proceeds the transpiration process whereas transpiration proceeds the temperature balance of plant body (by loss of overheat in the form of water vapour). This mechanism is called plant humidification method for temperature balance of plant body.

In the green house, air humidification method is applied for the temperature balance within the green house and plant body. In green house high humidity pressure is maintained so that water is in the form of fine mist. In order to allow the water mist to evaporate, energy is extracted from the atmosphere. This makes the temperature of the green house drop, as well as making green house moist. During sunny day, high humid pressure cause imadiation of the plant so that temperature of the plant maintains automatically.

Very high relative humidity

- Increase heat load of plants
- Reduce CO2 uptake
- Reduce transpiration influences translocation of food materials and nutrients

Very low relative humidity

- Increase evapo-transpiration
- Dehydration of plant (wilting effect)
- Stomatal closure

**Explain Hopkins Bio Climatic law and Orographic Effect. By Birendra Chaudhary, RN.20 and Rajan Phulara**

**Hopkins Bio-climatic law:**The phenological events in temprate North America are generally altered about 4 days for each change of $1^{\circ}$ of latitude northward , $5^{\circ}$ of longitude and 122 meter or 400 feet of altitude upward , the vernal alteration being retardation ( as of flowering ), the autumnal being acceleration ( as of leaf fall). This process of altering on the days due to change in latitude, longitude and altitude is the basic principle of Hopkins Bio- Climatic Law.

**Orographic Effect:** On a hot day, you might noticed water beach forming on the outside of a cold glass of water. This is caused by water vapour in the air cooling of from the cold of the glass and then condensing on to the glass. The same occurs when a weather system runs in to a mountain. As the system moves of side of the mountain, the temperature drops, causing water vapour in the air to also cool off and condense. Rain that results from this process is known as Orographic Rain.

The side of the terrain or mountain that causes the orographic lifting and that receives orographic rain is called the windward side. The windward side tends to lush with vegetation due to an abundance of precipitation. While the other side i.e leeward side, is dry and warm and results in dry spell called rain shadow effect . Many times you must have noticed that the mountaneous regions of the world receive more rainfall as compared to the coastal areas. These occurrences are attributed due to orographic effect.

Hence, Orographic effect is an atmospheric condition which is triggered as a result of forced upward movement of air upon encountering a mountain or high land this phenomenon eventually results in precipitation on the windward side of the mountain and rain shadow on it's leeward side. Orographic effect is also a term used to describe changes to air flow when the topography of the land forces air upward. These changes can cause disturbance in the weather system. For example as a weather system moves up a mountain, the temperature and pressure will change, offentimes resulting in some form of precipitation.

**Explain about five positive and negative effect of light on crop growth/yield? PAWAN KATHAYAT; ROLL NO;57**

Light play a vital role in plant growth/yield.It is required for germination,leaf expansion,growth of stem and shoot,fruiting,flowering,and thermal condition necessary for the physiological function of plant.some of the positive and negative effect of light on plant growth are listed below;

1. Photoperiodic effect

Day length is called photoperiod or light period. Day length is defined as the duration from the sunrise to sunset, which also includes the morning and evening twilights. Photoperiodism is the response of plant growth and development to photoperiod or light period relationship. It has been

observed that the initiation of the reproductive phase in the plants is initiated when certain duration of light period is obtained. Based on the duration of light period required, the plants are classified as a) short day plants b) long day plants and c) day neutral plants.

Short day plants are those whose reproductive phase is initiated when period of shorter light duration (maximum of about 12 hours) is provided e.g. rice, soybean, sesame, cowpea etc. Similarly, the long day plants require longer light duration (minimum of 13 hours) for the initiation of reproductive phase e.g. wheat, barley, oat, lentil, chickpea etc. Day neutral plants on the other hand do not have any specific requirements of duration of light period for the initiation of the reproductive phase e.g. buckwheat, sunflower, cotton, tobacco, majority of maize varieties and some varieties of cowpea.

2. Photosynthetic effect

Solar radiation intensity has its influence on photosynthesis of the plants. It is affected by quantity and quality of light. In general higher is the solar radiation higher is the photosynthetic rate. Normally, higher solar radiation intensity is suitable for most of the crop plants but the requirement varies with plant to plant, with their varieties and with their stages of growth. The radiation that utilized in the photosynthesis process includes the wave lengths ranging from 0.36-0.76 micron known as photosynthetic active radiation.

Not all the waves in solar radiation spectrum are equally important in plant growth and development processes. For example the radiation below 0.25 micron is harmful to the plants and that above 0.76 micron has almost heat or thermal effects only. In the colour spectrum of solar radiation wave of different colour bands have different effects on the plants. Yellow, orange and red bands are important in photoperiodism. Similarly, blue, orange and red rays are important in photosynthesis.

3. Photothermic effect

Another important influence of solar radiation intensity is in terms of increase in the plant temperature with the increase in the level of solar radiation intensity. The temperature of the air and soil affects all the growth processes of plants. Higher heat builds up in the plants result in increased transpiration demand. Plants increase their transpiration demand in order to dissipate the heat to maintain required plant temperature. Light also influenced on stomata and their opening and closing also. Usually leaves developing under full sunlight condition have reduced size and closer arrangement of stomata than the plants grown in shade

4. Seed dormancy and germination

Solar radiation or light also influenced on seed dormancy and germination. Depending upon the light requirement during seed germination, seeds of some plant species are classified as positively photoblastic and negatively photoblastic seed. Seeds of some plant species like lettuce, tobacco etc will not germinate in the absence of light and are called positively photoblastic seed. On the other hand, seeds of onions and amaranthus will remain dormant if exposed to light and these are called negatively photoblastic seed.

5. Chemical composition of crops

Cool bright conditions favor the conversion of starch into sugar. Crops grown in sufficient light have decreased acidity of cell sap, high C:N ratio, low K, Ca and P content.

- Principal of agronomy.
- www.farmersweekly.co.za.com

**What is photoperiodism? Explain about short day, long day & day neutral plants with example.**

**-:** Photo periodism is a differentiation of maximum duration of light exposed to the plant for flowering. It refers to the length of dark and light periods. Many flowering plants have protein that can sense seasonal changes in light. A plant will flower depending on these changes.

The effect of photoperiodism in plant is not limited to when they will flower. Photoperiodism can also effect the growth of other parts as well. Such as roots & stem. Additionally photoperiodism affects the loss of leaves in some plants during different seasons.

Each plant has a different photoperiod that it requires to flower and propagate. Plants generally falls into three photoperiod categories :-

- Long day plants
- Short day plants
- Day neutral plants

Long day plants generally flower during summer months when nights are short and days go longer, eg. Carnations & oats. On the other hand short day plants flower during seasons that have longer periods s of night. They require continuous amount of darkness before they flower, eg. Cotton, soybeans, rice. However some plants referred to as day neutral plants do not flower based on a particular photoperiodism.

1. **Long-day plants :-**Long day plants refer to the flowers that requires long light hour and short darkness hour before blooming. These plants require much less darkness to begin the process of flowering.
   Eg. California poppies and spinach are long day plants.
   A plant classification as a short-day plant on long day species is determined by photoperiodism. Manu flowering plants and vegetables are affected by photoperiodism. Some long day plant's examples are-: fox-globe, lettuce, petunias & hibiscus.
   The term long day may imply a plant needs more sunlight to bloom.
2. **Short-day plants :-**The short day plant is a plant that requires a lot of darkness and performs best with shortened hours of sunlight. Many spring plants and bulb bearing plants are short day plants.
   A short day plant is one, that requires less than 12 hour of light to grow and flower. Potted short-day plant can be forced to bloom by regulating the amount of day light or darkness a plant receives.
   Eg. Bulb bearing plants, tulip, Christmas cactus
3. **Day neutral plants :-**A day neutral plant is a plant that flowers regardless of the amount of light of daylight it receives. Corn and rice are examples of day neutral plant that will bloom whether the day is short or long.

Day neutral plant can thrive in either condition. All of the self pollination in grass, or wheat family would all be day neutral plants along with some of the vine plants or climbing plants like cucumber.

**Define photoperiodism?Explain about short day plant,long day plant & day neutral plant . Muna Thapa-44**

Photoperiodism refers to the response of plants to the lengths of dark and light periods .Many angiosperms or flowering plants,have a protein that can sense seasonal change in light . A plant will flower depending on these changes in light levels. Each plant has a diff photoperiod that it requires to flower & propagate.Plant generally fall into 3 photopheriod categories: long day plants,short day plants ,& day neutral plants.

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The effect of photoperiodism in plants is not limited to when they will flower.Photoperiodism can also effect the growth of roots and stems.Additionally ,photoperiodism affects the loss of leaves in some plants during diff seasons.

Although the 3 photoperiod categories seem to suggest that plants depend on the amount of daylight they receive ,modern biologists believe the amount of darkness that plants receive is what causes them to flower.

Long day plants generally flower during the summer months when nights are short and days go longer.Example of long –day plants are oats,carnations. On the other hand ,short day plant flower during seasons that have longer periods of night. They require a continuous amount of darkness before flower development can begin.some eg; cotton ,soyabeans,and rice however,some plants reffered to as day neutral plants donot flower based on a particular photoperiod.

Gardners can take advantage of the knowledge of a plant photoperiod by manipulating a plant into flowering before it would naturally do so.Manipulating a plant into a flowering stage can provide several benefits ,particularly to commercial growers.For eg;plants can then be manipulated to produce fruits or seeds outside of their usual season.

**What is photoperiodism? Lokendra Bist Roll no:39**

Photoperiodism is made of up two words `photo´ means `light´ and `period´ means `length of time.´ Therefore by definition photoperiodism is response of plants to relative length of day and night period.

Most of flowering plants have the ability to sense change in season( i.e.length of day & night) and flower at the right time. To do this they make use of photoreceptor( light- sensitive) protein called `phytochrome.´ Plants need exposure to light for critical duration and this duration is differents for different plants.Based on this critical duration plants can fall into following three categories:

1.)Long day plant: The plants which requires a light period longer than certain critical photoperiod( i.e.more than 12 hours) to flowers are called long day plants. These plants will flower in continuos light. The response is common in cool- season plants like wheat ,barley ,alfalfa , oat and sugarbeet.

2.)Short day plant: The plants which requires a light period less than critical photoperiod(i.e. less than 12 hours) to flowers are called short day plants.These plants doesnot flower in continous

light.The response is common in warm-season plants like corn ,rice ,soybean ,peanut and sugarcane.

3.)Day neutral plant: The plants which are not affected by critical photoperiod are called day neutral plants. Some day plants are tomato ,cucumber ,buckwheat ,cotton and sunflower.

Similary, Photoperiodism play important role to determines the season in which a particular plants shall come to flower.In this way, knowledge of photoperiodism effect is useful in keeping some plants in vegetative growth, to obtain higher yield of tubers ,rhizomes etc or keep the plants in reproductive stages.

Principle of crop production ; George Acquaah

Principle of Agronomy; SR Reddy

**Positive and negative effect of rainfall on crop growth Upendra G.C. Roll No.96**

1: In heavy and evenly distributed rainfall areas , crops like rice in plants and tea , coffee and rubber in western ghsts are grown.

2: Low land and uneven distribution of rainfall is common in drylands farming where drought resistance crops like pearl millet, sorghum and minor millet are grown.

3:Rainfall has major influence on yield of crops.

4:In desert areas grasses and shrubs are common where hot desert climate exist.

5 Distribution of rainfall is more important than total rainfall to have longer growing period especially in dry lands.

6:Rainfall one of the most important factor influence the vegetation of a place.

1:Plant population has to be less under rainfed condition.

2:Under more plant densities, more water is loss through transpiration.

3:If there is rain accompanied with lightening, hailstorm, precipitation it will damage the productivity.

4.Heavy rainfall causes landslides, flood, soil erosion in slopy lands.

**Define cardinal temperature and critical photoperiod varnalization soil solarization heaving? Rajan phulara ; Roll .No 68**

**1)Cardinal temperature** : For every group of crops there is minimum optimum and maximum temperature for their physiological function or survial collectively all these temp is termed as cardinal temp .Most of crops grows best at 15-30∘C .many crops plant dies at a temp of 45-55∘C.

Minimum temperature : It refers to the minimum thershold temp below which the plant growth and development ceases.Generally for winter and summer season crops it lies within the range between 0-5∘Cand 15-20∘C respectively .

Optimum temperature : The favorable temp range in which growth and development of plant is at its best is termed as optimum temp .For most of winter and summer season crops it lies within the range of 15-22∘C and 25-35∘C respectively .

Maximum temperature : It refers to the maximum temp limit above with the growth and development of the plant ceases out.The tolerence capacity to the maximum temp varies widely depending upon the crop species.The maximum temp range for winter and summer crops lies within the range of 30-35∘C and 45-55∘C

**2) Critical photoperiod:** The definite day length period above or below of which plant never blooms is critical period.Different species of plants have different critical photoperiod.The day langth to produce flower in short day plant has to be less than critical photoperiod otherwise they will not bloom.

**3)Vernalization:** Vernalization is derived from Latin wordvernum which means of the spring.It is commenly khown as cold treatment.There arr some plant like wheat which need chilling treatment for flowering and vegetative propagation.Vernalization is the artificial exposure of plants or seeds to low temp in order to stimulate flowering or to enhance seed production .It is mainly required for temperate zone plants.The typical varnalization temp is between 5-10∘C.

**3)Soil solarization and heaving:** Soil solarization is an environmentally friendly method of using solar power for controlling pest such as siol borne plant pathogens including fungi bacteria algae nematodes and insects and mite pests along with the weed seed.it is the method of using solar power for seedling in the soil by mulching the soil and covering it with trap usually with a transparent polythene cover to trap solar energy. It may also describe methods of decontaminating soil using sunlight or solar power. This energy causes physical chemical and biological changes in the soil. Soil solarization may be a convenient way for managing some soil pests in home garden or small field sites. For the best results it should be done in open unshaded areas during the summer months .By this process soil pest should be reduced for 3-4 months. **Heaving i**s partial lifting of plants out of ground as a result of frezzing and thawing of the surface soliing winter. Heaving can kill perennial forage crops such as alfalfa.

Reference: Principles of Agronomy and www.researchgate

**Explain about the positive and negative effects of temperature on crops growth? Samarpan Acharya**

Generally, plants grow faster with increasing air temperatures up to a point. Extreme heat will slow growth and also increase moisture loss. The temperatures for optimal growth vary with the annual flowers and vegetables are extremely sensitive to cold, and transplants should not be planted until

temperatures are consistently warm.Extremely hot or cold soil temperatures can also hamper plant growth, as well as affect seed germination.Cool temperatures in fall trigger the plant to reduce growth and store energy. As temperatures approach freezing, growth stops and the plant (if perennial) becomes dormant. Plants are better able to withstand cold temperatures when dormant. A sudden cold snap in late fall before the plant has had a chance to harden off can odo more harm than sustained cold temperatures in mid-winter.Many plants require a chilling period of acertain number of days before growth resumes in spring. Plants native to areas further south with a shorter chilling requirement may resume growth during a warm period in winter and then be damaged when cold weather returns. Plants native to the area will generally not break dormancy.Wide temperature fluctuations can be hard on plants, particularly in winter. Warm days followed by freezing nights can cause bark injury on trees with thin, smooth bark. Alternate freezing and thawing of soil can result in heaving of shallow-rooted plants.Temperature (along with day length in some cases) can also trigger flowering in some plants, as well as affect how long flowers last.Extreme temperatures (too hot or too cold) can inhibit fruit set on tomatoes and other garden plants. Temperature as well as moisture level may affect the flavor of fruits and vegetables. Hot weather can cause cool-season vegetables to bolt, resulting in reduced production and changes in flavor.An unexpected frost can cause special problems in spring or fall. Frost can damage cell walls or cell contents of actively growing plants. Frost is more likely in lowlying areas on a clear night with little wind. An early fall frost can be followed by a number of weeks of warm weather.Temperature can also have indirect effects on plants. A warm winter may result in a larger insect population the following season.

**Precipitation:**Precipitation comes in many forms - rain,snow, sleet, hail, and ice. The water available to plants for growth is affected by the amount and type of precipitation, as well as soil characteristics, temperature, and wind. The effects of too much or too little precipitation can be temporary or permanent, depending on the type of plant and how long the condition lasts.Water is necessary for virtually every function of plant growth. Lack of water damages plant cells, resulting in decreased growth, wilting, and leaf scorch, and eventually leaf drop and root damage.Too much water reduces the amount of oxygen in the soil, resulting in root loss or injury. It can also make the plant more susceptible to many fungal diseases.Heavy rain can damage plants, compact soil, and cause erosion.Snow, in addition to providing moisture, can also insulate and protect plants from temperature extremes and fluctuations. However, the weight of heavy snow can break branches (especially on evergreens). Snow cover can also make it more difficult for wildlife to find food and result in more damage to landscape plants. Ice and hail, as well as de-icing salts, can all cause damage to plants.

**Humidity:** Humidity refers to the amount of moisture in the air, and may or may not be associated with precipitation. High humidity reduces water loss from plants, and may increase the chance of disease.

**Wind:** Wind has a drying effect. This can dry out wet plants, reducing disease chances. However, it can also remove water faster than the plant can replace it. This can be a problem in summer when combined with high temperatures and low soil moisture. It can also be a special problem for evergreens in winter since they continue to lose moisture through their leaves or needles and are unable to replace it if the ground is frozen.Wind can disperse pollen, seeds, spores, insects, pathogens, salt, and noxious chemicals. Excess wind can do considerable damage to plant

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Principle of agronomy.

**Explain about green house effect. Explain the importance of it in agriculture. Seema**

Ans- G**reenhouse effect** is a warming of Earth's surface and troposphere (the lowest layer of the atmosphere) caused by the presence of water vapour, carbon dioxide, methane, and certain other gases in the air. Of those gases, known as greenhouse gases, water vapour has the largest effect.The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases.The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise be, allowing life on Earth to exist.

Greenhouse gases let the sun's light shine onto the Earth's surface, but they trap the heat that reflects back up into the atmosphere. In this way, they act like the glass walls of a greenhouse. This greenhouse effect keeps the Earth warm enough to sustain life. Scientists say that without the greenhouse effect, the average temperature of the Earth would drop from 14˚C (57˚F) to as low as –18˚C (–0.4˚F).

Some greenhouse gases come from natural sources. Evaporation adds water vapor to the atmosphere. Animals and plants release carbon dioxide when they respire, or breathe. Methane is released naturally from some low-oxygen environments, such as swamps. Nitrous oxide is produced by certain processes in soil and water. Volcanoes—both on land and under the ocean— release greenhouse gases, so periods of high volcanic activity tend to be warmer.

Most of the $CO_2$ that people put into the atmosphere comes from burning fossil fuels. Cars, trucks, trains, and planes all burn fossil fuels. Many electric power plants do, as well. Another way humans release $CO_2$ into the atmosphere is by cutting down forests, because trees contain large amounts of carbon. People add methane to the atmosphere through livestock farming, landfills, and fossil fuel production such as coal mining and natural gas processing. Nitrous oxide comes from agriculture and fossil fuel burning. Fluorinated gases include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and hydrofluorocarbons (HFCs). These gases are used in aerosol cans and refrigeration.

All of these human activities add greenhouse gases to the atmosphere. As the level of these gases rises, so does the temperature of the Earth. The rise in Earth's average temperature contributed to by human activity is known as global warming.

Greenhouse effect is very important for all living beings. It's only the greenhouse effect which has maintained the temperature of earth. Without greenhouse effect the temperature of earth would not be warm enough to sustain our ecosystem. Temperature without it is estimated to be

about 54 degree Fahrenheit. Apart from that poor people who depend upon land and weather for living will be affected to a greater extent. They will not be able to survive in such harsh climatic condition.

Crop and livestock productions directly contribute to the emission of greenhouse gases through the application of nitrogenous fertilizers, responsible for N2O emissions, and the digestion of ruminants, responsible for CH4 emissions. The various ways in which farm wastes are managed (spreading, etc.) also contribute to methane emissions.

The crop production sector is responsible for CO2 emissions both directly, depending on soil management practices, and indirectly, through the consumption of intermediate goods (fuel, etc.). On the other hand, like forests, agriculture is also a carbon sink.

Conversely, agriculture is highly dependent on climatic conditions (carbon dioxide concentration in the atmosphere, temperature, hydrological system, stability of climatic conditions over time), which could force production systems to adapt or to move.

The importance of green house on agriculture are :

***1.*** Agricultural soil management

These are nitrous oxide emissions and account for about 60 percent of the total emissions from the agricultural sector. Nitrous oxide is produced naturally in soils through the microbial processes of nitrification and de-nitrification. During nitrification, ammonium (NH4) produces nitrates (NO3,). During de-nitrification, nitrates (NO3,) are reduced to nitrogen gas (N2). An intermediate step in both of these processes is the creation of nitrous oxide (N20).

The large increase in the use of nitrogen fertilizer for the production of high nitrogen consuming crops like corn has increased the emissions of nitrous oxide. Although nitrogen fertilizer is essential for profitable crop production, the development of practices for more efficiently using nitrogen fertilizer has the potential to significantly reduce nitrous oxide emissions while also reducing production costs and mitigating the nitrogen contamination of surface and ground waters.

***2.*** Enteric fermentation

Methane is produced as part of the normal digestive processes in animals. During digestion, microbes in the animal's digestive system ferment feed. This process, called enteric fermentation, produces methane as a by-product which can be emitted by the exhaling and belching of the animal.

Because of their unique digestive system, ruminant animals (e.g. cattle) are the major emitters of methane. Beef cattle account for about 70 percent and dairy cattle for about 25 percent of these methane emissions. If beef and dairy cattle numbers increase, methane emissions will also increase.

Feed qualify and feed intake influence the level of methane emissions. In general, lower feed quality and higher feed intake lead to higher methane emissions.

***3.*** Manure management

Methane is produced by the anaerobic (without oxygen) decomposition of manure. When manure is handled as a solid or deposited naturally on grassland, it decomposes aerobically (with oxygen) and creates little methane emissions. However, manure stored as a liquid or slurry in lagoons, ponds, tanks or pits, decomposes anaerobically and creates methane emissions. Dairy cattle and swine produce about 85 percent of the methane emissions. Methane emissions will increase as the number of large scale livestock confinement systems increases.
Methane emissions can be reduced through the application of technologies designed to capture the methane and use it as an energy source. In addition to reducing methane emissions, methane capture will improve the profitability of the livestock operation by offsetting the need for fossil fuel energy from outside sources.

***4.*** Carbon dioxide from fossil fuel consumption

The use of fossil fuels in agricultural production accounts for eight percent of the emissions from agriculture. These emissions are primarily from combustion of gasoline and diesel fuel. Using renewable fuels can reduce the carbon dioxide emissions from agriculture production.

***5.*** Other

A variety of other sources produce greenhouse gas emissions. For example, most of the world's rice and all of U.S. rice is grown on flooded fields, which prevents atmospheric oxygen from entering soil. When rice is grown with no oxygen, the soil organic matter decomposes under anaerobic conditions and produces methane that escapes into the atmosphere.

**Hoopkins Bioclimatic law Bidhan Sejwel ; Roll:15**

Hopkins described bioclimatics as the attempt to correlate phenological phenomena of plants and animals with the various elements which make up the climate of the region. In 1889, Hopkins formulated the relationship of elevation, latitude and longitude to seasonal events such as the coming of spring. The relationship was coined the "Hopkins Law of Bioclimatics". Many horticulturalists and other plant enthusiasts use this law to determine a planting schedule.

It states "Phenological events (such as planting,harvesting,& morphological developments in plants) in temperate North America are generally altered about 4 days for each change of 5° of latitude northward, 5° of longitude eastward, or 400 feet of altitude upward, the vernal alteration being retardation (as of flowering), the autumnal being acceleration (as of leaf fall)"

**Explain about abiotic stress and different factors creating it:**

**:-** The abiotic stress is the negative impact of non-living factors on the living organisms in a specific environment.

Abiotic stress factors include naturally occurring often intangible and inanimate factors such as intense sunlight, temperature or wind that may cause harm to plants in the area affected. Abiotic stress is essentially unavoidable because of plants are especially dependent, if not solely dependent on environmental factors, so it is particularly constraining. Abiotic stress is the most harmful factors concerning the growth and productivity of crop worldwide. It is shown that abiotic stress factors are at their most harmful when they occur together, in combinations of abiotic stress factor.

**Factors creating abiotic stress:-**

- High wind
- Extreme temperature
- Drought
- Flood
- Wildfire

1. **High wind:-**
   The shape and height of plants severally affected in areas of high winds and the rate of transpiration, respiration also affected due to high wind.
2. **Extreme temperature:-**
   Temperature is a limiting factor of photosynthesis and low temperature therefore limits the growth of plants. But, extreme high and low temperature destroy plant cells and tissues which enforce the plant to die.
3. **Drought:-**
   Life needs water. Plants are rare at desert areas due to drought. So, drought is one of the main factor which creates stress on plant growth and development.
4. **Flood:-**
   Flood is a natural overflow of water during rainy season. It destroys the plant adaptation and due to flood some plant's roots get decay.
5. **Wildfire:-**
   During high temperate seasons dense forests are highly affected by forest fire. It destroys all the new born plants as well as it damage the essential microorganisms available in soil surface forest land.

**Explain about Mulching? Why it is done? What are the materials that could be used for Mulching? Sukraraj Stha; Roll No:-89**

The process of covering the soil surface around the plants to create favorable condition for the plant growth by reducing evaporation, suppressing weed growth, providing nutrients as the material decomposes. Mulches acts as barrier to movement of moisture out of the soil and they can be organic (straw, leaves, wood chips, etc) and man-made (plastics, newspaper, etc).

**Why it is done?**

- ✓ It keeps the soil underneath moist longer and prevent evaporation.

- ✓ Protects soil from harsh environmental condition.
- ✓ It provides a natural barrier to stop weed from growing & competing with plants for nutrients.
- ✓ It protects from soil run off and soil erosion.
- ✓ It adds organic matter to the soil and helps to resists pest & diseases.
- ✓ It increases biological activities in soil by providing microorganisms & earthworms.
- ✓ It improves soil drainage and structure as it decomposes.
- ✓ It protects plant from mud-splash during watering or rain.
- ✓ It helps to maintain warm temperature even at night.
- ✓ It can improve soil fertility for better production.

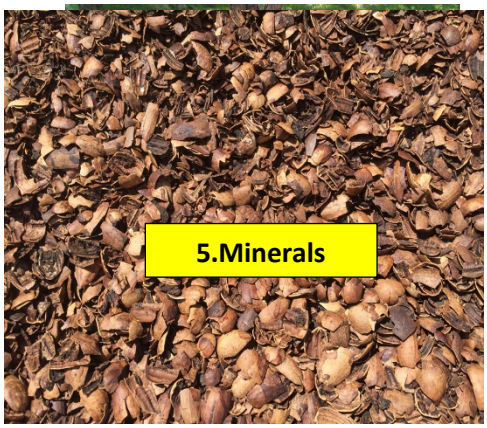
**Materials used for Mulching**

1.Straw

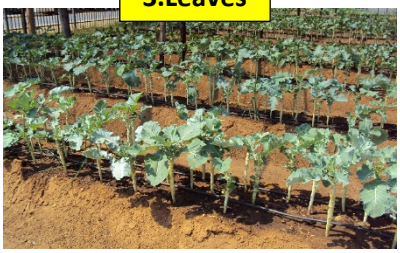
2.Newspaper

3.Leaves

4.Pine Niddles



5.Minerals



6.Compost

7.Grass

8.Grain Hulls

9.Cardboard


10.Wood

11.Plastic

**What are the factors to be considered for proper water management during crop production? Bipin Subedi; Roll No : 19**

Water is a key driver of sustainability. Crop production in many parts of the world is seriously limited by lack of water, and water supplies for agriculture are also diminish. Ultimately, this threatens the sustainability of agriculture in these regions, and furthermore agricultural water use has major impacts on the rest of the ecosystem. The supply of some freshwater is an absolute essential for all forms of agriculture, although the amount of water required varies greatly between different agricultural types and climatic regions. Some factors to be considered for proper water management during crop production are as below:

1 Blocking unauthorized wells

2 Reusing waste and additional water

3 Having strict rules against those farmers who waste the water

4 Penalizing unauthorized well users

5 Improvement and dredging aqueducts

6 Encouraging farmers who use new methods

7 Increasing government investment in agricultural water management

8 Making the streams ferroconcrete and preventing water waste in canals

9 Paying financial facilities to farmers

10 Encouraging farmers to attend in training courses

11 Installation of meters on water wells

12 Training farmers in order to optimize the use of water resources

13 Enhancing farmers' participation in water management

14 Operations of aquifer

15 Using pressurized irrigation methods

16 Increasing government loans to buy new irrigation systems

17 On-time irrigation

18 Changing cropping pattern

19 Using drought-resistant crops

20 Forming associations of people or groups

21 Using modern systems on small farms

22 Proper distribution of water in land areas

23 Holding training classes in the field of water management

24 Integration of lands to avoid wasting water

25 Privacy compliance and legal required distance between wells

26 Use products that use less water

27 Shortening basic channels for transporting water

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610175/

https://www.iaea.org/topics/agricultural-water-management

https://www.nap.edu/read/6031/chapter/5#57

**List the growth stages of cereal crops and legume crops. By Tarjan Bhandari and Ganesh Joshi**

**Growth stages of cereal crops**

Researchers have identified 10 major growth stages that all the cereal grain plants go through during a normal lifecycle. They are:

1. **Germination** - the emergence of the radicle and plumule from the seed
2. **Seedling** - the young, newly emerged plant
3. **Tillering** - the formation of lateral branches that originate from below-ground nodes on the stem
4. **Stem elongation (jointing)** - stem nodes appear above the ground level
5. **Booting** - the inflorescence expands inside the upper leaf sheath
6. **Heading** - cluster of florets form
7. **Flowering (anthesis)** - anthers extend from the glumes
8. **Milk** - early development of kernel having watery & whitish consistency
9. **Dough** - kernel has semi-solid consistency
10. **Ripening** - kernel loses moisture and is more solid

**Growth stages of Legumes**

Development stages of legumes are usually divided into two: vegetative and reproductive.

**Vegetative Stages (Vn)**
VE - Cotyledons emerge
VC - Cotyledon emerges and the unifoliate leaf unfolds
V1 - First node has leaves
V2 - Second node has leaves

V3 - Third node has leaves
Vn - nth node has leaves
**Reproductive Stages (R)**
R1 - Beginning blooming
R2 - Full bloom
R3 - Beginning pod
R4 - Full pod
R5 - Beginning seed
R6 - Full seed
R7 - Beginning maturity
R8 - Full maturity

Because all plants wll not be at the same developmental stage at the same time, staging is sometimes generalized as follows:

**Late vegetative** - stem is about 12 inches tall but no buds or flowers are visible
**Early bud** - about 1% of plants in the field have flower buds
**Mid bud** - about 50% of all plants have at least one flower bud
**Late bud** - about 75% of all plants have at least one flower bud

These stages can be applied to blooming (i.e. first bloom, one-tenth bloom, midbloom, full bloom).

***Criteria of essentiality of  nutrient. Anil Dahal- Roll N.2**

This concept was propounded by Arnon and stout(1939) and they considered 16

elements essential for the plant nutrition. For an element be regarded as an essential

nutrients,it must be satisfied following criteria:

1. The plant must be unable to complete it's life cycle in the absence of the mineral

elements.

2. They must be specific and cannot be replaced by other elements.

3. They must be directly involved in plant metabolism.

4. Deficiency symptoms can be corrected only supplying that deficiency elements.

*Source of plant nutrients:

1. Fertilizer

2. Manures

3. Plant residues

4. Soil amendments

5. Rain water

**List essential 18 elements with form and classified? By Rajan Phulara**

In plants 90% of the content is water where as nutrient comprises of 10% of total dry weight .A complete analyses of the plants detects large number of element however only certain elements are regarded as essential for plants. Previously 16 nutrient has been identified as essential nutients whereas 8 nutrient are recently added to the list of essential nutrients. Is classified as:

1.Structural element: They are to basic building components of plant body .they form 94%(C-45% O-43% H-6%) of plant composition so are called as structural elements .they are supplied by water and air.

2.Mineral nutrient : Based on their consumption extent by plants they are further classified as.

a. Macro nutrient : Nitrigen phosphrous potassium : supplied by fertilizer( primary nutrient)

b. Secondary nutrients: calcium magnesium sulpher:supplied by soil mixture (secondary nutrient )

c. Micro nutrient : These nutrients are required in less amount by plants .eg.iron, manganese ,zinc ,molybdenum ,boron, chlorine, copper.

Forms of elements used by plants:All the essential nutrient for plants are available in either free form or in molecular form.following table illustrate the availability forms of several essential nutrients.

| Elements | available forms |
|---|---|
| C | CO2 |
| H | H2O |
| O | H2O CO2 O2 |
| N | No3-, NH4- |
| P | H2PO4- ,HPO4^2- |
| K | K+ |
| Ca | Ca^2+ |
| Mg | Mg^2+ |
| S | So4^2- |
| Fe | Fe2+ |

| | |
|---|---|
| Mn | Mn2+ |
| B | Bo4^2+ |
| Zn | Zn2+ |
| Cu | Cu 2+ |
| Mo | MoO4^2+ |
| Cl | Cl^- |
| Ni | Ni+2 |

**Plant nutrients losses from soil Narendra Basnet Roll 49**

Different ways of plant nutrients losses from the soil are discussed below.:

- **Leaching** – Plant nutrients are lost beyond the reach of plant roots. Usually caused by excessive rainfall washing nutrients deep down into sub-soil beyond new roots reach.
- **Soil erosion** – Top soil is lost by the agent of erosion e.g. wind, water.
- **Monocropping** – This utilizes only specific nutrients from a particular zone making it exhausted. -It also causes accumulation of certain pests and diseases.
- **Continuous cropping** –This continuously exhaust the fertility of land unless the the land if fallowed.
- **Change of soil PH** -Use of either acidic or basic fertilizers affect soil pH and Consequently the presence of micro-organisms hence soil fertility affected.
- **Burning of vegetations** –Destroys organic matter and soil structure. Nutrients are lost and soil exposed to erosion.
- **Accumulation of salts** – Common in waterlogged areas and semi-arid areas in which poor drainage causes evaporation during the dry periods, making the soil saline.

**Difference between soil fertility and soil productivity? Naresh Singh Bhandari**

#Soil fertility:
1. It is the index of available nuterient to the plants.
2. One of the factors for crop production.
3. Can be analyzed in the laboratory.
4. It is the potential status of the soil.

#Soil productivity
1. It is the broader term used to indicate the yield of the crops.
2. Interaction of all the factor that determine the magnitude of yield.
3. Assessed in the field under particular climatic condition.
4. Resultant of various factor influencing soil management to produce crops.

**What are the source of plant nutrient.**
Plant nutrient is the study of the chemical element and compound necessary for plant growth, plant metabolism and their external supply.
Sources of nutrients are:
1. Organic manures
2. Plant residues
3. Chemical fertilizer
   -Ammonium fertilizer
   -Nitrate and Ammonium fertilizers
   -Amide fertilizers
   - phosphatic fertilizer
   - potassic fertilizers
4. Bio-fertilizres
5. Rain water
6. Soil amendments and other micro nutrients.

**What are secondary nutrient elements? Provide the forms that are absorbed by plants? Naresh Joshi; Roll no. 51**

**Secondary nutrients** are nutrients that slightly limit crop growth and are moderately required by plants. These nutrients *are* ***calcium, magnesium and sulphur.*** *Secondary* nutrients are as significant as primary nutrients in plants ,but they are needed in smaller quantities. They are necessary for the augmentation levels of roots and cells

1)**calcium :**calcium is an essential nutrient that plays a significant role in **plant growth.** Calcium helps to neutralise the organic acids that form during metabolism. Calcium also assists plants in the following ways:

- Absorption and translocation of other nutrients by roots.
- Facilitates disease resistance.
- Assists in conversion of nitrate -nitrogen to other essential forms required for protein formation.
- Required for cell division and cell wall formation.
- Activation of growth regulating enzymes systems.
- PH maintain.

2)**magnesium :**magnesium is an essential nutrient for the plants because it is a fundamental element make up enzymes that supports **plant development,** leaf chlorophyll and for crop quality. The nutrient also assists in the formation of oils, sugars and fats and the nutrient serve as a phosphorus hauler . A magnesium deficiency causes a **decreases in photosynthesis,** which limits crop production.

3)**sulphur :** It is an essential element of chlorophyll. It is involved in **nitrogen fixation** in leguminous plants and also helps in seed production. Sulphur adds colour ,a different smell

and flavour to various plants like garlic, brassica crops and onions. The nutrients also forms a significant parts of protein and amino acids. Sulphur is crucial for ensuring the protein content of leguminous plants.

***Forms of essential elements taken up by plants:***

TABLE 9. ESSENTIAL PLANT NUTRIENTS

| ELEMENT TAKEN INTO THE PLANT | SYMBOL | CLASSIFICATION | CHEMICAL FORM |
|---|---|---|---|
| Hydrogen | H | Nonmineral nutrient | $H_2O$ |
| Oxygen | O | Nonmineral nutrient | $O_2$ and $CO_2$ |
| Carbon | C | Nonmineral nutrient | $CO_2$ |
| Nitrogen | N | Primary macronutrient | $NH_4$+ and $NO_3$- |
| Phosphorus | P | Primary macronutrient | $H_2PO_4$- and $HPO_{42}$- |
| Potassium | K | Primary macronutrient | K+ |
| Calcium | Ca | Secondary macronutrient | $Ca_2$+ |
| Magnesium | Mg | Secondary macronutrient | $Mg_2$+ |
| Sulfur | S | Secondary macronutrient | $SO_{42}$- |
| Boron | B | Micronutrient | $B(OH)_3$ |
| Chlorine | Cl | Micronutrient | Cl- |
| Copper | Cu | Micronutrient | $Cu_2$+ |
| Iron | Fe | Micronutrient | $Fe_2$+ and $Fe_3$+ |
| Manganese | Mn | Micronutrient | $Mn_2$+ |
| Molybdenum | Mo | Micronutrient | $MoO_{42}$- |
| Nickel | Ni | Micronutrient | $Ni_2$+ |
| Zinc | Zn | Micronutrient | $Zn_2$+ |

- References: www.agclassroom.org, www.pioneer.com

**Define manure.what are the sources of manure?? By Kalpana Joshi**

Manures are the plant and animals wastes that serves as a nutrient source for the plants. Manures can also be defined as the organic matter derived from animal,human and plant residues which contain plant nutrients in complex organic forms.plant and animals residues are converted through bacterial action into readily available/usable ammonical N and nitrate N.thus they are relatively slow acting but they supply N for longer period of time.also, unlike fertilizers, they also contain almost all essential nutrients required by the plants and also they have profound effect on improving the physical status of the soil

Sources:

11. Farmyard manure: decomposed mixture of dung and urine of farm animals along with waste feeds, bedding material,fooder,etc
12. Animal manure:excreta of the sheep and goats.
13. Green manure: legumes,sunhemp,etc
14. Excreta of human being.
15. Sewage and sludge:human excreta are flushed out with water which is called sewage.solid portion called sludge and liquid portion called sewage.sewage water is used for irrigation.they are used in crop field after proper fermentation process so as to avoid foul smell.
16. Oil seed cakes: groundnut,castor, mustard and been cake
17. Meals(bone, blood and meat):bone blood and meat of dead animals from slaughter house and meat processing industries are processed to form meals these meals are the rich source of phosphorus and calcium.

**What is organic manure? How it is classified? Padam Thapa; Roll 56**
Manures may be defined as materials which are Organic in origin,bulky and concentration in nature and capable of supplying plant nutrients and improving soil physical environment having no definite chemical composition with low analytical value produced from animal, plant and other organic wastes and by products.Classification of organic manure

We know that organic manures are of different types on the basis of nutrient content per unit quantity, manures are broadly grouped into two class I.e. bulky and concentrated organic manure.

A: Bulky organic manures
Bulky organic manures generally contain fewer amount of plant nutrients as compared to concentrated organic manure.so,they should be applied in bulk in order to meetthe nutrient demands. They decompose slowly so for the supplement of nutrient they are applied 1 or 1.5 month prior to showing. They may be:

**1: Farm yard manure (FYM)**

The term farm yard manure refers to the well decomposed mixture of dung,urine,farm litter ( bedding material) and left over or used up materials from roughed or fodder fed to the Cattle.(0.5-1.5:0.4-0.8:0.5-1.9% NP)

2: Compost
Decomposed final product of organic wastes is simply termed as compost. The process of decomposing organic wastes is called composting. Compost is the result of microbiological decomposition of organic residue. ( 0.5-1.5:0.5-1:0.5-1.5%NPK)

3:Animal manure
The excreta of the sheep and goat are also a good source of nutrients for plants and contain higher nutrient content than in FYM.( 3:1:2% NPK)

4: Green manure
Green manures, although bulk in nature are especially grown for incorporation into the soil for improving the nutrient status of the soil. Usually legumes are popularly used as green manure as they have dual advantage ; one they add nutrient into the soil via their decomposition and secondly they have ta capacity of biological nitrogen fixation.E.g. Dhaincha,Sunhemo,Legumes

5: Night soil
The excreta of human beings ( both solid and liquid) are also theexcellent sources of nutrients for plants. (5.5:4:2%NPK)

**6:Sewage and sludge**

In modern civilization, human excreta are flushed out with water is called sewage .sewage has two components: solid portion called Sludge and liquid portion called sewage water. In general,sludge are rich in N and P and low in K. Sewage water is used for irrigation. They are used in the crop field after proper fermentation process so as to avoid foul smell.

**B. Concentrated organic manures**

Concentrated organic manures contain higher nutrient content per unit quantity than bulky organic manures. Their manurial values arelargely due to their nitrogen content although they supply smaller quantities of other nutrients too. They may be:

1:Oil seed cakes
These are the most common and important concentrated organic manures with low C:N ratio so that they decompose readily. They nitrify quickly releasing nitrogen in about a week. Cakes are usuallyapplied before sowing. Groundnut ,Castor,Mustard,and Neem cake are commonly used.

**2.Meals(Bone,Blood,and Meat)**

Bone,blood and meat of the dead animal from slaughter house and meat processing industries are processed to form the meals. These meals are the rich sources of phosphorus and calcium. They are slow acting and are beneficial for long duration crops.

References

1.Principle of Agronomy

2. Old notes

**What is farm yard manure ? What should be considered for proper utilization of nutrient contents? Pramod Bhatta Roll.no: 62**

Ans: farm yard manure is traditional manure and mostly readily availableto the farmers. Farm yard manure is decomposed mixture of cattle dung and urine with straw and litter used as bedding material and residues From the fodder fed to the cattle. The waste material of cattle shed consisting of dung and urine soaked in the refuse of the shade in collected daily and placed in the trenches about 6-7 m long, 1.5-2 m broad and 1m deep. Each trench is filled upto a height of about o.5 m above the ground level. Well rotten farm yard manure contains o.4- 1.5% N, 0.3-0.9% P2O5 and 0.3- 1.9 % k2O.

For the proper utilization of nutrient contents the following pratices should be done-

1. In case of farm yard manure, it should be utilized 1 month before planting crop.

2. It is necessary to calculate properly the requirements of nutrient dose for specific crop and land.

3. Evaluation of physical condition of soil is necessary for determination of proper requirement amount of nutrient.( soil test before planting)

4. For the proper utilization of nutrient we should maintain the storage system of manure.

I.e. protect from sunlight and water.

5. It should appiled properly to the field. I.e different methodology.

E.g: split dose if N to reducing leaching nutrient.

1. principles of agronomy

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**What is green manure? What are the characteristics of green manure cropping? Jagat Dhami; Roll no. 35**

Answer: Generally, manures are plants and animals wastes that are used as source of plant nutrients after decomposition.Green manures are the bulky organic manures made from green leaves (or green parts of plants) along with twigs. Green manuring is growing the field plants usually belonging to leguminous family and intercropping into the soil after sufficient growth. Important green manure crops are sun hemp, dhaincha, cluster beans and sesbania rostrate.

The characteristics of green manure cropping are:

1. Green manuring with sesbania gives higher yield rice on average by 20%.
2. Green manuring increases the population of bacteria and fungi.
3. Organic manure and nitrogen are added to the soil by green manuring.
4. Nutrient availability increases due to production of $co_2$ and organic acid during decomposition.

5. Improves soil structure, increase water holding capacity and decreases soil loss by erosion.
6. Growing green manuring crops in the off season reduces weed proliferation and weed grown.
7. Green manuring helps in reclamation of alkaline soils and root-knot nematodes can be controlled.
8. Green leaf manures of sun hemp, sesbania rostrata, calotropis and gliricidia species increases the DTPA-Zn and Cu status markedly.

**Define green manure and exaplain about characteristics of green manure crops. Asha Mishra**

Green manures, although bulk in nature are specially grown for incorporation into the soil for improving the nutrient status of the soil.Usually legumes are popularly used as green manure as they have dual advantage; one they add nutrient into the soil via their decomposition and secondly they have the capacity of biological nitrogen fixation. Characteristics of green manure crops are as follows:

1.Fast or grow rapidly: be able to grow well quickly under local conditions, especially, initially, so that weed growth is suppressed.

2. Capable of fast decomposition :be able to yield more leafy and succulent materials than woody or fibrous ones so that decomposition will be fast.

3.Nitrogen fixation ability: be leguminous as far as possible and be able to produce high amount of biomass with high nitrogen content so that nitrogen mineralized will be rapid and consequently there will be no nitrogen starvation of the succeeding crop.

4. High nutrient accumulation ability :have deep and fibrous root system to penetrate lower horizons and to extract nutrients to bring to the surface for the use of the succeding crops.

4. Protect soil: has ability to tolerate shade , flood , drought and adverse temperature.

**What is biofertilizer ? Explain about the sourse of biofertilizer.**

⇨ A biofertilizer is a substance which contains living organisms which when applied to seeds , plant surface,colonize rhizosphere or the interior of the plant and promotes growth by increasing the supply or avalibality of primary nutrient to the host plant. Biofertilizer promotes the growth of plant , trees by increasing the supply of essential nutrient to the host plant.It comprises of living organism which include micorhizal fungi , blue-green algae and bacteria. Mycorrhizal fungi pereferenially withdraw minerals from the organic matter for plants whereas cyanobacteria are characterized by the property of nitrogen fixation. **There are different sourse of biofertilizer which can be generally explained on the basis of nitrogen fixing characteristics. some of them are listed below:**

1. **Symbiotic nitrogen fixing bacteria;:**Rhizobium is one of the nitrogen fixing bacteria .Hence bacteria seek shelther and obtain food from plants. In return they help to provide fixed nitrogen to the plants.
2. **Loose association nitrogen fixing bacteria: Azosprillium** ia a nitrogen fixing bacteria that lkine ariund the roots of higher plants but donot develop a intimate relation with plants.It is termed as **rhizosphere** association as this bacteria collect plant **exudate** and same is used as food by them.Thus process is termed as associative mutualism.

3. **Symbiotic nitrogen fixing cyanobacteria**: A blue-green algae or cyanobacteria from the symbiotic association with several plants.Liverworths , cycad roots , ferns and lichens are some of the nitrogen fixing cyanobacteria . Anabena is found at the leaf cavaties of fern.It is responsible for nitrogen fixatation.The fern plant decay and release the same for utilization of the rice plants.Azolla Pinnate is a fern that resides in fern plant but they donot regulate the growth of the plants
4. **Free living nitrogen fixing bacteria:**They are free living soil bacteria which perform nitrogen fixatation.They are saprophytic anerobes such as clostridium, beijherinckii, Azotobactor , and ballus polumaxin.
5. **Phosphate solubilizing bacteria:** Pantoea agglomerans strain p5 or pseudomonas putida straimn p13 are abale to solubilize the insolubilize the phosphate from organic and inorganic phosphate sources.
6. **Fungi:** Other than bacteria there are some fungi which are also the source of biofertilizer.symbiotic association exist between plants and fungi too. These association are called Mycorrhizae. The fungus in this association absorbs phosphorous from the soil and provide it to the plant.

1.Vessey j. kevin (2003) general

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**Define bio-fertilizer . List the sources of bio-fertilizers and explain about two.**

Ans: A bio-fertilizer is a substance which contains living microorganisms or (PGPR)which when applied to seeds ,plant surface or soil, colonize the rhizosphere or the interior of plant and promotes growth by increasing the supply or avaibility of primary nutrients to the host.

Bio-fertilizer is a"eco-friendly" agro input which add nutrients through the natural process of nitrogen fixation ,solubilization of phosphorus ,and stimulating plant growth through the synthesis of growth promoting substances as well as by reducing some soil related disease.

1.Saprophytes : Microorganism that are capable of decomposing organic matter at faster rate can be used as fertilizer for quick release of nutrients . Aspergillus ,penicillium, Trichoderma are celluloytic fungi which break down cellulose of plant material. The natural process of decomposition is accelerated and compositing time is reduced by 4 to 6 weeks by the use of inoculants of these organisms.

2.Mycorrhiza and phosphorous solubilising Bacteria :phosphorous avaibility and fertilizer phosphorous use efficiency can be increased with mycorrhiza, phosphate solubilizing bacteria and fungi. Mycorrhiza inhabits roots of several crops and solubilise soil phosphates .some microorganisms like pseudomonas striate ,Aspergillus awaneorii and Bacillus polymyxa are capable of solubilising phosphates .

a.Ectomycorriza

b.Endomycorrhiza

3.Free living Nitrogen fixing bacteria:

Saprophytic: Bacillus polymyxa , clostridium etc

(distinguished into aerobic and anaerobic)

Photoautotropic :Rhodopseudomonas , chromatiumetc

4.Free living Nitrogen fixing cynobacteria:

Totypothrix,stigonema etc.

(extremely low cost biofertilizers)

5.Loose association of Nitrogen Fixing bacteria:

Azospirilium

(Rhizosphere association, also does associative mutalism or associative symbiosis)

6.Symbiotic Nitrogen fixing bacteria:

Rhizobium, actinomycete

7.Symbiotic nitrogen fixing cynobacteria:Azolla pinnata,Anabaena azollae

8.Microphos Biofertilizers: Bacillus polymyxa, pseudomonas striata

**Define biofertilizer. List the sources of biofertilizer and explain any two of them. By Bibhusha**

The natural fertilizers that are microbial inoculants of bacteria, algae and fungi (separately or in combination) which may help biological nitrogen fixation for the benefit of plants and help to build up the soil micro-flora and thereby soil health is known as bio fertilizers.

Some of the important sources of bio fertilizers are listed below:-

- Bacteria
- Cynobacteria (Blue green algae)
- Fungi

1)Bacteria

- Rhizobium is a bacterium living in the root of leguminous plants is a symbiotic association. The root cells of leguminous plant contained a purple coloured pigment called leghemoglobin in which the bacteria float to fix atmospheric nitrogen.
-Azospirillium lipoferum is another bacterium which lives in loose association with some grasses , rice and maize.
-Azotobacter, clostridium ,methanobacterium are free living bacteria which fix atmospheric nitrogen.

**2)Cynobacteria**

- The leaves of azolla(an aquatic pteridophyte ) have large number of plants of anabaena (a blue green algae) which have capacity to fix atmospheric nitrogen which is made available in azolla.
-Many free living Blue green algae (Anabaena,Nostoc, Aulusira) fix atmospheric nitrogen . Nostoc is placed in the rice crops and provide nitrogen to rice.

3)Fungi

Mycorrhiza is the symbiotic relationship between

roots of higher plants and fungi. It is of two types :-

A)Endomycorrhiza

➔ It is important in phosphate nutrition of plants. It penetrates cortex. It is also called Vesicular Arbuscular Mycorrhiza (VAM)

B)Ectomycorrhiza

➔ It increase water and nutrient intake by plants. These occurs on plants like pine,eucalyptus,ficus,oak etc. They absorb and store nitrogen, phosphorous, potassium and calcium in fungus. They also convert complex organic molecule into simple ,easy and absorbable form

**Explain about different source of manures. sonu singh Roll no. 87**

Manures are the plant and animal wastes that serves as a nutrient source for the plant. Manures can also be defined as the organic matter derived from animal, human and plant residues which contain plant nutrient in complex organic form. Plant and animal residues are converted through bacterial action into readily available/usable ammonical N and nitrate

N. thus they are relatively slow acting but they supply N for longer period of time. Also, unlike fertilizers, they also contain almost all essential nutrients required by the plant and also they have profound effect on improving the physical status of the soil. Different sources of manures are:

**1. Farm yard manure:** Decomposed mixture of dung and urine of farm animals along with wast feeds, bedding material, fooder, etc.

**2. Animal manure:** Excreta of the sheep and goats.

**3. Green manure:** Legumes, sunhemp, etc.

**4. Excreta of human being.**

**5. Sewage and sludge:** Human excreta are fludhed out with water which is called sewage. Solid portion called sludge and liquid portion called sewage. Sewage water is used for irrigation. They are used in crop field after proper fermrntation process so as to avoid foul smell.

**6. Oil seed cakes:** Groundnut, castor, mustard and been cake.

**7. Meals(bone, blood and meat) :** Bone, blood and meat of dead animals from slaughter house and meat processing industries are processed to form meals these meals are the rich source of phosphorus and calcium.

**Methods of fertilizer application BY; Sushma Regmi**

*Application of solid fertilizers:-*

1. *Deep soil application;*
   Organic manures are sometimes placed on the surface of the soil and incorporated into the soil with a plough or rototiller before planting.
2. *Broadcasting;*
   It refers to spreading of fertilizers uniformly all over the field. It is of two types:-
   - Basal application: It is the broadcasting of fertilizer at sowing time to distribute the fertilizer over the entire field and mix it with the soil.
   - Top dressing: It is the broadcasting of fertilizers in closely sown crops like paddy and wheat particularly to supply nitrogen in readily available form to growing plants.
3. *Banding;*
   It refers to the placement of fertilizers in bands. It is of two types:-
   - Hill placement: In this method, fertilizers are placed close to the plant in bands on one or both sides of the plant.
   - Row placement: In this method, fertilizers are applied in continuous band on one or both sides of the row where the crops are sown close together.
4. *Drilling;*
   In this method, the fertilizer is applied at the time of sowing by means of a seed – cum-fertilizer drill. This places the fertilizer and the seed in the same row but at the

different depths. Sometimes germination of seed and young plants may get damaged due to higher concentration of soluble salts.

*Application of liquid fertilizers:-*

5. *Foliar application*;
   It refers to the spraying of fertilizers solution containing one or more nutrients on the foliage of growing plants. The concentration of the spray solution has to be controlled otherwise it may result to serious damage.
6. *Fertigation;*
   It refers to the application of water soluble fertilizers through irrigation water. The nutrients are carried into the soil in solution. Generally, nitrogenous fertilizers are applied through irrigation water.
7. *Injection into soil;*
   In this method, liquid fertilizers are injected into the soil.
8. *Aerial application*;
   In areas where ground application is not practicable, the fertilizers solutions are applied by air craft.

**What are the factor affecting proper use of applied fertilizer? OM PRAKASH UPADHYAYA ROLL NO.;55**

**1) The nature of manure and fertilizers**

- Bulky organic manures, di-calcium and tri-calcium phosphates and slow release nitrogenous fertilizers become slowly available to the plants. Due to such reason these manure and fertilizers should be applied before sowing or at the time of sowing or planting. Highly mobile fertilizers i.e. nitrogenous fertilizers should be applied in splits with lower doses or as foliar spray, where as slightly mobile or immobile fertilizers i.e. phosphorus and potash should be applied in basal dose. Green manuring should be done at least a week before sowing crops so that they decompose well before seeding. Some manure and fertilizers may be used directly on the standing crop such as urea and oil cakes while some require treatment before application. After the treatment of urea with moist soil or di-calcium and tri-calcium phosphates with organic matter show better efficiency than direct application.
- Bio-fertilizers like Azolla sp may be grown in a standing crop of wet land rice and incorporated thereafter. Blue green algae can be grown in moist bare or cropped fields and incorporated before sowing or planting the crop. Bacterial fertilizer lime Rhizobium, azotobacter may be used as seed or soil inoculation before sowing.

**2. The soil types and soil water balance**

The types of soil plays an important role in nutrient use and nutrient use efficiency. In light soils the loss of nutrients through leaching is greater as compared to heavy soils. Due to such reason bulky organic manures should be applied before 1-2 weeks of sowing or planting and concentrated manures and rapidly soluble fertilizers should be applied as basal and split dose (top dressing)

Moisture content of the soils also play the important role in nutrient availability and their loss. In moist soil both bulky and concentrated manures can be applied by broadcasting or by localized placement method. In dry lands manure and fertilizers should be placed below the seed as pocket or contact placement. All the fertilizers and manures should be applied in the moist zone in case of dry lands. If they are not placed in the moist zone the solubility and release of nutrients are less. In wet soil the loss of N is more therefore to increase nitrogen use efficiency, slow release N fertilizers may be used. Ammonical fertilizer should be applied in the reduced zone and nitrate fertilizers in wet land rice as top dressing in splits.

3. T**he nature of the crop and cropping system**

- The requirements of nutrients in different crops and their different stage varies considerably. Most of the crops require N throughout their growth period but the rate of uptake may vary. The N uptake is slow at the initial stage of the crop and uptake is gradually increases to a maximum and then declines to a minimum or nil at maturity stage. It is better to apply N fertilizer in two or more splits of the total quantity as per the duration and requirement of the crop, soil type and type of fertilizer. In short duration crops like leafy vegetables, seedlings in the nursery, the entire dose of N may be applied as basal dressing to the soil or foliar spray. But in long duration crops like sugarcane split application (2-3 installments) of manure and fertilizer is adopted.
- www.agrimoon.com, **crop production.**

**What is chemical fertilizer? What are the different types of chemical fertilizer used in Nepal? Name: pravin BC Roll no. 60**

ANS: A chemical fertilizer is defined as any inorganic material of wholly or partially synthetic origin and it has a definite chemical composition. Chemical fertilizers are almost harmful to soil but in order to meet the demands of plant nutrients they are often used.

Different types of chemical Fertilizer in Nepal are as:

1. Nitrogenous Fertilizers:

(a) Nitrate fertilizers contain nitrogen in nitrate form; preferred by majority of plants, readily soluble in water and quickly available to plants. In moist and waterlogged conditions, these are leached down/converted into gaseous form and become available to plants. Sodium nitrate (16% N), Calcium nitrate (15.50% N); Potassium nitrate (13% N) are used worldwide.

(b) Ammonical fertilizers contain nitrogen in ammonical form; are quite resistant to leaching; hence, used in water-logged conditions also. Though readily soluble in water, these are not as quickly available to plants as nitrate fertilizers. Some time is required to convert $NH_4$ into $NO_3$; hence, suitable for slow-growing, long duration crops. Ammonium sulphate (20% N), Ammomum chloride (24-26% N), Diammonium phosphate (18% N) are widely used in India.

(c) Ammonical-nitrate fertilizers contain nitrogen in both forms—ammonical and nitrate e.g. Ammonium nitrate (33% N), Calcium ammonium nitrate (26% N).
2. Phosphate Fertilizers:

Next to nitrogen, phosphorus is the most deficient primary nutrient element in Indian soils:

(a) Water soluble phosphatic fertilizers contain phosphate in highly soluble form ($H_2PO_4$) in water, and therefore are readily available to the plants e.g., Single superphosphate (SSP: 16-18% phosphate); Double super phosphate (DSP: 32% phosphate); Triple super phosphate (TSP: 42% phosphate).

(b) Citric acid soluble phosphatic fertilizers— readily soluble in acidic water/weak acids- contain phosphorus in available form ($H_3PO_4$).

Basic slag (18% phosphate) byproduct of iron and steel industries. Dicalcium phosphate. Rich in phosphorus.

(c) Insoluble phosphatic fertilizers— completely insoluble in water; slightly soluble in weak acids like citric acid e.g., Rock phosphates (20-40% $P_2O_5$); Bone meal.

3. Potassic Fertilizers:

Chief commercial ones are Potassium sulphate (50% K20), and the muriate of potash (60% $K_2O$). NPK are complex fertilizers designed to supply all the three primary nutrients; are marked in different grades indicating the respective percentage of nitrogen (N), phosphorus ($P_2O_5$), and potash ($K_2O$) e.g., NPK 15-15-15 grade means that the fertiliser contains 15 percent each of N, $P_2O_5$ and $K_2O$. Production of chemical fertilizers involves huge amounts of energy e.g., for producing 1 kg of nitrogenous fertilizer, phosphatic fertilizer and Potassic fertilizer 80 MJ. 12 MJ and 8 MJ energy is consumed respectively.

**Chemical Fertilizer And Use Off Chemical Fertilizers In Nepal. Naresh Joshi-51**

What is chemical fertilizer?

A chemical fertilizer is defined as any inorganic material of wholly or partially

synthetic origin that added to the soil to sustain plant health.

Mainly three types of chemical fertilizer:

1. Nitrogenous fertilizer

2. Phosphatic fertilizer

3. Potassic fertilizer

1. Nitrogenenous fertilizer: Fertilizer which contains nitrogen as the major nutrient is nitrogenous fertilizer. Based on the chemical form in which nitrogen is combined with other elements within the fertilizer nitrogenous fertilizer can be:

- Nitrate fertilizers
- Ammonium fertilizers
- Nitrate and ammonium fertilizer
- Amide fertilizer

2.Phosphatic fertilizer: The fertilizer contain phosphorous as their major component termed as phosphatic fertilizer . Phosphatic fertilizer are broadly classified on the basis of their solubility either in water or in citric acid as

- Containing water soluble phosphate
- Containing citric acid soluble phosphate
- Containing insoluble phosphate

3.Potassic fertilizers: The fertilizer containing potassium as their nutrient are their major nutrient are termed as potassic fertilizers. Soil potassium exist in following 2 form based on their availability to the plants;

- Chloride form
- Non chloride form.

**Use of chemical fertilizers in Nepal:**

Synthetic pesticides spearheaded by DDT and BHC got introduced to Nepalese agriculture and public health during 1995. From then onwards their issue increased both on quantity and diversification in terms of newer synthetic pesticides. At that time, the general awareness on environment issues was so minimal and people were not told adequately about the hazardous aspect of the pesticides. People just saw their miraculous effect on malaria and pest. However, the long term effect on human health and environment was invisible. People started to sell pesticide as medicine. The introduction of new high yielding verities, intensification and commercialization of improved access to markets brought about major changes in plant protection. Appropriate crop protection

method became a very important factor for productivity and production of crop farmers; particularly in areas of commercial vegetables production are primarily relying on chemical pest control methods. Pesticides are not as extensively used on Nepal as other countries in Asia in termsof active ingredients used per hectare of croplands. The characteristics of Nepalese pesticide use in terms of location, intensity target crops, types of chemical and trends. However, there are some disturbing issues. The consumption of pesticide is increasing by about 10-20% per year and pesticide expenses in market oriented vegetables and fruits production in Nepal is a major cost factor. According to PPD report from 2003 the annual pesticide consumption comprises of 41% insecticides, 51.8% fungicides, and 7.2% others. Agriculture and health imports of 2001 is almost US$2.03 million of chemical pesticides. Farmers in general are applying pesticides in crop fields inefficiently and using traditional method in rice field and also overdose in vegetables and pollution of the environment as a whole. Awareness and skill regarding safety and efficient application of pesticides is not adequate in farmer's level. These can be upgraded to great extent by providing training to the farmers on the concept of integrated pesticide and pest management. Various types of pesticides and fertilizers in Nepal are increasing. To meet the food demand of the nation, the productivity of the agriculture should be used in adequate amount. However, the pesticides use of 142 grams per hectare is very low in compared to other countries.

In Nepal, nine Major Pesticides groups with seven subgroups of Insecticides are in use .The pesticide use amounts to 142 g/ ha which is low compared to other counties. Similarly, seven types of fertilizers are being used in Nepal viz. Urea, Diammonium Phosphate (DAP), Murate of Potash (MOP),Ammonium Sulphate (AS), Single Super Phosphate (SSP),Ammonium Phosphate Sulphate (APS) and NPK in Nepal and the its consumption is 19.65kg/ha in 204/05.

## Chemical Fertilizers and their characteristics

### NITROGEN FERTILIZERS

Nearly all chemical N fertilizers contain either ammonium ($NH_4^+$) or nitrate ($NO_3^-$) nitrogen. The nitrate form is quicker acting because it's more immediately mobile (leachable) and reaches the roots sooner if applied to a growing crop. But, remember gets converted quickly to mobile nitrate in warm soils (all of it within 7-10 days).

Most N fertilizers containing ammonium N have a gradual acidifying effect on the soil; All ammonium N fertilizers will release ammonia gas when applied to soils with pH's above 7.0. and if applied to the soil surface, significant amounts may be lost to the atmosphere by volatilization. Urea fertilizer releases ammonia at any pH. Losses can be avoided by placing such fertilizers a few centimeters deep.

**Common Nitrogen Fertilizers**

1. Ammonium Nitrate (33-34% N): Contains half nitrate N and half ammonium N, so is quicker acting than straight ammonium fertilizers; Absorbs moisture and becomes slushy in high humidity; should be kept in well sealed bag; it can become explosive if mixed with oil and releases oxygen when exposed to fire, which encourages combustion.
2. Ammonium Nitrate with Lime (26% N): It is coated with dolomitic limestone to neutralize the acid-forming properties of regular ammonium nitrate and to reduce moisture absorption.
3. Ammonium Sulfate (20-21% N): It contains 23% sulfur (or 69% sulfate) along with N.
4. Urea (45-46% N): The highest-strength solid form of N. Its N is initially in the amide form ($NH_2$) but is converted to ammonium in moist warm soils within 1-2 days (a week or two in cooler soils) and then to nitrate by soil bacteria. Urea is mobile and leachable until its amide N has been converted to ammonium. Regardless of soil pH, some N will be lost to the atmosphere as ammonia gas if urea is left on the soil surface. Losses are highest above a soil pH of 7.0 and can reach 35% when urea is broadcast (spread) over grass pastures. Losses are minimal, however, if rainfall or irrigation occur within a few hours after such surface applications. It can "burn" (injure) seeds and seedlings if placed too close due to release of free ammonia. It absorbs moisture, but not as much as ammonium nitrate. It can be fed to ruminants like cattle as a protein source (but should always be fed in combination with certain other feeds); the rumen bacteria convert the N to protein;
5. Sodium Nitrate (16% N): Its nitrate N is readily leachable. Unlike most ammonium N fertilizers, it has a gradual basic effect on the soil. It can easily burn seeds and seedlings because of its very high salt content. It absorbs moisture and can become slushy in high humidity, so storage bags should be well sealed.
6. Anhydrous Ammonia (82% N): It exists as a liquid under pressure and a gas when released into the soil. The highest-strength N fertilizer available. It must be injected into moist soil about 15 cm deep to avoid ammonia loss. Is very dangerous; inhalation and facial exposure can cause blindness and fatal lung damage and require special storage and application equipment.
7. Aqua Ammonia (21% N): It is made by dissolving ammonia gas in water. Has strong odor of ammonia. Unlike anhydrous ammonia, it doesn't have to be applied or stored under pressure. It should be applied at least 4-5 cm below the soil surface to avoid loss of ammonia as it releases irritating fumes. It requires special storage and application equipment.
8. Potassium Nitrate (13-0-44: See under K fertilizers).
9. Ammonium Phosphate Fertilizers: See under P fertilizers.

## PHOSPHORUS FERTILIZERS

The phosphorus in most chemical fertilizers comes from reacting rock phosphate with sulfuric, phosphoric, or nitric acids or with anhydrous ammonia. A chemical fertilizer's Phosphorous can exist in several forms which should be listed on the label: **Water-soluble Phosphorous**: This type of Phosphorous is soluble in water and moves quickly out of the granules into the soil. But, that doesn't mean it will be 100 percent available to plants, because it's still subject to the soil's ability to tie up (fix) P. When P fertilizer is placed in a band, hole, or half-circle near the row, it's recommended that at least half the fertilizer's P be water-soluble. When P fertilizer is broadcast on soils below pH 7.0, water solubility isn't important, because soil acidity helps dissolve the P. **Citrate-soluble Phosphorous**: This type of Phosphorous isn't soluble in water but will dissolve in a weak acid solution. Heat-treated rock phosphate contains largely citrate-soluble Phosphorous which is usable only in acidic soils. **Insoluble Phosphorous**: This type of Phosphorous isn't soluble in water or a weak acid solution, so it has very limited availability to plants. Most of the Phosphorous in raw rock phosphate is insoluble and only very slowly available, even in acid soils.

### Common Phosphorus Fertilizers

1. Single Superphosphate (16-22% $P_2O_5$, 8-12% S): A common Phosphorous fertilizer and also a good sulfur source. About 78% of its Phosphorous is water soluble (see above). Are made from rock phosphate and sulfuric acid.
2. Triple or Concentrated Superphosphate (42-48% $P_2O_5$): Has much more Phosphorous than single super but only 1-3% sulfur. About 84% of its Phosphorous is water soluble. Made from rock phosphate and phosphoric acid.
3. Ammonium Phosphate Fertilizers: There are 3 classes, all with 100% water-soluble Phosphorous viz. i) Mono-ammonium phosphate (11-48-0, 12-61-0) which works better than all-ammonium phosphate on alkaline soils; is low in sulfur and less likely to cause burning than DAP ii) Di-ammonium phosphate (16-48-0, 18-46-0, 21-53-0): A good Phosphorous source but can injure seeds or seedlings due to ammonia release if placed too close iii) Ammonium Phosphate sulfate (16-20-0, 13-39-0): Both are also good sources of sulfur (91% S in 16-20-0, 7% S in 13-39-0) iv) Miscellaneous NP and NPK Fertilizers: 20-20-0, 14-14-14, 12-24-12, etc.
4. Heat-treated Rock Phosphates: These vary a lot in P content and are made by heat treating rock phosphate which greatly increases its low availability. Its Phosphorous isn't water soluble but is citrate-soluble (see above) and will slowly become available in acid soils when broadcasted. It may be a cheap Phosphorous source in areas with phosphate deposits but is only recommended for acid soils or where organic matter is very high. It should be in a finely ground form and be applied by broadcasting to promote the release of its Phosphorous through soil reaction. It doesn't become available quickly enough to be used as the sole source of added Phosphorous for short-term annual crops like maize. Much higher rates are needed than for more available forms. Where mycorrhizae soil fungi are abundant, they increase the availability of rock phosphate to plant roots.
5. Basic Slag (8-25% $P_2O_5$): A by-product of steel making. About 60-90% of its P is citrate soluble, so it's best used on acid soils, much like heat-treated rock phosphate. It has a gradual basic effect on soils.

## POTASSIUM FERTILIZERS

The most common Potassic fertilizers are:

1. Potassium chloride (Murate of Potash): Contains about 60%-62% $K_2O$
2. Potassium sulfate: Contains about 48-50% $K_2O$ and 18% S.
3. Potassium nitrate (13-0-44).
4. NPK fertilizers like 10-20-10, etc.

NOTE: Tobacco, potatoes, and sweet potatoes are sensitive to high amounts of chlorides which affect crop quality. In this case, potassium chloride should be avoided or minimized.

**SECONDARY NUTRIENT FERTILIZERS (Calcium, Magnesium, Sulfur)**

**Calcium and Magnesium:** Even acid soils have enough calcium for most crops. Where liming is needed and magnesium is also deficient, dolomitic limestone (a mixture of calcium and magnesium carbonates) should be used. Liming with calcium only can also provoke a Mg deficiency. Gypsum has no effect on soil pH and is often used to supply calcium to crops with high needs, such as peanuts, without increasing the pH. Magnesium sulfate (epsom salts; 9-11% Mg) and Potassium magnesium sulfate (11% Mg) are other sources and have no effect on soil pH. The Mg content of fertilizers is often expressed in terms of magnesium oxide (MgO);

**Sulfur:** Some common fertilizers are good S sources like single superphosphate (8-12% S), ammonium sulfate (23-24% S), 16-20-0 (9-15% S), and potassium sulfate (17% S). Usually, the higher the NPK content of the fertilizer, the lower the S content (i.e. triple superphosphate contains only 1-3% S). Sulfur deficiencies are on the increase in non-industrial areas, due to the growing use of high-analysis fertilizers with lower S contents. It's usually a good idea to include a sulfurbearing fertilizer in a fertilizer program, especially on acid, sandy soils. Organic fertilizers are a good source of S. The S content of fertilizers is often expressed in terms of SO4 (sulfate).

**MICRONUTRIENT FERTILIZERS**

Some NP and NPK fertilizers may have added amounts of micronutrients (check the label) but usually too little to correct deficiencies. If a meaningful amount of a micronutrient is present, it may be indicated by a fourth number in the fertilizer formula, referring to it. Separate micronutrient fertilizers like copper sulfate, ferrous sulfate (iron), zinc sulfate, manganese sulfate, and borax can be used for soil or foliage (leaf) application. Micronutrient chelates: Specially synthesized forms of micronutrients called chelates are available and used where soil tie-up problems are serious. A chelate has a special molecular structure that protects the micronutrient from being tied up. Some fungicides like Maneb (containing manganese) and Zineb (containing zinc) can supply these micronutrients in conjunction with a disease control program.

**Explain about FYM and Compost. Tekendra Manni- RN.100**

Ans:- Farm yard manure is the decomposed mixture of cattle dung, urine, waste straw, grasses with litter and fodder. The well decompose FYM has all essential nutrient which

quality depend on source and nature of material we used. There are 2 method to preparation of FYM.

1. traditional method
2. Improve method

1. traditional method:-

It is the oldest method of preparation and storage of FYM. in this method dug pit and daily addition of material, dairy waste . after few month decomposing material in pit it will be ready to use.

2. improve method:-

this method reduce losses of nutrient in manure than traditional method because pith is protected from sun light, rain etc. it has also 2 method,

a) manure pit with no turning:-

in this method dig pit at first with 5m*3m*1 m dimension near livestock shed and divide 2 equal part. at fist use first one part of pit to adding material ,after fullfill of first part of pit, start useing second pit part. when second part of pit become full then first part pit`s material decomposed and will be ready for application.

b) pit with one month turning method:-

in this method dig 3 pit in series with 2m*2m*1m dimension and fill the first pit in first month. Then after replace material from first to second pit and refill first pit with new metrial. after continue replace material from first to second, second to third. when material decompose it will ready to use from third pit and going on.

*compost* is the mixture of organic matters, rotten plant and animal waste. compost has high nutrient content which improve soil physical character bestly. There are 2 method of composting:

a) pit method

b) Heap method

a) pit method:-

in this method at first dig 2m*2m*1m dimension pit and fill raw material at 30 cm then add 5 cm stertre( urine, ash, lime and red soil). After that again add 30 cm material and so on. when pit make full-filled , plaster the head of pit with cattle dung and soil. it takes 3 months to ready for application.

b)heap method:-

this method is suitable for rainy season and there where watter is logged condition. in this method wooden metrail is used at ground level and make heap above the wood with 30 cm material level and 5 cm streter material and plaster above the heap.when the farm excreta and grass were well rotton it make ready for use. it also takes about 3 months.

FYM and compost those are bulky nature organic manure because it needed more in volume to supply nutrient. they contain 0.5%N, 0.25%P, 0.5%K normally.

**What is irrigation ? Ganesh Prasad Joshi; Roll no. : 27**

It is generally defined as application of water to soil for the purpose of supplying the moisture essential for normal growth and development.In other word it is the human manipulation of hydrological cycle to improve crop production and quality and to decrease the economic effect to drought. i.e Irrigation requirement = water requirement – (effective rainfall + soil available moisture. Then,
Total water requirement = Transpiration + evaporation from soil +water used in metabolic process+water loss via run off , percolation etc + water required for land preparation and other purposed.

**Principle of irrigation:**

1. When there is adequate supply of water irrigation can provided any time so that the soil moisture can be maintained.
2. When water is in limited supply ,provide the irrigation at critical stage of crop.

**Methods of irrigation**

**Irrigation generally three types as below:**

**1.Surface irrigation**

**2.Sub-surface irrigation**

**3.Pressurized irrigation**

**1.Surface irrigation**

Surface irrigation means application of water by gravity flow to the cultivated land wetting either the entire field or part of field most irrigated area have characteristics land feature and they differ from those in other area.Hence , for efficient application of water it is important to select such method of irrigation which fit ones own land.eg.check basin ,ring basin, deep furrow and corrugation method .

**ii. Sub-surface irrigation**

⇨ This type of method more efficient than surface irrigation system.These methods applying water beneath the surface close to plant root so that either water seeps from sides of channels towards the plant roots or through capillary movement

upward.Application efficiencies 30.80% depending upon condition.It is most suitable for high temperature area where ET looses are very high where in controlling and maintance of surface water and application is very difficult.

**2.<u>Why irrigation is done ?</u>**

Irrigation is done for following cause.

- To supply the moisture essential for plant growth.
- For better utilization of production factor (Nutrient).
- To provide crop insurance against short spells of drought.
- To dilute /washout soluble salt
- To soften tillage pans
- Intensive cropping system is made possible.
- Timely seeded preparation and timly sowing
- To create favorable microclimate for crop growth
- Higher yield as well as stability in production.

**Explain about the different types of irrigation method. Bibhusa Adhikari**

Generally, Irrigation is the artificial application of water to the soil through various system of tubes, pumps and sprays. Irrigation is usually used in areas where rainfall is irregular or dry times or drought is expected. Irrigation water can come from groundwater, through springs or wells, surface water, through rivers, lakes or reservoirs or even other sources, such as treated wastewater or desalinated water. There are several method of irrigation, they vary in how the water is supplied to plants. The goal is to apply the water to plants as uniformly as possible, so that each plant has the amount of water it needs, neither too much nor too little.

Some of the different methods of irrigation are explained below:-

**1) Surface irrigation**

➔It is the oldest form of irrigation and has been in use for thousands of year. In surface irrigation system, water moves across the surface of an agricultural lands in order to wet it an infiltrate into the soil.

Surface irrigation can be sub-divided into furrow, border strip, basin irrigation or check basin method of irrigation.

**a)** Check basin meth

➔It is the most common method among surface methods of irrigation. It is suitable for close growing crops like groundnut, wheat, finger millet etc. In this method, field is divided into small plots surrounded by bunds on all the four sides. Water from the head channel is supplied to the field channels one after other. Each field channel supplies water to two rows of check basins and water is applied to one basin after another.

**b)** Basin irrigation method

➔ Basin method is almost similar to check basin method except that in the latter method where entire field is irrigated while in the basin method ,only the basin around the trees are irrigated. This method is suitable for fruit crops. Basins are connected by irrigation channels.

**c)** Furrow method

➔ It is adopted to crops grown with ridges and furrows. This method is suitable for crops like sorghum, maize, cotton, tobacco, tomato. The size and shape of the furrow depends on the crop grown and spacing adopted for the crop. Water is allowed into 3 to 5 furrows from the channel at a time depending on the stream size.

**d)** Border strip method

- In this method of irrigation, field is laid out into narrow strips, bordering with small bunds. Length of strip ranges from 30 to 300m and width from 3 to 15m. The border are laid out along the general slope. Water from the channel is allowed to into each strip at a time. This method is suitable for close growing crops and medium to heavy textured soils but not suitable for sandy soils.

**2)** Drip system of irrigation

➔ Drip irrigation is also known as trickle irrigation. In this system, water falls drop by drop just at the position of roots. Water is delivered at or near the root zone of plants drop by drop. This method can be consider as the most water-efficient method of irrigation, if managed properly. Evaporation and runoff can also be minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation and is also a means of delivery of fertilizers. Sprinkler irrigation

➔ In sprinkler system of irrigation, water is piped to one or more central locations within the field or distributed by overhead high pressure sprinkler or guns. A system using sprinklers, sprays or guns mounted overhead on permanently installed risers is often refered to as a soil- set irrigation system.

**What is surface irrigation and sub surface irrigation? Write advantage and disadvantage of its ? Aruna Thapa- Roll no.8**

**Surface irrigation** is where water is applied and distributed over the soil surface by gravity. Surface irrigation is often referred to as flood irrigation, implying that the water

distribution is uncontrolled and therefore, inherently inefficient. In reality, some of the irrigation

**Subsurface Textile Irrigation** (SSTI) is a technology designed specifically for subsurface irrigation in all soil textures from desert sands to heavy clays.

*Advantage of surface irrigation*

- Irrigation management is very easy and does not require modern technology and can largely build on local traditional knowledge;
- Adapts well to small land holdings and does not require high financial input;
- Adapts easily to flat topography and can function without outlet drainage facilities;
- Works well with short-term water supplies;
- Irrigation allows full utilization of rainwater and can achieve high application efficiencies;

*Disadvantages of surface irrigation*

- Requires level land to achieve high efficiencies (maximum land elevation fluctuation should not be greater than half the applied irrigation depth);
- Soils with high infiltration rates require small field sizes, which interferes with mechanization.
- Difficulty to apply small irrigation quantities, excess water is difficult to evacuate, particularly during times of excess rainfall;
- Plants are partly covered with water sometimes over extended periods (in low infiltration rate soils);
- Small basins require extensive delivery channels and are not easily adaptable to tractor mechanization.
-

*Advantage of sub surface irrigation*

- Joint management of irrigation and fertilization
- Simplicity
- Automation
- Production advantage

*Disadvantages of Sub surface irrigation*

- It requires an economic investment
- High maintenance and high quality water
- Water application pattern must planting pattern
-

**Explain about drip irrigation and sprinkle irrigation. Enlist advantages and disadvantages of them. Niranjan Kushwaha Roll 53**

Drip irrigation is a type of micro-irrigation systems 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. In this system the water is supplied with pressure after filtering it through the pipes with attached hoses designed to supply water in drops. Drip irrigation system distribute water through a network of valves, pipes, tubing and emmiters. Depending on how well designed, installed, maintained and operated it is, a drip irrigation systems can be more efficient than other types of irrigation systems such as surface irrigation or sprinkler irrigation.

**Advantages:**

- Fertilizer and nutrient loss is minimized due to a localized application and reduced leaching.
- Water application efficiency is high if managed correctly.
- Field leveling is not necessary.
- Fields with irregular shapes are easily accommodated.
- Recycled non-potable water can be safely used.
- Moisture within the root zone can be maintained at field capacity.
- Soil type plays a less important role in the frequency of irrigation.
- Soil erosion is lessened.
- Weed growth is lessened.
- Water distribution is highly uniform, controlled by the output of each nozzle.
- Labour cost is less than other irrigation methods.
- Variation in supply can be regulated by regulating the valves and drippers.
- Fertigation can easily be included with minimal waste of fertilizers.
- Foliage remains dry, reducing the risk of disease.

**Disadvantages:**

- Initial cost can be more than overhead systems.
- The sun can affect the tubes used for drip irrigation, shortening their lifespan.
- The risks of degrading plastic affecting the soil content and food crops. With many types of plastic, when the sun degrades the plastic, causing it to become brittle, the estrogenic chemicals (that is, chemicals replicating female hormones) which would cause the plastic to retain flexibility have been released into the surrounding environment.
- If the water is not properly filtered and the equipment not properly maintained, it can result in clogging or bioclogging.
- For subsurface drip the irrigator cannot see the water that is applied. This may lead to the farmer either applying too much water (low efficiency) or an insufficient amount of water, this is particularly common for those with less experience with drip irrigation.
- Drip irrigation might be unsatisfactory if herbicides or top dressed fertilizers need sprinkler irrigation for activation.
- Drip tape causes extra cleanup costs after harvest. Users need to plan for drip tape winding, disposal, recycling or reuse.

- Waste of water, time and harvest, if not installed properly. These systems require careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions, and suitability of drip irrigation system and its components.
- In lighter soils subsurface drip may be unable to wet the soil surface for germination. Requires careful consideration of the installation depth.
- Most drip systems are designed for high efficiency, meaning little or no leaching fraction. Without sufficient leaching, salts applied with the irrigation water may build up in the root zone, usually at the edge of the wetting pattern. On the other hand, drip irrigation avoids the high capillary potential of traditional surface-applied irrigation, which can draw salt deposits up from deposits below.
- The PVC pipes often suffer from rodent damage, requiring replacement of the entire tube and increasing expenses.
- Drip irrigation systems cannot be used for damage control by night frosts (like in the case of sprinkler irrigation systems)

References: https://en.wikipedia.org/wiki/Drip_irrigation

**Sprinkler irrigation:** This systems is used when water supply is not adequate. The water is pumped with pressure through the sprinkler, attached to pipes and these sprinklers are adjusted in such a manner to overlap up to one fourth area covered by the other sprinkler. They are then moved to the next point after sufficient percolation has taken place. This is suitable in those areas where the land is undulated or sloppy and the water supply is not regular from the canal.

**Advantages:**

- Suited to complete range of topographies and field dimensions.
- High irrigation efficiency due to uniform distribution of water.
- Accurate and easy measurement of water applied.
- Land leveling is not essential.
- Soluble fertilizer, herbicides and fungicides can be applied in the irrigation water economically and with little extra equipment.
- More land is available for cropping.
- No interfere with the movement of farm machinery.
- Can be used to protect to crop against high temperature that reduce the quantity and quantity of heaters.
- Easy to operate, operator may be trained quickly.
- Sprinklers are also used to irrigation high valued plantation crops like coffee, cardamom and orchards.

**Disadvantages:**

- It requires high initial investment.
- Power requirement is usually high since sprinklers operate with more than 0.5 $kg/cm^2$ water pressure.
- Fine textured soils that have low infiltration rate cannot be irrigated efficiently in host windy area.
- Loss of water due to evaporation from the area during irrigation.
- The water must be clean and free of sand, debris and large amounts of dissolve salts.
- Wind distorts sprinklers pattern and cause uneven distribution of water.
- Ripening of soft fruit must be protected from the spray.

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**What are the factors to be considered for Scheduling irrigation? BibhusaAdhikari Roll no–14**

Irrigation scheduling is the process used by irrigation system managers to determine the correct frequency and duration of watering.

Out side the growing season a farmers needs to irrigate will depend on several factors. The farmer must consider irrigate on requirement for tillage and crop cultivation or to ensure adequate moisture for planting. The farmer must know about the soil profile and water holding capacity of soil for the seed germination and plant growth.

> Therefore in irrigation scheduling we are talking about applying the right amount of water at the right time and in the right way. Irrigation and is part of irrigation water management. Proper irrigation scheduling is important for the efficient use of water energy and other production inputs such as fertilizer.

**Factors Influencing Irrigation Scheduling.**

Soil, crop and climatic factors influence when to irrigate and how much water to apply, i.e. they influence irrigation scheduling.

*Soil:* Here the important aspects are soil type and its water holding capacity. There is need to know how much water is available and how much of it can be depleted from the soil without necessarily affecting the crop, hence the talk about MAD.

*Root Growth:* For a given crop there is need to know, how do, or at what rate do the roots extend deep to tap moisture reserves deep down in the soil profile. Also, what is the nature of the roots of the crop, deep or shallow or whether they are fibrous or just a few. This affects water uptake and hence when to apply more water.

*Stage of Crop Growth :*Ensuring that crops are not stressed at a particular growth stage is important in crop performance. Some stages of crop growth require that there is sufficient water always and so this affects when to irrigate and how much water to apply. Critical stages vary with crop and growth stage. Examples of critical growth stages include; tasselling and silking in maize, flowering and grain filling in wheat and fruit enlargement in tomatoes. So during these stages water must be readily available to the crop.

*Weather Conditions:* Atmospheric conditions affect Eto e.g. dry, windy and hot conditions result in high Etc and crops so require more water. Under these conditions irrigation scheduling has to be closely monitored to avoid unnecessary stressing of the crops. Occurrence of rainfall also influence when or not to irrigate.

## Simple Techniques for irrigation scheduling

1. Soil-cum-sand miniplot Technique:

In this method one cubic meter pit is dug in the field.About five per cent of sand by volume is added to the dug soil, mixed well and the pit is filled up in the natural order.

2. Sowing high seed rate.

In an elevated area, one square meter plot is selected and crop is grown with four times thicker than normal seed rate.

3. Feel and Apperance Method

Moisture content can be roughly estimated by taking the soil from root zone into the hand and making it into a ball.

**ADVANTAGE**

The benefit of proper irrigation scheduling include.

- Improved crop yield .
- Improve crop quality.
- Water saving.
- Energy conservation.

- Lower production costs.
- It minimizes water-logging problems by reducing the drainage requirements.
- It assists in controlling root zone salinity problems through controlled leaching.
- It enables the farmer to schedule water rotation among the various fields to minimize crop water stress

**DISADVANTAGE.**

In practice we find irrigators sometimes fail to practise proper irrigation scheduling . Some of the reasons put forward for this are that;

- If a little water is good, then plenty of water should be even better,
- Benefits of proper irrigation scheduling are not really discernible,
- It is too much of a bother to engage in irrigation scheduling,
- Water is cheap, so there is no need to use it efficiently, and
- Water supply (on rotation) militates against proper irrigation scheduling.

. Irrigation scheduling is the most important in now a days in the agricultural system. Scheduling system that take account of the irragation need of individual plants and may well involve greater use of plant based system.

**Adverse Effect of Water Logging. By Louish Rijal(41)**

1. Depletion of oxygen in root zone and increase of $CO_2$ due to water logging. An aerobic condition adversely affects micro-organisms while harmful organisms proliferate and restrict the plant growth.

2. Physical or chemical and biological activities in the soil are disturbed due to low temp as a result of water logging. Thus pest and diseases infestation problem arises.
3. Water logging makes field operations difficult on impossible.
4. The adverse effects of water logging get accelerated when the capillary water brings salts from lower horizon of soil or they are present in the ground water used for irrigation.
5. Water logging adversely affect the soil water plant relationship there by creating ecological imbalance.
6. Secondary salinization caused by the salts which are brought up from lower horizon strict the uptake of moisture and nutrients in the plant roots and create toxic effect in the root system.
7. Due to excess soluble salts the physical condition of soil deteriorates. Highly deteriorated alkali soils have very low infiltration rates. Most rainfall goes as runoff, causing crop damages in adjoining area.
8. Crops yields reduced and some times crop failure due to inadequate uptake of moisture and nutrients and due to the injurious effect of salts or deteriorated soil condition.
9. Fodders grown in slat-affected soils may contain high molybdenum in or selenium and low amount of zinc. The nutritional imbalance may cause disease in live stock.

**What is drainage? What are the requirements of good drainage? Narendra S Thagunna; Roll 50**

**Drainage:** It is the removal of excess of water (which may be due to heavy rainfall or faulty irrigation) to enhance plant growth development, from the surface or root –zones of cultivated area or from the area to be prepared for cultivation in order to prevent waterlogging.

- **Importance of Drainage**
- Drainage reduces soil and nutrients loss from runoff and can help to avoid soil erosion.
- Drainage ensures for proper aeration of soil.
- Drainage prevents standing crops from choking.
- Drainage can help in removal of toxic elements from soil.
- Drained water can be collected and used for irrigation in dry periods in future.

**Requirements for good drainage-**

- The maximum duration and frequency of surface ponding
- Further supply of water should be checked if the water logging is due to faulty irrigation.
- Drainage system should be simple in form.
- Drainage system should be self cleansing.
- Soil structure should be crumby, spheroidal or granular.
- Sandy soil texture can aid to drainage.
- Drainage channels or pipes should be leakage proof.
- Drains for drainage should be of adequate size with proper sloping forwards.
- There should be no any obstacle like vegetation along the drainage channels.
- The banks of the drains should not be damaged by flow of water in the drains

**References:**

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**Q)What is seed? Give five definition of seed. Sapana Rai; ROLLNO-80**

1)Seed is defined as the fertilized mature ovule which contain embryo,reserved food material and protective layer covering outside.

2)Seed is an important stage in the higher plant and dispersal unit of the plant which helps in the propagation of the plant.

3)Seed is the embryonic ripened ovule form after pollen fertilization growing in hard or semi- hard coverings.

4)Seed is mature integumented megasporangium having embryonic plant with store food materials.

5)Seed is a part of flowering plant having embryo which develop into a new plants under favourable condition.

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**Real value of seed (RVS) - Ganesh saud; Roll 28**

RVS is the percentage of a seed sample that would produced seedling of the variety under certification.This is also known as utility percentage or real utility value of seed. The real value of seed is used to compare two or more seed samples which are almost similar in purity as well as germination percentage. For e.g: Let's take two sample,the first one has germination percentage whereas second one has lower germination percentage but higher purity percentage than first.In such case we cannot decide which one is superior over other.For this condition we will calculate real value of seed i.e the percentage of seed that will germinate.

Mathematically,

**RVS% =**

Enlist and describe characteristics of quality seeds. Shila Yadav Roll no.84

Quality seed is described as varietally pure with a high germination percentage, free from diseases and disease organism and with a proper moisture content and weight. Quality seed insures good germination, rapid emergence and vigorous growth.These aspects translate to a good stand(whether greenhouse or field).Poor quality seed results in 'skip',excessive thinning or yield reductions due to overcrowding,all of which diminish profitability.To become a quality seed,it should pass the certain standard fixed for certified seeds.

**Characteristics of quality seed:**

Seed is said to be quality if it posses the following characteristics.

1) **Genetic purity:** There should not be any genetic deterioration in the variety.If the breeder has placed in variety it is said to be genetically pure.Genetic purity is directly responsible for higher yield.There should not be off type plant and no varietal mixture.The seed must be true to type to its parents.
2) **It should have required level of physical purity:** Physical purity of a seed lot refers to the physical composition of seed lots.It must be clean and processed,free from inert materials,weed seeds and other crop seeds or variety.Higher the content of pure seeds,the better would be the seed quality. Physical purity level of crops is 98%, carrot is 95% and ragi is 97%
3) **Improved variety:** The variety must be truly superior to existing one.It must be latest and best suited to the area in regards to production and other characteristics.
4) **Physiological purity:** Quality seed should have high germination capacity and vigour.It should have high blood and plumpy grain.It must be dried to proper moisture percent.High germination percentage and vigour results into raising of an excellent crop having adequate plant production and uniform growth.Seed moisture is the most critical factor to determine viability during storage.The seed size,weight and specific gravity have been found positive correlation with seed germination and vigour in many crops.Must be uniform in texture and look.Optimum moisture content of some crops are:-cereals:10-12%,pulses:7-9%,oilseed:6-7%,vegetable:5-6 %
5) **Entomological quality:** The quality seed must be free from insects.The quality seed lot very much depends on its health.It shulould be free from insects and must be treated with proper chemicals.
6) **Free from objectionable weed seeds:** These are the seeds of weed species which are harmful in one or more of the following ways:
    - The size and shape of weed seeds are similar to the crop seed and difficult to separate them by mechanical means.
    - Weeds growth habit is determinate type and complete with crop for all resources.
    - Weed plants parts are poisonous or injurious to human and animals.
    - Weed plants also serve as alternative hosts for pests and diseases. E.g.Berseem:Chicory,paddy:wild paddy,cucurbits:wild cucurbits spp.,wheat:Convolvulus arensis etc. So these weeds should not be involved in the seeds.These reduces the purity and germination of seeds

**7)Free from designated diseases/pathological quality:**It refers to the diseases specified for the seed certification which may cause contamination of seed lot.So,the quality seed must be free from diseases.The quality seed lot very much depend on its health.It should be free from seed borne diseases and must be treated with proper chemicals

**8) Other characteristics:** Seed colour reflects the condition during seed maintain.Good normal colour and shine have been regarded as invaluable quality guides by the farmers from the time immemorial.

1)Https://www.kenyaplex.com

2)www.agriquest.info

3) principles of agronomy

**Why should we use quality seed? Explain the importance of using quality seed.**
**Pratikgya Paudel; Roll no.65**

A true seed may be defined as a fertilized mature ovule that posses an embryonic plant, store food material and a protective coat or coats, which is viable and has got capacity to germinate. Seed is said to be quality if it is scientifically produced and is distinctly superior in terms of genetic purity or varietal purity, freedom for on admixture of weeds and other crop seeds, seed health, high germination and vigour seed treatment and safe moisture content, etc.

A quality seed, to be stated as it is, should pass the predetermined standard fixed for the seed certification. If the given seed coat is able to meet the standard for seed certification, it is said to be quality seeds otherwise it is obviously the lower quality seeds. Seed quality plays an important role in the production of agronomic and horticultural crops. The use of good quality seed is a prerequisite for the satisfactory production of a good quality crop and is essential for export markets. The importance of quality seeds are described below:

- **Quality seed is a basic input in crop production:** Seed is the first input in any agriculture system and if quality of seed goes wrong all other inputs including fertilizers, irrigation will have no significance.
- **Less chances of insect, disease and weed appearance:** Quality seeds are also free from insects and pest attack as well as free from pathogens so there is reduced incidence of insect pest and disease.
- **High quality produce:** Quality seed has no varietal mixture off type, weed seed. So, we can get better quality produce. We get more prices from such produce.
- **Quality seed is a carrier of new technology:** Quality seed shows good response of other agricultural inputs like fertilizer, irrigation, weed control, etc. It encourages the farmers to use other inputs. When new wheat seed from Mexico was introduced in different countries, farmers started to use fertilizers, irrigation also. Thus, quality seed is a carrier of new technology.
- **Quality seed is a basic tool for food security:** Many countries previously insufficient in production of food have now become self-sufficient thanks to the introduction of quality seeds in their agriculture.
- **Quality seed has high genetic potential:** Proper use of agricultural inputs like fertilizer, irrigation, plant protection, etc. increases the productivity of a crop. But if the quality of seed is poor, it will not increase the productivity of crop in same proportion because of lower genetic potential of the seed.

- **Quality seed improves the productivity of crops:** It has found that the use of quality seed increased the productivity of crops by 10-30% as compared to local seed. Quality seed with all other recommended inputs would further increase the productivity of crops. Use of uncertified seed, local seed, and seed without source has damaged the crop in many places. Thus, quality seed play vital role in reducing food deficit by increasing production.

*References:*

http://www.fao.org

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Define seed germination & explain key process of seed germination? Gunjan Giri; Roll No:- 30

Germination is the process by which an organism grows from a seed or similar structure. Seed germination is the process of a fertilized plant ovary or seed developing inti new nature plant. The process of seed germination includes following 5 steps: -

**1)** Imbibition

The first step in seed germination is imbibition which results in swelling of the seed due to absorption of water by the dry seed. As the cellular constituent yet rehydrated the swelling takes place with a great force which rupture the seed coat & enable the radicle to come out in the form of primary root.

**2)** Respiration

As imbibition causes the resumption of metabolic activity respiration takes place in the seed. Initially the respiration may be anaerobic but soon it becomes aerobic as oxygen begins entering the seed.

- Seed of water plant including rice can germinate under waterby utilizing dissolved $O_2$
- Seed of land plants cannot germinate under water as they require more $O_2$ & they obtain $O_2$ from the air contained in soil.

Ploughing & hoeing aerate the soil and facilitate seedgermination.

**3)** Effect of light on seed germination

Seed greatly respond to light during germination & seed responding to light and named as photoblastic.

Photoblastic are divided into three:-

Positive photoblastic: They do not germinate in darkness so require sunlight for germination. Eg:- Lettuce, Tobacco etc.

Negative photoblastic

They cannot germinate if exposed to sunlight. Eg:- Onion, Lilyetes etc.

Non –photoblastic: They can germinate whether or not when they are exposed to light.

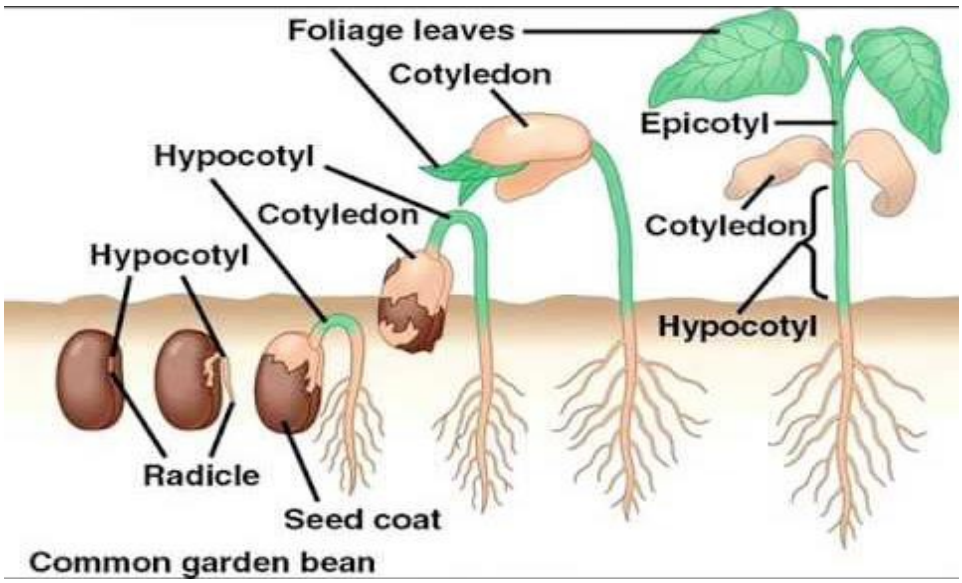
**4)** Mobilization of reserves during seed germination & role of growth regulator

During germination the cells of embryo resume metabolic activity & undergo division & expansion. Stored food nutrients need to be digested to use energy provided by aerobic respiration. The insoluble food is made soluble & complex food is made simples.

- ✓ Gibberellin promotes seed germination & early seedling grows.
- ✓ Abscisic acid (ABA) prevents germination as it is dormancy inducing hormones.
- ✓ Gibberellic acid initiates the synthesis of hydrolyzing enzymes.

**5)** Development of embryo axis into seedling

After all the favorable condition of air, water, sunlight, food the cells of embryo become metabolically active in growing region. The cell begins divisions from the seedling.

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**What is seed germination ? Explain all factors affecting seed germination . Tirsana Tamang Roll no.95**

Seed germination is defined as the emergence of those essential characters from the seed embryo which is able to give rise to a new plant under the favorable conditions of atmosphere and soil. All the viable seeds naturally germinate to give a new plant under the favorable condition.

Conditions necessary for germination :-

1. Water must be available so that when it is imbibed by the seed, metabolic processes within the seeds are enhanced.
2. Oxygen should be present for aerobic respiration to occur so as to supply energy for germination process.
3. Thirdly, there should be an appropriate temperature .

**Factorsaffectingseedgermination**

Various internal and external factors influence the germination of seed. They are :

a) Internal factors

**1)Maturity**

The main internal factor that affects seed germination is seed maturity. Only a mature seed can germinate under favorable condition to give rise to a healthy seedling.

**2) Dormancy**

In some plants, the embryo is not fully mature at the time of seed shedding. Such seed donot germinate till the embryo attains maturity. The freshly shed seed in certain plants maynot have sufficient amounts of growth harmones required for the growth of embryo. These seeds require some interval of time during which the harmones get synthesized.

**3) Seed health**

Insect pest attack, disease incidence, pathogens activity and as a whole seed health has also prime role in determining the germination of seeds.

b) External Factors

**1) Water (moisture)**

Prior to seed germination, all seeds must imbibe some water. Water is imbibed through the micropyl, through the hilum or directly through the testa. Water is needed to activate enzymes in the seed to initiate thr breakdown and translocation of stored food in the cotyledons and other storage materials for the seed. Depending upon the species, the seed may have to imbibe between 25 and 75% of its dry weight. Even though a certain minimum amount of moisture is needed for germination by all seeds, abundant moisture accelerates the process. By the same token, excessive drought or excessive moisture conditions are detrimental to seed germination.

**2) Temperature**

Temperature is an important factor whenever

biochemical reactions occur. It is a basis for adaptation for plant. ( cool and warm season plants )

Most seeds will germinate at 15°c to 30°c with the optimum being 25°c to 30°c. The maximum temperature for most seeds is 30°c to 40°c. Generally, cool season species requires a lower temperature for seed germination than warm season ones. These requirements become more exacting when seed quality is poor.

### 3) Air

Seedgermination is generally an aerobic process. A good exchange between soil air and atmospheric air is necessary to keep soil composition in proper balance. There should be adequate oxygen in the germination environment in order for physiological processes associated with germination to proceed. The amount of oxygen required depends on the species. A rice species has been reported to germinate under extremely low oxygen (near zero Oxygen) content of the atmosphere. On the other hand, carbondioxide is inhibitory to germination, especially when it occurs in a concerntration above 0.03% of the air.

### 4) Light

Light is not a universal requirement for germination as are temperature and moisture. In species that need it, the effect of light on seed germination is manifested through its intensity, wavelength and duration (photoperiod). High intensity is desired after seedling emergence for proper growth and development to avoid etiolation or spindly growth. In terms of wavelength, germination is most stimulated

by red light but inhibited by far red light.

**5) Exogenous chemicals**

Some chemicals induce or favour quick and rapid germination.

•Gibberellins stimulate germination in protoplasmic seeds.

- Hydrogen peroxide is used for legumes, tomato and barley.
- Ethylene is used for stimulating groundnut germination .

References

G.Acquaah.2011. Principles of Crop Production, 2nd edition. PHI learning Pvt. Ltd. New Delhi –110001

Suman Dhakal, Asst. Professor, Department of Agronomy, AFU

What do you mean by photoblastic seed ? Explain different categories of photoblastic seeds. Muna Thapa Roll no:-44

A seed whose germination is influenced by light .Seeds that are stimulated by light are described as positively photoblastic seed ,whose germination is inhibited by light are said to be negatively photoblastic. Three categories of photoblastic seed :-

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1.Positive Photoblastic

Positive photoblastic seed donot germinate in darkness and require exposure to sunlight for germination to occur .Example lettuce, tobacco.

2. Negative Photoblastic

Seed germinate in darkness & donot require sunlight for germination to occur .eg: onion ,Maize ,wheat .

3.Non photoblastic

Seeds germinate irrespective of the presence (exposure ) or absence (non exposure) of light.

**photoblastic | Encyclopedia.com**

**New proposal of classification of seeds based on forms of phytochrome instead of photoblastism**

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**Explain all method of breaking dormancy? Prava Khanal; Roll No.59**

Ans; There are 11 methods of breaking dormancy ,which are described below;

1)Scarification

2) Hot water treatment

3) Acid treatment

4) Leaching

5)Hormonal treatment

6) priming

7)Improvement of nutrition

8)Extension of viability

9) Inoculation of rhizobium

10) Gap filling

11) Hardening plant

Explanation

1) scarification; The process of breaking ,scratching,mechanically altering or softening the seed coats to make them permeable to water and gases is known as scarification.

2)Hot water treatment; seeds are dropped in water of 75 to 100c .

3)Acid treatment; It is usually done with concentrated sulphuric acid.

4) Leaching; The purpose of leaching is to remove germination inhibitors by soaking seeds in running water or by placing them in frequent change in water.

5)Hormonal treatment; Treating the seeds with gibberllic acid (GA3).

6) Priming; seeds are sometimes soaked in water for 24 to 48 hrs to introduce incipent germination as in rice.

7) Gap filling:Gap filling is advantage only when the gaps are large and filled with same age

plant.

Reference ; Principles of agronomy .

**Q.What are the different methods Of seed sowing?- Prabesh Bhandari Roll no: 58**

different methods of seed sowing are briefly explained below;

**1.Broadcasting**

It is the scattering of seeds by hand all over the prepared field followed by covering with wooden planks or harrow for contact of seed with soil .Crops like wheat,paddy,sesamum, methi etc are sown by this method.

Advantages;

- Quickest and cheapest method.

- skilled labour is not uniform.

- implement  is not required .

Disadvantages;

- Seed requirement is more

- Crop stand is not uniform.

- Result in gappy germination and defective.

**2.Drilling or line sowing**

It is the dropping of seeds into the soil with the help of implements such as mogha, seed drill, mechanical sees drill and then seeds  are covered by wooden planks or harrow to have contact between seed and soil. Crops like jowar,wheat,Bajara etc.are sown by this method.

Advantages;

- Seeds are placed at proper and uniform depths..

- Along the rows , interculturing can be done.

- Seed requirement is less than broadcasting.

Disadvantages;

- Require implement for sowing.

- Skilled person is required .

- Plant to plant spacing is not maintained.

**3.Dribbling;**

It is the placing or dribbling of seeds at cross marks made in the field with the help of marker as per the requirement of the crop in the both directions .It is done manually by dibbles . crops like groundnut, hy .cotton and castor are sown.

Advantages;

- Spacing between rows and plants is maintained .

- Seeds can be dribbled at desired depth.

- Seed requirement is less.

- Intercropping can be done.

Disadvantages;

- Labourious and time consuming method

- Increase cost of cultivation .

- require strict supervision .

**4. Transplanting.**

It is the raising of seedling on nursery beds and transplanting of seedlings in the laid out field . FOR this , seedlings ate allowed to grow on nursery beds for about 3-5 weeks. Beds are watered one day before the transplanting of nursery to prevent jerk to the roots . Besides the advantages and disadvantages of dribbling method, initial cost of cultivation of crop can be saved but requires due care in the nursery. Crops like paddy, fruits, Vegetables, tobacco are sown by this method .

**5 .Planting method.**

It is the placing of vegetative part of crops which are vegetatively propagated in the laid out field . Eg .tubers of potato,mother sets of ginger,and turmeric , sets of sugarcane etc .

**6.Putting seeds behind the plough..**

It is the dropping of seeds behind the plough in the furrow with the help of manual labour by hands . THIS method is followed for crops like wal or gram in some areas for better utilization of soil moisture. The seeds are covered by successive furrow opened by the plough. This method is not commonly followed for sowing of the crops .

**7.Mechanized seeding.**

It is accomplished with three categories of implements ; broadcast seeders ,grain drills and row crop planters . equipment called specialized planters are used . Some of the equipments are tobacco planter, potato planter . This is time saving method and reduces the number of passes over the soil with implements.

References.

1 Www.agrimoon.com

2 principle of crop production ( George accquah)

3 principle of agronomy ( SR REDDY)

Q) What is seed germination ? Explain all factors affecting seed germination .

Seed germination is defined as the emergence of those essential characters from the seed embryo which is able to give rise to a new plant under the favorable conditions of atmosphere and soil. All the viable seeds naturally germinate to give a new plant under the favorable condition.

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Suman Dhakal, Asst. Professor, Department of Agronomy, AFU

**Cropping System, Farming System and Cropping Pattern By, CHOODAMANI JOSHI; ROLL NO: - 22**

**Cropping system**

The crop, crop sequences and management techniques used on a particular field over a period of years. It includes all spatial and temporal aspects of managing and agricultural system. Historically cropping system has been designed to maximize yield, but modern agriculture is increasingly concerned with promoting environmental sustainability in cropping system. A crop choice is central to any cropping system. In evaluating a crop will be planted a farmer most consider its profitability, adaptability to changing environmental conditions, resistance to disease. Example rice- wheat –maize is the pre-dominant cropping system in Nepal.

**Farming System**

It is a resource management strategy to achieve economic and sustain agricultural production to meet diverse requirement to farm household while preserving the resource base and maintaining high environmental quality. It is a decision making unit comprising the farm household, cropping and livestock system that transform land, capital, and labor into useful product that can be consumed or sold. Farming system consists of several enterprises like cropping system, dairying, piggery, poultry, fishery, bee keeping, etc. These enterprises are interrelated. The end product and wastes of one enterprise are used as inputs in others. The waste of dairying like dung, urine, etc is used for preparation of FYM, which is an input in cropping system. The straw obtained from the crops is used as fodder for cattle's. Thus different enter prizes of farming systems are highly interrelated.

**Cropping pattern**

The yearly sequence and spatial arrangement of crops and fallow on a given piece of land. For examples in 1 ha area, 50% vegetable, 30% cereals and 20% may be fallow or any other combinations of crops or crop fallow.

**TYPES OF CROPPING PATTERN: -** Monocropping, multiple cropping, inter-cropping, mixed cropping, sequence cropping, relay cropping and rotten cropping.

**Why cropping patterns differ?**

It has been observered that different cropping pattern is adopted in different region of the same country. The main reason behind that is the climatic variation and resources avaibility. Land and water resources are limited for a high population. We need to adopt a highly productive cropping system to fulfill the need of people. Climatic factors play important role in selecting crop pattern. For e.g. rice is cultivated in rainy season when there is adequate amount of water is present.

**What is multiple cropping? Expalin the Advantage and dis advantage of multiple cropping?- Dipak prasad ojha ; Roll.N 24**

Ans : Multiple cropping is the practice of growing two or more crops in the same piece of land in growing in same season instead of one crop. Mixed cropping is also known as intercropping and crop rotation. It is Planting more than one will allow the crops to grow and work together on the same piece of land. Multiple cropping helps to improve soil fertility and it also increases crop yield. In this type of farming the products and the wastes that are from one crop plant helps in the growth of the other crop. same time on the same field. It is also known as multiple cropping. Planting more than one crop will allow the crops to grow and work together on the same piece of land. Multiple cropping helps to improve soil fertility and it also increases crop yield. In this type of farming the products and the wastes that are from one crop plant helps in the growth of the other crop.

**Advantage of multiple cropping**

- Farmers can keep their fields under continuous production
- There is reduction in the need of artificial fertilizers which can otherwise be expensive.
- There is geographic mixing of crops; this can help slow the spread of pest and other diseases in the growing season
- There are more land to be farmed with the same amount of labor and machinery.
- According to some scientific basis there is 10-25% increase in the yield in mixed farming versus monoculture.

- There are many cost related advantages in intercropping. Financial risks are distributed over diverse production of crops and livestock.
- This system is a powerful tool to improve agricultural systems

**Disadvantages of multiple cropping**

- Some plant crops are very specific in the type of soil they need for maximum profits.
- This type of farming system is done keeping in mind the needs of the soil and not the needs of the crop.
- Choosy crops are not preferred in mixed farming practices.
- Crops for multiple farming if not chosen properly, have chances of competition between the crops for nutrients.
- It also may reduce the fertility of the soil as more than one crop is grown at a time in the same piece of land.

**Multiple Cropping _ Dipesh Raj Bist, Roll no.25**

Growing of two or more crops on the same piece of land in one year is called as multiple cropping. The most important aspect of multiple cropping is the intensification of crop production into additional dimensions. Multiple cropping includes the dimensions of time and space; for example, when two crops share the same space at the same time.

Multiple cropping is not a new form of agricultural technology, but instead is an ancient means of intensive farming. Multiple cropping has been practiced in many parts of the world as a way to maximize land productivity in a specific area in a growing season. Generally, the practice of planting two or more crops on the same field is more common in tropical regions where more rainfall, higher temperature tures, and longer growing seasons are more favorable for continual crop production. As population has increased, increasing the need for agricultural production, the use of multicropping systems is more prevalent.

Multiple Cropping includes intercropping and sequence cropping.

**Intercropping**: Growing two or more crops simultaneously on the same field.Inter cropping is of four types, viz. mixed inter cropping, row inter cropping, strip inter cropping, and relay inter cropping.

**Sequential cropping** :Cultivation of two or more crops in sequence (one after another) on the same field in a year is known as sequential cropping. It is of three types, viz. double cropping, triple cropping and rotoon cropping.

- Things to consider for multiple cropping :

The major considerations in multiple cropping is given to crop selection.

Following points should be given due importance while selecting crop species for multiple cropping system:

(i) Both crops should not have similar rooting pattern. If one is shallow rooted, the other should be deep rooted so that both can absorb nutrients from different layers of soil.

(ii) Pulse crop should be included as one of the component. Most of the pulses are legumenous, with nitrogen fixing ability which enhance the nitrogen content of soil eventually increasing fertility of the soil.

(iii) Selected species should not have allelopathy(suppression of plant growth of one species by another species due to liberation of biologically active substance from the root or shoot).

(iv) There should be difference in the height of two species which would be able to capture much more light energy, raising efficiency, and potentially tentially, production.

(v) Selected crops should not have common diseases and insects.

(vi)Two crops that will mature at roughly the same time, or can wait while the other crop matures should be choosen.

Beside the selection of crop species following things should be considered for multiple cropping.

- the crop combinations and in put rations should be compatible with farmer's skill, enterprise preference,health, age and capital,
- assured irrigation facility,
- local availability of essential inputs lili improved seeds, fertilizers, pesticides
- stable marketing and storage facilities,
- good transportation facilities,
- easy availability of credit,
- availability of cheap labour, and
- proper adjustment of sowing and harvesting time of crops.

A due consideration to all these points will make multiple cropping successful and meaningful.

- <u>Multiple Cropping System is required due to following advantages :</u>

(i) It provides diversity of diets by planting different food crops together or in sequence.

(ii) It provides employment to rural labourers throughout the year.

(iii) It leads to stability of production.

(iv) It permits best possible use of land resources.

(v) Inter cropping and mixed cropping act as barriers in the spread of diseases and insects.

(vi) It reduces the risk of crop failure.

(vii) Fertilizer use can be more efficient because of the more diverse and deeper root structure in the system.

(viii) Dependence on one crop is avoided so that variabiIity in prices, market, climate, and pests and diseases do not have such drastic effects on local economics.

(ix) Legumes (as well as a few other plant families) are able to fix and incorporate nitrogen into the system thus increasing soil fertility.

(x) Recovery of investments can occur in much less time, especially where trees are combined with short term agricultural crops.

**Q. What is crop rotation? What are the principles of crop rotation?**

Crop rotation is a cropping practice in which a set of crop is cultivated in a pre-determined sequence, avoiding the same crop being cultivated continuously at the same location.
The crop rotation is stated as growing one crop after another on the same piece of land on different timings without impairing the soil fertility. It is also called sequence cropping.
Successful crop husbandry depends on the choice of right crop on the right soil.

**Principles of crop rotation**

1- Deep rooted crops should be succeeded by shallow rooted crops such as cotton,castor,pigeon pea,potato,lentil etc for good soil structure maintenance.

2- Follow a legume forage crop, such as clover or alfalfa,with a high-nitrogen demanding crop,such as corn to take advantage of the nitrogen supply.

3- Grow less of nitrogen-demanding crops, such as oats,barley and wheat in the second or third year after a legume sod.

4- Grow the same annual crop for only one year,if possible,to decrease the likelihood of insects,diseases and nematodesbecoming a problem.

5- Creation and maintenance of biodiversity in the agroecosystem as a means of establishing equilibrium in the system.Such an equilibrium would prevent the population explosion of any particular pest in agroecosystem,thereby creating a natural means of pest management.Organic farmers may use cropping system such as polycultures to creat biodiversity.

6- Cash crop must be selected while doing crop rotation and highly demanded crop should be cultivated.

7- Don't follow a crop with a closely related species, since insect,disease and nematode problems are frequently shared by members of closely related crops.

8- Alternate between crop with high root biomass and those with low root bio-mass.This is because a high root biomass provides food for soil microorganisms.

9- Include green manures and catch crops to protect soil erosion and nutrient loss through leaching and to accumulate nitrogen.

10- Use crop sequences that aid in controling weeds small grains compete strongly against weeds and may inhibit germination of weed seeds,row crops permit mid-season cultivation and sod crops that are mowed regularly or intensively grazed help to control annu- al weeds.

11- Use longer period of perennial crops such as a forage legume, on sloping land and on highly erosive soil.Using sound conservation practices such as no-till planting,extensive cover cropping or strip cropping (a practice that combbines the benefits of rotations and erosion control ) may lessen the need to follow this guidline.

12- Grow same crops that will leave a significant amount of residue,like sor- ghum or corn harvested for grain,to help to maintain organic matter level.

13- Long duration crops should be succeeded by short duration crops such as sugarcane,Napier,lucerne-cowpea, blackgram,groundnut.

14- In regions with limited rainfall, the amount of water used by crop may be critically important issues. Without plentiful irritation growing high- water use crops such as hay,as well as sun- flower and safflower,may not leave sufficient moisture in the soil for the next crop in the rotation.

15- Drough tolerated crops should be planted where water availability is less.

16- Be flexible enough to adapt to annual climate and crop price variations as well as development of soil pathogen and plant parasitic nematodes. For example dry land rotations have been introduced in the Great Plains to replace the wheat fallow system, resulting in better use of water and less soil erosion.

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Matirkatha.net
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Principles of crop production (George Acquaah)book.....

**Explain about the advantage of crop rotation- Sadhana Bohara; Roll No; 74**

The successive cultivation of different crop in a specified on the same field, in contrast to a one crop system or to haphazard crop successions .It help in reducing soil erosion and increase soil fertility and crop yield . Advantages of crop rotation are:

- Crop rotation improved the fertility of the soil and hence, bring about an increase in the production of food grains
- Crop rotation helps in saving on nitrogenous fertilizers, because leguminous plants grown during the rotation of crops can fix atmospheric nitrogen in the soil with the help of nitrogen fixing bacteria
- Crop rotation also prevents the plants from disease pathogen, this can be achieved by growing non host plants
- It also prevent the crop from insect
- Crop rotation can improve soil structure and fertility by alternating deep rooted and shallow rooted plants
- Crop rotation helps weed control and pest control. This is because weed and pests are very choosy about the host crop plant, which they attack when the crop is change the cycle is broke. Hence, pesticide cost is reduced.
- Increasing the biodiversity of crops beneficial effects on the surrounding ecosystem and can host of greater diversity of fauna, insects and beneficial micro-organisms in the soil.
- Integrating certain crops especially cover crops, into crop rotations is of particular value to weed management. These crop crowds out weed through competition.

https//;www.Quora
https//;www. britannica

**Explain sequence cropping, relay cropping and multistoried crop cropping**

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**Sequence cropping** involves growing two crops in the same field,one after the other in the same year. A form of multiple cropping in which crops are grown in sequence on the same field, with the succeeding crop planted after the preceding crop is harvested.
Example: planting maize in the long rains,then beans during the short rains.
Advantages**:**

1. The risk of total loss from drought,pest and disease is reduced.
2. It gives a maximum production from small plots.
3. Including legumes in the cropping pattern helps to maintain soil fertility by fixing nitrogen in the soil.

Disadvantages:

- High standards seeds are not used so there are no better quality of seeds.
- Large number of different crops in the field makes it difficult to weed.

**Relay cropping:**

Relay cropping is the process of growing one crop,then planting another crop,in the same field before harvesting the first.this helps to avoid competition between the main crop and the intercrop .it also uses the field for a longer time,since the cover crop usually continues to grow after the Main crop is harvested.

Advantages:

- The potential to reduce nitrate leaching.
- Increase carbon sequestration.
- Increase income for producers.

Disadvantages:

- It requires a greater level of management.
- Pest management and control practices must account for more crops being grown in close sequence.

**Multistoried cropping:**

Growing plants of different height in the same field at the same time is termed as multistoried cropping.it is mostly practiced in orchards and plantation crops for maximum use of solar energy. In this system,the tallest components have foliage of strong light and high evaporative demand and shorter components with foliage requiring shade or relatively high humidity.

**Advantages:**

- Income per unit area increases.
- Minimize risk of crop yield loss.
- Generate jobs and provide better labour use pattern.
- Help to maximize land use.
- Helps in effective weed control.
- Maintain an ecological balance.
- Higher production as the cultivation process is accelerated.
- Better and more consistent crop quality.
- Improve soil characteristics and add organic matter.

**Disadvantages:**

- Labour intensive.
- Chemical control of weeds,pests and disease may be difficult.
- Difficulty in mechanization.
- Adverse competitive effect .

Reference:civilsdaily.com,cropwatch.uni.edu,agricare

**Explain cropping index, cropping intensity and land equivalent ratio with example and formula.- Dikshya Chapagain; Roll no: 98**

***Cropping Index***

Cropping index is the number of crops grown per year on a given land area multiplied by 100.

$$Cropping\ index = \frac{Total\ number\ of\ crops}{Net\ cultivated\ area} \times 100$$

***Cropping Intensity(CII)***

Cropping intensity indicates the number of times a field is grown with crops in a year. It is calculated by dividing gross cropped area with net area available in the farm, region or country.

$$Cropping\ Intensity\ (CII) = \frac{Gross\ cropped\ area}{Net\ area\ available} \times 100$$

**Example:** A farmer has 5 ha of land. He has sown different crops in different seasons in one year as given below:

| Crops | Area sown (ha) | | |
|---|---|---|---|
| | Khariff | Rabi | Summer |
| Rice | 2 | - | 2 |
| Maize | 2 | 2 | 1 |
| Finger millet | 1 | - | - |
| Wheat | - | 3 | 1 |

Total area sown is 14 ha i.e. 5 ha (Khariff), 5 ha (Rabi) and 4 ha (summer).

$$CII = \frac{14}{5} \times 100 = 280\%$$

This shows that more than two (approx. 3) crops are grown in an year. The period occupied by the crop in the field is not considered. When long duration crops like sugarcane and cotton are grown, cropping intensity will be low, though the crops remain in the field for a longer time.

***Land Equivalent Ratio(LER)***

Land equivalent ratio (LER) is the relative land area under sole crops that is required to produce yields achieved in intercropping. It is a logical criteria for comparing intercropping system with pure culture. If LER is more than one, means lands are utilized efficiently and if LER is less than one, intercrop is not beneficial.

It is expressed as:

$$\text{LER} = \sum_{i=1}^{m} \frac{Yi}{Yij}$$

Where, $Y_i$ = yield of $i^{th}$ component from unit area grown as intercrop

$Y_{ij}$ = yield of $i^{th}$ component grown as sole crop

**OR,**

$$LER = \frac{Yield\ of\ crop\ A\ in\ intercrop}{Yield\ of\ pure\ crop\ A} + \frac{Yield\ of\ crop\ B\ in\ intercrop}{Yield\ of\ pure\ crop\ B}$$

**Example:** Suppose in a farmer's field the yields of maize and soybean grown as pure crops be 2 tons and 1ton/ha respectively. Let the yields of these crops when grown as intercrops be 1.75 and 0.5 t/ha respectively. The land equivalent ratio of maize and soybean intercropping system is follows:

$$LER\ of\ maize = \frac{Yield\ of\ intercrop}{Yield\ of\ sole\ crop} = \frac{1.75}{2.0}$$

$$LER\ of\ soyabean = \frac{0.5}{1.0}$$

$$LER\ of\ system = \frac{1.75}{2.0} + \frac{0.5}{1.0} = \frac{1.75 + 1}{2} = 1.37$$

LER of 1.37 indicates that 37% yield advantage is obtained when grown as intercrops compared to growing as sole crops. In other words, the sole crops have to be grown in 1.37 ha to get the same yield level that is obtained from 1.00 ha of intercropping.

Principles of Agronomy, T. Yellamanda Reddy & G.H. Sankara Reddy, Kalyani Publishers

www.quora

**Define Monoculture. Explain advantages and disadvantages. Bipana Joshi ; Roll-17**

The ritual of growing the same crop for many successive years is known as crop monoculture. In monoculture same crops is grown in the same land after year. For example ,in monoculture farming rice will be grown only with rice, particular type of potato will be cultivated only that type.

Advantage of monoculture

- Monoculture farming is fairly simple in nature, focussing all it's needs and preference on one single crop species. Farmers just need to prepare the soil, and irrigate the land based on one crops. So that ,the field is in better position and provide maximum output for a particular crop.
- Harvesting becomes also fairly easy, desired parts of a plant can be easily assembled without damaging other plants .
- Controlling pests and diseases becomes relatively easy. Growers just need to use one pesticide for all plants, because the disease affecting them would be common.
- Their is less competition for sunlight, nutrients and spaces from other species. It helps to control undesirable growth and gives maximum profits.
- The knowledge of single plant species is sufficient for a good crop, farmers need not worry about other species their cultivation methods, prevention, etc...
- Chemicals treatment is feasible, without having to worry about their side effects on other species.
- High gross margin .crops are market driven ,and easy to market such crops. Farmers particularly plants crop which can be consumed all year round and also those which will thrive under all weather conditions .

Disadvantage of monoculture

- Due to cultivation of Same crops over and over again, leads to reduce soil fertility, reduces the nitrogen composition in the soil.
- If a particular disease or pest can on one single plant, then it is possible affects all the other plants which leads to the destruction of the entire crop.
- Plant require multiple resources to thrive, however if a crop is planted in the same field for extended periods, it limits its chance of taking advantage of other nutrient in the soil.
- Their is also limited food options in monoculture. For the sake of saving their resources, farmers plant one single crops, leaving consumers with few option to service on, which leads to malnutrition especially in developing country.
- Planting crops over a large area can be time consuming for a farmers. Required more efforts and investment.

**What is soil tilth? What are characteristics of good soil tilth? Binod Prasad Shah Roll No. : 16**

It is the physical condition of soil resulting from tillage that influences crops emergence, establishment, growth and development. And said to be good when the soil is soft, friable and properly aerated. Tilth is a loose, friably, airy, powdery granular and crumbly structure of the soil with optimum moisture content suitable for working and germination or sprouting seeds and propagates. Soil tilth is that kind of physical condition of soil when it is loose. Not very powdery but granular and when these granules are felt between the fingers they are soft, friable and crumble easily under high pressure such soils permit easy infiltration of water and are retentive of moisture for satisfactory growth of plants.

**Characteristics of good soil tilth:**

- It should have higher percentage of larger aggregates (more than 5mm diameter) for irrigated farming.
- It should have higher %age of smaller aggregates (1-2mm diameter) for dry land farming.
- It should be porous and has free drainage up to water level.
- Micro-pores (capillary) and macro-pores (non-capillary) should be in equal proportion.
- The soil particle should not be easily eroded by water or wind.
- Soil should not be sticky when moist.
- Soil should permit easy infiltration of water.

https://www.agricreed.in>2018/03>soil
https://imp.center

**Enlist 15 tillage implement along their uses Lokendra Singh dhami; Roll no.40**

1) Harrow : we use chain harrow to aerated the soil; lift matter off the ground ,and help spread out matter of the ground. They can be used to break up chunks of fertilizer. The common used baseball diamonds' and landscaping.
2) Cultivator : A cultivator is any of several type of several types of farm implement used for secondary tillage used for removed weed or pulverized and stir the soil before planting.
3) Rotary tiller (Minitillers) : rotary tiller is used for small farms, fruit and vegetables, orchard, gardening and nursery suitable for soil conditioning and weed control.
4) Hand cultivate : it is used for cultirating garden plot and remove the weed.
5) Wooden plough : it means UK plough is a tool or farm implement used in farmer for initial cultivation of soil in preparation. For sowing seed or planting to loosen or turn the soil.
6) Tractor: A cultivator is a tool or farm implement used for secondary tillage. This implement spacing designed to all different.
7) Disk harrow: A Disk harrow is a farm implement that is used to till the soil where crop are to be planted. It is also used to chop up unwanted weed or crop remainders.
8) Hoe :A hoe is an ancient and versatile agriculture and horticulture hand tool used to shape soil remove weed clear soil.
9) Rake :A rake is broom for outside use a agronomy implement consisting of a toothed bar fixed transversely to Handel.
10) Cultipackler : This is the equipment that is used to crush soil clods, press small stone, remove air pockets and soon.
11) Subsoiler : The tool is tractor -mounted equipment that is used to break up and loosen the soil while deep tillage.
12) Seed drill :This is the tool that is used for doing seed of crop. The tool allows sowing the seed at needed, equal distance and proper depth.
13) Plough : Plough is the one of the most important agricultural tools. The function of this tools is to cultivate the soil to prepare in for sowing.
14) Grab-hoe : This tool to brake hard top soil.
15) Pick-mattock : it is very useful tool to dig and break stone .

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**<u>What is conventional tillage? Enlist five advantages and disadvantages:</u> Ramesh Karki; Roll No.71**

- The tillage system that leaves less than 15% of the soil covered with plant residue is called conventional tillage. In convectional tillage, the entire field is stirred up to a certain depth (called the plow depth). This requires using various kinds of implements. The final condition depends on the purpose of tillage and the crop to be produced. Convectional tillage incorporates two basic methods: clean till (in which no plant remains are left on the soil surface) or mulch till (some plants left on the soil surface). Mulch till is also a conservation tillage method.

  ***Conventional tillage consists of three general steps:***

  1. The land is first cleared to remove large pieces of debris and trees or shrubs. This is necessary to facilitate the use of tillage implements that are prone to damage from these obstacles. Low growing grasses can be readily plowed under without the need for a pre-plowing clearing operation.
  2. Primary tillage implements are then used to bury the remaining plant materials on the soil surface.
  3. The conventional tillage operations are completed by conducting a secondary tillage of the soil.

  During tillage the soil can be stirred to varying depth. In this regards, there are two general classes of tillage operation ; <u>primary tillage</u> and <u>secondary tillage.</u>

  ***Primary tillage:-***

  The mechanical manipulation of the soil that produces a rough finish unstable for seeding; usually precedes secondary tillage is called primary tillage. In this tillage, the top soil is plowed to a depth of 6-14 inches. The soil surface after the operation is rough with clods and unsuited for a seed bed for most seeding operations. The time of primary tillage depends on the soil type, soil moisture, climatic conditions and the time of seeding of crops. The depth of this tillage depends on the amount and nature of plant residue on the soil.

  ***Secondary Tillage:-***

  The mechanical manipulation of soil to produce a finer tilth for preparing seedbed; usually follows primary tillage is known as secondary tillage. It is done to a shallower depth (from 2 to 6 inches). The producer may also use this tillage for leveling and firming the soil. Three tillage operations are often conducted in certain sequence: *plowing, disking and harrowing.* The last two being secondary tillage operations. The sequence does not have a specific time between tillage operations. There may be several week between consecutive operations in the sequence. Disking pulverizes the clods whereas harrowing follows disking which further pulverizes the top soil.

***<u>Conventional tillage has advantages and disadvantages, including the following:</u>***

**Advantages:-**

- **i.** Even though tillage may cause compaction, it is the most convenient method of managing soil compaction when it occurs.
- **ii.** It is easier to apply fertilizers and perform other agronomic operations when the land is clean.
- **iii.** The lack of crop residues on the soil surface reduces the opportunity for overwintering/oversummering of pests.

**Disadvantages:-**

i. Erosion: The soil is left clean and exposed to agents of soil erosion.
ii. Compaction: Excessive and repeated use of tillage implements at the same depth places pressure on the soil in that region, resulting the compaction of soil creating a plow pan.
**iii.** Cost: Conventional tillage is expensive, requiring different implements and several energy-consuming passes over the field to complete the job.
**iv.** Soil organic matter loss: Soil organic matter decreases over time.

**George Acquaah;** Principles Of Crop Production**; 2015**
**:-** https://www.agriinfo.in/default.aspx?page=topiclist&superid=1&catid=37
**:-** Principles Of Agronomy**; T. Yellamanda Reddy & G.H Sankara Reddy; 1992**

**What do you mean by intercultural opertions ? Explain with By Shreya Tiwari**

All lighter and finer operations carried out on the soil and between sowing and harvesting are termed as intercultural operations. The machineries and implements used for this purpose are called as intercultural equipment. Different type inter cultural operations are listed and explained below:

**1. Weeding:**Removal of weeds is known as weeding .Weed is a plant grown where it is not desired. Key objectives are: to reduce the competition of weeds to crop plants for light, space, water and minerals and to get expected output from crop cultivation.

**2.Mulching:** Mulching is a method of conserving soil moisture.It is very important intercultural operation for rabi and rainfied crops. It is done by making a covering on the soil surface which actually reduces the evaporation of soil water.Mulches are material used for mulching.
*Advantages*

1.It keeps the soil moist during the dry season.
2.It suppresses weed growth and population.
3.Keeps the soilk cool during the dry and hot season.

**Types of Mulching**

**1.Natural mulching** : It is a method of breaking the surface of dry soil and generally done by stirring the soil surface by the help of some implements like niri,khurpi etc.Intercultural operation equipment used are water hyacinth,straw leaves. Upward movement of capillary water is restricted and soil moisture is conserved.

2. **Artificial mulching:** This includes the application of plant leaves,straw, water hyacinth,polyethene,saw dust etc so as to provide a covering on the surface of soil which can check the evaporation of soil moisture.Mulch crops like instance cow pea, Alylosia can be grown.

**3.Earthing Up** : Earthing up consists of lifting up or shifting the soil from the central portion of the space between rows towards the base of plants so as to cover the plant base or certain plant organs grows from below or at the soil surface.

**4.Removal of male bud:** The part of the inflorensence which consist of male flowers only is invariably termed in different parts of the world as male bud, heart or naval.

**5.Thinning**: Removal of excess plants after germinations from the crop field or seed bed is called thinning.Excess plants in a crop field reduces crop yield due to the intra crop competition. As a result there occurs a shortage of space nutrients,light,air moisture for individual crop plant whichultimately reduces yield.

1. www.celkau.aspx.com blog

2. www.cststudy.blogspot.com

**Write definition,meaning,types and advantage and disadvantage of conservational tillage. Harish Auji Roll No.31 .**

Conservation tillage:

Conservational tillage is defined as the any tillage sequence,the object of which is to minimize or reduce loss of soil and conservation of moisture.It is a soil management practice in which some crop residues remain on the soil surface after the tillage operation

The chief goals of this tillage are to reduce the soil erosion and conservation of moisture

***Types of conservational tillage:***

a.zero tillage: In zero tillage,the soil is left undistrube from harvest to planting except perhaps for injection of Basically there is no disturbance of soil except at seeding space.so this is also know as direct seeding system

b.Strip-tillage: With strip tillage,the seed row tilled prior to planting to allow residue removal,soil drying and warming .

c.Ridge tillage : In ridge tillage,the soil is also generally undistrubed from harvest to planting except for fertilizer injection .crops are seeded and grown on ridge or disk .weed control is accomplished bg herbicides,cultivation or both .

d.Mulch-tillage : Mulch tillage uses conventional broadcast tillage implements such as disks,chisel plows, rod weed etc but with limited passes across afield .so as to maintain plat residue on the soil .this was probably earliest approach to conservation tillage .

e.Minimum-tillage: Minimum tillage is that tillage to reduce the number of tillage and tillage equipments

*Advantages of conservational tillage*

1.reduction of soil erosion from wind and water

2.High soil infiltration and moisture because of large amount of crop residue

3.Reduction of cost of tillage.conventional tillage involves several passes with farm machinery and thus more costly in terms of fuel use .

4.Increased soil organic matter over prolonged period of no tillage

5.soil temperature moderation crop residue has an insulating effect on the soil.It shades the top soil and reduce the temperature

*Disadvantages of conservational tillage:*

1.Dependence on chemical i.e differents types of chemicals are used to control the weed which creates problems

2.The conventional tillage equipments used for seeding which equipments can not use for conservational tillage ,mainly can not use for zero tillage

3.High risk of insect,pests and pathogens in early crops establishment because of soil borne pathogens and soil surface insects.Due to high level of moisture favours the survival of soil pathogens

4.crop residues impede the application of fertilizer.

5.high risk of herbicide resistance .

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**Tillage – Definition – objectives – types of tillage - modern concepts of tillage – main field preparation**

**Tillage**

Tillage operations in various forms have been practiced from the very inception of growing plants. Primitive man used tools to disturb the soils for placing the seeds. The word tillage is derived from 'Anglo-Saxon' words *Tilian* and *Teolian*, meaning 'to plough and prepare soil for seed to sow, to cultivate and to raise crops'. **Jethrotull,** who is considered as father of tillage suggested that thorough ploughing is necessary so as to make the soil into fine particles.

**Tillage** is the mechanical manipulation of soil with tools and implements for obtaining conditions ideal for seed germination, seedling establishment and growth of crops.
**Tilth** is the physical condition of soil obtained out of tillage (or) it is the result of tillage. The tilth may be a coarse tilth, fine tilth or moderate tilth.

**Objectives of tillage**

The main objectives of tillage are,

- To prepare a good seed bed which helps the germination of seeds.
- To create conditions in the soil suited for better growth of crops.
- To control the weeds effectively.
- To make the soil capable for absorbing more rain water.
- To mix up the manure and fertilizers uniformly in the soil.
- To aerate the soil.
- To provide adequate seed-soil contact to permit water flow to seed and seedling roots.
- To remove the hard pan and to increase the soil depth.

To achieve these objectives, the soil is disturbed / opened up and turned over. **Types of tillage:** Tillage operations may be grouped into

1. On season tillage 2. Off-season tillage

**1. On-season tillage**

Tillage operations that are done for raising crops in the same season or at the onset of the crop season are known as on-season tillage. They may be preparatory cultivation and after cultivation.
***A. Preparatory tillage:*** This refers to tillage operations that are done to prepare the field for raising crops. It consists of deep opening and loosening of the soil to bring about a desirable tilth as well as to incorporate or uproot weeds and crop stubble when the soil is in a workable condition.
***Types of preparatory tillage***

a. Primary tillage

b. Secondary tillage
***a. Primary tillage:*** The tillage operation that is done after the harvest of crop to bring the land under cultivation is known as primary tillage or ploughing. Ploughing is the opening of compact soil with the help of different ploughs. Country plough, mould board plough, bose plough, tractor and power tiller drawn implements are used for primary tillage.
***b. Secondary tillage:*** The tillage operations that are performed on the soil after primary tillage to bring a good soil tilth are known as secondary tillage. Secondary tillage consists

of lighter or finer operation which is done to clean the soil, break the clods and incorporate the manure and fertilizers. Harrowing and planking is done to serve those purposes.

*Planking* is done to crush the hard clods, level the soil surface and to compact the soil lightly. Harrows, cultivators, *Guntakas* and spade are used for secondary tillage.
***c. Layout of seed bed:***This is also one of the components of preparatory tillage. Leveling board, buck scrapers etc. are used for leveling and markers are used for layout of seedbed.

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***B. After cultivation (Inter tillage):*** The tillage operations that are carried out in the standing crop after the sowing or planting and prior to the harvesting of the crop plants are called after tillage. This is also called as inter cultivation or post seeding/ planting cultivation. It includes harrowing, hoeing, weeding, earthing up, drilling or side dressing of fertilizers etc. Spade, hoe, weeders etc. are used for inter cultivation.

**2. Off-season tillage:** Tillage operations done for conditioning the soil suitably for the forthcoming main season crop are called off-season tillage. Off season tillage may be, post harvest tillage, summer tillage, winter tillage and fallow tillage.
**Special purpose tillage:** Tillage operations intended to serve special purposes are said to be special purpose tillage. They are,

**a. Sub-soiling:** To break the hard pan beneath the plough layer, special tillage operation (chiseling) is performed to reduce compaction. Sub-soiling is essential and once in four to five years where heavy machineries are used for field operations, seeding, harvesting and transporting. Advantages of sub-soiling are, greater volume of soil may be obtained for cultivation of crops, excess water may percolate downward to recharge the permanent water table, reduce runoff and soil erosion and roots of crop plants can penetrate deeper to extract moisture from the water table.

**b. Clean tillage:** It refers to working of the soil of the entire field in such a way no living plant is left undisturbed. It is practiced to control weeds, soil borne pathogen and pests.
**c. Blind tillage:** It refers to tillage done after seeding or planting the crop (in a sterile soil) either at the pre-emergence stage of the crop plants or while they are in the early stages of growth so that crop plants (sugarcane, potato etc.) do not get damaged, but, extra plants and broad leaved weeds are uprooted.

**d. Dry tillage:** Dry tillage is practiced for crops that are sown or planted in dry land condition having sufficient moisture for germination of seeds. This is suitable for crops like broadcasted rice, jute, wheat, oilseed crops, pulses, potato and vegetable crops. Dry tillage is done in a soil having sufficient moisture (21-23%). The soil becomes more porous and soft due to dry tillage. Besides, the water holding capacity of the soil and aeration are increased. These conditions are more favourable for soil micro-organisms.

**e. Wet tillage or puddling:** The tillage operation that is done in a land with standing water is called wet tillage or puddling. Puddling operation consists of ploughing repeatedly in standing water until the soil becomes soft and muddy. Puddling creates an impervious layer below the surface to reduce deep percolation losses of water and to provide soft seed bed for planting rice. Puddling is done in both the directions for the incorporation of green manures and weeds. Wet tillage destroys the soil structure and the soil particles that are separated during puddling settle later. Wet tillage is the only means of land preparation for transplanting semi-aquatic crop plant such as rice. Planking after wet tillage makes the soil level and compact. Puddling hastens transplanting operation as well as establishment of seedlings. Wet land ploughs or worn out dry land ploughs are normally used for wet tillage.

**Depth of ploughing**

The desirable depth of ploughing is 12 to 20 cm for field crops. The ploughing depth varies with effective root zone of the crop. The depth of ploughing is 10-20 cm for shallow rooted crops and 15-30 cm for deep rooted crops.

**Number of ploughing**

Number of ploughing depends on soil conditions, time available for cultivation between two crops and type of cropping systems. Zero tillage is practiced in rice fallow pulses. Minimum number of ploughing is taken up at optimum moisture level to bring favourable tilth depending on need of the crop.

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**Time of ploughing**

The optimum soil moisture content for tillage is 60% of field capacity.

**Modern concepts in tillage:**

Conventional tillage involves primary tillage to break open and turn the soil followed by secondary tillage to obtain seed bed for sowing or planting. With the introduction of herbicides

in intensive farming systems, the concept of tillage has been changed. Continuous use of heavy ploughs create hard pan in the subsoil, results in poor infiltration. It is more susceptible to run-off and erosion. It is capital intensive and increase soil degradation. To avoid these ill effects, modern concepts on tillage is in rule.

**1. Minimum tillage:** It aims at reducing tillage operations to the minimum necessity for ensuring a good seed bed. The advantages of minimum tillage over conventional tillage are,

• The cost and time for field preparation is reduced by reducing the number of field operations.

- Soil compaction is comparatively less.
- Soil structure is not destroyed.
- Water loss through runoff and erosion is minimum.
- Water storage in the plough layer is increased.

Tillage can be reduced in 2 ways
1. By omitting operations which do not give much benefit when compared to the cost. 2. By combining agricultural operations like seeding and fertilizer application.

The minimum tillage systems can be grouped into the following categories,

1. Row zone tillage

Primary tillage is done with mould board plough in the entire area of the field; secondary tillage operations like discing and harrowing are reduced and done only in row zone.

2. Plough plant tillage
After the primary tillage, a special planter is used for sowing. In one run over the field, the

row zone is pulverized and seeds are sown by the planter 3. Wheel track tillage

Primary ploughing is done as usual. Tractor is used for sowing; the wheels of the tractor pulverize the row zone in which planting is done.

In all these systems, primary tillage is as usual. However, secondary tillage is replaced by direct sowing in which sown seed is covered in the row zone with the equipment used for sowing.

**2. Zero tillage (No tillage):** In this, new crop is planted in the residues of the previous crop without any prior soil tillage or seed bed preparation and it is possible when all the weeds are controlled by the use of herbicides. Zero tillage is applicable for soils with a coarse textured surface horizon, good internal drainage, high biological activity of soil fauna, favourable initial soil structure and an adequate quantity of crop residue as mulch. These conditions are generally found in *Alfisols*, *Oxisols* and *Ultisols* in the humid and sub-humid tropics.

*Till planting*

Till planting is one method of practicing zero tillage. A wide sweep and trash bar clears a strip over the previous crop row and planter opens a narrow strip into which seeds are planted and covered. Here, herbicide functions are extended. Before sowing, the vegetation present has to be destroyed for which broad spectrum non selective herbicides like glyposate, paraquat and diquat are used.
Advantages

- Zero tilled soils are homogenous in structure with more number of earthworms.
- Organic matter content increases due to less mineralization.

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• Surface run-off is reduced due to presence of mulch. Disadvantages

- Higher amount of nitrogen has to be applied for mineralization of organic matter in zero tillage.
- Perennial weeds may be a problem.
- High number of volunteer plants and buildup of pests. **3. Stubble mulch tillage or stubble mulch farming**

  Soil is protected at all times either by growing a crop or by leaving the crop residues on the surface during fallow periods. Sweeps or blades are generally used to cut the soil up to 12 to 15 cm depth in the first operation after harvest and depth of cut is reduced during subsequent operations. When large amount of residues are present, a disc type implement is used for the first operation to incorporate some of the residues into the soil. This hastens the decomposition but still keeps enough residues on top soil.
  Two methods for sowing crops in stubble mulch tillage are,

  1. Similar to zero tillage, a wide sweep and trash bars are used to clear a strip and a narrow planter shoe opens a narrow furrow into which seeds are placed.

2. A narrow chisel of 5-10 cm width is worked through the soil at a depth of 15-30 cm leaving all plant residues on the surface. The chisel shatters the tillage pans and surface crusts. Planting is done with special planters.

Disadvantages of stubble mulch farming
• The residues left on the surface interfere with seed bed preparation and sowing operations.
• The traditional tillage and sowing implements or equipments are not suitable under these

conditions.
**4. Conservation tillage:** The major objective is to conserve soil and soil moisture. It is a system

of tillage in which organic residues are not inverted into the soil such that they remain on surface as protective cover against erosion and evaporation losses of soil moisture. If stubble forms the protective cover on the surface, it is usually referred to as stubble mulch tillage. The residues left on soil surface interfere with seed bed preparation and sowing operations. It is a year round system of managing plant residue with implements that undercut residues, losses the soil and kills the weeds. Advantages

• Energy conservation through reduced tillage operations. • Improve the soil physical properties.
• Reduce the water runoff from fields.

**Main field preparation:**

Tillage operations are generally classified in to two, preparatory cultivation and after cultivation. The preparatory cultivation or tillage is operations that are done before the cultivation. This preparatory cultivation is generally called as main field preparation. The main field preparation involves three processes, viz., primary tillage, secondary tillage and lay-out for sowing. Some of the important primary tillage implements are country plough, mould board plough, disc plough, chisel plough etc. Cultivators and harrows are generally used for secondary tillage purpose. However, in practical means, the first two (primary and secondary tillages) may not have any key difference, since; both operations are mainly carried out with same implement. Country plough and cultivators are used for both the purposes. After thorough ploughing, the field modified in to suitable way for planting such as ridges and furrows or beds and channels or pit according to the need of the crops. Such field modifications are mandatory for better crop production.

**Explain about 10 important of weeds? Anup Adhikari Roll No:- 05**

1) **Weeds adds organic matter and nutrients to the soil**

   Many weeds have luxuriant leady growth and when buried in the soil as green manure add considerable amount of organic matter and plant nutrients. Leguminous weeds have nutrient content of 1.5-6 % Nitrogen, which helps to maintain soil fertile.

2) **Weeds check wind, water and soil erosion**
   Weeds growing on desert lands, waste lands and sloppy fields lower wind and water erosion and also helps for protection of the environment.

3) **Some of the weeds are used as fodder for animals.**
   Some weeds have good palatable taste and of acceptable quality for animal feed if they are grazed or cut when young. Examples of such type of weeds are quack grass, lambis quarters, bethua etc.
4) **Some of the weeds have Economic importance**

Weeds such as (saccharum spontaneum) is used for thatching purpose and breeding sugarcane varieties for including hardlines. Similarly, nutgrass/nutsedge is used for making essence sticks.

5) **Some of the weeds are used as leafy vegetables**
   Some weeds are edible and can be used as vegetable purpose as they have palatable taste and have nutritional content. Such type of weeds are Wild Amaranth, common Mallow, Chenopodium album, Nettle, clover, watercress, water spinach, tandulaja (Amaranthus polygamers).
6) **Some of the weeds have medicinal value**
   Some of the weeds are also used for medicinal purposes. Such as Gumma (leuclas aspera) is used in snake bite, Maka (Eclipta erecta) is useful against cough and as hair oil, comfrey helps new skin cells grow to heal the wound quickly.
7) **Some of the weeds serves as ornamental & hedge plants**
   Some weeds such as Ghaneri( Lantana camara), Eichhomia crassipes, can be used as ornamental and hedge plants.
8) **Certain weeds helps to control nematodes**
   Crotalaria spp; calotropis spp, parthenium etc when incorporated in the soil helps for control of nematodes.
9) **Some of weeds are also used as Religious purpose**
   Weeds such as cynodon dactylon, Hariali, Aghada, Maka etc can be used during religious purposes. Cynadon is used to prepare garland during marriage.
10) **Weeds also helps to maintain pH**
    Some weeds also play important role to maintain pH such as leguminous weeds helps in nitrogen fixation which help to maintain pH.
    www.agriinfo.in
    www.agrihunt.com

**Explain at least 10 different losses caused by weed. -Susmita poudel; Roll no. 92**

A weed is a plant growing where it is not wanted. Losses caused by weeds are enlisted below:

1. **Increase in the cost of cultivation**:
   Tillage operation are done to control weeds and it is generally estimated that on an average about 30% of the total expenditure for crop production is on tillage operation and more labour is employed for weeding. This results in increasing cost of cultivation and reducing the margin of net profit.
2. **The quality of field produce is reduced :**

When the crop is harvested from a weedy field the seeds of weeds get mixed with the main crop which results in lowering the quality of the produce .Example; seeds of weeds in wheat, gram, etc. similarly, bundles of many leafy vegetables like methyl or palace contain green plants of weeds. They fence lower price in the market.

3. **Harbors pest and diseases:**

Weed present in the off-season on field bunds, wasteland, and irrigation channels, harbor pest and diseases which attacks the crop sown subsequently.
Examples'; Gram caterpillar in red gram.

4. **Menace to Human Health:**

Weeds harbor organism like mosquitoes that cause or transmit diseases. Some weeds are poisonous and other produce pollen which causes allergies to human. Many common weeds such as; Ruthenium weeds, Ragweed, Rye-Grass and privet cause asthma and other respiratory problems, especially in children.

5. **Interference:**

Weeds not only reduce yields of crop, but also interfere with agricultural operation. Sowing operation with seeds drill isn't possible if the weed infestation is high as they block the free flow of soil between the tynes. Harvesting is difficult and delayed due to presence of weeds.

6. **The quality of livestock products is reduced:**

Certain weeds eg. Hulhul when eaten by milch cattel impart an undesirable flavor to milk. Similarly weeds like gokhru get attached to the body of the sheep and impair the quality of wool. Certain poisonous weeds like Dhatura may cause death of cattle if they are unknowingly eaten by cattle.

7. **Weeds checks the flow of water :**

Weeds block drainage and check the flow of water in irrigation channels and field channels thereby increasing the seepage losses as well as losses through overflowing. The irrigation efficiency is also reduced.

8. **Weeds reduce the value of the land :**

Agricultural lands which are heavily infested with perennial weeds like Kans always fetch less price, because such lands cannot be brought under cultivation without incurring heavy expenditure on labour and machinery.

9. **Weeds secretions are harmful:**

Heavy growth of certain weeds like quack grass or motha lowers the germination and reduce the growth of many crop plants. This is said to be due to the presence of certain phytotoxins in these weeds.

10. **Loss in pisciculture:**

Fish production is greatly affected by the presence of aquatic weeds. When floating and submerged aquatic weeds became extremely dense, many fish species are unable to exist in such environment and vanish. It also cause imbalance in dissolved oxygen concentration.

www.icid.org
Principle of Agronomy.
Submitted by :

**How are weeds classified? Provide with examples. Badal subedi Roll no. = 12**

There are about 30,000 species of weeds in the world. Out of these about 18,000 are known to cause serious losses. The weeds with similar morphological characters,life cycle,requirements of soil,water,climatic condition etc are grouped together as a class or catergory. Some important classification of weeds used by weed researchers in world for different purposes are as follows:

**A) Classification according to anamoty:**

Depending their lifecycle weeds are classified-

- Annuals- Annuals weeds more commonly complete their lifecycle in one season. An annual weeds can be either, summer annual; kharif annual e.g- **foxtai**;winter annual e.g- **lambs quarter**
- Biennials weeds- Biennials weeds complete their life cycle in two years in the years in the first year they remains vegetative and in the second year they produce flowers and set seeds. E.g- **Daucus, Carota** etc
- Perennial weeds-
  Perennial weeds grow for three or more years. E.g- shallow rooted perennials- **Bermuda grass, quack grass** Deep rooted perennials- **Johnson grass.**

**B) Classification according to cotyledenous characters:**

- Monocots
- Dicots

**C) Classification according to nature of stem:**

Depending upon the development of bark tissue on their stem and branches weed can be classified as,

- Wood e.g – **lantana**
- Semi-woody
- Herbaceous species

**D) Classification according to origin of weeds:**

Many of weeds in india originated in some other part of the world.
For e.g – **Convolvulus sp – Eurasia, Cyperus – Euphorbia, Europe , Lantana-Africa.**

**E) Classification according to soil:**

Of the several variable of the soil, soil PH is implicated most frequently with the distribution of weed species. Weeds such as **red sorrel,corn sporry** and bracken tend to comminute with weed flora on saline and alkali soils.

**F) Classification according to climate:**

Temperature, rainfall, air quality , humidity, and solar energy have pronounced effect on the distribution of weeds. One could classify weeds as hillside weeds, tropical weeds etc.

**G) Noxious weeds:**

Noxious weeds is a plant arbitrarily defined as being espically undesirable troublesome and difficult to control for e.g **chicory, thistle, Bermuda grass (hariyali).**

Reference:

-www.agriinfo.in.com
-agropedia.iitk.blogspot.com

**Integrated weed management Practices . Narayan P Neupane Roll no:- 48**

Integrated weed management (IWM) is the control of weeds through a long-term management approach, using several weed management techniques such as:

- Physical control
- Chemical control
- Biological control
- Cultural control

1. **<u>Physical control</u>**

   Physical control is the removal of weeds by physical or mechanical means, such as mowing, grazing, mulching, tilling, burning or by hand. The method used often depends on the area of weeds to be managed, what the land is used for, physical characteristics and the value of the land.As with most control methods long-term suppression of weeds requires follow up weed prevention.

- **Hay making, mowing and grazing**

  Hay making, mowing and grazing before weeds produce seeds restrict the amount of weed seed in an area and reduce the spread of weeds.

- **Mulching**

  Mulching, by covering the ground with a layer of organic material, suppresses or kills weeds by providing a barrier between the weeds and sunlight. Mulching has an added advantage in that it improves the condition and moisture level in the soil. Planting competitive and desirable plants that provide a dense cover over the weeds suppresses weed growth in a similar way to mulching.

- **Tilling**

  Tilling, the ploughing or cultivation method that turns over the soil, buries the weed beneath the soil. This provides a barrier to the sun, therefore killing the weeds. Tilling is a form of physical control that can be easily undertaken over a wide area, using agricultural machinery. This method is useful for making soil ready for planting new crops, but it can lead to damage in soil structure and exposes the soil to erosion and further invasion by weeds.

- **Burning**

Burning removes the above-soil body of the weeds killing most of the plants. If carried out before seed is set it can prevent the further spread of weeds. Burning can be undertaken over a wide area with minimal human input. As with tilling, burning exposes the soil surface to erosion. If burning

is used as a control method, caution should be exercised to minimise the risk of harm to the environment and to those undertaking the activity.

- **Hand removal**

  Removal by hand, including hoeing, is a good method for selective removal of weeds without disturbing the surrounding desirable vegetation. It is very labour-intensive and is often only used in small areas, such as gardens or in larger areas during bush regeneration.

**2. <u>Chemical control</u>**

Although the use of chemicals is not always essential, herbicides can be an important and effective component of any weed control program.In some situations herbicides offer the only practical, cost-effective and selective method of managing certain weeds. Because herbicides reduce the need for cultivation, they can prevent soil erosion and water loss, and are widely used in conservation farming.In some cases, a weed is only susceptible to one specific herbicide and it is important to use the correct product and application rate for control of that particular weed. Common mistakes include incorrect identification of the weed or using inappropriate products.In most cases, weeds must be actively growing to be vulnerable to herbicide treatments.Herbicide resistance can also be an issue with some species.Conditions such as wind speed and direction, the possibility of rain and proximity to waterways should also be taken into account when preparing to use herbicides.

**3. <u>Biological control</u>**

It is the oldest methods of biological weed control . Biological control approach makes use of the invasive plants naturally occurring enemies , to help reduce its impact . These natural enemies of weed are often reffered to as biological control agent such as selective grazing of plants using domestics animals , insects and pathogens (disease causing organism like as bacteria and fungi)that attack seed , leaves stems and roots of plant . Plant introduce in new region that does not survive in on new nature .

Although the long-term biological control can be cost effective and can reduce the need for less desire able management practices, not all weeds are suitable for biological control

.

**4. Cultural control**

Cultural control is usually associated with farming systems, although some elements are relevant to landscape and bush care practices. It largely involves manipulating farming practices to suppress weed growth and production, while promoting the development of the desired plant.

The principles and techniques used to prevent weed spread are relevant to cultural control methods to limit the spread of weeds between different land areas.

Cultural control methods: Encourage the competitiveness of desired species that are more competitive and fast growing. This suppresses weed growth by reducing access to available sunlight, nutrients and moisture and can include:

- Choose plant and crop species or cultivars that are naturally more competitive. This can include using plant species that suppress other plant species by the release of toxins.
- Use high quality (large and plump) seeds, as they are more likely to produce vigorous and competitive plants.
- Use increased seeding rates and narrow row spacing.
- Use shallow seeding techniques, where possible, to allow the desired species to grow above the soil surface more quickly.
- Ensure the desired plant is placed in the optimum growing environment.
- Use fertilisers in the optimal growth period to encourage rapid growth of the desired species.
- If possible use plant species that are native to the local environment.
- Make it hard for weeds to adapt to weed management techniques. Using the same land management routines year after year may result in weeds adapting to these practices. Some practices that make it hard for weeds to adapt and therefore reduce their spread and vigour include:
- Rotate crops: if a weed has adapted to grain crops continuously being sown, then alternating with a broadleaf crop will remove the environmental condition to which the weed has adapted.
- Rotate species with different seasonal and growing cycles.
- Rotate herbicides with different modes of action to help delay the development of herbicide resistance.
-

**Explain different physical methods of weed control? Ashish chaudhary Roll no. (10)**

Physical force either manual, animal or mechanical power is used to pull out or kill weeds. Depending on weed and crop situation one or combination of these methods are used.

**1)Hand-weeding:** Pulling out weeds by hand or uprooting weeds by using small hand tool is known as hand weeding. Two aspects are important in hand weeding: the number of hand weedings to be done and the interval between two hand weedings. The number of hand weedings to be done depends on crop growth, weed growth and critical period of crop-weed competition. The number of hand weedings range from 2-4 for most of the field crops. The interval between two weedings depends on the quickness of weed growth which interferes with crop growth. Generally, it is 15-20days.

**2)Hand hoeing:** The entire surface soil is dug to a shallow depth with the help of hand hoes, weeds are uprooted and removed. After hand hoeing, the field is subjected to drying to avoid re-

establishing of uprooted weeds.This method is adopted in irrigated upland crops like finger millet, pearl millet, onion etc.
**3)Digging**: Weeds are removed by digging up to deeper layers so as to remove underground storage organs. It is very useful in the case of perennial weeds and it is donewith the help of pick axes or crowbars. Cynodon dactylon can be effectively controlled by this method.
4**)Mowing**: Mowing is the cutting of weeds to the ground level.Mowing is usually practiced in non-cropped areas, lawns and gardens wherein the grass is cut to a uniform height to improve the aesthetic value.The common mowing tools are sickle, scythe and lawn mower.
**5)Cutting**: Weeds are cut above the ground surface leaving stubble. It is most common practice against brush and trees. Cutting is done with the help of axes and saws.
**6)Dredging and Chaining** : Dredging and chaining methods are used to control aquatic weeds. Removing of weeds along with their roots and rhizomes with the help of mechanical force is called dredging. The floating aquatic weeds are removed by chaining. A very heavy chain is pulled over the water bodies to collect the weeds.
**7)Burning and Flaming:** Burning is the cheapest method of eliminating mature unwanted vegetation from uncropped areas like range lands, field bunds, roadsides, ditch banks etc.
It is also used to dispose off heaped weeds. However, it is a 'potential source of fire hazard.
**8)Mulches**: Mulches when applied on soil surface, do not allow weeds to germinate or to grow as light does not reach the soil.
**9)Intercultivation**: Intercultivation is a very effective and cheap method of weed control in line-sown crops. Intercultivation implements have a blade which cuts the weeds just below the soil surface and thus kills weeds. It also makes the surface soil loose and dry so that subsequent germination of weeds is avoided unless irrigation or rain follows.
Some of the interc ultivation implements have tynes, which open the soil and uproot the weeds. uproot the weeds.

1)www.Environment.gov.com
2)TANU AGRITECH PORTAL

**Explain about different methods of weed control. ArBin kumar Chaudhary; Roll -seven (7)**

There are various methods of weed control. Some of them are described below.

**●Preventative Weed Control**

Preventative weed control refers to any control method that aims to prevent weeds from being established in a cultivated crop, a pasture, or a greenhouse. Examples of preventative weed control would be using certified weed free seed, only transporting hay that is weed free, making sure farm equipment is cleaned before moving from one location to another, and screening irrigation water to prevent weed seeds from traveling along irrigation ditches.

**●Cultural**

Cultural weed control refers to any technique that involves maintaining field conditions such that weeds are less likely to become established and/or increase in number. Examples of cultural weed control would be crop rotation, avoiding overgrazing of pastures or rangeland, using well-adapted competitive forage species, and maintaining good soil fertility.

**●Mechanical**

Mechanical weed control refers to any technique that involves the use of farm equipment to control weeds. The two mechanical control techniques most often used are tillage and mowing.

**●Biological**

Biological weed control refers to any technique that involves the use of natural enemies of weed plants to control the germination of weed seeds or the spread of established plants. This is a rapidly expanding area of weed control with many examples. Examples of biological weed control include sheep to control tansy ragwort or leafy spurge, cinnabar moth and the tansy flea beetle to control tansy ragwort, the chrysolira beetle to control St. John's Wort, and the use of goats to control brush on rangeland.

**●Chemical**

Chemical weed control refers to any technique that involves the application of a chemical (herbicide) to weeds or soil to control the germination or growth of the weed species. In economic terms, chemical control of weeds is a very large industry and there are scores of examples of chemical weed control products. Common examples of chemicals used to control weeds in forages are 2,4-DB; EPTC; bromoxynil; and paraquat.

**Explain about cultural and biologocal method of weed control.**

1. **Cultural Method**

Cultural method of weed control can not eradicate the weeds totally but helps to reduce weed population. It is based on the cultivation practices and system. In this method following activities are done:

- Most adopted crop varieties having early seedling vigor should be selected. Use of high viable seed along with preplant seed and soil treatement.
- Use of soil amendment like gypsum or lime, addition of well rotten FYM, manure and fertilizer and seed inoculation.
- Crop rotation should be maintain. In the area of crop rotation there is low chance of weed spreading. Main weed of one crop may not germinate in another crop in same piece of land. For eg weed of wheat field may not grow in potato field.
- Tillage also play much more role in controlling weed culturally. Some of the weed seed are destroyed during tillage. During soil manipulation weeds are directly exposed to sunlight and are killed. Conventional tillage is mainly maintained.

- Drainage should be maintain properly. Flooding during rainy season may bring different kind of weed seed and deposit them in water logged area. These seed later germinate as weed and disturb main crop.
- Planting method, planting time also play role in controlling weed. Eg inter cropping, relay cropping etc.

## 2. Biological Method

In biological method weeds are controlled by using living organism present naturally. In this method natural enemy like insects, herbivorous fish and other organism. All kind of weeds can not be controlled by this method. **The control of opuntia spp in Australia and Lantanna camara I Hawaii by using scale insect(Dactylopius tomentotus) and Two beetal( Octotoma scabriopennis and Vroplata giraidi)** respectively . Same of the examples of biological weed control and biogents are given bellow.

| Weed name | Using Bioagent | Biogents types |
|---|---|---|
| Skeelton | Cephalosporium zoomatum | Fungi |

| | | |
|---|---|---|
| Alligators | Agasicles hygrophyla | insect |
| Aquatic weed | Common carp, chinese carp | Fishes |
| Hyacinth | Rhizoctinia blight | Fungi |
| Water hyacinth | Manteenae or sea cow | |

**Epigeal Germination Vs Hypogeal Germination - Birendra Chaudhary; Roll-2**

| S.N | Epigeal Germination | Hypogeal Germination |
|---|---|---|
| 1. | It is the process in which the seed leaves or the cotyledons are brought on to the surface along with the shoot during germination. | It is the process in which the seed leaves or the cotyledons remain below the soil surface during germination. |
| 2. | The hypocotyl is elongated in Epigeal germination. | Epicotyl is elongated in hypogeal germination. |
| 3. | the terminal or hypocotyl is curved to protect the cotyledon . | the terminal of the epicotyls is curved to protect the plumule. |
| 4 | The radical emerges first to form the hypocoytyls. | the radicle develops to form the root system. |
| 5 | Examples-:Onion, Castor, Bean. | Examples-:Arum, Grampea, Water lily, Maize. |
| | | |

1. Seed Vs Grain

| S.N | Seed | Grain |
|---|---|---|
| 1. | **A seed is an ovule containing an embryo.** | **A grain is a fusion of the seed coat and the fruit.** |
| 2. | It should be completely treated with pesticides, fungicides to protect from pests and fungi. | It should never be treated with any chemical since used for consumption. |
| 3. | Respiration rate and other physiological and biological process should be kept at low level during storage. | No such specifications. |
| 4. | Seeds are planted to grow another offsprings. | Grains are harvested for food. |
| 5. | Germination% and purity% must be calculated for pure seed. | Such calculations are not done for grains. |

2. Soil productivity Vs Soil fertility

| S.N | Soil productivity | Soil fertility |
|---|---|---|
| 1. | It is the capability of soil to produce specified crop yield under a set of environmental condition. | it is the ability of soil to provide all necessary elements to plant in available forms and in a suitable balance. |
| 2. | it depends upon fertility and location. | It is influenced by the physical, chemical, and biological factors of the soil. |

| | | |
|---|---|---|
| 3. | It is not the inherent property of the soil. | It is an inherent property of the soil. |
| 4. | All productive soils are fertile. | All fertile soils are not productive. |
| 5. | It is the broader term used to indicate crop yields. | It is consider as an index of available nutrients to plants. |

3. Subsistence Vs commercial farming

| S.N | Subsistence Farming | Commercial Farming |
|---|---|---|
| **1.** | It is the farming practice in which crops are raised for personal consumption. | It is the farming practice in which the farmer grows crops for the purpose of trade. |
| **2.** | It is practiced in small area. | it is practiced in large area. |
| **3.** | Traditional methods are used. | Modern technologies are used. |
| **4.** | it requires less number of labours and minimum capital. | it requires large number of labours and a big capital. |
| **5.** | it is enhance through the use of manures. | It is enhance through higher doses of modern inputs. |
| **6.** | Food grains, fruits and vegetables are grown. | Cash crops and cereals are grown. |

**Differentiate biotic and abiotic stress Rebanta Khadka; Roll no. 72**

| Biotic stress | Abiotic stress |
|---|---|
| 1. Biotic stress is negative impact of living factor on plant. | 1.Abiotic stress is negative impact of adverse environment factor. |
| 2. The effect of biotic stress is changeable one to another plant. | 2. The effect of abiotic stress is stable. |
| 3. The effect of biotic stress is dependent in plant density. | The effect of abiotic stress is independent in density. |
| 4.Directly related to stress | 4.indirectly related to stress. |
| 5. Man can control biotic stress by different methodology e.g- insecticide, herbicide, | 5. Man can't major control abiotic stress. E.g- high temperature effect. |
| 6. Example of biotic stress are pathogen(fungi, bacteria, virus, nematode) mites insect and animal stress | 6. example of abiotic stress are drought, sunscald, freezing injury, nutrient deficiency etc. |

reference # www.thoughtco.com.

**Difference between Agriculture and Agronomy-**

| Agriculture | Agronomy |
|---|---|
| 1. Agri means land and culture means cultivation .Hence agriculture is the process of cultivation of land . | 1. Agron means management of soil and nomous is study .Hence Agronomy is the study of management of land . |
| 2. The art or science of cultivating the ground ,including the harvesting of crops ,and the rearing and management of livestock ; tillage; husbandry; farming. | 2. The science of utilizing plants, animals and soil for food , fuel and fiber and more effectively and sustainably. |
| 3. Agriculture is a broad term including all aspects of crop production ,livestock farming ,fisheries . | 3. Agronomy is a part of agriculture which only deals eith the production of plants and crop management. |
| 4. The person who study about agriculture is “Agriculturist”. | 4. The person who study about the agronomy is “Agronomist” |

**Differences between Short day and Long day plants**

| Short day plant | Long day plants |
|---|---|
| 1. Short day plants flower when they are exposed to day length shorter than the critical maximum period. | 1. Long day plant flower when they are exposed to day length_longer than the critical minimum period. |
| 2. Short day plants are also called long night plants. | 2. long day plant are also called as short night plants. |
| 3. Examples :rice, green grams, soybeans, cotton. | 3. Examples : wheat, oat, barley. |
| 4. Short day plants usually flower in the early spring or autumn. | 4. Long day plants flower in the spring or early summer. |
| 5. The continuous dark period is the period for short day plants. | 5. Continuous day period is the critical period for long day plant. |
| 6. In short day plants, the flowering is not induced if the plants are subjected to short light and short dark period. | 6. In long day plants flowering is induced if plants are exposed to short light period with still shorter dark period. |
| 7. GA (gibberllic acid) does not induce flowering in short day plants. | 7. GA induces flowers in long day plants. |
| 8. In short day plants, the flowering is not stimulated when the long light period is interrupted with a dark period. | 8. In long day plants, the flowering is not inhibited when the dark period is intercepted by a flash of light. |

**Q. Difference between C3 and C4 plants**

| C3 plants | C4 plants |
|---|---|
| • C3 plants uses C3 cycle or calvin cycle for dark reaction of photosynthesis . | • C4 plants uses c4 cycle or Hatch- slack pathway for dark reaction of photosynthesis. |
| • Example :rye, wheat, oats, cotton. | • Examples :Maize, sugarcane, sorghum, amaranthus. |
| • C3 plats are cool season plants , commonly seen in cool and wet areas. | • C4 plants are warm season plants , commonly seen in dry areas. |
| • Majoritry of plants on earth are c3 plants . | • C4 plants are less in number. |
| • Leafs of C3 plants do not have kranz anatomy. | • Leafs of C4 plants have kranz anatomy. |
| • In C3 plants, the bundle sheath cells do not contain chloroplast. | • In C4 plants , the bundle sheath cells contain chloroplast. |

| | |
|---|---|
| • In C3 plants the CO2 fixation takes place only at one place.<br>• C3 plants require an optimum temperature range of 18-24 degree celcius. | • In C4 plants the CO2 fixation takes place twice.<br><br>• C4 plants require an optimum temperature range of 32-55 degree celcius. |

**DIFFERENCE BETWEEN FONDATION SEED AND IMPROVED SEED- Srijana Chaudhary; Roll-88**

| **Determinate growth** | **Indeterminate growth** |
|---|---|
| • Plants growth in which the main stem ends in an inflorescence or other reproductive st. and stops continuing to elongate indefinitely with only branches from the main stem .<br>• In this growth,flower buds initiate terminally;shoot elongation stops.<br>• Most animals and certain plants organs such as flower and leaves undergo determinate growth.<br>• Determinate tomatoes or "bush" tomatoes, are varieties that grow to compact height (3' - 4').<br>• For example, the term is applied to tomatoes that grow in more bushy shape and is most productive for single, larger harvest. | • Plant growth that is not terminated in contrast to determinate growth that stops once a genetically pre-determined st. has completely formed.<br>_____<br>• In this growth, flower buds born laterally shoot terminals remain vegetative.<br>• Most plants demonstrate indeterminate growth.<br>• Indeterminate tomatoes will grow and produce fruit until killed by frost and they can reach height up to 12 feet.<br>• For example, the term is applied to tomato varieties that grow in a rather gangly fashion, producing fruits throughout the growing season. |

| FOUNDATION SEED | IMPROVED SEED |
|---|---|
| 1. Foundation seed is the progeny of breeder seed and second grade seed in order of its genetic purity. | 1. Improved seed are the progeny of certified seed and are produced in the farmer's field with the inspection of seed certifying seed. |
| 2. It has white tag. | 2. It has yellow tag. |
| 3. It is available in limited quantity. | 3. It is available in sufficient quantity and used for commercial cultivation of crops. |
| 4. It's quality is relatively less pure compared to the Breeder seed. | 4. The quality is acceptable to the local market and consumers. |

**Differences between conservation tillage and conventional tillage- Hem Raj Joshi- Roll 33**

| Conservation tillage | Conventional tillage |
|---|---|
| 1. Conservation tillage is the traditional method of farming in which soil is prepared for planting by completely inverting it with a tractor-pulled plough, followed by subsequent additional tillage to smooth the soil surface for crop production. | 1. Conventional tillage refers to tillage operations considered standard for a specific location and crop and that tend to bury the crop residue usually considered as a base for determining the cost effectiveness of erosion control practices. |
| 1. In conservational tillage only secondary tillage operation is performed. | 2. In conventional tillage both primary and secondary tillage operation are performed. |
| 2. There is better soil conservation in this method. | 3. Surface soil is more prone to erosion. |
| 3. Decomposition of organic matter is slow so, microbial activity is less here. | 4. There is better microbial activity. |
| 4. Reduced use of labor and machinery equipment. | 5.The use of labor and machinery equipment is more in this tillage. |
| 5. There is less energy requirement in this process. | 6. There is more energy requirement in this process. |
| 6. Perennial weeds may become dominant. | 7. The weeds can be efficiently controlled in this method of tillage. |
| 7. This method is time saving. | 8. It takes more time in this process. |
| 8. The common types of conservational tillage includes zero tillage, mulch tillage, strip tillage, ridge tillage and minimum tillage. | 9. There are generally two classes of tillage operation- primary tillage and secondary tillage. |

| | |
|---|---|
| 9. It is modern way of tillage. | 10. It is traditional method of tillage. |


1. https://www.climatetechwiki.org/technology/conservation-tillage
2. http://www.fao.org/docrep/t1696e/t1696e09.htm
3. Agriculture Food University; Leture notes on: Principle of agronomy.
4. Pearson; (principle of crop production)
5. https://en.wikipedia.org/wiki/Conventional_tillage
6. **Difference between primary tillage and secondary tillage. Anil Dahal- 2**


| Primary tillage | Secondary tillage |
|---|---|
| 1. •It is done after the harvest of crop or untilled fallow | 1. •It is done after the primary tillage to bring a good soil tith |
| 2. •In this tillage operation, ploughing depth up to 15-20cm. | 2. •In this tillage operation, ploughing depth is 4-5cm. |
| 3. •Primary tillage plough the soil deeply to reduce soil strength. | 3. •Secondary tillage make the soil lighter and make them finer. |
| 4. •It's main objective is to control weeds to incorporate crop stubble and to restore soil structure. | 4. •It's main objective is to incorporation of manures and fertilizer, levelling, mulching, forming ridges and furrows. |
| 5. •MB plough, disc plough, sub-soiler, rotary plough are used in primary tillage. | 5. •Disc harrow, blade harrow, power harrow are used in secondary tillage. |

**DIFFERENCE BETWEEN BREEDER SEED AND CERTIFIED Seed Samriddhi Singh; Roll No: 78**

| BREEDER SEED | CERTIFIED SEED |
|---|---|
| 1. Breeder seeds or vegetatively propagated material is directly controlled by the originating or sponsoring plant breeding program. | 1. Certified seeds are the progeny of Foundation seed or parent for improved seeds. |
| 2. Breeder seed is produced from nucleus seed. | 2. Certified seed is produced from foundation seed by government agency or private agency. |
| 3. It is 100% genetically pure. | 3. It's qualities are certified by seed certifying agency. |
| 4. It has Golden Yellow label. | 4. It is given Blue level and supplied to farmers for cultivation. |

**Difference Between Weather and Climate, By Saurabh Subedi**

| Weather | Climate |
|---|---|
| 1. Weather is the typical physical condition of a atmosphere as regards temperature, humidity, wind speed etc. | Climate is the generalized condition of the atmosphere which represents and describes the characteristics of a region. |
| 2. Weather is the moment –wise state of the atmosphere of a geographical area. | Climate is the average weather in a given region. |
| 3. Under aberrant weather conditions, planners can adopt a short term contingent planning . | Climate helps in long term agricultural planning. |
| 4. Weather changes from place to place even in small locality. | Climate is different in different regions. |
| 5. Similar numerical values of weather of different places usually have same weather. | Similar numerical values of climate of different places usually have different climates . |
| 6. Weather of a place changes frequently in few hours or even in few minutes. | Climate of a place takes several years to change & thus it doesn't change frequently. |
| 7. Crop growth development and yield are decided by weather in a given season. | Selection of crops suitable for a places is decided based on climate for a region. |
| 8. Weather is greatly influenced by factors like temperature, humidity, air, pressure, cloudiness, precipitation etc. | Climate is influenced by two factors; temperature and precipitation. |
| 9. The study of weather is called Meteorology. | The study of climate is called climatology. |

**Difference Between Meteorology and Agrometeorology**

| Meterology | Agrometeorology |
|---|---|
| Meteorology is the study of characteristics, behaviour or phenomenon of atmosphere. | Agrometeorology is the study of relationship between atmospheric condition and agricultural production. |
| It is a branch of atmospheric physics. | It is a branch of agriculture meteorology. |
| It is a physical science. | It is a bio-physical science. |
| It concerns with weather forecasting and other weather related science. | It concerns with agro-advisory service to farmers. |
| It is solely related about weather. | It is related about the relationship between weather and crops. |

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| It is a linking science to the society. | It is a linking service to farming community. |

| S.N | Biological yield | Economic yield |
|---|---|---|
| **1.** | Biological yield is the total dry matter produced per plant or per unit area of land | Economic yield is the total weight per plant or Per unit area of land of a specified plant material that is of marketable value or other<br>economic purpose |
| **2.** | All the biological yield is not necessarily economic yield. | The entire economic yield is always biological yield. |
| **3.** | Plant itself is determined as biological yield on harvestion. | Producer determines the part of plant that is economic yield. |
| **4.** | Biological yield always includes both root system and shoot system of plant into account. | Economic yield rarely takes both shoot system and root system of plant into account. |
| **5.** | All the biological yield of a plant is not necessarily to be harvested.<br>**Example**<br>*For a corn plant,* whole the plant (below and above the ground) is biological yield and are harvested. | All the economic yield of a plant is harvested.<br>*For a corn plant*, the parts above the ground may be used for variety of economic purpose (i.e. food or feed) which is economic yield and are harvested but roots have no economic value thus are not harvested. |

Attainable Yield Vs Potential Yield By Roshani Bist

| Attainable Yield | Potential Yield |
|---|---|
| **1)** Attainable Yield is defined as the yield achieved in farmers' fields with best management practices including water pest and general crop management where nutrients are not limiting. | **1)** Potential Yield is the maximum yield possible given rainfall in the absence of any other constraints. |
| **2)** Attainable Yield is limited by water and plant nutrients. | **2)** Potential Yield is defined by $CO_2$ , temperature and crop characteristics. |
| **3)** Attainable Yield depends on management, pest, nutrients etc. | **3)** Potential Yield is totally depends on rainfall. |
| **4)** Attainable Yield is modern and modified way. | **4)** Potential Yield is traditional way. |
| **5)** Attainable Yield is costly. | **5)** Potential Yield is not costly. |

***DIFFERENCE BETWEEN GROWTH RESPIRATION AND MAINTENANCE RESPIRATION***

| | Growth respiration | VS | Maintenance respiration |
|---|---|---|---|
| 1. | Growth respiration is defined as the biosynthesis process within a growing organ and related phloem transport, excluding minerals uptake and nitrogen reduction. | 1. | Maintenance respiration is defined as the respiration needed to provide the energy for all plant metabolic processes that do not result in a net gain in plant dry matter. |
| 2. | It is also called synthesis or constructive respiration. | 2. | It is also called dormant or basal respiration. |
| 3. | This involves the energy required to convert assimilates into new cellular structural components, resultants for biosynthetic process, cellular transport and uptake of nutrients | 3. | It represents the energy required to maintain mature tissue biomass when the growth rate is zero. |
| 4. | It is essential for normal growth. | 4. | It is essential for biological health and growth of plant. |
| 5. | It is mainly associated with the carbon cost of synthesizing new tissue from glucose and minerals. | 5. | It is mainly associated with turnover of proteins and lipids and maintenance of ion concentration gradients across membrane. |

**Soil fertility Vs Productivity by Aanand Sah; RN.1**

**Soil Fertility**

1.It is considered as an index of available nutrients to plants .

2.It is one of the factors for crop production ,the other factors are water supply , slope of the land ,depth of water table etc.

3. It can be analysed in the laboratory .

4.It is the potential status of the soil.

5.It is an inherent property of soil .

**Soil productivity**

1.It is a broader term used to indicate yield of crops .

2. It is the interaction of all the factors that determine the magnitude of yields.

3. It can be assembled in the field under particular climatic conditions.

4.It is the resultant of various factors soil factors influencing soil management to produce crops .

5.It is not the inherent properties of the soil .

**Difference Between Growth respiration and maintenance respiration By Anup Adhikari**

| Growth Respiration | Maintenance Respiration |
|---|---|
| - It provides energy and products for the synthesis of structural and storage compound. | - It provides energy for the entire plant for routine works such as maintenance of membranes, protein cellular organization and for ion uptake. |
| - It depends upon the nature of compounds being synthesized and rate of photosynthesis. | - It depends upon body weight and ambient temperature. |
| - It is not directly affected by temperature. | - It is directly affected by temperature as rate of maintenance respiration depends on temperature. |
| - As the rate of growth respiration do not directly depends on temperature, carbohydrates are not lost and being utilized for growth | - As the rate of maintenance respiration depends on temperature, carbohydrates are lost without being utilized for growth. |
| - It is necessary for normal growth. | - It is consider as wasteful process under high temperature. |
| - It is also called Synthesis or constructive respiration. | - It is also called dormant or basal respiration. |

| Question No. | Assignments | |
|---|---|---|
| 1 | Explain about 5 positive and 5 negative effect of rainfall on crop growth/yield | UPENDRA G.C. |
| 2 | Enlist and describe characteristics of quality seed | SHILA KUMARI YADAV |
| 3 | Why should we use quality seed? Explain importance of using quality seed | PRATIGYA PAUDEL |
| 4 | What is seed? Give five definition of seed | SAPANA RAI |
| 5 | Differentiate between improved seed and foundation seed | SRIJANA CHAUDHARY |

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| 6 | Differentiate between certified seed and breeders seed | SAMRIDDHI SINGH |
| 7 | What is seed germination? Explain all factors affecting seed germination | TIRSANA TAMANG |
| 8 | What is seed dormancy? Explain about causes of dormancy in seed | NISCHAL PANDEY |
| 9 | Explain all methods of breaking dormancy | PRABHA KHANAL |
| 10 | Explain about Stratification and Scarification of seed for breaking dormancy | ROHIT NAYAK |
| 11 | Explain about drip irrigation and sprinkle irrigation. Enlist advantage and disadvantages of both | NIRANJAN KUMAR KUSHWAHA |
| 12 | Differentiate between primary tillage and secondary tillage | ANIL DAHAL |
| 13 | What is soil tilth? What are characteristics of good soil tilth? | BINOD PRASAD SHAH |
| 14 | Explain about importance of agriculture in Nepal. Enlist 15 points and explain them all | TARJAN BHANDARI |
| 15 | Explain about greenhouse effect. Explain the importance of it in agriculture | SIMA LAMICHHANE |
| 16 | Differentiate between conservation tillage and conventional tillage | HEM RAJ JOSHI |
| 17 | What is conventional tillage? Enlist 5 advantages and disadvantages | RAMESH BAHADUR KARKI |
| 18 | What is conservation tillage? Enlist 5 advantages and disadvantages | HARISH AUJI |
| 19 | Explain Zero tillage, Strip tillage, Minimum tillage, Mulch tillage, Puddling, Transplanting | SADHANA POUDEL |
| 20 | Explain in details about seed certification procedures of Nepal | RAJESH KUMAR SWARNKAR |
| 21 | Define cropping pattern, cropping system, farming system | CHOODAMANI JOSHI |
| 22 | Describe about different classes of seeds found in Nepal | BASUDEV BHATTARAI |
| 23 | What is multiple cropping. Explain advantages and disadvantages | AVASH BHATTARAI |
| 24 | Differentiate between intercropping and mixed cropping | DIPAK RAJ OJHA |
| 25 | Define Monoculture . Explain advantages and disadvantages | BIPANA JOSHI |
| 26 | Explain cropping index, cropping intensity and land equivalent ratio with example and formula | DIKSHYA CHAPAGAIN |
| 27 | What is crop rotation? What are the principles of crop rotation? | ASHA MISHRA |

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| 28 | Explain about advantages of crop rotation | SADHANA BOHARA |
| 29 | Enlist 15 tillage implements along with their use | LOKENDRA SINGH DHAMI |
| 30 | Define seed germination and explain key process of seed germination | GUNJAN GIRI |
| 31 | Explain Sequence cropping, relay cropping and multistoried cropping | KALPANA JOSHI |
| 32 | What do you mean by photoblastic seed? Explain different categories of photoblastic seeds | MUNA THAPA |
| 33 | What do you mean by inter cultural operations? Explain with examples | SHREYA TIWARI |
| 34 | What is irrigation? Why is it done. Enlist importance of irrigation | GANESH PARSAD JOSHI |
| 35 | Explain about surface and subsurface irrigation. Enlist advantages and disadvantages of both | ARUNA THAPA |
| 36 | Explain about 10 importance of weed | ANUP ADHIKARI |
| 37 | What are the factors to be considered for scheduling irrigation | APIL JOSHI |
| 38 | What are different types of drainage. Explain | KUMAR GUPTA |
| 39 | What are the factors that should be considered by agronomist for reducing yield gaps (between potential and average yield) | SWETA ADHIKARI |
| 40 | Explain about different types of irrigation methods | BIBHUSA ADHIKARI |
| 41 | Explain about adverse effect of water logging | LOUISH RIJAL |
| 42 | Define weed. At least 5 definition. Enlist at least 10 characteristics of weed | MAHESHWARI BOHARA |
| 43 | Explain about internal and external factor affecting seed germination | MANISHA KHANAL |
| 44 | Explain at least 10 different losses caused by weed | SUSMITA POUDEL |
| 45 | How are weeds classified. Provide with example | BADAL SUBEDI |
| 46 | Explain about preventive methods of weed management | NABIN OLI |
| 47 | Explain about different methods for eradication of weeds | ARBIN KUMAR CHAUDHARY |
| 48 | Explain about integrated management of weeds | NARAYAN PRASAD NEUPANE |
| 49 | Explain different chemical weed control methods with adv and disadv | PRAMOD K.C. |
| 50 | Explain different physical weed control methods | ASHISH CHAUDHARY |

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| 51 | Explain cultural and biological methods of weed control | GANESH KUMAR NEPALI |
| 52 | Define cropping density, optimum plant population. Differentiate FYM and Compost | NARAYAN BHUSAL |
| 53 | What is optimum plant population. Explain different factors affecting optimum plant population | BIPIN JOSHI |
| 54 | Explain about different methods of fertilizer application | GAURAV PANTA |
| 55 | What are the factors affecting proper use of applied fertilizers | OM PRAKASH UPADHAYAY |
| 56 | What is organic manure? How is it classified? | PADAM THAPA |
| 57 | What is green manure? What are the characteristics of green manuring crops | JAGAT DHAMI |
| 58 | Explain about different methods of seed placement/sowing | PRABESH BHANDARI |
| 59 | What is biofertilizer? Explain about sources of biofertilizers | NABIN GHIMIRE |
| 60 | What is chemical fertilizer? Explain about different types of chemical fertilizers used in Nepal | PRABIN BC |
| 61 | Differentiate between chemical fertilizer and biofertilizer | PRABIN DANGI |
| 62 | What is FYM? What should be considered for proper utilization of nutrient contents | PRAMOD BHATTA |
| 63 | Explain principal role of agronomist in increasing production and productivity without harming environment | AANAND SAH |
| 64 | Define food security. List and explain about all 4 pillars of food security | PRAMOD KUMAR SAH |
| 65 | Enlist and explain at least 10 causes of food insecurity in Nepal | RAM JANAM THARU |
| 66 | Explain role of agronomist in solving food insecurity problems (at least 20 points) | RACHANA CHAUDHARY |
| 67 | Name at least 20 common weeds found in Tikapur Campus with botanical name of 5 weeds | BIRENDRA MAHARA |
| 68 | Define Cardinal temperature and critical photoperiod, Vernalisation, Soil Solarization, Heaving | RAJAN PHULARA |
| 69 | What is drainage? What are the requirements of good drainage | NARENDRA SINGH THAGUNNA |
| 70 | What are the requirements of multiple cropping? What should be considered for multiple cropping | DIPESH RAJ BIST |

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| 71 | What is compost? How is it prepared? | ANISHA BOHORA |
| 72 | Differentiate Biotic and Abiotic Stress (at least 10 points) | REBANTA KHADKA |
| 73 | What is photoperiodism? | LOKENDRA BIST |
| 74 | Differentiate between short day and long day plant; Determinate and indeterminate growth; C3 plants and C4 plants; Agriculture and Agronomy | Dhan Bahadur Chaudhary |
| 75 | What is climate change? Explain at least 10 causes of climate change | TEKENDRA MANNI |
| 76 | What is mulching? Why is it done? What are the materials that could be used for mulching? | SUKRARAJ SHRESTHA |
| 77 | List and explain at least 5 impacts of climate change on Nepalese agriculture | ROSHANI BISTA |
| 78 | What is special purpose classification of crops? Explain at least 5 | HIMANCHAL KATTEL |
| 79 | Explain different phases of crop growth along with figure | SANJAY CHAUDHARY |
| 80 | Define Hopkins Bioclimatic law | BIDHAN SEJWEL |
| 81 | What is microclimate? Explain causes of microclimate | SATYA NIRAULA |
| 82 | Explain about different factors affecting plant growth (Genetic, Biotic and Abiotic factors- describe each component under each) | SAUHARDA ADHIKARI |
| 83 | Explain about 10 different measures to reduce the impact of climate change | SAURAB SUBEDI |
| 84 | What is real value of seed? Why is it calculated? | GANESH SAUD |
| 85 | Explain about 5 positive and 5 negative effect of light on crop growth/yield | PAWAN KATHAYAT |
| 86 | Differentiate between: Seed and Grain; Epigeal and Hypogeal germination; Subsistence and commercial farming; soil fertility and soil productivity (more than 5 differences expected for all) | BIRENDRA CHAUDHARY |
| 87 | Explain about different sources of manures | SONU SINGH |
| 88 | How plant nutrients is lost from soil ? | NARENDRA BASNET |
| 89 | Explain about 5 positive and 5 negative effect of temperature on crop growth/yield | SAMARPAN ACHARYA |
| 90 | What are the factors to be considered for proper light management during crop production | SUSHILA KUMARI GIRI |
| 91 | Explain principal role of agronomist in increasing production and productivity without harming environment | SUSHMA REGMI |

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| 92 | What are the factors to be considered for proper water management during crop production | BIPIN SUBEDI |
| 93 | What is agronomic classification? Explain all | ANITA REGMI |
| 94 | What are secondary nutrient elements? Provide the forms that are absorbed by plants | NARESH JOSHI |
| 95 | Enlist and explain 10 positive and 10 negative effect of green revolution | NARESH SINGH BHANDARI |

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| | |
| 1 | Special Purpose Classification of Crops. Explain any five |
| 2 | FYM and Compost |
| 3 | Sources of plant nutrients and Criteria of essentiality of elements |
| 4 | Climate change and its impact |
| 5 | Green manure and its characteristics |
| 6 | Define FS and causes of food insecurity in Nepal |
| 7 | What is agronomic classification. Explain |
| 8 | Importance of Agriculture |
| 9 | Vernalisation |
| 10 | Biological Yield Vs Economical Yield |
| 11 | What is crop growth |
| 12 | Cardinal temperature |
| 13 | Climate Change and its causes |
| 14 | Sources of Plant nutrient and criteria of essentiality (document 1 pdf.) |
| 15 | Growth stages of cereals |
| 16 | Growth stages of cereal crops and legumes |
| 17 | How can we improve efficiency of C3 plants for higher productivity |
| 18 | How can we improve efficiency of C3 plants |
| 19 | Biotic Stress and its effect on plant growth |
| 20 | Photorespiration and why it is not considered good for higher py |
| 21 | Crop Growth |
| 22 | Heaving and Soil Solarisation |

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| 23 | Conventional rain, Orographic rain, cyclonic and frontal rain |
| 24 | Conventional rain, Orographic rain, cyclonic and frontal rain |
| 25 | What is special Purpose classification. Explain any five |
| 26 | Vernalisation |
| 27 | Meteorology Vs Agrometeorology |
| 28 | Abiotic stress and factors creating it |
| 29 | Weather Vs Climate |
| 30 | Abiotic stress and factors causing it |
| 31 | Define photoperiodism. Explain Short day plants, long day plants and day neutral plants |
| 32 | Hopkins Bioclimatic law and orographic effect |
| 33 | Hopkins Bioclimatic law and orographic effect |
| 34 | Green House effect and its causes |
| 35 | Hopkins Bioclimatic law and orographic eff |
| 36 | Define harvest index |
| 37 | Solar radiation effect on plant growth |
| 38 | Factors effecting plant growth |
| 39 | Biotic factors affecting plant growth |
| 40 | Abiotic factor affecting plant growth |
| 41 | Growth respiration Vs Maintenance respiration |
| 42 | Microclimate and factors causing microclimate |
| 43 | Soil fertility and soil productivity |
| 44 | Sources of plant nutrients, criteria of essentiality |
| 45 | Define Chemical fertilizer |
| 46 | Chemical fertilizers , its classification and its use |
| 47 | Green revolution pros and cons |
| 48 | Different impacts of of Climate change |
| 49 | Biotic and abiotic factors affecting plant growth |
| 50 | Biofertilizer and sources |

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| 51 | Mitigation/adaptation measures for reducing impact of CC |
| 52 | Biofertilizers and sources |
| 53 | What happens to plant if it does not get sufficient sunlight |
| 54 | Determinate and Indeterminate growth |
| 55 | Growth stages of cereals |
| 56 | Different types of Monsoon and its imp in Nepal |
| 58 | Define Agronomic classification explain about 5 |
| 59 | C4 efficient than C3 why? |
| 60 | Soil Fertility Vs Productivity_png |
| 61 | Enhancing temp of soil_pdf |
| 62 | Define Photorespiration. Why is it not considered for good for plants |
| 63 | Importance of Relative Humidity on Plant growt |
| 64 | Definition of Green Manure and characteristics of Green manuring crops |
| 65 | What happens to plant if does not receive sufficient sunlight |
| 66 | What should be considered for reducing yield gaps |
| 67 | Explain how and why wind velocity and direction affect plant grwoth |
| 68 | Classify and list 16 essential elements and the forms absorbed by plants |
| 69 | Explain about Green House effect |
| 70 | Growth respiration Vs Maintenance respiration |
| 71 | How to enhance temp of Soil |
| 72 | Factors affecting plant growth |
| 73 | How solar radiation(light and temp) effect plant growth |
| 74 | Methods of fertilizer application |
| 75 | Define manure and what are the sources of manures |
| 76 | How wind effect plant growth |
| 77 | Cardinal temp |
| 78 | Special Purpose classification of Crop |

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| 79 | Importance of RH on plant grwoth |
| 80 | Define Sigmoid curve |
| 81 | Define S-Curve |
| 82 | List and explain causes of Climate change |
| 83 | Effect of temp on plant growth |
| 84 | Abiotic stress and factors causing it |
| 85 | Agronomy Vs Agriculture |
| 86 | Define growth and explain different phases of crop grwoth |
| 87 | Manures, imp and classification |
| 88 | Attainable Vs Potential Yield |
| 89 | Define Microclimate. Explain its causes |
| 90 | Define critical photoperiod |
| 91 | Soil fertility Vs Productivity |
| 92 | Explain different types of monsoon in Nepal |
| 93 | Manure and sources of Manure |
| 94 | Explain minimum temp, maximum temp, and optimum temp for plant growth |
| 95 | Effect of temp on plant grwoth |
| 96 | Green revolution pros and cons |
| 97 | Determinate Vs Indeterminate grwoth |
| 98 | Soil Solarization and Heaving |
| 99 | Climate change and its causes |
| 100 | Explain different types of drainage and explain any one |
| 101 | What is optimum plant population? What are different factors affecting optimum plant population |