THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

Fundamental of Agronomy
Practical Manual
Course Code: CC-AGP 105 Credits:4(3+1)

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Content

Experiment – 1: - Identificationof crop seeds,manuresand fertilizers

Objective :- 1) To identify different crop seeds, manures and fertilizers.

2)Tostudy the common namesof crops, seeds and also their scientific names as well as family. We can also notice the colour, Shape and test weight of the seeds of them.

Materials used :- 1) Different types of crop seeds.

2)Different types of manures.

3)Different types of fertilizers.

TABLE -1:-Identification of different types of cereal crops –

Sl. No.	Common name	Scientific name	Family	Phylum	Seed colour	Seed shape	Test weight
1.	Rice	*Oryza sativa L.*	*Poaceae*	Spermatophyta	Golden brown		
2.	Wheat	*Triticum aestivum L.*	*Poaceae*	Spermatophyta	Golden brown		

TABLE – 2:-Identification of different types of oilseed crops –

Sl. No.	Common name	Scientific name	Family	Phylum	Seed colour	Seed shape	Test weight
1.	Mustard (Brown)	*Brassica juncea* L. Czern & Coss	*Brassicaceae*	Spermatophyta	Brown		
2.	Mustard (Yellow)	*Brassica rapa* L.	*Brassicaceae*	Spermatophyta	Yellow		
3.	Groundnut(Peanut)	*Arachis hypogaea* L.	*Fabaceae*	Spermatophyta	Brown		
4.	Soybean	*Glycine max* (L.) Merrill	*Fabaceae*	Spermatophyta	Brown		

TABLE – 3:-Identification of different types of pulse crops –

Sl. No.	Common name	Scientific name	Family	Phylum	Seed colour	Seed shape	Test weight
1.	Green gram/ Mungbean	*Vigna radiata* (L.) Wilczek	*Fabaceae*	Spermatophyta	Green		
2.	Black gram/ Urdbean	*Vigna mungo* (L.) Hepper	*Fabaceae*	Spermatophyta	Black		
3.	Field pea	*Pisum Sativum* L.	*Fabaceae*	Spermatophyta	Yellow		
4.	Chickpea	*Cicer arietinum* L.	*Fabaceae*	Spermatophyta	Brown		
5.	Chickpea(Kabuli type)	*Cicer Arietinum* L.	*Fabaceae*	Spermatophyta	Yellow		
6.	Grass pea	*Lathyrus sativus* L.	*Fabaceae*	Spermatophyta	Deep brown		

- **TABLE- 4 :- Identification of manure**

Sl. No.	Common name	% of N,P,K
1.	Farm yard manure	0.5% N_2,0.2% P_2O_5 ,0.5% K_2O
2.	Bone meal	3-4% N_2, 20-25% P_2O_5 , 0% K_2O
3.	Vermicompost	0.5-1.5% N_2,0.1-0.3% P_2O_5, O.15-0.56% K_2O
4.	Horn and hoofmeal	13% N_2, 0% P_2O_5, 0% K_2O
5.	Mustard cake	5.2% N_2, 1.8% P_2O_5, 1.2% K_2O
6.	Neem cake	2-5% N_2, 0.5-1%P_2O_5, 1-2% K_2O

Identification of different types of fertilisers

1. Urea – Urea is a white, granular fertilizer which contains 46% Nitrogen. It is a straight fertilizer.

Chemical formula – $CO(NH_2)_2$

2. Single super phosphate(SSP) – It is white in colour and powder fertilizer. It contains 16% of P_2O_5 (major substance is phosphate), 12% Sulphur and 21% Calcium.

Chemical formula – $Ca(H_2PO_4)_2$

3. Muriate of potash – It is red in colour, powder fertilizer. It is a straight fertilizer which contains 60% of K_2O(main substance isPotassium).

Chemical formula – KCl

4. Diammoniumphosphate(DAP)-Itisacomplexfertilizer and darkish black in colour. It is granulate and contains 18% $N_2$and 46% Phosphate (P_2O_5).

Chemical formula – $(NH_4)_2$ HPO_4

5. Mixed fertiliser- It is a mixture of Nitrogen, Phosphate and Potassium and contains 10% N_2, 26% P_2O_5 and 26% K_2O.

Suggested link:

1. **https://www.youtube.com/watch?v=MonsMbIqJGY**
2. **https://www.youtube.com/watch?v=fFbYExvAgcE&list=PLPl_RlgoVyPsVau-SHxRAxn6IADtCSE-3&index=2**

➢ Observation

- **Conclusion / Physical significance**

Experiment – 2: -Study of different agroclimatic zones of India and West Bengal

Objectve – 1) To study about different agro-climatic zones of India.

2)study about different agro-climatic zones of West Bengal.

3)To understand the characteristics of different Agro - climate such as rainfall, temperature, Soil, topography, cropping, farming system etc .

Agroclimatic zones of India: -

Based on the criteria of homogeneity in agro- characteristics such as rainfall, temperature, soil, topography, types of crop grown, etc, the country has been divided into 15 agro-climatic zones by planning commission in the year of 1989.

Agroclimatic zones –

1. **Western himalayan region** – It consists of parts of Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh hills. These zones consist of podsolic soil, mountain soil and hilly brown soil. Rice, maize, saffron, wheat, barley, millets are the main crops. Ginger and mainly temperate flowers and vegetables are grown in this region.
2. **Eastern himalayan region** – Sikkim and Darjeeling hills, Arunachal Pradesh , Meghalaya, Nagaland, Manipur, Tripura, Mizoram, Assam, Cooch Bihar and Jalpaiguri district of West Bengal fall under this region. This region has high rainfall and high forest cover. Shifting cultivation (Jhum) is very common in this area.
3. **Lower gangetic plains –** West Bengal comes under this zone except some Northern parts of the state. This particular zone contributes about 12% of India's rice production. Sesamum, jute, mustard, rice, maize and potato are very common in this zone. This zone has the highest population density (692 per sq.km).
4. **Middle gangetic plains** – This zone consists of 12 districts of eastern Uttar Pradesh and 27 districts of Bihar. Rice is the principal crop but its productivity is low due to Zinc(Zn) deficiency in soil as well as salinity hazards. Poultry, dairy and inland fishery is also very common. There are large area under effecting land.
5. **Upper gangetic plains** -This zone consists of 32 districts of Uttar Pradesh. The cropping intensity of this zone is 144%. Cultivation of fodder crops and milk production is very common.
6. **Trans gangetic plains**-This zone consists of Punjab, Haryana, Union territory of Delhi and Chandigarh and Srinagar districts of Rajasthan. Rice – Wheat cropping system is very common.
7. **Eastern plateau and hills** – **It consists of 5 following sub- regions :-**

(i). Sub-region of Madhya Pradesh hills and Odisha inland.

(ii). Northern Odisha and eastern MP hills and plateau.

(iii). Chota Nagpur – northern and eastern hills and plateau.

(iv). Chota Nagpur south and WB hills and plateau.

(v). Chhattisgarh and Western Odisha hills.

Rainfall is very well in this region i.e. about 1300mm. Crops like red gram, groundnut and soybean are commonly grown.

8. **Central plateau and hills** – It consists of 46 districts of MP, UP and Rajasthan. Irrigation and cropping intensity are low and 75% area is rainfed. Literacy rate is very low and poverty ratio is veryhigh.
9. **Western plateau and hills** – This zone consists of Maharashtra, parts of MP and one district of Rajasthan. Sorghum and cotton are the major crops but this zone is known for the best quality of orange, grapes and banana.
10. **Southern plateau and hills** – This zone consists of Andhra Pradesh, Karnataka and Tamil Nadu. 81% area is coming under rainfed. Cropping intensity is 111%, low value cereals and millets are very common.
11. **East coast plains and hills** – This zone consists of 6 sub-zones –

(i).Coastal Odisha

(ii).North coastal Andhra Pradesh and Ganjam (iii).South coastal Andhra Pradesh

(iv).North coastal Tamil Nadu (v). Thanjavure

(vi). South coastal Tamil Nadu

Rice and groundnut are the important crops in this region.

12. **West coast plains and hills -** This zone covers parts of TN, Kerala, Karnataka and Goa. Rice and millets are the main crops.

Horticultural crops like mango, coconut and banana are very common.

13. **Gujarat plains and hills** – This region consists of 19 districts of Gujarat. Rainfall is very low. This zone is known for oilseed crops.

14. **Western dry region** – This region consists of 9 districts of Rajasthan. Average rainfall is 395mm per year. Pearl millet, guar, wheat, gram are verycommon.

15. **Island regions** – This zone covers the island territories of Andaman & Nicobar and Lakshadweep. Rainfall of 3000mm is spread over 8-9 months. Coconut is the main crop.

Agro-climatic zones of West Bengal -

Based on the criteria of homogeneity in agro- characteristics such as rainfall, temperature, soil, topography etc, WB has been divided into 6 agro- climatic zones which are as follows :-

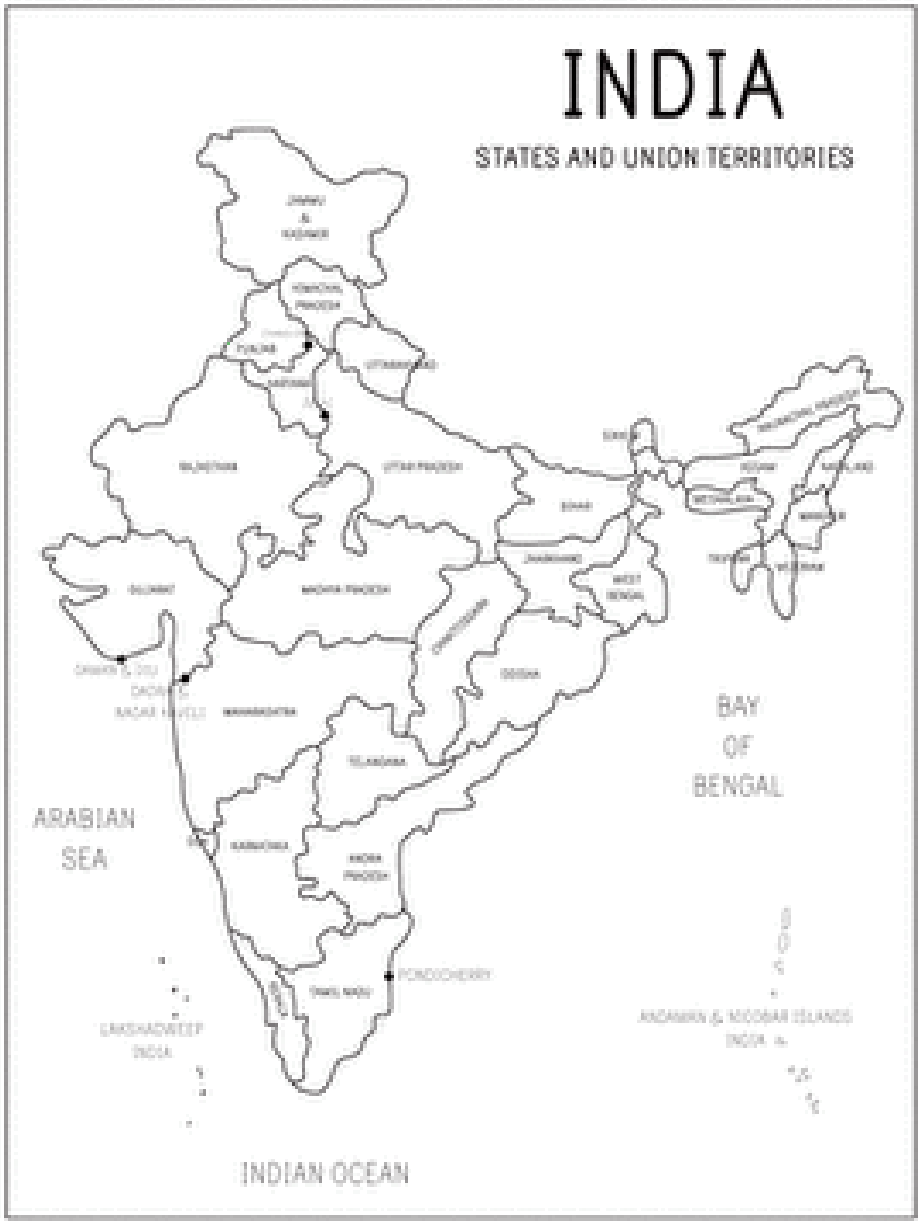
1. **Northern hill zone** – Broadly the regions come under sub- tropical humid climate with rainfall varying from 2500-3500mm, maximum and minimum air temperature being 19.5°C and 4.8°C(annual normal) respectively in this zone. The distribution of rainfall from March-May is 398.5mm, June-October is 2637.5mm and Nov-Feb is 68.5mm. The district of Darjeeling part and Jalpaiguri part fall within this zone. Total area falling under this zone is approx. 2.43lakh ha.
2. **Terai -teesta alluvial zone** – Tropical humid climate with rainfall between 2000-3000mm with maximum and minimum air temperature being 32.3°C and 12.8°C (annual norma)

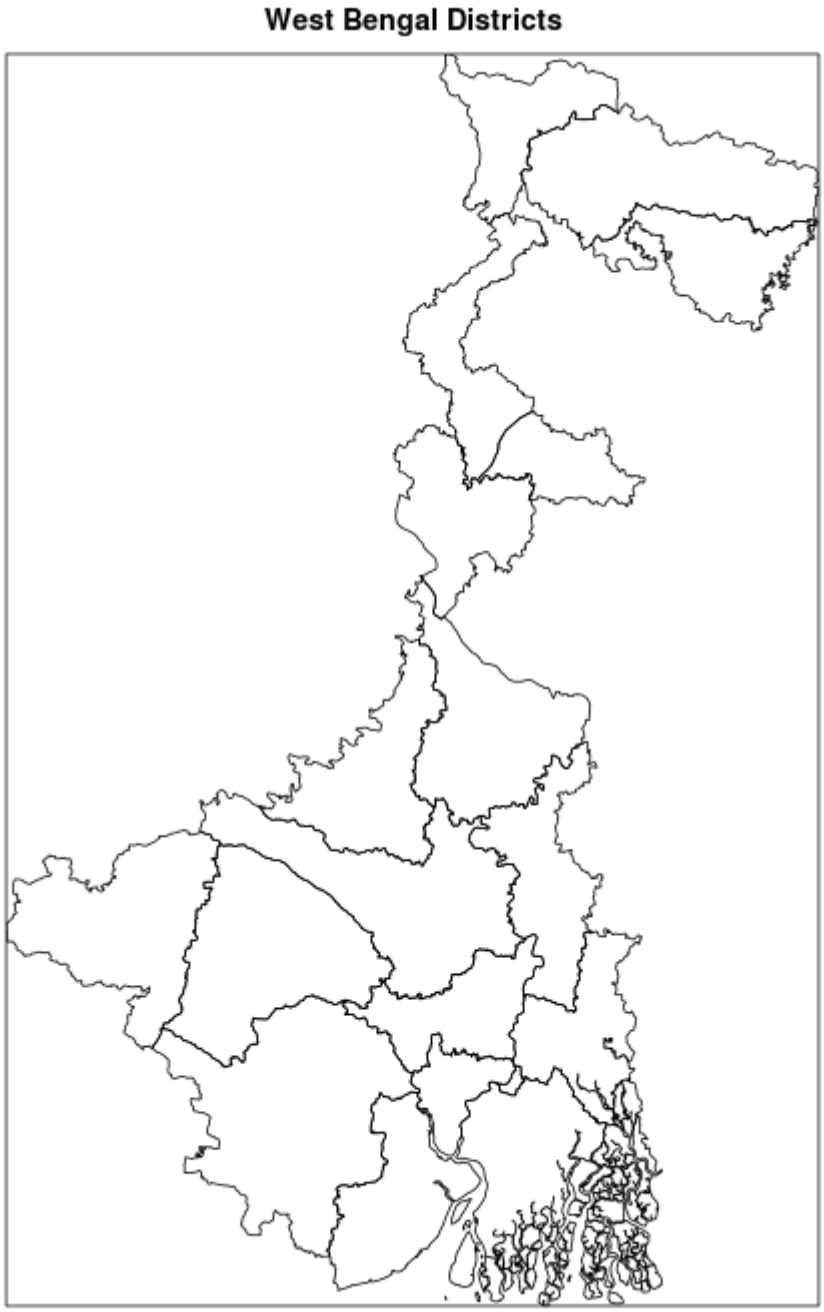
respectively are the main characteristics of this zone. The distribution of rainfall from March-May is 376.6mm, June- October is 2134.0mm and Nov-Feb is 42.6mm. The districts -

Cooch Bihar(part) and Uttardinajpur (part) fall within this zone. Total area falling under this zone is approx. 12.15lakh ha.

1. **Gangetic alluvial zone -** Climatically this zone comes under tropical humid and rainfall of 1350-12,650mm and air temperature varies between a maximum of 35°C and minimum of 15.6°C (annual normal). The distribution of rainfall from March-May is 233.8mm, June-October is 1206.0mm and Nov- Feb is 67.8mm. The districts - Cooch Behar(part), Dakshindinajpur, Malda, Murshidabad, South 24 parganas(part), Howrah(part), Hooghly(part),Bardhaman(part),Birbhum(part) covering this zone an area of approx. 15.3lakh ha.
2. **Undulating red &laterite zone -** Climatically this zone comes under tropical dry sub-humid having rainfall ranging from 1100-1400mm & air temperature being max. of 37°C & min. of 14.8°C (annual normal). The distribution of rainfall from March-May is 137. 0mm, June-October is 1224.4mm and Nov- Feb is 66mm.The districts - Bardhaman(part),Birbhum(part), Bankura(part), Purulia & Paschim Medinipur(part) fall within this zone covering 24.8lakh ha area.
3. **Vidhyan alluvial zone** -Climatically this zone comes under tropical moist sub-humid and rainfall of 1500-2000mm and air temperature varying between a maximum of 35.4°C and minimum of 15.2°C (annual normal). The distribution of rainfall from March-May is 137.23mm, June-October is 1206.12mm and Nov-Feb is 66.68mm. The districts – Murshidabad(part), Howrah(part), Hooghly(part),Bardhaman(part),Birbhum(part), Bankura(part), east Medinipur(part) and west Medinipur(part) fall within this zone covering 17.5lakh ha area.
4. **Coastal saline zone -** Climatically this zone comes under tropical humid and rainfall of 1600-1800mm and air temperature varying between maximum of 37°C and minimum of 22.7°C (annual normal). The distribution of rainfall from March-May is 195.0mm, June-October is 1475.2mm and Nov- Feb is 82.8mm. The districts – North 24 parganas (part), South 24 parganas(part), Howrah(part), east Medinipur(part) fall within this zone covering an area of approx. 14.6lakh ha.

Exercise: Identify the agro-climatic zones of India and West Bengal through the below mentioned maps.





Suggested link:

1. **https://www.youtube.com/watch?v=c2jUA_tq2Rw**
2. **https://www.youtube.com/watch?v=gBMc4OlzWws**

Result:-

Conclusion:

Experiment-3 Identification of different types of Tillage Implements and tools

Objective:

1.To know about different types of tillage implements.

2.To know the use of tillage implements and their role in crop field.

Materials Required:

a. Studied equipments-

- Wooden Plough or Indigenous Plough
- Tractor board plough
- Tractor drawn disc plough
- Rotary tillers
- Cage wheel
- Chisel plough
- Cono weeder
- Hoe cum rake
- Rigid cultivator
- Disc harrow
- Blade harrow
- Guntaka
- Mower
- Seed cum fertilizer drill
- Hand hoe
- Traditional hand tools.
- Traditional and Improved hoes.
- Wheel hoes.
- Animal drawn multi purpose hoe.

Description :

Wooden Plough or Indigenous Plough- Indigenous plough is an implement which is made of wood with an iron share point It consists of body, shaft, pole, share and handle. It is drawn with bullocks. It cuts a "V" shaped furrow and opens the soil but there is no inversion. Ploughing operation is also not perfect because some unploughed strip is always left between furrows. This is reduced by cross ploughing, but even then, small squares remain unploughed.

Tractor board plough- It is generally considered as the most important tillage implements, ploughing accounts for more fraction energy than any other field operations while working a tractor board plough does four jobs mainly

1.cutting the furrow slice

2.lifting the furrow slice.

3.inverting the furrow slice.

4.pulverising the furrow slice

Tractor drawn disc plough-The action of a disc plough is similar to the tractor board plough. Disc plough cuts, turns and in some cases breaks furrow slice by means of separating mounted large steel concave disc. A disc plough is designed with a view to reduce friction by making rolling plough button instead of sliding plough as in the case oftractor board plough. A disc plough works well in the condition where tractor board plough doesn't work satisfactorily.

Rotary tillers-The rotary cultivation is used for fine degree of pulverisation enabling the rapid and intimate mixing of soil. The functional component includes lines rotter and transmission depth control arrangement clutch and three-point linkage. The lines are fixed to the rotter and the rotter with lines revolve in the same direction as the tractor wheels. A depth control liver with the depth wheel provided on either side of the exist ensure proper depth.

Cage wheels- This is an iron luggaed with longless cage wheels are of two types which is half cage wheel and full cage wheel. The iron lugs provide required grills and facilit6ated easy movement in rice field. Half cage wheels are fitted to the rubber tyred wheels and used for full cage wheels, tyre wheels are removed and used.

Chisel plough- It is mainly used for breaking hard pans and for deep ploughing (60- 70 cm) with less disturbance to the top layers. Its body is thin with replaceable cutting edge so as to have minimum disturbance to the top layers It contains a replaceable share to shatter the lower layers.

Cono weeder- It's useful for burging the wheels in time planted rice fields in wet land. The weeder consist of a long handed two numbered of translocated casual rollers and a float. Theb rollers are fitted at the bottom of hand opposite direction and cone behind to others.

Conical rollers that separated plades on the periphery when the wheelers is co-operated in between two rows of standing crops. The roller uproot the wheels and bury them cone weeder operation triggers root growth.

Hoe cum rake-The Hoe cum rake is a multipurpose hand tool which consist of back blade on one side like and pronges on the other side. A wooder handel is fited for the operation. The flat blade is used for digging and rake side for weeding and collection of weeds and trashes.

Rigid cultivator-It is a tractor mounted implemented and consist of main frame made up of box section rigid times, four clames and shovels. The damping of line makes possible to adjust the distance between them. According to crop rows, the shovels are made of medium carbon steel or low allow steel, harden and tempered to suitable hardness. The shovels are mounted on the line with fastners and can be operated is controlling the hydrolic system of the tractor.

Disc harrow-It have a set of rotation disc set being mounted on a common shaft. Disc harrow is found very similar for hard ploughing with full of stalks and grasses. It cuts the soil, clods and roots. Disc harrow are mounted on one turn or more azles with may be set a variable angle to the time of motion. Disc harrow is divided into two classes

1.Single action

2.Double action

Blade Harrow- Blade harrows are used for different purposes like removal of weeds and stubbles, crushing of clods, working of soil to shallow depth, covering the seeds, intercultivation and harvesting of groundnut etc.

Guntaka- Guntaka or blade harrow is smaller than peddaguntaka. Though the length of the beam is almost same, weight of the beam is lighter than peddaguntaka. It is used for removal of weeds and stubbles and for covering crop seeds. It is worked by a pair of cattle.

Mower-It is a machine that uses common or more revolving blades to cut a lawn to an event height. The blades may be powered either by hand, pushing the angwerd forward ton operate the machine or mechanical blade or may have electric motor or any binternal combination of engines to spin their blades. Some mowers also include other abilities like matching/collection their clipping.

Seed cum fertilizer drills-Seed rills filled with fertilizer droping attachment are called seed cum fertilizers. Simultaneously in an acceptable poten seed cum fertilizer, drill has large seed box which is divided length wise into two compartment one for seed and other for fertilizer.

Hand hoe- Hand hoe is popular for manual operated box used in the farm. It consists of an iron blade and a wooded handle. The operator holds the handle and cuts the soil with which the weeds are cut and soil is stressed. The handle is short (30-40cm) long hence the operation uses the tools in bending posters. The cover is 5-7% per day.

Traditional hand tools :

(i) Khurpi- Khurpi is a traditional hand tools and made by local artisans for the use on small and marginal farmers. Khurpi is used in India may vary in their size, shape and weight, but they have common basic part i.e. a

cutting blade and a small wooden handle for the grip. The khurpi with a long narrow blade is preferred for weeding around the flower plants, broadcasted crops and vegetable crops. However, a man can weed out about 0.025 hectare in a day under normal condition.

Traditional and Improved hoes :

The hoe is a versatile form of implements used for many operations i.e. seed bed preparation, ridge making, channel shaping and weeding. It is also for removing plant roots, harvesting root crops and thinning drilled crops.

The two common types of hoe used by Indian farmers are:

(i) Hand hoes (ii) Animal drawn hoes.

Hand hoes are used to cultivate very small area of land by human labour. Among the indigenous type of hand hoes, the Kodali (narrow spade) is most popular one.

(i) Kodali- Kodali is similar to a phawara (broad spade), the difference being that instead of a wide thin cutting blade, a narrow long pointed thicker section blade is attached to the handle. The person working with it has to bend his body. It is used for inter cultivating maize and sugarcane crops, and for earthing up the potato crops sown in line. About 0.04 hectare can be covered in a day by one man.

(ii) Improved hand hoe- An improved hand hoe is operated in the standing position. It is provided with the long handle fitted in the middle of the cutting blade. One end of the blade is about 10 cm wide sharp edge and the other end is pointed narrow one for making small furrows. It can be used for cultivating and weeding very close to the individual plant.

(iii) The Grubber- The grubber is a manual pull type hoe suitable for weeding and inter culture of up land row crops in black cotton soil region. It is provided with three blades and the field capacity is 1/200 ha. per hour.

(iv) Rotary paddy weeder- Rotary paddy weeder is best suited for uprooting the weed and burying them into soil. The operator moves the tools forward and backward in narrow rows of paddy crops. It gives higher output and drudgery of the operator is considerably reduced.

(3) The wheel hoe- The wheel hoe is another implement which is used for cultivating the land between rows. It consists of a wheel, two handles and a type to place the cutting tool on. Either a reversible shovel or a three prong fork or rake or sweep is used as a cutting tool, depending upon the weed and moisture condition. A man operates the hoe in standing position by pushing through a short length each time. In a working day, 0.04 hectare can be covered.

(4) Animal drawn hoe- Animal drawn weeding implements are pulled either by single animal or a pair of animal. These implements may either be single row type or multi row unit. The three type cultivator or 'Triphali', Akola hoe, Bardole hoe or two 'Blade hoe' are most popular implements in different region for row crop interculture operations. It is essential to provide wider spacing (above 30 cm) for movement of animals and implements if animal drawn weeders are to be used.

The main parts of the blade hoe are : (i) Head piece (ii) Prong (iii) blade (iv) handle and (v) beam. The number of cutting blades on these hoes may be one or more. The prong make an angle of about 45 o downward with the horizontal plane. At the end of each prong, the blade is attached. It loosens the upper surface of the soil and is generally used for interculturing sorghum, cotton, groundnut and other kharif crops. The hoe width is maintained between 25 and 75 cm depending upon the size of the bullocks and types of soil.

Suggested link:

1. **https://www.youtube.com/watch?v=FjgTX8vFLc4**
2. **https://www.youtube.com/watch?v=qgMK6vqNkYY&t=11s**

Observation:

Conclusion/Practical significance:

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Experiment- 4 Determination of bulk density of an undisturbed core soil sample

Principle: To determine the bulk density of an undisturbed core soil sample, soil sample should be collected by core sampler and it should be dried in air. Then determine the volume of an core sample and its weight. Bulk density is defined as the mass of unit volume of dry soil.

B.D= $\frac{\text{weight of core soil collected}}{\text{volume of core sample collected}}$

B.D of most of the soil is 1.02-1.08g/cc

Materials Required:
Core sample
Knife
Slide callipers
Analytical balance
Oven

Procedure:
At first the soil sample is collected from the field by one soil sampler (core sampler). Then the sample is left out in the air for drying. After drying, take the height of the core sample by Vernier callipers or scale atleast 5 times and then determine the average height of the core sample for 5-6 times and take the average. From the value of height and radius, calculate the volume of the core sample using the formula:

$V=\pi r^2h$
where,r = radius
h=height

Now, B.D= $\frac{w}{v}$ (g/cc)

B.D= $\frac{w}{\pi r^2 h}$ (g/cc)

Calculation:
Weight of the core sample=w(g)
height of the core sample=h(cm)
radius of the core sample=r(cm)
therefore volume of the core sample= πr^2h (cm^3)
therefore B.D= $\frac{w}{\pi r2h}$ (g/cc)
weight of the core sample=1583g
height of the core sample=13cm
diameter of the core sample=10cm
radius of the core sample=5cm
therefore, volume of the core sample=πr^2h
$22/7\times5^2\times13\ cm^3$
$=1021.42cm^3$
Therefore, B.D= $\frac{w}{\Pi r^2 h}$
$=\frac{1583}{1021.42}$ (g/cc)

= 1.549 g/cc =1.55
Conclusion: The bulk density of the given soil sample is 1.55 g/cc.

Suggested link:

1. **https://www.youtube.com/watch?v=KO_Iyv7_vSk**
2. **https://www.youtube.com/watch?v=qcm1WTGlric**

Result:

Conclusion:

Experiment- 5 Determination of bulk density of a plough core soil sample

Principle: To determine the bulk density of an undisturbed core soil sample, soil sample should be collected by core sampler and it should be dried in air. Then determine the volume of an core sample and its weight. Bulk density is defined as the mass of unit volume of dry soil.

$$B.D = \frac{\text{weight of core soil collected}}{\text{volume of core sample collected}}$$

B.D of most of the soil is 1.02-1.08g/cc

Materials Required:
Core sample
Knife
Slide callipers
Analytical balance
Oven

Procedure:
At first the soil sample is collected from the field by one soil sampler (core sampler). Then the sample is left out in the air for drying. After drying, take the height of the core sample by Vernier callipers or scale atleast 5 times and then determine the average height of the core sample for 5-6 times and take the average. From the value of height and radius, calculate the volume of the core sample using the formula:

$V=\pi r^2h$
where,r = radius
h=height

Now, $B.D = \frac{w}{v}$ (g/cc)

$B.D = \frac{w}{\pi r^2 h}$ (g/cc)

Calculation:
Weight of the core sample=w(g)
height of the core sample=h(cm)
radius of the core sample=r(cm)
therefore volume of the core sample= $\pi r^2 h$ (cm^3)
therefore $B.D = \frac{w}{\pi r2h}$ (g/cc)

Problem:

weight of the core sample=1500 g
height of the core sample=13cm
diameter of the core sample=10cm
radius of the core sample=5cm

Solution:

Suggested link:

1. **https://www.youtube.com/watch?v=KO_Iyv7_vSk**
2. **https://www.youtube.com/watch?v=qcm1WTGlric**

Result:

Conclusion:

Experiment-6 Determination of soil moisture content by gravimetric method

Objective:

1. To determine the moisture content in a soil sample by gravimetric method.
2. To explain the importance of soil moisture determination in the efficient use of water.

Materials Required:

- Aluminium moisture box
- Soil sampling auger
- Balance with 0.001 g precision
- Electric drying oven
- Gunny sack or cloth
- Wooden or card board basket

Procedure:

1. Record the weight of empty moisture box (w).
2. Select a representative spot in the field to draw the sample. For instance, when sampling is to be done in the early growth stages of the crop then the sample should be collected from between two plants within a crop row. At mid and later growth stages the sample are to be collected from a point midway between two crop rows using one's judicious judgement.
3. Drive the auger into the soil and draw the soil sample from the desired soil depth.
4. Collect about 200g of soil sample from the grooves of the soil auger in previously weighted aluminium moisture box. Cover the box with lid immediately and store in wooden or card board basket.
5. Record the weight of moist soil sample + aluminium box on a sensitive balance to precision of 0.001 g (Wm).
6. Put the box (with lid open) in a electric drying oven at 105^{oC} for 24 hours or until two successive weighting records approximately the same value.
7. Record the value of dry soil sample + aluminium box (Wd).
8. Put the values in the table and calculate the moisture content in the soil sample.

Practical significance:

Knowledge of soil moisture content is important for irrigation scheduling, computation of evapotranspiration (crop water requirement), to infer the influence of water on crop growth and development.

Table of moisture content in soil sample

Sl.no	Particulars	Values
1.	Weight of empty moisture box (g) (w)	40g
2.	Weight of empty moisture box + moist soil g (Wm)	250g
3.	Weight of empty moisture box + oven dry soil (g) (Wd)	190g
4.	Weight of water lost in oven drying (g) (Ww-Wm-Wd)	60g
5.	Weight of oven dried soil (g) (Wds=Wd-W)	150g
6.	Gravimetric water content $^{\delta}m$= (Ww/Wds) ×100	40 %

Calculations:

Wt of the empty moisture box(w) = 40g

Wt of the moist including moisture box(Wm)= 250g

Wt of the oven dried soil including box (Wd)=190 g

Therefore, wt of the water loss in oven drying soil Ww

=Ww-Wd

=250-190 g

=60 g

Therefore, wt of the oven dried soil (Wds)= Wd-W

190-40 g

150g.

Therefore, Gravimetric water content-

$^{\delta}m = \frac{Ww}{Wds} = \frac{160}{150} \times 100$

= 40%

Answer: The Gravimetric water content of the given soil sample is 40%.

Suggested link:

1. **https://www.youtube.com/watch?v=DXbsVia6G2Y**
2. **https://www.youtube.com/watch?v=N2J-tvEeI4c**

Result:

Conclusion:

Experiment-7 - Numericals on evaporation

1. At the beginning of the week the depth of water in an evaporation pan was 8.25 cm. Rainfall during the week was 3.5 cm and 2.5 cm. Water was removed from the pan to keep water depth within a fixed range. At the end of the week, the gauge indicated a depth of 8.18 cm water in the pan. If the pan coefficient is 0.75, estimate the evaporation during the week from the surface of a reservoir under similar condition.

   Solution:

   Depth at the beginning of the week=8.25cm

   Rain during the week =3.5cm

   So, the total depth of water =(8.25+3.5)cm

   =11.75cm

   Some water was removed from the pan. So the depth of the water in the pan after removing 2.5cm of water is (11.75-2.5) =9.25

   The depth indicated by the gauge at the end of the week was 8.18 cm. So, water lost in evaporation =(9.25-8.18)cm = 1.07 cm

   Thus the evaporation from the pan was 1.07 cm

   We know, the actual evaporation from the lake

   =Epan × K pan

   = (1.07×0.75)cm

   =0.8cm/week

2. A crop is planted in the month of june and is harvested in September. The seedling, vegetative, reproductive and maturity stages are of 20, 35, 39 and 28 days respectively. The ET for the corresponding stages are 8.9, 9.4, 8.8 and 7.6 mm/day. The crop coefficient value for the various stages are 0.5, 0.6, 1.2 and 0.9 respectively. Calculate the crop evapotranspiration.

   Solution: We know, WTc= ETo ×Kc

   1. For seedling stage, ETo=8.9

      Kc=0.5

      Therefore, ETc= 8.9 ×0.5 =4.45 mm/day

      But the seedling stage lasts 20 days

      Therefore, evapotranspiration of seedling stage =20×m4.45

      =89mm

   2. For vegetative stage, ETo=9.4

      Kc=0.8

      Therefore, $(ETc)_2$ =9.4×0.8 =7.52 mm/day

      Therefore, total evapotranspiration of vegetative stage(as the vegetative stage lasts for 35 days) =7.52×35

=263.2mm

3. For reproductive stage, ETo=8.8

   Kc=1.2

   Therefore, $(ETc)_3 = 8.8 \times 1.2$

   $= 10.56$mm/day

   But the reproductive stage lasts for 39 days.

   Therefore, Total evapotranspiration of reproductive stage $= 10.56 \times 39 = 411.84$mm

4. For maturity stage, ET0=7.6

   Kc=0.9

   Therefore, $(ETc)_4 = 7.6 \times 0.9 = 6.84$mm/day

   But the maturity stage lasts for 28 days.

   Therefore, total evapotranspiration of maturity stage= (6.84×28)mm

   =1912.52mm

   So, for the entire evapotranspiration of the crop season is

   = (89+263.2+411.84+191.52)mm

   = 955.56mm

Suggested link:

1. **https://www.youtube.com/watch?v=rqqE5QxT4dM**
2. **https://www.youtube.com/watch?v=uqrvb6bnGR8**

Result:

Conclusion:

Experiment-8 Numericals on irrigation requirement and irrigation scheduling

1. Given the following soil moisture status and irrigation efficiency of 60%, find out the net and gross amount of irrigation water requirement.

Soil depth (cm)	Soil moisture % at FC	Actual soil moisture	BD (gm/cc)
0-15	20	10	1.4
15-30	18	12	1.5
30-45	18	14	1.6
45-60	19	16	1.6

Solution:

We know that, $NIR = \frac{Msc - Mbi}{100} \times BD \times Db$

So, for the first layer,

$(NIR)_1 = \frac{20-10}{100} \times 1.4 \times 15CM$

$= 2.1$ cm

Similarly, for the second layer,

$(NIR)_2 = \frac{18-12}{100} \times 1.5 \times 15$ CM

$= 1.35$ cm

For the third layer,

$(NIR)_3 = \frac{18-19}{100} \times 1.6 \times 15$cm

$= 0.96$ cm

And for the fourth layer,

$(NIR)_4 = 19-16 \times 1.6 \times 15$ cm

$= 0.72$ cm

Thus, the total $NIR = (NIR)_1 + (NIR)_2 + (NIR)_3 + (NIR)_4$

$= (2.1+1.35+0.96+0.72)$ cm

$= 5.13$ cm

Now, we know that the efficiency of irrigation is 60%.

Thus Gross Irrigation Requirement,

$GIR = \frac{5.13}{60} \times 100$ cm

$= 8.55$ cm

2. Calculate the cumulative evaporation required for scheduling irrigation at 0.5 and 0.8 with 5cm of water.

Solution: We know, scheduling irrigation is required at IW/CPE

So, $\frac{5}{CPE} = 0.5$

Or, CPE = $\frac{5}{0.5}$ = 10cm

Therefore, CPE required for scheduling irrigation at 0.5 is 10cm

Similarly, $\frac{5}{CPE} = 0.8$

Or, CPE = $\frac{5}{0.8}$ =6.25 cm

Therefore, CPE required for scheduling irrigation at 0.8 is 6.25 cm.

Suggested link:

1. **https://www.youtube.com/watch?v=1btsmrIm0JE**
2. **https://www.youtube.com/watch?v=-FOqF0GezBg**

Result:

Conclusion:

Experiment-9 Numericals on Irrigation

1. An irrigation system of 20L/sec is diverted to a plot of 10×8m. Depth of irrigation required is 10cm. How long does the irrigation stream need to be applied to irrigate the check plot?

   Solution:

   Area =8×10 = 80m2 = 80×100×100cm ^{2}

   Depth of irrigation (DI) = 10cm

   Discharge rate =20L/sec

   Therefore, volume of irrigation required = Area×Depth

   $=80,0000\times10\ cm^3$

   $=8000000\ cm^3$

   =8000 L

   Therefore, time of irrigation = $\frac{\text{Volume of irrigation water}}{\text{Discharge rate}}$

   $= \frac{8000}{20}$ sec

   = 400 sec

   =6.67 min

2. An area of 1ha is to be irrigated in 40hrs. With a discharge rate of 250 lit/min. What is the average depth of irrigation?

   Solution: Area =1ha=10,000 m2

   Discharge rate = 250 L/min

   Time of irrigation = 40hrs =40×60 min

   Volume of irrigation required = Area× Depth

   Or, Depth of irrigation = $\frac{\text{Volume}}{\text{Area}}$

   $250\times40\times60\times\frac{1}{1000}\ m^3$

   $=\frac{}{10,000\ m^2}$

   =0.06m

   =6cm

Suggested link:

1. **https://www.youtube.com/watch?v=Pv5pA0j1ihA**
2. **https://www.youtube.com/watch?v=XcU8NqFqcPI**

Result:

Conclusion:

Experiment no- 10 Identification of weeds

AIM : To understand different types of weeds and their propagation type.

OBJECTIVE:

1. To identify different types of kharif weeds.
2. 2. To study about scientific names, common names &propagation type of different kharif weeds.

MATERIALS REQUIRED:

1. Different types of weeds.

Table: Identification of weeds

S.N.	Name of weed (Local/English)	Botanical name	Group	Family	Salient characteristics
1	Bermuda grass	*Cynodon dactylon* L.	Narrow leaf	*Poaceae*	Perennial, adventitious roots, stolon

S.N.	Name of weed (Local/English)	Botanical name	Group	Family	Salient characteristics

Suggested link:

1. **https://www.youtube.com/watch?v=wBy3DLeEGl0&list=WL&index=34&t=218s**
2. **https://www.youtube.com/watch?v=gKPylyhZ53A&list=WL&index=32**
3. **https://www.youtube.com/watch?v=SFvcF6oNRME&list=WL&index=31**
4. **https://www.youtube.com/watch?v=WaClq6Xe8SY&list=WL&index=30**

Observation:

Conclusion:

Experiment no-11 Methods of herbicide application

1. Spraying
2. Broadcasting

Factors determining the methods of application are:-

Weed crop situation

Types of herbicides

Mode of action & selectivity

Environmental factor

Cost & convenience of application

Depending on the target site, the herbicides are applied are tabulated below:

Sl. No.	Soil application	Sl.no.	Foliar application
1	Surface	1	Blanket spray
2	Sub-surface	2	Directed spray
3	Band	3	Protected spray
4	Fumigation	4	Spot treatment
5	Herbigation		

1. **Soil application of herbicides**:
   - I. Surface application: soil active herbicides are applied uniformly on the surface of soil either by spraying or by broadcasting.The applied herbicides are either left undistributed or incorporated into the soil. Incorporation is done to prevent the volatization and photo decomposition of the herbicides. Eg. Fluchoralin- left undisturbed under irrigated condition and incorporated under rainfed condition.
   - II. Sub surface application- It is application of herbicide in a concentrated band, about 7-10 cm below the soil surface for controlling perennial weed. For this special type of nozzles introduced below the soil under the cover of sweep hood. Eg: Carbamate herbicide to controle cyperus rotundus, Nitralin herbicide to control Convolvulus arvensis.
   - III. Band application: application to a restricted band along the crop rows leaving an unsaturated band in the imter rows. Later inter rows are cultivated to remove the weeds. Saving in cost is possible here. Eg: when a 30cm wide band of a herbicide applied over a crop row that were spaced 90cm apart, then two- third cost is saved.
   - IV. Fumigation: application of volatile chemical into confined space to produce gas to destroy weed seeds called fumigation. Herbicides used for fumigation are called fumigants. These are for killing perennial weeds and as well for estimating weed seeds. Eg: methyl bromide, methane.
   - V. Herbigation: Its application of herbicide with irrigation water both by surface and sprinkler system. In india farmers apply fluchoralin for chillies and tomato, while in western counties EPTC is applied with sprinkler irrigation water in lucerne.
2. **Foliar application:**
   - I. Blanket spray: It's the uniform application of herbicides of standing crops without considering the location of crop. Only high selective herbicides are used here. Eg: spraying 2,4-Ethyl Ester to rice 3 weeks after transplanting.
   - II. Directed spray: It's the application of herbicides on weed in between rows of crops, spraying only, on weeds. This could be possible by use of protective shield orhood.Eg: spraying of glyphosate in between rows of tapioca using hood to control cyperous rotundus.
   - III. Protected spray: In this method non selective herbicides are applied on weeds by covering the crops which are wide spaced with polythene covers, etc. this expensive & laborious. However

farmers are using this technique for spraying glyphosate to control weeds in jasmine,cassava, banana,etc.

VI. Spot treatment: Its usually done on small area having serious weed infection to kill it & to prevent its spread. Rope wick applicator & herbicide glove are useful here.

Suggested link:

1. **https://www.youtube.com/watch?v=fdNgUsYpYzI&list=WL&index=39**
2. **https://www.youtube.com/watch?v=0c4frbuPSPc&list=WL&index=38**

Result:

Conclusion:

Experiment no-12 Methods of fertilizer application

Objective: To study about different methods of fertilizer application.

The relative efficiencies of various fertilizer application depend on many factor:

- Broadcast application may be less effective than banded or seed row application under some conditions.
- Fertilizer placed in the seed row can delay or severely reduced crop emergence.
- The max rate that can satisfy placed in the seed row depends on:

i. Crop type
ii. Soil moisture
iii. Soil type (clay and organic matter content)
iv. Type of fertilizer
v. Row spacing &
vi. Spread of seed & fertilizer (type of opener)

Nitrogen fertilizer application based on leaf colour chart

- The leaf colour chat (LCC) is an innovative cost-effective tool for real time or crop-need-based N management.0
- LCC is a visual & subjective indicator of plant nitrogen deficiency & is an inexpensive, easy to use & simple alternative chlorophyll meter/ SPAD meter (soil plant analysis development)
- It measures leaf colour intensity that is related to leaf N status.
- LCC is an ideal tool to optimize N use at high yield level, irrespective of the source of N applied, viz., organic manure, biologically fixed N, or chemical fertilizers.
- Thus, it's an eco-friendly tool in the hands of farmers. Now its manufactured with 4 colours called four panel LCC & six penal LCC.
- Moreover, LCC is provided with water proof laminated instruction sticker in the required regional language.

Purpose of using LCC: -

To apply adequate amount of N & avoid application of fertilizer more than required.

Use of LCC helps to determine N demand of the crop & guide right time of fertilizer nitrogen application to prevent unwanted N losses & their serious impacts on ecosystem.

Advantages of using LCC: -

More crop

Less cost

Avoid disease

Reduction of GHC emission

Diagram 1: Application of solid fertilizers

Broadcasting	placement	Band placement	Pellet application
Basal application	Plough sole placement	Hill placement	
Top dressing	Deep placement	Row placement	
	Localised placement		

- LCC is an ideal tool to optimize N use at high yield levels irrespective of the source of N applied, viz, organic manure, biologically fixed N, or chemical fertilizer.

- Thus it is an ecofriendly tool in the hands of farmer. Now, it's manufactured with 4 colour called Four penel LCC and 6 colours called Six penel Lcc.
- Moreover, Lcc is provided with water-proof laminated instruction sticker in the required regional language.
- Purpose of using LCC:
- To apply adequate amount of nitrogen and avoid application of fertilizer more than required.
- Use of LCC helps to determine nitrogen demand of the crops and guide right time of fertilizer nitrogen application to prevent unwanted nitrogen losses and their serious impacts on ecosystem.

Advantages of using LCC

- More crops
- Less cost
- Avoid disease
- Reduction of GHC Emission

- Application of solid fertilizer

a) Broadcasting: In generally banana crops, broadcasting method are not followed.
b) Placement: It refers to the placement of fertilizer in soil at specific place with or without reference to the position of the seed. It is recommended when the quantity of fertilizer to apply is small, development of root system is poor, soil have low level of fertility to apply phosphatic or photassic fertilizer.

I. Plough sole placement-

In this method, fertilizer is placed at the bottom of the plough furrow in a continuous band during the process of ploughing.

II. Deep placement-

- It is a placement of ammonical nitrogenous fertilizer in the reduction zone of soil particularly in paddy field, where ammonical nitrogen remains available to the crop.
- This method ensure better distribution of fertilizerin the root zone soil and prevents loss of nutrients by run- off.

III. Localised placement-

- It refers to the application of fertilizer into the soil close to the seed or plant in order to supply the nutrients in the adequate amounts to the roots of the growing plants.
- The common mrthods to place fertilizers in localized placement.

a) Drilling- The fertilizer is applied at the time of sowing by means of a seed- cum- fertilizer drill.
   - This places fertilizer and seed in same row but at different depths.
b) Side dressing- refers to the spread of fertilizer in between the rows and around plants. The common methods offside dressing are:
   - Placement of nitrogenous fertilizer by hand in between rows of the crops like maize, sugarcane, cotton, etc.
   - Placement of fertilizer around the tress like mango, apple, etc.
c) Band placement-
   - Refers to the placement of fertilizer in bands.

It's of two types –

(i) Hill placement-
Practiced for the application of fertilizer in orchards. In this method, fertilizers are placed close to the plant in bands on one or both sides of the plant.

(ii) Row placement-
When crops like sugarcane, potato, maize, etc. are sown close together in rows, the fertilizer applied in continuous bands on one or both side of rows, known as rows placement.

(d) Pellet Application –

- Refers to the placement of nitrogenous fertilizer in the form of pellets 2.5 to 5 cm deep between the roots of paddy.
- The fertilizer is mixed with the soil in the ratio of 1:10 and made small pellets of convient size to deposite in mud of paddy fields.

➢ Advantages of placement of fertilizer-

- Due to minimum contact between the soil and fertilizer, fixation of nutrients is greatly reduced.
- Weeds all over the field can't make use of fertilizer.
- Residual response of fertilizers is usually higher.
- Utilization of fertilizer by plants is higher.
- Loss of nitrogen by leaching reduced.
- Being immobile, phosphate are better utilized when placed.

2. Application of liquid fertilizer:

a) Starter solution-

Refers to the application of the N2P2O5 and K2O in the ratio of 1:2:1 and 1:1:2 to young plants at the time of transplanting, particularly for vegetables.

Starter solution helps in rapid establishment and quick growth of seedling. The disadvantages of starter solutions are:

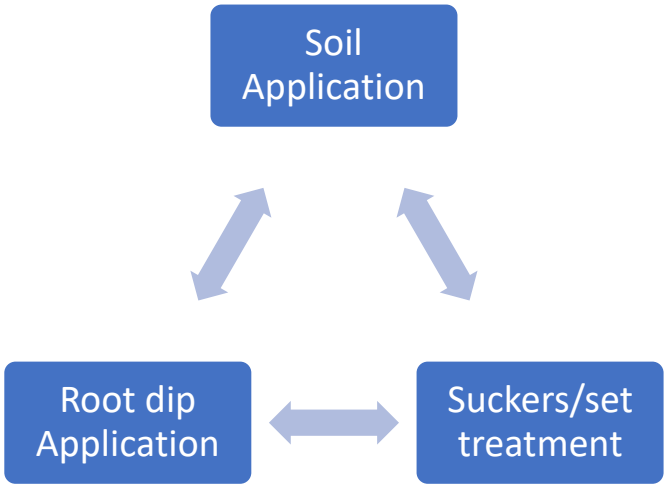
- Extra labour is required and
- The fixation phosphate is higher

b) Foliar Application-

- Refers to spraying of fertilizer solutions containing One or more nutrient on the foliage of growing plants.
- Several nutrient elements are readily absorbed by leaves when they are dissolved in water and sprayed on them.
- The concentration of spray solution has to be controlled.
- Effective for application of minor nutrients like Fe, Cu, Bo, Zn.
- Sometimes insecticides are also applied along with fertilizer.

c) Application through irrigation water

- Refers to the application of water-soluble fertilizer through irrigation.
- The nutrients are thus carried into the soil in solution.
- Generally nitrogenous fertilizers are applied through irrigation water.



BIO- FERTILIZERS APPLICATION METHODS

d) Injection into soil-

- Liquid fertilizers for injection into the soil may be of eithers pressure or non pressure types.
- Non pressure solution may be applied either on the surface or in furrows without appreciable loss of plant nutrients under most conditions.
- Anhydrous ammonia must be applied in narrow furrows at a depth of 12-15 cm and covered immediately to prevent loss of ammonia.

e) Arial application-

In areas where ground application is not practicable , the fertilizers are applied by aircraft mainly in the hilly areas, forests and grass lands or sugarcane fields, etc.

BIO- FERTILIZERS APPLICATION METHODS-

There are three ways of using the and fixing P.S.M bacteria.

SL NO	**Methods of application**	**Crops**	**Does/packets/acre**	**Water**	**Ratio of water**	Soil
1	Root dip application	All crops	200 bio-fertilizer	400ml	1:1	----
2	Sucker/set treatment	Sets of sugarcane base of banana	1 or 2 Kg	50 or 100 liters	1:50	----
3	Soil application	All crops	2 Kg	For wetting	------	40-5

- Root dipping: The required quality of azospirillum has to be mixed with 5 to 1 ltr of water at one corner of field and all plants have to kept for minimum ½ an hour before planting.

- Sucker treatment:
    - It's the most common method adopted for all types of inoculants.
    - Its effective and economic.
    - The coating can be done in a plastic bucket.
    - Solutions can be used as sticker add @ 15-25 ml/kg.
    - The bucket should be filled with 10% sugar solution or 40% gum Arabic or synthetic glue or glues of vegetables or animal origin or honey or 10% molasses or rice starch etc.
    - The use of sticker to increase the amount of inoculants that will adhere to sucker so that no. of rhizobia on each sucker must retain higher population i.e., 103 to 106.
- **Soil application:**
    - Mix 4 Kg each of bio fertilizers in 200Kg of compost and leave it overnight. Apply this mixture to the soil at the time of sowing or planting.
    - In plantation crops apply this mixture near root zone and cover with soil.

Suggested link:

1. **https://www.youtube.com/watch?v=0pJyYY0P3RI**
2. **https://www.youtube.com/watch?v=U-Ja8JtWy-Y**

Result:

Conclusion:

Experiment no- 13 Numerical exercises on fertilizer requirements

OBJECTIVE: To knew about the fertilizers calculation of different crops.

1. **The number of dose of rice is 60:30:30 Kg (N_2: P_2O_5: K_2O)/ha Calculate how much Urea, SSP and MOP is required to supply those nutrients?**

Solutions:

46% Nitrogen ispresent in Urea.

∴46 kg N is present in100 kg Urea

60 kg N is present in = $\frac{100}{46}$x 60 kg Urea

= 130.4 kg urea

≅ 130 kg urea

130 kg urea is required for 1 ha (2.5 acre)

∴for 1 acre = $\frac{130}{2.5}$ = 52 kg urea is required.

16% Phosphorus ispresent in SSP.

∴ 16 kg $P_2O_5$is present in 100 kg of SSP

So, 30 kg P_2O_5 is present in = $\frac{100}{16}$x 30 kg of SSP

= 187.5 kg of SSP

187.5 kg SSP is required for 1 ha (2.5 acre)

∴for 1 acre $\frac{187.5}{2.5}$ kg = 75 kg SSP is required.

60% Potassium is present in MOP.

60 kg of K_2O is present in 100 kg MOP

30 kg of K_2O is present in = $\frac{100}{60}$ x 30 kg MOP

= 50 kg MOP

∴50 kg of MOP is required for 1 ha (2.5 acre)

∴ for 1 acre $^{50}/_{2.5}$ = 20 kg of MOP is required.

Therefore, 52 kg Urea, 75 kg SSP and 20 kg MOP is required for 1 acre of rice.

2. **Calculate how much Urea, SSP and MOP is required to calculate 1 acre of land if the nutrient dose is 80:40:40 kg (N_2:P_2O_5:K_2O)/ha for sorghum crop.**

Solutions:

Urea contains = 46% N

46 kg N = 100 kg of Urea

$\therefore$ 80 kg N = $\frac{100}{46}$ x 80 = 173.9

$\cong$ 174 kg of Urea

$= \frac{174}{2.5}$ = 69.6 kg of Urea

SSP contains = 16% P

16 kg P_2O_5= 100 kg SSP

$\therefore$40 kg P_2O_5 = $\frac{100}{16}$ x 40 = 250 kg SSP

$= \frac{250}{2.5}$ = 100 kg of SSP

MOP contains = 60% K

60 kg K_2O= 100 kg MOP

$\therefore$ 40 kg K_2O = $\frac{100}{60}$ x 40 = 66.6 kg ofMOP

$\cong$67 kg of MOP

$= \frac{67}{2.5}$ = 26.8 kg of MOP

Suggested link:

1. **https://www.youtube.com/watch?v=-ZR_vQLS9Os&t=21s**
2. **https://www.youtube.com/watch?v=5HSjXm3yXHQ**

Result:

Conclusion/ Practical significance:

Experiment no- 14 Calculation on herbicidal requirement for field crops

Introduction: Requirement of a herbicide depends upon the types of herbicides, formulation percent of active Ingredients (a.i.) and area to be sprayed . Further The method of calculation of herbicide does in unit area land will be calculated.

Objective: To calculate the requirement of herbicide formulation for field crops.

Materials: Herbicide formulation are to be treated (land Surface), measuring tape, weighting balance, numerical etc.

→ Herbicide requirement for field crops:

All the herbicide recommendations are based on active ingredient (a.i.), once the a.i. is known, herbicide requirement can be determined by applying the formula:

$$\textbf{Quantity of herbicide (Kg/ha)} = \frac{\textbf{(Recommended dose)(kg a.i./ha)X(Area to be treated)(ha)}}{\textbf{\% a.i.in formulation}} \textbf{ X 100}$$

Example 1: Determine. the quantity of Glycel41 SL required to treat 2 ha of land, if the recommendation of Glycel is 0.5 kg a.i./ha.

Quantity of Glycel = $\frac{0.5 \times 2}{41}$ X 100 = 244 kg

[Glycel contains 41% a.i.]

Example 2: A herbicide contain active ingredient of 0.4 kg/l. and the desired rate of application is 1.5kg/ha. Calculate the quantity of herbicide required for 1 ha.

Quantity of herbicide formulation = $\frac{1.5}{40}$ X 100 = 3.75 litres

[0.4 kg a.i./l = 40% a.i.]

Suggested link:

1. **https://www.youtube.com/watch?v=sLUohJ5ZhKQ&t=216s**
2. **https://www.youtube.com/watch?v=OlAq8bGp1kE**

Result:

Conclusion/ Practical significance:

Experiment no-15 Study of yield contributing characters & yield estimation

Aim : To asses grain yield of different crops.

Procedure: a) Based on crop cutting (actual)

b) Based on yield attributes (estimated)

A) Based on crop cutting: In any given field crop in a unit area (say 10 sq.m or 1 sq.m area) is harvested, threshed, seed grains separated & weighed. The yield is expressed in terms of kg/ sq.m or kg/acre or kg/ha. As for example, if 100 gm paddy seeds were harvested from 1 sq.m area the yield is expressed as 100gm/sq .m or 400kg/ Acre or 1000 kg/ ha.

B) Based on yield attribute: Yield attributing characters are given below:

i) No. of panicles / cob/ heads per unit area

ii) No. of grain per panicles/ cob/ heads

iii) Test weight (1000 seed weight)

As for example in a maize field if no. of cobs are 4/ sq.m , no.of grains in each cob is 500 & test weight (1000 seed wt) is 300 gm . Then the yield of maize is calculated as given below.

$$\text{Yield} = \frac{10000 \times \text{no. of cobs per sq.m.} \times \text{no.of grains in each cob} \times \text{test wt.}}{1000 \times 1000 \times 100 \times 10}$$

$$= \frac{10000 \times 4 \times 500 \times 300}{1000 \times 1000 \times 100 \times 10}$$

= 6 t/ ha

Problem 1. Find out the yield of cotton in terms of seed-cotton, cotton seed, lint and ginning percentage if following data are provided:

(i) Plant spacing -90 cm x 60 cm

(ii) Average no. of sympodial branches/plant -5

(iii) Average no. of bolls/branch -4

(iv) No. of locules/boll -4

(v) Average no. of seeds/ locules -8

(vi) Seed to lint ratio -2.5 : 1

(vii)Test weight of cotton seed -140 g.

(viii) Area under crop -one hectare

Solution: Formulae of Yield of cotton seed (q/ha) =

$$\frac{\text{Area} \times \text{test weight (g)} \times \text{No.of sympodial branches} \times \text{No. of boll/branch} \times \text{locules/boll} \times \text{seeds/locules}}{\text{Spacing} \times 1000 \times 1000 \times 100}$$

= 10000x 140 x 5 x4 x 4 x 8/ 0.9 x 0.6 x 1000 x 1000 x 100 =16.6 q/ha

Yield of lint in q/ha= $\frac{\text{yield of cotton seed in q/ha}}{\text{Seed to lint ratio}}$ = 16.6 x1 / 2.5 = 6.64 q/ha

Yield of seed cotton = Yield of cotton seed + yield of lint = 16.6 + 6.64 = 23.24 q/ha

Ginning percentage = $\frac{\text{Yield of lint in q/ha}}{\text{Yield of seed cotton in q/ha}}$ = 6.64 x 100/ 23.24 = 28.45 %

Problem 2. What would be the yield of rice grains, if

(a) The average ear head density/m^2 = 260

(b) Average no of filled grains/panicle = 136

(c) Test weight = 20 g

Solution

Formula:

Yield of rice t/ha = $\frac{10000 \text{ x ear head/m2 x no.of filled grains/ear head x test wt.}}{1000 \text{ x } 1000 \text{ x } 100 \text{ x } 10}$

= $\frac{10000 \text{ x } 260 \text{ x } 136 \text{ x } 20}{1000 \text{ x } 1000 \text{ x } 100 \text{ x } 10}$

= 7.08 t/ha

= Yield of rice would be 70.8q/ha

Problem 3. Work out the yield of urd bean with the help of following data

(a) Spacing= 30 X 10 cm

(b) Branches/ plant = 5

(c) Pods/ branch = 20

(d) Grains/ Pod= 5

(e) Pods/ Plant= 100

(f) Test weight= 30 gm

Solution:

Formula:

Yield (q/ha)= $\frac{\text{Area (m2)x no.of grains/plant x test wt.}}{\text{Spacing (m) x 1000 x 1000 x 100}}$

$= \frac{10000 \text{ x } 500 \text{ x } 30 \text{ x } 100\ 100}{30 \text{ x } 10 \text{ x } 1000 \text{ x } 1000 \text{ x } 100}$

= 50 q/ha (Ans.)

Suggested link:

1. **https://www.youtube.com/watch?v=Etd8k0yblKA&t=176s**
2. **https://www.youtube.com/watch?v=URvOCwlZrAU&t=182s**
3. **https://www.youtube.com/watch?v=xoXY3ZiiLlA&t=252s**

Result:

Conclusion/ Practical significance:

Experiment no- 16 Seed germination & viability test

The most common tests are the cold germination test, accelerated aging test, the tetrazolium test and warm germination test. Each test is designed to evaluate various qualities of the seed. The most common test is a warm germination test because it is required by seed laws to appear on the label.

What is viability testing

Seed or plant viability is the measure of how many seeds or how much plant material in a lot are alive and could develop into plants that will reproduce under appropriate field conditions.

Why should viability be determined

It is very important that seeds or plant material stored in the genebank are capable of producing plants when sown in the field. They must have high viability at the start of storage and maintain it during storage. Seeds or plant material with a high initial viability will also survive longer in storage. Seed or plant viability declines slowly at first and then rapidly as the seeds or plant material age. It is important to know when this decline occurs in order to take action to regenerate the accession. Excessive deterioration will lead to loss of material.

When should viability be determined

Seed material

- Before seeds are packaged and placed in the genebank.
- At regular intervals during storage.

Viability testing is crucial for the monitoring of seed conservation. It can take from a few days to weeks, depending on the species. If possible, the results of viability tests should be made available before seeds or plant material are packaged and placed in the genebank so that poor quality seeds can be identified and regenerated.

While awaiting the results of viability tests, or if there is a delay in conducting the viability tests before storage, seeds should be placed in a cool environment to minimize their deterioration.

Suggested link:

1. **https://www.youtube.com/watch?v=3DSWj7JnXV8**
2. **https://www.youtube.com/watch?v=v5LhdAztgKQ**
3. **https://www.youtube.com/watch?v=-SMOoVHaNus**
4. **https://www.youtube.com/watch?v=BcFkoQc6t1w**

Observation:

Conclusion/ Practical significance: