Practical Manual
on
Crop Production Technology - II (*Rabi* Crops)

Course Code: CC-AGP 426
Course Credits: 2(1+1)

ज्ञानम् आत्म प्रदीपाय

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PRACTICAL NO. 1 **Date:**

SOWING OF WHEAT SEEDS THROUGH BROADCASTING AND BEHIND THE LOCAL PLOUGH

1.1 Objective:

To know about the sowing methods of wheat seeds through broadcasting and behind the local plough

1.2 Materials required:

Tillage implements and tools (spade, hand hoe, rake etc.), ladder/plank, measuring tape, weighing balance, seeds, manures and fertilizers etc.

1.3 Steps:

Sowing of wheat seeds following broadcasting method

a) Know the size of the plot/land allotted for seed sowing and calculate the required quantity of seed as per recommended seed rate.

b) Take the required amount of seeds after weighing on a balance.

c) Spread the seeds by hand or mechanical spreader all over the prepared field.

d) Cover up the seeds with the help of wooden plank or harrow for better contact with the soil.

Sowing of wheat seeds following putting seeds behind the local plough method

a) Take the required amount of seeds for the allotted plot/land for seed sowing after calculation as per recommended seed rate.

b) *Kera* method: Seeds are dropped in the furrows that have been opened behind the local plough by hand.

c) *Pora* method: Seeds are dropped in the furrows that have been opened behind the plough through a Pora or Nai or Hazara, a special attachment with the local plough.

d) Seeds are covered with soil of the successive furrow opened by the plough with the help of wooden plank or harrow.

1.4 Observations:

Crop	RDF	Seed rate	Spacing	Depth of sowing	Other management practices followed (if any)
Irrigated wheat					
Rainfed wheat					

1.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=gWs-FhrzMGI

https://www.youtube.com/watch?v=gVqwCICv-1Q

Fig. 1 Broadcasting

Fig. 2 Sowing behind the plough

Signature

PRACTICAL NO. 2 **Date:**

SOWING OF WHEAT SEEDS THROUGH DIBBLING AND DRILLING METHOD

2.1 Objective:

To know about the dibbling and drilling methods of sowing of seeds

2.2 Materials required:

Tillage implements and tools (seed drill, seed-fertilizer drill, hand tyne, rake etc.), ladder/plank, measuring tape, weighing balance, seeds, manures and fertilizers etc.

2.3 Steps:

Sowing of wheat seeds following dibbling method

a) Know the size of the plot/land allotted for seed sowing and calculate the required quantity of seed as per recommended seed rate.

b) Take the required amount of seeds after weighing on a balance.

c) Holes are made at a predetermined spacing and depth with the help of a dibbler or planter or very often by hand.

d) Seeds are then placed manually in that hole made previously.

e) Cover up the seeds for better contact with the soil.

Sowing of wheat seeds following dibbling method

a) Take the required amount of seeds for the allotted plot/land for seed sowing after calculation as per recommended seed rate.

b) Drop the seeds into the prepared seedbed with the help of implement such as seed drill, seed-cum-fertilizer drill or mechanical seed drill.

c) Seeds are then covered by wooden plank or harrow to have contact between seed and soil.

2.4 Observations:

Crop	Plot size	Fertilizer requirement / plot			Fertilizer source	Seed requirement / plot	Remarks (if any)
		N	P_2O_5	K_2O			
Irrigated wheat							

Rainfed wheat							

2.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=gWs-FhrzMGI

https://www.youtube.com/watch?v=gVqwCICv-1Q

Fig. 1 Dibbling

Fig. 2 Drilling

Signature

PRACTICAL NO. 3 **Date:**

SELECTION OF PLANTING MATERIALS FOR SUGARCANE CULTIVATION

3.1 Objective:

To select the quality planting material for sugarcane cultivation

3.2 Materials required:

7-8 months old sugarcane plant, meter scale, knife, chemicals for sett treatment, bucket etc.

3.3 Steps:

a) Select seed cane from well mannered, erect and healthy plant of 7-8 months age and preferably free from pests and diseases like red rot, smut, wilt etc.
b) Dry leaves of cane stalks are removed by hand to avoid any possible damage to buds.
c) Select the top one-third to half portion of cane as seed material being immature and having buds of high viability.
d) Cane is then cut into three budded setts usually 30-45 cm long with sharp knife.
e) Treat the setts immediately with fungicide (Agallol 0.5% solution).

3.4 Precautions:

The following precautions need to be taken while selecting the planting materials.

- Use only pest and disease free healthy setts.
- Plant age should not be more than 10-12 months.
- Careful preparation of planting materials without damaging the buds or setts.
- Chemically (fungicide) treated buds or setts should only be used as planting materials.

3.5 Conclusion:

Signature

PRACTICAL NO. 4 **Date:**

PLANTING OF SUGARCANE SETTS BY RING PIT METHOD

4.1 Objective:

To know about the planting of sugarcane setts by ring pit method

4.2 Materials required:

Tillage implements and tools (spade, hand hoe, etc.), measuring tape, sugarcane setts, chemicals for sett treatment, manures and fertilizers etc.

4.3 Steps:

a) Pits are made at the spacing of 180 cm between rows and 150 cm between individual pits within a row.
b) The pits are dug by spade or by using specially designed tractor drawn power tillers.
c) The pits are then filled with top soil, 5 kg of farmyard manure (FYM), 100 grams gypsum and 125 grams super phosphate and watered well before planting.
d) The setts are collected from the eight-month-old plants and treated with 0.5% Agallol for 10 minutes before planting.
e) About 16-20 double budded setts are used for planting.
f) The pits are then covered by 5-7 cm of soil after planting of setts and levelled.
g) Pits are irrigated daily for an hour through drip fertigation.

4.4 Observations:

Crop variety type	RDF	Setts type (2 or 3 budded)	No. of setts required /ha	Depth of planting	Remarks
Eksali					
Adsali					

4.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=NnhAvxmwsJA

https://www.youtube.com/watch?v=faZqhBCR8Q4&t=210s

Fig. 1 Planting through Ring Pit method

Fig. 2 Growth of crop under Ring Pit method

Signature

PRACTICAL NO. 5 **Date:**

IDENTIFICATION OF WEEDS ASSOCIATED WITH *RABI* CROPS

5.1 Objective:

To identify different types of weeds found in *rabi* season crops

5.2 Materials Required:

Practical manual, ball point pen or pencil, camera etc.

5.3 Steps:

a. Observe the *rabi* season crop fields at the early growth stages of crop for identification.

b. Identify the weed truly after locating it in the field and study their habitat, morphology and mode of propagation.

c. With the help of books, manuals, herbaria and other references, correct and scientific reporting of weed specimen can be done.

d. As you get a weed plant, make a visual observation & understand its basic characteristics.

e. Take the snaps of each weed observed and paste those photographs in practical notebook

5.4 Observations:

Table 5.1.Make a list of all weeds and note down the salient characteristics

Sl. No.	Name of weed (Local/English)	Botanical name	Family	Type	Important characteristics /Identification features

5.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=WaClq6Xe8SY
https://www.youtube.com/watch?v=gKPylyhZ53A

Cynodon dactylon

Digitaria sanguinalis

Eleusine indica

Dactyloctenium aegyptium

Euphorbia hirta

Amaranthus viridis

Signature

PRACTICAL NO. 6 **Date:**

STUDY OF MORPHOLOGICAL CHARACTERISTICS OF *RABI* CROPS

6.1 Objective:

To study the morphological description of *rabi* season crops

6.2 Materials Required:

Practical manual, ball point pen or pencil, camera etc.

6.3 Steps/Procedure:

a. Observe the standing crop throughout the growth period of the crop.

b. Note the plant characteristics of crop and verify with the information provided in the classes.

c. Take the snaps of different plant parts in the field and paste the photographs on the practical notebook.

d. Draw the sketches of the crop plant and its different parts.

6.4 Morphology characteristics:

(i) Underground parts: Shallow, deep, tap root, adventitious root, rhizomes, nuts, bulb etc.

(ii) Stem: Colour, size, nature (erect, prostrate, angular trailing etc.) nodes and internodes, solid, hollow, woody, tender

(iii) Branches: Branched, unbranched, pattern and arrangement

(iv) Leaf: Colour, size, shape, arrangement

(v) Flowers: Colour, size, type of inflorescence

(vi) Fruits / seeds: Colour, size, shape

(viii) Special points: Nature of plant sap (milky, juicy, gum etc.) and its colour, special modification on the plant etc.

6.5 Observation:

Table 6.1 Record the following observations

Sl. No.	Crop Name	Plant habit	Seed	Under-ground parts	Stem	Leaf	Flower	Special features
1								
2								
3								
4								

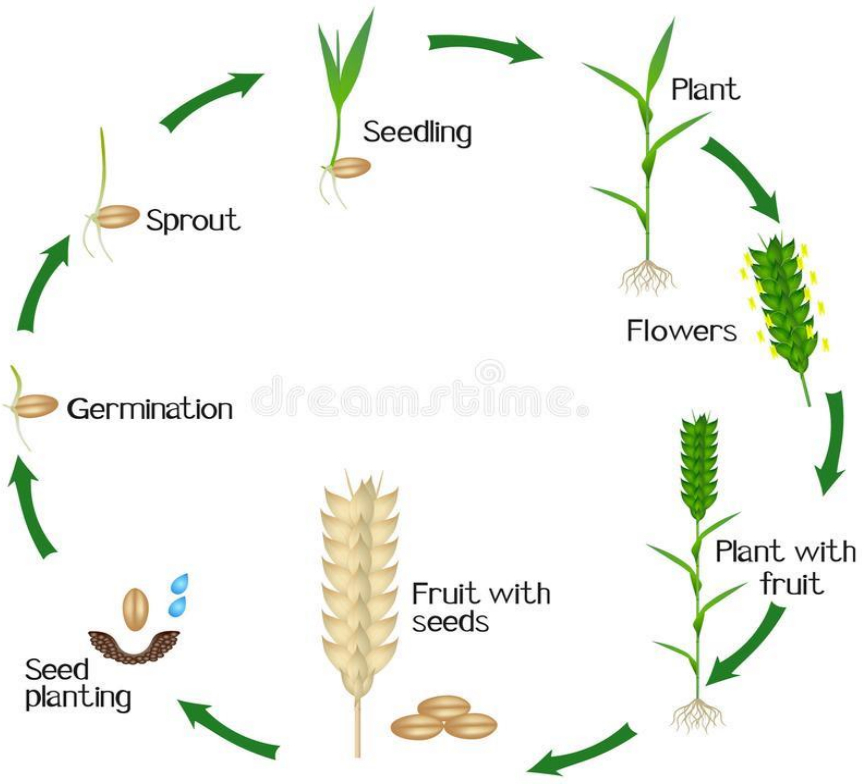
5								
6								
7								

6.6 Conclusion:

Video link:

https://www.youtube.com/watch?v=_Dv-DQh0OP8&t=284s

https://www.youtube.com/watch?v=MqFuWDMYcrg



Growth cycle of wheat crop

Figure:

Draw different morphological parts of a pulse/oilseed crop and point out all distinct part

Signature

PRACTICAL NO. 7 **Date:**

YIELD ESTIMATION OF *RABI* CEREALS ON THE BASIS OF YIELD COMPONENT METHOD

7.1 Objective:

To estimate the grain yield of *rabi* cereals by yield component method

7.2 Materials Required:

Field with well matured *rabi* cereal crops, meter scale, harvesting equipment (sickle, knife, etc.), gunny bags or baskets, balance, etc.

7.3 Steps:

a) Select a unit area with the help of a meter scale from the matured *rabi* cereal crop field at least from 5 places.
b) Then count the total number of plants from the selected 1 m^2 area.
c) Count the number of ear heads at least from 10 plants and calculate the number of ear head per plant simply by doing the average.
d) Take at least 10 ear heads from the selected 1 m^2 area and collect all the filled grains from those and make the average to get number of filled grains/ ear head.
e) Measure the 100 seed weight (seed index) with the help of a weighing balance.
f) Calculate the grain yield of *rabi* cereals on the basis of following formula.

$$\text{Yield (t/ha)} = \frac{10000 \times \text{No. of plants/m}^2 \times \text{No. of ear heads/plant} \times \text{No. of filled grains/ear head} \times \text{Seed index (gm)}}{100 \times 1000 \times 1000}$$

7.4 Calculation:

Crop	No. of plants /m^2	No. of ear heads /plant	No. of filled grains/ear head	Seed index (gm)	Estimated grain yield (t/ha)
Wheat					
Barley					

7.5 Conclusion:

Signature

PRACTICAL NO. 8 **Date:**

YIELD ESTIMATION OF *RABI* PULSES ON THE BASIS OF YIELD COMPONENT METHOD

8.1 Objective:

To estimate the grain yield of *rabi* pulses by yield component method

8.2 Materials Required:

Field with well matured *rabi* pulse crops, meter scale, harvesting equipment (sickle, knife, etc.), gunny bags or baskets, balance, etc.

8.3 Steps:

a) Select a 1 m^2 area with the help of a meter scale from the matured *rabi* pulse crop field at least from 5 places.
b) Then count the number of plants from the selected 1 m^2 area.
c) Count the number of pods at least from 10 plants and calculate the number of pods per plant simply by doing the average.
d) Take at least 10 pods from the selected 1 m^2 area and count the number of seeds from those pods and make the average to get number of seeds/pod.
e) Measure the 100 seed weight (seed index) with the help of a weighing balance.
f) Calculate the grain yield of *rabi* pulses on the basis of following formula.

$$\text{Yield (q/ha)} = \frac{10000 \times \text{No. of plants/m}^2 \times \text{No. of pods/plant} \times \text{No. of seeds/pod} \times \text{Seed index (gm)}}{100 \times 1000 \times 100}$$

8.4 Calculation:

Crop	**No. of plants /m^2**	**No. of pods /plant**	**No. of seeds /pod**	**Seed index (g)**	**Estimated grain yield (q ha^{-1})**
Chickpea					
Pea					
Lentil					

8.5 Conclusion:

Signature

PRACTICAL NO. 9 **Date:**

YIELD ESTIMATION OF *RABI* OILSEEDS ON THE BASIS OF YIELD COMPONENT METHOD

9.1 Objective:

To estimate the seed yield of *rabi* oilseeds by yield component method

9.2 Materials Required:

Field with well matured *rabi* oilseed crops, meter scale, harvesting equipment (sickle, knife, etc.), gunny bags or baskets, balance, etc.

9.3 Steps:

a) Select a 1 m^2 area with the help of a meter scale from the matured *rabi* oilseed crop field at least from 5 places.
b) Then count the number of plants from the 1 m^2 area.
c) Count the number of pods at least from 10 plants and make the average.
d) Take at least 10 pods from the selected 1 m^2 area and collect the seeds from those pods and make the average to get number of seeds/pod.
e) Measure the 100 seed weight (seed index) with the help of a weighing balance.
f) Calculate the seed yield of *rabi* oilseeds on the basis of following formula.

$$\text{Seed Yield (q/ha)} = \frac{10000 \times \text{No. of plants/m}^2 \times \text{No. of pods/plant} \times \text{No. of seeds/pod} \times \text{Seed index (gm)}}{100 \times 1000 \times 100}$$

9.4 Calculation:

Crop	No. of plants /m^2	No. of siliqua /plant	No. of seeds/siliqua	Seed index (g)	Estimated seed yield (q ha^{-1})
Rapeseed					
Mustard					
Safflower					

9.5 Conclusion:

Signature

PRACTICAL NO. 10 **Date:**

YIELD ESTIMATION OF SUGARCANE CROP FROM YIELD COMPONENTS

10.1 Objective:

To estimate the yield of sugarcane crop by yield component method

10.2 Materials Required:

Well matured sugarcane crops, meter scale, harvesting equipment (sickle, knife, etc.), rope, balance, etc.

10.3 Steps:

a) Select a 1 m^2 area with the help of a meter scale from the matured sugarcane crop field at least from 5 places.
b) Then count the number of plants from the selected 1 m^2 area.
c) Cut off the top vegetative portion to get the economic part of the plant.
d) Take the weight of all the plants and get the average weight of a single plant.
e) Calculate the yield of sugarcane on the basis of following formula.

$$\text{Economic Yield (q/ha)} = \frac{10000 \times \text{No. of plants/m}^2 \times \text{ Average weight of the plant (gm)}}{1000 \times 100}$$

10.4 Calculation:

Crop variety type	**Area**	**No. of plants /m^2**	**Total no. of plants**	**Average weight of plant (g)**	**Economic yield (q ha^{-1})**
Eksali					
Adsali					

10.5 Conclusion:

Signature

PRACTICAL NO. 11 **Date:**

JUICE QUALITY ANALYSIS OF SUGARCANE BY HAND REFRACTOMETER

11.1 Objective:

To analyze the quality of sugarcane juice by hand refractometer

11.2 Material required:

Matured sugarcane crop, hand refractometer (brix meter), puncturing needle, distilled water, towel etc.

11.3 Steps:

a. Select several number of well matured sugarcane plants from different places of the field.

b. Collect 3-4 drops of juice from the selected sugarcane crop with the help of cane puncturing needle.

c. Place the collected juice drops on the glass-stage of the hand refractometer.

d. Then close the glass-stage by its cover.

e. Look through the eyepiece of the hand refractometer and take reading carefully from the graduated scale attached with it.

f. Take the reading of juice drops of all other canes one after another collected from the field.

g. Work out the average from the noted brix values.

h. Estimation of sucrose content can be made using the refractometer brix reading with the help of the following equation -

$$\text{Sucrose \%} = \frac{RB - 306}{0.97} \times 100$$

Where, RB = Refractometer Brix value

11.4 Precautions:

The following precautions need to be taken while using the hand-refractometer.

- Thoroughly clean the refractometer glass stage and puncturing needle with distilled water after taking each reading.
- Wipe out the moisture and dry the glass stage and puncturing needle as well with a clean hand towel or tissue.

11.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=EzvLADgwCxI&t=448s

Signature

PRACTICAL NO. 12 **Date:**

STUDY OF SOME FIELD TRIALS ON *RABI* CROPS

12.1 Objective:

To study of some important agronomic field trials of *rabi* crops.

12.2 Materials Required:

Notebook, ball point pen or pencil, etc.

12.3 Steps:

a. Carry all the necessary things and reach within time at the farm.
b. After arrival at the site, contact the farm manager and discuss the purpose of your visit.
c. Observe the whole area to get details of the ongoing field trials on *rabi* crops.
d. Write down the information in your practical notebook as provided by the farm manager.
e. Note down special facilities available at the farm if any.
f. Seek clarification on any aspects or doubts related to field trials from the farm manager.

12.4 Observations:

Experiment details:

a. Title of the experiment:

b. Treatment Details:

Details of the layout:

a. Name of the crop ----------
b. Variety name----------
c. Gross area of the plot (m^2) ----------
d. Net area of the plot (m^2) ----------
e. Width of main irrigation channel (m) ----------
f. Width of the bunds between plots (m) ----------
g. Date of sowing ----------
h. Seed rate ----------
i. Spacing ----------
j. Fertilizer dose ----------

Table 12.1 Details of the crops under field trials at experimental farm

Sl. No.	Crop grown	Botanical name	Family	Area under crop (acre)	Remarks
1					
2					
3					
4					
5					

12.5 Conclusion:

Signature

PRACTICAL NO. 13 **Date:**

SOWING OF SEEDS OF FORAGE CROP

13.1 Objective:

To know about the sowing methods of forage crop seeds

13.2 Materials required:

Tillage implements and tools (spade, hand hoe, rake etc.), ladder/plank, measuring tape, weighing balance, seeds, manures and fertilizers etc.

13.3 Steps:

a) Know the size of the plot/land allotted for sowing of desired forage crop seeds.

b) Prepare the land well after incorporating the required amount of manures and fertilizers as recommended for the crop.

c) Calculate the required quantity of seed as per recommended seed rate.

d) Take the required amount of seeds after weighing on a balance.

e) Treat the seeds very well with seed treating chemicals or biological inoculants specifically for the legume forage crops.

f) Spread the seeds by hand all over the prepared field.

g) Cover up the seeds with the help of wooden plank or harrow for better contact with the soil.

13.4 Observations:

Crop	RDF	Seed rate	Seed treatment	Depth of sowing	Other management practices followed
Oat					
Berseem					
Lucerne					

13.5 Conclusion:

Signature

PRACTICAL NO. 14 **Date:**

HARVESTING OF *RABI* FORAGE CROPS

14.1 Objective:

To know about the criteria and methods of harvesting of *rabi* forage crops

14.2 Materials required:

Field with well matured *rabi* forage crops, harvesting equipment (sickle, hansua etc.), gunny bags or baskets, balance, etc

14.3 Steps:

a) Visit the field of different *rabi* forage crops at the maturity stage.

b) Check and verify all the criteria for harvesting as discussed in the class from the matured standing crops.

c) Then cut the crop with the help of a sickle or hansua leaving 20 cm of the basal part above the ground for quick re-growth.

d) Keep the harvested crop on the drying floor for storage as a hay.

e) In case of multi-cut system always leave the basal part of 15-20 cm above the ground during each cutting.

14.4 Observations:

Crop	No. of cuttings	Crop stage for first cutting	Time for subsequent cuttings	Green forage yield (kg/ha)
Oat				
Berseem				
Lucerne				

14.5 Conclusion:

Signature

PRACTICAL NO. 15 **Date:**

IDENTIFICATION OF MEDICINAL AND AROMATIC PLANTS

15.1 Objective:

To identify the important medicinal and aromatic crops

15.2 Materials Required:

Practical manual, ball point pen or pencil, camera etc.

15.3 Steps:

a. Visit the field of different medicinal and aromatic plants at your agriculture farm.
b. Observe all the crops thoroughly one by one and write down the plant characteristics in your notebook.
c. Identify the crop after verifying the plant characteristics with the information provided in the class.
d. Draw the sketches of the plants and all the parts of each plant.
e. Take the clear photos of each plant and various plant parts and paste those photographs in your practical notebook.

15.4 Observation:

Sl. No.	Crop name	Botanical name	Family	Origin	Plant parts used	Importance
1						
2						
3						
4						
5						

15.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=AVmxEE0Hr88

Signature

PRACTICAL NO. 16 **Date:**

STUDY OF MORPHOLOGICAL CHARACTERISTICS OF MEDICINAL AND AROMATIC PLANTS

16.1 Objective:

To study the morphological characteristics of medicinal and aromatic crops

16.2 Materials Required:

Practical manual, ball point pen or pencil, camera etc.

16.3 Steps:

a. Observe the standing crop throughout the growth period of the crop.

b. Note down the morphological characteristics of different plant parts of the crop and verify with the information provided in the classes.

c. Draw the sketches of the crop plant and its different parts.

d. Take the photos of each crop studied and paste those photographs in your practical notebook.

16.4 Morphological characteristics:

a. Plant: Annual, perennial, tall/short, tap root, adventitious root, herbs, shrubs etc.

b. Stem: Color, size, nature (erect, prostrate, angular trailing etc.) nodes and internodes, solid, hollow, woody, tender

c. Leaf: Color, size, shape, arrangement

d. Flowers: Color, size, type of inflorescence

e. Economic parts: Color, size, shape

f. Special points: Nature of plant sap (milky, juicy, gum etc.) and its color, special modification on the plant etc.

16.5 Observation:

Table 16.1 Record the following observations

Sl. No.	Crop Name	Plant type	Stem	Leaf	Flower	Economic part	Special features
1							
2							
3							

4							
5							
6							
7							

16.6 Conclusion:

Video link:

https://www.youtube.com/watch?v=MqFuWDMYcrg

Signature

PRACTICAL NO. 17 **Date:**

STUDY OF OIL EXTRACTION OF MEDICINAL AND AROMATIC CROPS

17.1 Objective:

To study the oil extraction process of different medicinal and aromatic crops through steam distillation method.

17.2 Materials Required:

Plant sample, Clevenger apparatus, heating mantle, analytical balance, distillation apparatus etc.

17.3 Steps:

a. Clean plant samples (leaves, stems, nuts etc.) are collected from the matured crop fields and cut those samples into small pieces.
b. Dry the sample thereafter and grind it properly for doing the extraction process effectively.
c. Take weight of the grind sample with the help of an analytical balance.
d. The sample is then mix with distilled water following the ratio of 8:1.
e. The mixture is then poured into the Clevenger apparatus set for the extraction process.
f. After about 3-4 hours of extraction, the resulting extracted oil is then stored in a conical flask.
g. The weight of the extracted oil is then measured and the oil content of the sample is calculated.

An estimation of oil percentage can be done using the equation –

$$\text{Oil content (\%)} = \frac{\text{Weight of the extracted oil}}{\text{Initial weight of the plant sample}} \text{ X } 100$$

17.4 Calculation:

Crop name	Weight of plant sample (g)	Oil yield (g)	Oil content (%)	Remarks
Mint				
Citronella				
Lemon grass				

17.5 Conclusion:

Video link:

https://www.youtube.com/watch?v=b9ECEc_l9FA

https://www.youtube.com/watch?v=pwHFxXRl-Ig

Signature

PRACTICAL NO. 18 **Date:**

VISIT TO AGRONOMIC PLOTS OF *RABI* CROPS IN RESEARCH FARM

18.1 Objective:

To study the agronomic plots of different *rabi* crops and their varieties in the research farm.

18.2 Materials Required:

Notebook, questionnaire, ball point pen or pencil

18.3 Steps:

a. Carry all the necessary things and reach within time at the farm.

b. Introduce yourself and discuss the purpose of your visit with the farm manager or in-charge of the farm after arrival.

c. Get the details about the farm and know its developmental consequences since from the establishment.

d. Observe the whole area to acquaint with all the ongoing experiments/trials at the farm.

e. Note down special research invention made available at the farm if any.

f. Get all the information as written in the questionnaire prepared early at the classroom.

18.4 Observations:

(i) Area of the farm (ha)

a. Under cultivation _____ ha

b. Single crop area _____ha

c. Double crop area _____ha

d. Under building, roads, channels, threshing floor etc _____ ha

(ii) Area under irrigation _____ha

(iii) Source of irrigation _____

(iv) Crop rotation followed _____

(v) List of equipment/farm machinery

18.5 Conclusion:

Table 18.1 Details of the *rabi* crops under research at the farm

Sl. No.	Common name	Botanical name	Family	Area under the crop (ha)	Area under seed production (ha)	Variety grown	Seed rate (kg/ha)	RDF (kg/ha)	Average yield (kg/ha)	Remarks (If any)
1										
2										
3										
4										
5										
6										
7										

Signature

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