Practical Manual B. Sc. (Hons.) Agriculture

Crop Production Technology–II (*Rabi crops*)

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Contents

Experiment No. 1 Date----------

Sowing Methods of Wheat

1.1 Aim

To know about the sowing methods of wheat

1.2 Materials required

Tractor, ladder/plank, Spade, hand hoe, rake, measuring tape, seed, fertilizers and water etc

1.3 Method

There are 5 methods of sowing which are followed in wheat which are described as follows. The sowing method is determined by the crop to be sown. Those are:

1. **Broad casting:** It is the scattering of seeds by hand all over the prepared field followed by covering with wooden plank or harrow for contact of seed with soil. Crops like wheat, paddy, Sesamum, methi, coriander, etc. are sown by this method.
2. **Drilling or Line sowing:** It is the dropping of seeds into the soil with the help of implement such as mogha, seed drill, seed-cum-ferti drill or mechanical seed drill and then the seeds are covered by wooden plank or harrow to have contact between seed & soil. Crops like Jowar, Wheat and Bajra, etc. are sown by this method.
3. **Dibbling:** It is the placing or dibbling of seeds at cross marks (+) made in the field with the help of maker as per the requirement of the crop in both the directions. It is done manually by dibbler. This method is followed in crops like Groundnut, Wheat, Castor, and Hybrid Cotton, etc. which are having bold size and high value.
4. **Transplanting:** It is the raising of seedlings on nursery beds and transplanting of seedlings in the laid out field. For this, seedlings are 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. The field is irrigated before actual transplanting to get the seedlings established early & quickly which reduce the mortality. Besides the advantages & disadvantages of dibbling method, initial cost of cultivation of crop can be saved but requires due care in the nursery. This method is followed in crops like paddy, fruit, vegetable, crops, tobacco, etc.
5. **Putting seeds behind the plough:** It is dropping of seeds behind the plough in the

furrow with the help of manual labour by hand. The seeds are covered by successive furrow opened by the plough. This method is not commonly followed for sowing of the crops.

1.4 Steps of main field preparation for ---------- crop

a) Seed rate

b) Seed treatment

c) Fertilizer and manure application

RDF----------

FYM----------

1.3 Conclusion

Signature of Faculty In-charge

Experiment No.2 Date----------

Sowing Methods of Sugarcane

2.1 Aim

To know about the sowing methods of sugarcane

2.2 Materials required

Tractor, Ladder/plank, Spade, hand hoe, rake, measuring tape, seed, fertilizers and water etc

2.3 Methods

2.3 .1 Planting in flat beds

- It is very popular method on Northern India and in parts of Maharashtra.
- Shallow furrows of 8-10 cm deep are made.
- Distance between two rows should be kept 75-90 cm.
- Generally 3 budded setts are used to plant in the end to end planting system.
- The furrow is covered by 5-7 cm of soil and field is leveled by planking.

2.3 .2 Ridge and Furrow Method:

- The method is adopted in areas with moderate rainfall but have drainage problem.
- Deep furrows are opened in 'V' shape,10-15 cm deep in N. India,20 cm in S.I.
- It is also practiced in Eastern UP,& in Peninsular India particular in heavy soils.

2.3 .3 Trench Method or Java method

- In some coastal areas as well as in other areas where the crop grows very tall and the strong
- winds during rainy season cause lodging of cane, trench method is adopted to save the crop from
  lodging.
- Trenches at a distance of 75-90 centimeters are dug with the help of ridger or by manual labour.
- Trenches should be about 20-25 centimeters deep.
- After this already prepared mixture of fertilizers (NPK) should be spread uniformly in the

- Trenches and mixed thoroughly in the soil.
- The setts are planted end to end in trenches.
- The tractor-drawn sugarcane planter is suitable device for planting cane in trenches.

.3 .4 Rayungan method

- It is Indonesian term meaning-a developed cane shoot with single sprouted bud. A portion of field is selected for Rayungan production is left at harvesting time.
- The top of the cane is cut off which results auxiliary buds begin to sprout.
- For quick and effective sprouting, fertilizer especially nitrogen in heavy dose is applied and field is irrigated.
- After 3-4 weeks sprouted buds are separated in single bud setts and transplanted on ridges.
- It is costly hence is not commonly adopted in India however is usually used for filling gap.

2.3.5 Distant Planting Method

- It was developed at Indian Institute of Sugarcane Research (IISR) Lucknow.
- Single budded setts are planted in nursery @ 20 q/ha or 18000 setts/ha.
- After 45-60 days single budded setts are planted in main field at 90cm×50cm.

2.3 .6 Pit Planting

- Method is very popular in Tillah soil in Assam and also in Kerala hilly tracts.
- Pits are made at interspacing of 20-30cm in rows along the contours with row to row spacing of 75 cm,
- Organic manure is placed at bottom of pits.
- Cane setts are placed in the triangle in pits and covered with soil.
- System can be used in rain fed agriculture

2.3.7 Skip Furrow Planting

- It is common in Orissa.
- It is hybrid of flat and trench method.
- Trenches are dug 45 cm apart & gap of 90 cm is left after each two rows

2.3.8 Sabling or Sprouting Method

- Plants are sown in fertile soil with wide spacing, shallow planting, frequent irrigations and adequate fertilization.
- Tillers soon after they develop their own roots are separated from the mother plant and planted separately.
- It is very successful in Java and Cuba.

2.3 .9 Tjeblock Method

- Improved over Rayungan method because it takes care of proper availability of energy and nutrient to all the buds.
- Here stalks are cut off at its half length and planted vertically with node in the soil for rooting.
- Planted ones and the mother stalks are adequately irrigated and fertilized.
- Now the upper buds of both Tjeblocks and mother cane, which sprout in due course of time, are planted by cutting them into setts, as rayungans.

2.3.10. Bud transplanting

- Sugarcane buds with half of its stalk can be planted in small polythene bags filled with organic manure and soil**.**
- After sprouting they can be transplanted in the main field.
- The polythene is tore at the bottom for the easy rooting. There is less mortality about 5 % only.

2.3.11 Algin method of sugarcane planting

- In this method, Upper most nodes are collected while striping the canes for crushing.
- Then planted in wheat field in rows after every 4 rows of wheat at 90 × 50 cm
- The method was developed by Allahabad Agriculture Institute, Allahabad.

2.4 Steps of main field preparation for sugarcane

a) Seed rate

b) Seed treatment

c) Fertilizer and manure application

FYM ----------

RDF----------

2.5 Conclusion

Signature of Faculty In-charge

Experiment No.3 Date----------

Identification of Weeds in *Rabi* Season Crops

3.1 Aim

To study identification of weeds in *rabi* season crops

3.2 Materials

Manual on weed management, books on botany, taxonomy, weed science, herbarium, pencil, white paper etc.

3.3 Procedure

- After locating different types of weeds, study their habitat, morphology and mode of propagation.
- Help of books, manuals, herbaria, exhibits and other references may be taken for correct and scientific reporting of weed specimen.
- As you get a weed plant, make a visual observation and understand it's basic characteristics.

3.4 Observations

Table 3.1.Make a list of all weeds and note down the salient characteristics given below

S.No.	Name of Crop	Name of weed (Local/English)	Botanical name	Propagation

3.5 Conclusion

Signature of Faculty In-charge

Experiment No.4 Date----------

Study of Morphological Characteristics of *Rabi* Crops

4.1 Aim

To study the morphological description of *rabi* season crops

4.2 Materials

The tools required will vary according to the operation in different crops. The tools required have been indicated in the procedure of harvesting the important crops. Some of these are

4.3 Morphology characteristics

(i) **Leaf :** Colour, size, shape, arrangement

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

(v) **Roots/under :** Shallow, deep, tap root, adventitious, root colour, rhizomes, ground parts : nuts, bulb etc.

(vi) **Juncture points :** Note the colour, shape, size of any plant part like hair, ligule, auricle, glands etc. present at the joining point of stem with root, leaf with stem, inflorescence with the main stem / branch etc.

(vii) **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.

4.4 Observations

Table 4.1 Record the following observations in the table given below

S.No.	Name of the crop	Root	Stem	leaf	Flower	Tallness	Duration
1							
2							
3							
4							
5							
6							
7							
8							

4.5 Conclusion

Signature of Faculty In-charge

Experiment No.5 Date----------

Study of Yield Contributing Characters of *Rabi* Season Crops

5.1 Aim

To know the yield contributing characters and yield calculation of *rabi* season crops.

5.2 Materials Required

(i) Polythene bags

(ii) Harvesting equipment like sickle, knife, etc.

(iii) Balance

(iv) Gunny bags or baskets, pans, etc.

5.3 Importance of optimum time of harvesting

- Delayed harvesting causes yield loss in quantitative manner.
- Early harvesting causes yield loss in quantitative manner
- Common visual symptoms are yellowing and drying.

There are 2 stages of maturity

5.4 Physiological maturity

No further addition of dry matter.

5.5 Maturity indices

- Attains 7-10 days after physiological maturity water moisture gets reduced. Harvesting is mostly done at harvesting maturity.
- In rice, it can be harvested when all the colour changes from green to yellow. moisture contents for harvesting is 20-25 %.
- In wheat moisture content for harvesting is <22 %. In maize it is about <30 % husk and silk becomes yellow and black respectively. But for sweet corn it is about 35 %.
- Pop corn ears should be harvested at 30 – 35 %. For sorghum it is less than 25 %. For millets it is 18-25 %.Yield potentials of crops/varieties can be accessed on the basis of yield attributes.
- Different crops have different yield attributing characters. After collecting information on these attributes, theoretical yield. These observations help farmers to choose a suitable crop or variety for cultivation. Some of the examples are:

1. **Wheat**

No. of plants /m^2

No. of productive tillers/plant

Total no of grains /ear head

Percent of fertile grains/ ear head

Test weight (1000 seed weight)

2. **Barley**

No. of plants / m^2

No. of ear heads/ plant

No. of seeds/ ear head

Test weight (1000 seed weight)

3. **Chickpea**

No. of plants /m^2

No. of pods/ plant

No. of seeds /pod

Test weight (1000 seeds weight)

4. **Rapeseed and mustard**

No. of plants /m^2

No. of pods/ plant

No. of seeds /pod

Test weight (1000 seeds weight)

5. **Sunflower**

No. of plants /m^2

No. of capitulum / plant

No. of seeds/ capitulum

Test weight (1000 seeds weight)

6. **Sugarcane**

Average weight of cane

No. of canes /m^2

7. **Potato**

   No. of plants /m^2

   No. of tubers/ plant

   Average weight of tuber

Yield per hectare through the single plant yield method and yield per unit area method can be calculated by using the following formula

Yield per ha = Wt. of seeds per plant x No. of plants per ha.

Or

Yield per ha = Yield per plot of 1.0 sq. m x 10,000

Problem 1: Calculate yield/ha of allotted crop adopting the above procedures

5.1 Conclusion

Signature of Faculty In-charge

Experiment No.6 Date----------

Yield and Juice Quality Analysis of Sugarcane

6.1 Aim

To determine the yield and quality parameters of sugarcane

6.2 Material required

- Refractometer (brix), tissue paper and syrup

6.3 Procedure

- Take refractomer
- Ensure the refractomer prisim surface is cleaned and dry
- Place a two to three drops of freash cane juice
- Look through the eyepiece while the prisim in light direction
- Focus on scale and take the reading
- Clean the refractometer immidity

6.4 Analysis Procedure

A minimum of two whole clumps or ten canes of all are randomly selected, should be taken as a sample. The sample is cut into pieces of 45 – 50 cm weighed and juice extracted by crushing in laboratory crusher twice which is collected in weighed bucket containing 0.5g mercuric chloride (preservative). Extracted juice is weighed and percentage of extracted calculated.

6.5 Juice Brix

Suspended particles in juice are removed by passing the juice through 150 mesh sieve. Fill up 1000 ml cylinder with the cane juice and allow it to settle for 15 minutes. Gradually lower the standard brix. Spindle and allow it to float. When the brix spindle becomes stationary. Take the brix reading at the line with the plain surface of juice and note the temperature of the juice and correct the brix at 20^{o}C from the chart.

6.8 Assessment of Ripening

As the crop advances in maturity, its water content decreases (77.88 %) sucrose content increases (8.02 %) and reducing sugar decreases (0.3- 3%). Both organic (0.5 -10 %) and inorganic (0.3- 0.8 %) non sugars also decreases. At peak maturity sugar content will be at its maximum , reducing sugars and non sugars at their optimum level.

When the cane stalk is cut across with a sharp knife, a little higher than its middle and the cut end exposed to reflect sunshine , if the end looks watery. The cane is unripe if it sparkles slightly it can be taken to be getting ripe. Trial boiling of juice to judge the maturity is common among farmers. If the gur set well in the boiling, gur making would be taken up. If not the cane will be tested again after few days,

The top –bottom ratio is also used to judge ripening, when cane starts ripening , its top portion accumulates sugar rapidly than bottom portion. If the ratio of the sugar content of the top one third cane to bottom one third is much less than one then the cane is unripe. When the ratio is one, nearly one or more than one , the cane can be considered as ripe.

The content of invert sugar in juice could also be considered for assessing cane ripeness when invert sugar reaches a level of 0.1 percent or less in juice. The cane is said to be ripe and its juice fit for boiling. The test can be made more precise by taking only the top portion. Allow invert sugar content at 0.3 percent or less in this portion is an indication of peak maturity.

Specific gravity of juice gives fair idea of cane maturity because concentration juice in cane is mostly because of sugar accumulation as part from a cane crusher. Only a brix sugar hydrometer and a jar are required for this method. Cane juice having 17 brix or more can be considered ripe .

In all above assessments actual determination requires less than a liter of juice. However, for a representative sample , atleast 20-25 cm canes have to be harvested and crushed for each sample. The best way to sampling is to choose 4-5 places in the field at random and from each place cut and collect all the canes growing in a 60 cm length. The juice extracted has to be thoroughly mixed for analysis.

Where maturity of a standing crop is desired a hand refractometer can be used. Its principle advantages are that it takes very little time and needs neither heavy equipment nor elaborate process. There is no need for harvesting the stalks. Each determination requires only 3-4 drops of juice, which can be extracted from standing canes by a cane punching needle designed for the purpose. The drops are placed on the glass stage of hand refractometer and concentration of

juice recorded scale seen through eye piece.

An estimation of sucrose content can also be made using the refractometer brix reading the equation

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

Where, RB = Refractometer brix value

Problem 1. Estimate cane yield , juice yield ,sugar yield (t/ha)and sugar recovery(%) of cane from the following data

a) Spacing =90×60 cm
b) No. of canes per clump =10
c) Average weight of cane =750 gram
d) Juice extraction percentage =70
e) Sugar percent in juice =18

2. Estimate refractometer brix value of cane juice cane from the following data

Conclusion

Signature of Faculty In-charge

Experiment No.7 Date----------

Study of Important Agronomic Experiments of *Rabi* Crops at Experimental Farms

7.1 Aim

To study of important agronomic experiments of *rabi* crops at experimental farms.

7.2 Materials Required

(i) Notebook

(ii) Ball point pen or pencil

(iii) Lunch box if necessary

7.3 Procedure

- Carry all the necessary things and reach the college in time.
- Get briefing on the visit from the teacher and leave the institution at the scheduled time so that you arrive well within time at the farm.
- After arrival at the site, contact the farm manager or in-charge of the farm or the person deputed for the purpose.
- Introduce yourself and discuss the purpose of your visit.
- Note down special facilities available at the farm.
- Seek clarification on any aspects or doubts, if required.

7.4 Observations

Field experiments were conducted during ----------

Experimental site.....

location is situated at ----------' N latitude and---------- ' E longitude with an average altitude

of 58.90 m above mean sea level.

Climate and weather condition

Temperature

Rainfall

Relative humidity

Experiment details

a)Title of the experiment:

b)Treatment Details:

7.5 Analysis of Experimental soil

- Texture.....
- pH.....
- organic carbon .....
- Available nitrogen .....
- Available phosphorus .....
- Available potassium .....

Table 7.1 Cropping history of the experimental field

Kharif	*Rabi*	*Zaid*

7.6 Details of the layout:

Lay out of the experiment has been shown

- Name of the crop ……
- Design .....
- Gross area of the plot m^2 ----------
- Net area of the plot m^2 .....
- No. of treatment combination ----------
- No. of replication .....
- Total no. of plots .....
- Width of main irrigation channel ----------
- Width of the bunds between plots ----------
- Planting direction .....
- Variety name.....
- Spacing .....

7.7 Conclusion

Signature of Faculty In-charge

Experiment No.8 Date----------

Study of *Rabi* Forage Experiments

8.1 Aim

To know about *rabi* forage experiments.

8.2 Materials Required

(i) Notebook

(ii) Ball point pen or pencil

(iii) Lunch box if necessary

8.3 Procedure

- Carry all the necessary things and reach the college in time.
- Get briefing on the visit from the teacher and leave the institution at the scheduled time so that you arrive well within time at the farm.
- After arrival at the site, contact the Farm Manager or In-charge of the farm or the person deputed for the purpose.
- Introduce yourself and discuss the purpose of your visit.
- Note down special facilities available at the farm.
- Seek clarification on any aspects or doubts, if required.

8.4 Observations

Field experiments were conducted during ----------

Experimental site.....

location is situated at ----------' N latitude and---------- ' E longitude with an average altitude

of 58.90 m above mean sea level.

8.5 Analysis of Experimental soil

- Texture.....
- pH .....
- organic carbon .....
- Available nitrogen .....
- Available phosphorus .....
- Available potassium .....

8.6 Climate and weather condition

a.Temperature

b.Rainfall

c.Relative humidity

8.7 Experimental details

- Name of the forage crop ……
- Design .....
- Gross area of the plot m^2 ----------
- Net area of the plot m^2 .....
- No. of treatment combination ----------

- No. of replication .....
- Total no. of plots .....
- Width of main irrigation channel : ----------
- Width of the bunds between plots : ----------
- Planting direction : .....
- Variety name: .....
- Spacing : .....

8.8 Conclusion

Signature of Faculty In-charge

Experiment No.9 Date----------
Study of Oil Extraction

9.1 Aim

In this experiment you will extract essential oils of Cloves, Cinnamon and Nigella Sativa by steam distillation.

9.2 Material

Petroleum benzene, Distillation apparatus ,trimble oilseed sample, heating mentle soxhlet glass ware and balance

9.3 Principle of essential oil extraction: - The specific extraction method employed is dependent upon the seed material to be distilled and the desired end-product. The essential oils which impart the distinctive aromas are complex mixtures of organic constituents, some of which being less stable, may undergo chemical alterations when subjected to high temperatures. In this case, organic solvent extraction is required to ensure no decomposition or changes have occurred which would alter the aroma and fragrance of the end-product.

9.4 Procedure:

1. The grind sample which already prepared by lab assistant is weight on analytical balance.
2. The sample is mix with petroleum benzine using a ratio 4:1.
3. Soxhlet apparatus is set for the extraction.
4. After about three hour of extraction, the round-bottomed flask is heated in the water bath of the concentrator apparatus.
5. The solvent is removed and the excess water outside the flask is dried.
6. The extracted fat is weight and the fat content of the sample is calculated

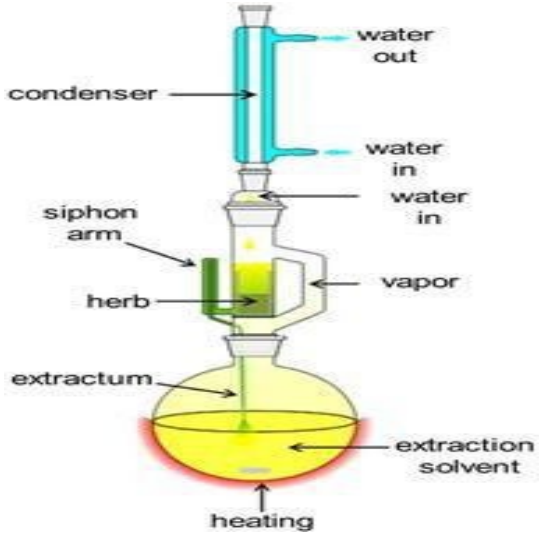

Fig 9.1: Soxhlet apparatus

9.5 Calculation

Item	Weight (g)
Round bottom flask before extraction	
Round bottom flask after extraction	
Thimble	
Thimble + mixture	

$$\text{Oil content (\%)} = \frac{\text{(Round bottom flask before extraction - Round bottom flask after extraction)}}{\text{Original Weight of the sample}} \times 100$$

9.6 Conclusion

Signature of Faculty In-charge

Experiment No.10 Date----------

Visit to Research Stations of Related Crops.

10.1 Aim

A field trip provides an opportunity to students to acquaint themselves with the important crops of the locality. They are able to know the climate, soil type, irrigation methods, farm and field operations, implements, latest varieties under cultivation, improved and indigenous implements, etc. They also come to know about the various steps involved in seed production in case this is one of the activities of the farm. Similarly, they can observe other activities going on at the farm.

10.2 Materials Required

(i) Notebook

(ii) Ball point pen or pencil

(iii) Lunch box if necessary

10.3 Procedure

- Carry all the necessary things and reach the college in time.
- Get briefing on the visit from the teacher and leave the institution at the scheduled time so that you arrive well within time at the farm.
- After arrival at the site, contact the Farm Manager or Incharge of the farm or the person deputed for the purpose.
- Introduce yourself and discuss the purpose of your visit.
- Note down special facilities available at the farm.
- Seek clarification on any aspects or doubts, if required.

10.4 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) Characteristics of the soil _____

(a) Texture _____

(b) pH _____

(c) N Content _____

(d) P_2O_5 Content _____

(e) K_2O Content _____

(ii) Source of irrigation _____

(iv) Area under irrigation_____ha

(v) Crop rotations followed_____.

(vi) List of equipment/farm machinery_____.

(vii) Area under rainfed crop_____.

Crop details

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

10.5 Conclusion

Signature of Faculty In-charge

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