**Practical Manual**

 **B.Sc. (Hons.) Agriculture**

 **Crop Production Technology-I: *Kharif* Crops**

**Course No.: ASAG2103**

**Credit: 3(2+1)**

**Semester: 3rd**



******

**Department of Agronomy and Agroforestry**

**M. S. Swaminathan School of Agriculture**

**Centurion University of Technology and Management, Paralakhemundi**

**www.cutm.ac.in**

**August, 2022**

**Practical Manual**

 **B.Sc. (Hons.) Agriculture**

 **Crop Production Technology-I: *Kharif* Crops**

**Course No.: ASAG2103**

**Credit: 3(2+1)**

**Semester: 3rd**

******

**Department of Agronomy and Agroforestry**

**M. S. Swaminathan School of Agriculture**

**Centurion University of Technology and Management, Paralakhemundi**

**www.cutm.ac.in**

**August, 2022**

**Department of Agronomy and Agroforestry**

**M. S. Swaminathan School of Agriculture**

**Centurion University of Technology and Management**

**Paralakhemundi**

***Certificate***

***Certified that this is a bonafide record of practical work done by***

***Mr./ Ms. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

***Regd. No. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in B. Sc. (Hons.) Agriculture degree programme, Course No. ASAG2103 entitled “Crop Production Technology-I” during 3rd semester of the academic year 2019-20.***

**Date: Faculty In charge**

**Evaluation System**

 **Crop Production Technology-I: *Kharif* Crops**

**Course No.: ASAG2103**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Marks distribution\*** | **Total marks (25)** | **Marks obtained** |
| **1** | **Record** | **5** |  |
| **2** | **Attendance** | **5** |  |
| **3** | **Field work** | **10** |  |
| **4** | **Viva** | **5** |  |
| **Total (25 marks)** |  |

 **Signature of Faculty In-charge**

**List of Experiments**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Exp. No.** | **Date** **of Exp.** | **Date of Submission** | **Title** | **Page No.** | **Signature**  | **Remark** |
| 1 |  |  | **Rice nursery preparation and transplanting of rice** |  |  |  |
| 2 |  |  | **Sowing of soybean, pigeonpea, mungbean, maize, groundnut and cotton** |  |  |  |
| 3 |  |  | **Effect of seed size on germination and seedling vigour**  |  |  |  |
| 4 |  |  | **Effect of sowing depth on germination of *kharif* crops** |  |  |  |
| 5 |  |  | **Identification of weeds in *kharif* season crops** |  |  |  |
| 6 |  |  | **Top dressing and foliar feeding of nutrients** |  |  |  |
| 7 |  |  | **Study of yield contributing characters and yield calculation of *kharif* season crops** |  |  |  |
| 8 |  |  | **Study of forage experiments** |  |  |  |
| 9 |  |  | **Morphological description of *kharif* season crops** |  |  |  |
| 10 |  |  | **Visit to research centre of related crops** |  |  |  |

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

**Rice Nursery Preparation and Transplanting of Rice**

**1.1 Aim**

To study about rice nursery preparation and transplanting of rice

**1.2 Materials required**

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

**1.3 Advantage of nursery raising**

* Sufficient time for main field preparation or we can increase the cropping intensity or manipulate cropping pattern by excluding the seedling stage in main field.
* Disease pest management will be easier.
* Weed growth also be less due to high density of seed.
* It is easier to manage under unfavorable weather condition.

Types of paddy nursery:

1. Wet nursery
2. Dry nursery
3. Dapog nursery

**1.4 Write steps of all the 3 types of rice nursery preparation**

**1.5 Transplanting**

Transplanting of healthy seedlings may be done in puddled soil at 4-5 leaf stage or when they are about 20-25 cm in height @ 2-3 seedlings not deeper than 2-4 cm.

|  |  |
| --- | --- |
| **Type of rice nursery** | **Age of seedling for transplanting (days)** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**1.6 Write advantages and disadvantages of transplanted rice.**

**1.7 Conclusion**

**Signature of Faculty In-charge**

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

**Sowing of Soybean**, **Pigeon pea, Mung bean, Maize, Groundnut and Cotton**

**2.1 Aim**

To study about sowing of soybean, pigeon pea, mung bean, maize, groundnut and cotton

**2.2 Materials required**

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

**2.3 Observation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl no.** | **Crop**  | **Seed rate** | **Spacing** | **Depth of sowing** | **Method of sowing** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Stage of crops** | **Plant height** | **No. of plants per m2** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**2.4 Steps of sowing methods for your own crop**

**2.5 Conclusion**

**Signature of Faculty In-charge**

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

**Effect of Seed Size on Germination and Seedling Vigour**

**3.1 Aim**

To study effect of seed size on germination and seedling vigour

**3.2 Seed germination**

 Germination is the process by which the embryo wakes up from the state of dormancy and takes to active life. Supply of water, favourable temperature, adequate supply of oxygen are main external conditions essential for germination, but, the seeds concerned must be viable, i.e. they must retain the power of germination. Light also has influence on germination of some seeds, but in most cases light regards germination at the early stages.

**3.3 Seedling vigour**

 It is the sum of those properties that determine the activity and performance of seed lots of acceptable germination in a wide range of environments’ (ISTA, 2015). As part of this definition they point out that it is not a single measurable property, but a concept associated with aspects of seed performance that include: rate and uniformity of seed germination and seedling growth; emergence ability of seeds under unfavourable environmental conditions; and performance after storage, particularly the retention of the ability to germinate. Vigour can therefore be considered as the potential performance of viable seeds in agricultural practice and this is determined by the complex interaction between genetic and environmental component.

**3.4 Observation**

**Table 3.1 Effect of seed size on germination and seedling vigour**

|  |  |  |  |
| --- | --- | --- | --- |
| **crop** | **Seed size (diameter in mm)** | **Germination %** | **Seedling vigour** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

* 1. **Conclusion**

**Signature of Faculty In-charge**

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

**Effect of Sowing Depth on Germination of *Kharif* Crops**

**4.1 Aim**

To study effect of sowing depth on germination of *kharif* crop

**4.2 Depth of sowing**

Depth of sowing is another important aspect for establishing a good crop stand. Uneven depth of sowing results in uneven crop stand. Plants will be of different sizes and ages and finally harvesting is a problem as there is no uniformity in maturity. Shallow or deep sowing results in lesser plant as all seeds do not germinate. The crop appears with uneven spread of plants with large number of gaps. Weed problem becomes serious under these conditions. It is therefore essential to sow the crop at optimum depth for obtaining good stand of the crop. The optimum depth of sowing depends on size of seed, seed reserve, coleoptile length and soil moisture. The thumb rule is to sow seeds to a depth approximately 3 to 4 times their diameter.

**4.3 Observation table**

**Table 4.1 Effect of sowing depth for germination**

|  |  |  |
| --- | --- | --- |
| **Crop** | **Depth of sowing**  | **Days taken for emergence** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**4.4 Conclusion**

**Signature of Faculty In-charge**

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

**Identification of weeds in *kharif* season crops**

**5.1 Aim**

To identify the weed species found in different *kharif* season corps

**5.2 Materials**

Quadrant, Books on Botany, Taxonomy, Pencil

**5.3 Procedure**

After locating different types of weeds, study their habitat, morphology and mode of propagation. Help of books, manuals, herbarium, 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.

**5.4 Observations**

**Table 5.1 Make a list of all weeds and note down the salient characteristics given below**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **Crop** | **Name of weed****(Local/English)** | **Botanical****name** | **Family** | **Control method**  | **Population (m2)** |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |

**5.5 Conclusion**

**Signature of Faculty In-charge**

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

**Top Dressing and Foliar Feeding of Nutrients**

**6.1 Aim**

To study about top dressing and foliar feeding of nutrients

**6.2 Materials**

Note book, pen , fertilizers and weighing balance

**6.3Top-dressing**

Spreading of fertilizer in standing crops is termed as top dressing without considering the crop rows but when the crop rows are taken into account and the fertilizer is dropped on the ground surface near the crop rows, then it is called as **side dressing.**

 **Recommended dose of nutrient (kg/ha)**

**Amount of fertilizers (kg/ha)** = ---------------------------------------------------------**×100**

 **Nutrient content in fertilizers (%)**

**6.4 Foliar spraying of nutrient solutions**

In this method of fertilizer application, urea, micro-nutrients and other required materials are dissolved in water, filtered and sprayed over the crop foliage by the help of a suitable sprayer. This method is preferred to other methods because it needs very little quantity of materials, the crop plants respond within 24 hours of application, soil reaction, topography and soil textures have no adverse effect on the nutrient availability and fertility status of the soil, however, uneven spraying and improper concentration of the solution may lead to hazardous effect over the crop.

**Amount of fertilizers (g/ lt of water)** = **Fertilizer solution (%) for spray × 10**

**Problem**

1. **Calculate the amount of Urea, SSP and MOP required to apply in 25 m2 area for rice if the RDF is N:P2O5:K2O :: 80:40:40 kg/ha. If nitrogen is split in two different stage of rice.**
2. **How much zinc sulphate would be required, if 2 % ZnSo4 is to be sprayed on 500 m2 maize crop and spray volume is 1000 lt/ha**

**6.5 Observation**

**After application of nutrients**

|  |  |
| --- | --- |
| **Stage** | **Growth** **(15 days intervals)** |
|  | **Plant height (cm)** | **Dry weight/plants (g)** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**6.6 Conclusion**

**Signature of Faculty In-charge**

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

**Study of Yield Contributing Characters and Yield Calculation of *Kharif* Season Crops**

**7.1 Aim**

To study of yield contributing characters and yield calculation of *kharif* season crops

**7.2 Materials Required**

Polythene bags, harvesting equipment like sickle, knife, balance, gunny bags or baskets, pans, etc.

**7.3 Yield attributes Observations**

**1. Rice**

 No. of tillers / unit area -

 No. of panicles / unit area-

 Average no. of grains / panicles-

 % of filled grains -

 Test weight of 1000 grains-

**2. Maize**

 Average no. of cobs/plant-

 Average no. of grain rows/cob-

 Average no. of seeds/grain row-

 Seed index of maize-

**3.Sorghum**

No. of earhead / plant-

No. grains / earhead-

Test weight (1000 grains)-

**4.Bajra**

Total no. of tillers / unit area-

No. of productive tillers / unit area-

Length of ear head-

No .of filled grains / ear head-

Test weight (1000 grains)-

**5.Ragi**

No. of productive tillers / unit area-

No. of fingers / ear head-

No. of filled grains/ ear head-

Test weight -

**6.Red gram**

No. of plants/ unit area-

No. of pods/ plant-

No. of seeds/pod-

Test weight-

**7.Blackgram**

No. of plants/ unit area-

No. of pods/plant-

No. of grains /pod-

Test weight-

**9.Groundnut**

Average no. of matured pods/plant-

No. of kernels/pod-

Test weight of kernels-(g)-

Shelling percentage-

**10.Cotton**

Average no. of sympodial branches/plant-

Average no. of bolls/branch -

No. of locules/boll -

Average no. of seeds/locule-

Seed to lint ratio -

Test weight of cotton seed in g.-

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.**

**7.4 Conclusion**

**Signature of Faculty In-charge**

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

**Study of Forage Crops**

**8.1 Aim**

To know about *kharif* forage crop.

**8.2 Materials Required**

Notebook and Ball point pen

**8.3 Observations**

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

Experimental site--------------------------

|  |
| --- |
| **Crop details** |
| **Crop name**  |  |
| **Variety name**  |  |
| **Crop duration**  |  |
| **Yield characteristics**  |  |
| **Yield**  |  |
| **Other details**  |

**8.4 Conclusion**

**Signature of Faculty In-charge**

 **Experiment No. 9 Date-------------**

**Morphological Description of *Kharif* Season Crops**

**9.1 Aim**

To study about the morphological description of *kharif* season crops**.**

**9.2 Materials Required**

Notebook and Ball point pen

**9.3 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: Shallow, deep, tap root, adventitious etc.

(vi) Juncture points: Note the plant part like hair, ligule, auricle, glands etc.

(vii) Fruits / seeds: Colour, size, shape and type of fruit

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

**9.4 Observation**

**Table 9.1 Record the following observations in the table given below**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **Name of the crop** | **Root** | **Stem** | **Leaf** | **Inflorescence** | **Height** | **Fruit/grain** |
| 1 |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |

**9.5 Conclusion**

**Signature of Faculty In-charge**

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

**Visit to Research Centre 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. Similarly, they can observe other activities going on at the farm.

**10.2 Materials Required**

(i) Notebook

(ii) Ball point pen or pencil

**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) P2O5 Content \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(e) K2O 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**

**References**

1. Chandrasekaran B., Annadurai K and Somasundaram V. A Textbook on Agronomy, New
Age International Publishers.

2. Das N.R., (2013) Principles manual on basic agronomy of Agronomy, Scientific Publishers.

3. Prasad R., (2013) Text book of field crop production , Indian Council of Agriculture Research

4. Reddy S.R., (2013) Agronomy of field crops, Kalyani Publishers

5. Singh S.S and Singh R., (2013) Principles & Practices of Agronomy, Kalyani Publishers.

6. Sarma Abhijit(2015) Numerical Agronomy, Kalyani Publishers

7.[www.tnau.agriportal](http://www.tnau.agriportal).