



College of Natural Sciences
Department of Biotechnology
Course Title: Research Methodology
Course code: BIOB 551
Credit Hours: 2
Instructor: Ayalew Talema (PhD)
Academic year: 2019/20
MSc in Botany, Year I, Semester II

March 2020
Dessie, Ethiopia

Course description

The course will address topics related to principles, concepts and process of research methods, steps in identification and prioritization of research problems, how to select a research topic, components of a research proposal, proposal evaluation criteria, techniques in tabulation and organization of analyzed data (tables, figures, etc.), skills related to presenting and interpreting results, how to prepare a conference paper, how to prepare a manuscript, types of journals and criteria in selecting scientific journals, how to review a paper, and research ethics.

The objectives of the course

This course is designed to:

- **Acquire basic knowledge on different type of research and the research process**
- **Understand the different components of a research proposal**
- **Develop skills for preparing research proposal**
- **To design and develop critical and analytical skills required to undertake scientific research, how to present research outputs in conferences, the processes of publications and prepare scientific report.**

Contents

1. Introduction

2.1. Definition of Research

2.2. Purpose of research

2.3. Type of research

2. Problems associated with field oriented research

2.1. Improper choice of methodology and personnel

2.2. Data related problems

2.3. Cultural Aspects

2.4. Financial constraints

3. Research planning

3.1. Principle of research planning

3.2. Steps in planning process

3.3. Research problem and question

3.4. Problem identification and selection

3.5. Type of problem

3.6. Ranking and prioritizing problems

Contents

3.8. Analysis of interaction among problems and causes

3.9. Preparation of research proposal

3.9.1. Definition and quality of a research proposal

4.2. Components of research proposal

4.2.1. Introduction (Background and justification)

4.2.2. Objective of the study

4.2.3. Literature review

4.2.4. Material and methods (study methodology)

4.2.5. Work plan

4.2.6. Logistic (budget)

4.2.7. Bibliography/Reference

Contents

5. Research report writing

5.1. Avenues of communication

5.2. Audiences and intent of a research communications

5.3. The IMRAD forms of scientific paper writing

5.4. Characteristics of good scientific research paper

5.5. Structure and part of a research paper

5.5.1. Title

5.5.2. Author(s)

5.5.3. Abstract

5.5.4. Introduction

5.5.5. Material and methods

5.5.6. Results

5.5.7. Discussion

5.5.8 Acknowledgment

5.5.9. Reference

5.5.10. Appendix (Anex)

Assessments

Proposal writing (30%)

Proposal presentation (20%)

Final exam (50 %)

Total (100%)

1. Definition of Research

- **Research :**
 - **any organized and carefully planned substantial effort designed to further knowledge and understanding of a subject**
 - **a scientific investigation aimed at discovering and applying new facts, and techniques.**
 - **systematic process of collecting and analyzing information to increase our understanding of the phenomenon under study**

1. Introduction cont...

- Research is an **ORGANIZED** and **SYSTEMATIC** way of **FINDING ANSWERS** to **QUESTIONS**.
- Old French root word *cerchier*, meaning to search or seek, and the prefix *re*, meaning again
- Research is seeking again

1. Introduction cont...

- **SYSTEMATIC**
 - **There is a definite set of procedures and steps which you will follow.**
 - **research process are certain things always done in order to get the most accurate results**

1. Introduction cont...

- **ORGANIZED**
 - There is **a structure or method** in going about doing research.
 - It is a **planned procedure**, not a **spontaneous one**.
 - It is **focused** and **limited to a specific scope**.

1. Introduction cont...

FINDING ANSWERS

- The **end of all research**.
- **Research is successful when we find answers.**
- Sometimes the answer is **no**, but it is still an answer.

1. Introduction cont...

QUESTIONS

- Are **central to research**.
- If there is no question,
 - the **answer is of no use**.
 - research has **no focus, drive, or purpose**.
- Focused on **relevant, useful, and important questions**.

1. Introduction cont...

- **Information gathered**
 - **Relevant to the question asked**
 - **Reliable and unbiased**
- **No guarantee that any given research actually produce relevant, reliable, and unbiased information.**

1. Introduction cont...

- **Where**
 - It can be carried out in the **laboratory**, **greenhouse**, pot culture or in the **field**.

1. Introduction cont...

1.3. Purpose/function of research

- Provide **answer to questions**
- Increase knowledge and understanding
- Establish facts and principles
- Develop **options in product and services**
(Through invention and innovation)

1. Introduction cont...

1.4. Types of Research

- Classified in to **different groups/type** based on
 - Objective
 - The attributes to be measured/ Type of data to be collected
 - Method of data to collection

1. Introduction cont...

1.4.1. Types of research based on Objectives

1) Basic /Fundamental/pure research

- To advance basic scientific knowledge
- Immediate practical application is not being a direct objective
- Primarily to learn rather than to make use of the findings

1. Introduction cont...

- Better understanding of the phenomena under investigation
- To discover or to illustrate theories and general principles.
- Provide basic knowledge that can be used in a wide variety of applied researches.
- In due course, use will probably come for most discoveries

1. Introduction cont...

2) Applied research

- Undertaken to **solve existing problems**
- To produce knowledge and technologies that can be **used in practice**.
- Directed toward using **knowledge gained from basic research**

1. Introduction cont...

- The distinction between basic and applied research is **not absolute**.
- There is **some kind of linkage/overlap** between the two research types.
- **Yesterday's pure research** becomes **today's applied research** that yields **tomorrow's processes**.

1. Introduction cont...

- **Both types of research are needed** because they tend to be **complement** each other.
- **Limited research resources exist.**
- **Problem solving with immediate practical application should be focused.**

1. Introduction cont...

3) Adaptive research

- designed to **adjust new technology to a specific set of environmental conditions.**
- **Taking applied research results from elsewhere and adapting them to a specific situation.**
- **The most applied type.**
- **No new scientific principle may be discovered .**

1. Introduction cont...

- Some technologies can be transferred from one area to other **with certainty that they will perform well.**
- This cannot be said about technologies concerning **biological sciences** such as agriculture.
- They have to **be modified to suit the climatic, edaphic, cultural and other conditions** of a country or region.

1. Introduction cont...

4) Strategic research

- Research aimed at **solving specific problems of strategic importance.**

1.4.2. Types of research based on attributes to be measured

Quantitative research

- There is a theory to be verified using relevant data.
- The concepts of the theory are translated into variables
- The variables are measured by some known methods to generate observation.

1. Introduction cont...

- Observations would be **analyzed and the results interpreted**
- The research carried out by one researcher can be **repeated(replicated by another researcher)**
- **Hypotheses** regarding the theory are established and tested

1. Introduction cont...

Qualitative research

- Not as straight forward as the more conventional quantitative methods.
- There is no theory to be verified.
- Attempting to discover the theory underlying the system or phenomenon under investigation.

1. Introduction cont...

- No need to make the **data fit the theory**
 - The data are used to **generate an unknown theory**
- **No hypothesis is constructed and tested(no theories to be verified)**

1. Introduction cont...

- **Inferior to quantitative research**
 - The procedures used are not rigorous
 - Can not be repeated by other researcher
- Does not mean that **it is less useful** as compared to the quantitative ones.
- Common in **social sciences** and is on limited use in biological sciences such as Agriculture

1. Introduction cont...

1.4.3. Types of research based on methods of data collection

1) Experimental research

- Where one can conduct a **controlled experiment** to observe the behavior of a variable or variables of interest
- It is carried out either in a **laboratory or in a field**.
 - Results obtained from field experiments are **less precise** as compared to **laboratory or greenhouse experiments**.

1. Introduction cont...

2) Non-experimental research

- Data are obtained **not from actual laid out experiments**, but from **survey research**
- Respondents are either **interviewed**, or are provided with **self-administered questionnaires** to generate data.
- In forest inventory for instance, no experiment is laid out.
- The researcher collects data **on the existing trees** and **shrubs using the techniques of sample survey**

1. Introduction cont...

- Information from secondary sources such as **archives**, **libraries** and **personal communications** do not involve experimentation and are therefore, non-experimental.
- They are commonly employed in **social science research** and not so much in biological sciences

Chapter 2. Problems associated with research

- Research work calls for **interest and dedication**
 - Produce results after **short period of hard work.**
 - Other requires **several years of commitments and devotion.**
- As there is **success** , there is also **failure** in research endeavor.

2. Problems associated with research cont...

- The success of many field-oriented researches depend on how one **overcomes problems during execution**
- Many of these problems caused by inadequate research plans
- Some researches that seem to be **carefully planned** may **not give satisfactory** results because of some problems

2. Problems associated with research cont...

- There are several ways of detecting such problems.
 - Looking into a literature on similar studies.
 - Exchange of ideas on the problems with colleagues (workshops, seminars, etc)
 - Consulting with senior research staff , discussing with farmers and mounting of pilot surveys

2. Problems associated with research cont...

- Many of the problems in research may be caused by
 - Inadequate **research plan**
 - Inadequate foresight (observation) of **field conditions**
 - Wrong choice of **methodology**
 - Data related problems
 - Manpower issues
 - Financial issues
 - Cultural issues

2. Problems associated with research cont...

2.1. Improper choice of methodology and personnel

- **Faulty procedures** followed and assignment of **unskilled personnel** to do the job
- Not only the **skill**, but also the **level of interest** of the participant is important
- **Research work** is not something that should be **forced up on** somebody.

2. Problems associated with research cont...

- **Good result** will be obtained if **interested group** undertake research work
- **Responsible individuals** who know the **significance/ importance of what they are doing.**
- **Some lazy data collectors** will collect information/ data **while sitting at home**

2. Problems associated with research cont...

- Particular attention at the **planning stage** should be given on **methodology used and personnel involved**
- One needs to know the **field condition** in order to be able plan the **layout of the field experiments**

2. Problems associated with research cont...

2.2. Data related problems

- we may find data, which have never been recorded before
 - wrong measurements
 - No previous records
- Standardization of measurement units (derivation of conversion factors)

2. Problems associated with research cont...

- For these types of problems
 - Date transformation using different statistical methods and
 - The use of missing value technique are always important
 - The standardization of units of measurement is also important at the planning stage

2. Problems associated with research cont...

2.3. Manpower and financial constraints

- Many developing countries have serious shortages of research personnel
- Researcher in various disciplines of horticulture is inadequate
 - Post harvest technology /processing, food science, biotechnology (tissue culture)

2. Problems associated with research cont...

- Implementation of a research project largely depends on **availability of funds**
- A research should **not be initiated /proposed** unless one is sure that **there is fund**
- Many excellently written proposals **fail due to lack of adequate funds.**
- Ongoing projects are **discontinued**

2. Problems associated with research cont

2.4. Cultural aspects

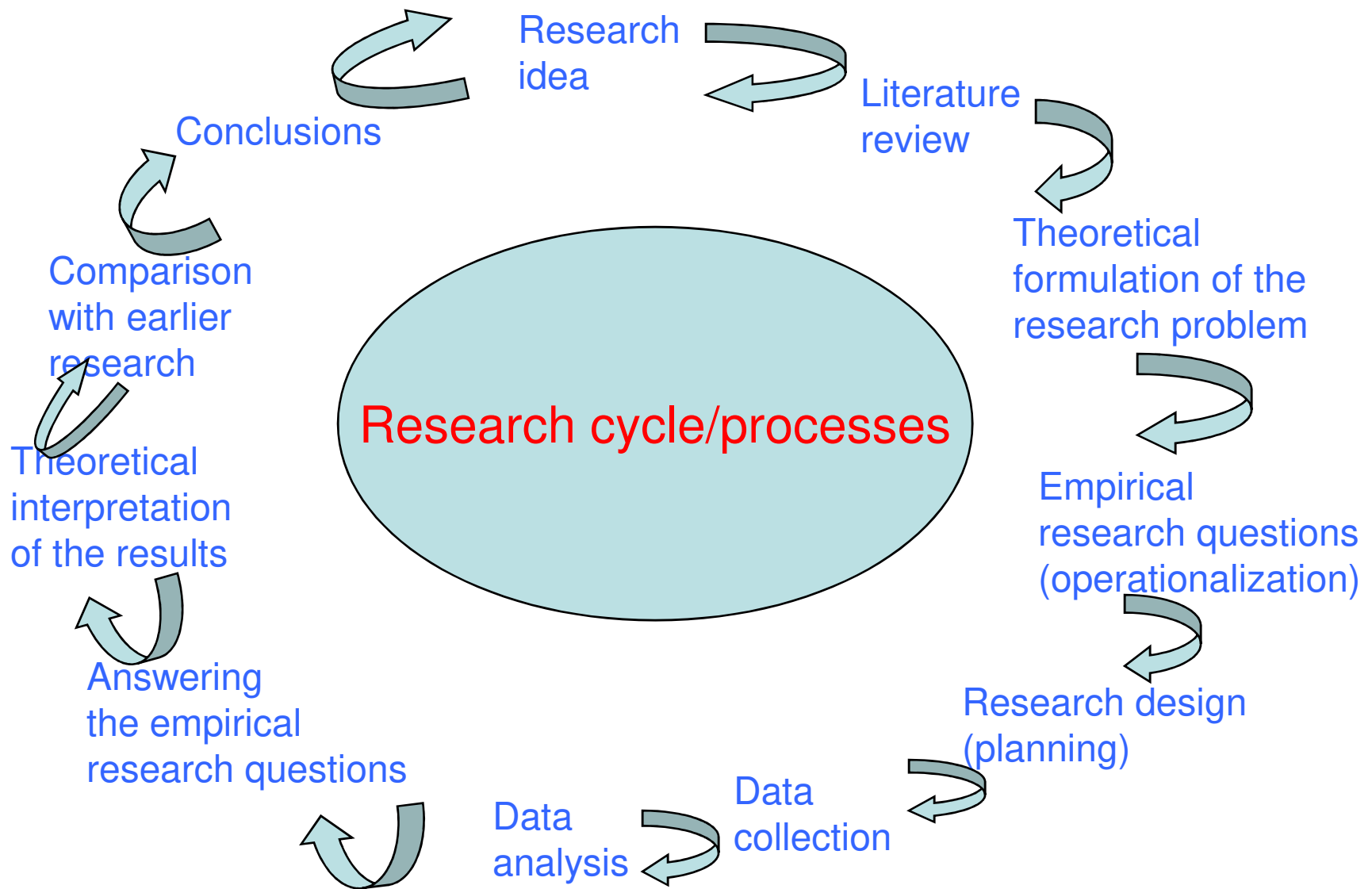
- Culture is an important social aspect to be considered
- There are certain culture which could create problems to field crew if adequate provisions are not made during planning stage
- Prior knowledge on what is accepted and what is not accepted by the society
- Language and culture of the society

Chapter 3.

Research planning

3.1. Introduction

- Project planning is a very important component of the project cycle



3. Research planning cont...

- Involves detailed description of
 - The research problem or problems and areas on which research is to be focused
 - Key activities to be undertaken
 - Manpower, funds and facilities required
 - The methods of implementation, co-ordination, monitoring and evaluation of the project output

3. Research planning cont...

- The need for planning (why?)
 - A. Improves utilization of resource, reduces costs
 - Where resources for research are severely limited
 - Many programmes and projects compete for the limited resources

3. Research planning cont...

- A number of projects from health, education, agriculture, industry and the service sector compete for same funds
- Hence, for efficient utilization of such scare resources, one has to properly planned his/her research project.

3. Research planning cont...

B. Facilitates the **implementation process** and obtaining expected output

- A properly **planned experiment** is **half executed**.
- One cannot hope to obtain the anticipated outputs without paying due **attention to the planning process**

3. Research planning cont...

3.2. Levels and principles of research planning

- The type of research planning depends upon the level at which the research is going to be undertaken

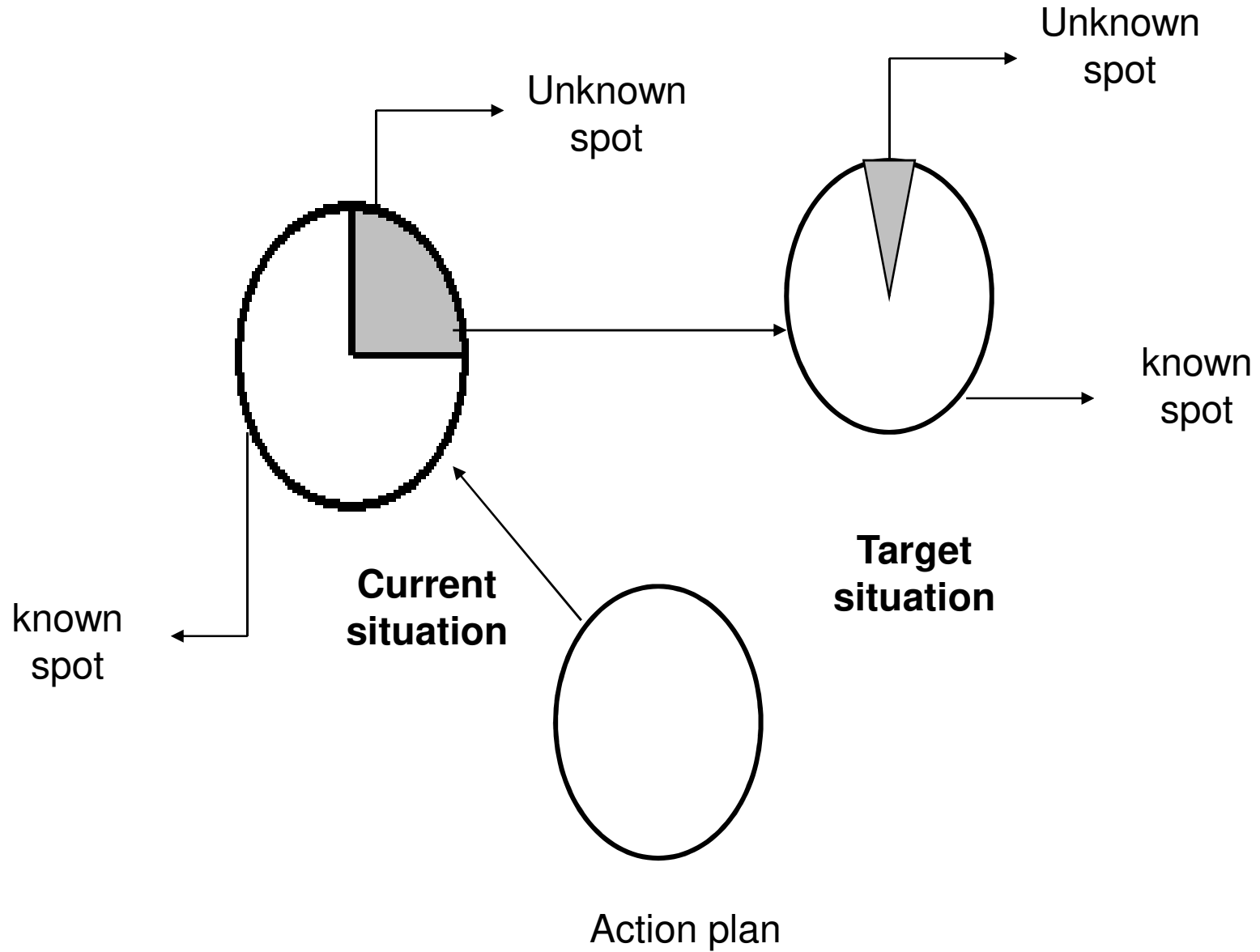
3. Research planning cont...

- Planning research can be considered at five levels:
 - At the level of the country as a whole
 - At the level an individual research institution
 - Research program
 - Project and
 - an individual study.
- The general principles employed for planning at each level are the same

3. Research planning cont...

3.3 Situation and Models in Undertaking Research

- The researcher has to assess
 - Current situation (problems and opportunities)
 - Preferred situation (intended targets)
 - Action plan (strategy to be adopted to attain target)
- In this process the researcher will go from one working model to another



3. Research planning cont...

- Not everything is known about the existing situation
- There is a gap that has to be bridged.
- Where the researcher identifies his problem and assesses the possibilities for the problem
- The amount of blind spot has decreased indicating an improvement on the previous situation

3. Research planning cont...

3.4 Steps in the planning process

- Six important steps *have been identified for the planning process.*
 - Problem identification
 - Ranking (prioritization) of problems
 - Identification of causes
 - Analysis of interrelations among problems and causes
 - Identification of solutions
 - Evaluations of solutions

3. Research planning cont...

3.5 Research problems and Research Questions

- Research always starts from a question or a problem of some sort
- To make an attempt to a solution something unsettling which we call a problem should manifest itself
- ***Research question Vs research problem***

3. Research planning cont...

3.5.1 Research problems

- An intellectual **challenge**, **difficulty**, **doubt**, etc. that a person faces when an undesirable situation arises.
 - Agricultural production systems in Southwest part of Ethiopia are **conducive for environmental degradation**
 - **Rural family incomes** are very low as compared to urban family incomes

3. Research planning cont...

- Such types of **problems cannot be solved** without further analysis
- Such intellectual challenges have to be **defined properly by asking relevant questions.**
- Possible to prepare a **research plan** with the aim of resolving the difficulties encountered

3. Research planning cont...

3.5.2 Research questions

- A **statement that inquires** about the problem itself.
- It is a **question or questions posed** by the researcher to bring out the salient points about the problem.
- The questions asked have to be **relevant to the issue of concern**

3. Research planning cont...

- Series of questions about what has gone wrong, why and what the causes are, etc. to be able to formulate the plan
- If this is not done, the research plan cannot be adequately formulated and the problem cannot be properly investigated.

3. Research planning cont...

- Suppose the problem of interest is related to the decline in coffee genetic resources of the country
- To analyze the problem, the researcher will have to ask some questions

3. Research planning cont...

- The following questions can be raised.
 - How is the **existing situation of genetic resources** of coffee in the forest?
 - How is the **rate of decline**?
 - What are the **causal agents**?
 - Which of the agents are **more serious**?
 - How could the **situation be reversed**?

3. Research planning cont...

- It could be noted that all questions are researchable.
- The researcher has reduced a complex problem to a series of research questions that can be investigated.
- Once the problem is reduced to a research question or questions, the researcher can prepare a plan, which leads to a solution.

3. Research planning cont...

3.6 Problem Identification and Selection

- The problems related to Agriculture sector are fairly well known.

3. Research planning cont...

- Already identified problems at national level
 - Lack of improved varieties
 - Lack of improved agronomic practices
 - Soil degradation, and genetic erosion
 - Post harvest losses
 - Diseases and pests

3. Research planning cont...

- Research ideas and research problems can be originate from many sources
 - Everyday life
 - Practical issues
 - Past research
 - Theory

3. Research planning cont...

- **Everyday life**
 - you can draw from your experiences and come up with many research topics.

3. Research planning cont...

- **Practical issues** can be a source of research ideas
 - The **existing evidences** can be used for the identification of the problems
 - If the **evidences are not sufficient** to put the problem in its **right perspective**, additional information may need to be collected

3. Research planning cont...

- The evidences for the existence of the problems may be
 - Deficiency symptoms
 - Crop response to fertilizer or application of other chemicals
 - Retardation of plant growth
 - Low yield
 - Etc

Table 3.1 Examples of problems and evidences

Problem	Evidence available	Additional evidence required
Nitrogen deficiency in coffee	“Poor soils” mentioned by farmers; eight years of response to nitrogen application to coffee	The existing evidence is sufficient; no more evidence required.
Phosphorus deficiency in potato	“Poor soils” mentioned by framers; two years of experiments have shown small, non-economic response to phosphorus. Many fields show usual signs of phosphorus deficiency	The evidence is sufficient; no more evidence required.
Drought stress in cassava at tuber formation	Field observations. Two years of experiments have shown significant yield advantage for earlier maturing variety.	There is sufficient evidence that problem is important; examination of meteorological data to determine frequency of drought and whether the last two years were representative may be needed
High cost of weeding in banana	Survey data show that farmers do two and sometimes three hand weeding. The cost of labor in the study area has risen by 50% in the last three years.	There is sufficient evidence that problem is important; interviewing farmers who are beginning to use herbicides regarding their experiences and opinions may be necessary.
Nitrogen deficiency in avocado	“Poor soils” mentioned by farmers; yellow leaves suggest nitrogen deficiency	No more evidence required

3. Research planning cont...

- **Past research** can be an excellent source of research ideas
 - Research usually generates more questions than it answers
- **Theory** (i.e., explanations of phenomena) can be a source of research ideas
 - Indigenous knowledge exist on sex identification of papaya

3. Research planning cont...

- The immediate obstacle is to **clearly define** the problem in **unambiguous terms** and to **delimit its boundaries**
 - Prior to attempting to formulate the research problem
1. **Determination of the beneficiaries of the research result**

3. Research planning cont...

- For example, the government may make a national policy decision to become **self-sufficient in food**.
- Direct research efforts towards **solving the problem of food production**.
- In this situation, the **immediate beneficiaries** of the research undertakings would be **agricultural producers**.

3. Research planning cont...

2. Decide the **level at which** the research should be carried out.

- In many cases, an **inadequate formulation** of the research problem is the cause of an **ineffective research**

3. Research planning cont...

3. The researcher should appreciate the need to discuss the **objectives set with the clients**

- Some times, the client does **not have well defined objectives**
- The initial task of researcher is to assist the **client in clarifying the objectives.**

3. Research planning cont...

4. Identification of the **context or environment** with which the problem is to be researched
 - Require a huge resources (financial, physical and human)
 - Common in giving **less emphasis** to such resources during the planning process.
 - Researchers often **end up** formulating research problems quite **outside the limits of available resources.**

3. Research planning cont...

3.7 Types of problems

- Nature of causes, two general types
 - **Biological limiting factors or natural phenomena**
 - **Inefficient use or misuse of resources** such as over or under application inputs, etc. (easier to correct)

3. Research planning cont...

3.8 Ranking (prioritization) of problems

- **Scientific research** is one of the prerequisites for sustainable social, economic and environmental development of a country
- However, it involves considerable **investment in manpower and facilities**.
- Thus, **it is difficult to fund all the research** their scientists may suggest desirable

3. Research planning cont...

- Analysis of the **existing state of affairs** may suggest **several potential problems** for research.
- But because of **limitation of human and other resources**, it may **not be possible** to research on **all identified problems**
- **Prioritization or ranking** of the problems based on some **predetermined criteria is a must**
- These lead the researcher to **make a selection among the many problems**

3. Research planning cont...

- **Priority setting** is the first step in solving a **series of problems**, which **compete for limited resources**.
- Generally speaking, in practice many research organizations **resolve such questions intuitively**

3. Research planning cont...

- There are **formal elaborate and objective procedures** by which problems can be ranked in order of priorities
- The system makes use of the **ratio of the social or economic benefit** of the anticipated research output to the **estimated cost** of the research.
- Such ratios are calculated for all the problems under consideration

3. Research planning cont...

- The ratios are compared among research problems, which compete for resources
- The cost benefit analyses are undertaken keeping in mind the:
 - **Intended beneficiaries**
 - **Size of these beneficiaries** and
 - **Quantitative value** of the research result to them.

3. Research planning cont...

- For example, ranking of agricultural problems may be based on
 - **Distribution of the problem**
 - **Importance of crop in question** (products, market, diet, etc.)
 - **Seriousness of the problem** (**severity of loss** ,yield; **frequency** of the problem ,insect and disease incidence, etc.)

3. Research planning cont...

- One may think that these procedures are **simple and fall through easily**.
- **Difficulties in quantifying** inputs and benefits
- The intention here is to show that **mathematically sound procedures** exist to make selections.

3. Research planning cont...

- Priority should be given to a problem **whose solution benefits a wide range of clients** at the expense of those that benefit a small group
- Finally, selection is made according to the **availability of the necessary resources** for tackling the problems

Table 3.2 Ranking of problems

N o	Type of problem	Distribution problem	Importan ce of crop	Seriousn ess of problem	Priority level
1	Nitrogen deficiency in coffee	Most farmers ***	Coffee ***	***	1
2	Phosphorus deficiency in potato	Several farmers **	potato ***	**	2
3	Drought stress in cassava at tuberization	Much of drought prone north **	cassava **	**	3
4	High cost of weeding banana	Some farmers **	banana ***	*	3
5	Manganese deficiency in coffee	Few farmers *	Coffee ***	*	5
6	Anthravnose attack on mango fruit	Some farmers **	mango *	*	4

3. Research planning cont...

- Table 2 shows ranking work done by students during the practical work conducted at Jimma University College of Agriculture**
- The students were grouped into three groups and were requested to score the set of problems according to the criteria given at the foot of the table.**
- The scores ranged from 1 to 3 for the distribution, importance and seriousness aspects**

Table 2 Ranking of problems by groups of students at a practical session

No	Problem	Distribution			Importance			Seriousness		
		I	II	III	I	II	III	I	II	III
1	Low seed germination in korerima	3	3	3	3	2	3	3	2	1
2	Poor survival of transplanted coffee seedlings	2	1	2	2	2	3	3	2	3
3	Die-back in citrus	1	1	1	2	2	1	1	1	1
4	Root knot nematodes in Tomato	-	2	1	-	1	1	-	1	1
5	Black rot of cabbage	3	2	2	3	3	3	2	2	2
6	Low coppicing ability of cinnamon	1	2	3	3	3	3	1	2	3
7	High rat population	1	2	1	2	3	2	1	3	1
8	Unreliability of survey data	1	1	1	2	1	2	1	1	1
9	Shortage of improved varieties of cassava	3	3	2	3	3	3	3	3	3
10	Erosion problem	2	2	2	3	3	3	3	3	3

3. Research planning cont...

- The priority ranking is done by looking at the **total of the ranks for each problem across the row.**
- For instance, the rank total for low germination problem is 9,7 and 7 for group one, two and three, respectively
- Whereas, it is 9, 9 and 8 for shortage of improved varieties of cassava and 4, 4 and 3 for dieback in citrus.
- This means that the first two problems are of high priority while the third one is not.

3. Research planning cont...

- **The overall priority is obtained by taking the **average ratings of the three groups.****
- **For the problems mentioned above, the averages are 7.67, 8.7 and 3.67, respectively.**
- **By so doing the following ranking is obtained**

3. Research planning cont...

Problem	1	2	3	4	5	6	7	8	9	10
Rank	1	5	8	7	3	4	6	8	1	2

3. Research planning cont...

- Additional criteria may need to be established to break the ties.
- In addition to **identification of the problem**, the researcher should assess evidences, which confirm or **support his observations** regarding the problem.
- The assessment could come from
 - Results of on-farm experiments
 - Field observation
 - On-farm surveys

3. Research planning cont...

3.9 Problems, causes and solutions

- Although it may **not be easy under all circumstances**, it is important to maintain a clear distinction between **problems, causes and solutions**
- The identification of a problem should lead to **possible solutions.**

3. Research planning cont...

- **Problem**
 - **Undesirable state of affairs** has taken place.
 - That is, something has **gone wrong** with the **existing situation**.
 - It is an effect or **result of a function of a given factor**

3. Research planning cont...

- **Causes**
 - There are **factors or reasons**, which are responsible for the creation of an undesirable state of affairs
 - The factors, which **produce or induce an effect**

3. Research planning cont...

- **Solutions**
 - This is actually what the **researcher does to get rid of the objectionable or unwelcome situation.**
 - It is a strategy worked out to overcome the causes and resolve the difficulty

3. Research planning cont...

Problem	Causes	solution
▪Three years after planting, coffee trees of farmers withered and died out at about the time the farmer was expecting some fruits	▪Existence of a clay pan at the depth of about thirty centimeters which has affected the normal development of the root system. ▪Upon uprooting some of the drying trees, one able to observe that the taproot, unable to penetrate the clay pan, has curved upward.	▪ Not continue to use the land for coffee production ▪It should be used either for growing shallow rooted plants or for grazing purposes. ▪Avoid planting coffee at the specific site and look for sites, which are free from a hard pan.
▪Lose of coffee seedlings after planting due to late season drought.	▪Late planting	▪Determination of the right date of planting

3. Research planning cont...

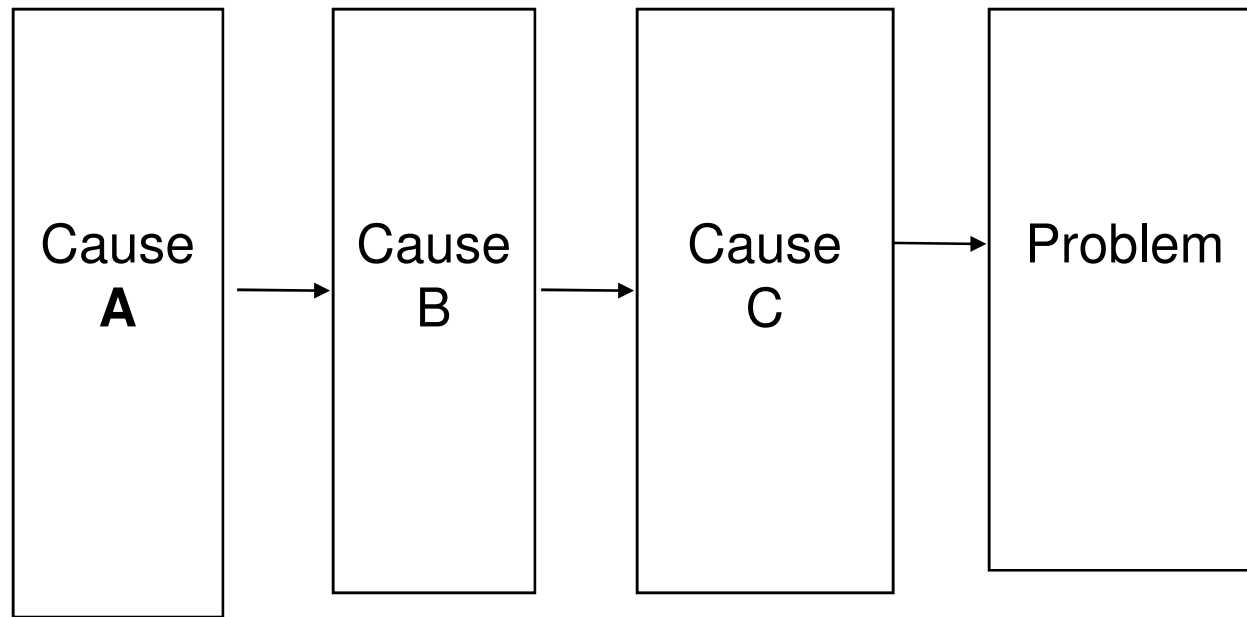
3.9.1. Identification of causes of problems

- Giving attention to the **causes of a problem** is an important stimulus for **identification of solutions**
- List all **possible causes** and eliminating the less important ones
- In some cases, **several causes** may contribute to a problem.

3. Research planning cont...

3.9.2. Chain of causes

- In some cases a single factor will be responsible for causing a problem
- There are also cases in which several causes follow one another and eventually result in a problem
- A factor can be considered as an effect as regards the factor immediately preceding it and a cause to the one, which follows it.



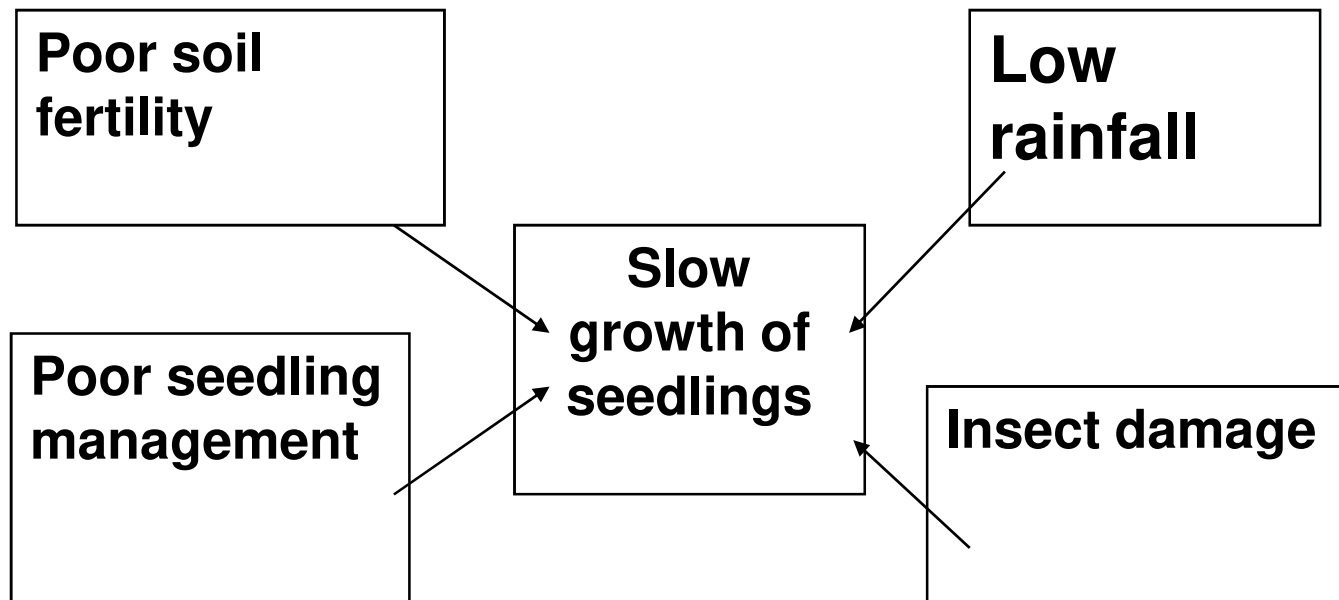
3. Research planning cont...

3.9.3. Multiple causes

- This is a situation in which **more than one cause** may be identified **for a single problem**.
- **All the causes** of the problem have to be addressed in order to obtain a realistic solution to the problem.

3. Research planning cont...

- Slow growth of seedlings in the field
- Let us also assume that the causes identified :
 - Poor soil fertility
 - Poor seedling management
 - Low rainfall
 - Insect damage



3. Research planning cont...

- This is a situation in which **several causes act together** to effect hardship on the grower.
- Unlike chain of causes, which work in succession, multiple **causes work simultaneously**.
- It is possible to have **multiple causes** and a **chain of causes** working together to generate a problem.

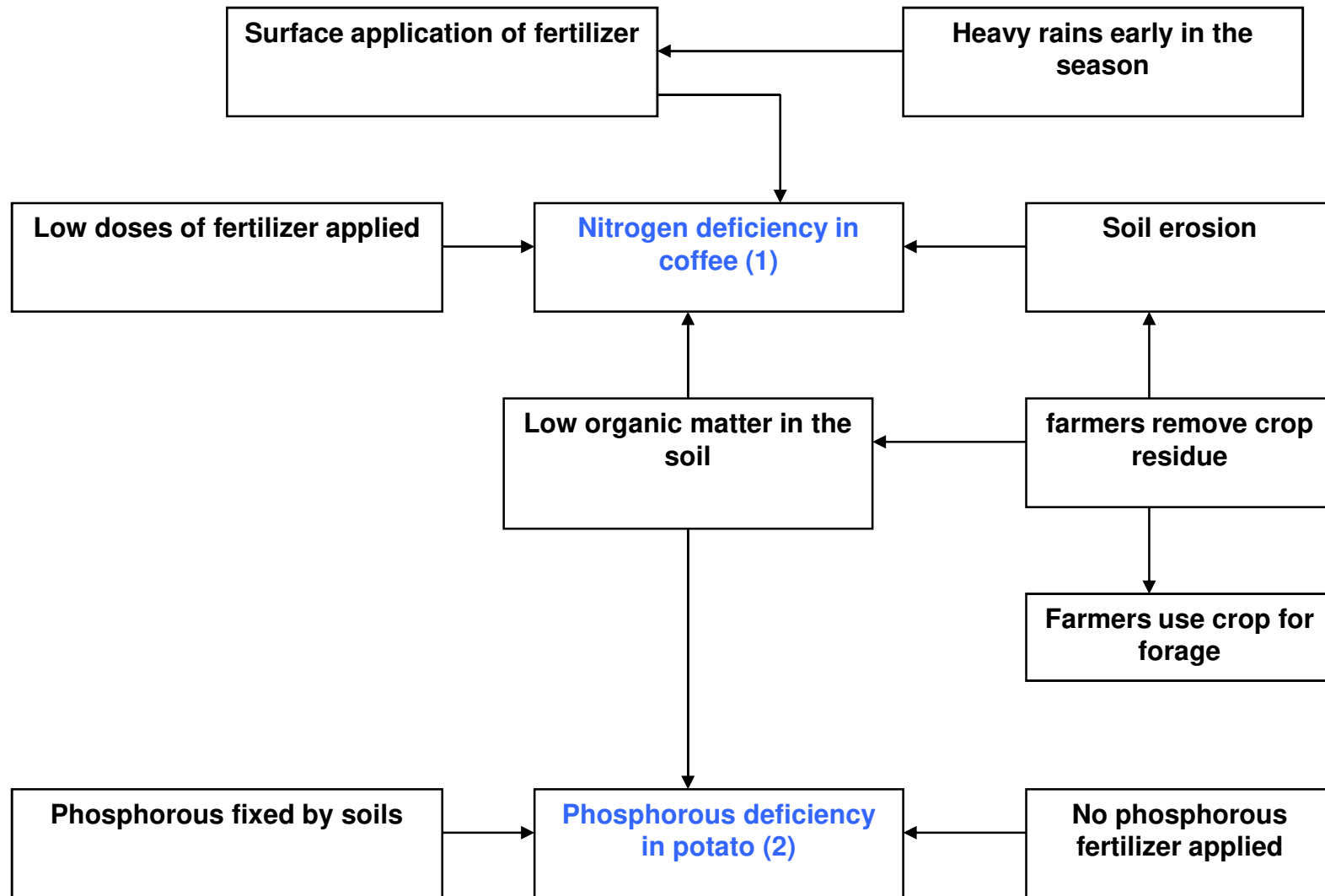
3. Research planning cont...

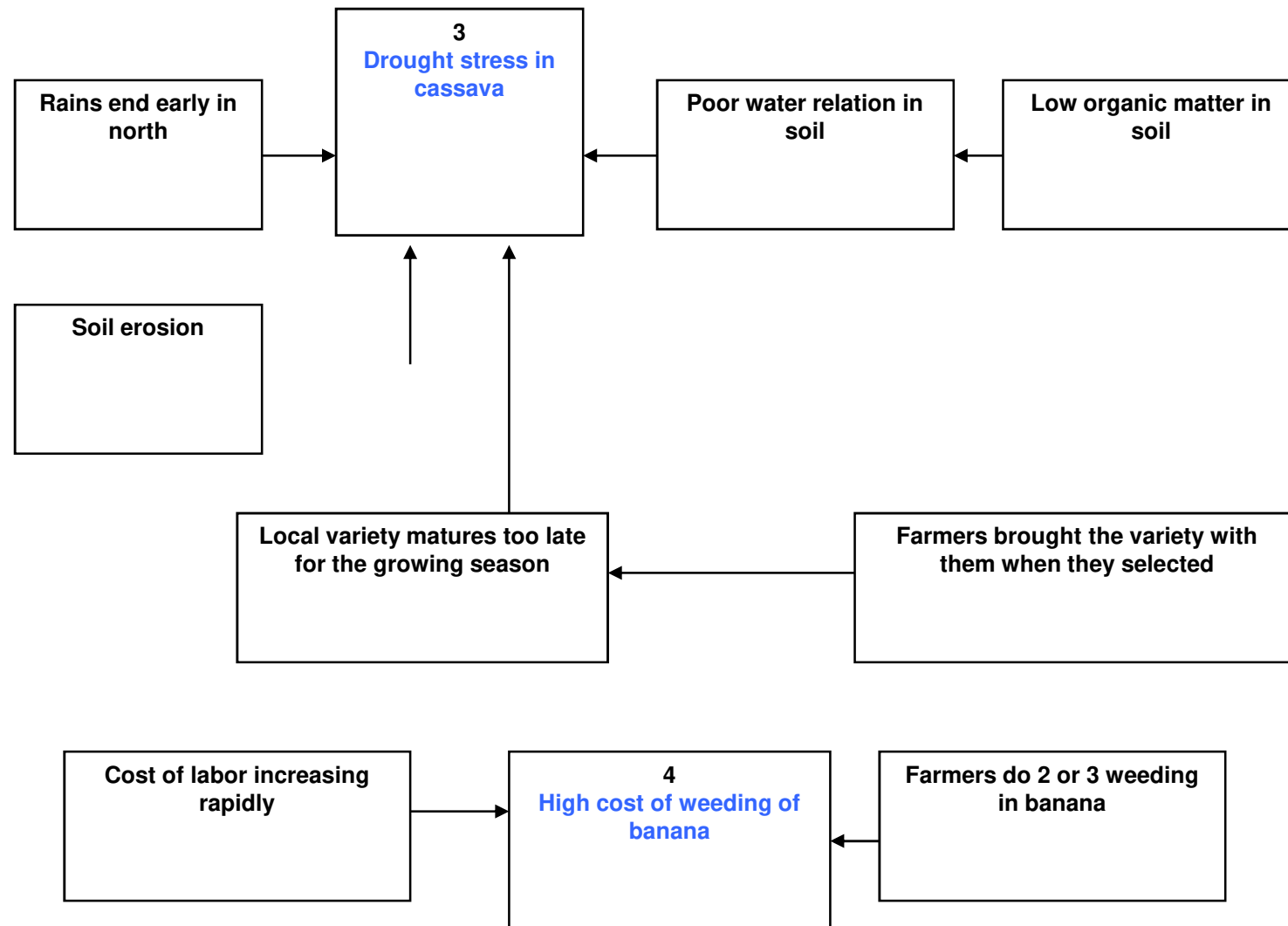
3.10 Analysis of interrelations among problems and causes

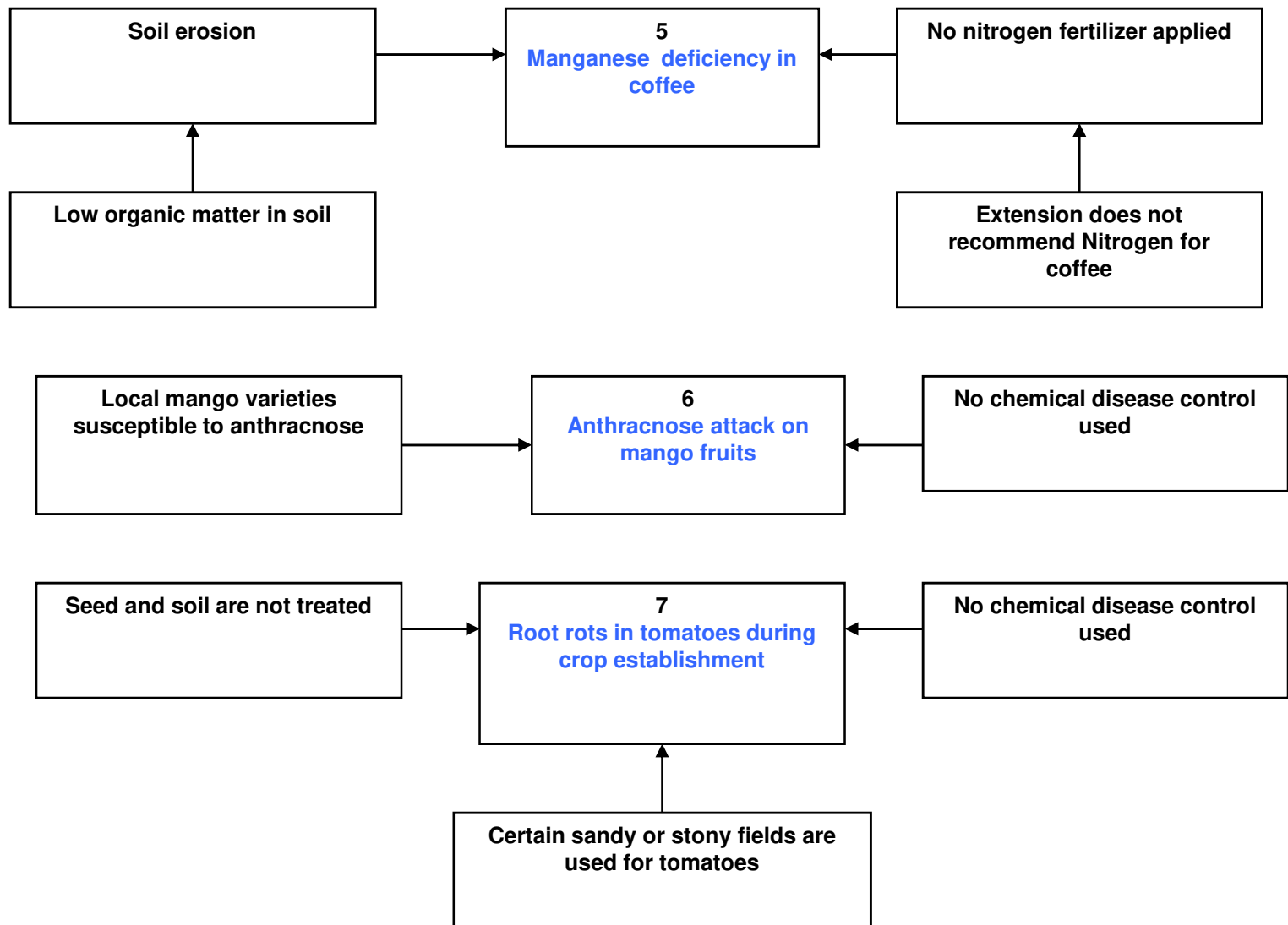
- Meaningful solution can be established if interrelations between problems and causes are clearly understood.



3. Research planning cont...







Chapter 4.

Preparation of research proposal

- Research proposal is coined from two words research and proposal
- **Proposal** lexically means a course of action, activity etc. proposed
- Written document requesting both authorization and funds to undertake a specific project in laboratory, library, field etc.

4. Preparation of research proposal cont...

- There is **no a hard and fast format** in scientific research proposal writing.
- It **varies from one organization to another**, from one country to another.

4. Preparation of research proposal cont...

- Though the format varies, the essence expressed in different formats remains the same.
- The different types of research defined/explained in the earlier chapters use almost a similar research proposal writing format

4. Preparation of research proposal cont...

- Even the research proposal **format of short, medium and long term** research is the same.
- What matter is that there will be **different stages/phases in which the preceding phase** output will have an impact for the subsequent phases.

4. Preparation of research proposal cont...

- The **major components** of a scientific research proposal are:
 - Abstract ????
 - Introduction (Background and Justification)
 - Objectives
 - Literature review
 - Materials and methods
 - Work plan
 - Logistics
 - References
 - Appendix (annex)

Flowchart: Steps in the development of a research proposal

Questions you must ask	Steps you will take	Important elements of each step
What is the problem and why should it be studied?	Selection, analysis and statement of the research problem	- problem identification - prioritising problems - analysis - justification
What information is available?	Literature review	- literature and other available information
Why do we want to carry out the research? What do we hope to achieve?	Formulation of research objectives	- general and specific objectives - hypotheses
What additional data do we need to meet our research objectives? How are we going to collect this information?	Research methodology	- variables - types of study - data collection techniques - sampling - plan for data collection - plan for data processing and analysis - ethical considerations - pre-test or pilot study
Who will do what, and when?	Work plan	- human resources - timetable
What resources do we need to carry out the study? What resources do we have?	Budget	- material support and equipment - money
How will the project be administered? How will utilisation of results be ensured?	Plan for project administration and utilisation of results	- administration - monitoring - identification of potential users
How will we present our proposal to relevant audiences, community and the funding agencies?	Proposal summary	- briefing sessions and lobbying

4. Preparation of research proposal cont...

Title

- The title should be as explicit as possible
- Should be descriptive, clear and short
- Should capture and reflect the content of the research proposal
- Should enable the readers to understand the concepts, methodologies and outputs of the study
- It should include the subject (i.e. crop, pest, soil, animal, disease, etc.,)

4. Preparation of research proposal cont...

- It should include the **line of investigation**
 - Breeding for disease resistance
 - Evaluation of agronomic characteristics
 - Selecting for adaptability
 - Economic fertilizer rate
 - Yield evaluation
 - Irrigation requirement
 - Chemical control
 - Location or locations

4. Preparation of research proposal cont...

- If a research activity contains more than three factors (lines of investigation), it may well be better to split that activity
- It is easier to find suitable experimental designs to meet the objectives.

4. Preparation of research proposal cont...

- Except multilocal trial (e.g. survey, national yield trials), it is better to treat activities by single locations.
- Agronomic and soil fertility trials
- Influenced by the peculiarities of the environment unless such locations are similar in their environmental characteristic

4. Preparation of research proposal cont...

- You can go to **many sources** to find topics or issues that can lead to research questions.
 - Personal experience
 - Professional books
 - Articles in professional periodicals
 - Other teachers and administrators
 - Bibliographies of various types
 - Unpublished research by others

4. Preparation of research proposal cont...

The abstract

- Provides the information of a **lengthy proposal in just one page**
- Provides a precise of the **whole problem to be investigated**
- It should be **concise and informative**

4. Preparation of research proposal cont...

- The **abstract of a proposal** should contain the **following points in approximately 300 words, or no more than one page:**
 - **Title**
 - **Statement of the problem and objectives**
 - **Methodology of investigation**
 - **Expected results**

4. Preparation of research proposal cont...

Background and Justification

- Overall **theoretical background** underlying the issue at hand
- Cover the **importance or significance of the study**, its rational or justification
- **Review of previous studies** to reveal what is known of the subject(**gap in knowledge and current trend**)

4. Preparation of research proposal cont...

- Generally some of the question to be addressed are:
 - What are **current and previous studies** have been made on the issues to be studied?
 - What is the **available information** on the magnitude, nature and causes of the problem?
 - What are the **present gaps in knowledge**?

4. Preparation of research proposal cont...

- What makes the **problem worth studying**
- Why has the **problem not been tackled yet?**
- What do you **intend to fill the gaps or solve the problem?**
- What is the **conceptual framework?**

4. Preparation of research proposal cont...

Objectives

- The statement of objective specifies **what the researcher intended to do**
- What is to **be achieved by the proposed investigation**
- Two type objective can be identified
 - General objective (overall aim of the study)
 - Specific objective (detail aim of the project)

4. Preparation of research proposal cont...

- Generally the objective of a typical research:
 - Should be **cohesive and logically arranged**
 - Should be **relevant to the problem statement**
 - Should be stated in a form which shows the **relations between the variables**
 - **Not too many**

The Literature Review

Literature Review

- **What is a literature review?**
 - It is **not a compilation of every work** written about a topic
 - It is **not simply a list of sources** reviewed separately for their own merit
 - It is a survey or overview of the literature found to be significant to a topic
 - It is a collection of **scholarly works you've found to have relevance to a guiding topic** (e.g., your thesis statement or research question)

4. Preparation of research proposal cont...

- Review means **see again, examine, or study again** examine critically or deliberately, to give critical evaluations of.
- Literature review means **locating literature in a variety of sources**
- Reading it carefully and thoroughly, evaluating the content
- **Breaking it down into themes and organizing it into themes** along the line of investigation

4. Preparation of research proposal cont...

- The importance can be indicated in the following saying:

“Research starts in the library and ends in the library.”

- **Continuous process that cuts across all stages of the research process in a dynamic way**

4. Preparation of research proposal cont...

- What are the purposes and importance of literature review?
- Benefit from previous findings
 - dimensions of the problem
 - potential difficulties in the area of investigation
 - unique context and potential contribution of the research project
- Review may lead to
 - either changing the study topic
 - reshaping the cover gap that others did not cover or overlooked

4. Preparation of research proposal cont...

- It can help to (as summary)
 - Increase your **knowledge of your topic**
 - Identify **important authors and works** in your area of research
 - Identify **opposing points of view**
 - Identify **gaps in the literature**
 - Identify **new research, theories, and/or methodology** in your area of research
 - **Avoid duplication**

4. Preparation of research proposal cont...

- Sources of literature
 - Primary sources
 - original documents
 - books and original articles
 - secondary sources
- Types of Literature
 - Theoretical works and review
 - Methodological reviews
 - Original findings and reviews of them

4. Preparation of research proposal cont...

- **How to obtain relevant literature**
 - **Almanac (directories and indexes)**
 - **Books**
 - **Abstracts**
 - **Journals**
 - **Encyclopedia and Handbooks**
 - **Personal communications**
 - **Newspapers and magazines**
 - **Specialized agencies**
 - **Visits**
 - **Modern technologies**

4. Preparation of research proposal cont...

Materials and Methods (Methodology)

- Give **full details to show with what and how the research activity is to be carried out**
- Methodology employed Vary according to the **type of investigation** being made
- Make sure that the experimental design or methodology selected is the **best to meet the objectives of the research activity**

4. Preparation of research proposal cont...

- **Materials and methods normally include**
 - **Site (location) characterization**
 - **Equipment**
 - **Tools**
 - **Procedure of investigation**
 - **Data to be collected**
 - **Method of data collection and analysis**
 - **Designs to be used**
 - **Replication number over sites and years**
 - **Meteorological data**
 - **Number of farmers to participate**
 - **Duration**

4. Preparation of research proposal cont...

- **Data collection methods**
 - **Survey (interviews and questioners) (social scientists)**
 - **Observation**
 - **Direct measurement (technical scientists)**
- **Each has pros and cons that must be weighed up in view of a rich and complex context**

4. Preparation of research proposal cont...

- **Survey**
 - **Surveying involves gathering information from individuals using a questionnaire**
 - **Interviews can range from**
 - **formal to informal**
 - **structured to unstructured**
 - **can be one on one or involve groups**

4. Preparation of research proposal cont...

- Three **methods of interview** (Structured Interviews)
 - Face-to-face interviews
 - Self-administered questionnaires
 - Telephone interviews



4. Preparation of research proposal cont...

Work plan

- There are **three steps** in the formulation of work plan
 - Analysis of **tasks**
 - **Time estimates** of each tasks
 - Synthesis of the **plan**

Table1: A sample to synthesize a 12-month research project plan

Activity	May	Jun	Jul	Aug	Se	Oct	Nov.	De	Jan	Feb	Mar
Literature search	X	X	X	X	X	X	X	X	X	X	X
Develop proposal		X									
Research designing			X	X							
Pilot study				X							
Field work					X	X					
Data collection					X	X	X				
Data analysis								X			
Write up								X	X		
Report circulation for comments									X	X	
Dissemination workshop										X	X

4. Preparation of research proposal cont...

Logistics

- The steps in presentation of **budget** should proceed in the following manner
 - Study the **sequence of research activities** or work plan
 - Estimate the **cost of each activity**
 - **Group similar expenditure** items together
 - Allow for **inflation**
 - Present a detailed **periodic budget**; and
 - Present a **budget summary** covering all years of the project

Table 2: Personnel cost

Qualification	Quantity	Duration (in days or months)	Payment rate (per day/per month)	Total cost
Junior researcher				
Technical asst.				
Field asst.				
Daily laborer				
Guard				
Sub total				

Table 3: Equipment and supplies

Item	Unit	Quantity	Unit cost (birr)	Total cost
Seed				
Pesticides				
Fertilizers				
Glassware				
Meters				
Barrels				
Subtotal				
April 20	Ayalew Talema, Wollo University			145

Table 4: stationery

Item	Unit	Quantity	Unit cost	Total Cost
Record books				
Lined paper				
Typing paper				
Diskette				
Computer and accessories				
Printer				
Subtotal	Ayalew Talema, Wollo University			146

Table 5: Travel cost and perdiem

Description	Rate per day	Total days	Total costs
Researcher			
Technical asst.			
Field Asst.			
Enumerators			
Driver			
Subtotal			

Table 6: Field offices and laboratories

Description	Area in m²	Cost per m²	Total cost
Field offices			
Laboratory			
Greenhouse			
Subtotal			

Table 7: Human resource development and training

Description	Number	Budget per person	Total cost
Ph.D			
M.Sc			
B.Sc			
Development agents			
Farmers			
Subtotal			
April 20	Ayalew Talema, Wollo University		149

8. Transportation facilities

Item	Unit	Quantity	Unit cost	Total cost
Land cruiser				
Toyota pickup				
Motorcycles				
Bicycle				
Subtotal				

Budget summary

Item	Sub-totals
Personnel cost	
Equipment and supplies	
Stationery	
Travel cost and perdiem	
Fuel & lubricants	
Field offices and laboratories (infrastructure)	
Total	
Contingency (5%)	
Grand Total	

4. Preparation of research proposal cont...

References (Bibliography)

- What is a **citation** and **why are they used**?
- What is **plagiarism**?(And why you should care!)



4. Preparation of research proposal cont...

- An **alphabetical or numerical list** with complete source of relevant information about a given subject
- Whether writing an **essay or project**, or writing an **article** or **book** for publication, you should always quote, **reference**, or **cite**, the source from which any assertions are made or from which factual information or direct quotations come
- **Reference Vs Citation**

4. Preparation of research proposal cont...

- The important reasons for citing are :
 - To **acknowledge** other people's ideas
 - To enable **readers** [and markers] of your work to **check back** to the source material
 - To **demonstrate** that you are including other peoples ideas to illustrate points and support your arguments.
- Hence, this use of the **work of others has to be acknowledged** in the bibliography section

4. Preparation of research proposal cont...

- Failure to credit some one else's work is to *plagiarise... to “take and use (the thoughts, writings, inventions, etc. of another person) as one's own”*.
- Plagiarism is the act of presenting the words, ideas, images, sounds, or the creative expression of others as your own.
- Plagiarism is therefore a form of theft and will be taken seriously in the academic setting.

4. Preparation of research proposal cont...

- How do you reference ?
- There are **three things** to remember when referencing:
 - *The "elements" to include in the citation.*
 - Name of the author
 - Title of the book or article
 - Date of publication
 - Volume (if any) and
 - Name of publisher
 - you should *make a habit of recording full details of* an item at the time you use it.

4. Preparation of research proposal cont...

- **House Style** (of publisher or course of study).
 - Though the elements making up a reference are **fairly standard** you may find **subtle differences** in presenting them on paper
 - **underlining, *highlighting* or using "quotation marks"** are all acceptable alternatives for indicating journal titles.
 - “***Instructions to Authors***” will be given to potential authors by the publisher

4. Preparation of research proposal cont...

- **Choice of Referencing System**
 - There are **three common systems** for referencing: the **Harvard** (*author-date*) system , the **Vancouver** (*numerical*) system and **footnotes system**
 - Each **offers a format for citing references** in the text and then listing those references at the end of the work.

4. Preparation of research proposal cont...

- For **two authors**, **name both of them**: Jones and Johnson (1983)
- With **three or more authors**, use *et al.* (**Meaning "and others"**): Smith *et al.* (1983) or Smith *et al.* (9).
- However, **all authors' names** should be given in the reference list.
- For **two or more articles by the same author** (s) in the **same year** distinguish between these by adding **lower case letters** (a, b,c,d etc): Brown (1983a, 1983b) or smith *et al.* 1983a, 1983b).

4. Preparation of research proposal cont...

- The reference list must include **all published works referred to in the text**
- Each reference to a periodical publication must include in order
 - The **name** (s) of the author (s)
 - The **year** of publication
 - The full **title of the article**
 - The **publication** in which it appears
 - The **volume and inclusive page numbers**

4. Preparation of research proposal cont...

- Reference to a book or bulletin must give
 - The author or authors
 - The year
 - The title
 - The edition if other than the first
 - The publisher
 - The city of publication, and
 - The number of the volume (if two or more).
- If particular pages in a book are cited, mention them in the text (Edson *et al.* 1980, p.152)

4. Preparation of research proposal cont...

- On Ethiopian different views are there: names should be given in full and not be inverted (A.A).
- Arrange the list alphabetically by the names of the first authors and then by the second and third authors as necessary.
- Ethiopian names are alphabetized by the first name.
- Two or more articles by the same author (or authors) are listed chronologically.

4. Preparation of research proposal cont...

- Do not capitalize the titles of articles, bulletins, or books except the first letter of the first word and proper names.
- If you are not sure of the correct abbreviation for a periodical, write it in full
- As examples, a few of the more common types of literature citations are shown below.
- They should be double spaced in your manuscript.

4. Preparation of research proposal cont...

Journal article

- Singh, M.R., Sharma, P.R., and Singh, L.I. 1999. Genetic divergence among rice bean cultivars of Manipur hills. *Indian Journal of Genetics* **59**(2):221-225.
- Frew Mekbib.1997. Farmer participation in common bean genotype evaluation: the case of eastern Ethiopia. *Experimental Agriculture* **33**:399-408.

4. Preparation of research proposal cont...

Books

Single Author

- Mayo, O. 1980. *The Theory of Plant Breeding*. Oxford University Press, New York.
- Mesfin wolde Mariam. 1984. Rural vulnerability to famine in Ethiopia: 1958-1977. Vikas publishing Hous, New Delhi.

Multiple Author

- Gomez, K.A. and A.A. Gomez. 1984. *Statistical Procedures for Agricultural Research*. 2nd ed. John Wiley and Sons., Inc., New York.



4. Preparation of research proposal cont...

Books in subsequent edition

- Allard, R.W.1999. Principle of Plant Breeding,2nd ed. John Wiley and Sons, Inc, New York.



4. Preparation of research proposal cont...

Chapter in a book

- Melaku Worede, Tesfaye Tesema, and Regassa Feyissa 2000. Keeping diversity alive: an Ethiopian perspective. *In: Stephen, B and Brush B. (eds.). Genes in the field; on farm conservation of crop diversity, Lewis Publishers, USA.*

4. Preparation of research proposal cont...

- **Books Edited by single or multiple editors**
 - Harlan, J.R., Wet, J.M.J. and Stemler, A.B.L.(eds).1976.Origins of Africa Plant Domestication. Mouton, The Hague.



4. Preparation of research proposal cont...

- **No Author given**
 - [Anonymous.1954](#). Agriculture of Ethiopia, Vol.1.JATS and IECAMA, Addis Ababa,Ethiopia.

4. Preparation of research proposal cont...

Paper in proceedings

- Amsalu Nebiyu. 2004. Explorations and Collection of Root and Tuber Crops in Southwestern Ethiopia: *Its Implication for Conservation and Research*. In: Proceedings of the 11th annual Conference of the Crop Science Society of Ethiopia, 26-28 April 2004, Addis Ababa, Ethiopia.



4. Preparation of research proposal cont...

- Paper presented at conference but **not yet published**

Weyessa Garedew and Birhanu Tsegaye.2009. Trends of avocado (*Persea americana* M.) production and its constraints in Mana Wereda, Jimma Zone: A potential crop for coffee diversification. Second Ethiopian Horticultural sciences society workshop, Addis Ababa, Ethiopia (**In press**)

4. Preparation of research proposal cont...

EARO/IAR reports

- EARO (Ethiopian Agricultural Research Organization). 1999. National Research Strategy for Pulses. EARO, Addis Ababa, Ethiopia
- IAR (Institute of Agricultural Research). 1995. Jimma Research Center Progress Report for the period 1996. IAR, Jima, Ethiopia.

4. Preparation of research proposal cont...

Thesis or dissertation

- Admasu Tsegaye. 2002. On Indigenous Production, genetic diversity and crop ecology of Enset. [PhD Thesis](#), Wageningen University, The Netherlands.
- Mesfin Abebe. 1975. Ecophysiology of “Noug” (*Guizotia abyssinica* cass). [PhD Dissertation](#), University of California, USA.



4. Preparation of research proposal cont...

- **Internet sources /Websites**
 - Burke,T.E., and Lemon,S.D.1995.Distributing forest planning information
[.www.fao.org/waicent/forestinfo.ht](http://www.fao.org/waicent/forestinfo.ht)



4. Preparation of research proposal cont...

Other references

- Do not put an unpublished work in the reference list unless it has been fully approved and a date set for its publication.
- Unpublished results and other source material should be mentioned in the text within parentheses.
- Unpublished references include personal communications and any other sources of information not usually found or catalogued in libraries.

4. Preparation of research proposal cont...

- And such unpublished references should be placed in the **body of the text, not in the reference list.**
- Use parentheses to enclose the complete name of the author, the year (if available) and appropriate title, location, or other information needed to establish the authenticity of the reference or help the reader locate it.

4. Preparation of research proposal cont...

- Example:
 - (Alemu Gebre Wold, IAR, 1999 pers. Comm.)
 - (Yilma Kebede, IAR, 1986 unpubl. Data)



Typical researcher writing a paper...



5. Preparation of Research Report

- Objective of report writing
- Avenues of communication in science
- Audiences and Intent of a Research Communication
- Structure and part of a research paper(IMRAD form of scientific paper)
- Characteristics of a good scientific paper
- Data presentation
- An introduction to oral presentation of a scientific paper.

5. Preparation of Research Report cont...

- 5.1. Objective
- Research is a process through which development constraints are systematically addressed to find solutions to one or more societal problems.
- Research results have no value unless they are summarized in a form in which others can use them.
- The researcher is obliged to give a detailed account of all his experience pertaining to the research problem.

5. Preparation of Research Report cont...

- Evolves an **outlay of large sum of money**, nobody is expected to do research for its own sake.
- All research work is carried out with some **specific purpose and beneficiaries in mind**.
 - To solve a given problem that a **society is facing**
 - **Broaden the prospect of knowledge** of mankind
- Whatever the purpose may be, the outputs of the work should be **made available for the end users**

5. Preparation of Research Report cont...

- One common question researchers often ask is, 'Why should scientists write research papers?'
- The many reasons include
 - Helping advance knowledge in a particular field,
 - Supporting the progression of a professional career
 - Satisfying the donor who provided the funding for research
 - Becoming famous

5. Preparation of Research Report cont...

- The most important reason to write research papers and reports is to communicate
- Because effective communication is vital for science to progress.
- Before starting to write a scientific paper or report, ask yourself the following questions:

5. Preparation of Research Report cont...

- Has the **research work advanced** enough to be reported?
- Is this to be a **progress report**, a **final report** of the research or a paper for publication?
- Is the **paper or report to be submitted to a donor**, to an institution of higher learning for a degree or as an organizational annual report?



5. Preparation of Research Report cont...

- Will help the researcher to write better theses, dissertation and journal articles as well as periodic reports
 - To strengthen scientific communication capabilities of agricultural research scientists
 - Encourage and promote a culture of scientific publication among researchers.

5. Preparation of Research Report cont...

5.2. Avenues of communication in science

- Many Avenues of communication are open to scientists who want to deliver information on their research and results.
 - Vehicles for addressing scientific and general audiences include:
 - Research communications
 - Extension and popular Research journals
- Communication**

5. Preparation of Research Report cont...

Research communications

- **Research reviews**
- **Conference papers**
- **Theses**
- **Book chapter**
- **Annual reports**
- **Newsletters**
- **Project proposals**
- **Lectures**
- **Meetings with individuals**
- **Leaflets**
- **Posters**

Extension and popular Research journals Communication

- **Extension manuals**
- **News paper reports**
- **Magazine articles**
- **Radio and TV broadcasts**
- **Films and video**
- **Audiovisual shows**
- **Practical demonstrations**
- **Photographs**

5. Preparation of Research Report cont...

- Effective communication depends on delivering the right message in the right way to the right audience.
- Many excellent scientists do not write well because they do not take the time to try to communicate skillfully
- The extension and popular material, on the other hand, is more often produced by extension or media professionals

5. Preparation of Research Report cont...

Research journal

- To publish scientific papers that communicate **new and original information to other scientists**
- The research paper takes a **hypothesis that has been tested by experimental methods to come to conclusions.**
- Are the **most common organs of communication** in science.

5. Preparation of Research Report cont...

- There are two main types of readers of research papers
 - One is the **specialist in the field** who wants to read the entire paper to partake of all its information
 - The other is the **casual reader**, who is interested mainly in the **results**, or perhaps the experimental **methodology** employed, as background to the reader's own work.

5. Preparation of Research Report cont...

Research review

- A review article is like an extended version of the discussion in a research article.
- An essential feature of a review is that the reader is led to the cutting edge of a given area of research

5. Preparation of Research Report cont...

- A good review **gathers together all important work** on a topic, **but it is not simply a catalogue of facts.**
- It **synthesizes work done**; it **analyses** and **interprets** existing facts and theories within a particular field.



5. Preparation of Research Report cont...

Conference paper /proceeding

- A paper delivered orally at a conference is necessarily short.
- It confines itself to a brief presentation of the objectives and the methods of the work and the results, the interpretation of which may be preliminary.
- Its clearly stated points can be brought out in the discussion

5. Preparation of Research Report cont...

Thesis or dissertation

- The telling characteristic of a thesis or dissertation is **its length**.
- A work of this type is the **written evidence of sustained research** done over a considerable period, usually 2-4 years.
- It generally contains **an extensive review of the literature** as well as the results of several experiments, all of which were **aimed at testing a single hypothesis**.

5. Preparation of Research Report cont...

Annual report /progress report

- Describes work completed in any 12-month period.
- The intent is not so much to conclusively prove a hypothesis
- But rather to spell out objectives, describe activities and justify budget expenditure for a piece of research undertaken in the year.

5. Preparation of Research Report cont...

Newsletter

- to disseminate information of interest to its readers quickly and in a readily digestible format.
- Thus the content of most contributions carries little emphasis on justification or methodology.
- Most newsletters address a general readership and should not be used as a substitute for publication of research results in refereed journals

5. Preparation of Research Report cont...

5.3. Audiences and Intent of a Research Communication

- Readers of agricultural and related research fall into different groups.
 - Researchers with in a specific field of research
 - Researchers with a peripheral interest
 - Research managers
 - University teachers
 - Extension agents



5. Preparation of Research Report cont...

- Farmers
- Policymakers
- Donor agents
- Members of government and research communities
- Commercial business people
- Members of government
- Students



5. Preparation of Research Report cont...

- Research communications have **different intents**.
- They take the **same basic information** and treat it in different **ways to convey the same message** to different audiences.
- The technical content of a given message will differ according to the audience (**SeeTable**)



Table 1. Technical content and audience of different types of scientific writing

Avenue	Technical content (1 = high, 6 = low)	Audience
Research papers	1	Researchers with and outside the discipline, university students and lecturers, senior extension workers, research managers
<u>Book chapters</u> •Technical •General	2	Same as research paper
	4 or 5	Technicians, students, extension workers
Research reviews	2 to 4	Researchers outside a discipline, university students and lecturers, extension workers, commercial interests
Theses	1	Researchers within a discipline, university students and lecturers
Conference papers	2 or 3	Researchers within and outside a field, university students and lecturers, research managers
<u>Annual reports</u> •Highlights •Main text	3 or 4	Donors, policymakers, government committees, extension agents, institute directors
	1	Researchers within and outside a field, university students and lecturers, research managers
Newsletters	5 or 6	Researchers within and outside a field, students and lecturers. Extension agents, policymakers, expert farmers

5. Preparation of Research Report cont...

- The way in which the technical content of any publication packaged is crucial to its understanding by an audience.
- If the person reading the material cannot understand it, the effect of the work is lost entirely.



5. Preparation of Research Report cont...

5.4. Characteristics of a good scientific paper

- A good scientific paper should:
 - Present an accurate account of the research investigation
 - Be clearly written and easily understood
 - Follow the particular style of the scientific discipline

5. Preparation of Research Report cont...

- Be free of jargon and local slang
- Have appropriate and adequate illustrative material, all of which should be relevant to the subject of the report
- Not contain any plagiarized material



5. Preparation of Research Report cont...

5.5. Structure and part of a research paper

- Scientific research is an **organized and logical activity**
- Therefore reporting research must also be well **organized and logical**
- In general, a research report or paper is written using the **IMRAD logic**.
- The IMRAD format is a **simple format** universally used in scientific reporting.
- The acronym IMRAD is derived from- **I**ntroduction, **M**aterials and methods, **R**esults **A**nd **D**iscussion

5. Preparation of Research Report cont...

- A typical scientific research paper consists of the following elements, listed here in the order in which they appear in the paper
 - Title
 - Author (s)
 - Postal addresses
 - Abstract
 - Introduction
 - Materials and methods
 - Results
 - Discussion
 - Acknowledgements
 - References

5. Preparation of Research Report cont...

- **Title:** As this is the 'label' of the paper, make it brief and suitable for indexing
- **Author(s):** List the names of the people who have done the work and written the paper
- **Postal addresses:** include full addresses, to enable readers to correspond with the authors
- **Abstract:** Briefly describe the problem and the solution
- **Introduction:** what is the problem? Define your problem and justifications

5. Preparation of Research Report cont...

- **Materials and methods:** How did you study the problem? Enable others to repeat your experiment
- **Results:** what did you find? Present data here
- **Discussion:** what do these findings mean? Discuss your results
- **Acknowledgements:** Give credit or thanks to those who helped substantially
- **References:** List your authority for statements made

5. Preparation of Research Report cont...

5.6. Data presentation

- Data that have been collected and analyzed in a scientific investigation are presented in the results section of a scientific paper.
- These data represent the research findings and may be presented as tables, graphs, figures or photographs

5. Preparation of Research Report cont...

- Tables
 - Good for presenting precise numerical data.
 - The essential feature of good table is its simplicity and clarity
 - There is no much use in including too much data in a single table.
 - Too much data opens for the door for confusion



5. Preparation of Research Report cont...

- All tables including those that appear in the appendix should be **numbered to permit easy identification**
- The word **Table** followed by its number is placed in the first line.
- Every table has **title or heading**
- The **title of each table** must correspond exactly with that given in the **List of Tables**.

5. Preparation of Research Report cont...

- No table, which is **not referred** to in the text, must be included in the body of the paper.
- Generally **a table consists** of most or all of the following elements:
 - Number and title
 - Column headings
 - Row headings
 - Field, or body of the table
 - Footnotes

5. Preparation of Research Report cont...

Table 1. Rice production in East Africa

title

Column headings

Row headings or stub

Country	<i>title</i>	<i>title</i>	Production ^b
	<i>title</i>	<i>title</i>	1988-90
Kenya	<i>title</i>	<i>title</i>	54
Madagascar	<i>title</i>	<i>title</i>	2310
Malawi	<i>title</i>	<i>title</i>	40
Somalia	<i>title</i>	<i>title</i>	16
Tanzania	<i>title</i>	<i>title</i>	692
Uganda	<i>title</i>	<i>title</i>	20
Eastern Africa	<i>title</i>	<i>title</i>	3137

Footnotes

Source: (WARDA, 1992)

^a growth rate %

^b production '000 t

Body or field

5. Preparation of Research Report cont...

- Chart and Graphs /figures
 - Pictorial presentation of data
 - Graphs are best for illustrating trends and relationships among sets of variables.
 - Figures are devices used for the purpose of presenting data clearly and concisely.
 - Used when relationship that the reader might not grasp when examining complex statistical data presented in tables.

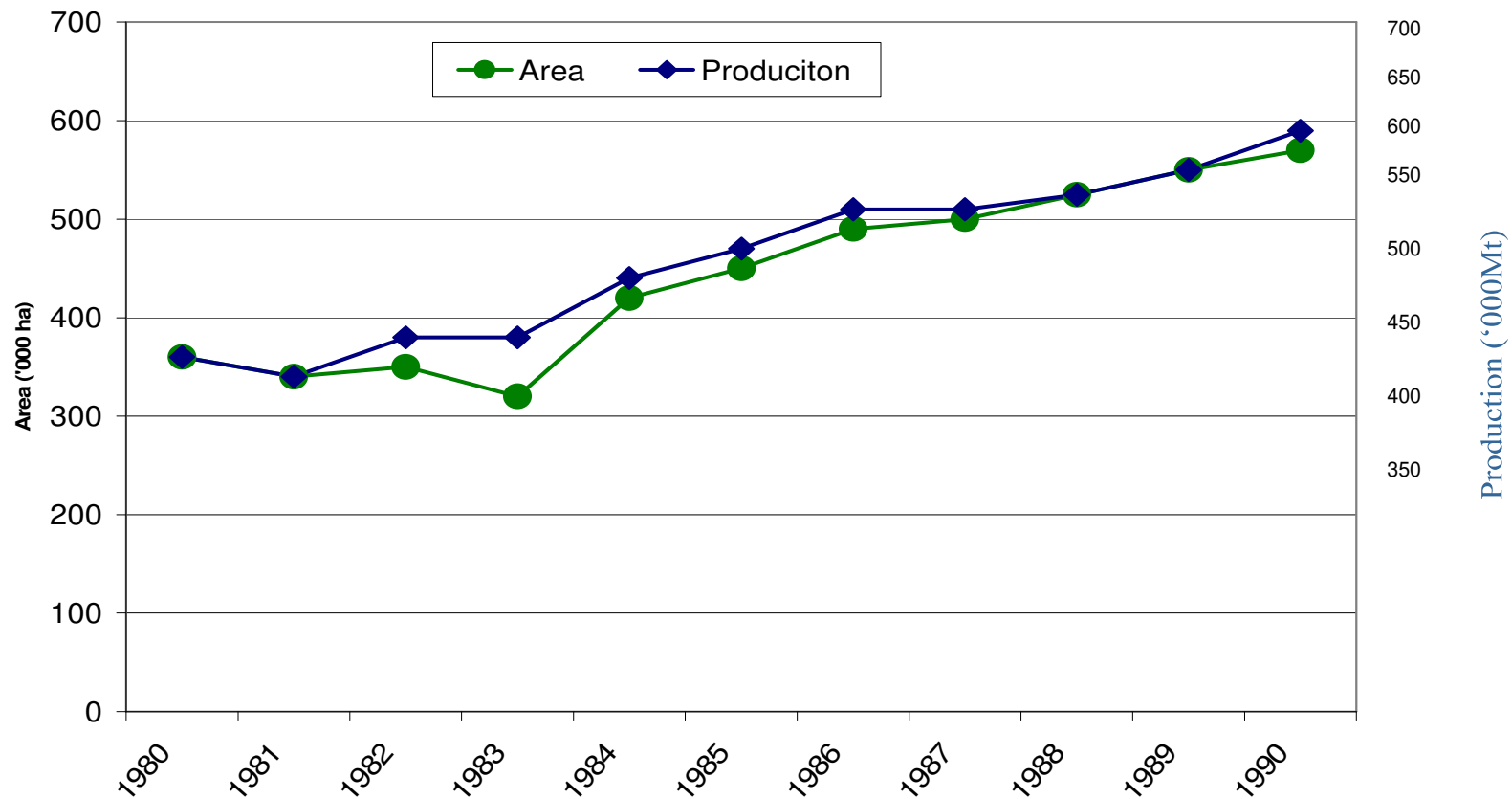
5. Preparation of Research Report cont...

- Graphs should be simple and clear
- Contain relevant legends, independent of the text, organized in the way they present data and not crowded
- They should be used only if they bring significant ideas or relationship in to a sharp focus for the reader more quickly and effectively

5. Preparation of Research Report cont

- Examine the data carefully and decide what should be illustrated and which type of illustration best suits the data
- Choose a line graph if you wish to demonstrate the relationship between two data sets, or a dynamic comparison over time.

5. Preparation of Research Report cont



5. Preparation of Research Report cont

- Use a **pie chart** to **compare sizes** or proportions of components of a system

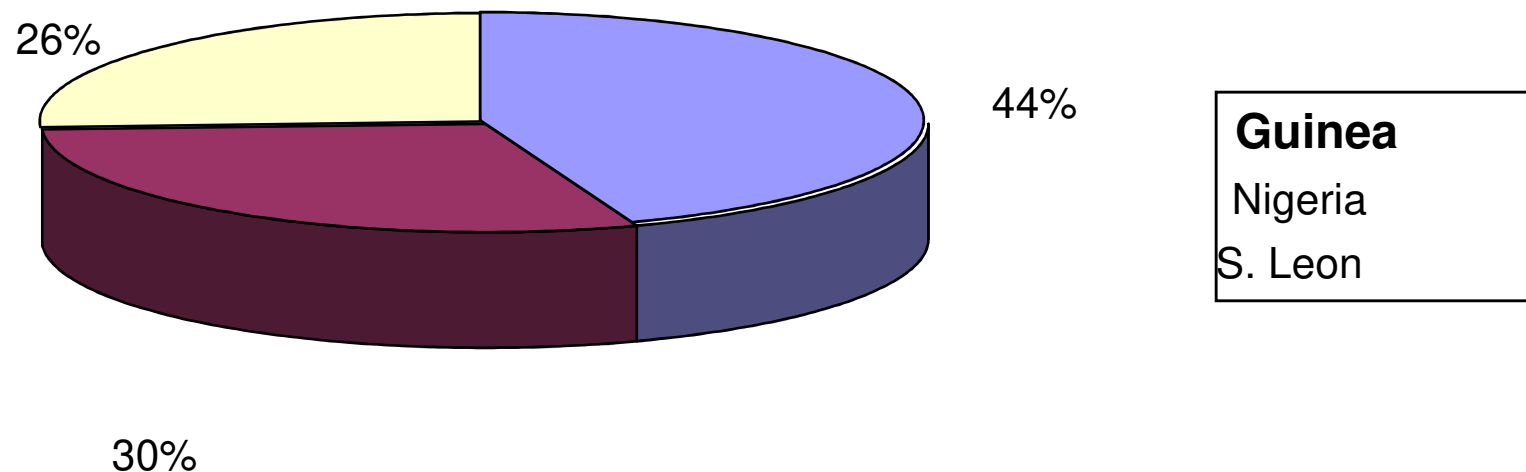
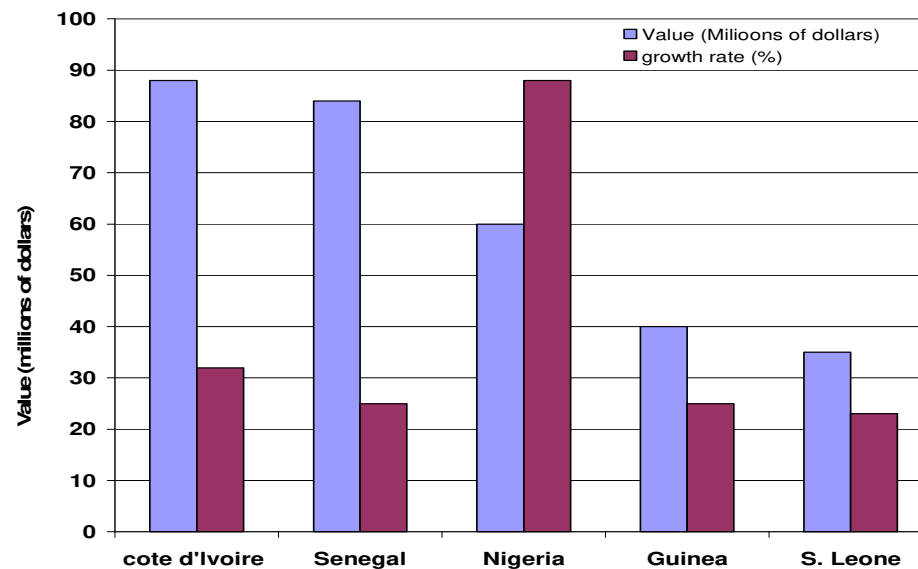


Figure 2. Total rice consumption in Africa, average 1988-90. [different forms of pie charts can be used to show proportions]

5. Preparation of Research Report cont

- Use **histograms** to show **frequency distributions** of observations for each class of variable such as weights or crop yields



5. Preparation of Research Report cont

- Use a **thematic map** to show the pattern of an experimental layout, or a geographic map to show the distribution on insect pests, for example, over a country or region.
- Use **photographs** to show the actual appearance of a **specimen or something else** you wish to describe.



5. Preparation of Research Report cont

- Figures and photos give vivid evidence of research findings
- A graph or a figure tells its own story
- Do not repeat everything that your audience can see from the illustration just as if it were not there.
- But it is good to draw attention to important points that the graph illustrates.
- The two elements, text and figure, should complement each other.

5. Preparation of Research Report cont...

5.7. Oral presentation of research results

- There are **major differences between** a scientific article written for reading and one written to be read at a scientific meeting
 - has the **luxury of lingering over the text to absorb** the material, even going back to a previous paragraph
 - the listener may have **only one chance to** understand the material that is being presented

5. Preparation of Research Report cont...

- Speaker needs to **present each idea clearly**-and perhaps even repeat key points.
- In most scientific meetings, each speaker (except invited keynote speakers) is **normally allowed only about 15 minutes** (1 min for introduction and 2 min for conclusion)
- Scientists wishing to present their work at meetings should take the **time to prepare adequately**.

5. Preparation of Research Report cont...

- Speaking at a normal speed
- Avoid citing references and acknowledgements
- Prepare or select your illustrative material such as slides or overhead transparencies very carefully.
- Do not crowd too much data into the visual materials.

5. Preparation of Research Report cont...

- Rehearse with a colleague so that you know your presentation will fit into the allotted time
- Put your illustrations in the order you will use them and number them accordingly.
- If you are using slides, mark them so you know which way they go into the projector tray.

5. Preparation of Research Report cont...

- Speak clearly to your audience, not at your audience
- Present a single idea or fact in a variety of ways by varying your construction and voice.
- Be relaxed and confident, look at the audience, not at the floor or out the window, no matter how shy you may be.



5. Preparation of Research Report cont...

- Allocate your presentation time-Introduction 35%, Methods 40%, and results and Discussion 25%.
- At the end of your presentation, do not forget to thank the chair and the audience for their attention



The end of the class
Thank you