

Research Methods in Horticulture

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Knowledge

Knowledge is a familiarity with someone or something, which can include information, facts, descriptions or skills acquired through experience or education.

It can refer to the theoretical or practical understanding of a subject.

Research

The word research is derived from the Middle French "**recherche**", which means **“to go about seeking”**.

"In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge" (Martin Shuttleworth).

"Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue".

It consists of three steps: 1) Pose a question, 2) collect data to answer the question, 3) and present an answer to the question.

Research

“Research can be defined as the search for knowledge or any systematic investigation, to establish novel facts, solve new or existing problems, prove new ideas, or develop new theories, usually using a scientific method”

Scientific Research

- Scientific research relies on the application of the scientific method.
- This research provides scientific information and theories for the explanation of the nature and the properties of the world around us.
- It makes practical applications possible.
- Scientific research is funded by public authorities, by charitable organizations and by private groups, including many companies.
- Scientific research can be subdivided into different classifications according to their academic and application disciplines.

1) Pure Research, Basic Research, or Fundamental Research

- It is research carried out to increase understanding of fundamental principles. Many times the end results have no direct or immediate commercial benefits. Pure research can be thought of as arising out of curiosity.
- However, in the long term it is the basis for many commercial products and applied research. Pure research is mainly carried out by universities.

2) Applied Research

- It is a form of systematic inquiry involving the practical application of science.
- Applied research deals with solving practical problems and generally employs empirical methodologies.

Why Conduct Research?

- **To better understand various phenomena**
- **To add information to the knowledge pool on a specific subject**
- **To disprove fraudulent claims**
- **To improve education, agriculture or your discipline**
- **To improve the ranking of the institutions**
- **To obtain grants**
- **To get promotions**

Major Limitations in Conducting Research

- **Time**
- **Costs**
- **Energy**
- **Access to resources/Availability of infrastructure**
- **Approval by authorities**
- **Ethical concerns**
- **Expertise**

Steps in Conducting Research

The major steps in conducting research are

- Identification of research problem/writing a hypothesis**
- Literature review/finding background information**
- Specifying the purpose of research**
- Designing the study, collection of data**
- Analyzing and interpreting the data**
- Reporting and evaluating research**

Identification of research problem

The process starts by clearly identifying the problem you want to study and considering what possible methods will affect a solution.

Then you choose the method which may be used, and formulate a hypothesis to predict the outcomes.

Suggestions for finding a topic

- Discuss your ideas with your course instructor.
- Discuss your ideas with a reference librarian.
- Look over the index and the article titles in a specialized encyclopedia that covers a relevant subject area or discipline.

Identifying a topic

For example, you may want to improve student essays, but you don't believe that teacher feedback is enough. You hypothesize that some possible methods for writing improvement include **peer workshopping**, or **reading more example essays**. Favoring the former, your experiment would try to determine if peer workshopping improves writing in high school seniors.

You state your hypothesis: peer workshopping prior to turning in a final draft will improve the quality of the student's essay.

Testing the topic

- Before you commit to a specific topic for your research, do a scan to make sure that your topic isn't completely covered in another paper; at the same time ensure that there is enough information available to complete the project. If in doubt, ask your professor.
- If you are finding too much information and too many sources, narrow your topic.
- Finding too little information may indicate that you need to broaden your topic by using a more general term or terms in your search.

Writing Hypothesis and Identifying Research Problem

Experiment

- ✓ **A set of actions and observations**
- ✓ **Also we can say planned and systematic inquiry**
- ✓ **Used to verify or nullify a hypothesis, research, or causal relationship between variables**

Why Develop a Problem Statement

- ✓ **Clarify what is to be determined or solved**
- ✓ **Restrict the scope of the study to a specific question**

Good Research Problems

- ✓ Make a contribution to a body of a knowledge.**
- ✓ Lead to a new research problem and further research**
- ✓ Opens new avenues for research**
- ✓ Statement of relationship between variables**

Possible Sources

- ✓ **Experiences**
- ✓ **Deductions from theory**
- ✓ **Related literature**
- ✓ **Testing the effectiveness of an innovation**

Selecting a Research Problem

- ✓ **Select a general area**
- ✓ **Read the related literature**
- ✓ **Look for evidences**
- ✓ **Ask for help**
- ✓ **Look at your own work**
- ✓ **Ask someone to give you a researchable problem**

Selecting a Research Problem

- ✓ **High degree of Interest**
- ✓ **Within your capabilities and resources**
- ✓ **Required info and data for research are available**

Correctly Stated Problem

- ✓ Identifies the variables being investigated**
- ✓ Indicates some kinds of relationship among the variables**
- ✓ Identifies the target population**
- ✓ Stated as simple as possible**

Problem Statement

- ✓ Among the large potato fields with below average yield, is there a difference in yield between those fields which received any specific treatment individually and those which do not received specific treatment**

Hypothesis

- ✓ **Intellectual guess**
- ✓ **Tentative statement proposes explanation to some event or problem**
- ✓ **Testable statement**
- ✓ **May Include Prediction**

A Good Hypothesis

- ✓ **Has explanatory power**
- ✓ **States the expected relationship between variables**
 - ⇒ **Identifies variables**
 - ⇒ **Identifies independent and dependent variables**
 - ⇒ **Identifies direction of relationship**

A Good Hypothesis

✓ Testable

⇒ Can make necessary observations

⇒ Variables are measurable

✓ Consistent with existing knowledge

⇒ Theory

⇒ Logic

⇒ Related research

✓ Stated simply and concisely

Null Hypothesis

- ✓ **A statement of no relationship**
- ✓ **Used in statistical analysis**
- ✓ **Possibilities:**
 - ⇒ **No difference**
 - ⇒ **Different from research hypothesis**

Example

- ✓ H_0 : The dropout rate for students enrolled in the UCA was no different than that of students enrolled in Food Sc. in the main campus of UOS

Research Hypothesis

✓ It is a tentative statement suggested as a solution to some problem. It may be the statement about expected relationship or expected difference between two or more variables in the study

⇒ Example:

⇒ H_1 : The dropout rate for students enrolled in the UCA was lower than that of students enrolled in Food Sc. in the main campus of UOS

⇒ This is directional H_1

Specific Objective & Research Questions

- ✓ **It is statement of what the researcher is trying to accomplish, and it is appropriate only for descriptive studies**
- ✓ **The alternate of research objective is research question, which highlights the specific issue in the study**

Important Note

- ✓ **Any lab procedure, followed without a hypothesis is really not an experiment. It is just an exercise or demonstration of what is already known**

Basic Terms

❖ Factor

The independent experimental variables are called factors.

❖ Level

A particular outcome of the independent variable is called level of the factor.

❖ Treatment

A *treatment* is a procedure whose effect on the experimental material is to be measured. OR

Basic Terms

❖ Treatment

A treatment is a specific combination of the level of different factors

❖ **Example: Say an experiment to evaluate (24 treatments)**

i. 8 varieties under each of 3 different level of fertility.

ii. 4 varieties at 3 level of spacing for 2 planting dates.

Basic Terms

❖ Experimental Unit (EU)

An *Experimental Unit (EU)* is the piece of experimental material to which one trial of a single experiment is applied.

❖ Sampling Unit

A sampling unit is that fraction of the experimental unit on which the effect of the treatment is measured.

Basic Terms

❖ Block

A group of homogenous experimental units is called a *block*.

❖ Random

If treatments are assigned to a set of units in such a way that every unit is equally likely to receive any treatment, the assignment is said to be *random*.

❖ Replicated

When a treatment appears more than once in an experiment, the treatment is said to be *replicated*.

Basic Terms

❖ Experimental Error

Experimental error is the variation among experimental units, which have been treated alike.

Variation comes from two main sources. Firstly there is the inherent variability that exists in the experimental material to which treatments are applied. Second, there is the variation, which results from any lack in uniformity in the physical conduct of the experiment.

Basic Terms

❖ Response

Any quantitative observation obtained from an experimental unit after the application of a treatment is called response.

❖ Layout

Actual placement of treatments on the experimental units.

One of the major goals of a sound research procedure is to reduce experimental error and thus increase precision.

Basic Terms

- ❖ **Experimental error can be reduced in the following ways:**
 - ❑ **Blocking**
 - ❑ **Increase the number of replicates**
 - ❑ **Proper use of efficient statistical design**