

## I. GENERAL POLICIES

### 1.1. Rights and Responsibilities

Master and doctoral degrees awarded by the University of Agriculture, Peshawar, require completion of thesis and dissertation<sup>1</sup>. In accordance with policy established by the academic council, the Director Advanced Studies and Research (DASAR) is responsible for overseeing that the requirements for the advanced degrees are met. DASAR and its office will also be responsible that standards necessary for approved organization, format of the exposition as a whole and its chapters, and processing, binding, and storing of thesis and dissertation are also met. It is also the responsibility of chairman advisory committee, members of the advisory committee, the members of board of studies, and other officials who affix their signature on the approval page to see that the style and format is followed. Information in this booklet will serve to guide both master and doctoral degrees candidates in the preparation of copies of thesis and dissertations that are to be submitted to various departments. The DASAR will refuse to accept any thesis and dissertation that fail to meet these standards.

It is the student's responsibility to ensure both the deadlines and procedures described below are met and that all necessary documents are complete and in full compliance with departmental and University requirements. It is the responsibility of the student, adviser, and advisory

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<sup>1</sup> Though thesis and dissertation are used interchangeability and mean the same in some countries and universities, in other countries and universities they are distinguished. We in this manual use thesis for the scholarly writing based on research for the award of MSc. degree and dissertation as the scholarly writing based on research for the award of PhD degree.

committee that synopsis is approved preferably before starting the research for thesis and dissertation.

It is the responsibility of the students, adviser, advisory committee, research supervisor (in case of off-campus research), and chairman of department to check the research/experiments in field and check the accuracy of data recorded

### **1.2. Enrollment**

All graduate students must be enrolled in the university while working on their thesis<sup>2</sup>. They must be enrolled during the semester they defend the thesis even though their final year has been completed. They should enroll in a thesis category.

## **II. PHYSICAL SPECIFICATIONS AND GENERAL GUIDELINES**

Virtually all thesis submitted are now being written and produced with the assistance of word processors and computers. Preparing a thesis with a word processor offers many advantages. It also may raise problems that normally are not encountered when a final or earlier versions of thesis is typed using a typewriter. Whether prepared with or without word processors or computers, all thesis must follow the guidelines and requirements outlined in this booklet. The limitations of software or hardware, limited knowledge of the capabilities of software or hardware,

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<sup>2</sup> Though the word thesis and dissertation and their plurals refer to reports for the awards of advanced degrees as given in footnote 1, thesis and dissertation is also used to mean both in the detailed information about the style unless specifically mentioned for specified degree because each time writing both the words look awkward and take more space.

and ignorance of approved format and style do not absolve the candidate from the responsibility of meeting the guidelines. The general text of the manuscript must have double spacing. Tables, long quotations, footnotes, bibliographies and captions may be single spaced. Only single sided copies will be accepted. Strike-overs and chemical corrections such as Sno-Pake, Ko-Rec-Type or Liquid Paper are not acceptable on the final copies.

### **2.1. Paper**

White paper, **A4** size must be used and both original and reproduced copies should be on **65-70** gram paper. Standard photo-duplication paper is generally acceptable for the submitted final copies. Onionskin and erasable papers are not accepted.

### **2.2. Margins**

To allow for binding and trimming the following margins must be maintained: **3.5 cm** on the left margin and **2.5 cm** on the other three margins (right, top and bottom) must be used. Page numbers and other elements separated from the main text of a page must also fall within these margins. Somewhat larger margins should be set to allow for error and for the enlargement produced by some forms of reproduction.

Most word processors i.e. MS-Office can justify the right and left margin. If right justification is used unhyphenated words may not be accommodated in the same line and a large amount of space may be created. Excessive dead space may not be acceptable.

All materials must have adequate margins. Sheets larger than the

standard paper size must be folded in an appropriate manner. Dittoes are not accepted. Mimeographed forms or questionnaires if legible and clean but not meeting the margin requirements, may be folded and inserted in a white or manila envelope **6½ x 9½** maximum and mounted on a regular size page. Each page enclosed in this manner must be included in the pagination of the entire thesis. The page on which the envelope is mounted should have inclusive page numbers when needed, whereas other pages have single page numbers.

### **2.3. Pagination**

Page numbers are to appear in the upper **right hand corner** of the page and at least two single spaces above the nearest line of text and within the margin boundaries. The page number for the first page of chapter should appear at the **bottom** of the page. Every page must be numbered and page numbers should appear in the same location on the page except first page of the chapters of the body of the thesis.

### **2.4. Preliminary Pages**

Numbers must not be typed on the Title Page or the Thesis Approval pages. The next page is numbered "**iv-starts from abstract**" and all other pages followed the abstract of preliminary material are numbered consecutively in lower case Roman numerals.

### **2.5. Text and Reference Matter**

Use Arabic numerals beginning with "**1 starts from chapter-I i.e. Introduction**" on the first page of the text and continue throughout the rest of the thesis including the reference matter. Every page must be

numbered consecutively including pages containing non-textual materials such as illustrations, plates, figures, etc.

The insertion of manually prepared tables, figures and illustrations and other last minute changes may make it difficult to accomplish the required sequential pagination. In such cases, page numbers may be added manually using a typewriter after the entire thesis has been assembled provided that all page numbers are of the same type face and type size.

### **III. SPECIFIC GUIDELINES FOR THE PARTS OF THE THESIS**

The detailed organization of a thesis may vary from subject to subject, and from department to department. There are, however, two general rules which should govern format preparation in any thesis:

- Keep the format as simple as possible. Complexity breeds confusion.
- The mode of presentation should be consistent throughout the thesis.

Keeping these two points in mind can both simplify the task of organizing the thesis and minimize the possibility of it being rejected by departmental format checkers or the office of DASAR.

#### **The thesis has three main parts or divisions:**

- Preliminary pages
- The text (main body)
- The appendix

Some sections within the preliminary pages and the appendix are optional, but the order of items within the thesis, regardless of what parts may be left out, is as follows:

## A-PRELIMINARY PAGES

- Blank page (optional)
- Title page (unnumbered). See pages 7, 24 & 25
- Thesis approval pages (unnumbered). See pages 7, 26-28
- Examiner approval page for master students. See pages 8, 28
- Vita (optional).
- Abstract (first numbered preliminary page is **iv**) See pages 8 & 29
- Dedication (optional). See page 8 & 30
- Acknowledgements (optional). See pages 8 & 31
- Table of Contents. See pages 9 & 32
- List of Tables (optional). See pages 9 & 33
- List of Figures & Illustrations (optional) See pages 9 & 34
- List of Symbols (optional) See pages 10 & 35
- List Abbreviations (optional) See pages 10 & 36

## B-Text (Main Body)

1. Introduction (starts from page 1). Chapter-I
2. Review of Literature. Chapter-II
3. Methods and Materials. Chapter-III
4. Results. Chapter-IV
5. Discussion. Chapter-V
6. Summary, Conclusions and Recommendations. Chapter-VI
7. Literature Cited. Chapter-VII

## Appendix

Appendix-I (Anova Tables) & Appendix-II (Replicated Data).

## DESCRIPTION OF THE PRELIMINARY PAGES

### 3.1. Title Page

The title page should have title, candidate name, nature of the report, name of the degree, insignia of the university, names of the department, faculty and university, and month and year defended. The title should be brief but should show the nature of the research reported. The candidate's full name must agree with **official records (registration number)** in the University of Agriculture Peshawar. The month and year when the thesis was defended in the Board of Study should be listed on the bottom of the title page. Formatting of the title page, which includes spacing and the use of capital and small letters, must be exactly as in the sample title page shown on **page 24 (PhD) and 25 (Master)**.

### 3.2. Thesis Approval Page

This page should have title of the work at the top, the title should be identical to that on the title page. The page must show the candidate's full name as shown on his/her official graduate record. The name of the degree to be conferred and the specific field of study should be written out in full, e.g. Master of Science (Hons) and PhD in (subject e.g. Agronomy, Plant Breeding and Genetics etc.). This page should have signatures of the supervisory committee, Chairman of the department, convener of the board of studies, Dean of faculty, and DASAR in original.

### **Examiner approval page For Master student only.**

This page bears the signature of external and internal examiners as a proof of approval and final viva exam by the external examiner and is inserted after Viva exam before final permanent binding of the thesis. This page should also have title and student name at the top.

### **3.3. Abstract**

An abstract should immediately follow the thesis approval page or examiner approval page and must be numbered accordingly, i.e. **page iii or iv**. It should contain approximately 200 words, be single spaced, and briefly discuss the **rationale, objective, methodology, results (findings) and conclusion** (See page 29).

### **3.4. Dedication (Optional)**

Dedication should appear on a separate page; the spacing should be as the body of the thesis (See page 30).

### **3.5. Acknowledgements (Optional)**

Though in The University of Agriculture Peshawar, generally, the students acknowledge help of supervisor, Chairman, Dean of faculty, members of the supervisory committee, friends etc.; however, it is their duty to provide reasonable help which should not be acknowledged. However, it is logical to acknowledge those who helped you beyond their duty; organizations or persons who gave financial support for research, who provided of equipments, from whom you borrowed equipment, who provided material: who helped you and it was not their duty like help in research method, analysis, etc. Help of friends should not be acknowledged (See page 31).



### **3.6. Table of Contents**

Each thesis must have a **Table of Contents** that shows all major sections, including Literature Cited and Appendix. The amount of detail used in listing, sub-sections within chapters is left to the discretion of the author in consultation with the advisor. The wording and presentation of all entries (capitalization, fonts, characters etc.) must be identical to the body of the thesis. All entries must have a corresponding page number with leader dots or dashes connecting the entry to the page number. No section preceding the Table of Contents, nor the Table of Contents itself, may be listed in the Table of Contents. The preliminary sections which follow the Table of Contents may be included ([See page 32](#)). The table of content may be simple listing of some preliminaries, chapter headings and appendix or detailed table of content showing major sections in the chapters.

### **3.7. List of Tables**

For the convenience of the reader, a **List of Tables** may be included. It should be separate from, and immediately follow the **Table of Contents**. Each entry should have the same number and title as that which accompanies the corresponding table in the body of the thesis. Exceptionally long captions may be abbreviated to the extent of using only the first full sentence. The format of the List of Tables should follow that of the Table of Contents ([See page 33](#)).

### **3.8. List of Figures/Illustrations (Optional)**

These are all governed by the same rules as the list of Tables and immediately follow the list of **Tables** ([See page 34](#)).

### **3.9. List of Symbols (Optional)**

For sample list of symbols please [see page 35](#), follow the list of **figures**.

### **3.10. List of Abbreviations (Optional)**

For sample list of abbreviations please [see page 36](#), follow the list of symbols if any.

## **B-THE TEXT**

The major body of a thesis consists of:

- Introduction
- Review of Literature
- Methods and Materials
- Results
- Discussion
- Summary, Conclusions and Recommendations.
- Literature Cited

### **3.11. Introduction**

The body of the thesis starts with the Introduction (**Page 1**). It presents the specific problem, purpose, study, and the objectives of the study. **The hypothesis are stated and how they relate to the problems.** The theoretical implications are discussed and how the present study adds to the foundation of knowledge. Throughout the thesis, care should be taken that the author's personal opinions are not interjected. Writing in the first person should be avoided.

### **3.12. Review of Literature**

This indicates the historical background for the study and as a result of this section gaps should be identified of which the present study helps to fill. A logical continuity between the previous and present work should be maintained. Do not report each study separately but synthesize findings and make one analysis. If a number of previous studies have similar results, cite all studies and report the results at once. Logical order should be followed and not alphabetical or chronological as one. The review should be relevant to the research conducted and presented in the exposition; avoid reviewing literature on crops other than the one you included in the research/experiment and on data you did not record/reported. Name (s) of author and year should be used for citing works in this chapter. For single author write as Amanullah (2015) or (Amanullah, 2015); for two authors (Amanullah and Stewart, 2015) or Amanullah and Stewart (2015), and for three or more authors as Amanullah et al. (2010) or (Amanullah et al., 2010). All the citation in the whole text must be reported in [Literature Cited \(Chapter-VII\)](#).

### **3.13. Materials and Methods**

This chapter presents a detailed description of the materials used, and the process and procedures of the research. It must include the design of the experiment, description of the population, treatments details, and sampling procedures. Though decisions about the research/experimental design and outline for analysis of data is made at initial stages of planning thesis research, it is important that appropriate experimental design used for the research and experimentation and appropriate statistical analysis especially proper mean comparison procedure used to achieve the

objectives -- must be mentioned; the methods of data collection must be presented and how the data was treated.. In some cases the word “Material” is not applicable, and thus the chapter heading may be “Methodology”. The presentation in this chapter must have enough details so that another person should be able to read this chapter and duplicate the research.

### **3.14. Results**

Summarizes the data collected and the statistical treatment. The chapter should follow a logical sequence and each objective or hypothesis should be treated. All the results should be reported; significant and not significant positive or negative. Report the data in sufficient detail to justify conclusions. All the data proposed to be recorded in the synopsis must be reported in this chapter. The discussion of implications is not appropriate here. Generally, the data will be presented in tables and charts; data presented in table must not be presented in charts/figures as it is duplication. Bar graph should be used for presenting the results of levels of qualitative factor and line graph should be used to present results of quantitative factors. It is better to present statistically significant interaction graphically: For presenting significant interaction in case of factorial use appropriate line graphs, bar graphs or response surfaces. . The information in the tables should not merely be repeated in the body, an analysis of the data should also be presented.

### **3.15. Discussion**

Give the why's of the results. Relate your results to previous findings and how they support or negate previous findings and why. It is better to relate different types of data with each other and extract meaningful important findings.

### **3.16. Summary**

Provides an opportunity to summarize the research and literature, and interpret the implications of the results. The conclusions and recommendations reached should be based on the research findings and not the writer's opinions. Although the detailed organization of the text will vary from subject to subject, the mode of presentation must be consistent throughout. Chapters normally begin with a new page. Only major divisions may begin with a new page and every effort should be made to avoid having partially filled pages except at the end of a chapter. Whenever the heading of a section or sub-section appears near the bottom of a page, it must be followed by at least one line of text, or the heading should be forced to the top of the next page. Presentation of subsequent sub-sections within a chapter must be continuous. Partially filled pages of text are acceptable only at the end of a chapter or on non-textual pages such as those presenting tables and illustrations.

### **3.17. Conclusions and Recommendations**

Conclusions is the comprehensive summary of the findings must be written at the end of **SUMMARY (Chapter-VI)**. Conclusions ends with a statement which will lead to the recommendations.

### **3.18. Illustrative Materials**

In most cases, the body of the thesis will include certain materials other than ordinary text, e.g. illustrations, formulas, footnotes, etc. In such cases the following guidelines should be observed. Illustrations may be inserted wherever the author feels appropriate, but as a general rule, should appear as near as possible to, the part of the text relating to them.

Sometimes, illustrations cannot be inserted easily into the body of the thesis, without involving the breaking of a paragraph. Possible solutions to this problem include: inserting the illustration at the end of the paragraph; on a separate, non-textual page that immediately follows the page of text on which the illustration was first mentioned; having materials grouped together at the end of the chapter. In any event, all illustrations should be numbered consecutively throughout the entire thesis. Illustrations running longer than one page such as a Table may be continued on one or more pages. In such cases all subsequent pages of the illustration must include the illustration number and the notation that it is continued.

#### **Tables**

Tables are effective ways of presenting quantitative data. They should be self-explanatory and stand alone. Pages 30-32 show examples of different kinds of tables as they appear in thesis. When referring to a table in text, refer to it by its number, e.g. the grain yield data are shown in **Table 1** (see **page 37**). The title of the table should give full details; units must be given.

## Figures

Illustrations, not tables, are usually called figures. They include photographs, graphs or charts. The number and title of a figure is shown at the bottom of the figure rather than at the top. Non-professional lettering is not acceptable for figures. Simple type face is preferred (see page 40).

## Quotations

Any material that is duplicated from another source must be given appropriate credit. In the text it should be enclosed with double quotation marks. Long quotations must be indented from both sides.

## Formulas

Mathematical and chemical formulas may be printed or neatly hand lettered. Complex mathematical formulas of two or more lines should not be included in text lines but should be placed in the proper position in the center of the page between lines of text. The lines in structural chemical formulas and hand letter mathematical formulas must be drawn with an ink that will allow the production of clear photocopies. For example:



Equations in a text should not project above or below the lines. Those that cannot be displayed on a line of text should have a double space above and below them. Equations can be drawn using **MS-Word**.

## Statistics in Text

When using a statistical term in narrative, use the term not the symbol.

Use the symbol for percent only if it is preceded by a number.

Examples: It was found that 97% of the plants. Fifty seven per cent of the population.

## Citations

It is recommended that the author's surname and date of publication method of citation be used. The surname and year of publication are inserted in the text at the appropriate point.

**Examples: Single author: Amanullah (2016)** reported that application of nitrogen in splits increased grower's income under semiarid condition. OR Application of nitrogen in splits increased grower's income under semiarid condition (**Amanullah, 2016**). **Two authors: Amanullah and Inamullah (2016)** reported that application of 120 kg P ha<sup>-1</sup> and 15 kg Zn ha<sup>-1</sup> increased harvest index in rice hybrid. OR application of 120 kg P ha<sup>-1</sup> and 15 kg Zn ha<sup>-1</sup> increased harvest index in rice hybrid (**Amanullah and Inamullah, 2016**). When there are **more than two authors** then the first author should be followed by "et al." i.e. Amanullah et al. (**2016**) concluded that under dryland condition, application of 90 kg P ha<sup>-1</sup> and deep tillage (45 cm) was found better for improving growth, yield and yield components of mungbean **OR** Application of 90 kg P ha<sup>-1</sup> and deep tillage (45 cm) was found better for improving growth, yield and yield components of mungbean under dryland condition (Amanullah et al., **2016**).



### **3.19. Literature Cited**

Each thesis must have a list of references entitled "**Literature Cited**" which cites all books, articles, and any other sources of material related to the thesis research (**cited in the text**). Citations must be in alphabetical order beginning with the author's surname. It is customary for this section to be placed at the end of the thesis. The identified literature only cites references used in the text. Other documents should not be listed. Each entry usually contains the author name /author's names, date of publication, title, journal/book name, volume, issue, and page number.

Regarding names and family names in Pakistan and some other countries, use full name if breaking it into so the called family name and given name create problems. Examples will clarify the point: write in full the name Hidayatullah as breaking it to copy the style of other countries like "Ullah, H." or "H. Ullah" is a sin (*astaghferullah*) and incorrect as no boy will call him "ullah". The same is true for Abdullah, Abdur Rahman, Abdurrahim, Amanullah, Hidayatur Rahman, Hidayat ur Rahman, Abdurrab, Abdul Rab, and others. Some persons use tribe name as family name, which should be discouraged, because there are thousands of persons in a tribe.

The publishing data for a journal article include name of the journal, its volume, number if any and the pages for article. For the book the publishing data is publisher name, city and country where the book is published. The Literature Cited section (**Chapter-VII**) lists only the literature cited in the thesis/dissertation.

### **3.20. Journals or Periodicals**

Give surname and initials of all authors. Use commas to separate surnames and initials. When there are two or more authors use "and" before the name of the last author. A period will follow authors. For the first author, the family name should be followed by the initial. For subsequent authors give initial followed by the family name. Use the name of the organization as the author where the name of the author is not given. Give the year the article was published. If a periodical, give month and date of following year. Finish with a period. Capitalize only the first name of the title and subtitle and finish with a period. Give the name of the journal in accordance with the recommendation in the American National Standards for Abbreviations. Give inclusive page numbers and finish with a period.

Amanullah, L.K. Almas and P. Shah. 2010. Timing and rate of nitrogen application influence profitability of maize planted at low and high densities in Northwest Pakistan. *Agron. J.* 102(2): 575-579.

### **3.21. Books**

For author and date of publication refer to section on Journals. If the book is edited, place "ed" or "eds" in parenthesis after the name of the last editor. Capitalize only the first word of the title and the subtitle. If there are more than one edition (ed) or volume (vol), they should be included in parenthesis. Give the publisher, followed by a colon, and the name of the city. End with a period.

Steel, R.G.D, J.H. Torrie and D. Dickey. 1996. Principles and Procedures of Statistics. McGraw-Hill, New York.

When the reference is from a chapter of an edited book, it is treated the same as a journal article with the book title in *Italics*. Do not underline the chapter title. At the end of the chapter title, the book editor (s) will appear as in M. Larramendy and S. Soloneski (eds):

Amanullah and S. Khalid. 2016. Integrated use of phosphorus, animal manures and biofertilizers improve maize productivity under semiarid condition. In: M. Larramendy and S. Soloneski (eds), *Organic Fertilizers-From Basic Concepts to Applied Outcomes*. InTech, Croatia.

### **3.22. Research Reports**

For author and date of publication refer to section on Journals. The title should be followed by the report number in parenthesis (no. 81-231). The exact name as it appears on the publication of the agency should then follow.

### **3.23. Presented Papers**

The reference should be the same as a journal article except the meeting should be listed in place of the journal title. (Presented at -----).

Amanullah. 2016. Global Soil Threats: The Role of Integrated Nutrient Management for Improving Crop Productivity, Grower's Income, Soil Health and Sustainability. Presented at the International Summit of Health and Lifestyle: Global Soil Threats held on 04<sup>th</sup> to 05<sup>th</sup> May, 2016, University of Tehran, Iran.

### **3.24. Doctoral Dissertations and Master Thesis**

Inamullah. 2014. Zinc and phosphorus management for rice under rice-wheat cropping system in Malakand. PhD Dissertation submitted to the Department of Agronomy, The University of Agriculture Peshawar.

Nangial Khan. 2015. Growth and yield of wheat varieties as affected by phosphorus management. MSc (Hons) Thesis submitted to the Department of Agronomy, The University of Agriculture Peshawar.

### **3.25. Magazine Article**

Amanullah. 2011. Rice and phosphorus. Rice Plus. 4: pp. 4.

### **3.26. Appendix (Optional)**

In some thesis, it may be desirable to include certain materials e.g. test forms, blank record forms, detailed apparatus descriptions, extensive tables of raw data, computer programs, statistical analysis, etc. that do not actually form a part of the text. These materials should be included in the Appendix. The Appendix is not given a chapter section. If there are two or more types of materials, they should be headed as appendices.

## **D-TYPING AND PUNCTUATION STANDARDS**

The following standards should be adhered to:

Colons (:), semi-colons (;), commas (,) should all be followed by a single space. Full stops (.) should be followed by two spaces except after an abbreviation where only a single space is needed. A dependable printer is necessary for controlled formatting and clean, sharp impressions. The type size should be 12 point. Any common, distinctively legible, non-

script type face may be used. Laser printer or ink-jet printer should be used for final copy. Photocopies should be very clean and text should be acceptable. For those using printing hardware with fabric ribbons, there should be no smudges, smears, letters filled in, shadows or fuzzy pages. Ink must be uniform. A sufficient number of ribbons should be used to ensure ink uniformity. Printers or typewriters equipped with carbon ribbons or laser printers are preferred. Dot matrix printers are acceptable for thesis production only if they possess near-letter-quality capability. An acceptable dot matrix printout must exhibit the following characteristics: no visible space between the dots of individual characters, smooth and well defined character shapes, and uniformly dark images. Please submit samples of output to the DASAR if there are any questions about the acceptability for thesis submission.

#### **IV. SUBMISSION OF THESIS**

Before submitting thesis and dissertation for the board of studies meeting the drafts of the exposition must be checked for **plagiarism ( $\leq 19\%$ )**. Six copies of the thesis must be submitted to the department 10 days before the Board of Studies meets for final examination. One copy of the thesis, to determine if the standards are met, must be submitted to the Director of Advanced Studies and Research (**DASAR**) 10 days before the Board of Study meets. The Director of Teaching will notify the department if the thesis meets the specified requirements. If they are not met and the thesis is unacceptable to the **DASAR**, the Board of Studies must be rescheduled.

Upon successful completion of the Board of Studies and Examination, five corrected copies of the thesis/dissertation will be deposited with the advisor's office. Until this has been done the student will not be allowed to graduate and receive a completed transcript.

The Board of Study and examination may be rescheduled only once after a failure. If a candidate fails a second time he/she will be considered a failure and not allowed to re-enroll in the University.

## V. LITERATURE CITED

Amanullah. 2016. Rate and timing of nitrogen application influence PFP and agronomic NUE of maize planted at low and high densities on calcareous soil in Northwest Pakistan. *J. Plant Nutr.* 39 (5): 683–690.

Amanullah and Inamullah. 2016. Dry matter partitioning and harvest index differ in rice genotypes with variable rates of phosphorus and zinc nutrition. *Rice Sci.* 23(2): 78-87.

Amanullah, Majidullah and A. Muhammad. 2016. Effect of tillage and phosphorus interaction on yield of mungbean (*Vigna radiata* L., Wilczek) with and without moisture stress condition. *PONTE.* 72(2): 114-139.

Amanullah. 2015. Specific leaf area and specific leaf weight in small grain crops “Wheat, Rye, Barley, and Oats” differ at various growth stages and NPK Source. *J. Plant Nutr.* 38(11): 1694–1708.

Amanullah and B.A. Stewart. 2015. Analysis of growth response of cool season cereals “wheat vs. rye” grown in organic and inorganic soils. *Emirates J. Food & Agric.* 27(5): 430-440.

Amanullah, L.K. Almas and P. Shah. 2010. Timing and rate of nitrogen application influence profitability of maize planted at low and high densities in Northwest Pakistan. *Agron. J.* 102(2): 575-579.

## APPENDIX

|                       |       |
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**ZINC AND PHOSPHORUS MANAGEMENT FOR RICE UNDER  
RICE-WHEAT CROPPING SYSTEM IN MALAKAND**

**BY  
INAMULLAH**

*A dissertation submitted to The University of Agriculture, Peshawar in partial  
fulfillment of the requirements for the degree of*

**DOCTOR OF PHILOSOPHY IN AGRICULTURE  
(AGRONOMY)**



**DEPARTMENT OF AGRONOMY  
FACULTY OF CROP PRODUCTION SCIENCES  
THE UNIVERSITY OF AGRICULTURE, PESHAWAR  
KHYBER PAKHTUNKHWA-PAKISTAN  
JANUARY, 2014**



**GROWTH AND YIELD RESPONSE OF MAIZE TO PHOSPHATE  
SOLUBILIZING BACTERIA, ANIMAL MANURES AND PHOSPHORUS**

*BY*

**SHAH KHALID**

*A thesis submitted to The University of Agriculture, Peshawar in partial fulfillment of the  
requirements for the degree of*

**MASTER OF SCIENCE (HONS) IN AGRICULTURE  
(AGRONOMY)**



**DEPARTMENT OF AGRONOMY  
FACULTY OF CROP PRODUCTION SCIENCES  
THE UNIVERSITY OF AGRICULTURE, PESHAWAR  
KHYBER PAKHTUNKHWA-PAKISTAN  
OCTOBER, 2015**

# ORGANIC AND INORGANIC N-FERTILIZER MANAGEMENT FOR RICE UNDER RICE-WHEAT CROPPING SYSTEM

BY

**HIDAYATULLAH**

*A dissertation submitted to The University of Agriculture, Peshawar in partial  
fulfillment of the requirements for the degree of*

**DOCTOR OF PHILOSOPHY IN AGRICULTURE  
(AGRONOMY)**

**Approved by:**

\_\_\_\_\_  
Dr. Amanullah  
Associate Professor

Chairman Advisory Committee

\_\_\_\_\_  
Prof. Dr. Amanullah Jan

Member

\_\_\_\_\_  
Prof. Dr. Zahir Shah (SES)

Member

\_\_\_\_\_  
Prof. Dr. Bashir Ahmad

Chairman & Convener Board of Study

\_\_\_\_\_  
Prof. Dr. Muhammad Afzal

Dean Faculty of Crop Production Sciences

\_\_\_\_\_  
Prof. Dr. Farhatullah

Director Advanced Studies and Research

**DEPARTMENT OF AGRONOMY  
FACULTY OF CROP PRODUCTION SCIENCES  
THE UNIVERSITY OF AGRICULTURE, PESHAWAR  
KHYBER PAKHTUNKHWA-PAKISTAN  
APRIL, 2014**

**GROWTH AND YIELD RESPONSE OF MAIZE TO PHOSPHATE  
SOLUBILIZING BACTERIA, COMPOST AND PHOSPHORUS**

**BY  
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THE UNIVERSITY OF AGRICULTURE,  
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**GROWTH AND YIELD RESPONSE OF MAIZE TO PHOSPHATE SOLUBILIZING  
BACTERIA, ANIMAL MANURES AND PHOSPHORUS**

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**Comparative performance of mungbean (*Vigna radiate* L.) vs. mash bean (*Vigna mungo* L.) as influenced by organic sources and phosphorus fertilization under rainfed condition**

**Saifullah and Amanullah**

**Department of Agronomy, The University of Agriculture, Peshawar, Pakistan, February, 2016**

**ABSTRACT**

**Rationale:** Grain legumes yields are primarily nutrients and water-limited in dryland condition under semiarid climates.

**Objective:** The objective of this research was to evaluate the impact of integrated phosphorus levels and organic sources on phenological development, growth and yield of mungbean (*Vigna radiate* L.) and mash bean (*Vigna mungo* L.) under rainfed condition.

**Methods:** The impact of phosphorus levels (0, 30, 60 and 90 kg P ha<sup>-1</sup>) and organic sources (animal manure, legume residues, and animal manures + legume residue)] was investigated on summer pulses (mungbean vs. mash bean) under rainfed condition in northwest Pakistan.

**Results:** The results revealed that increase in P levels enhanced phenological development, improved growth, increased number of nodules plant<sup>-1</sup>, pods plant<sup>-1</sup>, thousand seed weight, grain and biological yield as well as harvest index of both crops. Combined application of animal manures and legume residues (5 t ha<sup>-1</sup> each) ranked first in terms of better growth and higher yield and yield components of both crops. Mungbean was found more economical with higher yield and greater net returns than mash bean in the study area.

**Conclusion:** We concluded from this study that application of 60 kg P ha<sup>-1</sup> along with combined application of animal manures and legume residues (5 t ha<sup>-1</sup> each) could improve legumes growth, and increase productivity and profitability under rainfed condition in semiarid climates.



*To Mom and Dad,  
who always picked me up on time  
and encouraged me to go on every adventure,  
especially this one*



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## LIST OF SYMBOLS

- $a$  = rate of volume of aliquot to volume of liquid in UF cell
- $A$  = moles of ligand out of stirred UF cell in permeate
- $A_b$  = concentration of bound species in the UF cell
- $A_c$  = concentration of ligand in the cell (moles/liter)
- $A_f$  = Concentration of free ligand in the UF cell (moles/liter)
- $A_m$  = concentration of membrane polymer per unit upstream sample volume
- $A_p$  = concentration of ligand in the permeate (moles/liter)
- $A_r$  = Total moles of ligand initially
- $K_a$  = Association constant
- $K_b$  = Binding constant
- $K_d$  = Dissociation constant
- $K_e$  = Equilibrium constant
- $K_m$  = Partition coefficient between solution and membrane
- $n$  = Number of binding sites per macromolecule
- $N$  = Number of aliquots of sample taken during experiment
- $P$  = Concentration of protein
- $r$  = Molar of ligand bound to protein
- $S_b$  = Volume of protein solution in the stirred UF cell (liters)
- $V_c$  = Volumes diluted = volume of permeate/retentate volume =  $V_p/V_c$
- $V_d$  = Volume of permeate out from stirred UF cell (liters),
- $V_p$  = Volume of ligand in the reservoir fed into the stirred cell (liters)
- $V_r$  = Apparent void volume

## LIST OF ABBREVIATIONS/ACRONYMS

|                                       |   |     |
|---------------------------------------|---|-----|
| Berseem Straw                         | = | BS  |
| Biological Yield                      | = | BY  |
| Cattle Manure                         | = | CM  |
| Crop Growth Rate                      | = | CGR |
| Days to Physiological Maturity        | = | DPM |
| Degrees of Freedom                    | = | DF  |
| Filled Grains Paicle <sup>-1</sup>    | = | FGP |
| Grain Spike <sup>-1</sup>             | = | GPS |
| Grain yield                           | = | GY  |
| Harvest Index                         | = | HI  |
| Hulling Percentage                    | = | HP  |
| Leaf Area Index                       | = | LAI |
| Leaf Area Plant <sup>-1</sup>         | = | LAP |
| Leaves Dry Matter                     | = | LDM |
| Leaves Plant <sup>-1</sup>            | = | LP  |
| Means Sum of Square                   | = | MSS |
| Mixture                               | = | M   |
| Net Assimilation Rate                 | = | NAR |
| Onion Leaves                          | = | OL  |
| Organic Sources                       | = | OS  |
| Panicle Dry Matter                    | = | PDM |
| Panicle Initiation                    | = | PI  |
| Panicle Plant <sup>-1</sup>           | = | PP  |
| Physiological Maturity                | = | PM  |
| Plant Height                          | = | PH  |
| Ratio                                 | = | R   |
| Sheep Manure                          | = | SM  |
| Straw yield                           | = | SY  |
| Sum of Square                         | = | SS  |
| Thousand Grains Weight                | = | TGW |
| Tillers Plant <sup>-1</sup>           | = | TP  |
| Total Dry Matter                      | = | TDM |
| Total Nitrogen in Grains              | = | TNG |
| Total Nitrogen in Straw               | = | TNS |
| Total Soil Nitrogen                   | = | TSN |
| Unfilled Grains Panicle <sup>-1</sup> | = | UGP |
| Weeds Dry Weight                      | = | WDW |
| Weeds Fresh Weight                    | = | WFW |
| Wheat Straw                           | = | WS  |
| Years                                 | = | Y   |

**Table 1. Grain yield (kg ha<sup>-1</sup>) of maize hybrid as affected by phosphorus (P), animal manures (AM) and phosphate solubilizing bacteria (PSB).**

| PSB         | P (kg ha <sup>-1</sup> ) | Animal manures (5 t ha <sup>-1</sup> ) |         |        | Mean PSB x P |
|-------------|--------------------------|--|---------|--------|--------------|
|             |                          | Sheep                                  | Poultry | Cattle |              |
| Without PSB | 40                       | 4133                                   | 4398    | 4026   | 4186         |
|             | 80                       | 4447                                   | 4691    | 4592   | 4577         |
|             | 120                      | 5084                                   | 5228    | 4578   | 4963         |
|             | 160                      | 5225                                   | 5639    | 4715   | 5193         |
| With PSB    | 40                       | 4412                                   | 4660    | 4071   | 4381         |
|             | 80                       | 4808                                   | 5468    | 4518   | 4931         |
|             | 120                      | 5150                                   | 5875    | 5068   | 5364         |
|             | 160                      | 5028                                   | 5765    | 5096   | 5296         |
|             | 40                       | 4273                                   | 4529    | 4049   | 4284 c       |
|             | 80                       | 4628                                   | 5079    | 4555   | 4754 b       |
|             | 120                      | 5117                                   | 5552    | 4823   | 5164 a       |
|             | 160                      | 5126                                   | 5702    | 4905   | 5245 a       |
| Without PSB |                          | 4722                                   | 4989    | 4478   | 4730 b       |
| With PSB    |                          | 4849                                   | 5442    | 4688   | 4993 a       |
|             | Mean                     | 4786 b                                 | 5216 a  | 4583 c |              |

Means followed by different letter (s) with in each category are significantly different using LSD test ( $p \leq 0.05$ )

LSD<sub>0.05</sub> for AM = 194

LSD<sub>0.05</sub> for P = 159

LSD<sub>0.05</sub> for PSB = 26

AM x PSB = ns

AM x P = \*

PSB x P = \*\*

AM x PSB x P = ns

\*\* Significant at 1% level of probability

\* Significant at 5% level of probability

ns non-significant

## APPENDIX-I

**Table 2.** Analysis of variance for grain yield ( $\text{kg ha}^{-1}$ ) of maize hybrid as affected by phosphorus (P), animal manures (AM) and phosphate solubilizing bacteria (PSB).

| SOV            | DF | SS       | MS      | F-ratio | Probability |
|----------------|----|----------|---------|---------|-------------|
| Replications   | 2  | 542918   | 271459  | 2.96    | --          |
| Animal manures | 2  | 5007327  | 2503664 | 27.26   | 0.00        |
| PSB            | 1  | 1250953  | 1250953 | 13.62   | 0.00        |
| AM x PSB       | 2  | 3444403  | 1722201 | 1.87    | 0.20        |
| Error I        | 10 | 918505   | 91850   | --      | --          |
| Phosphorus     | 3  | 10504919 | 3501640 | 63.29   | 0.00        |
| AM x P         | 6  | 296971   | 49495   | 0.89    | 0.51        |
| PSB x P        | 3  | 259388   | 86463   | 1.56    | 0.22        |
| AM x PSB x P   | 6  | 773260   | 128877  | 2.33    | 0.05        |
| Error II       | 36 | 1991890  | 55330   | --      | --          |
| TOTAL          | 71 | 21890533 |         |         |             |

CV main plot (%) 6.23

CV sub plot (%) 4.84

## APPENDIX-II

**Table 3.** Original replicated data on grain yield ( $\text{kg ha}^{-1}$ ) of maize hybrid as affected by phosphorus (P), animal manures (AM) and phosphate solubilizing bacteria (PSB).

| Animal manures ( $5 \text{ t ha}^{-1}$ ) | PSB         | Phosphorus ( $\text{kg ha}^{-1}$ ) | R1   | R2   | R3   |
|--|-------------|------------------------------------|------|------|------|
| Sheep                                    | Without PSB | 40                                 | 4054 | 4355 | 3991 |
|  |             | 80                                 | 4121 | 4602 | 4620 |
|  |             | 120                                | 5003 | 5186 | 5062 |
|  |             | 160                                | 4731 | 5532 | 5411 |
|  | With PSB    | 40                                 | 4300 | 4121 | 4816 |
|  |             | 80                                 | 4977 | 4449 | 4998 |
|  |             | 120                                | 5390 | 5033 | 5027 |
|  |             | 160                                | 4942 | 5109 | 5032 |
| Poultry                                  | Without PSB | 40                                 | 4424 | 4809 | 3962 |
|  |             | 80                                 | 4887 | 4835 | 4350 |
|  |             | 120                                | 5046 | 5033 | 5604 |
|  |             | 160                                | 5364 | 5662 | 5890 |
|  | With PSB    | 40                                 | 4216 | 4725 | 5039 |
|  |             | 80                                 | 5386 | 5281 | 5737 |
|  |             | 120                                | 5975 | 5652 | 5998 |
|  |             | 160                                | 5806 | 5461 | 6028 |
| Cattle                                   | Without PSB | 40                                 | 4025 | 4206 | 3848 |
|  |             | 80                                 | 4569 | 4464 | 4743 |
|  |             | 120                                | 4348 | 4623 | 4763 |
|  |             | 160                                | 4601 | 4862 | 4681 |
|  | With PSB    | 40                                 | 3821 | 4256 | 4135 |
|  |             | 80                                 | 4165 | 4534 | 4856 |
|  |             | 120                                | 4853 | 5047 | 5304 |
|  |             | 160                                | 4988 | 5124 | 5176 |

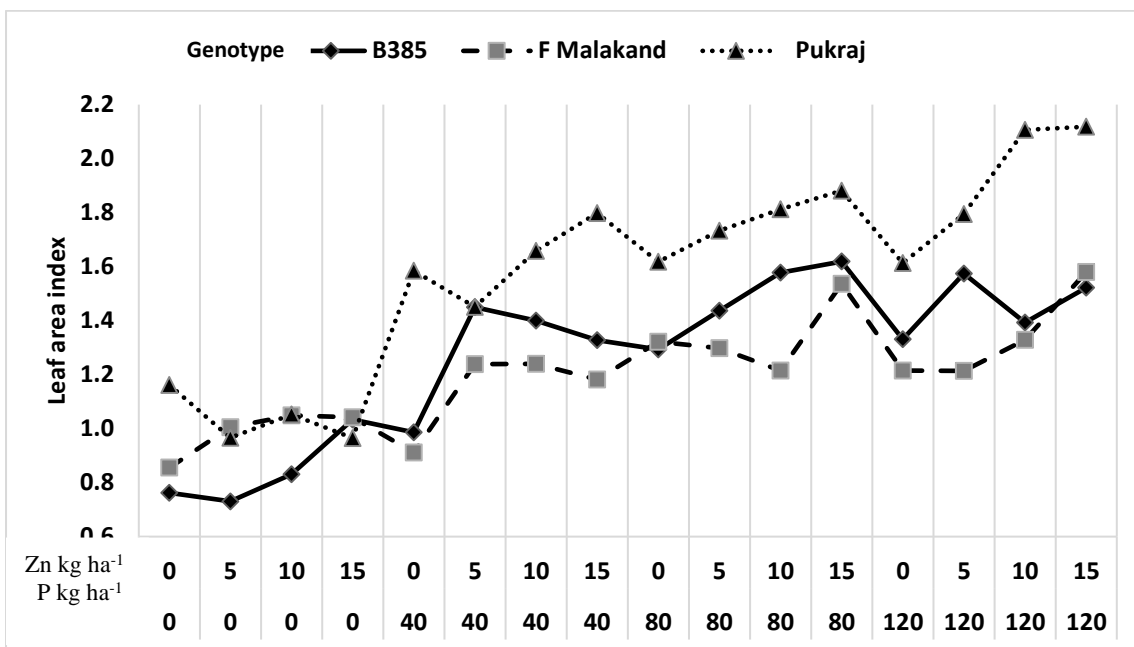


Fig. 1. Response of leaf area index of rice (*Oryza sativa* L.) to interaction among genotypes, phosphorus and zinc levels (G x P x Zn).

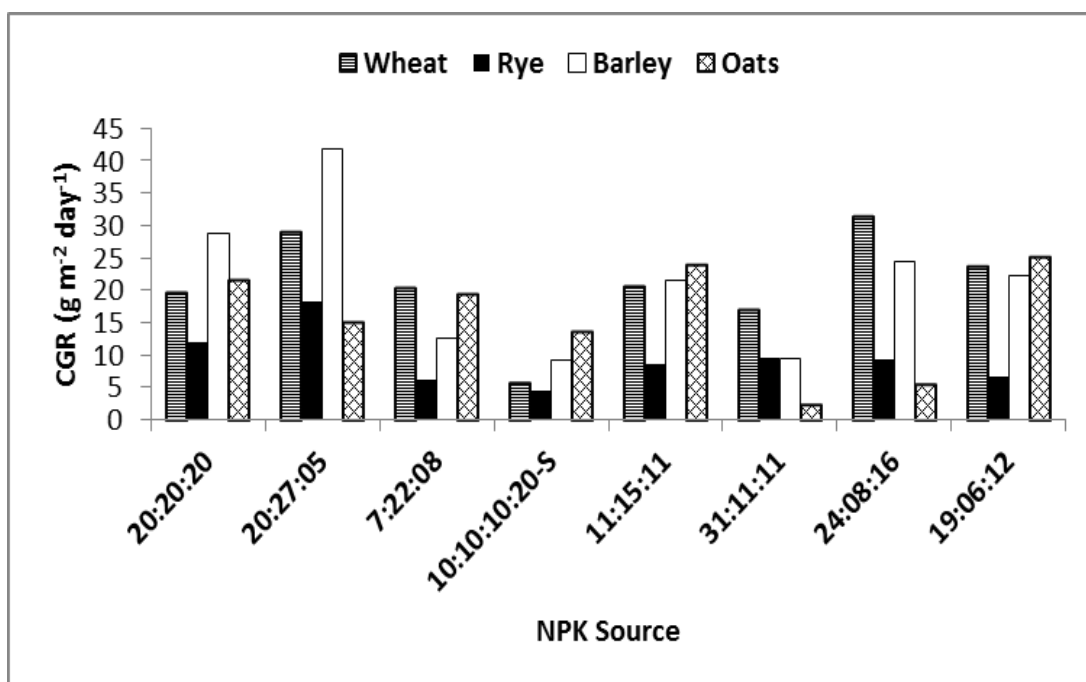


Fig. 2. Crop growth rate ( $\text{g m}^{-2} \text{day}^{-1}$ ) response to interaction between cool season cereals and NPK sources.