

A GUIDE TO THESIS PREPARATION FOR GRADUATE STUDENTS IN THE DEPARTMENT OF SOIL SCIENCE

January 2018

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This document has been prepared to aid graduate students in the Department of Soil Science in the preparation of M.Sc. and Ph.D. theses. The student should also consult "Graduate Thesis/Practicum Guidelines and Info" published by the Faculty of Graduate Studies (http://umanitoba.ca/faculties/graduate_studies/thesis/guidelines.html), which includes certain regulations regarding the thesis and conditions which must be met before the degree is granted by the University of Manitoba.

The Department of Soil Science gratefully acknowledges the Department of Plant Science, whose thesis guide was used as a basis.

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SECTION I

General Expectations for Graduate Theses at the University of Manitoba

All theses must be written according to a standard style manual acknowledged by a particular field of study and recommended by the major Department, be lucid and well-written, and be reasonably free from typographical and other errors.

In general, the Department of Soil Science recommends the style guidelines for publication in the Canadian Journal of Soil Science. Other general references for style include: the Council of Science Editors Manual; the American Society of Agronomy Environmental Science and Technology; the Journal of Agricultural and Food Chemistry; or the Soil Science Society of America Journal.

M.Sc.

In general, the thesis should demonstrate that the student has mastery of their field.

Ph.D.

In general, the thesis should demonstrate the candidate's competence to complete a research project and present the findings. The thesis must constitute a distinct contribution to knowledge in the major field of study and the material must be of sufficient merit to be, in the opinion of the examiners, acceptable for publication. A recognized ability for independent investigation must be demonstrated by the candidate.

Expectation of M.Sc. Theses

A minimum of one research chapter written in a paper format of sufficient quality to be submitted to an appropriate refereed scientific journal. A thesis Research Chapter will typically range between 20 and 40 Pages. Additional research chapters may be required by the Advisory Committee in consultation with the student.

Expectation of Ph.D. Theses

A minimum of three research chapters written in a paper format of sufficient quality to be submitted to an appropriate refereed scientific journal. A thesis Research Chapter will typically range between 20 and 40 Pages. Additional research chapters may be required by the Advisory Committee in consultation with the student. It is highly desirable that Ph.D. students would have submitted their research chapters to an appropriate refereed scientific journal prior to their thesis defence date. However, this process should not defer the thesis examination, and it is not a mandatory requirement for a satisfactory outcome.

Advisory Committee Involvement

It is in the best interest of students to consult with their Advisory Committee members near the completion of the thesis, and ensure that the committee members are aware of the nature of the thesis content before receiving it for examination.

SECTION II

General Regulations for Thesis Preparation

Printing

The official version of the thesis is a PDF version approved by the Faculty of Graduate Studies. Note that students may also elect to print a hard copy version, which is bound. The page size should be 8.5" x 11", the type reading across the 8.5" dimension. The text should be double spaced and 12 point font.

All candidates should make a special effort to assure that their theses are reasonably free of typing, spelling and grammatical errors. No strikeouts, interlineations or crossing out of words or letters are permissible.

Canadian spelling is preferred (e.g., Oxford Canadian English Dictionary); but either American or British spelling is acceptable provided that it is used consistently throughout the thesis.

Pagination

Each page in the thesis must be assigned a number and the pages must be arranged consecutively. Although the title page does not bear a typed number, it will be counted as page "i". Preliminary pages, from the title page through the abstract, will be numbered consecutively in small Roman numerals (ii, iii, iv, etc.), typed in the bottom centre 13 mm from the bottom of the page.

Beginning with the first page of the text and including all separately paged figures, tables and plates, and the bibliography and appendix, consecutive Arabic numerals are typed in the bottom centre 13mm (0.5") from the bottom of the page. Unnumbered pages or pages bearing a number and letter (e.g., 3A, 3B) are not permitted.

Margins

Throughout the thesis, a margin of 25 mm (1") should be kept on all sides of the page. All illustrations should conform to these dimensions as closely as possible.

Preparation of Figures

All figures should be functional. As a rule, they should not repeat material presented in Tables unless they are necessary for analysis or clarification. Where a graph summarizes data from

tables, and the data may be a useful resource for other workers, the table should be placed in an appendix at the end of the thesis.

Figures should be numbered consecutively within a chapter with Arabic numerals. The chapter number should be used as a prefix for the figure number. If possible, the number (e.g., Figure 4.1) should be placed below the figures. The title or legend will follow the number in sentence case, the first letter being typed two spaces after the number. If the legend consists of more than one line, the second and any following lines should be indented four spaces (about 10 mm) and should be single spaced.

e.g., Figure 4.1 The effect of temperature on the rate of growth and yield of spring wheat.

Each figure should appear as closely as possible after the citation in the text that relates to it. An example of a figure is in Section V of this document.

Preparation of Tables

No vertical rules are used in tables. Tables are usually typed in portrait orientation, but extensive data may be typed in landscape orientation. In this case the table should be oriented so that the top of the table is at the bound edge of the document.

All tables are numbered consecutively within a chapter with Arabic numerals. The chapter number should be used as a prefix for the table number (e.g., Table 2.1) . The table number with title is placed above the table. The title is typed two spaces after the number. If the title consists of more than one line, the second and any subsequent lines should be indented four spaces (10 mm) and should be single spaced.

e.g., Table 2.1 The effect of temperature on the rate of growth and yield of spring wheat.

If footnotes are used with a table, they should be typed below the table. All footnotes should be single spaced and indented three spaces. Each footnote is referred to in the table by a lower case letter or by a symbol.

Each table should follow as closely as possible after the citation in the text of the thesis. An example of a table is in Section V of this document.

Presentation of Equations and Formulae

Format for presentation of equations, formulae etc. should be consistent throughout the thesis. Style selected should be consistent with that of journal selected or to be selected for publication. Brackets, [], should be used to denote concentrations and parenthesis, (), should be used to denote activities in chemical equations. Consult, the Style Manual and journal selected for publication of manuscripts for correct format of equations and symbols. Equations should be numbered with the number placed on the right hand side of the equation in brackets. Examples of equations are in Section V of this document.

SECTION III

Guidelines for Thesis

Students in the Department of Soil Science may prepare and submit their M.Sc. or Ph.D. thesis in a format containing published manuscripts or manuscripts suitable for publication in a scientific journal. There is no longer an option to write a Traditional Style Thesis, which is a thesis without specific independent papers.

General Regulations

In addition to the general guidelines specified by the Faculty of Graduate Studies for M.Sc. or Ph.D. theses, the following regulations must be met:

1. A mere collection of manuscripts is not acceptable; nor can reprints of published manuscripts be accepted.
2. Manuscripts which have been published or accepted by a journal prior to the thesis submission may be included in the body of a thesis provided that, in the opinion of the Advisory Committee, the research described in the manuscripts was conducted under the supervision of the advisor while the student was registered in the Faculty of Graduate Studies at the University of Manitoba. In this case, a footnote to the page starting the data chapter will indicate the order list of authors and their affiliation and also if a form of the chapter has been published, accepted, or submitted to a specific journal.
3. The style of the thesis must be uniform throughout regardless of whether papers will be submitted to different journals.
4. Manuscripts in which the student is not senior author require a footnote to indicate the part that is the student's contribution. The student must have actively participated in data analysis, interpretation and writing of the manuscript.
5. All material pertinent to the thesis regardless of acceptability for publication in journals must be included in the thesis.
6. Manuscripts shall be treated as major division headings. Any reference to manuscripts in the thesis should be by chapters and not as published documents.
7. For specific information on format and dates for submission of final theses, see the Faculty of Graduate Studies "Graduate Thesis/Practicum Guidelines and Info" (http://umanitoba.ca/faculties/graduate_studies/thesis/guidelines.html).

Parts of the Thesis

Every thesis is composed of three parts; the preliminaries, the text and the appendices (if needed). Each part has several sections, which must be arranged in the following order:

The Preliminaries, composed of:

TITLE PAGE

ABSTRACT

FOREWORD

ACKNOWLEDGMENTS

TABLE OF CONTENTS

In this section the page numbers are in small roman numerals i.e., i, ii, ... v, etc.

The Text, composed of:

INTRODUCTION

THE MANUSCRIPTS - Each manuscript is presented separately as a major section.

OVERALL SYNTHESIS

The APPENDICES if needed.

Specific Format Regulations - The Preliminaries

Title Page

The information on the title page must be complete and must be symmetrically arranged. The title page should contain the following information: The title of thesis, the name of the University, the degree for which the thesis is submitted, the name of the department, the full name of the author, the date and the copyright notation (©). The title must be a meaningful description of the content of the thesis. Double spacing is used between the lines of the title when more than one line is needed. Single spacing is used between the lines for other information when more than one line is needed.

The example, in Section V of this document, gives the correct upper and lower case format and spacing. No punctuation is used on the title page. The name of the degree should be given in its full and correct detail. The date should be that at which the degree is conferred (i.e., February, May, October).

Abstract

The thesis must contain a short abstract that summarizes the entire thesis. This section follows the title page and is headed by the word ABSTRACT, centered 50 mm below the top of the page, in upper case letters without punctuation.

The abstract should give, in essay style, a short statement of the thesis problem, a brief exposition of the methods used, and a condensed summary of the findings and conclusions. The statement of the problem and summary of findings are most important. No citations of literature, tables or figures are allowed in the abstract. Short tables may be included (GENERALLY NOT RECOMMENDED) but figures or illustrations are not allowed. For maximum abstract length, see the Faculty of Graduate Studies “Graduate Thesis/Practicum Guidelines and Info” (http://umanitoba.ca/faculties/graduate_studies/thesis/guidelines.html).

The first paragraph, which begins three lines below the heading, should contain the following information: The author's name (last name first), the degree for which the thesis was written, the university and date degree was conferred, the complete title of the thesis, and name of the major professor. The following example will indicate the correct form:

Clark, Allan Bruce. M.Sc., The University of Manitoba, May, 1986. A Study of the Factors that Influence the Time Required to Obtain a Graduate Degree. Major Professor; Simon A. Legree.

Approval and Copyright Forms

These forms are completed after approval by the examining committee and submitted to the Faculty of Graduate Studies at the time that the final thesis is submitted. Check the current procedure through the Faculty of Graduate Studies.

Foreword

The foreword provides a context for the research chapters of the thesis. The information should include the names of the journals to which the research chapters are currently submitted or published, if applicable, as well as the student's contribution in multi-author publications in relation to other members of the research team.

Acknowledgments

Most theses include a brief statement of thanks for aid received. The page is entitled ACKNOWLEDGMENTS as a centered heading in capital letters without punctuation. The heading is typed 50 mm from the top of the paper and the text begins on the fourth line (10 mm) below the heading.

Table of Contents

This section is headed TABLE OF CONTENTS and will list the titles of the chapters (or parts or sections) and their subdivisions exactly as they appear in the body of the thesis together with their page citations. Also included are the references and appendices.

The heading is centered on a line 50 mm from the top of the page, in upper case letters and without punctuation. The column of page numbers is headed "Page" and placed 2 lines below the main heading. The entries begin 2 lines further down.

Titles of main sections are typed in upper case letters, all sub-sections in upper and lower case letters. A line of vertically aligned periods extends from the last word of the title or sub-title to the page number. The page numbers are aligned by the last digit of the number.

Titles of the main sections begin at the left hand margin. Sub-titles are indented two spaces from the first letter of the heading. Second sub-titles are indented two more spaces. Double space between main titles and between main titles and sub-titles. Single space between sub-titles. Whenever a title or sub-title is longer than one line, each line after the first is single spaced and indented two more spaces than the first line. No terminal punctuation is used for any line of the table of contents. See the attached example for format for TABLE OF CONTENTS including format for pagination and listing of the preliminaries, text and reference matter.

Specific Format Regulations - The Text

Each major division of the thesis should begin on a new page with the heading typed in upper case letters and centered 50 mm from the top of the page. If the section contains sub-divisions, those of the first order should appear as centered headings in upper and lower case letters. This heading is boldfaced and typed three lines below the preceding text or heading. Second order headings are also boldfaced and typed in upper and lower case. They begin at the left margin. No terminal punctuation is used after any of these headings. Subtitles of the third order are treated as paragraph headings. They should follow the same rules as the other subheadings, but they run into the paragraph and are followed by a period and two spaces.

Sample headings and subheadings:

1. MAJOR DIVISION HEADING

1.1 First Order Subdivision Heading

1.1.1 Second Order Subdivision Heading

1.1.1.1 Third Order Subdivision Heading. This heading runs into the paragraphs it begins.

INTRODUCTION

This chapter is meant to inform the audience about the background of the thesis and place the research chapters in a larger scientific context. This chapter needs to include appropriate literature, but not be an exhaustive literature search that is unrelated to the thesis. Figures and Tables can be incorporated into this chapter if relevant. This section should contain a statement of the objective(s) of the work so that the reader can proceed with the nature and aim of the study

in mind. A description of focal areas of each following chapter is given providing reader with an understanding of the logic-flow of the thesis. The General Introduction Chapter would typically range between 8 and 25 pages long.

MANUSCRIPTS

Manuscripts shall constitute the body of the thesis and should be complete and prepared in accordance with the general guidelines previously outlined. Tables, and figures, should be prepared as recommended by the journal. However, literature cited should be the author and year system with references normally listed only in the literature cited section at the end of the thesis.

Each manuscript should normally follow the format outlined below or the format outlined by the journal selected for publication.

Title of the manuscript (MAJOR HEADING)

Abstract

Introduction

Methods

Results and Discussion (these can be broken into separate Results and Discussion sections)

Conclusions

References

OVERALL SYNTHESIS

This section should present a synthesis and overall summary of the findings of the thesis as a whole. It should emphasize the connections between the chapters, if applicable, and the contribution of the collection of studies towards the overall objectives outlined in the introduction to the thesis. As such, this section should minimize repetition of information that is already summarized within each of the research chapters. Practical implications of the research and recommendations for further study in the field of investigation should be included in this section. This section need not be long (typically between 5 and 12 pages), but must provide a unifying discussion to connect the individual manuscripts and develop the overlying theme of the thesis. Figures and Tables can be incorporated into this chapter if relevant.

Specific Format Regulations - The Reference Matter

References within text

The Department of Soil Science recommends that students follow the author-year system.

In the author-year system references are cited in the text by author and year of publication, e.g., "Smith (1970) investigated ...". In the text, all authors are mentioned in the citation if there were not more than two. If three or more authors were involved, the citation in the text reads Smith et al. (1970). If two or more cited articles by the same author or authors (names in the same order) have the same publication year, list the entries chronologically, with lowercase italic letters (a, b, c) after the dates. e.g.,

Smith, R.P., C.R. Jones, and L.B. Hicks. 1969a.

Smith, R.P., C.R. Jones, and L.B. Hicks. 1969b.

If two or more authors (manuscripts) are cited in succession, citations should be listed in chronological order from (earliest to latest) date or listed alphabetically but order used must be consistent throughout the thesis. Examples of reference citations are included in the following paragraph:

“Soluble Mn fertilizers are rapidly converted to insoluble forms shortly after application (Sanchez and Kamprath 1959; Smith et al. 1992; Zhang and Zhang 1994). The decrease in solubility of applied Mn is more pronounced in calcareous than in noncalcareous soils (Sanchez and Kamprath 1959). Several investigators (York et al. 1954; Foy 1964; Cheng 1982) have reported that application of KCl fertilizer enhanced Mn uptake by crops. Smith (1970) and Jones et al. (1981) investigated ...”.

Reference Section

This section is headed “References” and is presented after each data chapter, as well as after the Introduction and Synthesis and Summary sections, if required. It will contain all references cited by the author in the chapter.

In this section, the references should be arranged in alphabetical order by first author's surname and year. All authors of a multi-author publication are listed surname first, followed by initials and year of publication. The full title of the paper follows the date. Only the first letter of the title is capitalized. This is followed by the name of the publication, volume number and page numbers. Except for single word titles, the titles of journals are usually abbreviated. A list of standardized abbreviations can be found in the Council of Science Editors Style Manual. References to books should list the author and editor, title of the book (underlined), the edition, the publishers, place of publication, year and the page numbers. Use upper case for first letter of major words of the title of the book.

Note that the suggested Reference formatting can be varied in circumstances where the chapters have been published in a journal that has a different format. However, we encourage a consistent

format throughout the thesis to aid the reader. The following examples indicate a preferred format:

Milham, P.J., Awad, A.S., Paull, R.E. and Bull, J.H. 1970. Analysis of plants, soils and water for nitrate using an ion-selective electrode. *Analyst* **95**:751-757.

Murphy, J. and Riley, J.P. 1962. A modified single solution for determination of phosphate in natural waters. *Anal. Chem. Acta* **27**:31-36.

Olsen, S.R. and Sommers, L.E. 1982. Phosphorus soluble in sodium bicarbonate. Pages 421-422. in A.L. Page et al. (Eds.). *Methods of Soil Analysis, Agronomy Monograph 9, Part 2*. 2nd edition. ASA, Madison, WI. U.S.A.

Agriculture Canada Expert Committee on Soil Science. 1987. The Canadian system of soil classification. 2nd edition. Agriculture Canada, Ottawa, ON. Publ. 1646. 164 pp.

Appendices

If this section is needed, it is placed at the end of the thesis. The section includes supplementary illustrative material, original data and statistical tables too lengthy for inclusion in the text. This section is headed APPENDIX or APPENDICES, typed in upper case letters and centered 50 mm from the top of the page. The various appendices are labelled I, II, etc. along with the title of the particular appendix e.g., I. Water Content of Soils.

SECTION IV

Distribution, Approval, Publication and Copyright of Thesis

Distribution

Ph.D. Candidates - must submit an electronic copy of their thesis to the Faculty of Graduate Studies using the online system on the FGS tab in JUMP. The Faculty of Graduate Studies then forwards the thesis to the internal examining committee members for approval prior to identifying and submitting an electronic copy to an external examiner. For details of Ph.D. thesis submission, consult the FGS Academic Guide.

Master's Candidates - after consultation and with the approval of their Advisor, may distribute one copy to each examining committee member. At this time, the Advisor will notify the Department Head of distribution and request the Departmental Graduate Student Assistant to submit a Thesis Title and Examiners form indicating the names of members of the committee.

Approval

The Faculty of Graduate Studies arranges all Ph.D. Oral Examinations, and The Department of Soil Science (Advisor and Head) arranges the Master's Oral Examination. In order to be recommended for the degree:

1. The candidate must successfully complete the Oral Examination and make all revisions to the thesis as required by the committee.
2. Must submit one digital version as an e-thesis at the MSpace website. The electronic version must be submitted in Portable Document Format (PDF); check the Faculty of Graduate Studies website for current procedures.
3. Must submit the original Approval Form signed by all members of the committee. The title of the thesis and name of the student on the approval form must read the same as on the title page of the thesis.
4. Must complete and sign the forms indicated on The faculty of Graduate Studies website under "Thesis/Practicum Submission Checklist"

Publication of Bound Copies

The student may elect to have printed bound copies of the final thesis. The cost of these copies is borne by the student.

Research Ethics Board Approval

The approval from a U of M Research Ethics Board (REB) may be required prior to the student proceeding with the information gathering procedures for the thesis or practicum. The original letter of the approval from the REB should be kept by the student. A copy of the original should be submitted to FGS at the completion of the thesis/practicum. For further information on ethics refer to: <http://umanitoba.ca/research/ors/ethics/>.

Consent and Access to Information Forms

Sample copies of consent forms that were used to obtain consent from participants to take part in the information gathering procedures for the thesis or practicum must be included in the Appendices.

In some cases, approval from an agency or institution or corporation may have been required before the information gathering procedures could proceed. The original approval form for access should be retained by the student with a copy provided to FGS upon completion of the thesis/practicum.

Use of Copyrighted Material

If the thesis or practicum includes copyrighted material, permission must be obtained from the copyright holder. FGS has developed a form that can be utilized when requesting the use of

copyrighted material (http://umanitoba.ca/faculties/graduate_studies/media/permission_to_use_copyright_material.pdf).

In some cases, copyright holders prefer to use their own permission forms and/or will provide their permission electronically. Both of these are acceptable by FGS.

Images or more than a reasonable extract (according to the Copyright Act) of another person's work must be accompanied by written permission from the copyright holder(s). Obtaining the permission may take a considerable amount of time; therefore, this must be taken into consideration when meeting a thesis submission deadline. A reference to written permission having been obtained must be included under the image or text. The reference should also include the date the permission was granted, and the name/title of the copyright holder(s). The original form(s) signed by the copyright holders should be retained by the student with a copy provided to FGS at the completion of the thesis/practicum.

The thesis/practicum cannot be accepted by FGS if permission has not been obtained. It is important that the student and their Advisor ensure that the permission has been granted. In some cases the copyright holder cannot be located or the cost is prohibitive to using the text or image. In these situations the text or image may have to be omitted from the thesis/practicum.

Subsequently, information on where the reader can locate the image or text should be included, such as the URL, title of book/journal, volume and issue number, page number, publisher, and date of publication. A description of the purpose or significance of the text or image should be provided.

SECTION V

Examples

The following pages contain examples.

Title Page

**The Effect of Soil Type
on Chemical Transport**

by

John C. Smith

A Thesis

Submitted to the Faculty of Graduate Studies of
The University of Manitoba
in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Department of Soil Science

University of Manitoba

Winnipeg, Manitoba

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Figure Example

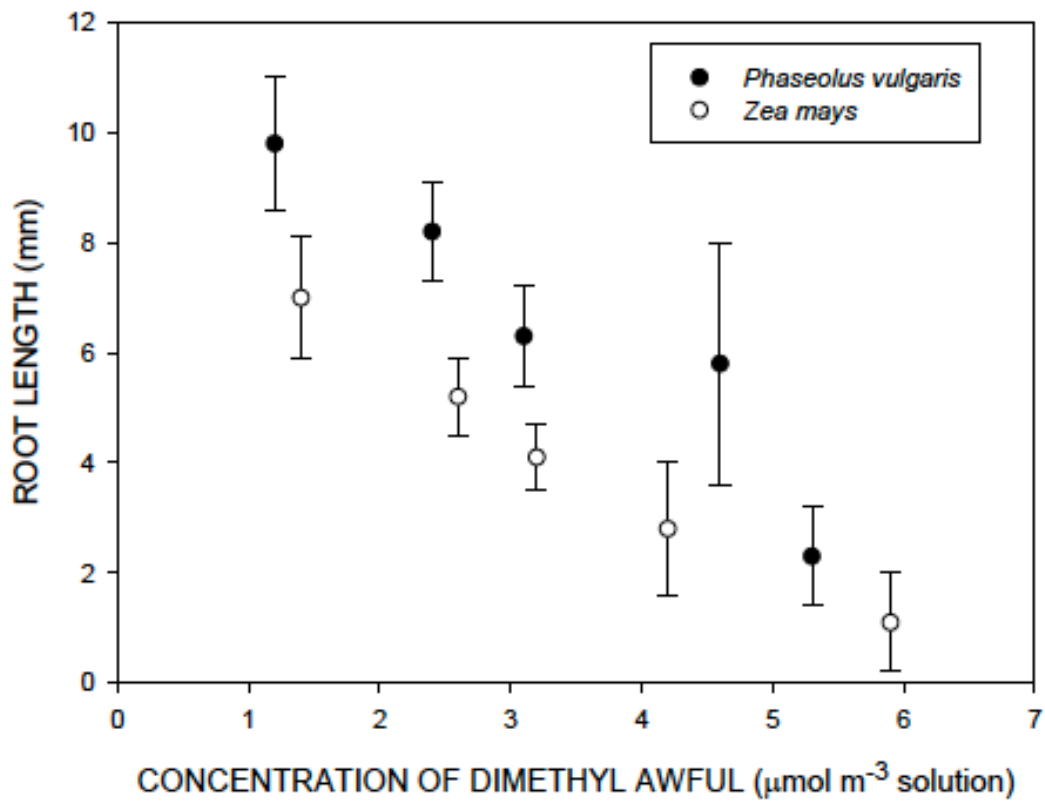


Figure 4.1 Effect of dimethyl awful on root growth of *Phaseolus vulgaris* L. and *Zea mays* L. after 30 days exposure to a constant concentration in soil solution. Error bars represent ± 1 standard error.

Table Example (with thanks to Inoka Amarakoon and Francis Zvumoya)

Table 2. Least square mean antimicrobial concentration in runoff as affected by manure application method and runoff volume collected

Treatment	Chlortetracycline from CTC ^a	Chlortetracycline from CTC ^a SMZ ^b	Sulfamethazine	Tylosin
	$\mu\text{g L}^{-1}$			
Application method				
Surface	43.3 ^a	75.3	3.9 ^a	0.02
Incorporated	16.9 ^b	12.3	2.6 ^b	0.06
Volume (L)				
1	31.3	39.1	3.1	0.03
5	34.9	42.9	3.7	0.04
9	29.1	46.0	3.3	0.02
13	24.9	47.2	2.9	0.06
		<i>P</i> value		
Application method	0.07	0.0001	0.03	0.005
Volume	0.13	0.02	0.16	0.11
Application method × Volume	0.92	0.03	0.45	0.03

^a Chlortetracycline treatment.

^b Treatment consisting of a 1:1 mixture of chlortetracycline and sulfamethazine.

^c Means in the same column followed by the same letter are not significantly different according to the Tukey-Kramer test ($P < 0.1$). Mean separation letters are applied to the main effects only in the absence of a significant interaction. Significant interactions are plotted in Fig. 1 (chlortetracycline from CTC^aSMZ) and Fig. 2 (tylosin).