

Impact of Roundup and Clearfield herbicides on soil nutrients, and the biomass, activity and diversity of soil microorganisms

By

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Declaration

I declare that this thesis is a record of original work and contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text.

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7 November 2016

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Preface

This research was performed over 10 months as part of a Master of Biotechnology (Plant Biotechnology). In accordance with the requirements of the program, the research is presented in the format of a manuscript for submission to a peer-reviewed scientific journal. I have chosen to follow the format of the leading journal in soil science, *Soil Biology & Biochemistry*. My co-author of the manuscript is A/Prof Timothy Cavagnaro, who suggested the project, supervised my research and reviewed drafts of the manuscript.

The manuscript in this thesis is intended as the first draft of a manuscript for future publication, once biodiversity analysis has been done. The word count for the manuscript (excluding references and supplementary material) is 5747.

I have followed these instructions except that I laid all tables and figures within text in place of putting at the end; did not use line numbering; and kept the page format as follows: font Arial Narrow 12 on A4 pages, with 1.5-cm margins at the top, bottom and right-hand side of the page and a 3.5-cm margin on the left-hand side of the page in order to satisfy the thesis guidelines for the Master of Biotechnology (Plant Biotechnology) program.

Abstract

Roundup and Clearfield are herbicides that have been widely used globally and their use is expected to increase in the coming years. However, these herbicides may affect soil microbes that are important for soil health because of their roles in cycling carbon and soil nutrients. There have been no studies to explore the effect of Clearfield on microorganisms. In this study, the effect of Roundup and Clearfield GM resistant herbicides on microorganisms was investigated. The experiments were designed to measure soil nutrients (available phosphorus and nitrogen), microbial biomass carbon (MBC), and microbial activity (respiration and enzymes) in the soil every 7 days over a 28 day period. Soil microbial diversity was also measured at 28 days using an amplicon sequencing based approach. The results revealed no positive or negative effects of either herbicide at their recommended and five times recommended rates. This study was conducted on soil samples in the lab, but a larger scale studies on the agronomic effects of the two herbicides on microbes in field environments are recommended.

Key words: herbicides, microbes, soil nutrients, microbial biomass carbon (MBC), microbial activity.