

EVALUATION AND CHARACTERIZATION OF HERBICIDE RESISTANCE IN ITALIAN
RYEGRASS (*Lolium multiflorum* Lam.) BIOTYPES TO DICLOFOP-METHYL AND
ALTERNATIVE MANAGEMENT OPTIONS

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Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Plant Pathology, Physiology, and Weed Science

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April 26, 2004

Blacksburg, Virginia

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(ABSTRACT)

Italian ryegrass (*Lolium multiflorum* Lam.) is a competitive weed in small grain production areas throughout the northwestern and southeastern US. In small grains, Italian ryegrass has generally been controlled with postemergence treatments of diclofop, or diclofop-methyl, a member of the subfamily of the aromatic carboxylic acid family, the aryloxyphenoxypropionates.

The first incidence of diclofop resistance in Italian ryegrass was reported in Virginia in 1995. Experiments to characterize diclofop resistance in several Virginia biotypes of Italian ryegrass included the following objectives: (1) evaluation of the presence of diclofop resistance in several Italian ryegrass biotypes collected across Virginia, (2) evaluation of alternative herbicide efficacy for diclofop resistant Italian ryegrass control, and (3) characterization of the aryloxyphenoxypropionate (APP) resistance mechanism in resistant Italian ryegrass biotypes.

The response of 32 biotypes to diclofop collected from various locations statewide with varying histories of diclofop applications confirmed diclofop resistance in Virginian Italian ryegrass populations. At 4-times the label-recommended application rate, only 50% of biotypes previously exposed to diclofop in a cropping situation were adequately controlled versus 94% of the biotypes not previously treated with diclofop. Tralkoxydim provided the most effective control of four of the biotypes. No postemergence treatment effectively controlled one biotype previously exposed to diclofop applications. Effective preemergence herbicide treatments for Italian ryegrass control in the greenhouse included acetochlor (two formulations) and flufenacet

plus metribuzin. In the field, flufenacet plus metribuzin resulted in excellent Italian ryegrass control, little crop injury, and acceptable barley yields.

Acetyl-coenzyme A carboxylase (ACCase) assays and herbicide absorption, translocation, and metabolism studies were conducted to investigate resistant mechanism(s) to two APP herbicides, diclofop and quizalofop. ACCase assays indicated no differences in enzyme activity between the two biotypes of Italian ryegrass evaluated. Furthermore, no significant differences in the specific activity of ACCase were detected between the two biotypes in the absence of diclofop.

[¹⁴C]Quizalofop-P absorption, translocation, and metabolism did not differ between resistant and susceptible Italian ryegrass biotypes. Lack of a significant biotype effect suggests that differential metabolism does not explain the differential response to diclofop treatments observed in the herbicide dose-plant response experiment.

DEDICATION

This dissertation is dedicated to my children, **Nataliya** and **Aleksandr**, and my wife, **Galina P. Morozova**. Every day they gave me reason to continue with my scientific pursuits and were an abundant source of love, joy, inspiration, and support.

This dedication also extends to my family, specifically to my mother **Ludmila I. Morozova**, my father-in-law **Piotr P. Yesin**, and my American mother and father, **Tatum** and **Paul Saunders**. They did not exactly understand what I was doing, but remained my steadfast supporters, with plenty of encouragement, patience, and never-ending supply of advice (often times very contradictory on a day-to-day basis). In the end, I must admit that they were right...

...”it” can be done.

ACKNOWLEDGEMENTS

First and foremost I thank Dr. E. Scott Hagood for the opportunity to study and conduct research at Virginia Polytechnic Institute and State University. I am truly grateful for his support, guidance, advice, leadership and most of all friendship.

I thank all the members of my committee, Dr. Dan Bran, Lloyd Hipkins, Dr. Craig Nessler, and Dr. Henry Wilson, for their ideas and timely suggestions over the past few years, and help in manuscript preparation and review. I thank the late Dr. Kriton Hatzios, whose extensive expertise and thorough knowledge of weed science will be sorely missed.

Special thanks go to Shawn Askew, Neysa Call, and Wendy Pline for their friendship, which became my daily support system while pushing me along the way, as well as their guidance in laboratory procedures and interpretation of the results.

I thank Claude Kenley, who has helped me with various research projects and whose help in conducting field experiments proved to be invaluable. Likewise, I thank Sue Meredith for her daily guidance in laboratory procedures, instructions in good file-keeping, and encyclopedic knowledge of ordering catalogues.

My gratitude is extended to all of my friends and colleagues, Gregory Armel, James Ashley, Kevin Bradley, Rakesh Chandran, Steve King, David Langston, Dan Poston, and Robert Richardson. None of this work would have been possible without you keeping me from getting frustrated when things wouldn't seem to go right. I will forever cherish the memories of our escapades at Weed Science contests, Weed Science Society hospitality suites, and football games.

A deep and sincere thank you to my Russian and American parents for their continued encouragement throughout my college carrier and graduate school in Russia and the United States, and for supporting the choices I made.

Most of all, I thank my wife, Galina P. Morozova, for her never-ending love through the years, believing in me and keeping me on-track when it would seem like an impossible task.