

## Table of Contents

	<b>Page Number</b>
Abstract	ii
Acknowledgements	iv
List of Figures	viii
List of Tables	x
Chapter I	
Introduction and Literature Review	1
• Field and laboratory investigations of sulfentrazone in potato	1
• Laboratory, greenhouse, and field investigations of the experimental herbicide AE F130060 03 for Italian ryegrass ( <i>Lolium multiflorum</i> ) management in winter wheat	3
• Field, greenhouse, and growth chamber Investigations of growth and Reproductive ability of imidazolinone-susceptible and -resistant smooth pigweed ( <i>Amaranthus hybridus</i> L.)	6
Chapter II	
Response of potato ( <i>Solanum tuberosum</i> ) and selected weeds to sulfentrazone	14
• Abstract	14
• Introduction	15
• Materials and Methods	17
• Results and Discussion	20
• Acknowledgements	25
• Literature Cited	26
Chapter III	
Absorption, translocation, and metabolism of sulfentrazone in potato ( <i>Solanum tuberosum</i> ) and selected weeds	39
• Abstract	39
• Introduction	40
• Materials and Methods	41

	• Results and Discussion	44
	• Sources of Materials	47
	• Acknowledgements	48
	• Literature Cited	49
	• Captions for Figures	54
Chapter IV	Responses of winter wheat ( <i>Triticum aestivum</i> ) and diclofop-methyl-sensitive and -resistant Italian ryegrass	56
	• Abstract	56
	• Introduction	57
	• Materials and Methods	60
	• Results and Discussion	65
	• Sources of Materials	70
	• Acknowledgements	72
	• Literature Cited	73
	• Captions for Figures	82
Chapter V	Control of Italian ryegrass ( <i>Lolium multiflorum</i> ) in wheat ( <i>Triticum aestivum</i> ) with several postemergence herbicides	84
	• Abstract	84
	• Introduction	85
	• Materials and Methods	89
	• Results and Discussion	93
	• Acknowledgements	100
	• Literature Cited	101
Chapter VI	Influence of AE F130060 03 application timing and rate on wheat ( <i>Triticum aestivum</i> ) response and Italian ryegrass ( <i>Lolium multiflorum</i> ) control	113
	• Abstract	113
	• Introduction	114
	• Materials and Methods	118
	• Results and Discussion	122

	• Acknowledgements	133
	• Literature Cited	134
	• Captions for Figures	137
Chapter VII	Wheat ( <i>Triticum aestivum</i> ) cultivar tolerance To AE F130060 03	151
	• Abstract	151
	• Introduction	152
	• Materials and Methods	154
	• Results and Discussion	157
	• Acknowledgements	161
	• Literature Cited	162
Chapter VIII	Characterization of growth and reproductive Ability of imidazolinone-sensitive and -resistant smooth pigweed ( <i>Amaranthus hybridus</i> L.)	170
	• Abstract	170
	• Introduction	171
	• Materials and Methods	173
	• Results and Discussion	178
	• Sources of Materials	184
	• Acknowledgements	184
	• Literature Cited	185
Chapter IX	Summary	199
Vitae		203

## List of Figures

Chapter	Figure	Title	Page Number
III	3.1	Absorption of [ <sup>14</sup> C] sulfentrazone per g fresh weight of common lambsquarters ( <i>Chenopodium album</i> L.), jimsonweed ( <i>Datura stramonium</i> L.), and potato ( <i>Solanum tuberosum</i> L.) after 6, 12, 24, and 48 h root exposure	55
IV	4.1	Absorption of [ <sup>14</sup> C] AE F130060 03 by winter wheat and Italian ryegrass	83
VI	6.1	Growth responses of diclofop-methyl-sensitive and -resistant Italian ryegrass to incremental rates of AE F130060 03 (6.1A) and diclofop-methyl (6.1B) as a percent of nontreated biomass	138
VIII	8.1	Noncompetitive growth of smooth pigweed biotypes in the greenhouse	190
	8.2	Vegetative, reproductive, and total shoot biomass production for imidazolinone-susceptible (S) and -resistant (R1, R2, R3, R4, and R5) smooth pigweed biotypes in the greenhouse	191
	8.3	Seed production per plant for imidazolinone-susceptible (S) and -resistant (R1, R2, R3, R4, and R5) smooth pigweed biotypes in the greenhouse	192
	8.4	Smooth pigweed germination over a 12 d imbibition period	193
	8.5	Effect of plant density on smooth pigweed shoot growth in the field	194
	8.6A	Noncompetitive growth of smooth pigweed biotypes at one plant m <sup>-2</sup>	195

8.6B	Competitive growth of smooth pigweed biotypes at 16 plants m <sup>-2</sup>	196
8.6C	Competitive growth of smooth pigweed biotypes at 36 plants m <sup>-2</sup>	197
8.7	Smooth pigweed vegetative, reproductive, and total biomass as influenced by plant density in the field	198

## List of Tables

Chapter	Table	Title	Page Number
II	2.1	Environmental conditions at and following preemergence and at-emergence applications in 2000 and 2001	30
II	2.2	Potato injury from sulfentrazone and other herbicides in 2000 and 2001	31
II	2.3	Average potato height in 2001 and average potato flowering in 2000 and 2001 from sulfentrazone and other herbicides	33
II	2.4	Control of common lambsquarters, common ragweed, and annual grasses from sulfentrazone and other herbicides	35
II	2.5	Potato grade and yield as influenced by sulfentrazone and other herbicides in 2000	37
III	3.1	Translocation of [ <sup>14</sup> C] sulfentrazone from roots to shoots in common lambsquarters, jimsonweed, and potato after 6, 12, 24, and 48 h root exposure	52
III	3.2	Sulfentrazone metabolism by common lambsquarters, jimsonweed, and potato seedling as influenced by time and plant portion	53
IV	4.1	Interaction of herbicide treatment and Italian ryegrass population on biomass production of diclofop-methyl-sensitive and -resistant Italian ryegrass	79
IV	4.2	Translocation of [ <sup>14</sup> C] AE F130060 03 in winter wheat and Italian ryegrass	80

IV	4.3	Metabolism of AE F130060 00 in winter Wheat and Italian ryegrass as influenced by time, herbicide safener, and Italian ryegrass population	81
V	5.1	Levels of diclofop-methyl resistance and densities of Italian ryegrass populations, and rainfall before and after herbicide applications in Accomack and Northampton Co., VA in 2000 and 2001	105
V	5.2	Late-season control and inflorescence emergence of diclofop-methyl-sensitive Italian ryegrass following postemergence herbicide applications in 2000 and 2001 at Painter, VA	106
V	5.3	Early-season wheat injury, wheat grain yield, and percent Italian ryegrass seed in harvested grain samples following herbicide applications to diclofop- methyl-sensitive Italian ryegrass at Painter, VA	108
V	5.4	Early-season wheat injury following herbicide applications for control of diclofop-methyl-resistant Italian ryegrass near Cape Charles, VA and at two sites near Pungoteague, VA	110
V	5.5	Late-season inflorescence emergence and control of diclofop-methyl-resistant Italian ryegrass following postemergence herbicide applications near Cape Charles, VA in 2000 and Pungoteague, VA in 2001	111
VI	6.1	Levels of diclofop-methyl-resistance and densities of Italian ryegrass populations, and rainfall before and after herbicide applications in Accomack and Northampton Co., VA in 2000 and 2001.	139

VI	6.2	Influence of herbicide rate and application timing on wheat injury 2 wk following herbicide applications for control of diclofop-methyl-sensitive Italian ryegrass near Painter, VA in 2000 and 2001	141
VI	6.3	Influence of herbicide rate and application timing on diclofop-methyl-sensitive Italian ryegrass control near Painter, VA	142
VI	6.4	Influence of herbicide rate and application timing on diclofop-methyl-sensitive Italian ryegrass inflorescence emergence near Painter, VA	144
VI	6.5	Wheat yield following herbicide Applications for control of diclofop-methyl-sensitive Italian ryegrass near Painter, VA in 2000	146
VI	6.6	Wheat injury following herbicide applications for diclofop-methyl-resistant Italian ryegrass control near Cape Charles and Pungoteague, VA	147
VI	6.7	Influence of herbicide application timing on diclofop-methyl-resistant Italian ryegrass control near Cape Charles and Pungoteague, VA	149
VI	6.8	Diclofop-methyl-resistant Italian ryegrass inflorescence emergence following herbicide applications near Pungoteague, VA in 2002	150
VII	7.1	Influence of AE F130060 03 application on biomass production of winter wheat cultivars in the greenhouse	165
VII	7.2	Influence of AE F130060 03 treatment and winter wheat cultivar on wheat injury, tillering, and plant height in field experiments	166



VII	7.3	Influence of AE F130060 03 treatment and winter wheat cultivar on wheat grain yield in 2000	168
VII	7.4	Influence of AE F130060 03 treatment and winter wheat cultivar on wheat grain yield, moisture, and kernel weight in 2001	169
VIII	8.1	Nonlinear regression coefficients for growth curves in Figure 8.1 (smooth pigweed growth in the greenhouse) and Figure 8.4 (smooth pigweed germination) for one imidazolinone-susceptible and five -resistant smooth pigweed biotypes	188
VIII	8.2	Nonlinear regression coefficients for growth curves in Figure 8.5 (effect of plant density on smooth pigweed growth) and Figure 8.6 (8.6A, smooth pigweed growth at one plant m <sup>-2</sup> ; 8.6B, 16 plants m <sup>-2</sup> ; and 8.6C, 32 plants m <sup>-2</sup> )	189