

Table of Contents

	Page #
Abstract	ii
Acknowledgments	iv
List of Figures	viii
List of Tables	ix
Chapter I	Introduction and Review of Literature 1
	■ Characterization of ALS-Inhibiting Herbicide-Resistant Smooth Pigweed 1
	■ Corn Weed Management Programs Utilizing Mesotrione in Combinations with Other Herbicides 4
	■ Literature Cited 9
Chapter II	A New Site Mutation in the ALS Gene Confers Resistance to Four Classes of ALS-Inhibiting Herbicides 14
	■ Abstract 14
	■ Introduction 14
	■ Materials and Methods 16
	■ Results and Discussion 20
	■ Sources of Materials 23
	■ Acknowledgments 24
	■ Literature Cited 25
Chapter III	Characterization of ALS Resistance in Several Smooth Pigweed Biotypes 37
	■ Abstract 37
	■ Introduction 37
	■ Materials and Methods 39

	■ Results and Discussion	41
	■ Sources of Materials	45
	■ Acknowledgments	46
	■ Literature Cited	47
Chapter IV	Mesotrione, <i>S</i>-metolachlor, and Atrazine Mixtures	
	Preemergence in Corn (<i>Zea mays</i>)	54
	■ Abstract	54
	■ Introduction	55
	■ Materials and Methods	56
	■ Results and Discussion	57
	■ Acknowledgments	60
	■ Literature Cited	61
Chapter V	Mesotrione, Nicosulfuron plus Rimsulfuron, and	
	Atrazine Mixtures in Corn (<i>Zea mays</i>)	67
	■ Abstract	67
	■ Introduction	68
	■ Materials and Methods	69
	■ Results and Discussion	71
	■ Acknowledgments	76
	■ Literature Cited	77
Chapter VI	Mesotrione and Nicosulfuron plus Rimsulfuron plus	
	Atrazine in Corn (<i>Zea mays</i>)	89
	■ Abstract	89
	■ Introduction	90
	■ Materials and Methods	91
	■ Results and Discussion	93
	■ Acknowledgments	97
	■ Literature Cited	98

Chapter VII	Mesotrione, Rimsulfuron plus Thifensulfuron, and Atrazine Mixtures in Corn (<i>Zea mays</i>)	106
	■ Abstract	106
	■ Introduction	107
	■ Materials and Methods	109
	■ Results and Discussion	111
	■ Acknowledgments	114
	■ Literature Cited	115
Chapter VIII	Summary	124
Vita		126

List of Figures

Chapter	Figure	Title	Page #
II	2.1A	Whole-plant response of susceptible and resistant smooth pigweed biotypes to the sulfonylurea herbicide chlorimuron	31
	2.1B	Whole-plant response of susceptible and resistant smooth pigweed biotypes to the sulfonylurea herbicide thifensulfuron	32
	2.1C	Whole-plant response of susceptible and resistant smooth pigweed biotypes to the imidazolinone herbicide imazethapyr	33
	2.1D	Whole-plant response of susceptible and resistant smooth pigweed biotypes to the pyrimidinylthiobenzoate herbicide pyrithiobac	34
	2.1E	Whole-plant response of susceptible and resistant smooth pigweed biotypes to the triazolopyrimidine sulfonanilide herbicide cloransulam	35
	2.2	<i>Arabidopsis thaliana</i> seedling growth on media that contained no selection agent, hygromycin at 25 mg L ⁻¹ , or imazethapyr at 0.5 or 5 µM	36

List of Tables

Chapter	Table	Title	Page #
II	2.1	Oligonucleotide primer sequences used in sequencing reactions	29
	2.2	Summary of whole-plant responses for susceptible (S) and resistant (R11) smooth pigweed biotypes to five ALS-inhibiting herbicides	30
III	3.1	Oligonucleotide primer sequences used in sequencing reactions	50
	3.2	Resistance ratios (R/S) of four resistant (R5, R6, R7, R8) smooth pigweed biotypes to five ALS-inhibiting herbicides based on GR ₅₀ values	51
	3.3	Biomass reduction of one susceptible (S) and four resistant (R5, R6, R7, R8) smooth pigweed biotypes by selected rates of five ALS-inhibiting herbicides	52
	3.4	Whole-plant response summary for susceptible (S) and resistant (R5, R6, R7, R8) smooth pigweed biotypes to five ALS-inhibiting herbicides	53
IV	4.1	Rainfall at 10-d intervals for 20 d after preemergence applications in 2001, 2002, and 2003	63
	4.2	Common lambsquarters and common ragweed control 6 WAT with preemergence mesotrione, <i>S</i> -metolachlor, and atrazine treatments	64
	4.3	Morningglory species and smooth pigweed control 6 WAT with preemergence mesotrione, <i>S</i> -metolachlor, and atrazine treatments	65

	4.4	Corn yield with preemergence mesotrione, <i>S</i> -metolachlor, and atrazine treatments	66
V	5.1	Planting date, herbicide application dates, and corn height and stage at time of applications	80
	5.2	Weed height and density at the time of postemergence applications	81
	5.3	Corn response 2 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	82
	5.4	Common lambsquarters control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	83
	5.5	Common ragweed control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	84
	5.6	Smooth pigweed and morningglory species control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	85
	5.7	Large crabgrass control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	86

	5.8	Giant foxtail control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	87
	5.9	Corn yield from POST mesotrione, nicosulfuron plus rimsulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron POST	88
VI	6.1	Planting date, herbicide application dates, and corn height and stage at time of applications	101
	6.2	Weed height and density at the time of postemergence applications	102
	6.3	Common ragweed and morningglory species control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron plus atrazine, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron plus atrazine POST	103
	6.4	Large crabgrass and giant foxtail control 8 WATP from POST mesotrione, nicosulfuron plus rimsulfuron plus atrazine, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron plus atrazine POST	104
	6.5	Corn yield from POST mesotrione, nicosulfuron plus rimsulfuron plus atrazine, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb nicosulfuron plus rimsulfuron plus atrazine POST	105
VII	7.1	Planting date, herbicide application dates, and corn height and stage at time of applications	118

7.2	Weed height and density at the time of postemergence applications	119
7.3	Corn response 2 WATP and common lambsquarters control 8 WATP from POST mesotrione, rimsulfuron plus thifensulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb rimsulfuron plus thifensulfuron POST	120
7.4	Common ragweed and morningglory species control 8 WATP from POST mesotrione, rimsulfuron plus thifensulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb rimsulfuron plus thifensulfuron POST	121
7.5	Giant foxtail and large crabgrass control 8 WATP from POST mesotrione, rimsulfuron plus thifensulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb rimsulfuron plus thifensulfuron POST	122
7.6	Corn yield from POST mesotrione, rimsulfuron plus thifensulfuron, and atrazine combinations and from PRE <i>S</i> -metolachlor plus atrazine alone and fb rimsulfuron plus thifensulfuron POST	123