

## **Using Zidua® (pyroxasulfone) for Italian ryegrass control in winter wheat in the Pacific Northwest – a report on Zidua crop safety and weed control efficacy**

Zidua (pyroxasulfone) is a recently developed herbicide in the isoxazoline family (inhibitor of Very Long Chain Fatty Acid or VLCFA synthesis). Zidua has the potential to be readily available for seedling absorption without leaching past the seed zone. Three studies were conducted near Pullman, WA in 2013-2014 to evaluate: 1) the safety of Zidua on winter wheat and 2) the efficacy of Zidua on Italian ryegrass.

### **1. Evaluating winter wheat response to Zidua applied PRE, delayed PRE or early POST.**

A study was established in the fall of 2013 at the Spillman Agronomy Farm near Pullman, WA. Winter wheat (variety 'ARS-Amber') was planted at a 90 lb/A rate on October 7, 2013 with a Horsch air seed drill. Treatments consisted in different Zidua rates applied alone or with different tankmix partners. One treatment consisted in Axiom® (flufenacet plus metribuzin) applied at a recommended labeled rate to compare crop responses to Zidua with response to another VLCFA inhibitor (flufenacet) labeled in winter wheat. The experimental design was a randomized complete block with 4 replications. Plots were 12 ft wide by 30 ft long. Treatment application details are presented in Table 1.1. PRE and delayed PRE applications were followed by 0.25 in of supplemental water applied through a plot-sized PVC-pipe sprinkler system. Treatments are detailed in Table 1.2. The entire study area was maintained weed-free with Discover® NG, WideMatch® and MCPA at recommended labeled rates.

No injury was observed on winter wheat during the growing season. Head trapping, a common injury symptom with VLCFA inhibitors, was evaluated by counting the number of trapped head in 2, 2.7 ft<sup>2</sup> quadrats per plot. There were no differences in head trapping among treatments. Plots were harvested using a 5 ft header combine. Treatments did not affect wheat test weight or yield.

Table 1.1. Treatment application details.

Application code	A	B	C
Date	October 8, 2013	October 23, 2013	April 2
Application volume (GPA)	10	10	15
Crop Stage	Pre-emergence	Delayed pre-emergence (80% of coleoptiles >0.4 in.)	Post-emergence (2 to 4 leaves, pre-tillering)
Air temperature (°F)	45	55	39
Soil temperature (°F)	46	49	45
Wind velocity (mph)	4.3	5	4.6
Cloud cover (%)	90	0	50

Table 1.2. Winter wheat initial injury levels, head trapping, test weight and yield.

Treatment	Application Code	Rate		October 29, 2013	June 6	August 19	
				Wheat injury	Wheat head trapping	Wheat yield	Test weight
		oz pr/A	lb ai/A	%	plants/ft <sup>2</sup>	bu/A	lb/bu
Nontreated				-	0.1	79	53.9
Zidua	A	1.25	0.027	2.5	0.1	70	56.5
Zidua	A	1.5	0.032	1.8	0.4	81	54.7
Zidua	B	1.25	0.027	4.8	0.1	86	54.9
Zidua	B	1.5	0.032	4.3	0.5	88	53.5
Zidua	B	1.25	0.027	3.5	0.2	71	56.1
Sencor®		1.45	0.028				
Zidua	B	1.5	0.032	3.0	0.1	91	54.0
Sencor		1.45	0.028				
Axiom	B	10	0.137 (flufenacet) + 0.035 (metribuzin)	4.8	0.2	72	56.5
Zidua	C	2.0	0.043	-	0.2	85	54.8
Axial® XL	C	16.4	0.021	-	0.2	95	53.9
Zidua	C	2.0	0.043	-	0.1	83	53.6
Axial XL		16.4	0.021				

## **2. Evaluating Italian ryegrass response to Zidua applied PRE, delayed PRE or early POST.**

A study was established in the fall of 2013 at the Cook Agronomy Farm near Pullman, WA. Winter wheat (variety 'ARS-Amber') was planted at a 90 lb/A rate on October 22, 2013 with a Monosem precision vacuum planter. Treatments consisted in different Zidua rates applied alone or with different tankmix partners. One treatment consisted of Axiom applied at a recommended labeled rate to compare crop responses to Zidua, since flufenacet, a component of Axiom, is also a VLCFA inhibitor. The experimental design was a randomized complete block with 4 replications. Plots were 12 ft wide by 30 ft long. Treatment application details are presented in Table 2.1. PRE and delayed PRE applications were followed by 0.25 in of supplemental water applied through a plot-sized PVC-pipe sprinkler system. Treatments are detailed in Table 2.2. The entire study area was maintained free of broadleaf weeds by using WideMatch® and MCPA at recommended labeled rates.

Wheat injury and Italian ryegrass control were visually evaluated throughout the season. Head trapping, a common injury symptom with VLCFA inhibitors, was assessed by counting the number of trapped head in 2, 2.7 ft<sup>2</sup> quadrats per plot. Plots were harvested using a 5 ft header combine. No significant wheat injury or head trapping was observed (data not presented). Results are presented in Table 2.2. Italian ryegrass control was significantly lower when Zidua was applied early in the spring (application C) than when Zidua was applied shortly after planting (applications A and B). Differences in weed control did not translate into wheat yield or test weight differences.

Table 2.1. Treatment application details.

Application code	A	B	C
Date	October 24, 2013	November 6, 2013	April 16
Application volume (GPA)	10	10	15
Crop Stage	Pre-emergence	Delayed pre-emergence (80% of coleoptiles >0.4 in.)	Post-emergence (2 to 4 leaves, pre-tillering)
Air temperature (°F)	54	43	46
Soil temperature (°F)	49	43	43
Wind velocity (mph)	4.3	3	6
Cloud cover (%)	0	99	100

Table 2.2. Italian ryegrass control and winter wheat test weight and yield. Means followed by the same letter are not statistically significantly different at  $\alpha=0.05$ .

Treatment	Application Code	Rate		June 3	August 11		
				Italian ryegrass control	Italian ryegrass control	Wheat yield	Test weight
		oz pr/A	lb ai/A	%	%	bu/A	lb/bu
Nontreated				-	-	110	55.9
Zidua	A	1.25	0.027	90 a	86 a	134	54.1
Zidua	A	1.5	0.032	95 a	95 a	133	56.0
Zidua	B	1.25	0.027	96 a	93 a	127	55.2
Zidua	B	1.5	0.032	93 a	95 a	131	54.9
Zidua	B	1.25	0.027	79 a	90 a	128	55.8
Sencor		1.45	0.028				
Zidua	B	1.5	0.032	95 a	94 a	126	55.7
Sencor		1.45	0.028				
Axiom	B	10	0.137 (flufenacet) + 0.035 (metribuzin)	87 a	93 a	119	54.6
Zidua	C	2	0.043	52 b	20 b	118	54.8
Axial XL	C	16.4	0.021	52 b	53 ab	113	55.2
Zidua	C	2	0.043	31 b	21 b	98	55.3
Axial XL		16.4	0.021				

### **3. Using a large scale experimental design to evaluate winter wheat Italian ryegrass response to Zidua**

To offer a more comprehensive study of crop and weed response to Zidua, a large-scale trial was set up in the fall of 2013 at the Cook Agronomy Farm near Pullman, WA. Winter wheat (variety 'ARS-Amber') was planted at a 90 lb/A rate on October 7, 2013 with a Horsch air seed drill. Five treatments (detailed in Table 3.2) were applied each to a strip approximately 110 ft wide by 1980 ft long. Strips were adjacent to each other and varied in topography. Non-treated check consisted of randomly assigned GPS locations. At the time of treatment applications, designated non-treated check GPS locations were covered by a 6 ft by 8 ft plastic tarp, which was removed shortly after application. There were between 20 to 22 non-treated areas in each treated strip.

All treatments were applied using a tractor-mounted sprayer with a 50 ft boom at 10 GPA. Conditions for each application are detailed in Table 3.1.

Italian ryegrass pressure was evaluated by counting plants in 2, 2.7 ft<sup>2</sup> quadrats within each non-treated check area and in the immediately adjacent treated area. Counts were performed on May 15.

Yield data was obtained in early August by harvesting one 10.8 ft<sup>2</sup> quadrat in the center of each non-treated area and one 10.8 ft<sup>2</sup> quadrat in the immediately adjacent treated area. Total wheat biomass was measured before threshing samples to obtain grain yield.

Such an experimental design does not lend itself to a statistical test comparing treatments with one another. However, using a paired t-test allows to evaluate weed and crop response for each treatment separately compared with a non-treated check. Results of all paired t-test performed on the data are presented in Table 3.2.

All treatments reduced Italian ryegrass pressure compared to a non-treated check. Zidua plus Sencor applied at a delayed pre-emergence stage reduced the Italian ryegrass population by more than 90% of the non-treated check levels. When Zidua was applied alone at 1.5 oz/A as a delayed pre-emergence treatment, it reduced Italian ryegrass pressure by more than 70% of the non-treated check levels.

Zidua applied as an early pre-emergence at 1.25 oz/A reduced wheat biomass by 7% compared to the non-treated check. The biomass reduction did not reflect in a grain yield reduction.

Zidua plus Axial XL, applied as an early post-emergence treatment, resulted in a 15% and 16% reduction in biomass and grain yield, respectively when compared to the non-treated check.

Table 3.1. Treatment application details.

Application code	A	B	C
Date	October 11, 2013	November 18, 2013	April 2
Crop Stage	Pre-emergence	Delayed pre-emergence (80% of coleoptiles >0.4 in.)	Post-emergence (2 to 4 leaves, pre-tillering)
Air temperature (°F)	52	57	39
Soil temperature (°F)	48	46	41
Wind velocity (mph)	3.3	4.1	6
Cloud cover (%)	20	0	50

Table 3.2. Wheat total biomass, grain yield and Italian ryegrass counts. Non-treated check data is indicated in parenthesis. An asterisk (\*) indicates a significant ( $\alpha=0.05$ ) difference between treated and non-treated areas.

				Italian ryegrass		
				count	Biomass	Grain yield
	Application			(nontreated	(nontreated	(nontreated
Treatment	Code	Rate		check)	check)	check)
		oz pr/A	lb ai/A	plants/ft <sup>2</sup>	lb/A	bu/A
Zidua	A	1.25	0.027	0.9 (1.9)*	103 (108)	77 (81)
Zidua	A	1.5	0.032	1.9 (5.4)*	104 (112)*	81 (86)
Zidua	B	1.25	0.027	1.1 (2.6)*	100 (100)	73 (59)
Zidua	B	1.5	0.032	0.7 (2.6)*	96 (100)	68 (73)
Zidua	B	1.25	0.027	0.1 (1.7)*	105 (100)	77 (74)
Sencor		1.45	0.028			
Zidua	C	2.0	0.043	1.0 (2.2)*	96 (112)*	71 (84)*
Axial XL		16.4	0.021			

#### 4. Conclusions

Small-scale trials found no injury caused by Zidua on winter wheat at the doses used (up to 2 oz/A). In the large scale trial, there was a yield reduction compared to the non-treated check after an early post application of Zidua tankmixed with Axial XL.

In general, late (early post-emergence) applications of Zidua resulted in lower control of Italian ryegrass than pre-emergence applications, even when tankmixed with an herbicide with a postemergence activity such as Axial XL.

The greatest numerical levels of Italian ryegrass control were achieved by Zidua applied with Sencor as a delayed pre-emergence treatment. In the small-scale trial, Zidua plus Sencor provided over 90% control of Italian ryegrass (with Zidua applied either at 1.25 or 1.5 oz/A). In the large-scale trial, Zidua (at 1.25 oz/A) plus Sencor reduced Italian ryegrass population by over 90% of its levels in the non-treated areas. Delayed pre-emergence applications of Zidua alone resulted in control of Italian ryegrass above 90% in the small scale trial, but not in the large scale trial.

**Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to \$7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.**