Weed Research in Kentucky Bluegrass and Perennial Ryegrass Seed Production - 2015

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I. Fall-planted Kentucky Bluegrass and Perennial Ryegrass field trial.

A field trial evaluating herbicide options for annual grass control in Kentucky bluegrass and perennial ryegrass new seedings was planted Aug. 19, 2014. Perennial ryegrass and Kentucky bluegrass were seeded with a cone seeder in six inch rows at 6 lbs seed/acre. Weedy grasses (rattail fescue and alkali grass) were broadcast seeded with a Brillion seeder. One row of Cadet Kentucky bluegrass contaminated with annual bluegrass was also seeded in each split plot. Plots were 7.5 feet wide by 30 feet long and herbicide treatments replicated four times in a randomized complete block design.

The trial was located on a Warden sandy loam soil at the WSU-Prosser Roza research site. Herbicide treatments were applied with a bicycle sprayer equipped with four flat fan nozzles calibrated to deliver 20 GPA. Preemergence (PRE) herbicide treatments were applied Aug. 21, 2014 and postemergence (POST) treatments applied Sept. 12, 2014 when Kentucky bluegrass was 1 to 1.5 inches tall and perennial ryegrass averaged 2.5 inches tall.

Table 1. Herbicide treatments tested in newly seeded Kentucky bluegrass and perennial ryegrass in 2014-15 at Prosser, WA.

Trt No.	PRE applied 8/21/14	Rate	EPOST applied 9/12/14	Rate
1	Mesotrione (Callisto)	6 fl oz	Mesotrione + NIS + UAN	3 fl oz
2	Mesotrione	6 fl oz	Tembotrione (Laudis) + NIS	3 fl oz
3	Mesotrione	6 fl oz	Topramezone (Impact) + MSO	0.75 fl oz
4	Mesotrione	6 fl oz	Linuron (Lorox)	1 lb ai/a
5	Mesotrione	6 fl oz	Linuron	2 lb ai/a
6	Mesotrione	6 fl oz	Glufosinate (Rely) + Goal	0.19 lb ai/a + 1.5 oz
7	Mesotrione	6 fl oz	Glufosinate + Goal	0.38 lb ai/a + 1.5 oz
8	Mesotrione	6 fl oz	Glufosinate + Ethofumesate (Nortron)	0.38 + 1 lb ai/a
9	Mesotrione	6 fl oz	Glufosinate + Metribuzin	0.38 + 0.14 lb ai/a
10	Mesotrione	6 fl oz	Pyroxasulfone (Zidua)	0.13 lb ai/a
11	Amicarbazone (Xonerate)	3.5 fl oz	Amicarbazone + NIS (canceled, crop dead)	3.5 fl oz (canceled)
12	Amicarbazone	5.25 fl oz	Amicarbazone + NIS (canceled, crop dead)	3.5 fl oz (canceled)
13	Amicarbazone + Mesotrione	3.5 + 6 fl oz	Amicarbazone + NIS *(late POST in spring*) (canceled – crop dead)	4.2 fl oz (canceled)
14	Amicarbazone	5.25 fl oz	Amicarbazone + NIS (canceled, crop dead)	5.25 fl oz (canceled)
15	Amicarbazone + Mesotrione	3.5 + 6 fl oz	----	----

16	Amicarbazone + Mesotrione	3.5 + 6 fl oz	Amicarbazone + NIS (canceled, crop dead)	3.5 fl oz (canceled)
17	Mesotrione	6 fl oz	Amicarbazone + NIS	3.5 fl oz
18	Mesotrione	6 fl oz	Quinclorac (Paramount) + MSO	0.25 lb ai/a
19	Mesotrione	6 fl oz	Amicarbazone + NIS	2.8 fl oz
20	Gowan 1093	4 oz	-----	----
21	Nontreated check			

Results. All treatments of Xonerate (amicarbazone) applied PRE from 0.11 to 0.164 lb ai/a (3.5 to 5.25 fl oz) excessively injured Kentucky bluegrass and perennial ryegrass and greatly reduced stands (Fig. 1). POST applications of Lorox (linuron) alone at 1 and 2 lb ai/a and metribuzin at 0.14 lb ai/a with glufosinate (Rely) excessively injured Kentucky bluegrass and perennial ryegrass and greatly reduced stands. However, metribuzin and linuron treatments provided the greatest control of weedy grasses suggesting that lower rates of linuron or metribuzin might provide weedy grass control with less injury to Kentucky bluegrass or perennial ryegrass (Fig. 2).

Pyroxasulfone (Zidua) at 0.133 lb ai/a applied early POST greatly stunted the growth of both Kentucky bluegrass and perennial ryegrass. POST applied quinclorac (Paramount), tembotrione (Laudis), topramezone (Impact), and Gowan 1093 only slightly injured Kentucky bluegrass and perennial ryegrass, but did not control emerged grass weeds well. Sequential applications of Callisto alone (PRE followed by POST) were safe on both Kentucky bluegrass and perennial ryegrass, but did not control grass weeds well.

The most promising treatments for grass control on perennial ryegrass were Callisto applied PRE followed POST with either Rely plus Nortron, Rely plus Goal, or by Xonerate at 0.088 lb ai/a to 0.11 lb ai/a (2.8 to 3.5 fl oz). Xonerate treatments applied POST were more injurious to the ryegrass than the Rely plus Goal or Rely plus Nortron tank mixes.

The same four treatments were also the most promising for grass control in Kentucky bluegrass. Callisto applied PRE followed POST with either Rely plus Nortron or Rely plus Goal resulted in only 7 to 15% injury in Kentucky bluegrass. Xonerate at 0.088 lb ai/a to 0.11 lb ai/a applied POST were much more injurious (41 to 61%) to the Kentucky bluegrass than the Rely plus Goal or Rely plus Nortron tank mixes, but controlled weedy grasses from 66 to 68%.

II. Greenhouse Response of Rattail fescue, Alkali grass, annual bluegrass, Kentucky bluegrass, and Perennial Ryegrass to Asulam (Asulox).

Greenhouse trials were conducted to determine the response of Kentucky bluegrass, perennial ryegrass, and three weedy grasses; alkali grass, rattail fescue, and annual bluegrass to asulam (Asulox) applied at two rates; 1.6 and 2.5 lb ai/a at the 2-4 inch, 3 leaf stage and the 4-5 inch 4-5 leaf stage. Seed of each grass species was sown separately in 4-inch pots filled with potting mix (Sunshine). Herbicides were applied at the two stages of grass growth using a single nozzle bench sprayer calibrated to deliver 25

GPA. Percent visual injury of each grass species was rated at 3 and 6 weeks after treatment (WAT) and the experiment was repeated.

Results. In the first trial conducted, Asulox injured perennial ryegrass the least, ranging from 27 to 71% at 6 WAT, and all other grass species, including Kentucky bluegrass were injured from 62 to 99% (Table 2). Applying at the later stage and at the higher Asulox rate resulted in more injury or control than applying at the earlier stage and at the lower rates.

In the second trial, Asulox injured perennial ryegrass the least at 33 to 69% and Kentucky bluegrass was injured 24 to 99%, while injury to weedy grasses ranged from 76 to 99%. Alkali grass and rattail fescue were injured the most over both trials. Injury to all grasses was greater when applied at the later stage of growth and Asulox applied at 2.5 lb ai/a resulted in greater injury than Asulox applied at 1.7 lb ai/a.

Kentucky bluegrass tolerance to Asulox was not adequate in these trials and it is questionable whether there is adequate safety to perennial ryegrass to warrant further research.

Table 2. Injury or control of five grass species 6 weeks after application of Asulox at two growth stages and two rates in greenhouse trial at WSU-Prosser in 2015. Experiment 1.

	Perennial ryegrass	Kentucky bluegrass	Annual bluegrass	Rattail Fescue	Alkali grass
Early					
Asulox 1.7 lb ai	27 l	62 j	67 i	69 hi	75 fg
Asulox 2.5 lb ai	42 k	72 gh	81 de	83 d	78 ef
Late					
Asulox 1.7 lb ai	41 k	98 a	94 ab	96 a	89 c
Asulox 2.5 lb ai	71 ghi	98 a	96 a	99 a	90 bc

Means followed by the same letter are not significantly different at P=0.05 level.

Table 3. Injury or control of five grass species following application of Asulox at two rates in greenhouse trial at WSU-Prosser in 2015. Experiment 2.

	Perennial ryegrass	Kentucky bluegrass	Annual bluegrass	Rattail Fescue	Alkali grass
Early					
Asulox 1.7 lb ai	33 h	34 h	76 d	91 b	98 a
Asulox 2.5 lb ai	41 g	86 c	77 d	91 b	97 a
Late					
Asulox 1.7 lb ai	63 f	24 i	97 a	97 a	99 a
Asulox 2.5 lb ai	69 e	99 a	99 a	98 a	99 a

Means followed by the same letter are not significantly different at P=0.05 level.

III. Established Kentucky Bluegrass Cultivar response to Asulox and Xonerate.

A field trial was conducted to evaluate Kentucky bluegrass cultivar response to Asulox (asulam) and Xonerate (amicarbazone) herbicides applied POST. The trial was located on a commercial field containing 21 cultivars of Kentucky bluegrass seed located on a sandy loam soil near Paterson, WA. Kentucky bluegrass cultivars had been planted the previous fall and ranged from 1 to 2.5 inches tall at the time of herbicide applications on March 16, 2015. Xonerate was tested at 0.11 lb ai/a (3.5 fl oz) plus nonionic surfactant (NIS) at 0.25% v/v and Asulox was tested at 2.5 lb ai/a (6 pts) plus NIS at 0.25% v/v. Herbicides were applied with a back pack CO_2 pressurized sprayer with three flat fan nozzles calibrated to deliver 20 GPA. Plots were 5 ft by 15 feet and treatments were not replicated. Herbicides were applied perpendicular to the planting direction of the 21 Kentucky bluegrass cultivars. Applications of each herbicide were repeated on April 15, 2015 to the same plots.

Results. Injury on Kentucky bluegrass cultivars following Asulox at 2.5 lb ai/a ranged from 2 to 35% injury at 30 DAT. Lato cultivar was injured the greatest and Krypton, A03-1017, Harmonie, and Madison were injured the least. Injury to all Kentucky bluegrass cultivars was greatly increased following the second application of Asulox (average 79% injury at 29 DAT). At 29 DAT (after second application), injury ranged from 55 to 95%. Cultivars KCCL4 and Blackjack were injured the least and Bluenote and A05361 were injured the greatest. Two sequential applications of Asulox at 2.5 lb ai/a rate were too injurious to Kentucky bluegrass to warrant further research with this herbicide. One application may have some merit and was relatively safe on many cultivars.

Injury on Kentucky bluegrass cultivars following Xonerate at 0.11 lb ai/a (3.5 fl oz) was less than with Asulox and ranged from 0 to 15% injury at 30 DAT. Only two cultivars, KCCL4 and Aviator were injured 10% or more. Injury to all Kentucky bluegrass cultivars was increased following the second application of Xonerate (average 19.5% injury at 29 DAT). At 29 DAT (after second application), injury ranged from 5 to 60%. Cultivars Ridgeline, Madison, PST, and Krypton were only injured 5% while KCCL4 and Aviator were injured 40 and 60%, respectively. Xonerate may have potential for use in Kentucky bluegrass seed production when applied POST to established grass.

There was not enough grass weeds in the trial to collect weed control data. Volunteer wheat was present, but was not controlled well by either herbicide.

Table 4. Kentucky Bluegrass cultivar response to sequential POST applications of Asulox and Xonerate herbicides near Paterson, WA in 2015. Herbicides were applied March 16 and again April 15, 2015.

		Kentucky Bluegrass Injury					
		10 DAT	22 DAT	30 DAT	15 DAT	29 DAT	56 DAT
Treatment	Cultivar	3/26/15	4/7/15	4/15/15	4/30/15	5/14/15	6/10/15
		---------- (%) ----------					
Asulam	Prafin	2	2	5	50	70	70
2.5 lb ai/a	RAD 553	0.5	3	8	50	75	70

	Lato	5	15	35	80	90	97
	Gladstone	3	5	10	60	83	98
	Aviator	3	5	10	25	90	98
	Ridgeline	5	5	8	25	68	70
	Arc	3	2	8	45	70	95
	Milagro	1	1	5	38	60	85
	Bluenote	5	10	12	80	95	96
	Skye	3	5	10	70	85	80
	A03-1017	2	5	3	30	85	80
	Harmonie	1	1.5	3	50	75	99
	Madison	0	2	3	30	80	95
	Midnight	1	3	8	60	85	95
	KCCL4	0.5	10	8	20	55	30
	Blackjack	3	5	8	30	60	40
	Arrowhead	3	7	12	30	85	98
	PST	0.5	2	10	70	80	70
	Legend	4	7	15	68	90	90
	A05361	2	3	10	90	95	98
	Krypton	0	0	2	30	80	88
	AVERAGE	2.3	4.7	9.2	49.1	78.9	83.0
Amicarbazone	Prafin	0	0	0	12	8	5
0.11 lb ai/a	RAD 553	0	5	5	25	28	3
	Lato	0	5	3	28	35	5
	Gladstone	0	2	2	10	20	3
	Aviator	0	15	15	40	60	80
	Ridgeline	0	3	0	5	5	0
	Arc	0	1	0	12	30	3
	Milagro	0	0	0	5	7	0
	Bluenote	0	0	0	10	25	5
	Skye	0	0	0	8	7	5
	A03-1017	0	0	0	12	15	0
	Harmonie	0	0	0	15	20	0
	Madison	0	0	0	5	5	0
	Midnight	0	3	2	30	23	0
	KCCL4	0	10	10	45	40	0
	Blackjack	0	0	0	30	25	0
	Arrowhead	0	0	2	30	30	0
	PST	0	0	0	5	5	0
	Legend	0	0	0	8	9	0
	A05361	0	0	0	5	8	0
	Krypton	0	0	0	5	5	0

	AVERAGE	0.0	2.1	1.9	16.4	19.5	5.2

IV. Fall-planted Kentucky Bluegrass field trial.

A field trial evaluating herbicide options for annual grass control in Kentucky bluegrass new seedings was planted Aug. 17, 2015. Kentucky bluegrass (Jacklin Seed) was seeded with a cone seeder in six inch rows at 5.5 lbs seed/acre. One row each of weedy grasses, rattail fescue and annual bluegrass, were seeded with a single row seeder in each plot. Plots were 7.5 feet wide by 25 feet long and herbicide treatments replicated three times in a randomized complete block design.

The trial was located on a Warden sandy loam soil at the WSU-Prosser research site. Herbicide treatments were applied with a four nozzle bicycle sprayer calibrated to deliver 20 GPA. PRE treatments were applied Aug. 17, 2015 POST treatments applied Sept. 11, 2015 when Kentucky bluegrass was 1 to 1.5 inches tall.

Table 5. Herbicide treatments tested in newly seeded Kentucky bluegrass in 2015 at Prosser, WA.

Trt No.	PRE applied 8/17/14	Rate	EPOST applied 9/11/15	Rate
1	Mesotrione	6 fl oz	----	----
2	Mesotrione (Callisto)	6 fl oz	Mesotrione + NIS + UAN	3 fl oz
3	Mesotrione	6 fl oz	Glufosinate + Goal	0.38 lb ai/a + 1.5 oz
4	Mesotrione	6 fl oz	Glufosinate + Goal + AMS	0.38 lb ai/a + 1.5 oz
5	Mesotrione	6 fl oz	Glufosinate + Ethofumesate (Nortron)	0.38 + 1 lb ai/a
6	Mesotrione	6 fl oz	Amicarbazone (Xonerate) + NIS	1.6 fl oz
7	Mesotrione	6 fl oz	Amicarbazone + NIS	2.2 fl oz
8	Mesotrione	6 fl oz	Glufosinate + Linuron (Linex)	0.38 + 0.25 lb ai/a

Results. Sequential applications of Callisto (mesotrione) alone (PRE followed by POST) were safe on Kentucky bluegrass, but did not control annual bluegrass and only partially suppressed rattail fescue 30 to 50% (Fig. 3, 4, and 5). POST applications of applications of Xonerate (amicarbazone) at both rates and Rely (glufosinate) plus Linex (linuron) excessively injured Kentucky bluegrass (>95%) and greatly reduced stands. Kentucky bluegrass was too young at the time of application in this trial to tolerate POST applications of Xonerate well.

The three most promising treatments for grass control on newly seeded Kentucky bluegrass were Callisto PRE followed POST with either Rely plus Goal (with or without AMS) or followed by Rely plus Nortron. However, significant crop injury occurred with all these treatments and only partial control of the grass weeds was obtained. Control of these grass weed species in new plantings of Kentucky bluegrass remains a difficult challenge.

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Paul Hedgpeth and Jory Iverson also contributed grass seed, land for research trials, and invaluable advice on conducting the trials.

Figure 1. Kentucky bluegrass and perennial ryegrass injury Oct. 24, 2014 following herbicides applied Aug. 19, 2014 and Sept. 12, 2014 at Prosser, WA. See complete treatment list in Table 1.

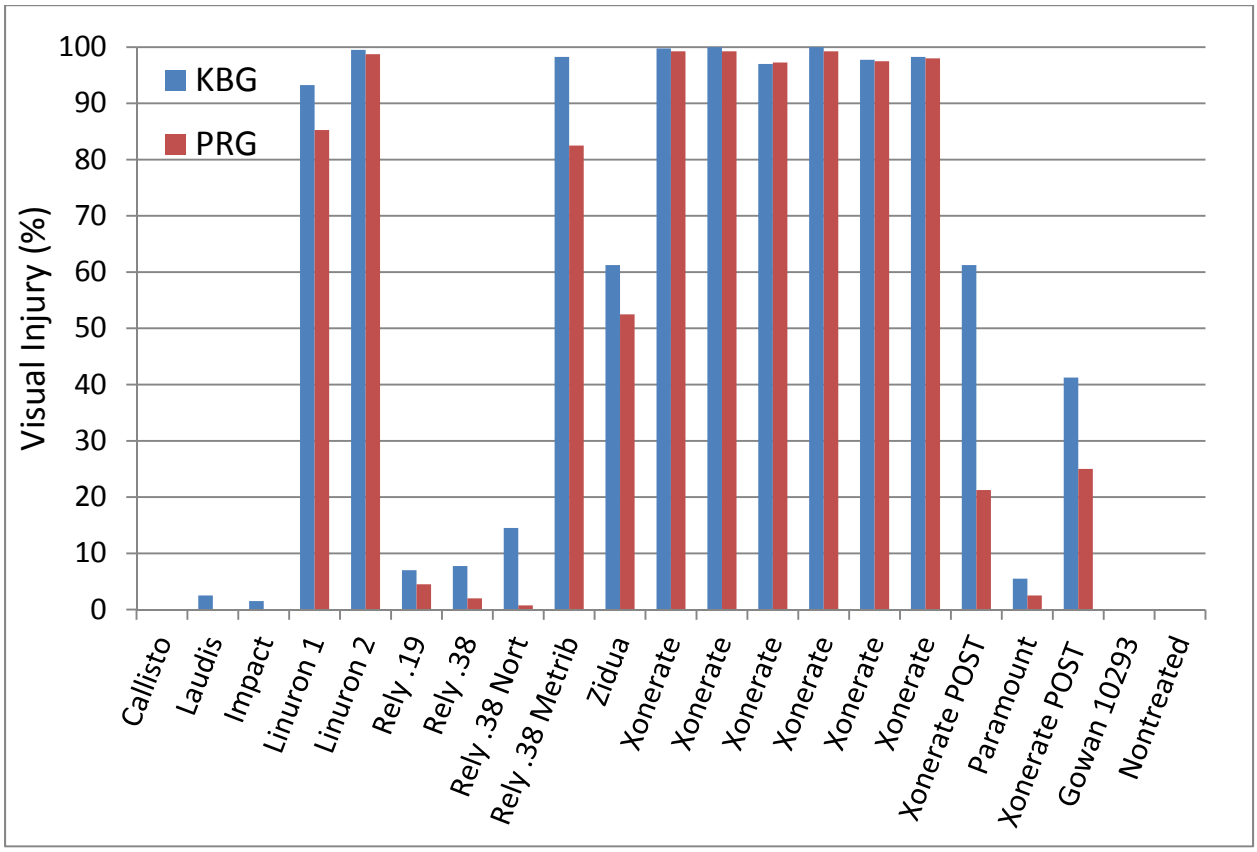

Figure 2. Rattail fescue and alkali grass control Oct. 24, 2014 following herbicides applied Aug. 19, 2014 and Sept. 12, 2014 at Prosser, WA. See complete treatment list in Table 1.

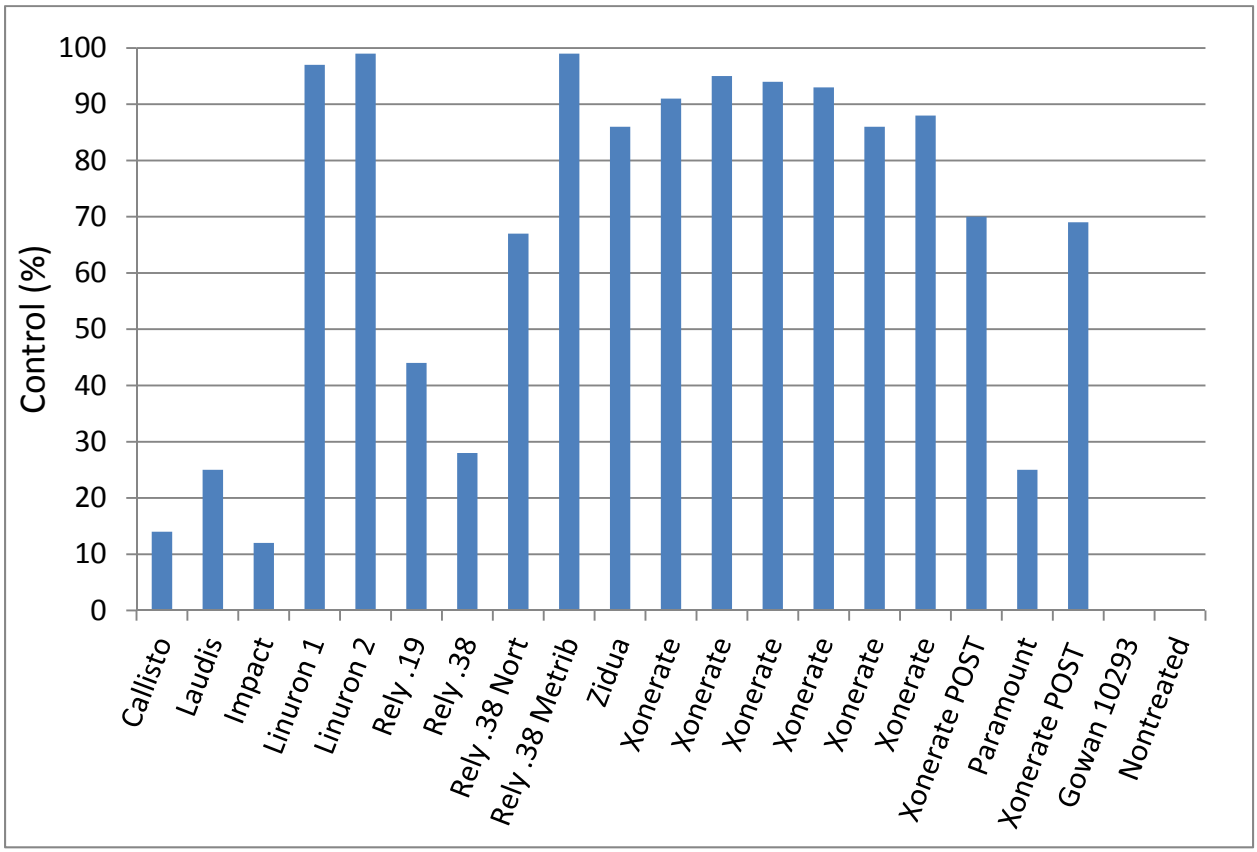

Figure 3. Kentucky bluegrass injury 2 and 4 weeks following herbicides applied Aug. 17, 2015 and Sept. 11, 2015 at Prosser, WA. See complete treatment list in Table 5.

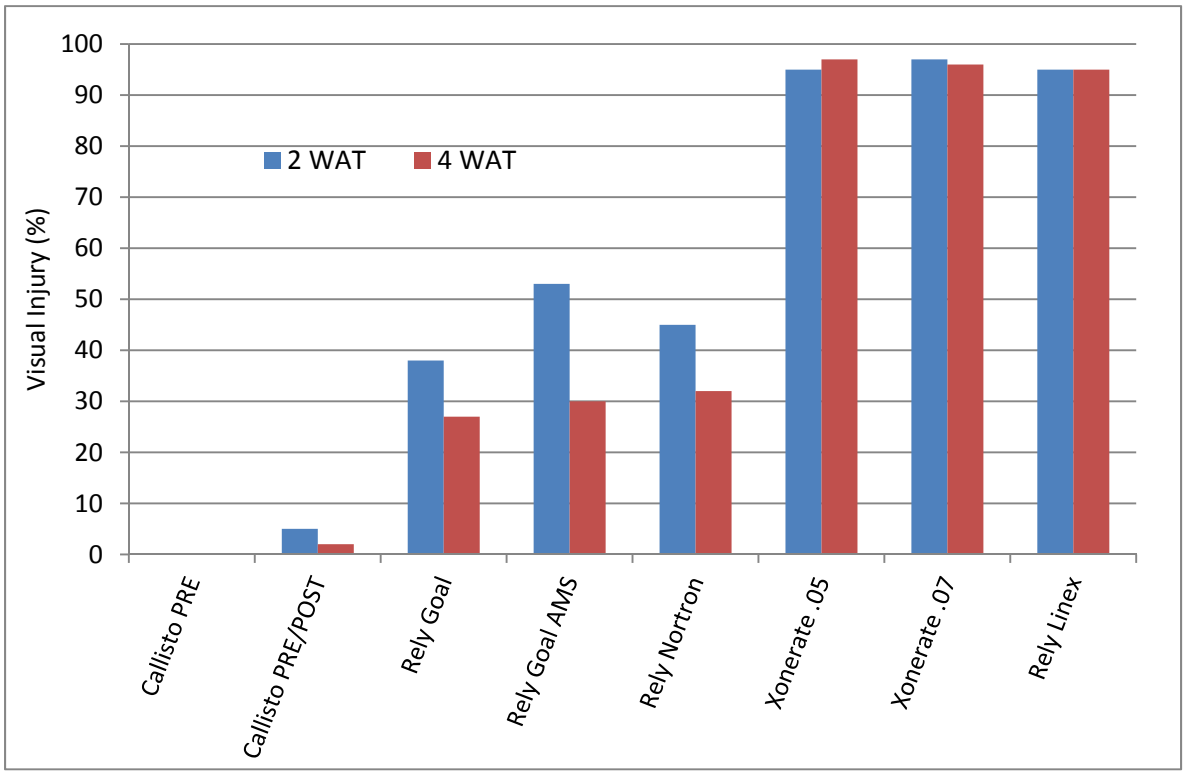

Figure 4. Annual bluegrass control 2 and 4 weeks following herbicides applied Aug. 17, 2015 and Sept. 11, 2015 at Prosser, WA. See complete treatment list in Table 5.

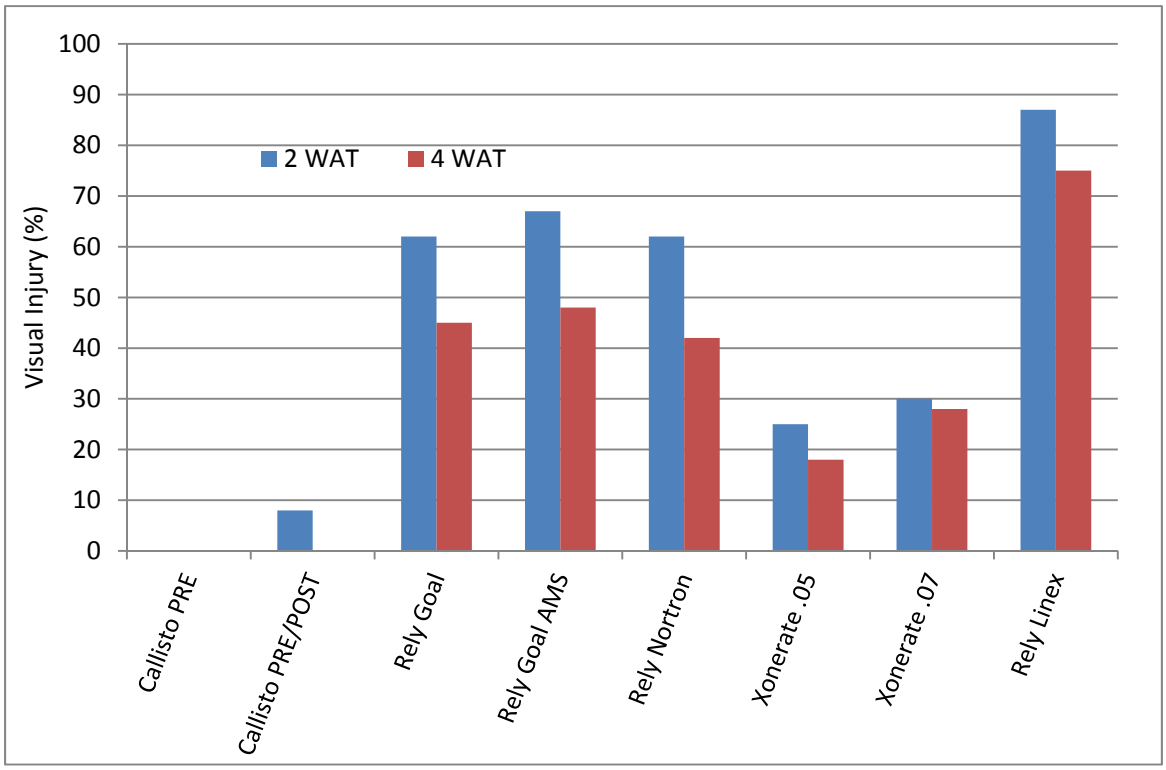

Figure 5. Rattail fescue control 2 and 4 weeks following herbicides applied Aug. 17, 2015 and Sept. 11, 2015 at Prosser, WA. See complete treatment list in Table 5.