Seed Bank Management for Italian Ryegrass in Eastern WA

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Seed bank management for Italian ryegrass is critical component of an integrated management system. However, little is known of the seedbank longevity of Italian ryegrass in Washington. The objective of this study is to evaluate the efficacy of control on Italian ryegrass germination with applied chemical methods within a high rainfall zone in eastern Washington over a two-year cropping period. Italian ryegrass is becoming more prevalent and widespread within Eastern Washington, with higher rates of resistance to numerous herbicide modes of action. The preemergence herbicide indaziflam was used to prevent the germination of Italian ryegrass seedlings at the WSU Cook Agronomy farm, near Pullman WA. and near Almota, WA. Additionally, indaziflam was used within the wheat production system to gain an understanding of residual effects that the active ingredient of indaziflam has on the crop safety for eastern Washington dryland crops.

Two identical studies were established at the WSU Cook Agronomy farm near Pullman and the other trial near Almota, WA. The study was conducted in a randomized complete design with 4 replications and 3 different treatments among the repetitions. Each plot measured to be 30’ by 35’. In year 1, indaziflam was applied postemergence to soft white spring wheat varieties that were infested with Italian ryegrass at both locations within the direct-seeding systems. For both trials, indaziflam treatments were applied with Axial Bold and NIS on May 8th of 2020 at the 2 to 3 tiller stage of the spring wheat (Table 1). Treatments were applied using a CO2 powered backpack sprayer calibrated to 15 gallons per acre, at 3 mph. Italian ryegrass seedlings were barely emerged from the soil, if not emerged. Soil seedbank samples were collected from the trial site before planting and after harvest. Italian ryegrass density was assessed for both trials 1 month after treatment and before harvest from a 1-m² quadrant place randomly at two sites per plot. Harvest at the WSU Cook Agronomy study began on September 3, 2020 and harvest began on August 27, 2020 at Almota. A Wintersteiger plot combine with a 5-ft header was used to harvest plots. One day after harvest, the labeled bags were weighed and recorded.

For the second cropping year, dryland rotational small grain and broadleaf crops were planted to assess effects from the preemergence application of indaziflam applied the previous season. Each main plot was divided into 5 sub plots, measuring approximately 7 feet wide and 35 feet long. The crop varieties that were seeded, date seeded and harvested are displayed in Table 2. Soil seedbank samples were collected from the main plots before planting and from each sub-plot after harvest for later analysis of the Italian ryegrass seedbank. Italian ryegrass densities were assessed with 2 1-m² quadrats place randomly in each sub-plot. Italian ryegrass densities were assessed at planting and before harvest (Figures 2 and 3). Weekly assessments of percent Italian ryegrass control, crop injury and crop stand density for wheat, canola, barley, chickpea and fallow was recorded for each site location (Tables 3 and 4). All crops were harvested with a Kincaid plot combine at a single 5-foot swath, bagged and weighed and then analyzed for yield. Figures 4 through 8 correspond to each crop within each indaziflam treatment at the Almota site and Figures 9 through 13 correspond to each crop among each treatment at the Pullman site.

Throughout the second cropping year, general maintenance applications occurred for each of the crops planted that required maintenance. All pesticides were applied with a backpack CO2 powered boom sprayer. In the fall of 2020 before planting, pyroxasulfone was applied at 2

oz/A plus glyphosate at 24 oz/A plus nonionic surfactant to control emerged weeds and augment remaining weeds before the winter wheat was planted. Once planted and emerged, winter wheat was fertilized by streaming UAN at a 50/50 ratio with water. In the spring of 2021 before planting of each spring crop, glyphosate was applied at 24 fluid ounces per acre with nonionic surfactant to kill weeds that have emerged in the early spring. After spring planting and adequate emergence of each spring crop, UAN was applied by streaming at 50/50 ratio with water. No spring application for winter wheat was applied due to poor emergence. Canola was applied once with the suggested glyphosate product that was Roundup PowerMax at 22 fluid ounces per acre with nonionic surfactant to control the emerged Italian ryegrass within the crop. Barley was applied with pinoxaden at 15 fluid ounces per acre to control wild oats and pyrasulfotole plus bromoxynil at 13.5 fluid ounces per acre to control certain broadleaves like prickly lettuce and common lambsquarters. Chickpeas were applied with clethodim at 6 fluid ounces per acre to control wild oats. Chemical fallow was applied once with glyphosate at 24 fluid ounces per acre with nonionic surfactant to control all weeds to allow the ground to lay idle.

Data was subjected to an analysis of variance using the statistical package built into the Agricultural Research Manager software system (ARM 8.5.0, Gylling Data Management). There was no significant difference between treatments for either site. Early preemergence (PRE) application timings had no significant differences in weed control, crop injury and yield. Field research with treatments including indaziflam are being conducted to understand how herbicide efficacy can differ from year to year as climatic conditions change in dryland cropping systems inastern Washington.

The Pacific Northwest experienced abnormal weather patterns for the 2021 cropping year. Precipitation for the 2021 cropping season was lower than previous years. The 2021 drought limited the number of growing degree days for the crops grown and the germination rate of Italian ryegrass within the seedbank compared to a normal cropping season (Figure 1). Overall densities of Italian ryegrass was low and variable, with greater densities observed in particular replications in Almota and Pullman (Figures 2 and 3). Winter wheat stands were marginal due to a planter error, and were rated as injury (Tables 2 and 3). Spring broadleaf crops were not affected by the previous year's treatment of Esplanade, regardless of rate. Italian ryegrass control was assessed, although the drought conditions caused typical postemergence treatments applied to each crop in Pullman to fail. The 3 oz/A rate of Esplanade applied the previous season appeared to control Italian ryegrass more effectively than the lower rate or the nontreated in each crop, although the effect was not significant. Yield of the various crops was highly variable, and very low in Pullman (Tables 6 and 7). The variability precluded any conclusions based on the applications of Esplanade. Overall, Esplanade appears to be a potentially useful component of an integrated Italian ryegrass management system, particularly when rotations include broadleaf crops.

Table 1. Crops and varieties that were used in the field trials in Almota and Pullman, along with seeding and harvest dates.

		Almota		Pullman	
Crop	**Variety**	**Seeding Date**	**Harvest Date**	**Seeding Date**	**Harvest Date**
Winter Wheat	Hulk	Oct. 8, 2020	Aug. 4, 2021	Oct. 15, 2020	Aug. 12, 2021
Barley	WSU 12075-026	Apr. 15, 2021	Aug. 4, 2021	May 3, 2021	Sept. 2, 2021
Canola	Truflex	Apr. 15, 2021	Aug. 31, 2021	May 3, 2021	Sept. 8, 2021
Chickpea	Sierra	Apr. 15, 2021	Aug. 20, 2021	May 3, 2021	Sept. 2, 2021
Fallow	-	-	-	-	-

Figure 1. Precipitation data for Pullman and Almota area for 2020 (A) and 2021 (B), indicating the well below average moisture conditions for 2021. Weather data provided by the National Weather Service.

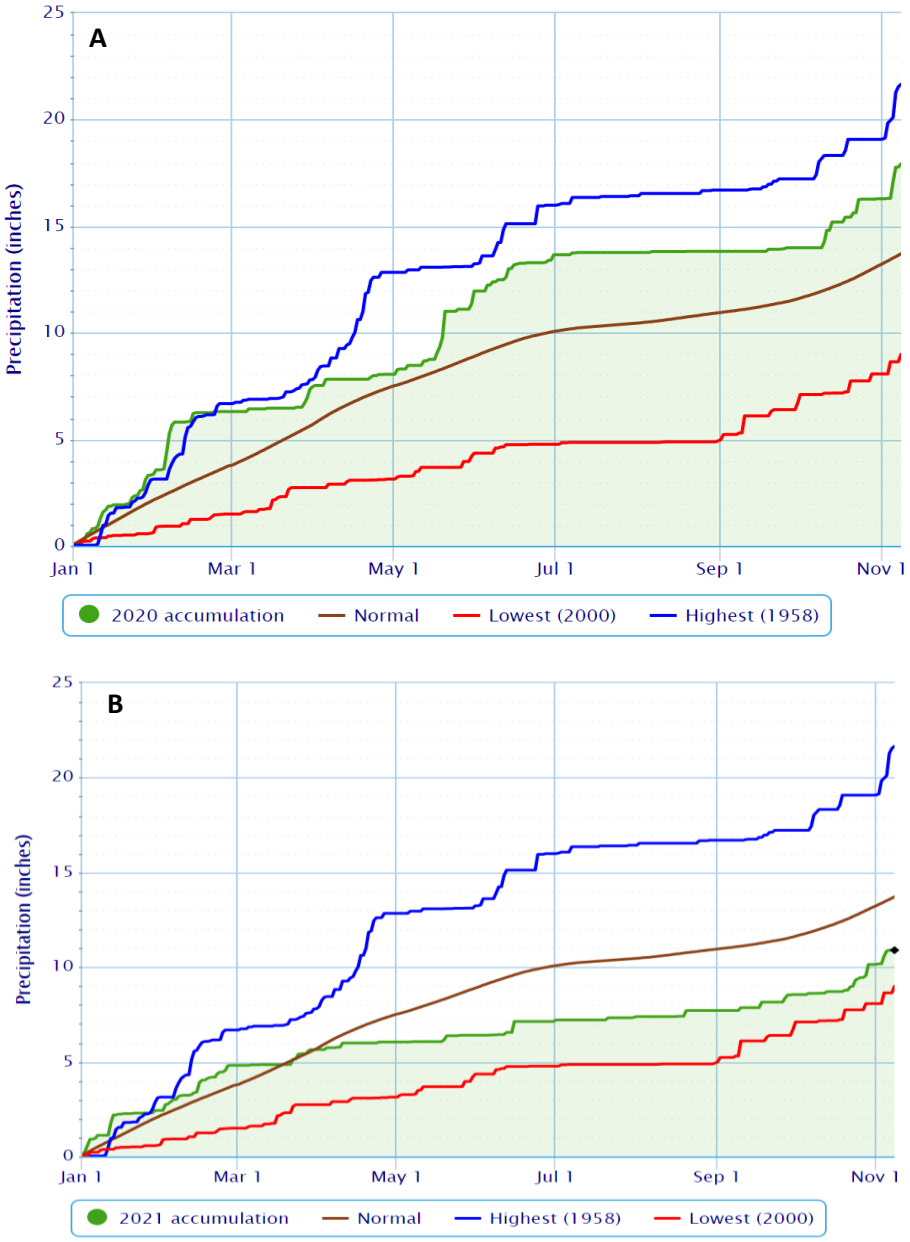

Figure 2. Italian ryegrass (IR) density/m^2 among treatments before planting and harvest events for Year-2, near Almota, WA. Initial IR density before planting at 332 Days after treatment (DAT) (Chart A). IR Density at 453 DAT (harvest) for canola, wheat, chickpea, barley and fallow systems (Charts B-F).

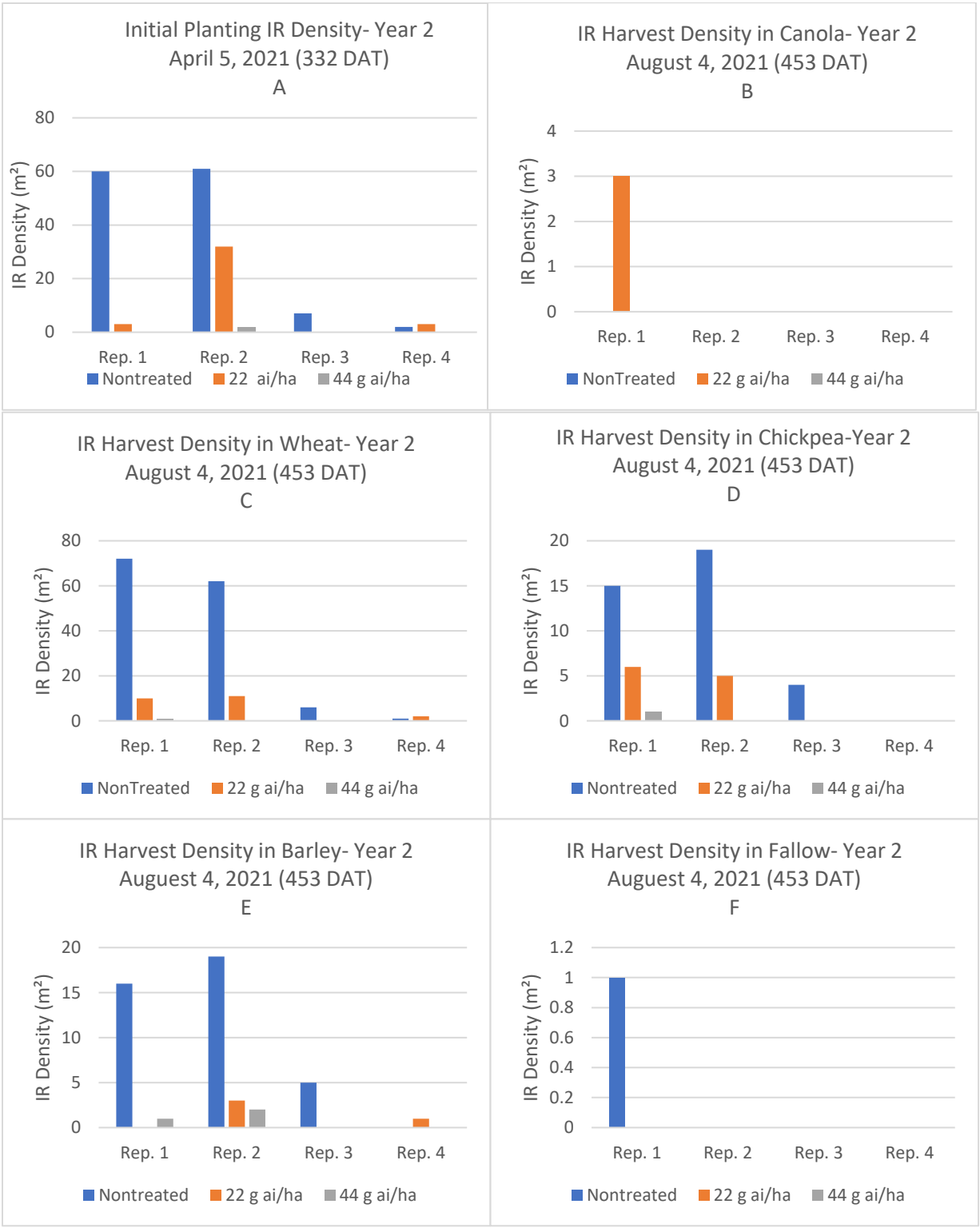

Figure 3. Italian ryegrass (IR) density/m^2 among treatments before planting and harvest events for Year-2, near Pullman, WA. Initial IR density before planting at 370 Days after treatment (DAT) (Chart A). IR Density at 460 DAT (harvest) for canola, wheat, chickpea, barley and fallow systems (Charts B-F).

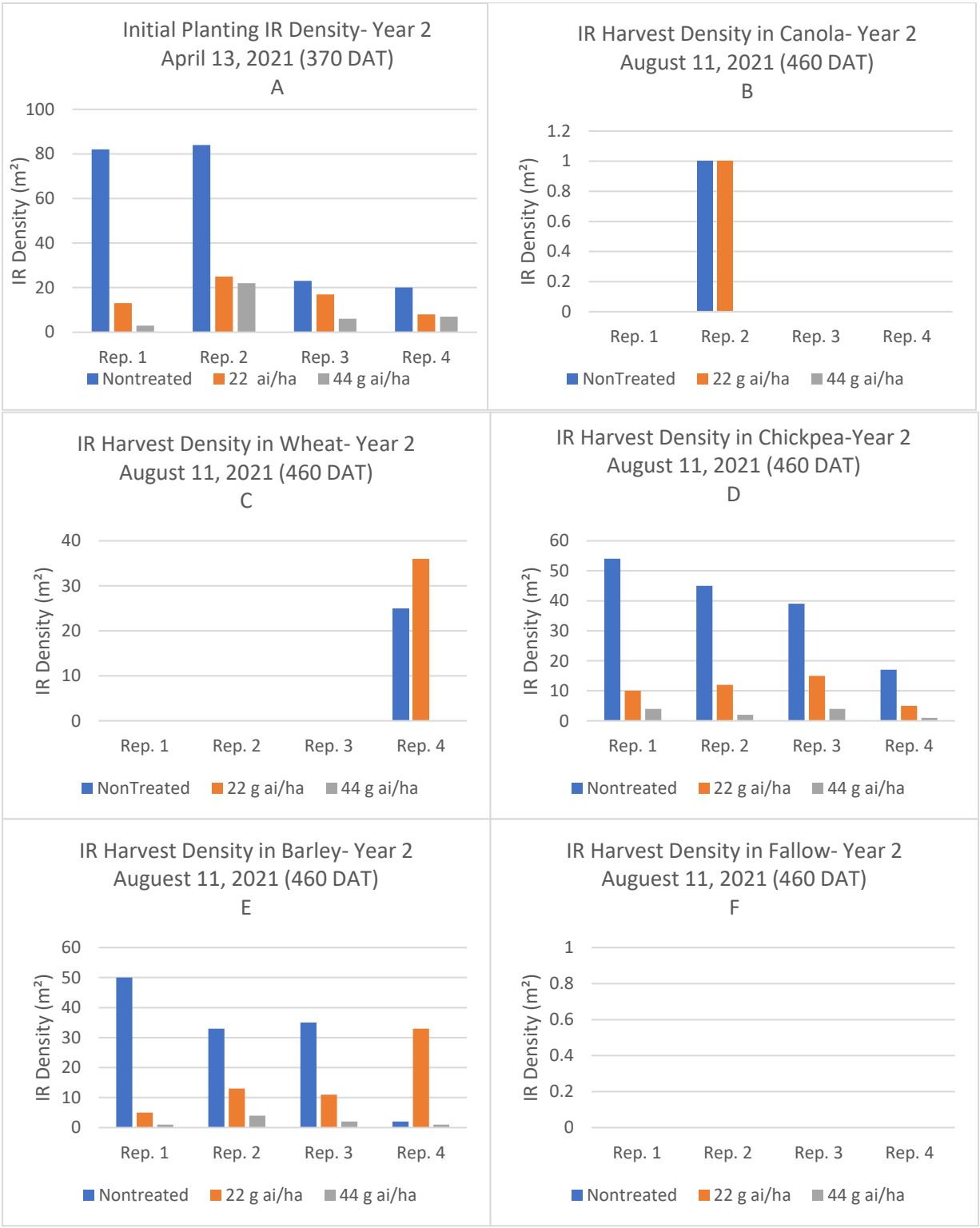

Table 2. Crop injury for wheat, canola, barley, and chickpea following the Esplanade application applied to spring wheat the previous crop season, near Almota, WA.

			Treatment			
			Nontreated 0 fl oz/A 0 g ai/ha	Esplanade 1.5 fl oz/a 22 g ai/ha	Esplanade 3 fl oz/a 44 g ai/ha	
Crop	Date	DAT[2]	%			*LSD*
Wheat	*6/2/2021*	*390*	34	14	44	*ns*
	6/24/2021	*412*	42	24	20	*ns*
	8/4/2021	*453*	31	36	35	*ns*
Canola	*6/2/2021*	*390*	1	9	15	*8*
	6/24/2021	*412*	14	11	13	*ns*
	8/4/2021	*453*	10	10	9	*ns*
Barley	*6/2/2021*	*390*	2	6	11	*10*
	6/24/2021	*412*	5	9	14	*8*
	8/4/2021	*453*	9	10	12	*ns*
Chickpea	*6/2/2021*	*390*	0	0	5	*ns*
	6/24/2021	*412*	1	1	0	*ns*
	8/4/2021	*453*	11	5	6	*ns*

Table 3. Crop injury for wheat, canola, barley, and chickpea following the Esplanade application applied to spring wheat the previous crop season, near Pullman, WA.

			Treatment			
			Nontreated 0 fl oz/A 0 g ai/ha	Esplanade 1.5 fl oz/a 22 g ai/ha	Esplanade 3 fl oz/a 44 g ai/ha	
Crop	Date	DAT[2]	%			*LSD*
Wheat	*6/09/2021*	*397*	87	62	75	*ns*
	6/23/2021	*411*	100	87	87	*ns*
	8/09/2021	*458*	100	80	81	*ns*
Canola	*6/09/2021*	*397*	10	5	2	*ns*
	6/23/2021	*411*	14	16	12	*ns*
	8/09/2021	*458*	9	6	0	*ns*
Barley	*6/09/2021*	*397*	7	9	6	*ns*
	6/223/2021	*411*	11	7	16	*ns*
	8/09/2021	*458*	7	9	14	*ns*
Chickpea	*6/09/2021*	*397*	0	0	0	*ns*
	6/23/2021	*411*	0	0	0	*ns*
	8/09/2021	*458*	2	0	5	*ns*

Table 4. Italian ryegrass control for wheat, canola, barley, and chickpea following the Esplanade application applied to spring wheat the previous crop season, near Almota, WA.

			Treatment			
			Nontreated 0 fl oz/A 0 g ai/ha	Esplanade 1.5 fl oz/a 22 g ai/ha	Esplanade 3 fl oz/a 44 g ai/ha	
Crop	Date	DAT[2]	%			*LSD*
Wheat	*6/2/2021*	*390*	40	82	96	*ns*
	6/24/2021	*412*	39	67	77	*ns*
	8/4/2021	*453*	41	74	90	*ns*
Canola	*6/2/2021*	*390*	100	100	100	*ns*
	6/24/2021	*412*	100	100	100	*ns*
	8/4/2021	*453*	95	94	95	*ns*
Barley	*6/2/2021*	*390*	52	86	97	*ns*
	6/24/2021	*412*	42	76	90	*ns*
	8/4/2021	*453*	56	84	86	*ns*
Chickpea	*6/2/2021*	*390*	55	85	97	*ns*
	6/24/2021	*412*	57	76	91	*ns*
	8/4/2021	*453*	50	70	92	*ns*
Fallow	*6/2/2021*	*390*	49	77	92	*ns*
	6/24/2021	*412*	47	75	90	*ns*
	8/4/2021	*453*	94	97	95	*ns*

Table 5. Italian ryegrass control for wheat, canola, barley, and chickpea following the Esplanade application applied to spring wheat the previous crop season, near Pullman, WA.

			Treatment			
			Nontreated 0 fl oz/A 0 g ai/ha	Esplanade 1.5 fl oz/a 22 g ai/ha	Esplanade 3 fl oz/a 44 g ai/ha	
Crop	Date	DAT[2]	%			*LSD*
Wheat	*6/09/2021*	*397*	51	7	54	*ns*
	6/23/2021	*411*	0	2	2	*ns*
	8/09/2021	*458*	0	2	12	*ns*
Canola	*6/09/2021*	*397*	80	59	75	*ns*
	6/23/2021	*411*	95	95	95	*ns*
	8/09/2021	*458*	95	94	99	*ns*
Barley	*6/09/2021*	*397*	80	56	67	*ns*
	6/23/2021	*411*	57	37	56	*ns*
	8/09/2021	*458*	51	30	56	*ns*
Chickpea	*6/09/2021*	*397*	84	59	80	*ns*
	6/23/2021	*411*	60	27	57	*ns*
	8/09/2021	*458*	59	45	57	*ns*
Fallow	*6/09/2021*	*397*	77	41	72	*ns*
	6/23/2021	*411*	83	63	80	*ns*
	8/09/2021	*458*	86	69	81	*ns*

Table 6. Yield for wheat, canola, barley, chickpea following the preemergence application of Esplanade in spring wheat the previous cropping season, near Almota, WA.

Treatment	Rate		Wheat	Chickpea	Barley	Canola
	Oz/A	g ai/A	lb/A			
Nontreated	0	0	922	844	1015	140
Esplanade	1.5	22	567	832	623	68
Esplanade	3	44	111	1461	725	69
		LSD	*ns*	*ns*	*ns*	*ns*

Table 7. Yield for wheat, canola, barley, chickpea following the preemergence application of Esplanade in spring wheat the previous cropping season, near Pullman, WA.

Treatment	Rate		Wheat	Chickpea	Barley	Canola
	Oz/A	g ai/A	lb/A			
Nontreated	0	0	0	169	403	72
Esplanade	1.5	22	23	94	280	70
Esplanade	3	44	113	114	327	82
		LSD	*ns*	*ns*	*ns*	*ns*

Disclaimer

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.