




A Family of Farmers

Italian Ryegrass Control

Jake Gelineau and Eric Smith



Outline

- ▶ Characteristics
 - ▶ Habitat
 - ▶ Herbicide Resistance
 - ▶ Chemical control in Wheat vs. Garbs
 - ▶ Learn from the Aussie's
 - ▶ Cultural Control
 - ▶ Mechanical Control
 - ▶ Monitoring
- 

Characteristics

- ▶ Italian Ryegrass, *Lolium multiflorum* Lam.
- ▶ Native to southern Europe
- ▶ Cool-season annual
- ▶ Can grow to height of 3 feet
- ▶ Small claw-like auricles at leaf sheath and blade junction
- ▶ Seed head is a solitary spike with long awns
- ▶ Leaf blades are flat, glossy, and generally hairless
- ▶ Root system can reach 3 feet deep
- ▶ Genetically diverse species



Characteristics Cont.

- Reproduces entirely by seed
- Can emerge from 7 inches deep
- Seed will germinate in 7 to 10 days
- One plant can produce up to 300,000 seeds
- Seed has physiological dormancy
- On the Palouse seed can be viable for 3 - 5 years
- Seed dormancy is longer in poorly drained soils



Habitat

- ▶ Prefers sub-irrigated poorly drained soils
- ▶ Adaptive to multiple cropping systems
- ▶ Air temps between 68 – 77
- ▶ Soil temps of between 50 - 65
- ▶ Ryegrass is shade intolerant



Herbicide Resistance

- ▶ Cross resistance is the population resistant to two chemicals that use the same site of action
- ▶ Multiple resistance are populations that are resistant to three or more different groups
- ▶ Italian Ryegrass has both cross resistance and multiple resistance
 - ▶ In the Pacific Northwest Italian Ryegrass has known resistance to:
 - ▶ Group 1 (ID, OR, WA), Group 2 (ID, OR, WA), Group 9 (OR), Group 10 (OR), and Group 15 (ID, OR, WA)

Weed Resistance

Target Site Example

Group 1



Group 2



Year 1



Year 2



Year 3



Year 4



Control in Winter Wheat

- ▶ Group 15 is the most effective option we still have in winter wheat
 - ▶ Zidua (Pyroxsulfone), Anthem Flex (Pyroxsulfone + Carfentrazone), Axiom (Flufenacet + Metribuzin)
 - ▶ We like the Pyroxsulfone with Metribuzin combo because the Metribuzin will pick up emerged ryegrass plants
 - ▶ We also like Pyroxsulfone with Carfentrazone as it seems that aim is bringing something to the table
 - ▶ Followed by Spring application with a Group 2
 - ▶ The root pruning effect of the fall application of group 15 makes the group 2 spring application more effective

Guide for Herbicide Rotation in the Pacific Northwest

To avoid selecting for herbicide-resistant weeds, do not use herbicides from the same color group more than once within three years. Rather, rotate to a different group every year of the production system.

Herbicide group number and site of action	Herbicide chemical family	Herbicide common name	Herbicide trade name	Resistant weeds in the PNW	States with resistant weeds		
Group 1 Acetyl CoA carboxylase (ACCase) inhibitors	cydohexamethyldioxane	clothodim	Select Max, Envoy, several others	Italian ryegrass	ID		
		anthoxypim	Prest, several others	Italian ryegrass	ID		
		haloxypim	Achieve	Italian ryegrass	ID		
		amifloxyphenoxypropionate	Shovier NC	Italian ryegrass Wild oat	ID ID		
		diclofop	Hoelon	Wild oat Italian ryegrass	ID, OR, WA ID, OR, WA		
		fenoxaprop	Puma, Accalm	Wild oat	ID, OR		
		flazasulfop	Fuazade DX	Downy brome	OR		
		quizalofop	Aaaron II, Terra	Italian ryegrass	ID		
		phenylpyrazoline	proflazasulfon	Asial	Italian ryegrass	ID, OR	
		Group 2 Acetolactate synthase (ALS) inhibitors	imidazolinone	*imazamox	Reyton, Beyond, Clearmax (Beyond + MCPA)	Downy brome Spiny sowthistle	OR WA
*imazapic	Plattex						
*imazapyr	Arasal, Chopper, several others						
*imazethapyr	Pursuit			Prickly lettuce Kochia Spiny sowthistle Black mustard Mayweed thistle	ID ID ID ID		
sulfonyleurea	*chlorsulfuron			Glean, Teler	Prickly lettuce Kochia Russian thistle Italian ryegrass Mayweed thistle Smallseed leaflet	ID, OR, WA ID, OR, WA ID, OR, WA OR, WA OR	
	*chlorsulfuron/metsulfuron			Finlex	Smallseed leaflet	OR	
	*methametsulfuron			Muster			
	*metazasulfuron			Sandax			
	mesosulfuron-mesosulfuron-propoxyacarbato			Dagry	Italian ryegrass	ID	
	*metsulfuron			Ally, Escort, Cimaron	Prickly lettuce Kochia Russian thistle Smallseed leaflet	ID, OR OR OR OR	
	*nicosulfuron	Accent					
	*pimsulfuron	Beacon	Downy brome	OR			
	*prosaulfuron	Peak					
	*rimesulfuron	Mainix					
Group 3 Microtubule assembly inhibitors	dinitroanilines	*bensufen	Balan				
		*ethalfluthalin	Bonelan, Corbit				
		*oryzalin	Surflan				
		*pendimethalin	Power II, D, Pendulum, several others				
		*prodiamine	Barricade, Endurox, several others				
		*trifluralin	Treflan, Trust				
		benzoxazole	*pyramifluor	Kurb	Wild oat	OR	
		Group 4 Synthetic auxins	phenoxycetic acids	2,4-D	several		
				2,4-DB	several		
				MCP	several		
metoprop (MCPP)	several						
benzoic acids	*dicamba			Bonvel, Clarity, several others	Kochia	ID	
pyridines	*aminopyralid			Mixxton			
	*clopyralid			Strong, Transline, Omega			
	*fluroxypyr			Suresta, Vista, Spight			

(continued on next column)

Herbicide group number and site of action	Herbicide chemical family	Herbicide common name	Herbicide trade name	Resistant weeds in the PNW	States with resistant weeds
Group 4, continued	pyridines, cont.	*picloram	Tordon K, Tordon 22K	Yellow starthistle	WA
		*triclopyr	Garlon, Remedy, Remova		
Group 5 Photosystem II inhibitors	quinoline-carboxylic acids	*atrazine	AAtra	Common lambsquarters	ID, OR, WA
		*atrazine	Princap, Semaize	Common groundsel	ID
		*atrazine	Valpar, Phomox	Annual bluegrass Kochia	OR, WA ID
		*atrazine	Valpar, Phomox	Common groundsel	WA
		*atrazine	Valpar, Phomox		
		*atrazine	Valpar, Phomox		
		*atrazine	Valpar, Phomox		
		*atrazine	Valpar, Phomox		
		*atrazine	Valpar, Phomox		
		*atrazine	Valpar, Phomox		
Group 6 Photosystem II inhibitors (same site as groups 5 and 7 but different binding behavior)	benzothiadiazoles	benflazoc	Senegren		
		benflazoc	Senegren		
Group 7 Photosystem II inhibitors (same site as groups 5 and 6 but different binding behavior)	ureas	*fluroxypyr	Karmax, Drea	Common lambsquarters Annual bluegrass	OR OR
		*fluroxypyr	Lonox, Lines		
Group 8 Lipid synthesis inhibitors but not ACCase inhibitors	thiocarbamates	butylate	Sutan, Sutan+ (contains safener)		
		cydoxate	Ro-Nast		
		EPTC	Epitan		
		EPTC + safener	Briscane		
Group 9 EPSP synthase inhibitors	glyoxes	glyphosate	Roundup, several others	Italian ryegrass	OR
		glyphosate	Roundup, several others		
Group 10 Glutamine synthase inhibitors	phosphinic acids	glufosinate	Rely, Liberty, several others		
		glufosinate	Rely, Liberty, several others		
Group 14 Inhibitors of protoporphyrinogen oxidase (PROX)	diphenylethers	*oxyfluorfen	Goal, several others		
		N-phenyl-phthalimides	flumiclorac	ReSource	
		*flumiclorac	Chateau, Valor, SureGuard		
		triazinones	carfentrazone	Aim, several others	
Group 15 Inhibitors of very-long-chain fatty acid synthesis	chloroacetamides	acetochlor	Harness, Surpass, several others		
		acetochlor	Harness, Surpass, several others		
Group 16 Unknown	benzofuranes	ethofumesate	Norton, several others	Annual bluegrass	OR
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
		ethofumesate	Norton, several others		
Group 17 Unknown	organostannic	MSMA	several		
		MSMA	several		
Group 20 Inhibitors of cell wall synthesis site A	nitrites	*dichlobenil	Canoron, Barve		
		dichlobenil	Canoron, Barve		
Group 22 Photosystem I electron diverters	bipyridyliums	disquit	Reglone, Roward		
		paraquat	Gramoxone Inteon, several others		
Group 26 Unknown	pyrazolone carboxylic acids	diflufenacet	Avenge	Wild oat	ID
		diflufenacet	Avenge		
Group 28 Inhibitors of 4-HPPD**	isoxazoles	pyroxasulfone	Husk (contains bromoxynil)		
		pyroxasulfone	Husk (contains bromoxynil)		
Group 28 Inhibitors of 4-HPPD**	triazolones	mesotrione	Callisto		
		mesotrione	Callisto		

** 4-hydroxyphenylpyruvate decarboxylase

Group 15 Inhibitors of very-long-chain fatty acid synthesis	chloroacetamides	acetochlor	Harness, Surpass, several others	
		alachlor	MicroTech, several others	
		dimethenamid(-p)	Outlook	
		metolachlor	Stalwart, several others	
		s-metolachlor	Dual Magnum, Dual II Magnum	
		oxyacetamides	flufenacet	Define, Axiom (contains metribuzin)
		acetamides	napropamide	Devrinol

isoaxzoline pyroxasulfone **Zidua®**

New Herbicide Family in Group 15

*Indicates herbicides that can persist in soil for most of the growing season or from one growing season to the next. © 2007 by the University of Idaho

Italian Ryegrass

Moscow, ID 2016

Untreated

Zidua 1.5 oz

Italian Ryegrass

Potlatch, ID 2016



Italian Ryegrass Control in Winter Wheat



Axiom 10 oz 'fb' PowerFlex

Zidua 1.5 oz 'fb' PowerFlex

PowerFlex

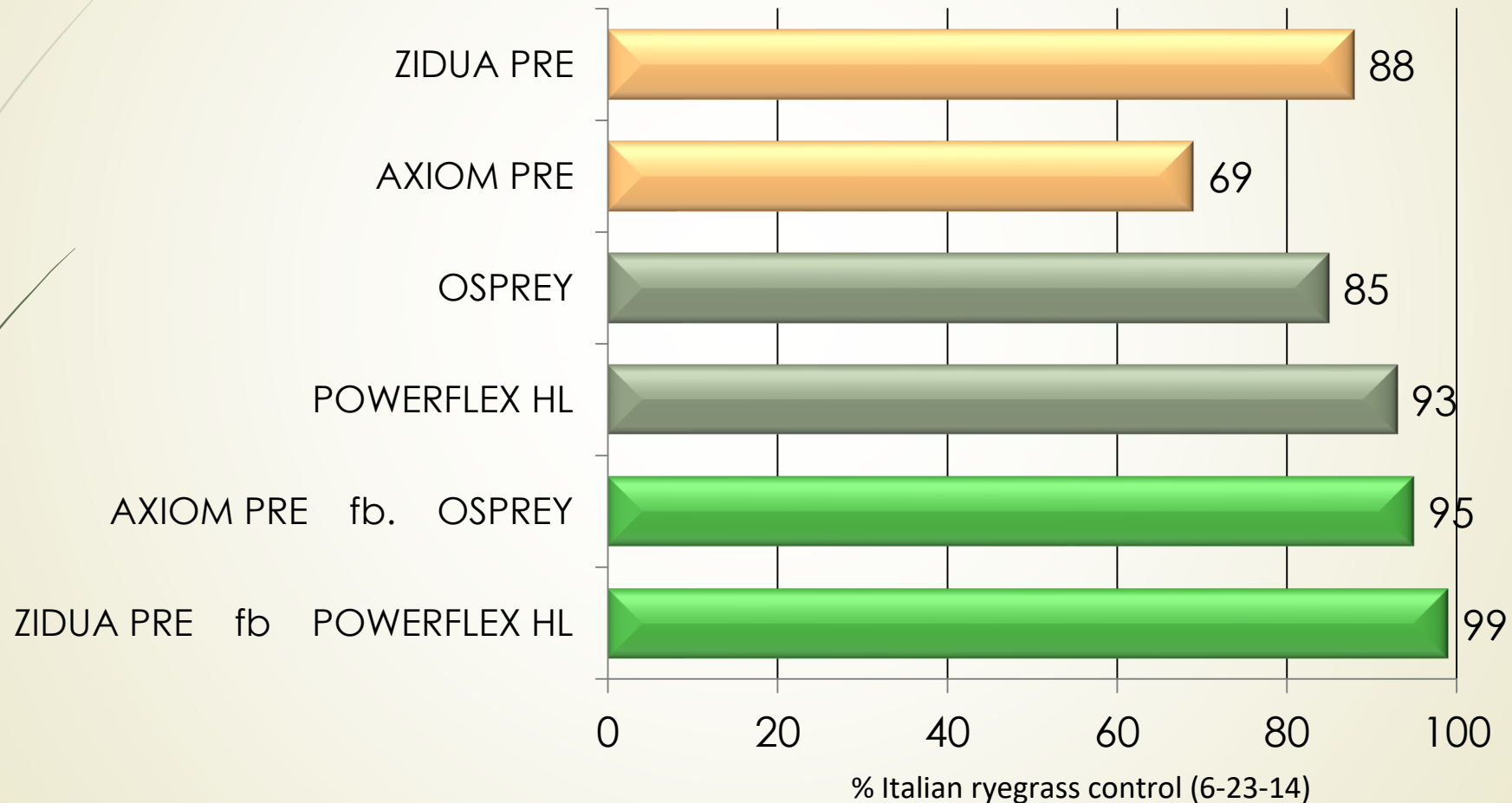
Root Pruning

Italian Ryegrass



DON'T
DRO

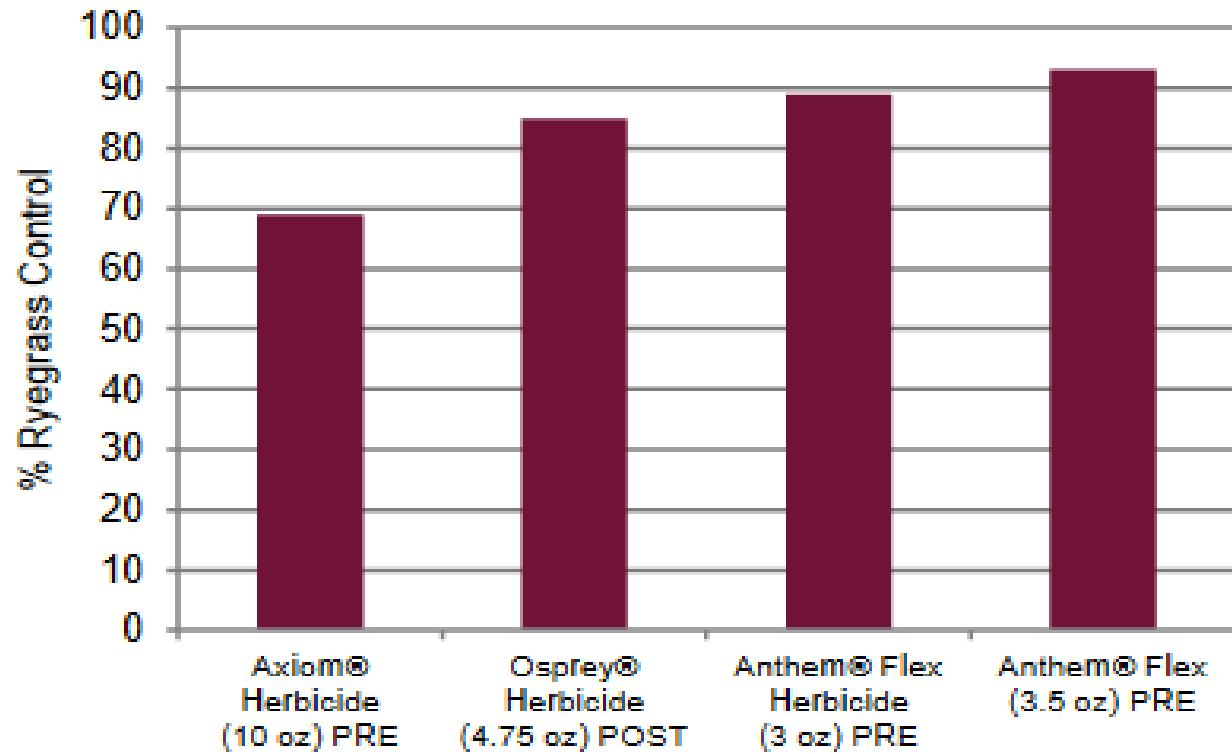
Sequential Applications for Italian Ryegrass



2014, 4 reps. Variety: ORCF 102. Planting date: 10/6/13, 1.0-1.25 in. deep, PRE applications made on 10/11/13 (wheat sprouted), POST applications made on 5/7/14 (IR 1 leaf to 5 tiller). Previous crop: lentil.

Courtesy of: The McGregor Company

Italian Ryegrass Control in Wheat



Bruce Palmer, McGregor Research Station
2014 – Oksdale, WA



- ▶ Anthem Flex is Pyroxysulfone+ carfentrazone (aim) - Group 15, Group 14

PRE's followed by Osprey Xtra vs Powerflex HL

- WSU study in 2016-17 by Lyon and Wetzl
- Looking at Osprey Xtra which isn't labeled for wheat yet
- It is a combo of group 2's
- They compared Axiom, Zidua, and Anthem Flex followed by Osprey Xtra vs Powerflex HL
- Best treatment with Osprey Xtra in yellow
- Best treatment with Powerflex HL in Red

Treatment #	Treatment	Rate (oz/A)	Application Date	6/14/17 Italian ryegrass control -----0-100%-----	8/7/17 Yield bu/A
1	Nontreated Check	--		--	58 e
2	Axiom DF	10	10/4/16	77 b ²	92 cd
3	Zidua	1.5	10/4/16	89 a	111 ab
4	Anthem Flex	3.5 fl oz	10/4/16	92 a	103 a-c
5	Axiom DF	10	10/4/16	79 b	99 bc
5	Osprey Xtra ¹	4.75	4/11/17		
6	Zidua	1.5	10/4/16	91 a	107 a-c
6	Osprey Xtra ¹	4.75	4/11/17		
7	Anthem Flex	3.5 fl oz	10/4/16	95 a	116 ab
7	Osprey Xtra ¹	4.75	4/11/17		
8	Osprey Xtra ¹	4.75	4/11/17	15 d	66 e
9	Axiom DF	10	10/4/16	80 b	107 a-c
9	PowerFlex HL ¹	2	4/11/17		
10	Zidua	1.5	10/4/16	94 a	120 a
10	PowerFlex HL ¹	2	4/11/17		
11	Anthem Flex	3.5 fl oz	10/4/16	95 a	116 ab
11	PowerFlex HL ¹	2	4/11/17		
12	PowerFlex HL ¹	2	4/11/17	24 c	76 de

Pre-Post Grass Weed Control Study

- Evaluate pre-emerge herbicides (rates & ratios) with different modes of action (MoA) on tough annual grassy weeds - Italian Ryegrass
- 21 pre-emerge herbicides
- Three Modes of Actions: Group 3, 15 & 27
- 6 different active ingredients
- 3 Treatments with various MoA herbicides
- Group 1 and Group 2 herbicides will be applied post-emerge over the top of the pre-emerge treatments
- Evaluate combinations of PRE and POST herbicides on the new CoAXium Wheat Production System



Control in Garbs

- ▶ Roundup or tillage to kill early flushes pre-plant
- ▶ Use a group 3 “yellow’s” such as Sonalan or Prowl pre-plant incorporate
- ▶ Both Sonalan and Prowl do have some efficacy on ryegrass
- ▶ Pre-plant Group 15’s such as Dual II Magnum (pictured)
- ▶ Pre-emerge Group 14’s such as Valor
- ▶ Post-emerge, best results with group 1 clethodim with MSO, UAN or AMS, and non-ionic surfactants



Dual Magnum Sprayer Skip



Learn from the Aussie's

- ▶ Australians have Rigid Ryegrass which is very similar to Italian Ryegrass
- ▶ They have resistance to additional modes of action including group 15 and group 9
- ▶ They rely heavily on trifluralin - Group 3, trade name Treflan
 - ▶ This chemistry isn't a good fit for the PNW due to our climate and geography
 - ▶ Labeled on winter wheat as pre-plant incorporate or a post-plant incorporate
 - ▶ In Australia they are broadcasting pre-plant then seeding into it with narrow hoe opener for incorporation

Cultural

- ▶ Planting habits
 - ▶ Consider higher seeding rates to outcompete the weeds
 - ▶ Managing seeding dates in order to kill flushes of ryegrass. Delayed plantings
 - ▶ Use certified weed free seed (From PNW Coop)
 - ▶ Use treated seed to help with seedling emergence and plant establishments





Rotation

- ▶ The best rotation to reduce Italian ryegrass populations in higher rainfall zones on the Palouse would be a 4 – year rotation with at least 2 years out of wheat
- ▶ An example of this would be a WW-SW-SC-(CH,P,L)
- ▶ This may not be economically sustainable long term however agronomically, it may make sense
- ▶ Growing spring crops allows for killing of fall/ winter emerging ryegrass
 - ▶ Use of Roundup ready crops such as canola
 - ▶ Perennial crops such as alfalfa
 - ▶ Rotation with cover crops
 - ▶ Spring Pulse
 - ▶ Timothy
 - ▶ Fallow
 - ▶ Oats



Crop Considerations

► Competition

- Early seedling vigor is important
- Narrower row Spacing
- Canopy closure critical to outcompete Italian rye
- Italian rye is shade intolerant
- Apply starter package to give crop an early advantage
- Sow crops and varieties that have:
 - Canopy closure; Spring Pea vs. Lentil
 - Early emergence and vigor
 - Leafy vegetation characteristics that will shade out competition; Canola
 - Choose varieties with strong tillering characteristics

Roundup ready canola

- Excellent rotation option
- Canola is a very good canopy closer
- Roundup ready varieties give you opportunity to spray three times in season
- Guys in the Palouse have had good luck with HyCLASS 930 RR or HyCLASS 955 RR



Round-up ready and non-GMO Alfalfa

- Gives another chance to spray in season to control flushes
- Varieties such as WL 355RR should be a good fit
- Consider taking out poorly drained areas or waterways that are a problem for several years to reduce seed bank
- Could use non GMO varieties such as Rugged as long as you are haying prior to seed set



Drainage Tile

- ▶ Italian Ryegrass prefers poorly drained soils
 - ▶ Post-emergent chemicals also do not work as well in these soils
 - ▶ Install tile lines in these areas
 - ▶ Good spot for Alfalfa/Timothy



Strategic Tillage

- ▶ Plowing/chiseling
 - ▶ Use deep burial tillage to reduce seed persistence
 - ▶ Integrate Liming on plow years to distribute in profile
 - ▶ Better herbicide efficacy in more neutral pH soils






Strategic Tillage Cont.

Two different Australian studies done:

- ▶ Strategic tillage may help manage resistant weeds in no-till systems
- ▶ Strategic tillage reduces weed populations and resistance to soil residual herbicides
- ▶ Efficacy depends on tillage frequency and seed burial efficacy



Strategic Tillage cont.

- ▶ No-till growers were not able to bring resistance levels back to zero however they were able to get some herbicide efficiency back that they had lost
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Mowing

- Mow your problem areas to prevent Italian ryegrass from going to seed on stubble and hay ground



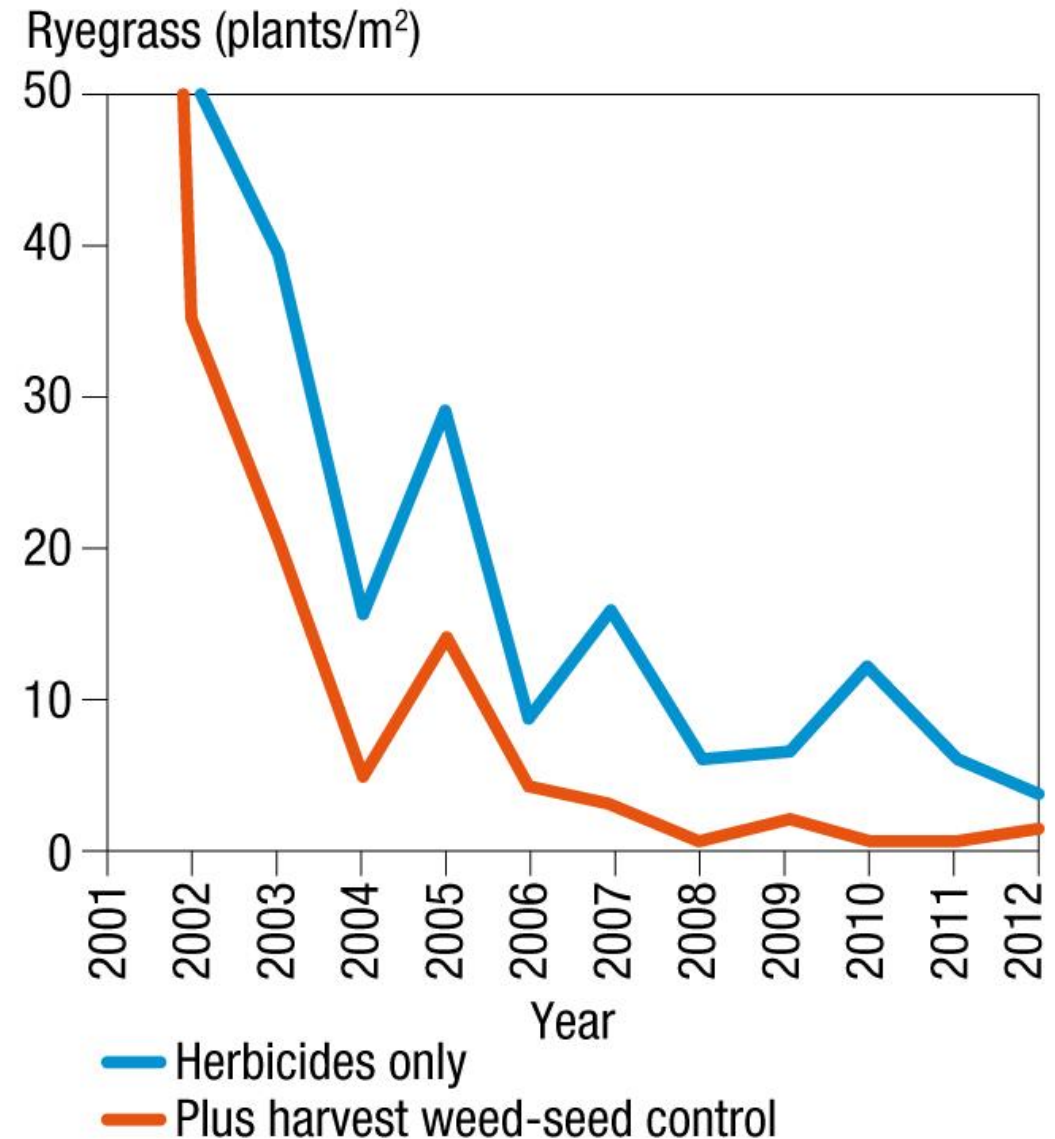
Cleaning Equipment

- ▶ Clean equipment between fields
 - ▶ Combines
 - ▶ Tractors/Bank-out Wagons
 - ▶ Drills
 - ▶ Implements
 - ▶ Trucks

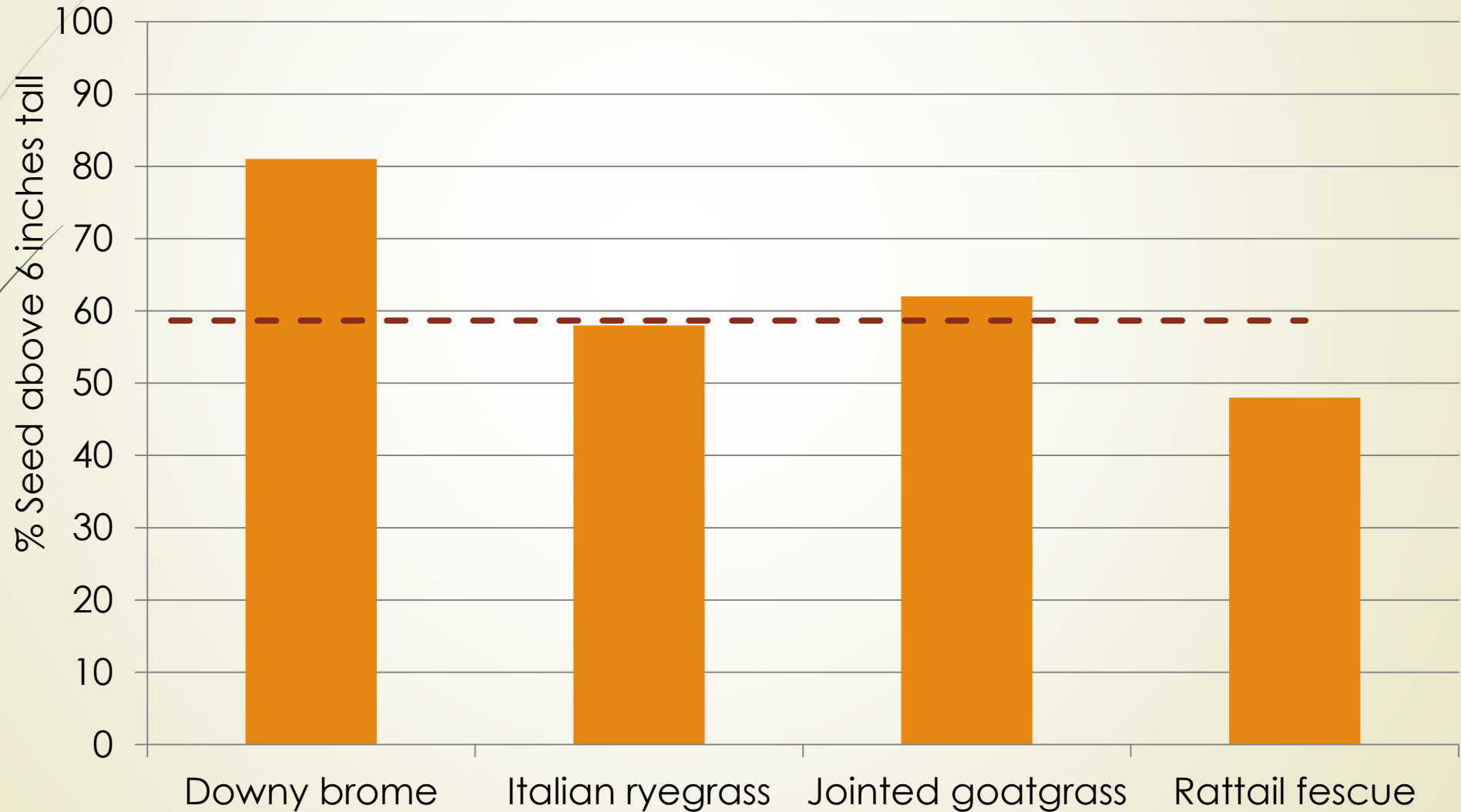


Harvest Weed Seed Control

- For harvest weed seed control to work, the weed seed must remain in the head at harvest!
- The Australian Rigid Ryegrass has up to 93% of seed still in the head at harvest
- Italian Ryegrass is closer to 60%



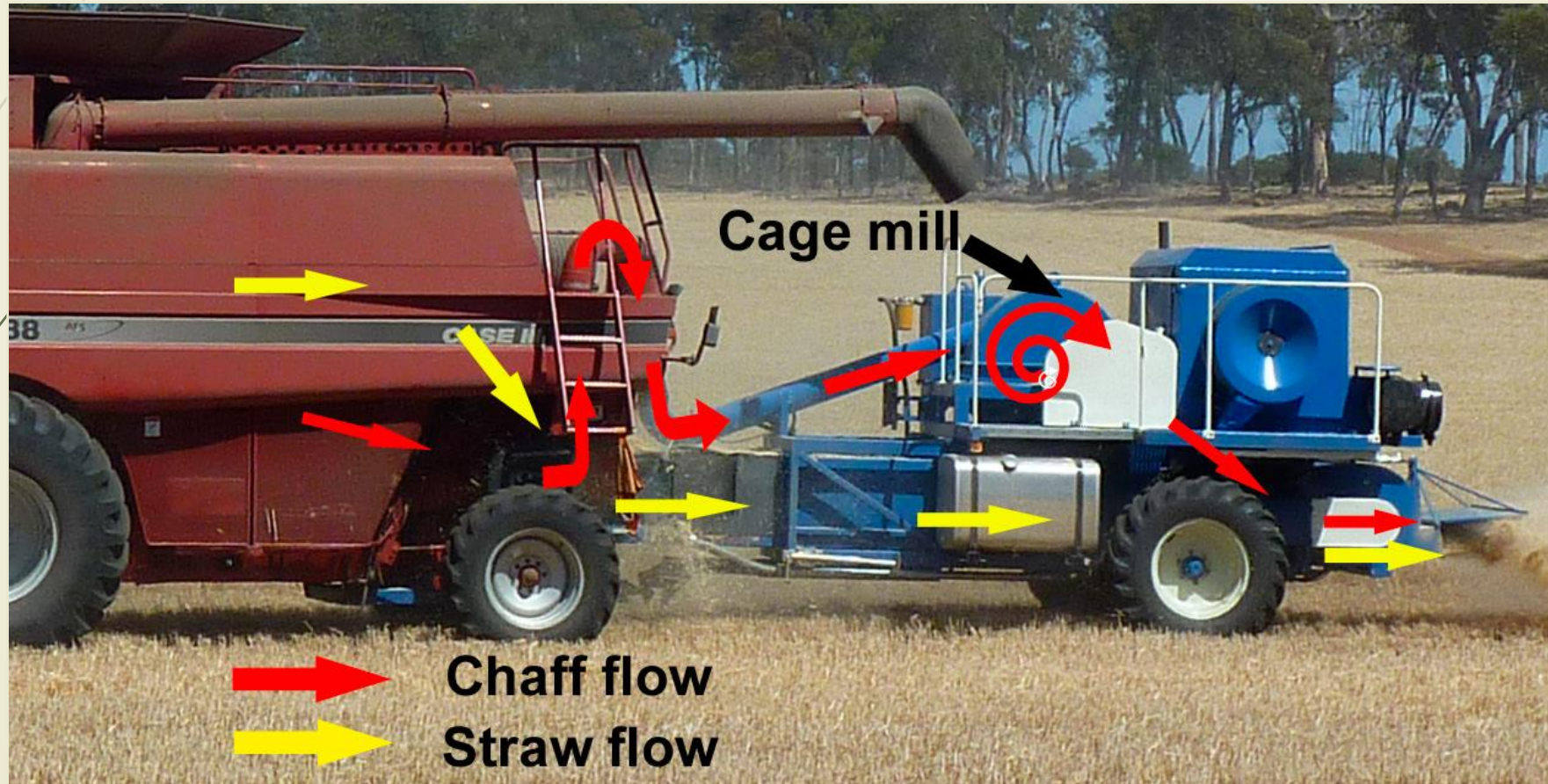
Seed Retention at Harvest



Weed Seed Destruction

- ▶ Harrington Seed Destructor
 - ▶ Integrated into the rear of the combine
 - ▶ Using it in Australia
 - ▶ Uses hydraulically driven cage mills to pulverize chaff where weeds are concentrated
 - ▶ The cage mills will destroy up to 99% of weed seeds that enter them
 - ▶ 150K us dollars
 - ▶ Works in Australia on Rigid Ryegrass up to 93% of Ryegrass is still in the head at harvest
 - ▶ Need to cut the crop low (header down to beer can from ground)
 - ▶ Needs higher horsepower combines
- ▶ Seed Terminator
 - ▶ Lower cost option around 75K
 - ▶ Works the same as the Harrington Seed Destructor

Harrington Seed Destructor



Integrated Harrington Seed Destructor



ihSD



Windrow Burning

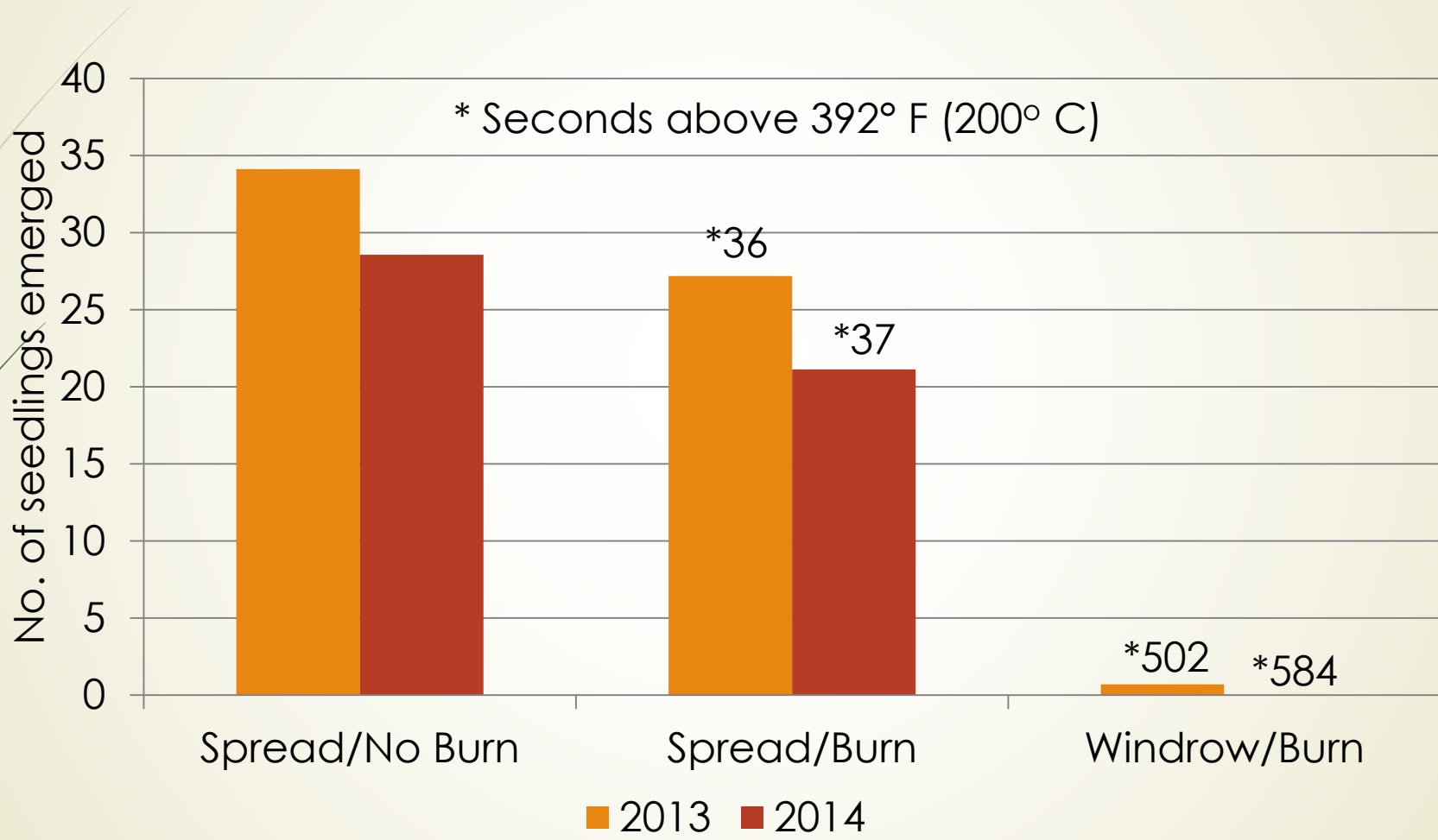
- Chaff is concentrated into windrows
- When burned fire is hotter than burning standing stubble
- Fire needs to reach temps of 752 F for a minimum of 10 seconds
- Method used extensively in Australia
- Up to 99% of Ryegrass control
- Low cost option
- Downside is limited burn days, highly regulated, and public perception
- Drew Lyon did a study in 2013 and 2014 looking at efficacy on the Palouse



Germinating Italian Ryegrass After Burning



Italian Ryegrass Seed Survival



No Burn vs. Burn P=0.003
Spread vs. Windrow P=0.002

No Burn vs. Burn P<0.001
Spread vs. Windrow P<0.001



Direct Bailing

- ▶ Buy attachment from dealer to tow behind baler
- ▶ Several currently in use in the PNW
- ▶ Weed seed also has to be in the head at harvest
- ▶ Does require more horsepower to run baler
- ▶ Can be up to 95% effective
- ▶ Removal of residue is a downside

Glenvar Bale Direct System

Up to 95% of *Ryegrass* seed collected and removed in baled harvest residues



Monitoring for resistance

- Send samples into WSU small grains
- Ian Burke's lab runs the herbicide resistance testing program
- It is important to know what the resistance levels are on your farm
- Testing for resistance allows growers to choose herbicides with the knowledge that they will be effective
- Testing is part of the IWM approach for wheat producers in Europe and Australia and should be considered essential for PNW growers as well
- If you need contact information or have questions
<http://smallgrains.wsu.edu/submit-samples-to-the-wsu-resistance-testing-program/>



Conclusion

- ▶ We do not want to go down the resistance road to where Australia is now
- ▶ There are no new chemistries coming to market in the near future
- ▶ We need to manage for resistance so we don't lose the tools we have
 - ▶ Know your resistance levels – get tested
 - ▶ Use multiple sites of action
 - ▶ Scout fields after spraying to look for weed escapes
 - ▶ control the weed escapes
- ▶ Rotation is critical
- ▶ Don't be afraid of using an IPM approach
- ▶ Do not want to use too many GMO crops as we DO NOT want to get glyphosate resistance

Thank You!

- ▶ We appreciate your business!!
- ▶ If you have any questions please feel free to contact us!

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