Herbicide Carryover and Weed Resistance Issues in Canola

Brian Jenks North Dakota State University

Herbicide rotation interval to Canola

Herbicide	Months
Acuron GT/Flexi	18
Armezon/Pro	9
Authority Assist	40
Authority Elite	12
Authority MTZ	24
Balance Flex	18
Beyond/Raptor	18
Capreno	18
Callisto	10
Corvus	17

Herbicide	Months
Fierce EZ	12
Huskie FX	9
Laudis	10
Metribuzin	18
Pursuit	40
Reflex/Flexstar	18
Spartan Charge	24
Spartan Elite	12
Valor (cont till)	8-12
Zidua	12-18

What factors can affect herbicide activity and degradation?

MoistureSoil typeTemperatureSoil pH

Organic matter

Microbes

• Triazines (Group 5)

High pH: Less adsorbed (neutral charge), more available for plant uptake

Low pH: More adsorbed (+ charge), less available for plant uptake

The greater persistence of atrazine at high pH is due to the herbicide being more susceptible to degradation (acid catalyzed hydrolysis) when it is bound to soil colloids than when it is in free solution. Hydrolysis ceases about pH 6.8. • Sulfonylureas (Group 2)

High pH: Less adsorbed (- charge), more available for plant uptake

Low pH: More adsorbed (neutral charge), less available for plant uptake

The greater persistence of SUs at high pH is due to the herbicide being more susceptible to degradation (acid catalyzed hydrolysis) when it is bound to soil colloids than when it is in free solution. Hydrolysis ceases about pH 6.8. • Imi's (Group 2) Microbial degradation

High pH: Less adsorbed above pH 6.5, Shorter herbicide persistence

Low pH: More strongly bound at pH <6.5, Longer herbicide persistence

Mostly anionic form above 6.5, neutral and cationic form below 6.5.

• Spartan (Group 14)

High pH: More active (- charge), more crop injury

Low pH: Less active (neutral charge), less crop injury

•Spartan degraded by microbes

• Factors affecting microbial activity will affect Spartan persistence (cold, dry, etc.)

-above soil pH 6.5 primarily negatively charged, more in solution, and available for plant uptake -as soil pH approaches 6.5 or lower, neutral charge, more adsorbed, less available in soil solution -less effective weed control....need higher rate

-longer persistence

-I₅₀ values 3-4X higher for low pH compared to high pH (Szmigielski et al 2012)

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Wild oat and green foxtail resistance

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Burial						Length of b	urial (mo)				
depth	7	13	19	25	33	48	60	84	108	168	Mean
cm						% viable see	d at Fargo -				
0-4	15	11	13	14	6	5	2	1	0	0	7
6-10	15	13	15	15	13	9	7	3	Õ	0	9
$6-10 + N^{a}$	11	9	10	9	9	5	3	1	0	0	6
12-16	25	22	20	19	15	9	9	3	0	0	12
18-22	26	24	25	23	16	18	14	7	3	0	16
24-28	29	23	26	27	23	19	15	7	4	<1	17
3034	28	26	28	27	26	29	16	11	3	0	19
Mean	21	18	20	19	15	13	11	5	1	<1	
LSD (0.05)	length length = depth =	by depth = 7 = 3 = 2									
					%	b viable seed	at Williston				
0-4	9	8	8	7	7	4	5	4	1	0	5
6-10	12	13	10	12	14	11	11	13	9	0	10
6-10 + N ^a	8	9	6	6	6	4	4	4	2	0	5
12-16	19	16	16	12	14	16	16	16	10	0	14
18-22	17	17	19	18	15	15	17	15	11	<1	14
24-28	19	17	19	17	19	15	17	18	15	0	16
3034	20	20	20	18	19	19	20	21	15	0	17
Mean	15	14	14	13	13	12	13	13	9	<1	
LSD (0.05)	length t length = depth =	by depth = N = 3 : 2	S								

Table 2. Percent viable wild oats seed as influenced by length of burial, burial depth, and location.

^aN = ammonium nitrate (34-0-0) at 168 kg ha⁻¹.

Grass herbicides used in wheat and broadleaf crops

Group 1

Group 2

Herbicide	Common name	Subgroup	Herbicide	Common name	Subgroup
Puma	Fenoxaprop	1-fop	GoldSky	Pyroxsulam	TPS
Discover	Clodinafop	1-fop	Everest	Flucarbazone	SACT
Axial XL	Pinoxaden	1-den	Varro	Thiencarbazone	SACT
Select	Clethodim	1-dim	Raptor/	Imazamox	Imi
Assure II	Quizalofop	1-fop	Beyond	(Clearfield only)	

Only Group 1 herbicides used



Grower used Everest 8 out of 12 years



Reduced green foxtail control

Poor control could be due to multiple things:

- 1) antagonism from broadleaf herbicides
- 2) reduced absorption
- 3) reduced translocation
- 4) change in herbicide metabolism
- 5) site of action at the membrane or enzyme level may be less sensitive to inhibition by the herbicide when plants are stressed.

Reduced green foxtail control may be due to drought stress

"Although drought-stressing green foxtail before and up to 1 d after herbicide application did not reduce control with fluazifop-P in growth chamber trials, extending the drought stress for 2 to 4 d after herbicide application reduced control of green foxtail with fluazifop-P by 40 and 57%, respectively." (Boydston, Weed Sci.)

Low soil water content for 10 to 14 days before and 7 days after herbicide application reduced control of green foxtail with fenoxaprop, fluazifop-P, haloxyfop, and sethoxydim. Withholding irrigation for 10 to 14 days before herbicide application did not reduce control of green foxtail with normal use rates of herbicides if plots were irrigated at the time of application." (Boydston, Weed Sci).

Reduced green foxtail control

Effect of soil pH on green foxtail growth?

"Growth of green foxtail was greater at pH 4.8 than at pH 7.3. (Weaver and Hamill, Weed Sci.)

Green foxtail resistance testing (% resistant)

Herbicide	Group	2015-2021	2021
Puma	1	68	
Discover	1	68	
Axial XL	1	52	
Everest	2	15	
GoldSky	2	18	
Varro	2	17	
Raptor	2	1	
Assure II	1	50	
Select	1	4	
llastad		n=139	n=21

Green foxtail resistance testing (% resistant)

Herbicide	Group	2015-2021	2021
Puma	1	68	86
Discover	1	68	71
Axial XL	1	52	81
Everest	2	15	24
GoldSky	2	18	24
Varro	2	17	19
Raptor	2	1	5
Assure II	1	50	76
Select	1	4	10
llostod		n=139	n=21

Wild oat resistance testing

(% resistant)

Herbicide	Group	2016-2021	2021
Puma	1	77	
Axial XL	1	38	
Everest	2	73	
GoldSky	2	69	
Varro	2	86	
Raptor	2	48	
Assure II	1	74	
Select	1	11	
		n=242	n=34

Wild oat resistance testing

(% resistant)

Herbicide	Group	2016-2021	2021
Puma	1	77	88
Axial XL	1	38	35
Everest	2	73	85
GoldSky	2	69	53
Varro	2	86	91
Raptor	2	48	24
Assure II	1	74	82
Select	1	11	18
		n=242	n=34

Here are some control options, not in any specific order.

- 1. RR crops: corn, soybean, canola
- 2. LL crops: corn, soybean, canola
- 3. Barley is very competitive. Take out early flush or two with tillage or Roundup.
- 4. Far-Go can be used in small grains, dry pea
- 5. Axial still works for some growers, not all.

6. Zidua is a long shot, but may work in some situations. I don't see Zidua being very effective for wild oat in conventional tillage because wild oat tends to be distributed 0-4 inches or deeper. Zidua works best on the soil surface, needs to be in the germination zone. Thus, it may work better for foxtail that is emerging from the close to the soil surface. In no-till, weeds are concentrated in the top inch or so, thus Zidua may be more effective in no-till. However, Zidua needs a lot of rain (>0.5 inch) to be activated. Zidua can be tied up in old crop residue.

- 7. Later planting date to remove 1-2 weed flushes
- 8. Higher seeding rate to provide more competition
- 9. Taller variety

10. In no-till, spray glyphosate PRE late as possible before crop emergence.

- 11. Always tank mix full rate Select with Liberty in LL canola (spray wild oat no later than 2-3 leaf stage of wild oat)
- 12. Consider a crop where you can use Select (I know there are some peas in eastern ND/western MN)

13. May have to dust off Eptam off the shelf. It's still listed on CDMS.

Assuming a crop was in wheat in 2021, consider a heavy broadleaf rotation for a few years. One possible example may be:

RR Soybean – RR/LL Stack Canola – Barley – RR soybean – LL canola – Wheat

(In recent studies and grower experience, we have not seen sclerotinia become a huge problem in a tight soybean-canola rotation. But, still need to monitor and spray, especially in the canola.)

Foxtail isn't competitive?

May 12:PREMay 23:0.13May 24:0.41June 6:0.61

Untreated

Balance + Atrazine (PRE) Balance + Atrazine + Harness (PRE)

Weed of the year: Kochia





Applied: June 22 Photo: June 29

Kochia control with Impact and Atrazine

Impact + AMS + MSO 1 oz

Impact + Atrazine + AMS + MSO 1 oz + 16 oz

Miscellaneous

- Try different options to minimize weed seed production
- Wild oat less competitive in no-till
- Kochia seed viability about 2 years
- Kochia now needs at least 2 modes of action
- Use multiple modes of action where possible
- Monitor annual herbicide use to broaden MOA
- Spray small weeds (1-3")
- Use PRE's (pray for rain)
- Use fall applications where possible

Questions?