Herbicides Persistence and Rotation to Cover Crops

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The question about whether corn or soybean herbicide programs will pose a problem for establishing fall cover crops has become a common question, particularly in areas of severe drought where corn is harvested earlier than normal and the desire to plant a cover/forage crop is strong. If you look at the rotation crop restrictions for corn and soybean herbicides in the Penn State Agronomy Guide (http://extension.psu.edu/agronomy-guide) (Tables 2.2-17 and 2.4-15), you will see that many products limit rotation to alfalfa and/or the clovers as well as some of the small grains. This is a good place to start when thinking about rotation to fall cover crops. However, these tables are inadequate because these cash crop rotation restrictions may be due to the concern for herbicide residues accumulating in forage or feed rather than carryover injury. If the crop is not going to be harvested and consumed by livestock or humans, then the primary concern is carryover injury and achieving an acceptable stand that provides the benefits of a fall or winter cover. Cover crops that are not harvested can be planted after any herbicide program, but the grower assumes the risk of crop failure.

Two factors become important when trying to predict the potential for carryover injury to rotational crops. 1.) How long does the herbicide last or persist in the soil assuming that it has soil activity, and 2.) How sensitive is the rotational crop to potential herbicide residues? Herbicides with shorter half-lives (the time it takes for 50% of the active ingredient to dissipate) are always less of a concern. Of course several factors influence the rate of dissipation such as rainfall, soil texture and soil pH, etc., however, most guidelines generally are for "normal" conditions (e.g. not severe drought). In general, products with a 4 month or less rotation restriction for the species of interest, close relative, or sensitive species (i.e. clovers) should pose little problem. These products typically have half-lives of less than 30 days. Species sensitivity can play a role if only a small amount of residue is necessary to cause injury and the herbicide persists. Quite often, small seeded legumes and grasses like the clovers and ryegrass and mustard species like canola are very sensitive to some herbicides.

The following table provides some persistence and carryover information for some commonly used corn and soybean herbicides. Some of this information is our best guess and only pertains to the eastern US, not heavy Midwest soils or the western US where soils have high soil pH and rainfall is lower.

Table 4. Common corn and soybean herbicides, estimated half-lives, cash crop restrictions and their potential to injure fall cover crops.

CORN							
Herbicide	**Active ingredient**	**Normal Rate/acre**	**Half life (days)** [1]	**Cash crop restrictions**	**Fall cover crops**		**Other**
					OK to plant	**Concern for**	
2,4-D 4S	2,4-D	1-2 pt	7	Plant anything 30 days after application	All grasses	Wait 30 days before planting sensitive broadleaves	Amine formulations more water soluble and can leach into seed zone
Accent 75DF/ Steadfast75DF	nicosulfuron/ nicosulfuron+ rimsulfuron	0.66 oz/ 0.75 oz	21	Sensitive crops have 10-18 month restriction	Fall cereal grains, ryegrass	Small seeded legumes, mustards, sorghum	More persistent in high pH soils (> 7)
Atrazine 4L	atrazine	1-2 qt	60	Can plant corn, sorghum, and soybean the following year (some products allow others)	Sorghum species	Cereals, ryegrass, legumes, and mustards	More persistent in high pH soils (> 7). Rates < 1 lb/acre can allow more flexibility
Balance Pro 4L Balance Flexx 2L	isoxaflutole	3 fl. oz 6 fl. oz	50-120	Small seeded legumes and vegetables have a 10 to 18 month restriction	Fall cereals grains	Cereals, Ryegrass, legumes, and mustards	15 inches of cumulative precipitation required from application to planting rotation crops except soybean, barely, wheat, sorghum, and sunflower
Callisto (includes Lumax, Lexar, Halex GT, etc.)	mesotrione	3-6 fl. oz	5-32	10 to 18 months for legumes and vegetables	All grasses	Small seeded legumes, mustards	Sequential applications (PRE fb POST) increase the potential for injury
Clarity/ Banvel 4S (Distinct and Status)	dicamba	16 to 24 fl. oz	5-14	15 days per 8 fl. oz/acre for small grains	All crops	Only at high rates or less than 120 days after application	Anything can be planted after 120 days with 24 fl. oz/acre or less
Dual II Mag 7.62E/Cinch	metolachlor	1.67 pt	15-50	Labeled for use on many crops	Almost anything	Annual ryegrass or other small seeded grasses	Higher rates and later applications more of a potential problem

Capreno 3.45SC	tembotrione + thiencarbazone	3 fl. oz	15	Four mo. for wheat, 10 mo. for barley, sorghum, oats and alfalfa	Wheat, triticale, rye	Small seeded legumes, mustards, sorghum	15 inches of cumulative precipitation required from application to planting rotation crops except wheat
Corvus 2.63SC	isoxaflutole+ thiencarbazone	5.6 fl. oz	50-120	Four mo. for wheat, 9 mo. for barley and 17 mo. For alfalfa, oats, sorghum, and canola	Wheat, triticale, rye	Small seeded legumes, mustards, sorghum	15 to 30 inches of cumulative precipitation from application to planting for sensitive crops
Harness 7E (Degree, Warrant)	acetochlor	2 pt	10-20	Four mo. for wheat and 9 mo. for alfalfa and clovers	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops are allowed after corn harvest
Impact/Armezon 2.8SC	topromesone	0.75 fl. oz	14	Alfalfa, canola, soybean and sunflower have a 9 mo. restriction	Wheat, barley, oats, and rye are allowed after 3 mo. Ryegrass should also be OK	Although many broadleaves are restricted, Impact does not have much soil activity	We have not seen this herbicide carryover in PA.
Laudis 3.5SC	tembotrione	3 fl. oz	14	Four mo. for cereal grains, 10 mo. for sorghum, canola, and alfalfa	Cereal grains after 4 mo.	Unknown - Small seeded legumes, mustards could be a problem	Other crops may be seeded after a successful field bioassay.
Peak 57WG (& Spirit)	prosulfuron	1 oz	9-152	Cash crop restrictions ranged from 10 mo. for soybean and tobacco to 22 mo. for alfalfa and canola	Cereal grains and sorghum are labeled, other grasses	Small seeded legumes, mustards	More persistent in high pH soils (> 7)
Permit/Sandea 75DF	halosulfuron	2/3 oz	9-27	Nine mo. for alfalfa, clovers, soybean and 15 mo. for canola	Cereal grains and sorghum after 2 mo. and other grasses	Small seeded legumes, mustards	Halosulfuron also an ingredient in Yukon
Resolve 25DF (Resolve Q)	rimsulfuron	2 oz	2-4	Winter cereals have a 3 mo. restriction and many crops are restricted for 10 mo.	Based on the short half-life, most fall cover crops should be OK in PA	None	More persistent in drought conditions

Simazine 4L (Princep)	simazine	1-2 qt	60	Can plant corn, sorghum, and soybean the following year (some products allow others)	Sorghum species	Cereals, Ryegrass, legumes, and mustards	Soil pH > 7
Stinger 3S (Hornet and Surestart)	clopyralid	5 oz	40	Recrop intervals 10.5 to 18 mo. for legumes.	All grasses	Small seeded legumes	

SOYBEAN							
Herbicide	**Active ingredient**	**Normal Rate/acre**	**Half life (days)** [1]	**Cash crop restrictions**	**Fall cover crops**		**Other**
					OK to plant	**Concern for**	
Assure II/Targa 0.88E	quizalofop	8 oz	60	Most broadleaves OK	Most broadleaves	All grasses if less than 120 days or at high rates	Plant anything after 120 days
Authority 75DF (Spartan 4F)	sulfentrazone	4 oz	32-302	12 to 24 months for legumes and some vegetables	Cereals and ryegrass	Small seeded legumes, mustards, sorghum	Labeled on tobacco, sunflowers, transplanted tomato
Classic 25DF (Canopy, Envive, etc.)	chlorimuron	0.5-2 oz	40	12 to 30 months for small seeded legumes	Cereals and ryegrass	Small seeded legumes, mustards, sorghum	More persistent in high pH soils (> 7) and with higher soil applied rates
FirstRate 84WDG	cloransulam	0.3 to 0.6 oz	8-33	Four months to wheat, 9 mo. to alfalfa, corn, sorghum and oats, 12 mo. for barley, and 18 mo. for tobacco	Wheat, triticale, rye	Small seeded legumes, mustards, sorghum	The restriction for transplanted tobacco is 10 mo. for 0.3 oz/acre. Sugarbeet and sunflower have a 30 month restriction.
Pursuit 2S	imazethapyr	4 fl. oz	60-90	Recrop restrictions range from 4 to 18 mo.	Wheat, triticale, rye, alfalfa, clover	Oats, sorghum, mustards	Any crop can be planted 40 months after Pursuit application
Raptor 1E	imazamox	5 fl. oz	20-30	Recrop intervals range from 3 to 18 mo.	Wheat, triticale, rye, alfalfa, clovers	Slight risk for mustards	Most cash crops allowed 9 mo. following application

Reflex 2E/ Flexstar 1.88E	fomesafen	1.5 pt	100	Recrop intervals range from 4 to 18 months	Cereal grains	Small seeded legumes, mustards, sorghum	Since fomesafen is often applied postemergence, soil activity can surprise users
Scepter 1.5AS	imazaquin	0.66 pt	60-90	Recrop intervals range from 11 to 18 months	Cereal grains	Small seeded legumes, mustards	Carryover much more of a risk with drought
Select 2E	clethodim	10 oz	3 d	Most broadleaves OK	All broadleaves	None assuming at least 30 days.	Plant anything after 30 days
Valor 51WDG	flumioxazin	2.5 oz	12-20	Recrop restrictions up to 10 mo. for no-till alfalfa, clover and 12 mo. for no-till canola	All grasses	Small seeded legumes and mustards	Based on the half-life, all nonfood/feed winter cover crops should be OK

CORN AND SOYBEAN							
Herbicide	**Active ingredient**	**Normal Rate/acre**	**Half life (days)** [1]	**Cash crop restrictions**	**Fall cover crops**		**Other**
					OK to plant	**Concern for**	
Glyphosate 4L	glyphosate	0.75 to 1.25 lb	47	No restrictions preemergence	All	None	Glyphosate does not have soil activity at normal use rates
Gramoxone 2S	paraquat	2 pt	1000	No restrictions preemergence	All	None	Paraquat does not have soil activity at normal use rates
Harmony 50WDG	thifensulfuron	1/8 oz	12	Any crop can be planted 45 days after application	No restrictions for wheat, barley, and oats	None with 45 day waiting interval	Harmony Extra also contains tribenuron
Liberty 2.34L	glufosinate	22 - 36 fl. oz	7	No restrictions for canola, corn, and soybean. Small grains have a 70 day restriction.	All	Food or feed residues rather than crop injury may be a concern	Glufosinate does not have soil activity at normal use rates
Metribuzin 75DF (Sencor)	metribuzin	0.33 lb	14-60	Recrop restrictions range from 4 to 12 mo.	Cereal grains and ryegrass	Slight risk for small seeded legumes and mustards	Nonfood/feed winter cover crops allowed
Outlook 6E	dimethenamid	16 fl. oz	20	Four mo. for cereal grains and anything the following spring	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops should be OK after corn harvest

Prowl H2O 3.8CS	pendamethalin	3 pt	44	Wheat and barley after 4 mo. Other rotational crops the following year.	Cereal grains	Small seeded legumes and annual ryegrass	We have not seen this herbicide carryover in PA. Nonfood/feed winter cover crops should be OK
Python 80WDG (Hornet and Surestart)	flumetsulam	1 oz	14-120	Cash crop restrictions from 4 mo. for alfalfa and cereals to 26 mo. for canola	Cereal grains	Small seeded legumes, mustards, and annual ryegrass	Cover crops and forage grasses are restricted for 9 mo.
Sharpen 2.85SC (Verdict and Optill)	saflufenacil	3 fl. oz	7-35	Any crop can be planted 4 mo. after application	All	None	This product has been reported more persistent in western Canada
Zidua (Fierce, Anthem etc.)	pyroxasulfone	0.133	20	4 mo. for wheat, 11 mo. for other small grains, and 10 mo. for alfalfa	Most crops should be fine	Food or feed residues rather than crop injury may be a concern	Nonfood/feed winter cover crops should be OK after corn harvest

[1] Herbicide half-life estimates derived from the WSSA Herbicide Handbook, and from other scientific literature.

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