**Herbicide Carryover and Herbicide Efficacy in Potatoes**
2019

Herbicide persistence into the next growing season can restrict potato production. There are many herbicides that can carryover in the soil for one or more years. Carryover of herbicides can affect emergence rate and growth, causing a reduction in potato yield and quality. The carryover potential of herbicides varies because of their chemical structure, the soil characteristics, and environmental conditions amongst many factors. It is always a good practice to review previous herbicide applications to a field where plans have been made to plant potatoes.

Here are some general rules for herbicide breakdown:

1. Many herbicides are broken down in soil by microbial decomposition. In addition, sulfonylureas and triazines are broken down by chemical reactions like acid hydrolysis.
2. Herbicide molecules must be free from binding to soil particles or organic matter for soil microorganisms to degrade.
3. Most herbicide molecules are more tightly adsorbed to soil particles in dry soils than moist soils.
4. Chemical degradation of herbicides in soil is affected by soil pH. Acid hydrolysis nearly ceases at soil pH above 6.8.

Restrictions for planting potatoes in North Dakota can be found in the North Dakota Weed Control Guide (Table 1). This information is from current registration labels as available. For states outside of North Dakota, check the herbicide labels for specific instructions on potato rotation.

Most herbicides labeled for potatoes are preemergence herbicides (Table 2). When applying a preemergence herbicide it is important to know what weed species need to be controlled. An understanding of the weed species can help the applicator choose which herbicide(s) will be most effective. Many herbicides can be tank mixed to increase the spectrum of weeds controlled. It is common to mix preemergence herbicides, and tank mixing may also result in an additive or even a synergistic effect of the herbicides on weed control. After applying preemergence herbicides, activation of the herbicides is essential for active weed control. This is done by either irrigation or rainfall. Refer to the label of the herbicide for more specific information on the amount of irrigation or precipitation needed for activation.

There are a few postemergence options in potato (Table 3), but depending on the cultivar being grown this list can become more limited. In general, metribuzin can be used postemergence on most russet-skinned cultivars and not on smooth-skinned cultivars. Broadleaf weed control on postemergence smooth-skinned potatoes, such as the red- and white-, and yellow-skinned potatoes, is limited to rimsulfuron. Postemergence herbicides are most effective at controlling small weeds, those that are 1 inches or less in height. Grasses are typically best controlled by using a Group 1 herbicide. The best defense against weeds in potato production is utilizing mechanical tillage, timely herbicide applications, and good scouting to control weeds early.

Table 1. Potato Rotation Restrictions for North Dakota. Adopted from 2018 North Dakota Weed Control Guide.

| Herbicide | Months after application | Herbicide | Months after application |
|---|---|---|---|
| Acuron | 10 | **Osprey** | 10 |
| **Anthem/Max** | 4 | **PerfectMatch** | 18 |
| **Armazon/Pro** (0.5 fl oz) | 9 | Permit* | 9 |
| atrazine* (0.38 lb ai) | NCS | **Plateau** | 48b |
| atrazine* (0.38-0.5 lb ai) | NCS | **PowerFlex HL** | 9 |
| atrazine* (0.5-1 lb ai) | 2CS | **PrePare** | 9 |
| **Authority Assist** | 26 | **Prequel** | 6 |
| **Authority Elite** | 4 | **Prowl EC / H2O** | 0 |
| **Authority First/Sonic** | 18 | **Pursuit** | 26 |
| **Authority MTZ** | 12 | **Quelex** | 15 |
| **Autumn Super** (i) | 18 | **Raptor / Beyond** | 18t |
| **Balance Flexx** (j) | 6 | **Realm Q** | 10 |
| **Beyond** | 18t | **Reflex** | 0 |
| **Boundary** | 0 | **Require Q/Resolve Q** | 0 |
| **BroadAxe XL** | 4 | **Revulin Q** | 10 |
| **Capreno** (i) | 18 | Rimsulfuron*(1oz DF/A) | 0 |
| **Callisto/GT** | 10 | **Sharpen** (1 fl oz) (v) | 4 |
| **Callisto Xtra** | NCS | **Sharpen** (2 fl oz) (v) | 5 |
| Coruvs (i) | 17 | **Sharpen** (3 fl oz) (v) | 6 |
| Curtail* / M* | 18 | **Solstice** | 10 |
| Dicamba (0.5 lb ai) | 4 | **Sonalan** | NCS |
| Dicamba (>0.5 lb ai) (h) | 6 | **Spartan Charge** | 4 |
| **Everest** | 9 | **Spartan Elite** | 4 |
| **Extreme** | 26 | **Starane Flex** | 9 |
| **Facet L** | 24b | **Status** (h) | 4 |
| **Far-Go** | NCS | Stinger* | 18 |
| **Fierce** | 4 | **SureStart II** | 18 |
| **FirstRate** | 18 | Surpass* | NCS |
| **Flexstar / GT 3.5** | 0 | **Surveil** | 18 |
| **Halex GT** | 10 | **Talinor** (a) | 9 |
| Harness* | NCS | **Tordon** (1.5 oz) | 2CS |
| **Huskie** | 9 | **Travallas** (e) | B |
| **Huskie Complete** | 18b | Treflan* | 0 |
| **Impact** | 9 | **TripleFlex II** | 18 |
| **Instigate** | 10 | **Valor / Chateau** (c) | 4-10 |
| **Laudis** | 10 | **Varisto** | 18t |
| **Liberty 280** | 2.3 | **Varro** | 18b |
| **Lumax EZ (<3 pt/A)** | 18 | WideMatch* | 18 |
| **Marvel** | 0 | **Wolverine Advanced** | 9 |
| Metribuzin* (u) | 12 | **Zidua** | 4 |
| **Milestone** (b) | B | **Zidua Pro** | 26 |
| Nortron* | 12 | | |
| **Olympus** (0.2-0.4 oz) | B | | |

*Or generic equivalent.
**NCS** = Next cropping season after herbicide application.
**2CS** = Second cropping season after herbicide application.

**a** Refer to label – restrictions may be adjusted based on herbicide rate, rainfall, tillage, soil type, soil pH, bioassay, and ND 24(c) labels.

**b** Bioassay. Do not plant until field bioassay indicates it is safe. Crop rotation after atrazine* is rate and soil pH dependent. Python, Hornet, and SureStart/TripleFlex = 26 month rotation + successful field bioassay. FirstRate = 30 month rotation + successful field bioassay. Pursuit = 40 month rotation + successful field bioassay.

**c** Valor 2 oz/a + tillage = 4 months; Valor 2 oz/a - tillage = 8 months; Valor 3 oz/a + tillage = 5 months; Valor 3 oz/a - tillage = 10 months.

**e** Above soil pH 7.9, soil bioassay must be performed.

**h** Any rotational crop may be planted 120 days following application of dicmaba at 1.5 pt/A or less, excluding days when ground is frozen. For all crops and rates greater than 1.5 pt/A allow 45 days per 1 pt/A of Banvel* used excluding days when ground is frozen.

**i** Crops with a 9- or 10-month rotation restriction require 15 inches of cumulative precipitation after application. Crops with a 17- or 18-month rotation restriction require 30 inches of cumulative precipitation after application. Soil at 7.5 pH or above require crop rotation to be extended from 9 or 10 months to 17 or 18 months and from 17 or 18 months to 24 months.

**j** Requires 15 inches of cumulative precipitation during the growing season following application. An 18 month restriction applies to Prequel and rimsulfuron* applied above rates indicated or if drought follows application. Refer to label if higher rates are used.

**m** Do not plant lentil, potato or any other broadleaf crop grown for seed for 18 months unless risk of injury is acceptable.

**t** Rotation to potato is: 9 months: soil pH >6.2 and rainfall is >18 inches/year or 18 months: soil pH <6.2 and rainfall is <18 inches/year

**u** Must add 2 months if soil pH is 7.5 or above.

Table 2. Relative herbicide effectiveness on weeds applied preemergence. The following ratings show relative herbicide effectiveness at labeled rates. Under favorable conditions control may be greater than indicated and under unfavorable conditions herbicides may give erratic results. Dry and cool weather increases herbicide persistence while wet and/or warm weather reduces herbicide persistence. Adapted from the 2016 North Dakota Weed Control Guide.

| | | Grasses | | | | | | | Broadleaves | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SOIL- APPLIED HERBICIDES*** | Mode of Action** | Barnyardgrass | Brome, Downy | Foxtail, Green | Foxtail, Yellow | Quackgrass | Volunteer Cereals | Wild Oat | Buckwheat, Wild | Cocklebur, Common | Horseweed (Marestail) | Kochia | Lambsquarters |
| Boundary* (Pre) | 5,15 | F-G | - | F-E | F-E | N | P | P | F-G | P | F | F-G | G |
| Chateau* (Pre) | 14 | N | F-G | P | P | N | N | N | P-F | N | F-E | F-G | G-E |
| Dual* (PPI/Pre) | 15 | P-E | P-F | F-E | F-E | N | P | P-F | N-P | N | N | N-P | P-F |
| Linex* (Pre) | 7 | F | - | F | F | P | P | P | G | P | - | F | E |
| Rimsulfuron (Pre) | 2 | G | - | G | F-G | N | G | F | P | F | P[1] | G[1] | F |
| Metribuzin* (PPI/Pre) | 5 | P-F | F-G | P-F | P-F | N-P | P-G | N | F-G | P-F | F | F-G | P-F |
| Outlook* (PPI/Pre) | 15 | G-E | P-G | G-E | G-E | N | F-G | P | N | N | N | N | F-G |
| Prowl* (PPI) | 3 | E | F-G | G-E[1] | E | N | N | P-F | P | N | N | P | F-G |
| Reflex* (PRE) | 14 | P-F | - | P | P | N | N | N | P | P | - | F | F |
| Sonalan (PPI) | 3 | E | F | E[1] | E | N | P | P | P | P | N | P | G |
| Treflan* (PPI) | 3 | E | F-G | E[1] | E | N | N | P-F | N | N | N | P | F-G |

| | | Broadleaves | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SOIL- APPLIED HERBICIDES*** | Mode of Action** | Lanceleaf Sage | Mustard, Wild | Mustard, Winter Annual | Nightshade, E Black | Nightshade, Hairy | Pigweed, Redroot | Waterhemp (ALS-R) | Prickly Lettuce | Ragweed, Common | Smartweed, Annual | Thistle, Russian | Crop Safety*** |
| Boundary* (Pre) | 5,15 | F | G-E | G-E | P | P | G-E | G-E | G-E | P-F | G | G-E | S-M |
| Chateau* (Pre) | 14 | N | G | G | E | G-E | G-E | G-E | F-G | N-P | F | F-G | S-M |
| Dual* (PPI/Pre) | 15 | N | N | - | N | N | F-G | F-G | N | N | N | P | S-M |
| Linex* (Pre) | 7 | - | E | - | F-G | F-G | E | G | - | G-E | G-E | F | N-S |
| Rimsulfuron (Pre) | 2 | N | F | - | P | P | E | N | - | F | P | P | N-S |
| Metribuzin* (PPI/Pre) | 5 | F | G-E | G-E | P | P | G-E | F-G | G-E | P-F | G | G-E | N-S |
| Outlook* (PPI/Pre) | 15 | N | P-F | - | F-G | F-G | G-E | G | - | N | N | P-F | S-M |
| Prowl* (PPI) | 3 | N | N | P | N | N | G-E | G | N | N | P | F-G | N-S |
| Reflex* (PRE) | 14 | - | F | - | G | F | E | E | - | G | F-G | P | S |
| Sonalan (PPI) | 3 | N | N | P | P | P | E | G-E | P | N | P | G-E | S |
| Treflan* (PPI) | 3 | N | N | P | N | N | E | G-E | N | N | P | G | N-S |

PPI = Preplant Incorporated, Pre = Preemergence. Shallow PPI = greater and more consistent weed control compared to PRE.
*Or generic equivalent.
**Numbers represent herbicide mode of action from a numerical classification system found on page 108-109 of NDSU Weed Guide.
***Cultivars vary in their response to herbicides and to environmental conditions. Cool and wet weather can slow plant metabolism and make herbicides more available to the plant, which may increase crop injury.
[1]Herbicides will not control resistant biotypes or provide minimal control in tank-mix/premixes with alternative modes of action.

Weed control ratings in this section are based on the following scale:

E = Excellent = 90 to 99% control
G = Good = 80 to 90% control
F = Fair = 65 to 80% control
P = Poor = 40 to 65% control
N = None = No control
"-" = insufficient information

Crop Safety

N = No injury, plant growth is normal.
S = Slight visible injury, but yield should not be affected by any direct injury.
M = Moderate visible injury, but yield should not be affected by any direct injury.

Table 3. Relative herbicide effectiveness on weeds applied postemergence. The following ratings show relative herbicide effectiveness at labeled rates. Under favorable conditions control may be greater than indicated and under unfavorable conditions herbicides may give erratic results. Adapted from the 2015 North Dakota Weed Guide.

| | | Grasses | | | | | | | Broadleaves | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **POST - APPLIED HERBICIDES*** | Mode of Action** | Barnyardgrass | Brome, Downy | Foxtail, Green | Foxtail, Yellow | Quackgrass | Volunteer Cereals | Wild Oat | Buckwheat, Wild | Cocklebur, Common | Horseweed (Marestail) | Kochia | Lambsquarters |
| Rimsulfuron | 2 | G-E | - | G-E | G-E | G-E | G-E | G-E | N | N | N | E[1] | F |
| Metribuzin* | 5 | F | N | F | F | P | P | - | G | P | F-G | F-G | E |
| Poast | 1 | E | P-G | E | E | F | G-E | G-E[1] | N | N | N | N | N |
| Select* / Select Max | 1 | E | P-E | E | E | G-E | E | E | N | N | N | N | N |

| | | Broadleaves | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **POST - APPLIED HERBICIDES*** | Mode of Action** | Lanceleaf Sage | Mustard, Wild | Mustard, Winter Annual | Nightshade, E Black | Nightshade, Hairy | Pigweed, Redroot | Waterhemp (ALS-R) | Prickly Lettuce | Ragweed, Common | Smartweed, Annual | Thistle, Russian | Crop Safety*** |
| Rimsulfuron | 2 | - | E | E | G/N | P-F | E | N | - | P | F | P[1] | N-S |
| Metribuzin* | 5 | - | E | E | P | P | G | P-G | G-E | E | E | - | N-M |
| Poast | 1 | N | N | N | N | N | N | N | N | N | N | N | N |
| Select* / Select Max | 1 | N | N | N | N | N | N | N | N | N | N | N | N |

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Crop Safety

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S = Slight visible injury, but yield should not be affected by any direct injury.
M = Moderate visible injury, but yield should not be affected by any direct injury.

*Adapted from the 2019 North Dakota Weed Control Guide