



# Potato Progress

Research & Extension for the Potato Industry of Idaho, Oregon, & Washington

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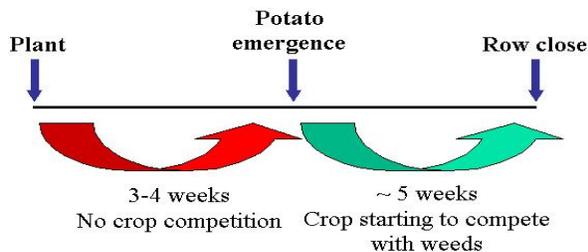
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## Weed Control: It's All about the Timing...

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### Where does weed control fit between planting, potato emergence, and row closure?

From potato planting to row closure is a busy time for growers. It's also a busy time for weeds. Getting the herbicides on at the right time and linking up with tillage operations between planting and row closure is the key for weed control from start to finish. Depending upon location, potato variety, and a few other factors including the weather, time from planting to emergence can be 3 to 4 weeks, and from emergence to row closure when the potato finally starts to help control the weeds with shading and competition, 4 to 5 weeks (**Figure 1**).



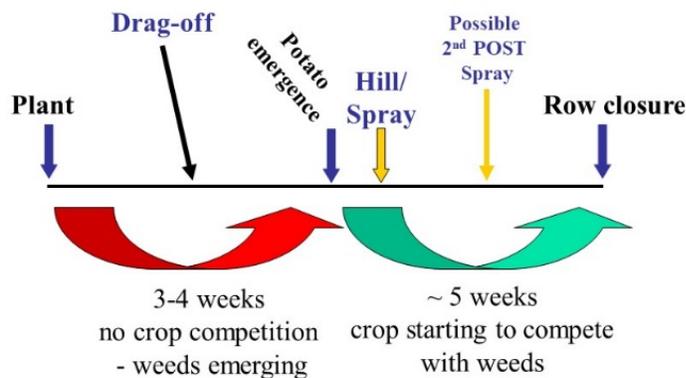
**Figure 1.** Time between planting, potato emergence, and potato row closure.

Now here's why timing matters. University of Idaho research has shown that if hairy nightshade at a density of 2 per meter-row is not controlled from a few days after potato emergence to 22 days later, which would be before row closure, U.S. No. 1 tuber yield losses of 5% or greater will occur. It's worse, of course, if that nightshade competes all season long. If only one per meter-row gets through weed control efforts and competes with the crop from emergence to vine kill, then as much as 21% U.S. No. 1 yield is lost.

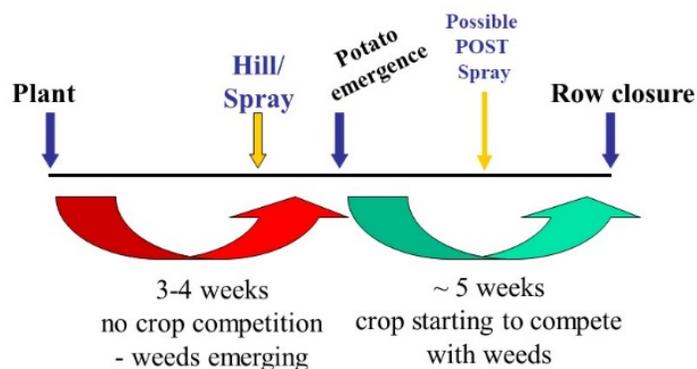
There are different approaches to tillage timing, and this article will concentrate on two: 1) "Drag-off" before potato emergence and "hilling-reservoir tillage" after potato emergence. *Herbicides are applied*

after hilling postemergence to the potatoes (**Figure 2**). Tillage after planting and before potato emergence with a harrow or similar equipment to “knock down” the moderate hill that was built at planting, usually referred to as drag-off, then waiting until after potato emergence when the potato rows can be seen before tillage with equipment set-up for hilling and reservoir tillage at the same time; 2) Hilling-reservoir tillage only – a hilling-reservoir tillage operation after planting but *before potato emergence* (**Figure 3**).

Preemergence herbicides are applied after hilling before potato emergence with or without a subsequent application of postemergence herbicides.



**Figure 2.** Drag-off before potato emergence and hilling-reservoir tillage after potato emergence. Herbicides are applied after hilling postemergence to the potatoes. A 2<sup>nd</sup> postemergence spray may be necessary.



**Figure 3.** Only hilling-reservoir tillage after potato emergence. Herbicides are applied after hilling but preemergence to the potatoes. A postemergence spray may be necessary.

In the two scenarios, the hilling-reservoir tillage operation is the last one to be performed until harvest. The equipment is set up for reservoir tillage between the potato rows and hilling the potato rows at the same time making it a one-pass operation.

Reservoir tillage creates divots in the furrow which can make the irrigation water infiltration rate slow for more efficient irrigation (**Figure 4**).

Hilling – cultivation with equipment throwing soil out of the furrow up into the row area to form a hill. Hilling can reduce tuber exposure to sunlight, which lessens tuber greening. Furthermore, soils are aerated and structure of some soils improved (especially those high in silt and very fine sand).

**NOTE:** Some refer to reservoir tillage by one of the equipment trade names, **Dammer Diker®**.



**Figure 4.** Reservoir tillage.

Equipment adaptations for herbicide application after hilling-reservoir tillage: Some growers have adapted their equipment to include a spray boom behind the equipment's paddle wheels so that the herbicide is applied after the hilling and not disrupted. The herbicide is sprinkler-incorporated with overhead irrigation.

**Always read and follow the herbicide label. When tank-mixing herbicides, use the most restrictive label. Information such as rates, potato variety sensitivity, pre-harvest intervals, and rotational crop restrictions are not provided in this article.**

#### **Up-front information:**

Using an integrated weed management strategy will provide the best weed control in potatoes. Integrated weed management makes use of all the cultural, mechanical, chemical, and biological tools available for weed control, rather than relying on any single weed control tool. Studies in Idaho have shown that when weed populations are low and a competitive potato variety is grown, cultivating when weeds are small ( $\frac{1}{2}$  inch tall) and potato plants are 4 to 6 inches tall can provide economical weed control.

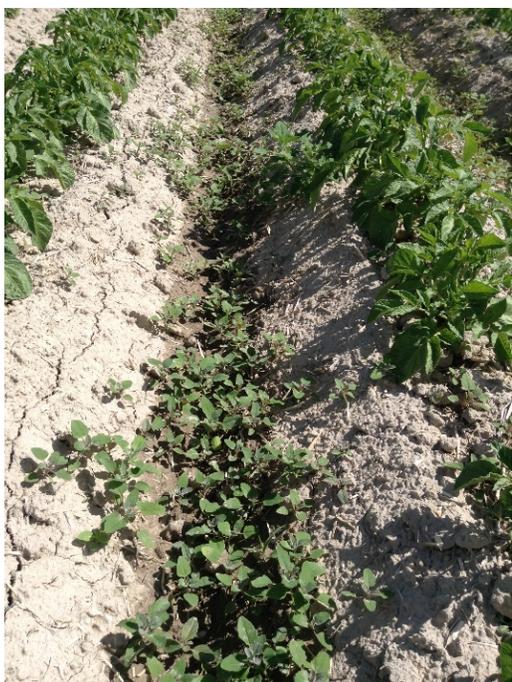
Properly timed cultivations can control early germinating annual weeds, as long as weeds are no more than two to three true leaf stage, which is usually <1 inch-tall, at the time of cultivation (**Figure 5**).

- 3- to 4-inch tall weeds can sometimes still be eliminated, however, when >4 inch, cultivation is not effective (**Figure 6**).
- If the cultivator is not set up properly, weeds may be left on the sides of hills (**Figure 7**).
- Even though large weeds are initially covered with soil during a cultivation, they can survive and re-emerge.
- If soil is wet, cultivation should be delayed to avoid compaction and weeds can't "re-root" in the wet soil.

- In-row weeds will most likely not be controlled with in-furrow tillage, although soil thrown up onto tops of hill may cover small, emerged weeds enough to kill them.



**Figure 5.** The size of most of the emerged weeds seen here between the potato rows are cotyledon to 2 true leaves, less than 1-inch tall, so cultivation at or before this time would usually be effective at controlling these weeds.



**Figure 6.** Most of the weeds pictured here are greater than 3 inches tall and a cultivation would not provide effective control.



**Figure 7.** Hilling equipment was not set properly and weeds were left on the side of the hill.

*NOTE: Hilling of potatoes larger than 8 to 10 inches tall may result in root-pruning and reduced tuber yields and quality.* Multiple cultivations may cause soil compaction, reducing aeration and potato growth and producing clods that bruise potatoes at harvest.

*Tillage after herbicides already have been applied will disrupt the herbicide barrier and bring up untreated soil, and perhaps, additional weed seed.*

**Tank-mix herbicides** with different mechanisms of action in order to attain broad spectrum weed control and prevent or delay the development of herbicide-resistant weed populations. Design herbicide tank-mixes to target the weeds present in a given field. Rotate herbicide mechanisms of action from year-to-year.

**Scenario 1. Drag-off before potato emergence and hilling-reservoir tillage after potato emergence. Herbicide application after that last tillage operation.**

A drag-off tillage is performed for reasons including the desire to knock down the hills created at planting so that the seed piece is closer to the warm soil surface for a faster germination than if buried at the 5 to 6 inch planting depth in relatively colder soil. The field is leveled, however, and unless a precision planter with GPS features is used the final hilling-reservoir tillage cannot occur until after potato emergence when the rows can be seen.

Of course, the drag-off and hilling can control weeds which have already emerged. Some herbicides can even be incorporated with a shallow tillage operation with care taken to not damage the seed piece or potato shoots close to the surface. However, as mentioned, *tillage after herbicides already have been applied will disrupt the herbicide barrier.* Therefore, herbicides in this scenario would be most effective if applied after hilling-reservoir tillage that has been conducted after potato emergence.

Chemigation (or attaching a spray boom to the back of the equipment as mentioned) can be the most effective means of herbicide application after reservoir tillage, however, some sprayers are designed to be

driven across the reservoir-tillage divots on the sides of the hills while still maintaining a level spray boom for even distribution of the herbicide.

Consequently, only the following herbicides are labeled for application after potato emergence:

**rimsulfuron (Matrix and others)**

- Can control emerged weeds listed on the label – best when less than 1 inch tall.
- A split postemergence + postemergence application is allowed. Matrix can also be applied preemergence + postemergence.
- Do not exceed 2.5 oz/A (0.039 lb ai/A).
- Can be applied via chemigation.

**metribuzin (multiple trade names)**

- Can control emerged weeds listed on the label – for optimum control apply before weeds are 1” tall.
- May be applied via chemigation.
- Preemergence + postemergence split applications are labeled.
- Postemergence + postemergence split applications are allowed in Idaho, Oregon, and Washington only.
- Do not exceed 1 lb ai/A total metribuzin per season.

**EPTC (Eptam)**

- Does not control emerged weeds.
- Highly volatile, so if applied with a ground-rig rather than chemigation, it must be incorporated (sprinkler-incorporation is preferred) the same day as application.

**pendimethalin (Prowl H2O and others)**

- Does not control emerged weeds.
- Early postemergence up to the 6-inch stage of potato growth.
- Can be chemigated postemergence.
- **NOTE: This herbicide is labeled for preemergence-incorporated applications before or at drag-off, however, subsequent tillage will disrupt the herbicide layer and weeds can emerge.**

**s-metolachlor (Dual Magnum)**

- Does not control emerged weeds.
- Postemergence chemigation through center pivot is allowed.
- Postemergence application may be applied over a previous Dual Magnum application, but do not apply more than 3.6 pt/A of Dual Magnum in a single crop season.

**Boundary a formulated mix of s-metolachlor + metribuzin**

- The metribuzin in this product can control emerged weeds listed on the label.
- Depending on the Boundary rate used, tank-mixing with additional metribuzin is allowed as long as rate limits and label specifics are followed.
- Postemergence chemigation through center pivot is allowed.

**metolachlor (Stalwart and others)**

- Does not control emerged weeds.
- *Chemigation can only be used for preemergence timing.*

- NOTE: *of the postemergence herbicides listed above, only rimsulfuron and metribuzin have activity on emerged broadleaf weeds.*

**Postemergence grass control only with sethoxydim (Poast or Poast Plus and others) and clethodim (Select and others).** Do NOT chemigate these postemergence, grass-only herbicides.

**Scenario 2. Only a hilling-reservoir tillage operation which is then followed by herbicide application before potato emergence with or without postemergence herbicide application(s).**

The hilling-reservoir tillage in this scenario can be performed any time after planting and before potato emergence. Waiting one to three weeks after planting would allow for some weeds to emerge, which if small enough, will be killed with the hilling. Regardless of timing, a “clean bed” is created and herbicide application should occur as soon after the tillage as possible to be effective (**Figure 8**).

Now herbicides that can only be applied before potato emergence are an option. In addition to these herbicides, and other than those grass-only herbicides, the ones mentioned in Scenario 1 can also be applied preemergence. In fact, all except Matrix and metribuzin only have activity on weeds which have not yet emerged (sometimes referred to as having soil-residual activity).

NOTE: *all of these preemergence herbicides can be applied by ground or via chemigation.* If applied by ground, rain or sprinkler irrigation must occur for incorporation and activation in the top two-inch layer of soil where most weed seeds germinate. Although incorporation of some of these herbicides does not have to occur immediately, since the herbicides do not have activity on emerged weeds, the best control possible is usually achieved when the herbicide is incorporated as soon as possible after application.

**dimethenamid-p (Outlook)**

**ethalfluralin (Sonalan)**

**flumioxazin (Chateau)**

Chateau is an herbicide which should be applied as early as possible after planting because at least 2 inches of settled soil covering the potato sprouts at application (and incorporation) time.

**fomesafen (Reflex)**

- For use in potatoes grown with overhead irrigation only.
- Only for use in ID, WA, OR with Special Local Needs 24 (c) labeling. Check your state for labels and label expiration dates.

**trifluralin (Treflan and others)**

**linuron (Linex or Lorox and other trade names)**

- Linuron has some activity on emerged weeds, however, must be applied before potato emergence to avoid injury.
- Currently, linuron, marketed as Linex, can only be used in potatoes grown west of the Rocky Mountains in ID, WA, and OR per Special Local Needs 24 (c) labels. Check your state for label expiration dates and other restrictions.

**sulfentrazone (Willowood Sulfentrazone 4SC and others)**

Sulfentrazone is highly mobile in soils with pH of 7.5 or greater. Application to these soils, especially if coarse-textured, and/or irrigation with highly alkaline water (high pH) after applying sulfentrazone, may increase the amount of herbicide available in the soil solution for uptake by the potato crop. Crop injury can occur in these situations.

**A formulated pre-mix of sulfentrazone and metribuzin (Willowood MTZ 4SC)**



**Figure 8.** Weed control after a hilling operation with a correctly-timed preemergence application of Outlook + Linex (ground-applied and sprinkler-incorporated w/in 24 hrs of application).

### **Preemergence + Postemergence combinations**

Metribuzin can be applied preemergence + postemergence not exceeding 1 lb ai/A total per season.

Matrix can be applied preemergence + postemergence not exceeding a total of 2.5 oz/A (0.039 lb ai/A) per season.

Sometimes, when any of the preemergence-only herbicides are used, a postemergence application may also be needed due to heavy weed pressure, late-germinating weeds, preemergence herbicides did not have activity on certain weed species, or as part of the herbicide program plan. Matrix and/or metribuzin are commonly used in this instance since they can be applied postemergence to the potatoes and have activity on emerged weeds. Timing in relation to weed size is extremely important (Figure 9).

**What if weeds have emerged before potato emergence – before or after drag-off and/or hilling-reservoir tillage?** “Burndown” herbicides with foliar activity only (no soil residual activity) can be used; these are non-selective herbicides that destroy any emerged plant and must be applied before potato emergence. Glyphosate, paraquat, and/or carfentrazone (Aim) are labeled for this timing in potatoes. These herbicides do not have soil activity. Tillage after application is okay but an appropriate amount of time for the herbicides to work must occur before that tillage.



**Figure 9.** Herbicides were applied postemergence to the weeds and potatoes, but some of the weeds were too large at application time to be controlled. In addition, an herbicide effective on hairy nightshade was not included in the overall program.

### **Summary:**

Timing matters. Coordination of tillage operations and herbicide applications is critical for successful, season-long weed control. Effective weed control measures should be implemented before potato row closure. Allowing weeds to remain for as long as 3 weeks after potato emergence can result in yield loss.

- Properly timed cultivations can control early germinating annual weeds when performed before the weeds get to large. Less than one-inch tall, 2- to 3-leaf weeds is ideal.
- Matrix and metribuzin are the only herbicides that are safe to emerged potatoes AND have foliar activity on emerged broadleaf weeds.
- Besides those two, only Prowl H2O (or 3.3EC), Eptam, Dual Magnum, or Stalwart can be applied to emerged potatoes safely – they won't kill emerged weeds, however. Boundary, the mix of metribuzin and s-metolachlor can also be applied after potatoes emerge and does have some activity on emerged weeds.
- Linex (where labeled for use) can control emerged weeds but cannot be applied if potatoes are emerged.
- Other herbicides that can only be applied to potatoes before emergence and that have soil activity are Chateau, Outlook, Sonalan, Sulfentrazone, Treflan, and Reflex (where labeled for use).
- “Burn-down” herbicides such as glyphosate, Aim, or paraquat can also be applied preemergence to potatoes. They do not have activity on weeds which have not yet emerged. Properly-timed tillage after these herbicides are applied is okay.
- Tank-mix/rotate herbicides with different mechanisms of action.
- Design tank mixtures to target the weeds present in a given field.

**Good luck and may you have perfect timing in 2019!**

## 2019 WA Commercial Potato Seed Lot Pick up & Trial Information

*Info also available each year at: [www.potatoes.wsu](http://www.potatoes.wsu)*

Commercial potato seed samples are requested from WA Growers for the 2019 Washington Seed Lot Trial. **Two hundred whole (single drop) seed is an acceptable sample size, or 50 lbs of 4 oz single drop seed.**

**Requested: 50 lbs of 2-4 oz whole seed, no seed treatments  
We want a representative sample - if applicable, include a  
representative amount of rotten tubers!**

**(Seed over 6 oz is not acceptable)**

A representative sample is needed. Sampling the first (or last) 300 seed from the truck is not likely to provide a representative sample of the lot. Sample tags may be obtained by calling the Potato Commission at 509-765-8845.

Your assistance with collection and drop off of seed samples is needed. Seed samples may be taken to the WSU Othello Research Unit (509-488-3191); located on Booker Road ¼ mile south from State Highway 26 and about five miles east of Othello. For sample pick up and any questions regarding the seed lot trials please call:

**South Basin:** Tim Waters (509-545-3511), Mark Pavek (509-335-6861), or Zach Holden (509-335-3452).

**North Basin:** Carrie Huffman Wohleb (509-754-2011), Mark Pavek (509-335-6861), or Zach Holden (509-335-3452).

**Westside:** Don McMoran (360-428-4270), Mark Pavek (509-335-6861), or Zach Holden (509-335-3452).

In the North Basin, one seed “drop-off” has been established. It is located at Qualls Ag Labs (Mick Qualls, 509-787-4210 ext 16) on the corner of Dodson Road and Road 4; come to front office between 8 am and 5 pm. Please call the numbers below to arrange additional pick up sites. Samples will be picked up at 2:00 pm the day before each planting date (below) to be included. Growers planting in early March should drop their samples off at the Othello Research Center or store the samples and call the numbers below for pick up. For all alternative pick up locations or questions please call Mark Pavek at 509-335-6861 or Zach Holden at 509-335-3452.

**PICK UP DATES ARE ONE DAY PRIOR TO THE PLANTING DATES BELOW**

*The seed lot planting dates for 2019 are:*

1st (Early)	April 1
2 <sup>nd</sup>	April 15
3 <sup>rd</sup>	April 29
4th (Late)	May 13

## *2019 Potato Field Day - Thursday June 27*

This year's virus reading of the seed lots will take place on June 11 and 25