

POTATO WEED MANAGEMENT WORKSHOP

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WEED CONTROL IN POTATO AND POTATO VARIETY TOLERANCE WITH SPARTAN

Spartan, a new, preemergence potato herbicide, is on track for full-label use in the 2004 growing season. EPA recently approved registration of Spartan for potatoes. The herbicide's manufacturer, FMC Corporation, wrote the appropriate potato label language and submitted the label December 2003. EPA has up to 90 days to review and approve the label. Once that is done, potato growers will have the green light to add Spartan to their weed management arsenal. Some Idaho potato growers were able to use Spartan in 2003 due to a Section 18 Emergency Exemption Use allowed by EPA.

Spartan, common chemical name – sulfentrazone, has a mode of action that is new to potato and the crops in rotation with potato in the Pacific Northwest (PNW). The herbicide works by inhibiting one of the enzymes involved in chlorophyll production. Spartan should be applied preemergence to the weeds. Spartan has been included in weed control and potato tolerance trials at the Aberdeen Research and Extension Center since 1999.

In these trials, Spartan has provided good to excellent season-long control of hairy nightshade, redroot pigweed, common lambsquarters, and kochia in these trials (data not shown). The herbicide was applied preemergence to the weeds and the potato crop after hilling or just before potato emergence, and sprinkler incorporated with ½ to ¾ inches of irrigation water.

Another herbicide must be included in the tank mixture with Spartan for control of grassy weeds (Figure 1). Herbicides already labeled for use in potatoes tested as tank-mix partners in University of Idaho research trials were Dual II Magnum/Dual Magnum, Eptam, Matrix, Prowl, and Sencor. These partner herbicides are compatible with Spartan in a mixture and work well when applied preemergence.

Spartan at 2 or 4 oz per acre (one and two times the lowest proposed label rate) was applied preemergence to four potato varieties in tolerance trials at U of I's Aberdeen Research and Extension Center in 2000, 2001, and 2002, and by USDA/ARS Weed Scientist, Dr. Rick Boydston in Paterson, WA trials conducted in 2001 and 2002 (Table 1). Except for one year, very slight injury symptoms of stunting, and/or leaf discoloration or malformation observed early in the growing season were gone by the end of the season, and tuber yield and quality was not affected by either rate of the herbicide regardless of trial location (Table 1).

In 2001, however, when many PNW potato fields, including the tolerance-trial fields, were affected by unusual heat stress occurring before row closure, tuber yield and quality of Spartan-treated potatoes in these trials were reduced compared to the untreated controls (Table 1). Apparently, the slight herbicide stress tolerated in other years, was not tolerated as well by potatoes when combined with the heat stress occurring so unusually early in the season.

Until further research is conducted, Spartan may not be used on potatoes grown for seed. Both ground and aerial application of Spartan will be allowed. FMC Corp. has requested permission to apply Spartan via chemigation. If not chemigated, optimum performance can be achieved if rainfall occurs or if irrigation is used after application to activate the herbicide. This moisture must be received within 7 days of Spartan application. Although shallow, mechanical incorporation may be used in areas without irrigation, sprinkler irrigation incorporation is the most appropriate method providing correct herbicide placement and activation.

A range of Spartan rates from 2 to 5.3 oz per acre will be labeled since Spartan weed control and crop tolerance can be affected by soil texture, % organic matter (OM), and pH. ***Because of soil properties here in the PNW, the rate range for potatoes grown in most Idaho, Oregon, or Washington fields will be 2 to 4.5 oz per acre*** (Table 2). Soil pH is one of the major soil characteristics affecting Spartan herbicide. Soil %OM and texture also may be important factors influencing Spartan performance, depending on soil pH. Language on the proposed label will be as follows:

- Spartan DF activity is greatly influenced by soil pH. As soil pH increases, the solubility of Spartan increases dramatically, thus increasing the availability of the active ingredient to the crop and weeds.
- The use rate of Spartan must be adjusted to account for the soil pH within the soil texture classification. If the pH of the soil is greater than 7.5, use the lower rates included in the rate range within the appropriate soil texture and organic matter ranges.
- When using Spartan on coarse texture soils having 1.5% organic matter or less with high pH, use the lowest rate listed in the rate range of the chart for the soil texture and crop being treated. Some adverse crop response may occur on coarse-textured soils with low organic matter (less than 1.5%) and pH of 7.5 or higher, or on highly eroded soils, or in areas of calcareous outcroppings. Spartan use rates should be reduced in those areas.
- Inadequate seed furrow closure or shallow planting (less than 1.0 inch) may result in undesirable crop response. As expected, poor growing conditions such as excessive moisture, low temperatures, soil compaction and diseases may also cause undesirable crop response.

Workshop attendees were given a copy of Table 2 and were asked to determine the appropriate Spartan rate based on the following information in two scenarios.

Scenario 1:

Coarse-textured soil (sands, loamy sands, sandy loams), high pH (>7.5), low organic matter (<1%).

- The minimum sprinkler incorporation water amount should be used (0.5 inches) to place the herbicide in the appropriate area - not too deep.
- With adequate soil moisture, herbicide applied at the low to medium rate in the recommended rate range (2 to 3 oz/A) will be available for weed uptake and should provide effective control.
- Herbicide also will be available for uptake by the potato crop in this situation and some crop injury may occur. As in PNW research trials, if other crop stress is minimal or nonexistent, herbicide injury will most likely not result in reduced tuber yield or quality
- Since soil pH is high, texture is coarse, and %OM low, the herbicide may degrade to a less than effective concentration or move below the weed germination zone before potato row closure. Depending on initial tank mix partner(s), additional weed control measure may be needed for season-long weed control.
- The higher rates recommended for this type soil and %OM may be needed to adequately control high density weed populations. The lowest rate is recommended on the label.

Scenario 2:

Medium textured soil (sandy clay loams, sandy clays, loams, silt loams, silts), low to high pH, low to medium %OM (<1% to 3%).

- Sprinkler incorporation water amounts within the recommended range can be used.
- With adequate soil moisture, herbicide applied at a rate within the recommended rate range should be available for weed uptake and should provide effective control. Higher rates may be needed in this type soil with relatively high %OM.
- Herbicide also may be available for uptake by the potato crop in this situation and some crop injury may occur, especially if this type soil has >7.5 pH coupled with <1%OM. If soil pH is <7.5, however, injury may not occur until after potato crop irrigation has been initiated and 1 to 2 irrigation events have taken place. As in PNW research trials, if other crop stress is minimal or nonexistent, herbicide injury will most likely not result in reduced tuber yield or quality.
- Even if soil pH is relatively high, an effective herbicide concentration should remain in the weed germination zone long enough for adequate weed control from potato emergence through row closure for season-long weed control.
- If %OM is relatively high in this soil type, the higher rates in the recommended rate range may be needed to adequately control high density weed populations.

NOTE: *Spartan rates above 4.5 oz per acre only will be allowed on fine-textured soils (silty clay loams, silty clays, clay loams, clay) with >3%OM.*

Sugar beet planted in University of Idaho research trials the next year after Spartan herbicide was used in potatoes were not injured and yields were not reduced compared to untreated checks. These results were observed in two separate follow crop trials conducted on a loam soil with 1 to 1.4 %OM and 7.8 to 8.0 pH at the Aberdeen Research and Extension Center in southeastern Idaho. ***Until more follow crop trials can be conducted in PNW potato production areas on different soil pH, %OM, and soil type conditions, FMC will have a 36 month plant-back restriction for sugar beet on the potato label.***

- Potato, mint, limas, dry shell pea and beans, or sunflowers, may be planted anytime after Spartan use in potatoes.
- Wheat, rye, oats, or barley can be planted as soon as 4 months after Spartan use in potatoes.
- Corn grown for grain or silage, popcorn, or seed corn may be planted 10 months after Spartan use in potatoes.
- Alfalfa may be planted 12 months after Spartan use in potatoes.
- Sweet corn, popcorn, or corn grown for seed may be planted 18 months after Spartan use in potatoes.
- Sugar beet may be planted 36 months after Spartan use in potatoes.

No endorsement of named products is intended nor is criticism implied if similar products are not mentioned.

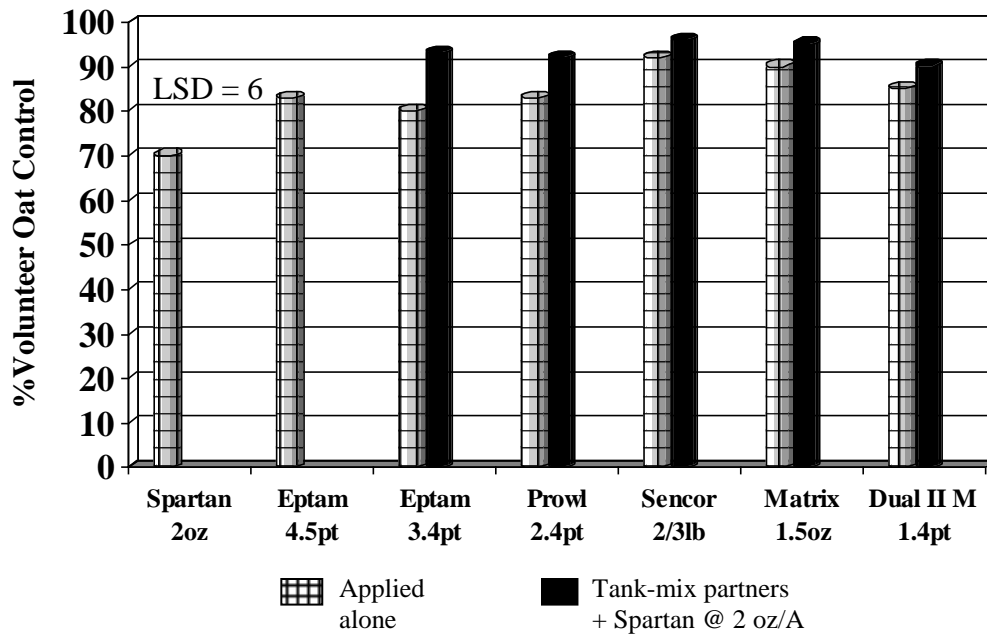


Figure 1. Volunteer oat control with Spartan applied alone (2 oz/A) or with Eptam (3.5 pt/A), Prowl (2.4 pt/A), Sencor (2/3 lb/A), Matrix (1.5 oz/A), or Dual II Magnum (1.4 pt/A) in 2003 at the Aberdeen Research and Extension Center. The tank-mix partners also were applied alone. All applications were preemergence after hilling, and were sprinkler incorporated with 2/3 inch water.

Table 1. Potato variety tolerance to Spartan - information and summary for trials conducted in 2000, 2001, and 2002 in Idaho, Oregon, and Washington.

2000 – 2 and 4 oz/A ID, OR, WA*	2001 and 2002 – 2 and 4 oz/A (5.3 oz/A in WA)	
	ID and WA	ID
Russet Burbank	Russet Burbank	Bannock Russet
	Ranger Russet	Alturas
	Russet Norkotah	
	Shepody	
•Some early injury was observed = leaf blackening, crinkling, slight stunting		
•Did not translate to yield reduction EXCEPT in 2001		
•2001 = early heat stress (before row closure)		
•Reduction in yields at Aberdeen for all varieties		
•Reduction in yield for Ranger Russet and Shepody in WA		
•Potato plants could not deal w/ the heat stress and herbicide stress at the same time		
* ID location was the Aberdeen Research and Extension Center; Oregon location was the Malheur Experiment Station; Washington location was near Paterson, WA.		

Table 2. Spartan use rate table on **proposed** FMC Corp. potato label.

Spartan DF Potato Use Rate Table (proposed)* Preemergence Application			
	Ounces Spartan DF per acre		
	Soil Texture		
% Organic Matter	<u>Coarse</u>	<u>Medium</u>	<u>Fine</u>
<1.5	2.0 – 3.0	2.0 – 3.0	2.5 - 3.5
1.5-3	2.0 – 3.0	2.5 – 4.0	3.0 – 4.0
>3	3.0 – 4.0	3.5 – 4.5	4.0 – 5.3
	Sands, Loamy sands, Sandy loams	Sandy clay loams, Sandy clays, Loams, Silt loams, Silts	Silty clay loams, Silty clays, Clay loams, Clay
*Refer to the previous information on the influence of soil pH on Spartan use rates.			

WEED CONTROL WITH POSTEMERGENCE APPLIED MATRIX + EPTAM

Eptam (2 pts/A) + Matrix (1.5 oz/A) + MSO (1% v/v) applied in a postemergence tank mixture improved broadleaf weed control compared with Matrix + MSO in a 2003 trial at the Aberdeen Research and Extension Center. The addition of AMS (1% v/v) to Matrix + Eptam + MSO resulted in greater broadleaf and grass control than the other two treatments. The chemical manufacturers/owners of Matrix and Eptam may label the Matrix + Eptam postemergence tank mixtures for weed control at these rates for use in potato in 2004. The current labels do not support this low rate of Eptam.

Table 3. Late-season weed control with postemergence applied Matrix + Eptam (1.5 oz + 2 pt/A) with methylated seed oil (MSO) at 1% v/v, or with MSO + ammonium sulfate (AMS) at 1% v/v MSO + 1% v/v AMS Plus. Matrix + MSO also was applied postemergence.

Postemergence application rates	Common			
	Redroot pigweed	lambs-quarters	Kochia	Hairy nightshade
	----- % season-long control -----			
Matrix 1.5 oz/A + MSO	82	80	80	88
Matrix + Eptam (2 pt) + MSO	85	88	88	90
Matrix + Eptam (2 pt) + MSO + AMS	90	95	93	95
	Volunteer Green			
	oat	foxtail		
	--% season-long control --			
Matrix + MSO	90	87		
Matrix + Eptam (2 pt) + MSO	90	90		
Matrix + Eptam (2 pt) + MSO + AMS	95	95		

No crop damage was observed and treatment tuber yields were similar to weed-free (untreated) control.