

Effect of Vydate on Potato Plant Health

Jeff Miller and Trent Taysom
Miller Research, Rupert, ID

Introduction

Soil fumigation with metam sodium is an effective method for reducing soil-borne fungal pathogens such as *Verticillium dahliae*, *Fusarium* species, *Pythium* species, and *Rhizoctonia solani* (Hamm et al., 2003; Miller, unpublished data) and nematodes (Ingham et al., 2007a; Ingham et al., 2007b). Soil fumigation can also reduce weed populations, however, this is often seen as a secondary benefit since weeds in potatoes are primarily managed through other herbicide options.

Alternatives to metam sodium fumigation are needed. New EPA (2012) regulation of metam sodium has restricted the use of this product. The buffer zone requirements have made it impractical to apply metam sodium in some situations. These regulations have resulted partially from worker handler safety issues and unfavorable public perception. Additionally, some have argued that repeated use of metam sodium in the same field over time has resulted in a decrease in efficacy. Research has shown that repeated applications of metam sodium can result in accelerated degradation of the active ingredient, making the application less effective (Triky-Dotan et al., 2009).

2013 Results

Results from a trial sponsored by DuPont in 2013 showed that a full season program of Vydate (active ingredient oxamyl) combined with two applications of Vertisan (active ingredient penthiopyrad) was more effective than applying metam sodium at 40 gallons/acre (Tables 1 and 2). DuPont's V2 Advantage program utilizes Vydate in-furrow at planting followed by five in-season foliar applications combined with Vertisan in-furrow and then again at the time of first plant trash on the ground.

All programs increased the gross processing dollar return per acre when yield and grade parameters were entered into a mock processing contract. When this value was adjusted for the cost of the program, the highest net return was realized from the V2 plus metam sodium at 20 gallon (MS20) treatment (Table 2). Somewhat surprisingly, the metam sodium at 40 gallon (MS40) treatment did not provide a positive return. The improvement in yield compared to the untreated check (UTC) was negated by the cost of the application.

It needs to be emphasized that the fumigation treatments in this trial were applied in the spring (March 25) as opposed to fall fumigation. It is generally accepted that fall fumigation is more effective and the metam sodium treatments may have been more beneficial had they been applied in the fall of 2012.

These results indicated that the V2 program could be an alternative to spring-applied metam sodium if growers could not use or chose not to use metam sodium. An additional result was that using metam sodium at a lower rate (20 gallons) combined with the V2 program was more effective than metam sodium fumigation alone.

Table 1. Programs evaluating the use of Vydate and Vertisan (V2) for potato yield and grade.

Program	A=3/25 (pre-plant)	B=5/1 (in furrow)	C=6/12 (8-10" rosette)	D=7/2 (first trash)	E=7/16 (D+14 days)	F=7/31 (E+14 days)	G=8/14 (F+14 days)
UTC		Quadris					
MS40	Vapam (40 gal)	Quadris					
MS20	Vapam (20 gal)	Quadris					
V2		Vydate + Vertisan	Vydate	Vydate + Vertisan	Vydate	Vydate	Vydate
V2 + MS40	Vapam (40 gal)	Vydate + Vertisan	Vydate	Vydate + Vertisan	Vydate	Vydate	Vydate
V2 + MS20	Vapam (20 gal)	Vydate + Vertisan	Vydate	Vydate + Vertisan	Vydate	Vydate	Vydate

Vydate applied at 2.1 pt/acre, Vertisan at 16 fl oz/acre, and Quadris at 8 fl oz/acre.

Table 2. Effect of Vydate/Vertisan and Vapam on potato yield, quality, and size (cv. Russet Burbank; Acequia, ID; 2013).

Program	Yield (cwt/acre)	% US#1	Processing Return (\$/acre)	Net Dollar Return (relative to UTC)
UTC	539 c	76 ab	3947 c	--
MS40	582 ab	71 abc	4167 bc	0
MS20	568 bc	77 a	4197 bc	140
V2	578 b	67 c	4326 b	226
V2+MS40	611 a	66 c	4315 b	105
V2+MS20	613 a	70 bc	4714 a	394
LSD (P=.10)	32.3	6.2	361.1	
Standard Deviation	26.3	5.0	294.5	
CV	4.52	7.12	6.89	
Grand Mean	582.06	70.73	4274.93	
Treatment Prob(F)	0.0137	0.0481	0.0628	

Means followed by same letter do not significantly differ (P=0.10, LSD). Mean comparisons performed only when ANOVA Treatment Prob(F) is significant at the pre-determined mean comparison level (<0.10). Significant values are bolded.

2014 Trial

The trial was repeated twice in 2014. DuPont sponsored a repeat of the trial conducted in 2013 and the Northwest Potato Research Consortium (NPRC) sponsored a trial which only looked at the efficacy of Vydate (no Vertisan). Going into the 2014 season Vertisan was not available for use by potato growers in the Pacific Northwest due to Maximum Residue Limits (MRL) restrictions on Vertisan's penthiopyrad mode of action.

The programs in the NPRC trial are listed in Table 3.

Table 3. Treatments utilized in the NPRC trial evaluating combinations of Vydate and metam sodium.

Program	A=10/29 (fall pre-plant)	B=4/23 (in furrow)	C=6/11 (8-10" rosette)	D=7/1 (first trash)	E=7/14 (D+14 days)	F=7/29 (E+14 days)	G=8/12 (F+14 days)
UTC							
MS40	Vapam (40 gal)						
Vyd2		Vydate	Vydate				
MS20-Vyd2	Vapam (20 gal)	Vydate	Vydate				
Vyd4		Vydate	Vydate	Vydate	Vydate		
MS20-Vyd4	Vapam (20 gal)	Vydate	Vydate	Vydate	Vydate		
Vyd6		Vydate	Vydate	Vydate	Vydate	Vydate	Vydate
MS20-Vyd6	Vapam (20 gal)	Vydate	Vydate	Vydate	Vydate	Vydate	Vydate

Vydate applied at 2.1 pt/acre for all applications.

Metam sodium (either 20 or 40 gallons) significantly increased total yield (Table 4) and marketable yield (data not shown) compared to the untreated check. None of the Vydate programs provided a significant increase in yield compared to the untreated check. In hindsight we should have included a treatment evaluating metam sodium at 20 gallons alone in order to determine if the yield increase in treatments 4, 6, and 8 were due to the metam sodium alone or a combination of the metam sodium and Vydate. Tuber quality was relatively poor in 2014 with about 50% of all tubers being graded as US#1. The gross processing dollar return and net dollar return per acre (relative to the check) was observed with metam sodium applied at 40 gallons/acre.

A secondary goal of the 2014 trial was to determine how many applications of Vydate were necessary to obtain the yield and quality benefit from Vydate that was observed in 2013. In 2014 none of the Vydate treatments provided an economic benefit over using metam sodium and so this question could not be answered.

A reduced rate of Vapam combined with Vydate was an effective way to manage nematodes in 2014 (Table 5). Even though the Columbia root knot nematode (*Meloidogyne chitwoodi*) population was above 260 per 250 cc soil, we did not observe any damage in tubers after harvest. (Soil samples collected in this trial were too late to accurately measure stubby root nematode populations (*Trichodorus* and *Paratrachodorus* spp.)).

If Vydate could be used to reduce the rate of metam sodium, a significant reduction in the amount of pesticide active ingredient would be realized. Vapam at 40 gallons/acre results in 170 lb of active ingredient applied to the field. Six applications of Vydate without Vapam results in about 6 lb of active ingredient. A combination of Vapam at 20 gallons and six applications of Vydate results in about 89 lb of active ingredient. If the Vapam/Vydate combination could work, a substantial reduction in pesticide active ingredient would be realized.

Table 4. Effect of metam sodium and Vydate on yield and quality (cv. Russet Burbank; Acequia, ID; 2014).

Description Rating Unit	Total Yield (cwt/acre)	% US#1	Processing Return	Net Dollar Return (relative to UTC)
Trt Program				
1 UTC	581 c	55 ab	3270 bc	--
2 MS40	672 a	59 a	4242 a	786
3 Vyd2	575 c	48 bc	2909 cde	-448
4 MS20-Vyd2	661 ab	50 bc	3627 b	177
5 Vyd4	588 c	48 bc	2848 def	-597
6 MS20-Vyd4	635 b	47 bc	3218 bcd	-320
7 Vyd6	580 c	41 c	2999 cd	-533
8 MS20-Vyd6	647 ab	44 c	3248 bcd	-377
LSD (P=.10)	28.9	9.02	413.4	
Standard Deviation	23.8	7.41	343.3	
CV	3.85	15.19	10.94	
Grand Mean	617.18	48.82	3137.15	
Treatment Prob(F)	0.0001	0.0519	0.0001	

Means followed by same letter do not significantly differ (P=0.10, LSD). Mean comparisons performed only when ANOVA Treatment Prob (F) is significant at the pre-determined mean comparison level (<0.10). Significant values are bolded.

At this point in time, we are not ready to recommend the use of a Vydate program as a replacement for metam sodium. When examining both 2013 and 2014 results together, using Vydate in combination with a reduced rate of metam sodium appears to provide the most effective approach to prolonging vine health, increasing yield, and controlling nematode populations. The trial needs to be performed again to see if 2013 or 2014 results are more typical.

Table 5. Effect of metam sodium and Vydate on nematode populations in 250 cc soil (cv. Russet Burbank; Acequia, ID; 2014).

Description Rating Unit	Columbia Root Knot
Trt Program	
1 UTC	260 a
2 MS40	0.55 c
3 Vyd2	139 a
4 MS20-Vyd2	0.55 c
5 Vyd4	182 a
6 MS20-Vyd4	0 c
7 Vyd6	58 ab
8 MS20-Vyd6	0 c
LSD (P=.10)	0.78t
Standard Deviation	0.64t
CV	53.79
Grand Mean	1.2t
Treatment Prob(F)	0.0001

Means followed by same letter do not significantly differ (P=0.10, LSD). Mean comparisons performed only when ANOVA Treatment Prob (F) is significant at the pre-determined mean comparison level (<0.10). Significant values are bolded. t=Mean descriptions are reported in transformed data units, and are not de-transformed. Data were transformed using the log (X+1) transformation (Columbia root knot and stubby root) and the square root (X+0.5) transformation (Pin). Back transformed means are given in the table.

References:

- EPA (United States Environmental Protection Agency). 2012. Soil Fumigant Mitigation Factsheet: Buffer Zones. EPA 735-F-12-003. Office of Pesticide Programs, Arlington, Virginia.
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