

**Sierra Cascade Intensive Forest Management Research Cooperative Proposal 10-01  
Milestone VM**

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Title: Aminopyralid Site Preparation and Conifer Tolerance

Year Approved: 2010

**Executive Summary:**

Milestone VM (aminopyralid) is a relatively new product in California. It was registered for use in 2008 for non-crop sites. Currently Dow AgroScience is compiling data in the hope of obtaining a forestry label.

Milestone VM is a pre and post emergent herbicide that controls a wide variety of broadleaf weeds (including legumes) and brush. It is an auxin and has both foliar and soil activity. The residual control is proving to be quite good and the product is an excellent inhibitor of seed germination. It is also showing some unique properties for brush control when tank mixed with other products. It has very low use rates, with maximum label rates at seven ounces per acre (0.1 lb ae/ac).

Previous testing has indicated no conifer tolerance for "over the top" applications, but directed applications around trees appears to be feasible. There is also a strong potential to broaden the spectrum of control when tank mixed with Velpar DF. The major questions surrounding Milestone VM and forestry at this point are regarding conifer tolerance as a site preparation spray and the duration of control by season. Milestone VM might have a fit as a site preparation treatment for some of the chemically intolerant conifers such as sugar pine, cedar,

and redwood, although testing has yet to be done.

The stated objective of this study is to evaluate the effect of aminopyralid rate and timing on vegetation control and conifer tolerance of ponderosa pine and Douglas-fir when applied as a pre-plant site preparation treatment with Milestone VM alone and in combination with Velpar DF compared to Velpar DF as the operational standard.

The study will have two sites, one east side Cascade site and a low elevation west side Cascade site. Each site should be a fresh clear-cut or wildfire that has not had any chemical treatment prior to the trials. The plan will be to spray the east side site in the fall of 2010 and the low elevation site in the spring of 2011. Both sites will be planted in the spring of 2011. The study design will be a completely randomized block design with four replications. Stock type and seed lot will be the same for all trees of each species in the study. The stock type will be similar to what is operationally planted on the site.

Treatments to be studied include: Milestone VM alone at 0.0625, 0.11, and 0.22 lbs. a.i./acre; Milestone VM at 0.11 lbs. a.i./acre plus Velpar DF at 1.0 a.i./acre, and Velpar

DF alone at 2.5 lbs. a.i./acre. All applications will be applied at 10 gallons per acre at 30 psi. Base line data for conifer height and caliper will be taken at time of planting. End of season evaluations will take place at the end of the first and second growing seasons after treatment and will consist of ocular estimates of vegetation percent cover by species for the weeds and brush, ocular rating of conifer damage, and measurement of conifer seedling height and caliper.

**2010:** The fall site is located on property owned and managed by Sierra Pacific Industries approximately 10 miles west of Dana, California. Elevation is approximately 4000 feet. Slope is between 0 and 10 percent. The site is a sub-soiled clear-cut that was planted three years ago and has never received any herbicide treatment. As a result, the site is dominated by herbaceous vegetation with relatively poor stocking. Study plots were established in areas with no conifer stocking. Plot size is 12 feet by 36.3 feet (0.01 acre).

The study site was installed and sprayed on October 6, 2010. All treatments were applied with a 12 foot backpack boom sprayer and all plots were sprayed with one timed pass. Sprayer was calibrated prior to application.

**2011:** The spring site is also located on property owned and managed by Sierra Pacific Industries approximately ten miles south of Dunsmuir, California in the Sacramento Canyon. Elevation of the site is approximately 3000 feet on a west aspect.

The site was pre-harvest sprayed with Chopper prior to logging. After logging, no further chemical or mechanical treatments were conducted.

The spring trial was installed and sprayed on March 11<sup>th</sup>, 2011. Treatments and application procedures were similar to those used on the fall site.

Plots were planted on both sites in the spring of 2011. Ten ponderosa pine and ten Douglas-fir were planted in each of two rows in every plot. All ponderosa pine were styro 6's and Douglas-fir were styro 8's. The spring site was planted on March 17, 2011 and the fall site was planted on May 6, 2011. All seedlings were initially measured for caliper and height at planting.

The spring and fall sites were evaluated on August 31, 2011. Percent cover for competing vegetation was visually estimated by species as was percent bare ground. Caliper and height were measured for all surviving trees and percent survival was calculated along with stem volume. Terminal bud damage and needle damage were assessed on a scale from 0 to 10 with 0=No Damage and 10=Most Severe.

Data were analyzed using SAS statistical software and analysis of variance with Tukeys HSD procedure for multiple comparisons. Data were analyzed as a completely randomized block design with four replications.

First year results indicated that Milestone VM by itself has extremely good tolerance

on both Douglas-fir and ponderosa pine at all rates tested in these trials at either timing. Vegetation control with Milestone VM by itself was poor. Control improved dramatically with the addition of Velpar DF at 1.33 lbs product per acre. See Tables 1 and 2 for efficacy data.

Percent bare ground was significantly greater for both the Velpar DF treatment at 3.33 lbs product per acre and the 1.33 lbs Velpar DF plus 7 oz of Milestone VM treatment compared to all other treatments and the control in the fall trial. The spring site had very little vegetation occupy the site in the first season after planting. At the end of the first season, percent bare ground in the controls averaged 87.5 percent. As a result, no significant differences were found between treatments regarding percent bare ground.

Annual grasses were controlled very well with the operational standard of 3.33 lbs Velpar DF in the fall having a percent cover of 1.5 percent compared to 52.5 percent in the controls. The result was significantly different from the controls and the lowest rate of Milestone VM by itself ( $p < 0.05$ ). The tank mix of Velpar DF at 1.33 lbs plus Milestone VM at 7 oz did very well having an annual grass percent cover of 16.25 percent, however the result was not significantly different from the control. No significant differences were found on the spring site for annual grass control, but this was due to virtually no annual grass occupying the site.

The main effect of treatment was also significant for prickly lettuce control in the fall, however multiple comparisons between treatments failed to yield any treatments significantly different from each other. The Velpar treatment at 3.33 lbs, Velpar at 1.33 lbs plus 7 oz of Milestone VM and the 14 oz Milestone VM treatment gave good to excellent control (0%, 3.25% & 5.75% cover respectively) compared to 18.75% cover in the controls.

While treatment was determined to be significant regarding snowberry and deerbrush control in the spring, the results appear to be an artifact due to the overall lack of cover for either species. Therefore, the results are not deemed to be real. Similar results were found for yellow nutsedge in the fall trial but also are most likely the result of high variability between replications. No other individual species were significantly affected by treatment.

The ponderosa pine seedlings planted in the spring trial, appeared to suffer from some type of nursery issue, as seedlings suffered an abnormal amount of mortality even in the control plots.

Douglas-fir and ponderosa pine survival, height or stem volume was not significantly affected by treatment in either the spring or the fall trial ( $p < 0.05$ ). Douglas-fir caliper was significantly larger in the treatment with Velpar DF at 3.33 lbs compared to the control trees in the fall. Caliper was not significantly different for Douglas-fir seedlings among any of the chemical treatments. Calipers were significantly

larger for ponderosa pine seedlings treated in the fall with either the Velpar DF alone at 3.33 lbs or 1.33 lbs Velpar DF plus 7 oz of Milestone VM compared to all other treatments with the exception of the 14 oz Milestone VM treatment. Caliper was not significantly affected by treatment in the spring trial. See Tables 3 through 6 for conifer tolerance data.

Stem volume in the fall timing for both Douglas-fir and ponderosa pine was largest with either the 7 oz Milestone VM plus 1.33 lb Velpar DF combination or the Velpar DF by itself at 3.33 lbs. The results were not statistically significant at the  $p < 0.05$  level, but the values were very close and the trend is probably real.

Overall, Milestone VM appears to provide insufficient vegetation control by itself. However, in combination with low rates of Velpar DF, control is increased

significantly. Ponderosa pine and Douglas-fir both appear to be very tolerant to Milestone VM in either the spring or fall, even up to twice the maximum label rate. No terminal bud or needle damage was noted in either species. The fact that no significant differences existed for seedling caliper, height, stem volume or survival for either Douglas-fir or ponderosa pine between the operational standard of Velpar DF alone at 3.33 lbs compared to the tank mix of 7 oz Milestone VM plus 1.33 lbs Velpar DF suggest that this may be a suitable alternative to straight Velpar, especially when intolerant conifers are involved. The tank mix also provided similar vegetation control. These data compare well with the analogous trials conducted in the FSC Research Group. Final data will be collected in the fall of 2012 for both timings.

		% Cov	% Cov	% Cov	% Cov	% Cov
TREATMENT	%Bare Ground	Annual Grass	Prickly Lettuce	Deer Brush	Willow Herb	Yellow Nutsedge
4 oz/ac MVM	16.25	60.0	12.0	4.25	2.25	3.25
7 oz/ac MVM	26.25	42.5	15.0	1.25	0.75	4.5
14 oz/ac MVM	40.0	33.75	5.75	1.25	0.5	3.75
7 oz MVM + 1.33 lbs Velp DF/ac	73.75	16.25	3.25	1.0	0.25	1.25
3.33 lbs/ac Velp DF	93.75	1.5	0.0	0.0	0.5	0.0
Control	18.75	52.5	18.75	2.25	1.0	2.5

Table 1. Percent bareground and percent cover by species ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

		% Cov	% Cov	% Cov	% Cov	% Cov	% Cov	% Cov
TREATMENT	%Bare Ground	Ann. Grass	Prickly Lettuce	Deer Brush	Bull Thistle	Snow Berry	Brack. Fern	Yellow Nutsedge
4 oz/ac MVM	92.75	2.5	0.0	0.25	0.0	0.5	2.25	0.75
7 oz/ac MVM	95.75	0.0	0.0	0.0	0.0	1.0	5.0	1.0
14 oz/ac MVM	95.0	0.0	0.0	0.25	0.0	0.0	4.25	1.0
7 oz MVM + 1.33 lbs Velp DF/ac	95.5	0.0	0.25	0.0	0.25	0.0	3.75	0.5
3.33 lbs/ac Velp DF	97.75	0.0	0.0	0.0	0.0	0.25	0.5	0.0
Control	87.5	0.0	0.5	1.5	0.0	0.25	7.5	1.25

Table 2. Percent bareground and percent cover by species five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

	Cal	Ht	Stem Vol	Percent	Terminal	Needle
TREATMENT	mm	cm	cm <sup>3</sup>	Survival	Bud Rating	Rating
4 oz/ac MVM	3.64	25.04	3.74	92.5	0.0	0.0
7 oz/ac MVM	4.01	27.51	4.69	75.0	0.0	0.0
14 oz/ac MVM	4.06	25.45	4.69	95.0	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	4.44	26.12	5.59	87.5	0.0	0.0
3.33 lbs/ac Velp DF	4.58	25.14	5.69	92.5	0.0	0.0
Control	3.41	22.82	2.88	90.0	0.0	0.0

Table 3. Douglas-fir measurements ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

	Cal	Ht	Stem Vol	Percent	Terminal	Needle
TREATMENT	mm	cm	cm <sup>3</sup>	Survival	Bud Rating	Rating
4 oz/ac MVM	5.55	33.23	11.49	97.5	0.0	0.0
7 oz/ac MVM	5.61	34.38	12.16	100.0	0.0	0.0
14 oz/ac MVM	5.85	34.22	12.41	92.5	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	5.36	31.7	9.65	100.0	0.0	0.0
3.33 lbs/ac Velp DF	5.48	32.58	11.31	100.0	0.0	0.0
Control	5.37	32.18	10.36	95.0	0.0	0.0

Table 4. Douglas-fir measurements five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

	Cal	Ht	Stem Vol	Percent	Terminal	Needle
TREATMENT	mm	cm	cm <sup>3</sup>	Survival	Bud Rating	Rating
4 oz/ac MVM	4.69	16.92	4.03	97.5	0.0	0.0
7 oz/ac MVM	4.68	18.44	4.21	92.5	0.0	0.0
14 oz/ac MVM	5.10	16.41	4.62	95.0	0.0	0.3
7 oz MVM + 1.33 lbs Velp DF/ac	5.57	20.43	6.65	95.0	0.0	0.0
3.33 lbs/ac Velp DF	5.61	17.53	5.77	97.5	0.0	0.0
Control	4.59	20.45	4.65	92.5	0.0	0.0

Table 5. Ponderosa pine measurements ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

	Cal	Ht	Stem Vol	Percent	Terminal	Needle
TREATMENT	mm	cm	cm <sup>3</sup>	Survival	Bud Rating	Rating
4 oz/ac MVM	5.79	20.29	7.04	72.50	0.0	0.0
7 oz/ac MVM	6.29	24.01	9.99	52.50	0.0	0.0
14 oz/ac MVM	5.83	18.7	6.79	72.5	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	5.7	19.92	6.83	70.0	0.0	0.0
3.33 lbs/ac Velp DF	6.07	21.38	8.33	70.0	0.0	0.0
Control	5.68	21.38	7.59	62.5	0.0	0.0

Table 6. Ponderosa pine measurements five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.