

**Sierra Cascade Intensive Forest Management Research Cooperative Proposal 13-02**  
**Pindar GT/GoalTender “Over the Top”**

Principal Investigator: Ed Fredrickson

Title: Broadcast Release “Over the Top” with Pindar GT and GoalTender

Year Approved: 2013

**Executive Summary:**

Over the last several years, there has been a concerted effort to find a residual site preparation chemical that not only provides effective vegetation control but also provides better conifer tolerance to hexazinone intolerant conifers such as Douglas-fir, white fir, sugar pine, and incense cedar. Much progress has been made, a large part of which has been a direct result of this cooperative. As of January 26, 2013, Milestone has been registered in California forestry by Dow AgroSciences and they are currently evaluating three other alternative site preparation chemicals: Pindar GT (oxyfluorfen + penoxulam), GoalTender (oxyfluorfen), and Dimension (dithiopyr). Pindar GT and GoalTender are two of the most promising residual chemicals to be tested to date. Several trials have been established to evaluate pre-plant site preparation efficacy and conifer tolerance. The results to date have been extremely good. Both products show excellent conifer tolerance and provide comparable vegetation control to the operational standard of Velpar DF.

Often it is not logistically possible to apply residual herbicides before planting occurs. Velpar DF applications have the advantage of being able to be applied pre or post

planting without added risk of conifer injury. It would be highly advantageous for any new residual chemistry to have the same flexibility. Goal 2XL (GoalTender’s predecessor) has been tested over many conifer species in forest nurseries with excellent tolerance, but neither GoalTender or Pindar GT has been tested over seedlings under field conditions. This proposal is for a series of trials that would evaluate the conifer tolerance associated with applications broadcast “over the top” of newly planted conifer seedlings in the spring and fall with Pindar GT and GoalTender,

This trial will be established in a freshly logged clearcut or wildfire that was slated for planting in the spring of 2013. The selected unit should not have had any residual chemical treatment to date. This trial will be completely randomized with four replications per treatment. Plot size will be 12 feet by 36.3 feet (0.01 acres). Plots would be established and marked prior to planting. All plots would be planted prior to application in the spring of 2013 with 15 trees each of ponderosa pine, Douglas-fir, and white fir. Five trees of each species would be designated as “dig” trees for destructive sampling to evaluate root growth. The remaining ten trees would be

measurement trees. The first ten trees by species in each plot would be initially measured for caliper and height at time of planting.

Two sets of plots would be established on the same site, one for a spring application and one for a fall application (all plots would be planted in the spring of 2013). Spring applications would occur within several weeks of planting. The fall timing would occur in October 2013. All applications would be at ten gallons per acre and applied with a CO<sub>2</sub> powered backpack sprayer with a twelve foot boom at 30 psi. The sprayer would be calibrated prior to application and each plot would be sprayed with one timed pass.

Treatments will include: 3 pts. Pindar GT per acre applied in the spring and fall; 6 pts. Pindar GT per acre applied in the spring and fall; 3 pts. GoalTender per acre applied in the spring and fall; 6 pts. GoalTender per acre applied in the spring and fall; and control.

Evaluations will occur in the fall of 2013, 2014, and 2015 (fall timing only in 2015). Only spring applications would be evaluated in the fall of 2013. Evaluations for the spring applications in the fall of 2013 would consist of percent bare ground, percent cover by individual competitive plant species and total percent cover to assess vegetation control. The five trees designated for destructive sampling would be excavated and roots evaluated for number of new roots and root length. The measurement trees would be evaluated for

percent survival, percent brownout, and vigor. No caliper or height measurements would be taken in 2013. Both spring and fall timings would be evaluated in the fall of 2014 including all ratings taken in the fall of 2013, plus caliper, height, and stem volume for the spring timing only for all ten measurement trees per species. Only the destructive sampling trees from the 2013 fall application would be evaluated for root effects in the fall of 2014. All previous evaluation criteria plus caliper, height, and stem volume would be evaluated in the fall of 2015 for the fall timing only.

Analysis of variance and multiple comparison procedures using orthogonal contrasts will be used to analyze all data.

**2013:** A trial was established in 2013 on property owned and managed by Sierra Pacific Industries on the Pondosa Fire near Manton, CA. The objective of the trial was to evaluate the “over the top” conifer tolerance of Douglas-fir, white fir, and ponderosa pine to applications of Pindar GT and GoalTender at a standard and 2X standard rate.

All plots were planted on March 25<sup>th</sup> with 15 trees each of Douglas-fir, white fir, and ponderosa pine. Ponderosa pine were Styro 5 and all fir were Styro 8 container stock from Cal Forest Nursery. Ten of the 15 trees planted are measurement trees and the remaining five trees were slated as “dig” trees to evaluate root growth based on treatment.

Two spray timings were utilized for this trial consisting of a spring and fall application. The spring timing was applied on March 26<sup>th</sup> one day after planting. The fall application was on October 1st. Treatments included Pindar GT and GoalTender at 3 and 6 pints per acre at ten gallons per acre spray volume for both timings. Treatments also included a non-treated control. Due to the lateness of the fall treatment, data were only collected in 2013 for the spring application timing.

Evaluations were done on August 13<sup>th</sup>. Evaluations included percent bare ground, percent cover by species, conifer survival, conifer percent brownout, and number of new roots and root length for each conifer species.

Data were analyzed using SAS statistical software. Analysis of variance was used to determine significance of the main effects of treatment and orthogonal contrasts were used to make specific comparisons among treatments. Analysis of variance was used to determine if there were any differences in initial seedling size among treatments. If initial seedling size was found to be significantly different among treatments, analysis of co-variance was used to adjust for initial seedling size difference with initial tree size as the co-variate. Vegetation data were analyzed using analysis of variance for the main effects, and multiple comparisons of means were done using Student Newman Kewls least significant difference procedure. Orthogonal contrasts were used to make specific comparisons among treatments.

Seedling survival or percent brownout did not significantly differ by treatment for any species in the trial. Therefore, it can be inferred that applications of either Pindar GT or GoalTender had no effect on seedling health. Survival was greater than 96 percent for all species and percent brownout was under 10 percent. The only brownout that occurred on site was due to a May frost, and it was relatively minor (Table 2).

The main effect of treatment was not significant regarding the number of new roots or root length (see Appendix 1, page 11 for conifer damage and root codes). Orthogonal contrasts indicated that the combined treatments were not significantly different from the controls. Multiple comparison procedures also failed to show any significant differences between treatments (Table 3).

Treatment was a significant factor regarding vegetation control. This site was heavily dominated by squaw carpet which had not yet germinated at the time of the spring application. Both Pindar GT and GoalTender inhibited the germination of squaw carpet seedlings, but Pindar GT provided significantly better control than GoalTender ( $P \leq 0.05$ ). All Pindar GT treatments had significantly more bare ground and less squaw carpet cover than the control. There was no significant difference in percent bare ground between Pindar GT and GoalTender although Pindar GR provided slightly more bare ground. Applications of Pindar GT at either rate provided significantly more control of squaw carpet than the lower rate of

GoalTender. Squaw carpet control with the low rate of GoalTender was not significantly different than the control. There was no significant difference between the low and high rates within either the Pindar GT or GoalTender treatments (Table 1).

This trial provided several important observations. The conifer safety of Pindar GT and GoalTender appears to be excellent either as a pre-plant site preparation

treatment or as an "over the top" release treatment. Neither the number of new roots or root length was affected by any treatment. Probably the most unexpected result was the inhibition of squaw carpet seedling germination with Pindar GT. GoalTender suppressed squaw carpet germination somewhat, but Pindar GT virtually stopped it altogether. This has significant implications to any vegetation management strategy.

TREATMENT	% BARE GROUND	% COVER SQUAW C.	% COVER G.L. MANZ	% COVER BRACKEN	% COVER OTHER
3 PT PIND GT	89.5	3.0	0.8	5.0	2.8
6 PT PIND GT	96.0	2.0	0.5	2.0	0.3
3 PT GOAL T	85.0	14.0	0.8	1.0	1.3
6 PT GOAL T	82.0	8.0	0.5	6.3	2.5
CONTROL	59.0	29	1.0	5.0	3.7

Table 1. Spring timing. Percent bare ground and percent cover by species for the Pindar GT Over the Top trial five months after treatment.

TREATMENT	PONDEROSA PINE		DOUGLAS-FIR		WHITE FIR	
	SURVIVAL	% BROWN OUT	SURVIVAL	% BROWN OUT	SURVIVAL	% BROWN OUT
3 PT PIND GT	98.2	1.2	98.2	6.2	100.0	6.2
6 PT PIND GT	100.0	0.0	100.0	7.5	100.0	6.2
3 PT GOAL T	98.2	0.0	98.2	5.5	98.2	6.2
6 PT GOAL T	100.0	0.0	98.2	8.0	100.0	8.0
CONTROL	100.0	0.0	100.0	5.0	96.5	7.5

Table 2. Spring timing. Percent survival and percent brownout for ponderosa pine, Douglas-fir and white fir five months after treatment.

TREATMENT	PONDEROSA PINE		DOUGLAS-FIR		WHITE FIR	
	# NEW ROOTS	LENGTH OF NEW ROOTS	# NEW ROOTS	LENGTH OF NEW ROOTS	# NEW ROOTS	LENGTH OF NEW ROOTS
3 PT PIND GT	6.0	9.2	6.0	8.9	6.0	6.4
6 PT PIND GT	6.0	6.9	5.8	7.0	5.8	4.6
3 PT GOAL T	6.0	8.8	6.0	7.2	6.0	7.2
6 PT GOAL T	6.0	9.1	6.0	9.4	6.0	7.5
CONTROL	6.0	7.9	6.0	8.4	5.8	6.4

Table 3. Spring timing. Number of new roots and root length ratings for ponderosa pine, Douglas-fir and white fir five months after treatment.