Miller, J.H. 1982. Hardwood control using pelleted herbicides and burning. In: Proceedings, 35th Annual Meeting Southern Weed Science Society; 1982 January 19-21; Atlanta, GA. [Champaign, IL]: southern Weed Science Society. 210-215.

HARDWOOD CONTROL USING PELLETED HERBICIDES AND BURNING.[1/] James H. Miller, Southern Forest Experiment Station, Forest Service-USDA, Auburn University, Alabama 36849.

ABSTRACT

Treatments using combinations of pelletized herbicides with prescribe burning were tested for planting site preparation on steep terrain (> 35% slopes) in the Alabama Piedmont. Mixed forests of southern pines, oaks, and hickories occupied areas before logging. Three burning treatments (no-burn, pre- and post-harvest) were applied randomly among three 4-acre major plots at each of three study locations or blocks. Each major plot was split into seven half-acre minor-plots with buffer strips for testing herbicides. Herbicide treatments, randomly assigned among minor-plots, were: picloram (Tordon 10K) at 2.5 and 5 lb ae/a; tebuthiuron (Spike 20P) at 2 and 4 lb ai/a; hexazinone (Velpar Gridball (2cc)) at 1.5 and 3 lb ai/a; and a no-treatment check. Overatory topkill, after two growing seasons, was complete with both rates of tebuthiuron and also the 3 lb rate of hexazinone when followed by a post-harvest burn. Hexazinone at 1.5 lb and both picloram rates were most effective in combination with pre-harvest burning. Sprouts and other small stems were best controlled with preharvest burning and the high rate of tebuthiuron. All herbicides showed promise as site preparation treatments for steep sites except for the low rate of picloram, ineffective unless burned.

INTRODUCTION

About 18 million acres of forest lands in the southeastern United States have slopes greater than 35 percent, where mechanical site preparation should not be used. Steeplands can be found in all physiographic regions, but most frequently in the Hilly Coastal Plain, Piedmont, and Ridge-Valley Regions. As slope increases, heavy equipment becomes operationally inefficient because of increasing fuel requirements. More importantly, land clearing treatments on hilly sites can initiate sheet and rill erosion which can lead to permanent degradation of site productivity (3). Treatments for steeplands using combinations of herbicides and prescribed burning hold promise as effective prescriptions with costs comparable to mechanical options and with minimal impacts to soils. This study, based on terrain of more than 35 percent slope, examined hardwood control by soil-active herbicides alone and in combination with two different timings of burning and a no-burning check.

[1/] Discussion of herbicides in this paper does not constitute recommendation of their use or imply that uses discussed here are registered. If herbicides are handled, applied, or disposed of improperly, they can harm humans, domestic animals, desirable plants, and pollinating insects, fish, or other wildlife, and may contaminate water supplies. Use herbicides only when needed and handle them with care. Follow the directions and heed all precautions on the container label.

Use of trade names is for the reader's informations and convenience. Such use does not constitute official. endorsement or approval by the U.S. Department of Agriculture to the exclusion of any other suitable product.

Pelletized herbicides rather than foliar-sprays were used in this study because of the following advantages of application: 1) absence of drift, 2) less exacting weather conditions (i.e., higher winds and light precipitation) allow more latitude in planning and performing forestry operations 3) iower application cost results from these advantages, and 4) the small woodlot owner can manually perform application.

MATERIALS AND METHODS

Study areas were on lands owned and managed by Kimberly-Clark Corporation, located in the southern-most extension of the Piedmont Plateau, east-central Alabama. Mixed pine-hardwood stands with trees up to 120 years old occupied the sites before logging, with loblolly (Pinus taeda L.), shortleaf (P. echinata Mill.), and longleaf pines (P. palustris Mill.) commonly on ridges and hardwoods on the slopes. Chestnut oak (Quercus prinus L.) and hickories (Carya spp) were the predominant overstory hardwoods with scattered trees of white oak (Q. alba L.), southern red oak (Q. falcata Michx.), northern red oak (Q. rubra L.), black oak (Q. velutina Lam.) and water oak (Q. nigra L.). The mid-story was mainly sourwood (Oxydendrum arboreum (L.) DC), flowering dogwood (Comus florida L.), and red maple (Acer rubrum L.) with regeneration of overstory species. Blueberry (Vaccinium spp) was the common groundshrub.

Soils in general were shallow, rarely exceeding 30 inches, with stones often comprising over 50 percent of the volume. Loamy surface soils increased in clay content with depth. Site index was approximately 90 ft for loblolly and 70 for southern red oak at.50 years.

Three different study locations were used within a two county area. At each location (blocks) three major plots (4 a each) were established as replications of three different burning treatments, i.e., no-bum, pre- and post-harvest. Preharvest burning was in April and the post-harvest in October. Major plots were split into seven half-acre minor-plots with buffer strips for randomly-assigned herbicide treatments: picloram (Tordon 10K) at 2.5 and 5.0 lbs ae/a, tebuthiuron (Spike 20P) at 2 and 4 lbs ai/a, hexazinone (Velpar Gridball (2cc)) at 1.5 and 3 lbs ai/a, and a no-treatment check. Hexazinone was applied in grid-patterns in April, 1980, while tebuthiuron and picloram were broadcast evenly over the plot by hand in January and April, respectively.

Herbicide plots were rectangular with the shortest dimension parallel to the contour and the longest side extending from the ridge down to the top of stream-side management-zones. Thus, variations in site quality from ridge to lower slope were encompassed within plots.

All trees more than 12 ft from a plot boundary and greater than 3.5 in diameter breast height (d.b.h.) were selected for measurements. Trees were tagged, recorded by species and measured in l-in d.b.h. classes in 1980 and topkill assessed by 5 percent increments in August, 1981. Three 1/100th-acre plots were located within each treatment plot along planted seedling rows, at the upper-, mid-, and lower-slope positions. All hardwoods and shrub stems greater than 1 ft in height but less than 3.5 in d.b.h. were counted in August, 1981. Thus, control of sprouts, hardwoods seedlings, and shrubs were indicated through these measurements.

Topkill and stem-number data were analyzed using an analysis of variance and Duncan's New Multiple Range Test, with percents transformed to arcsine √percentage. Percent values in tables are means of untransformed data.

RESULTS AND DISCUSSION

Complete overstory control was achieved with both rates of tebuthiuron and the 3 lb rate of hexazinone when followed by a post-harvest burn (Table 1). Hexazinone at the 1.5 lb rate and picloram at both rates controlled the most hardwoods when combined with preharvest burning. The interaction between herbicides and burning was not significant. Overall, preharvest burning was significantly better than a post-harvest or no-bum; topkill increased on the "check" plots (merely burned) by approximately 30 percent. Preharvest burns were applied in April when most hardwoods and shrubs were in a half-leaf condition, apparently the most susceptible period for fire injuries. Increased effectiveness of spring burning for hardwood control on Piedmont sites has also been reported by Goebel et al (1). Fire characteristics differ on these steeper slopes compared to flatter terrain, and increasing slope apparently increases hardwood-control effectiveness.

Table 2 shows species susceptibility to the herbicides. Picloram was not effective on white oaks and sourwood at both rates, and on red oaks and blackgum (*Nyssa sylvatica* L.) at the 2.5 lb rate. There were no sweetgum (*Liquidambar styraciflua* L.) or yellor poplar (*Liriodendron tulipifera* L.) on picloram plots receiving no-burn treatments. Tebuthiuron showed least control on sweetgum, a species recognized as resistant to tebuthiuron. Hexazinone showed good broad-spectrum control on all hardwoods at these test rates. Pine resistance to hexazinone is a great benefit in pine release treatments; however, unwanted pines left after harvest require control during site preparation. Thus, the higher rate of hexazinone would be recommended when a large number of nonmerchantable and suppressed pines remain unharvested.

Preharvest burning in the spring combined with higher rates of all herbicides resulted in the least amount of small-stem competition (Table 3). Preharvest burning alone reduced stem numbers by 35 percent compared to 15 percent with the post-harvest bum. Hexazinone was the least effective in controlling sprouting; thenumber of stems on the 1.5 lb rate and no-burning plots increased by 15% over untreated plots. Smaller pellets of hexazinone (i.e., 1/2 cc) formulations have reportedly (2) increased efficacy on small stems and will replace the 2 cc-pellet tested in this study.

Preharvest burning should result in an immediate increase in sprouts but a decrease in hardwood seedlings and shrubs. Small stems, 1 and 2 in d.b.h., are usually completely controlled but larger hardwoods, 3 to 10 in d.b.h., are only topkilled, resulting in resprouting. Thus, to be effective, herbicides applied 1 yr after the preharvest-bum must control sprouts. The reverse situation occurs with a post-harvest burning after a herbicide application. Herbicide rates resulting in incomplete overstory and mid-story control usually results in prolific sprouting. These sprouts then can be somewhat controlled by the post-harvest burn if fuel and thus burning are evenly distributed to yield a sufficiently hot fire around most stems. However, logging activities often separate the fuel into patches, making broadcast ignitfon difficult if not impossible. In this study post-harvest fires burned only an average of 43% of the areas. Igniting individual hardwood tops failed to boost the average. The development of mass-ignition techniques, such as aerial drip-torches, may solve these problems and improve the effectiveness of post-harvest burning for competition control and planting preparation.

LITERATURE CITED

1. Goebel, N. B., E. V. Brender, and R. W. Cooper. 1967. Prescribed burning of pine-hardwood stands in the upper Piedmont of South Carolina. South Carolina Agriculture Experiment Station, Department of Forestry Research Series No. 16. 22p.

2. Michael, J. L. 1981. Effect of pellet size on defoliation and estimated kill of small stems treated with hexazinone. Proceedings Southern Weed Science Society 34:192-196.

3. Miller, J. H. 1980. Competition after windrowing or single-roller chopping for site preparation in the southern Piedmont. Proceedings Southern Weed Science Society 33:139-145.

Table 1. Percent topkill of all overstory hardwoods in the 2nd growing season following herbicide and prescribe burning treatments.

Herbicide	Rate	Burning: Preharvest	Post	None	Mean Value[1/]
	lbs/a	-------------------% topkill		---------------------	
Tebuthiuron	4.0 ai	99	100	94	98 a
	2.0 ai	94	100	88	94 abc
Hexazinone	3.0 ai	97	100	93	97 ab
	1.5 ai	92	82	86	87 bc
Picloram	5.0 ae	81	76	71	76 c
	2.5 ae	81	60	43	61 cd
Check		44	15	12	24 e
Mean Value		84a	76b	69b	

-1/Mean values in a column or row followed by the same letter are not significantly different at the 0.05 level,

'Table 2. Mean percent topkill (number of stems) in the 2nd growing season for six herbicide treatments and a nontreated check (without burning).

Species Groups	Picloram 2.5 lb	Picloram 5 lb	Tebuthiuron 2 lb	Tebuthiuron 4 lb	Hexazinone 1.5 lb	Hexazinone 3 lb	Check
	----------------------% topkill (no. stems)						-------------------
White oaks	30(32)	62(32)	100(30)	100(12)	100(11)	100(19)	4(48)
Red oaks	50(7)	97(11)	99(19)	100(25)	99(17)	100(16)	24(11)
Hickories	99(11)	100(11)	95(27)	100(28)	96(19)	100(22)	1(18)
Sourwood	13(23)	34(6)	99(12)	100(9)	99(12)	95(15)	8(9)
Dogwood	88(10)	100(9)	99(8)	100(6)	92(13)	100(7)	3(8)
Blackgum	1(4)	80(6)	96(10)	100(6)	100(3)	100(8)	0(2)
Sweetgum	0(0)	0(0)	58(2)	55(5)	100(2)	100(1)	0(7)
Yellow poplar	0(0)	0(0)	100(2)	90(3)	100(1)	100(4)	0(5)
Pines	100(18)	100(11)	100(5)	100(4)	50(9)	78(45)	6(10)

Table 3. Sprouts, hardwood seedlings and shrubs (number of stems per acre) in the 2nd growing season following herbicide and prescribe burning treatments.

Herbicide	Pate	Burning			Mean[1/] Value
		Preharvest	Post	None	
	lbs/a	------------------------Stems/a------------------------			
Picloram	5.0 ae	2838	3366	3093	3099 a
	2.5 ae	5522	4279	3740	4609 abc
Tebuthiuron	4.0 ai	1430	4367	4972	3590 ab
	2.0 ai	4037	4477	5632	4715 abc
Hexazinone	3.0 ai	2508	6479	6127	5038 abc
	1.5 ai	2816	5534	9757	6035 bc
Check	—	5511	7115	8459	7028 c
Mean Value[1/]		3564a	5088ab	5959b	

[1/] Mean values in a column or row followed by the same letter are not significantly different at the 0.05 level.