CHOPPER HERBICIDE SITE PREPARATION FOR DIFFERENT BEDDING TIMINGS AND VEGETATION COMPLEXES IN NORTH FLORIDA

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Abstract—The use of Chopper® (BASF Corporation, Research Triangle Park, NC) herbicide applied with an oil and water carrier was tested for site preparation. Tests were installed at eight locations to examine slash pine (*Pinus elliottii* Engelm.) response and vegetation control with different vegetation types and timings of bedding. Chopper was applied in October at three rates by itself and tank-mixed with triclopyr or glyphosate. Two locations bedded in September included post plant herbaceous weed control treatments of Arsenal AC® (BASF) or Oustar® (Dupont) instead of Chopper tank mixes. Chopper site prep treatments were effective on poorly to somewhat poorly drained spodosols with either gallberry [*Ilex glabra* (L.) Gray] or titi (*Cyrilla racemiflora* L.) and fetterbush [*Lyonia lucida* (Lam.) Koch] vegetation. Chopper rates < 32 ounces-per-acre resulted in poorer pine growth. Tank mixes with triclopyr or glyphosate did not improve pine response or vegetation control in most instances. Pine response and vegetation control following Chopper site prep was variable on moderately well-drained soils. Herbaceous weed control treatments differed in performance, but Oustar did not control woody vegetation and Arsenal only suppressed woody vegetation.

INTRODUCTION

Recognition that lack of woody and herbaceous weed control can reduce pine yields by more than 50 percent (Miller and others 2003) has increased the use of site prep herbicides in the lower Coastal Plain of north Florida. Early pine growth is hampered by both herbaceous and waxy leafed woody shrub species common to the area (Lauer and Glover 1998). The use of herbicides is commonly combined with bedding, but bedding cannot all be done in a short period of time. The large number of acres bedded and changing soil moisture conditions necessitate that bedding operations are performed throughout the year prior to planting.

Chopper® is a 2-pounds-per-gallon active ingredient emulsifiable concentrate formulation of imazapyr. The use of this formulation in an oil and water carrier improves uptake on waxy leafed species. The efficacy of Chopper and Chopper tank mixes used with oil carriers has not been widely tested on vegetation complexes in the lower Coastal Plain region to determine optimal prescriptions.

There were two objectives to this investigation: (1) to examine efficacy of Chopper and tank mixes of Chopper applied with a high percentage oil carrier on several vegetation complexes common to north Florida; and (2) to investigate slash pine response and vegetation control to these treatments following a range of bed timings. Timing of bedding across several vegetation complexes was examined by installing a study series at eight different locations.

PROCEDURES

Treatment Regimes

There were two treatment regimes used in this study series. Chopper site prep and tank mixes with Chopper were investigated using locations bedded between January and August. Woody vegetation at these locations had top growth by the time of the October application. Alternatively, two locations that were bedded in September had relatively clean beds, and tank mixes with foliar active herbicides were not considered. Instead, Chopper site prep was compared to post plant herbaceous weed control.

The first treatment regime was used at the six locations bedded between January and August. The 10 treatments were an untreated check, 3 rates of Chopper (24, 32, and 48 ounces-per-acre), and these 3 Chopper rates tank-mixed with 32 ounces-per-acre Garlon 4® (Dow Agrosciences) (triclopyr) or 64 ounces-per-acre of a 4 pounds-per-gallon active ingredient formulation of glyphosate. Triclopyr and glyphosate were only included with Chopper and were not tested by themselves.

The second treatment regime was used at the two locations bedded in September. The 6 treatments were the untreated check, 3 rates of Chopper (24, 32, and 48 ounces-per-acre), and 2 post plant herbaceous weed control (HWC) treatments. The HWC treatments were Arsenal AC® (imazapyr) at 6 ounces-per-acre and Oustar at 13 ounces-per-acre.

Treatment Application

Treatments were applied to plots that were 3 beds wide and 80 feet long. All treatments were replicated three times in a randomized complete block design at each location. Site prep treatments were applied at 15 gallons-per-acre using water and 12.5 percent (by volume) methylated seed oil. These broadcast applications were made in October before planting using a three-nozzle boom sprayer with Turbo Flood® (Spraying Systems Co.) 2.0 nozzles. HWC treatments were banded applications made March 28 over planted trees. A 6-foot band was treated with a two-nozzle boom sprayer equipped with Turbo Flood 2.0 nozzles.

Soils and Vegetation

A total of eight study locations were installed across a range of soils and vegetation complexes. There were three main groupings of soils and vegetation. The spodosols with gallberry group included three locations (March, July, and

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Citation for proceedings: Connor, Kristina F., ed. 2006. Proceedings of the 13th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS–92. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 640 p.

September bed) located on poorly to somewhat poorly drained spodosols with vegetation dominated by gallberry and low panic grass (*Dichanthelium* spp.). The spodosols with titi and fetterbush group included two locations (January and August bed) located on poorly drained spodosols dominated by titi and fetterbush. The moderately well-drained soils group included three locations (May, July, and September bed). Vegetation varied by location, but common species were oaks (*Quercus* spp.), saw palmetto [*Serenoa repens* (Bartr.) Small], sumac (*Rhus* spp.), bracken fern [*Pteridium aquilinum* (L.) Kuhn], blackberry (*Rubus* spp.), greenbriar (*Smilax* spp.), low panic grass, sedges (*Cyperus* spp.), poorjoe (*Diodia teres* Walt.), spurges (*Euphorbia* spp.), fireweed [*Erechtites hieracifolia* (L.) Raf. *ex* DC.], dogfennel [Eupatorium capillifolium (Lam.) Small], and pokeweed (*Phytolacca americana* L.).

Measurements

Measurements were made on a 60-foot length of the middle bed within each treatment plot. Vegetation was assessed using ocular estimates of percent cover in June and October of the first growing season and in June of the second growing season. Pines were measured in December of the second growing season. Pine groundline diameter (nearest 0.04 inch) and total height (nearest 0.03 foot) were measured for each tree.

Analysis

This summary compares year 2 average pine volume index, total percent cover in June of the first growing season, and total woody percent cover in June of the second growing season. Pine volume index was computed as the volume of a cone in cubic inches using groundline diameter and total height. Total percent cover is the total cover of all vegetation and includes all woody and herbaceous vegetation. Total woody cover is the total cover in woody vegetation and includes trees, woody shrubs, woody vines, and blackberry.

Major factors that affect pine growth are the level of vegetation control by June of the first growing season, longer term woody control, and pine tolerance. Early pine growth is a measure of pine tolerance and response to early herbaceous and woody vegetation control but does not account for the longer term impact of woody vegetation. Consideration should be made for the level of woody control achieved 20 months after treatment (June of the second growing season).

These measures were compared at each location using analysis of variance. Direct treatment comparisons were made to determine if herbicide treatments differed from the check, if there were linear or quadratic trends with Chopper rate, if using a tank mix with Chopper made a difference, and if there were any interactions between Chopper rate and tank mixes. The check treatment was considered a baseline in this analysis. Chopper treatments were compared to this baseline check, but tests of rate effects only consider differences among the 24, 32, and 48 ounce Chopper rates. Comparisons were considered significant if the probability of no difference was < 5 percent. Triclopyr and glyphosate are only tested with Chopper, because they were not included as stand alone treatments.

RESULTS AND DISCUSSION

Pine Response

General patterns of pine response and the magnitude of response were related to soil drainage class and vegetation complex. The greatest pine response occurred on poorly to somewhat poorly drained spodosols with gallberry or titi and fetterbush vegetation. Response was more variable on moderately well-drained soils that did not have gallberry or titi and fetterbush.

Pine response was significant for all herbicide treatments on spodosols with gallberry or titi and fetterbush vegetation with two exceptions (fig. 1). The first exception was the lack of pine response at the July bed–gallberry location. Pine response at this location was limited by poorly formed beds. The second exception was that only the HWC treatments and site prep treatments with 32 ounces of Chopper improved pine response at the September bed–gallberry location. All herbicide treatments increased pine volume at the three other locations. Pine volume increased as the rate increased from 24 to 32 ounces of Chopper with the best pine response achieved with 32 ounces of Chopper at 3 locations. Tank mixes of Chopper with either triclopyr or glyphosate did not significantly change pine volume response except for the August bed—titi and fetterbush location where comparable maximum responses were achieved by 32 ounces of Chopper, 32 ounces of Chopper with glyphosate, or 48 ounces of Chopper with triclopyr (significant interaction). Slash pine volume averaged across the 4 responsive locations was 98 cubic inches and 16 cubic inches per tree for the best responding treatments and the untreated check, respectively.

Pine response was variable (fig. 2) for the moderately well-drained soil locations that had little or no gallberry, titi, or fetterbush. Chopper site prep treatments increased pine

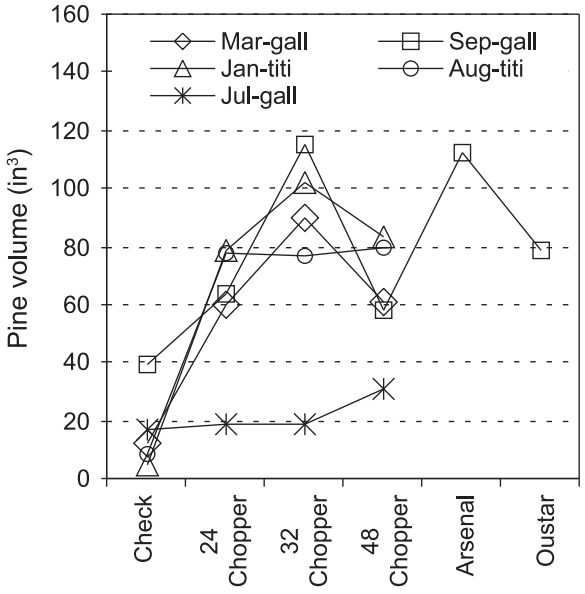

Figure 1—Year 2 pine volume index for locations on spodosols with gallberry or titi and fetterbush vegetation. Volume averages for Chopper include Chopper tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

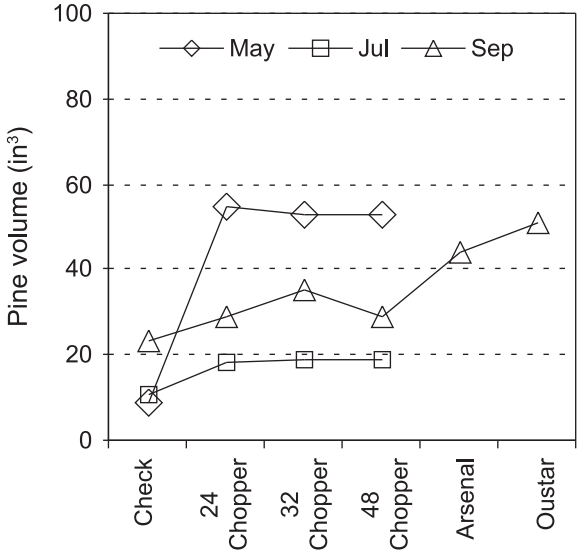

Figure 2—Year 2 pine volume index for locations on moderately well-drained soils with little or no gallberry or titi and fetterbush vegetation. Volume averages for Chopper include Chopper tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

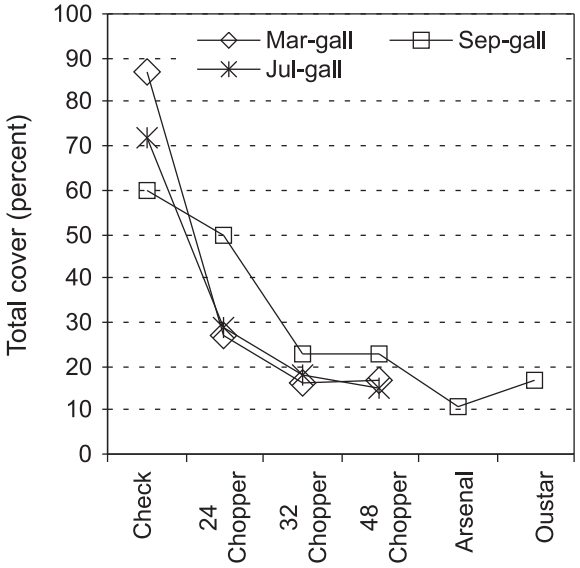

Figure 3—Total cover in June of the first growing season for spodosols with gallberry. Cover means for Chopper include Chopper tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

volume only at the May bed location. HWC treatments increased pine volume at the September bed location. Pine volume responses to the best herbicide treatments ranged from 19 to 54 cubic inches per tree compared to an average check volume of 14 cubic inches.

Spodosols with Gallberry

Pine response to herbicide treatments was impressive except at the location with poorly formed beds. The use of tank mixes did not improve pine response even though they improved vegetation control to some extent. This is probably due to the small magnitude of improved control. First June cover on the check ranged from 60 to 87 percent compared to 22 percent or less cover for most of the herbicide treatments (fig. 3). The better pine response for the 32 ounce Chopper rate is probably due to improved control, particularly herbaceous control, over the 24 ounce Chopper rate. All rates of Chopper and tank mixes with Chopper reduced gallberry to < 2 percent cover. The addition of triclopyr did improve control at the March bed location by 10 percent, but this did not translate into improved pine growth. The post plant Arsenal and Oustar treatments had less than 20 percent cover but were only included at the September bed location which had low levels of woody vegetation.

All herbicide treatments provided woody control through June of the second growing season with the exception of the lowest Chopper rate at the September bed location and the Arsenal and Oustar treatments (fig. 4). All Chopper rates controlled woody vegetation that had resprouted on beds. The higher 32 and 48 ounce Chopper rates were required at the September bed location where resprouting was limited at time of application. Although pines responded to Arsenal and Oustar treatments, the Arsenal treatment did not completely control woody vegetation, and the Oustar treatment provided no control of woody vegetation. This was only acceptable at this location because woody cover was relatively low.

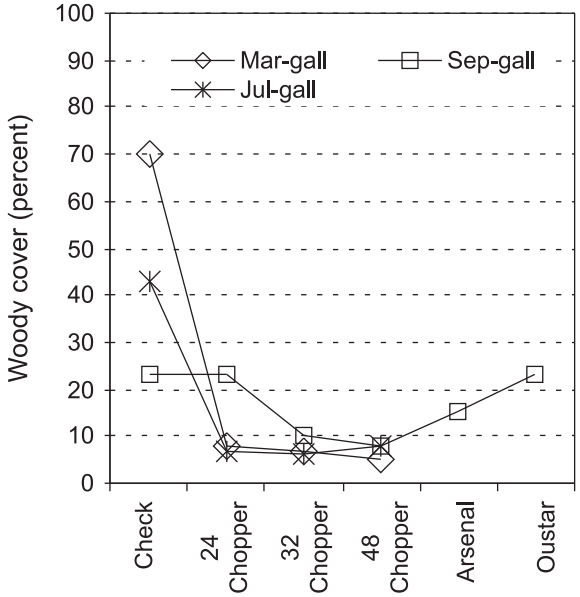

Figure 4—Woody cover in June of the second growing season for spodosols with gallberry vegetation. Cover means for Chopper include Chopper tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

Spodosols with Titi and Fetterbush

Pine response peaked from using 32 ounces of Chopper on these sites. There was no benefit to using tank mixes. However, no treatments provided total woody control. These sites are characterized by good pine response and little colonization of herbaceous vegetation once woody vegetation is controlled. These treatments controlled or suppressed woody vegetation (fig. 5), so total vegetation cover was close to 20 percent or less in June of the first growing season. Initial

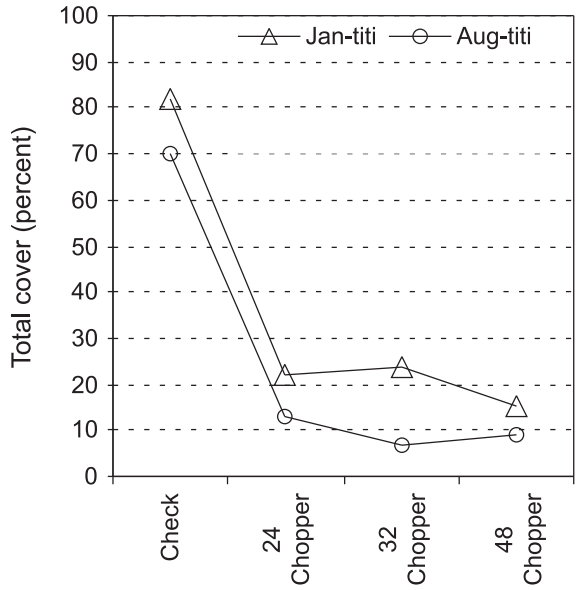

Figure 5—Total cover in June of the first growing season for spodosols with titi and fetterbush vegetation. Cover means for Chopper rates are the average of Chopper and Chopper tank mixes.

control appeared better at the August bed location, but woody cover was about 30 percent in June of the second growing season at both locations (fig. 6).

Moderately Well-Drained Soils

Pine response was variable at these three locations, but much of this variation was related to the level of vegetation control achieved by herbicide treatments. Vegetation control was probably related more to vegetation present than month of bedding. Application of these results requires a better understanding of the differences in vegetation development on moderately well-drained soils.

The May bedded location vegetation was primarily brackenfern, oaks, blackberry, low panic grass, sumac, and saw palmetto. All herbicide treatments decreased cover in June of the first growing season to about 31 percent (fig. 7). Treatments controlled brackenfern, oaks, low panic grass, and sumac. Fireweed and sedges made up about two-thirds of the cover on herbicide treated plots but were minor species on the untreated check. Blackberry and saw palmetto made up the other third of cover on treated plots. Woody cover in June of year 2 was significantly lower than the check (fig. 8) and was primarily blackberry and saw palmetto for all treated plots. Triclopyr provided better woody control than did glyphosate (34 versus 17 percent cover), but blackberry cover was reduced by all herbicide treatments. Pine response was comparable for all treatments and was not affected by the minor differences in vegetation control.

The June bed location was on a moderately well-drained spodosol. The surface horizon was droughty and low in fertility. Vegetation control was poor (fig. 7). Treatments controlled low panic grass, blackberry, and oaks, but this cover was replaced by broadleaf herbs by June of the first growing season. Broadleaf herbs on treatment plots were predominantly poorjoe and spurges. Woody control was good for all treatments (fig. 8), and all treatments controlled oaks and blackberry. Pine response was positive but not significant at this location due to poor control of herbaceous vegetation.

The September bed location was responsive to vegetation control, but the quality of vegetation control achieved was limited. First year vegetation composition included many species of broadleaf herbs, oak, sumac, blackberry, and greenbriar. Broadleaf herbs were fireweed, dogfennel, pokeweed, and brackenfern. This composition suggests a higher

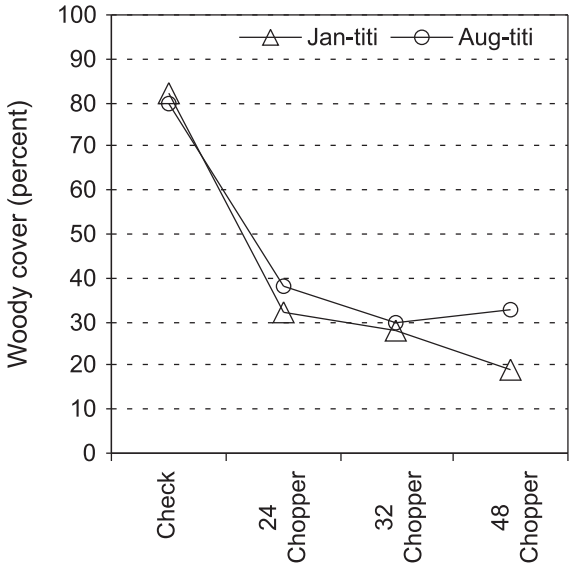

Figure 6—Woody cover in June of the second growing season for spodosols with titi and fetterbush vegetation. Cover means for Chopper rates are the average of Chopper and Chopper tank mixes.

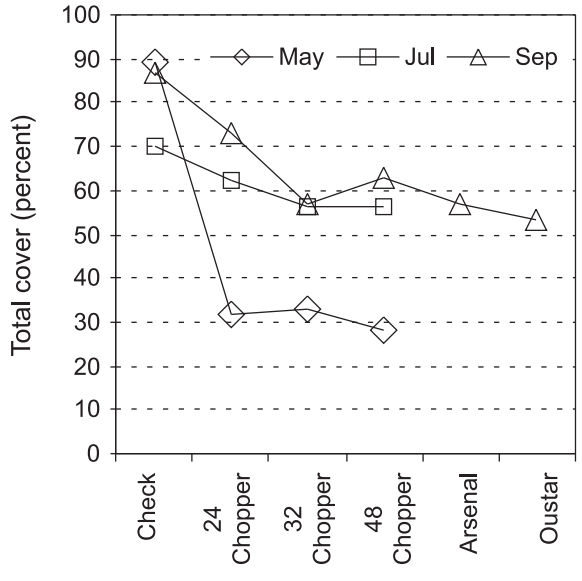

Figure 7—Total cover in June of first growing season for moderately well-drained soils with little or no gallberry or titi and fetterbush vegetation. Cover means for Chopper include Chopper tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

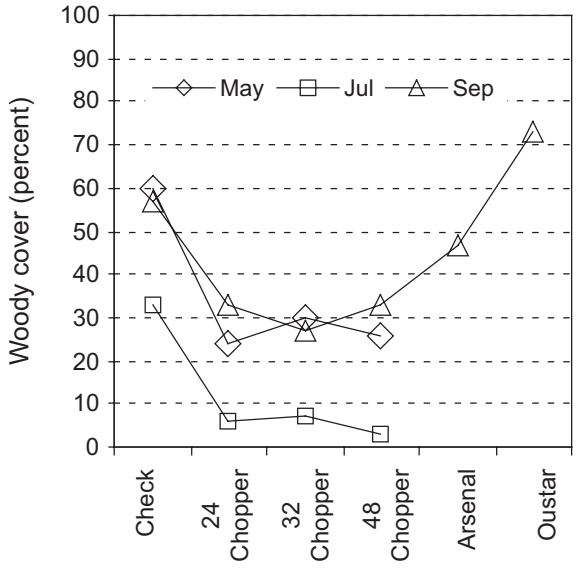

Figure 8—Woody cover in June of the second growing season for moderately well-drained soils with little or no gallberry or titi and fetterbush vegetation. Cover means for Chopper rates include tank mixes except the location with Arsenal and Oustar treatments that had no tank mixes.

fertility level than other locations. Chopper treatments controlled grass and woody vegetation but not broadleaf herbs. Arsenal did a better job of controlling a mixture of herbs and woody. Oustar provided the best control of herbs but not woody vegetation. Treatments only reduced total cover in June of the first year by about a third of that on the check (fig. 7). Early pine response was dependent on herbaceous control with Arsenal and Oustar providing the best response, but longer term response may be limited by the lesser control of woody vegetation (fig. 8). Pine response was relatively large compared to the level of weed control achieved, and more effective herbicide treatments should be sought for these fertile sites.

All Chopper site prep rates provided similar levels of vegetation control on moderately well-drained soils. Chopper site prep controlled woody vegetation and provided the best control of herbaceous vegetation where it was well established (May bed) at the time of application. Post-plant herbaceous weed control provided the best control of herbaceous vegetation for the September bedding and the best early pine response. Woody vegetation was not controlled by post plant HWC and may limit future pine growth. Pine response to vegetation control improved with site quality, but treatments need to be developed that provide more complete vegetation control on moderately well-drained soils.

CONCLUSIONS

Chopper applied with oil and water carrier performed well on poorly and somewhat poorly drained spodosols with either gallberry or titi and fetterbush vegetation. The 32 ounce Chopper rate usually provided the best pine response and often improved vegetation control compared to the 24 ounce Chopper rate. Tank mixes of Chopper with triclopyr or glyphosate did not improve vegetation control or pine response. Total cover in June of the first year was near 20 percent or less for the 32 and 48 ounce Chopper rates, so first year herbaceous weed control may not be required. Arsenal performed better than Oustar at the one location where these treatments were included, because Arsenal suppressed woody vegetation and Oustar did not. However, post plant herbaceous treatments will not provide the expected longer term response if woody vegetation levels are high.

The titi and fetterbush vegetation complex was not completely controlled by any treatment, but Chopper treatments provided enough control in the first year to achieve a sizable pine response. Tank mixes did not improve control, and there was evidence that tank mixes with the 24 ounce rate of Chopper sometimes provided poorer control. These results also indicate that tank mixes with higher rates of glyphosate and triclopyr should be tested to determine if more complete control of titi and fetterbush is possible.

Pine response and vegetation control on moderately well-drained soils was variable. These locations varied with respect to bed timing and fertility. Best control was achieved by the May bedding with established vegetation at the time of the October Chopper application. All treatments reduced first June cover to about 31 percent, controlled woody shrubs and trees, and controlled brackenfern and grasses. Chopper provided poorer control at the other two locations where broadleaf herbs emerged the year after planting. All Chopper with oil treatments provided some level of blackberry control at all locations and did not “release” blackberry.

Herbaceous weed control treatments performed better than Chopper site prep for the September bed location on a moderately well-drained soil. This location appeared to have higher fertility than other locations based on first year vegetation. Although herbaceous weed control treatments were the best treatments, Oustar did not control woody vegetation and Arsenal did not control all herbaceous vegetation and only suppressed woody vegetation. These treatments did not reduce first year June cover to < 50 percent. Evidence suggests that doubling of pine response may be possible if more effective treatments could be developed for moderately well-drained soils.

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