Auburn University
Southern Forest Nursery
Management Cooperative

# RESEARCH REPORT 13-05

## CONTROLLING MORNING GLORY (*IPOMOEA SP*.) IN HARDWOODS USING PRE AND POST-EMERGENCE HERBICIDES AT THE EAST TENNESSEE AND NATIVE FOREST NURSERIES

By
Scott Enebak, Ben Whitaker, Barry Brooks and Paul Jackson

### INTRODUCTION

Morning glory (Convolvulaceae Family) includes multiple plant species characterized by an aggressive annual or perennial weed with a climbing or twining form. The family contains at least 50 genera and over a 1000 species. While some of the plants in the family provide valuable crops such as the sweet potato, in forest-tree nurseries they are a plant to be reckoned with. This weedy vine will twine all over the nursery bed, covering your seedlings to the point of smothering. Another common name for this plant is "bindweed." The weed is usually introduced either by seed or invasive roots from untreated areas within the nursery. The plant's success as an annoying weed lies in its thick fleshy roots which travel long distances just under the soil surface. Since morning glory is a perennial weed, control lies in removing the entire root system. Hand or machine weeding can remove large quantities of roots, but any broken pieces are capable of sprouting new growth. Thus, chemical control is required in all areas of the nursery to minimize problems in the cropping areas. Hardwood seedlings are often mentioned as difficult to manage due to morning glory and its habit of "tying up the seedlings" and the lack of herbicides that can be used over/in hardwood seedlings. It is therefore no surprise that according to the 2012 Nursery Practices Survey, morning glory was one of the top three weeds reported by nursery managers as needing attention. To address the issues of morning glory in hardwood seedling beds, the Nursery Cooperative undertook nursery and greenhouse trials that examined some previously untested herbicides. The objectives of this particular trial were: 1) to evaluate hardwood seedling tolerance to selective herbicides targeting morning glory and 2) to determine the efficacy of these herbicides on morning glory greenhouse pot trials using different soil types.

## METHODOLGY

*Nursery Trials.* The two nurseries used were the East Tennessee State Nursery, Delano, TN and the Native Forest Nursery near Chatsworth, GA. To examine the effects on hardwood seedlings and to determine the degree of control on morning glory three herbicides applied at two rates: They included Pendulum® AquaCap (38.7% pendimethalin) at 34 and 68 oz/ac, Dismiss® (39.6% sulfentrazone) at 4 and 8 oz/ac, and Broadstar® (0.25% flumioxazin) at 100 and 200 lb/ac. All three herbicides have been either shown to control morning glory or have morning glory listed on the label. The Nursery Cooperative tested Pendulum® AquaCap and Dismiss® on hazelnut, common persimmon, and plum at the Native Forest Nursery at Chatsworth, GA and on swamp chestnut oak, water oak, and willow oak at the Tennessee State Nursery at Delano, TN. At the East Tennessee Nursery, the seed were sown on February 13, 2012 and the herbicide treatments were applied on May 1, 2012. At the Chatsworth Nursery the seed were sown on April 18, 2012 and treated on May 2, 2012. The herbicide Broadstar® was tested in conjunction with Pendulum® AquaCap and Dismiss® on common persimmon (Native Forest Plants) and swamp chestnut oak (East Tennessee Nursery). The two morning glory species observed were red (*Ipomoea coccinea*) and ivy leaf (*Ipomoea hederacea*) morning glory.

The herbicides were applied by AU Nursery Cooperative personnel using a $CO_2$ hand sprayer calibrated at 22 gallons per acre on six different hardwood seedling species. Each treatment plot was one seedling bed wide X 5 feet in length that was replicated five times. The experimental area were the seedlings in one treatment plot and 175 feet of one nursery bed was used plus 20 feet of buffer for each trial. The nursery staff made observations and recorded abnormalities in seedling growth within the treated plots and reported that information to the Nursery Cooperative staff in Auburn. Prior to herbicide applications, soil samples were collected from the first six inches of soil in each treatment plot. The samples were pooled and analyzed for organic matter, pH, and soil texture (sand, silt, and clay contents). Morning glory control was evaluated by the percent of weed coverage in each plot for each treatment. At the end of the growing season, seedlings in each treatment plot were lifted from inside a 9 x 48 inch frame placed in the center of the plot. At the Nursery Cooperative laboratory at Auburn University, seedling density, root collar diameter, height, and root/shoot dry weights was measured to determine seedling tolerance to the various herbicide treatments.

*Greenhouse Trials*. Although the herbicides used in the Nursery Trials were labeled for use and control of morning glory in forest-tree nurseries, a parallel greenhouse study tested the efficacy of the different herbicides rates on the growth of morning glory sown in nursery soils. Soil from the Native Forest Nursery near Chatsworth, GA and the ArborGen SuperTree nursery near Shellman, GA was collected on May 23 and May 25, 2012 respectively. Seventy 1-gallon pots were filled with each soil and then sown with 5 morning glory seeds each on May 30, 2012. Pots were placed in the greenhouse and watered to saturation. On June 4, 2012 the pots with the sown morning glory seeds plants were treated with herbicides applied at two rates including

Pendulum® AquaCap (38.7% pendimethalin) at 34 and 68 oz/ac, Dismiss® (39.6% sulfentrazone) at 4 and 8 oz/ac, and Broadstar® (0.25% flumioxazin) at 100 and 200 lb/ac were tested. The herbicides were applied by AU Nursery Cooperative personnel using a CO2 hand sprayer calibrated at 22 gallons per acre on 10 pots per treatment for each soil type. Morning glory plants were monitored for herbicide affects for four weeks post spraying after which the number of plants were counted for each pot x treatment, harvested and dried to determine morning glory biomass by soil and herbicide treatment.

## RESULTS AND DISCUSSION

*Nursery Trials*. Soil collected and analyzed at the Soil Testing Laboratory in Auburn University indicated similar soil types for the two nurseries. Soil samples from the Native Plants Nursery in Chatsworth, GA indicated a sandy loam (63:30:7) soil, with soil pH of 5.9 and organic matter content of 2.9%. Samples collected from the East Tennessee Nursery near Cleveland, TN indicated a sandy loam (58:34:7) soil with a soil pH of 5.2 and organic matter content of 2.5%.

The efficacy of the herbicides on morning glory control within the plots was difficult to determine due to: 1) the lack of morning glory within many of the plots and, 2) the seedlings hiding/covering up any morning glory within the plots. However, based on seedling quality and quantity data collected at the end of the growing season; common persimmon, hazelnut, swamp chestnut oak, water oak and willow oak are tolerant to the post-emergent application of Pendulum® AquaCap, Dismiss®, and Broadstar® (Tables 1-5). In contrast, plum seedlings were negatively affected by the application of Dismiss®, and to some extent by Pendulum AquaCap® and Broadstar® at the Native Forest Nursery in Chatsworth, GA (Table 6) as all herbicides and rates resulted in fewer, smaller seedlings. Thus, plum is not a good candidate for post-emergence control of morning glory using these herbicides. In contrast, there were no significant differences among the treatments for common persimmon and hazelnut at the Native Forest Nursery (Tables 4 & 5) or among the swamp chestnut oak and water oak at the Tennessee State Nursery (Tables 1-3). There were no significant differences in seedling quality when treated with Broadstar® on common persimmon and swamp chestnut oak at either nursery location.

*Greenhouse Trials.* Soil collected and analyzed at the Soil Testing Laboratory in Auburn University indicated different soil types for the two nurseries used in the pot trials. This was intentional as soil type affects herbicide activity. Soil samples from the Native Forest Nursery in Chatsworth, GA indicated a sandy loam (63:30:7) soil, with soil pH of 5.9 and organic matter content of 2.9%. Whereas the soil type from the ArborGen Supertree nursery in Shellman, GA was a sand (91:8:1), with a soil pH of 5.5 and an organic matter content of 1.1%. All herbicide treatments resulted in significantly less morning glory fresh weight than the control for both soils. This is evident in the bar graphs in Figure 1 (Native Plant Nursery soil) and Figure 2 (Shellman, GA) soils. As suspected and expected, there was a soil type interaction as Broadstar®

was more effective at the lower rates in sandier soils. The number of morning glory plants per pot was significantly reduced when Broadstar® (200 lb/ac) was applied to plants grown in the soil from Chatsworth, GA, while both rates of Broadstar® reduced morning glory plants per pot when compared to the control using the soil from Shellman, GA (Fig 1 & 2). Dismiss® applied at 8 oz/ac and Pendulum® AquaCap applied at 34 oz/ac slightly reduced the number of morning glory plants per pot in soil from Shellman, GA. There was no difference in the number of plants per pot when Dismiss® at 4 oz/ac and Pendulum® AquaCap at 68 oz/ac were compared to the control.

## MANAGEMENT IMPLICATIONS

1) Based on seedling quality and quantity data collected at the end of the growing season; common persimmon, hazelnut, swamp chestnut oak, and water oak are tolerant to the post-emergent application rates of Pendulum® AquaCap, Dismiss®, and Broadstar®.

2) Seedling quality and quantity data collected from plum concludes that all herbicides and rates used were detrimental to the production of plum seedlings with Dismiss® at 8 oz/ac the most severe in the reduction in plantable seedlings.

3) In the greenhouse soil pot trials, both rates of Broadstar® reduced morning glory numbers. However, better control (as measured by living plants and biomass) occurred in the sandier soils from Shellman, GA with the 100 lb/ac more effective than the 200 lb/ac rate when compared to the loamy sands from Chatsworth, GA.

**Table 1.** Swamp Chestnut Oak seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the East Tennessee Nursery in Delano, TN 2012.

| Species | TRT | DENSITY | | CULLS | | PLANT | | RCD | | HT | | SHOOT WT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *seedlings/ft²* | | *seedlings/ft²* | | *seedlings/ft²* | | *mm* | | *cm* | | *grams* | |
| Swamp Chestnut Oak | Control | 1.7 | a | 0.1 | a | 1.6 | a | 11.8 | a | 62.8 | a | 35.1 | a |
| | PAC34 | 1.5 | a | 0.0 | a | 1.5 | a | 11.9 | a | 78.2 | a | 68.9 | a |
| | PAC68 | 1.9 | a | 0.1 | a | 1.8 | a | 10.4 | a | 72.1 | a | 60.1 | a |
| | DIS4 | 1.9 | a | 0.1 | a | 1.8 | a | 10.2 | a | 66.2 | a | 49.7 | a |
| | DIS8 | 1.8 | a | 0.0 | a | 1.8 | a | 10.8 | a | 67.7 | a | 51.7 | a |
| | BROAD100 | 1.7 | a | 0.1 | a | 1.6 | a | 10.3 | a | 65.0 | a | 35.7 | a |
| | BROAD200 | 1.3 | a | 0.1 | a | 1.3 | a | 11.6 | a | 77.6 | a | 65.7 | a |
| | (LSD) | (0.97) | | (0.14) | | (0.90) | | (3.62) | | (17.0) | | (34.6) | |
| | | ----------P > F---------- | | | | | | | | | | | |
| | Treatment | 0.9034 | | 0.3989 | | 0.8995 | | 0.892 | | 0.3965 | | 0.2955 | |

Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Table 2.** Water Oak seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the East Tennessee Nursery in Delano, TN 2012.

| Species | TRT | DENSITY | | CULLS | | PLANT | | RCD | | HT | | SHOOT WT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *seedlings/ft²* | | *seedlings/ft²* | | *seedlings/ft²* | | *mm* | | *cm* | | *grams* | |
| Water Oak | Control | 11.4 | a | 3.3 | a | 8.1 | a | 5.8 | a | 54.9 | a | 11.0 | a |
| | PAC34 | 10.9 | a | 3.3 | a | 7.6 | a | 6.0 | a | 56.0 | a | 14.6 | a |
| | PAC68 | 11.2 | a | 3.6 | a | 7.5 | a | 5.7 | a | 54.8 | a | 11.0 | a |
| | DIS4 | 11.8 | a | 3.4 | a | 8.6 | a | 6.0 | a | 58.3 | a | 12.5 | a |
| | DIS8 | 11.8 | a | 4.0 | a | 8.3 | a | 5.9 | a | 56.0 | a | 11.7 | a |
| | (LSD) | (2.5) | | (2.2) | | (1.6) | | (0.50) | | (4.9) | | (4.2) | |
| | | ----------P > F---------- | | | | | | | | | | | |
| | Treatment | 0.927 | | 0.9446 | | 0.626 | | 0.6003 | | 0.566 | | 0.3576 | |

Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Table 3.** Willow Oak seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the East Tennessee Nursery in Delano, TN 2012.

| Species | TRT | DENSITY | | CULLS | | PLANT | | RCD | | HT | | SHOOT WT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *seedlings/ft²* | | *seedlings/ft²* | | *seedlings/ft²* | | *mm* | | *cm* | | *grams* | |
| Willow Oak | Control | 14.9 | a | 6.4 | ab | 8.5 | c | 5.7 | a | 60.2 | b | 10.8 | b |
| | PAC34 | 13.8 | a | 4.5 | ab | 9.3 | bc | 5.8 | a | 63.1 | ab | 11.9 | ab |
| | PAC68 | 15.3 | a | 4.3 | b | 11.0 | a | 6.1 | a | 65.9 | A | 13.5 | a |
| | DIS4 | 15.0 | a | 4.7 | ab | 10.3 | ab | 6.1 | a | 68.2 | a | 14.2 | a |
| | DIS8 | 15.1 | a | 6.6 | a | 8.5 | c | 6.1 | a | 66.1 | a | 13.8 | a |
| | (LSD) | (1.7) | | (2.0) | | (1.6) | | (0.41) | | (4.9) | | (2.4) | |
| | ----------P > F---------- | | | | | | | | | | | | |
| | Treatment | 0.4134 | | 0.0615 | | 0.0128 | | 0.0971 | | 0.0262 | | 0.0532 | |

Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Table 4.** Hazelnut seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the Native Forest Nursery in Chatsworth, GA 2012.

| Species | TRT | DENSITY | | CULLS | | PLANT | | RCD | | HT | | SHOOT WT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *seedlings/ft²* | | *seedlings/ft²* | | *seedlings/ft²* | | *mm* | | *cm* | | *grams* | |
| Hazelnut | Control | 10.5 | a | 1.9 | a | 8.5 | a | 5.6 | a | 38.9 | a | 4.7 | a |
| | PAC34 | 8.9 | a | 1.5 | a | 7.4 | a | 5.5 | a | 38.2 | a | 4.1 | a |
| | PAC68 | 7.8 | a | 1.2 | a | 6.6 | a | 5.8 | a | 37.8 | a | 4.9 | a |
| | DIS4 | 10.8 | a | 1.9 | a | 8.8 | a | 5.3 | a | 37.1 | a | 4.5 | a |
| | DIS8 | 10.1 | a | 1.3 | a | 8.8 | a | 5.4 | a | 38.1 | a | 4.5 | a |
| | (LSD) | (2.9) | | (0.83) | | (2.9) | | (0.48) | | (2.3) | | (0.95) | |
| | ----------P > F---------- | | | | | | | | | | | | |
| | Treatment | 0.2196 | | 0.1607 | | 0.4281 | | 0.3593 | | 0.5866 | | 0.4559 | |

Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Table 5.** Persimmon seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the Native Forest Nursery in Chatsworth, GA 2012.

| Species | TRT | DENSITY *seedlings/ft²* | | CULLS *seedlings/ft²* | | PLANT *seedlings/ft²* | | RCD *mm* | | HT *cm* | | SHOOT WT *grams* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Persimmon | Control | 5.4 | a | 0.25 | a | 5.2 | a | 6.1 | a | 44.1 | ab | 5.3 | a |
| | PAC34 | 4.0 | a | 0.55 | a | 3.5 | a | 6.3 | a | 41.5 | bc | 3.8 | a |
| | PAC68 | 4.8 | a | 0.45 | a | 4.3 | a | 5.8 | a | 40.9 | c | 3.8 | a |
| | DIS4 | 5.5 | a | 0.50 | a | 5.0 | a | 6.1 | a | 43.8 | ab c | 4.7 | a |
| | DIS8 | 5.3 | a | 0.30 | a | 5.0 | a | 6.4 | a | 42.6 | ab c | 4.9 | a |
| | BROAD100 | 6.1 | a | 0.44 | a | 5.6 | a | 5.6 | a | 42.3 | ab c | 3.8 | a |
| | BROAD200 | 5.5 | a | 0.56 | a | 4.9 | a | 6.1 | a | 44.7 | a | 4.8 | a |
| | (LSD) | (2.4) | | (0.57) | | (2.3) | | (0.75) | | (2.7) | | (1.7) | |
| | ----------P > F---------- | | | | | | | | | | | | |
| | Treatment | 0.7103 | | 0.9065 | | 0.5317 | | 0.4041 | | 0.0605 | | 0.3777 | |

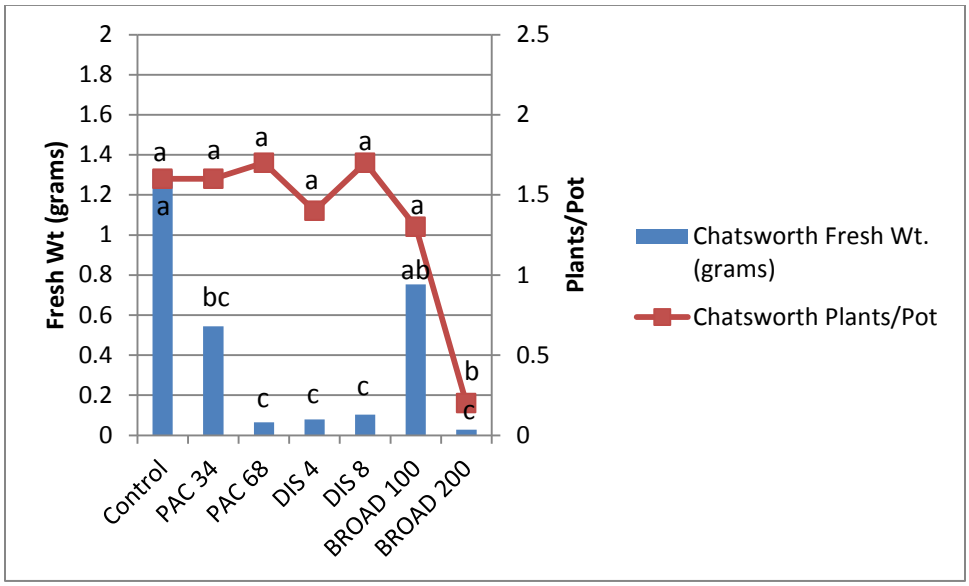
Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Table 6.** Plum seedling density, culls, plantable, RCD, height and shoot weight treated with post-emergence herbicides at the Native Forest Nursery in Chatsworth, GA 2012.

| Species | TRT | DENSITY *seedlings/ft²* | | CULLS *seedlings/ft²* | | PLANT *seedlings/ft²* | | RCD *mm* | | HT *cm* | | SHOOT WT *grams* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plum | Control | 7.2 | a | 0.9 | b | 6.3 | a | 6.2 | a | 44.4 | a | 6.5 | a |
| | PAC34 | 5.7 | ab | 0.6 | b | 5.0 | a | 6.6 | a | 43.3 | a | 7.3 | a |
| | PAC68 | 5.1 | ab | 0.4 | b | 4.7 | a | 6.5 | a | 43.6 | a | 7.3 | a |
| | DIS4 | 5.1 | ab | 0.7 | b | 4.3 | a | 6.7 | a | 44.4 | a | 7.8 | a |
| | DIS8 | 3.0 | b | 1.8 | a | 1.2 | b | 6.4 | a | 48.6 | a | 6.0 | a |
| | (LSD) | (2.5) | | (0.80) | | (2.09) | | (1.12) | | (5.12) | | (3.1) | |
| | ----------P > F---------- | | | | | | | | | | | | |
| | Treatment | 0.0429 | | 0.0216 | | 0.0016 | | 0.8731 | | 0.2211 | | 0.7604 | |

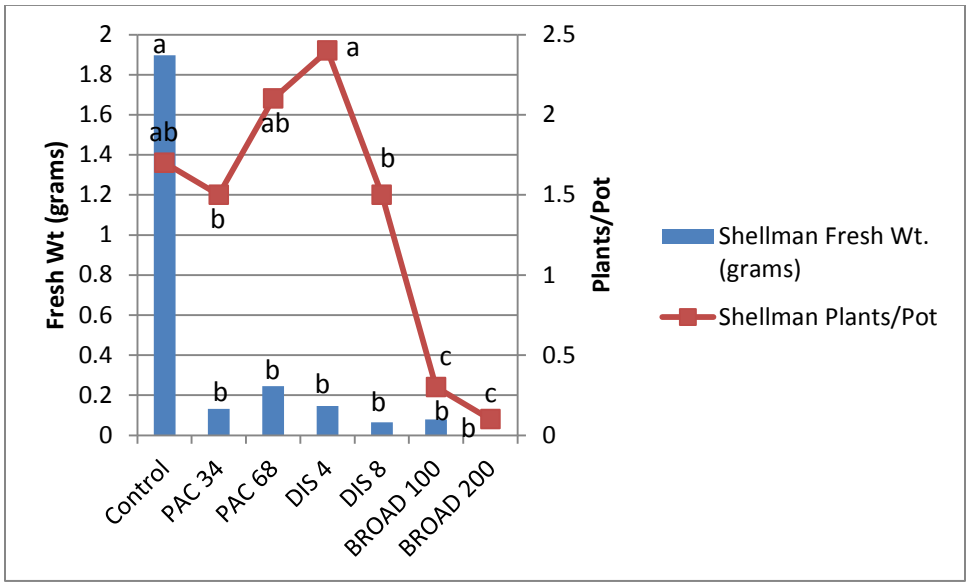
Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®, BROAD=Broadstar®, Number is oz/ac except for Broadstar® as lb/ac. Letters denote significant differences at alpha=0.05 level.

**Figure 1.** Morning glory fresh weight and plants per pot grown in soil from Chatsworth, GA four weeks after treatment with three different herbicides.




Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®,
BROAD=Broadstar®. Number is oz/ac except for Broadstar® in lb/ac.
Letters denote significant differences at alpha=0.05 level.
Soil texture type is sandy loam (63:30:7) soil, with soil pH of 5.9 and organic matter content of 2.9%.

**Figure 2.** Morning glory fresh weight and plants per pot grown in soil from Shellman, GA four weeks after treatment with three different herbicides.




Control=no treatment, PAC= Pendulum® AquaCap, DIS=Dismiss®,
BROAD=Broadstar®. Number is oz/ac except for Broadstar® in lb/ac.
Letters denote significant differences at alpha=0.05 level.
Soil texture type is sand (91:8:1), with a soil pH of 5.5 and an organic matter content of 1.1%.