

**Project Title:** Development of Innovative Weed Control Programs for Michigan Nurseries

**Partner Organization:** Michigan Nursery & Landscape Association  
2149 Commons Parkway, Okemos, MI 48864

## PROJECT SUMMARY

The tremendous efficacy and duration of efficacy that we received with just one *dormant* application, allowed us to change the original protocol of applying two subsequent herbicides, to only one, additional application on July 19, 2016 at Northland Farms (NF) and Gardens Alive (GA). No additional applications were conducted at Lincoln Nursery, as some treatments were still commercially viable at 9 months after application (MAT). Although, we changed from the original protocol, our outcomes targets and performance measures were all exceeded and in only one case did we fall short by 19%. In this one case we achieved a 56% reduction in weed growth, when shooting for a 75% reduction, over the entire year-long program. However, few growers would be unhappy with a 56% reduction!! We attribute the majority of our success to the novel application timing of Dec. 14, 2015 and the use of Marengo 15 oz in this period followed as a 2<sup>nd</sup> application with SureGuard 8 oz or SureGuard 12 oz followed by Marengo 7.5 oz or SureGuard 8 oz. Both of these herbicide performed exceptionally as mid-December applications and helped with residual control into the 2<sup>nd</sup> application.

## PROJECT PURPOSE

The objectives of this trial were to evaluate over the top (OTT) use of various non-traditional pre- and post-emergence herbicides on early winter dormant ornamentals, followed by in-season advanced pre-emergence herbicides attending to mode of action (MoA) rotation, long-term efficacy and minimal phytotoxicity. Success was measured quantitatively as > 75% reduction in weed biomass, at the project's conclusion, and by less than 20% crop injury of any kind. These measures were accomplished by harvesting weed biomasses from control areas (no herbicides) versus treated areas and calculating change in growth index values (initiation of trials – project completion) for the various crop. This project addressed the discrepancy between how herbicides are usually studied and what a MI nursery growers requires. Herbicides are studied as points in time applications; however, nursery growers apply consecutive applications in a season-long herbicide program. The issues of what impact sequential applications, over a cropping cycle, have on the crop, and weed control based on the timing of the application were addressed. Also, due to the severity of weed infestations, following years of economic downturn, this project was timely and of great importance in restoration and recovery of high-value crops that were neglected in the downturn and now are of high- and augmented-value. This study was the culmination of the years of research and of previous SCBGs including: 791N1300090 - *Addressing Foremost Weed Control Issues for MI Nursery & Landscape Industries*; 791N2200136 – *Major Weed Control Issues in MI Nurseries*; and, 12-25-B-1468 – *Weed Control in Specialized and Traditional MI Nursery Crops*. These previous projects were the basis for propose ten season long programs for MI nursery crops and weed issues.

## PROJECT ACTIVITIES

During the course of this project we conducted two herbicide applications to eight crops at three nurseries (one dormant and one mid-season); we conducted 8 evaluations; performed two measures of growth (one with full weed biomass collections, including timings of weeding, and both including measures of stock to calculate volume of growth increases), volume is a preferred way to evaluate quality and not just growth increases.) In total ten technical presentations were given re the successes of this project, four trade articles were published and one PowerPoint was downloaded to our website for an estimated outreach to 35,210 program beneficiaries. The outreach of this project has been beyond the reach of MI nursery growers and has assisted specialty crop growers in other states in the Midwest. Of course, enhancing the specialty crop industry in the region only benefits the specific state, for as the region's economy goes, so goes the state.

## GOALS AND OUTCOMES ACHIEVED

Bench Mark, Target #1 and Performance Measure #1 and 2: Meet - Surveys were conducted at each participating nursery in Nov. 2015 providing us with their current weed control programs. The control programs were designated into four categories: *non-existent or nil* (Lincoln Nurseries); *non-aggressive* (Northland Farm); *mildly aggressive* (Zelenka); and, *aggressive* (Bay Landscaping). Random sampling on fields for weed biomass calculations were collected in Dec., 2015 before any applications and initial growth measures. Starting heights and calipers were collected for the B&B operations (Lincoln and Bay Landscaping), and growth index values were collected and calculated by field and site at liner operations (Lincoln and Zelenka). One MNLA magazine trade article re current practices and problematic weeds was published in March. 2016 for the May/June magazine issue (see Appendix A – in Additional Information).

Bench Mark #2: Exceeded – Due to the success of the dormant applications a second application in March 2016 was not required; therefore, activities were performed in Bench Mark #3. In the spring up to June 30, 2016 three evaluations were conducted and averaged.

Bench Mark #3, Target #2 and 3 and Performance Measure #2 and 3: Exceeded - Before the second (July 19, 2016) application random sampling of field sections for weed biomass calculations in control and treated plots were performed. Growth index (GI) (which is a measure of plant volume) values were collected and calculated by field and site at liner operations [Northland Farms (Table1) and Zelenka (Table 3)]. Heights and calipers were not collected for the B&B operations at Lincoln (Table 2) as dormant applications were still providing above commercial control. Bay Landscaping at Bay City, MI had been discontinued due to expenses after three weeks following application and is not included in this report. The GI calculations, plus the four evaluations conducted after the 2<sup>nd</sup> application, indicate targets 2 and 3 had been exceeded after one application. Greater than 80% and 70% reductions in weed biomass at Northland Farm in *Thuja* and *Euonymus*, respectively (Table1) and >80% reductions in weed biomass at Zelenka in *Buxus* (Table 3). To meet performance measures 2 and 3, we wanted a total increase in crop growth of 20% before the second application. Again, we surpassed our performance measures with crop growth increases of 56.7%, 124.5% corresponding to the 80% and 70% reductions in weed biomass at Northland Farm in *Thuja* and *Euonymus*, respectively (Table 1). The *Buxus* at Zelenka increased in growth volume by 103.8% corresponding to the 86.8% reduction in weed biomass with the Barricade + Gallery SC application (Table 3).

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The *Syringa* and *Euonymus* at Zelenka increased in volume by 24.8% and 37.7%, respectively (Table 3). Unfortunately, both crops were hand-weeded due Zelenka's change of ownership that was occurring in this period. These hand weeding events prevented the calculation of corresponding weed biomass reductions with the increases in growth.

No growth or weed biomass calculations were done for Lincoln as after 33 weeks or 8 months following dormant applications (Table 2). At 8 months after treatment no, two and one treatment in the Kentucky Coffeetree, 'Autumn Blaze' Maple and 'Red Jewel' Crabapple, respectively, were still providing commercially acceptable weed control. Leaving these treatments to run their course at Lincoln, helped later with us understanding some of the interactions of 2<sup>nd</sup> applications with the 1<sup>st</sup> at other sites.

In summary, of eight remaining crops, after only one application of herbicide, at the three nurseries, six crops shared a top treatment for reducing weed growth and correspondingly increasing crop growth. This top performing crop in 6 of 8 crops was Lontrel + Marengo SC applied dormant in Dec. 2016 (Table 1, 2 and 3). The only two exception crops were the *Buxus* and *Euonymus* at Zelenka (Table 3). In these two crops the best performing treatment was Tower + Barricade (Table 3). We attribute this divergence to the predominant weed species in these two Zelenka fields of Mugwort or *Artemisia vulgaris*. The Tower (as a shoot inhibitor) seemed have some superior efficacy with this weed. This finding will be built upon in our 2016 SCBG studies. In addition, we out-performed, performance measure #1, with one extra MNLA magazine article being published in their July/August issue. Furthermore, four presentations were given to national representatives of the specialty crop sector at trade and scientific conferences including, Cultivate 2016, ASHS and ISHS in this period (see Appendix A - in Additional Information).

***Bench Mark #4, Target #4 and Performance Measure #4:*** In terms of performance measure #4, two additional MNLA magazine articles published in the Sept/Oct and Nov/Dec. 2016 issues. This exceeded the performance measure #4 since no article publications were required in this period. Moreover, two presentations were given to state representatives of the specialty crop sector at the Michigan Nursery and Landscape Association, GLTE conference, in this period (see appendix A – in Additional Information).

We had targeted to cut weed biomass after the second application compared to the control by another 30% for a total weed biomass cut of 75% over the year-long program. Again, we had reached this 75% target with the *Thuja* and *Euonymus* at Northland Farms (NF) with reduction in weed biomass before the second application of 82 – 96% and 72 to 31%, respectively, after the first dormant application only (Table 1). However, using the rating scores for efficacy we did achieve additional cuts in weed biomass of another 10 to 30% compared to the control (Table 1) after the 2<sup>nd</sup> application. We also achieved our 4<sup>th</sup> performance measure(s), of an additional 10% crop growth increase and weed control cost reduction by 10%, versus hand-weeding (Table 1). Unfortunately, only the *Euonymus* at Northland could be used to calculate these gains do to hand weeding issues with the one other remaining Northland crop. However, two treatments the SureGuard (8 oz/ac) following the Casoron CS(3 gal ai/ac) dormant application and the Marengo SC (7.5 oz/ac) following the Basagran + Gallery dormant application (each at 1 lb ai/ac) yielded 19.7 and 25.6% growth gains, respectively at NF.

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Hand weeding timings conducted before the 2<sup>nd</sup> application, determined that averaged across fields and crops, 142.2 grams of weed fresh weight could be hand weeded/ minute. By calculating at \$15.00/h for labor, and converting our 6 ft<sup>2</sup> plots to represent 43,560 ft<sup>2</sup> (or one acre plots), we estimated savings in the *Euonymus* SureGuard (8 oz/ac) following the Casoron CS(3 gal ai/ac) dormant application at \$435.75/ac versus the controls. We also liberally allocated only 20% of the total field was infested in our \$435.75/ac savings. This 20% or 80% reduction was liberal as it considered Zelenka's current program as delivering this amount of weed control (although it was not). The \$436 saving more than paid for the SureGuard at 12 oz (~ \$150.00/ac) that reaped this saving in hand weeding versus their current program Tower+ Pendulum Aqua Cap which is ~100.00/ac. In summary we exceeded our 10% cut in cost with a 44% cut in weed control program costs, calculated as:

\$436.00 (hand weeding) + \$100.00 (chemical program) minus 2 applications of SureGuard at 12 oz/ac (dormant) and 8 oz/ac (in-season) (= \$300.00):

Therefore at \$536.00 - \$300.00/536 X 100 = 44%/ ac saving are provided.

In addition, this cost saving relies upon the use of a dormant application in Dec. which is a down-time in the industry, thus additional labor efficacy gains could be estimated.

Again, we far exceeded our 75% target at Lincoln Nursery with reduction in weed growth with only one application, with treatments at 9 MAT providing 80% control (Marengo SC) (Table 2) in the *Acer* and one at 80% in the *Malus* (Marengo SC) (Table 2). These gains are incredible as Lincoln had no field weed control program at the initiation of this study in 2015. Lincoln staff were so amazed by the results that they have whole-hearted embraced Marengo in their fields. Taking fields that were infested with weeds to productive, yielding B&B production. We believe, this projects may have saved the field tree growing program at Lincoln. At trial initiation, Lincoln was in a staff void for the field tree nursery program. Due to staff changes, not even mowing in the rows was occurring. We had to expend significant time hoeing plots around each treatment, species, and replication, in order to see the ground and sometimes the trees, and apply the treatments. At the trial, during the March 3 final measures, clean areas, as we had left them in Dec. 2015, after hoeing and spraying. The savings in meeting a 10% reduction in the weed program at Lincoln, is not the proper performance measure. The real performance measure should have been saving an entire portion of the business i.e. B&B production. Therefore, the cost saving at this site is worth far more than ½ a million, and far surpasses any 10% reduction in weeding costs. One treatment (Lontrel +Marengo) that had been most effective up to July, 2016 and even to 9 MAT in the *Malus* proved in the final measures in 03/03/2017 or 63 WAT to assert a cost in growth to the trees (Table 2). This was also seen in the *Acer*. For this reason the best treatment in terms of weed control and corresponding increase in growth versus the control was Marengo SC in all three species at 15 oz/ac. We saw a non-significant change in height at Lincoln with *Gymnocladus* (Table 2), a 10% increase in height with *Acer*, and 8.3% increase in caliper with *Malus* with the use of Marengo (Table 2). This site alone made the project a success – it was like a 1 in 50 year test!

Furthermore, we were only short 19% in meeting our overall 75% target at Gardens Alive, despite going through many set-backs and changes and hindrances. One crop provided full growth measures before the 2<sup>nd</sup> application, and one crop had a full set of final measures on 03/03/2017, the *Syringa* (Table 3). Therefore, the *Syringa* is the only crop we can discuss, at this location, in terms of targets and performance measure #4. We achieved at trial end a 56% increase in plant volume with the SureGuard 8 oz/ac following the Lontrel + Marengo SC (7.5

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oz/ac), a 52% increase with SureGuard (8 oz/ac) following the Casoron CS (3 gal ai/ac) dormant application, a 55% increase in growth with SureGuard 8 oz following SureGuard 12 oz applied dormant (each at 1 lb ai/ac) at Gardens Alive (Table 3). Associated with these reductions in weed growth we had corresponding tremendous increases in growth that far exceeded any performance measure set of 112.6% with the SureGuard 8 oz/ac following the Lontrel + Marengo SC (7.5 oz/ac) and 110.5% with the SureGuard (8 oz/ac) following the Casoron CS (3 gal ai/ac) dormant application (Table 3).