



ECONOMICS OF USING PLANT GROWTH REGULATORS IN THE LANDSCAPE

A Sensitivity Analysis of Using Paclobutrazol for Shrub Maintenance

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Labor is one of the largest expenses in the landscape services industry, and maintenance services, such as pruning, is one of the most labor-intensive tasks. In order to provide labor-intensive services and remain profitable, labor savings has become a major objective for landscape business owners and managers. In looking for cost-effective ways to lower labor costs, plant growth regulators (PGRs) have been introduced to the landscape industry as a relatively new tool to control shrub growth and reduce labor expenses. While PGRs can be a cost-effective tool to control growth in shrubs and reduce labor pruning, lack of information on the economic feasibility of PGRs has limited their adoption.

This publication is the second of three articles illustrating the economics of PGRs in the landscape industry. Using a sensitivity analysis, this publication analyzes how changes in hourly wages impact cost savings in PGR experiments.

- The first publication in the series (HO-315-W) investigates the labor and dollar savings of applying PGRs in three shrubs located in three states.
- The third article (HO-317-W) provides a guide to use a financial tool developed to understand the economic benefits of PGRs.

Findings from this series can help landscape maintenance business managers understand the economic impact of using PGRs and their direct effect on costs. The series discusses variables that should be considered in the decision-making process of using PGRs for shrub maintenance, including hourly wages, PGR rate, shrub species, and area of coverage. Information from this series can help business owners, managers, and crew supervisors decide if the extra cost of PGRs can be justified by the reduction of labor costs in different geographic zones and under certain labor wages.

The Role of PGRs

PGRs tend to reduce plant growth through the action of an active ingredient, such as paclobutrazol. Paclobutrazol suppresses plant growth by acting as gibberellin biosynthesis inhibitor and blocking plant cell elongation (Norcini et al., 1996). PGRs are widely accepted in the ornamental industry to control plant height, shape, and overall size (Greenhouse Management Magazine, 2012). While PGRs have been adopted by some sectors of the Green Industry, its adoption is somewhat limited among landscape maintenance businesses.

Few researchers have investigated the effect of PGRs in shrub growth and size. Setia et al. (1995) found that paclobutrazol applications resulted in shorter and more compact shrubs. Foliar sprays of paclobutrazol resulted in growth suppression for *Ligustrum japonicum*, *Ligustrum sinense*, *Loropetalum chinensis*,

and *AbeliaXgrandiflora*. One of the major potential benefits of PGRs applications include reduced time required to prune trees and shrubs, reduced number of pruning events, and biowaste reduction.

Data and Economic Analysis

Data and methodology for this study is described in detail in the first article of this series, *A Partial Cost Analysis of Using Paclobutrazol for Shrub Maintenance*. Economic analyses were based on the U.S. average hourly wage for landscaping and groundskeeping workers at \$13.73 per hour (Bureau of Labor Statistics, 2018). Shrubs used in the analysis include Confederate jasmine, Asiatic jasmine, and Thorny eleagnus (Figure 1).

Sensitivity analysis is a tool used to help managers and decision-makers understand how macroeconomic shocks (industry or country) and microeconomic changes (business) can impact business success. In other words, sensitivity analysis simulates shocks that businesses can face to indicate how uncertainty impacts businesses. For example, sensitivity analysis can be used to investigate the effect of changes in inputs (e.g., hourly wages) on business outputs (e.g., costs). In our study, changes in hourly wages may be due to changes in labor supply and/or demand or local and federal laws that stipulate minimum wages for landscape workers.



Figure 1. Confederate jasmine, Asiatic jasmine, and Thorny eleagnus in landscapes.

Sensitivity analysis was conducted to compare the effect of changes in hourly wages on the partial cost savings for each shrub experiment (see first article of series, HO-315-W). Sensitivity analysis was carried out using the range of hourly wages in the landscape industry for workers involved in trimming and pruning activities, which includes:

- The federal minimum hourly wage at \$7.25 per hour;
- The average hourly wage for landscaping and groundskeeping workers at \$13.73 per hour; and
- The 75th percentile hourly wage for tree trimmers and pruners at \$22.73 per hour.

What Did We Find?

Results from this study illustrate how, depending on the species and location, pruning costs can be greatly reduced by applying PGRs for shrub maintenance. Findings from Table 1 suggest that applying PGRs resulted in cost savings for all experiments when hourly wages were higher than \$21 per hour, a value close to the average hourly wage for shrub and tree pruners in the industry (\$19.47) (Bureau of Labor Statistics, 2018). Specifically, Table 1 illustrates how *Confederate jasmine* (FL), the experiment that resulted in monetary losses after PGR application (see first article of series, Table 5), resulted in cost savings when wages were higher than \$21 per hour.

PGRs applications could be useful for landscaping businesses aiming to reduce pruning and labor costs. As shown in Table 1, Asiatic jasmine (FL) experienced the highest cost savings as wages increased from \$7.25/hour to \$22.73/hour. For example, cost savings went from \$333/ft²/year at \$7.25/hour to \$1,824/ft²/year at \$22.73/hour wages. An explanation of the increase in cost savings may be that the labor demand for pruning maintenance that can be greatly offset by reduced shrub growth due to PGR applications. Consistent with Smiley et al. (2009), it seems that applying paclobutrazol has more economic benefits for fast growing shrub species.

Take Home Message

The low availability of skilled employees and tight labor market for temporary employees is a threat that affects the quality and availability of landscape services, as well as the profitability of the industry, issues that could both be partially solved with the use of PGRs. As labor market availability decreases and hourly wages increase, the economic importance of PGRs is likely to increase.

PGRs can help landscape businesses save money, as long as the cost of application is lower than the costs of pruning untreated shrubs. Our results show that cost savings of PGR applications is strongly correlated with hourly wages. Applying PGRs for shrub maintenance resulted in cost savings for all shrub species when hourly wages are higher than \$21 per hour.

Potential benefits of PGRs may go further than time and cost savings. Benefits may also include savings on waste disposal and increased labor safety. Given the fact that PGRs reduce shrubs' biomass production, savings in waste disposal can potentially increase the economic benefit of PGRs. By reducing plant growth, PGRs can diminish the amount of workers' exposure to pruning tools and equipment use. According to Buckley et al. (2008), landscape services is an industry with high incidence of injury and illness rates and fatalities. For example, 45% of fatalities among landscape services workers are due to the use and operation of tools and machinery (NIOSH, 2008). Similarly, 51% of fatalities in the landscape industry were incurred by groundskeepers working in ornamental shrub and tree maintenance (Bureau Labor of Statistics, 2005).

This research has demonstrated that PGRs can be an economically feasible tool to decrease pruning labor, especially when hourly wages increase. Managers and owners of landscaping businesses should consider three specific variables when determining the economic impact of PGRs: 1) area of application, 2) rate of applications, and 3) hourly wages. Increasing wages and pruning demand are directly correlated with cost savings due to PGR applications. Further research should investigate the impact of PGRs on labor allocation over time, potential impact on waste disposal and employee safety, as well as include other shrub species and management practices.

Table 1. Effect of hourly wage on pruning cost savings from PGR use in shrubs.

Shrub species	Hourly Wages (\$/Hour)																
	7.25	8	9	10	11	12	13	13.73	14	15	16	17	18	19	20	21	22.73
Confederate jasmine	-50	-47	-44	-41	-38	-34	-31	-29	-28	-25	-21	-18	-15	-12	-8	-5	0
Asiatic jasmine	333	406	502	598	695	791	887	958	984	1,080	1,176	1,273	1,369	1,465	1,561	1,658	1,824
Asiatic jasmine	0	1	3	7	11	16	20	23	24	28	32	37	41	45	49	53	60
Thorny eleagnus	-1	10	25	41	56	71	86	97	101	116	131	146	161	176	191	207	233

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