HO-315-W

ECONOMICS OF USING PLANT GROWTH REGULATORS IN THE LANDSCAPE

A Partial Cost 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. While plant growth regulators (PGRs) can be a cost-effective tool to control growth in shrubs and reduce labor expenses, lack of information on the economic feasibility of PGRs has limited their adoption.

Using a partial cost analysis approach, this publication is the first of a series of three articles illustrating the economics of applying PGRs in the landscape industry.

- **This publication will address the labor and dollar savings of applying PGRs in three shrubs located in three states.**
- The second publication (HO-316-W) will provide results from a sensitivity analysis to illustrate how hourly wages impact labor costs and dollar savings for these experiments.
- 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 role of using PGRs and their direct effect on costs. The series discusses what variables should be considered in the decision-making process of using PGRs for shrub maintenance, including rate of application, area of coverage, and labor demand. 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.

Shrub Pruning in the Landscape Industry

Shrub pruning is the purposeful removal of plant parts (Kuhns, 1998). It is performed by reducing the length of unwanted growth or fast-growing stems in order to maintain a desired shape or size (Purcell, 2015). Pruning is considered one of the most important cultural practices in landscape management (Klingeman, 2008), and performing this activity in a proper way can help businesses build long-term relationships with their clientele.

Due to the complexity of proper techniques and safety issues, pruning labor is among the highest-paid occupations in the landscape industry (Bureau of Labor Statistics, 2018). Most pruning activities are performed by landscape and groundskeeping workers, who receive an average hourly wage of $13.73 (Bureau of Labor Statistics, 2018). The main activities of these workers are a combination of mowing, trimming, planting, watering, and fertilizing. It is important to keep in mind that average hourly wages can vary depending on the location. Figure 1 illustrates the 2019 annual mean wages for landscaping and groundskeeping workers in the U.S.

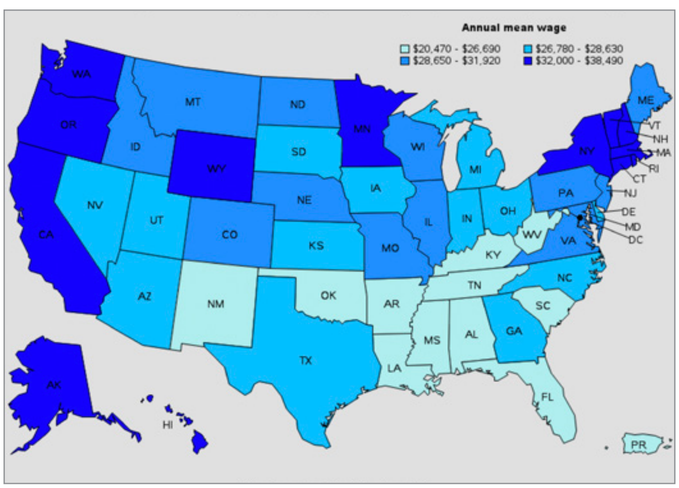

Figure 1. Annual mean wage of landscaping and groundskeeping workers in 2019. Source: U.S. Bureau of Labor Statistics.

Use of Labor-Saving Technologies in the Landscape Industry

Labor is one of the most important and expensive inputs for green industry businesses (Amir, 2019) and it promises to remain a major worry for landscape business owners and managers (Lawn and Landscape, 2018). Historically, landscape businesses tend to be more dependent on labor than other segments of the green industry (Hodges, et al., 2015). In addition, the seasonality of the services and a tight labor market can make filling temporary jobs difficult. To decrease costs, business owners and managers of landscape businesses are constantly looking for ways to improve the quality and speed of manual labor.

Recently, landscaping companies have started adding PGRs to their maintenance toolkit. PGRs 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). Setia et al. (1995) found that paclobutrazol resulted in shorter growth in shrubs, and treated plants were more compact. Although PGRs are widely accepted in the ornamental industry, their adoption among landscape maintenance companies is limited.

Data and Methodology

Data for this study comes from four experiments conducted between April and May 2016 in Florida, Texas, and Indiana. Account managers of landscape maintenance companies collected data on three shrub species: Confederate jasmine (*Trachelospermum jasminoides*), Asiatic jasmine (*Trachelospermum asiaticum*), and Thorny eleagnus (*Elaeagnus pungens*).

Area of treated (treatment) and untreated (control) shrubs was measured at the beginning of the experiment. Table 1 illustrates pruning interval, area of experiment, as well as location, by experiment. Area of control and treatment groups were the same between control and treatment, but varied by experiment. Figure 2 illustrates the use of Confederate jasmine, Asiatic jasmine, and Thorny eleagnus in landscapes.

Table 1. Description of PGR experiments.

Shrub	Start of experiment	Pruning interval	Area (ft^2)	Location
Confederate jasmine	April 18	Every 14 days	2,721	Orlando, FL
Asiatic jasmine	April 19	Every 8 days	1,358	Orlando, FL
Asiatic jasmine	May 5	Every 7 days	7,182	Houston, TX
Thorny eleagnus	April 20	As needed	5,276	Indianapolis, IN

Figure 2. Confederate jasmine, Asiatic jasmine, and Thorny eleagnus in landscapes.

Data collected included number and time of pruning events and agrochemical (PGR and surfactant) applications. Shrubs in the treated group were treated with one PGR application via foliar spray after a general pruning. Equipment used for agrochemical applications was a mounted gas power sprayer and a Green Garde JD9 gun with nozzle adjusted to spray at a 45 degrees cone angle. The pressure at the pump was set to approximately 85 PSI. PGR (Paclobutrazol; Trimtect; Rainbow Treecare Scientific Advancements; Minnetonka, MN) and surfactant (Glycerin, diethylene glycol and alkyl polyglucoside; Audible 90; Exacto Inc.; Sharon, WI) rates followed product manufacturer recommendations (6.4 to 9.6 fl. oz/gal for PGR and 2ml/gal for surfactant). Time of PGR and surfactant application and ready-to-use solution (RTU) were recorded at time of application. Account managers performed visual evaluations at 6-7 weeks after treatment (WAT), depending on shrub species.

Table 2 illustrates the data collected as well as the length of each experiment. Experiments ranged between 6 and 12 weeks. We computed the percent reduction of number of pruning events and hours per pruning between control and treated shrubs. For example, Table 2 shows treated Confederate jasmine (FL) received 67% fewer pruning events and 70% fewer hours per pruning event when compared to the control group.

Shrubs in the control group received between 20 (Confederate jasmine in FL, Asiatic jasmine in TX, and Thorny eleagnus in IN) and 30 pruning cycles (Asiatic jasmine in FL). To conduct the analysis, we forecasted the annual number of pruning events for treated shrubs by multiplying the number of pruning events in a year for the control group and the percent reduction in number of pruning events for treated shrubs (Table 2). The forecasted annual number of pruning events for treated shrubs ranged between 3 and 20 pruning events. For example, Confederate jasmine (FL) resulted in 7 annual pruning cycles for treated shrubs, a 67% reduction from 20 annual pruning cycles for control shrubs. Thorny eleagnus received the same number of annual pruning cycles (20 pruning cycles) for both treatment and control group; yet the time of each pruning event was significantly lower for treated than control shrubs (1 hour/pruning event for treated shrubs vs. 9 hour/pruning event for control shrubs). Account managers reported that each pruning event for Thorny eleagnus included only the removal of runners and escapes, in contrast to whole shrub shearing for the control group.

Control and treatment groups received similar fertilization and pesticide regimes throughout the duration of the experiment. Table 3 shows the PGR rate of application followed the recommended rates of application by the manufacturer, which was similar for most species (9.6 fl. oz./gal), except for Asiatic Jasmine in Texas (6.4 fl. oz./gal). Table 3 also illustrates the amount of RTU solution used to complete foliar applications of PGR. Spray time was computed for PGR and surfactant applications.

Economic Analyses

A partial cost analysis helped us investigate the change in labor costs due to PGR applications for shrub maintenance. We standardized values to dollars per 500 ft^2 per year ($/500 ft^2/year). For example, the cost of pruning was standardized to dollars spent in pruning an area of 500 ft^2.

Table 2. Effect of Trimtect PGR treatment on number and timing of pruning events on Confederate Jasmine.

			Pre-treatment		Control		Treatment			
Shrub	State	No. weeks	No. events	Hours/ event	No. events	Hours/ event	No. events	Hours/ event	Reduction No. events (%)	Reduction hours per event (%)
Confederate jasmine	FL	6	1	1	3	1	1	0.3	67	70
Asiatic jasmine	FL	12	1	10	8	10	1	10	88	0
Asiatic jasmine	TX	6	1	3.75	6	3.75	1	3.75	83	0
Thorny eleagnus	IN	12	1	9	1	9	1	1	0	89

Table 3. Time required to treat common shrubs with PGR.

			PGR				Surfactant			
Shrub	State	Area (ft^2)	App/year	Rate (fl. oz/gal)	RTU (gal/app)	Spray time (h)	App/year	Rate (ml/gal)	RTU (gal/app)	Spray time (h)
Confederate jasmine	FL	2,721	1	9.6	16	0.2	1	2	16	0.2
Asiatic jasmine	FL	1,358	1	9.6	40	0.5	1	2	40	0.5
Asiatic jasmine	TX	7,182	1	6.4	30	1.1	1	2	30	1.1
Thorny eleagnus	IN	5,276	1	9.6	47	0.6	1	2	47	0.6

Table 4. Pruning labor costs for PGR treated and untreated shrubs.

		Control			Treatment		
Shrub species	State	Events per year	Annual hours pruning 500 ft^2	Annual cost pruning 500 ft^2	Events per year	Annual hours pruning 500 ft^2	Annual cost pruning 500 ft^2
Confederate jasmine	FL	20	3.68	$50.46	7	0.37	$5.05
Asiatic jasmine	FL	30	110.46	$1,516.17	4	13.81	$189.57
Asiatic jasmine	TX	20	5.22	$71.69	3	0.87	$11.95
Thorny eleagnus	IN	20	17.06	$234.32	20	1.90	$26.02

Table 5. Partial cost analysis for each shrub species in the control and treatment groups.

		Control		Treatment					
Shrub species	**State**	**Cost of pruning labor**	**Partial net cost**	**Cost of pruning labor**	**Cost of application labor**	**Cost of PGR**	**Cost of surfactant**	**Partial net cost**	**Cost Savings**
Confederate jasmine	FL	$50.46	$50.46	$5.05	$1.01	$72.77	$0.10	$78.92	-$28.46
Asiatic jasmine	FL	$1,516.57	$1,516.57	$189.57	$5.06	$364.51	$0.49	$559.62	$956.95
Asiatic jasmine	TX	$71.69	$71.69	$11.95	$2.07	$34.46	$0.07	$48.55	$23.14
Thorny eleagnus	IN	$234.21	$234.32	$26.02	$1.52	$110.24	$0.15	$137.93	$96.28

Partial net costs for treated shrubs were computed by adding labor costs from pruning and agrochemical applications, cost of PGR and surfactant, estimated in dollars spent pruning 500 ft^2 per year. Cost savings from the use of PGRs was calculated by subtracting the pruning labor cost and agrochemicals for the treated shrubs from the cost of pruning labor of untreated shrubs (control). Economic analyses do not account for other maintenance costs (e.g., fertilization, pesticide applications, etc.).

Results

Table 5 illustrates the partial net cost analysis. Three out of four experiments resulted in cost savings after applying PGR. PGR treatments of Asiatic jasmine (FL and TX) and Thorny eleagnus (IN) resulted in cost savings of $956.95, $23.14, and $96.28 per 500 ft^2 per year, respectively. The amount of cost savings is mainly due to high demand of pruning hours in each species, which was offset by suppressed growth after PGR applications (as reported in Table 3). Regardless of higher PGR costs incurred for Asiatic jasmine (FL), this experiment had the highest cost savings ($956.95/500 ft^2/year), which may be explained by the effect of PGRs offsetting a high demand of pruning events (30 pruning cycles per year) and hours per event (10 hours/pruning event).

Applying PGRs to control growth of Confederate jasmine (FL) resulted in a negative economic impact. The dollar difference between the partial net cost of control and treatment groups resulted in a monetary loss of $28.46/500 ft^2/year. This negative impact is likely the result of two main factors considered in this analysis: 1) a high rate of PGR application (9.6 fl. oz/gal), which resulted in "curved leaves" as reported by account managers; and 2) a low demand of pruning hours for Confederate jasmine in Florida. To illustrate, the number of hours required to prune control Confederate jasmine was 3.68 per event for 500 ft^2 in a year, the lowest number of pruning hours need among all experiments (Table 4).

Discussion

Findings from this study show that, depending on the shrub specie, PGRs can reduce the labor needs in landscape maintenance due to a reduction of pruning events and pruning time of each event. For example, applying PGRs can reduce the number of pruning events up to 83% (Asiatic jasmine, TX) and hours per pruning cycle up to 89% (Thorny eleagnus, IN).

Our results show that PGR applications can be an economically feasible tool to effectively reduce the frequency of pruning landscape shrubs. Freeing up pruning labor can help managers reduce the number of employees sent to a job visit, reallocate labor, and increase business profitability overall. Additionally, business managers could reallocate employees to other tasks that offer higher return and spread out pruning activities during high labor demand. Results from our study show that, after accounting for PGR and surfactant costs, application of PGRs can result in annual cost savings. For example, experiments with Asiatic jasmine in Florida resulted in annual cost savings of $956.95 per 500 ft^2 per year (when considering hourly wages of $13.73). Beyond reducing labor needs, using PGRs for shrub maintenance can also reduce travel time and other maintenance costs, including fuel, and wear and tear of vehicles and equipment.

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