PESTICIDE APPLICATION 2021 REPORT

Pesticide Applications to Boise Parks and Recreation Managed Properties in 2021

Executive Summary

After disruptions to maintenance efforts and schedules in 2020, 2021 saw a return to normalcy with typical application targets being met and progress being made on the Pesticide Use Reduction Pilot Program. Use of glyphosate-based herbicides continued to fall in 2021 continuing the trend from previous years. This is due, in large part, to a shift away from post-emergent herbicide use and toward the use of preemergent granular products. Turf damage from white grubs remains to be an issue. To protect pollinator species, the department discontinued the use of nearly all neonicotinoid-based insecticides in 2021. To achieve control of white grub populations the department is instead using a product named Acelepryn G with the active ingredient chlorantraniliprole. Potentially because of this shift, granular insecticide use also fell in 2021. It remains to be seen if this was due to unique circumstances surrounding 2021 or if the new product is a more effective control.

Because of disruptions in 2020, the decision was made to extend the pilot by one year meaning that the program will now culminate at the end of the 2022 growing season. At that time policy changes will be made to support pesticide use reduction. Changes will incorporate lessons learned through the pilot program as well as public feedback gathered throughout the process.

Pictured: An example of a tree well growing in with turf. Application of glyphosate-based herbicides to clear vegetation from tree wells was one of the primary uses of glyphosate at manicured parks. This practice has been eliminated at pilot sites and has been met with support.

A Note Regarding Pesticide Use on City of Boise Lands

Pesticides are powerful tools for the management of public parks and open spaces. They provide a means for land managers and horticulturalists to swiftly and effectively prevent or respond to undesirable organisms in our public spaces. As with any tool, pesticides have drawbacks. It is becoming clearer that broad use of pesticides has negative effects, especially on often unseen but vital components of ecology: soil microbes, pollinating insects, and biodiversity.

As stewards of public land Boise Parks and Recreation must not become complacent in the application of pesticides. For every application there must be a clear and defensible reason for the use of that substance. Integrated pest management principles must be observed, and minimal impact solutions should always be prioritized.

Boise Parks and Recreation is tasked with the maintenance of more than 7,000 acres of public land. Responsible use of pesticides is vital to the health and usability of these communal spaces. With continued judicious use of these tools, we can meet the needs of our community now and ensure that our natural resources are available for generations to come.

Daniel Roop
Sustainability Specialist
Parks and Recreation Department
(208) 608-7611
droop@cityofboise.org

BOISE
CITY OF TREES

Contents

1. Introduction

The 2021 growing season saw a return to relative normality for the operations of Boise Parks and Recreation (BPR) after disruption from the COVID-19 pandemic in 2020. The Pesticide Use Reduction Pilot Program (PURPP) which was launched in Spring of 2020 continued for its second year. Where we saw an increase in public use at many sites in 2020, it returned to routine levels.

The following report details pesticide use by BPR in fiscal year 2021 (October 1, 2020 – September 30, 2021). This document also provides an update on the Pesticide Use Reduction Pilot Program. The PURPP continues to be successful in accomplishing its primary goal of investigating potential routes for the reduction of glyphosate-based herbicides (GBH) at BPR managed sites. Additionally, through lessons learned in the PURPP, BPR dramatically reduced the use of imidacloprid containing insecticides in 2021. Imidacloprid is a neonicotinoid pesticide linked with pollinator decline in many ecosystems. Please refer to Section 4 for more information

2. Changes to 2021 Maintenance:

- GameOn, which was adopted for control of broadleaf plants in turf in 2020 was swapped back to Chaser 2 Amine, a cheaper alternative. This was done after using GameOn in 2020 failed to produce better results than Chaser 2 Amine which has been used for many years.
- Criterion 0.5G, which is used primarily to control billbug infestations in turf was swapped for Acelepryn G, an environmentally safer alternative. This change resulted in an increased chemical budget in 2021 due to the higher cost of Acelepryn G. For more discussion on this topic refer to Section 4

3. Pesticide Applications

In 2021, BPR applied an equivalent of 355 gallons of liquid formulated pesticides and 8201 lbs. dry formulated pesticides. The liquid formulation total includes approximately 85 gallons of GBH. As can be seen in Figure 1, product applications shifted dramatically away from liquid formulated pesticides and toward dry formulations. GBH applications fell again in both absolute and relative terms. With a nearly 50% reduction in total GBH applications from 2020, GBH made up only 24% of total liquid formulated applications in 2021 (See Figure 2).

The most highly applied products in use by BPR can be broadly separated into three distinct groups: products used for broad spectrum control of unwanted vegetation, those used for selective control of broadleaf species in turfgrass, and products used to control insects, primarily billbug[1]. Figure 3 shows the amount of broad-spectrum herbicide products applied in 2021 compared with previous years. It should be noted that Treflan 5G and Surflan AS are not technically broad-spectrum herbicides.

[1] Several species of Sphenophorus, a genus of weevil. Billbug feed on turfgrass roots and stems. Kentucky Bluegrass (Poa pratensis) is especially susceptible.

They are both preemergent, selective products that target annual plants. However, their use on BPR managed sites primarily offsets the use of broad-spectrum herbicides so they have been categorized as such.

Most Highly Applied Active Ingredients by weight:

1. 2,4-D
2. Glyphosate
3. Triclopyr
4. Dichlobenil
5. Oryzalin
6. Ethephon*
7. Pendimethalin
8. Glufosinate-ammonium
9. Trifluralin
10. Fluroxypyr-meptyl

*Note: Ethephon, a growth regulator, is applied only at golf courses managed by BPR: Warm Springs Golf Course and Quail Hollow Golf Course.

For better understanding of the chemical load on managed properties, product applications were also broken down into amount of active ingredient applied. This differs from the figures given above because the amount of active ingredient varies broadly between products. The most highly applied active ingredient was 2,4-Dichlorophenoxyacetic acid (2,4-D) - a postemergent, selective broadleaf herbicide. 2,4-D applications made up 33% by weight of all active ingredient applied to BPR sites in 2021. This was followed by glyphosate (postemergent, broad spectrum), and triclopyr (postemergent, selective). Glyphosate and triclopyr applications made up 23% and 12% by weight respectively of all active ingredient applied. All other active ingredients applied in 2021 made up significantly less. Total amounts of active ingredient applied can be found in Appendix B.

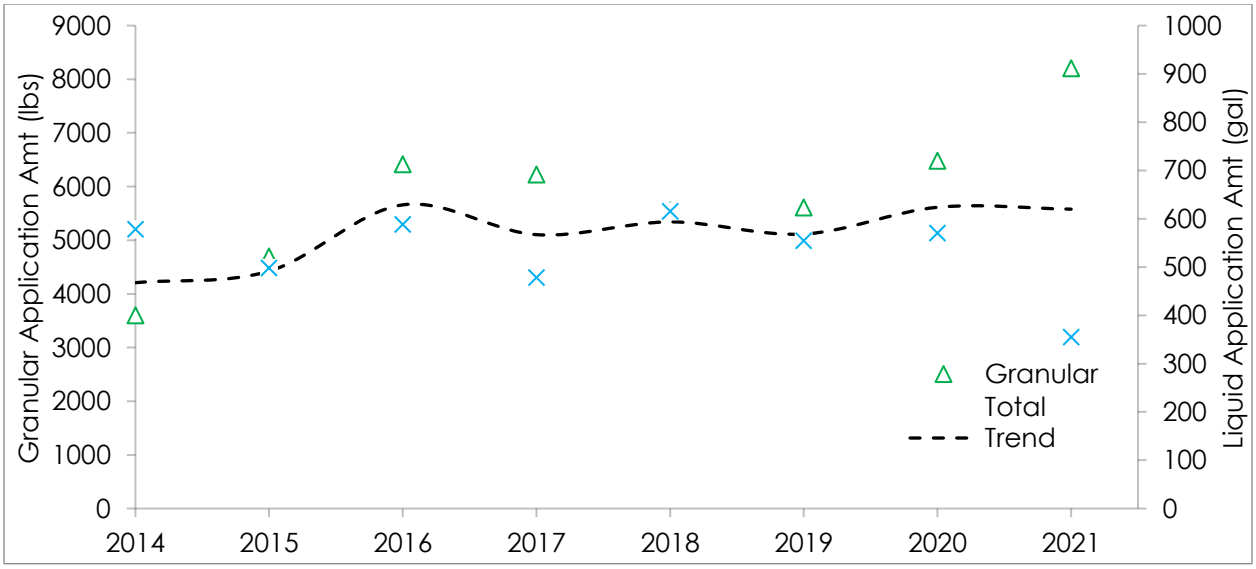

Figure 1: Total equivalent amounts of liquid and dry formulated pesticides from application logs. Dry formulated pesticides are measured in pounds (lbs) on the left-hand axis. Liquid formulated pesticides are measured in US gallons (gal) on the right-hand axis. Dotted line indicates the trend and does not represent any actual application amount.

Figure 2 (Left): Proportion of total liquid formulated applications that contain glyphosate as an active ingredient.

Broadleaf selective herbicide use is shown in Figure 4. The use of Confront which contains the active ingredient clopyralid, an environmentally persistent chemical, was stopped in 2017. GameOn was introduced as the primary broadleaf control product in 2020. The higher rate of use for GameOn in 2020 is explained by the lower amount of active ingredient in the product. GameOn was not reordered on the 2021 chemical bid. GameOn use in 2021 was from supply leftover from 2020.

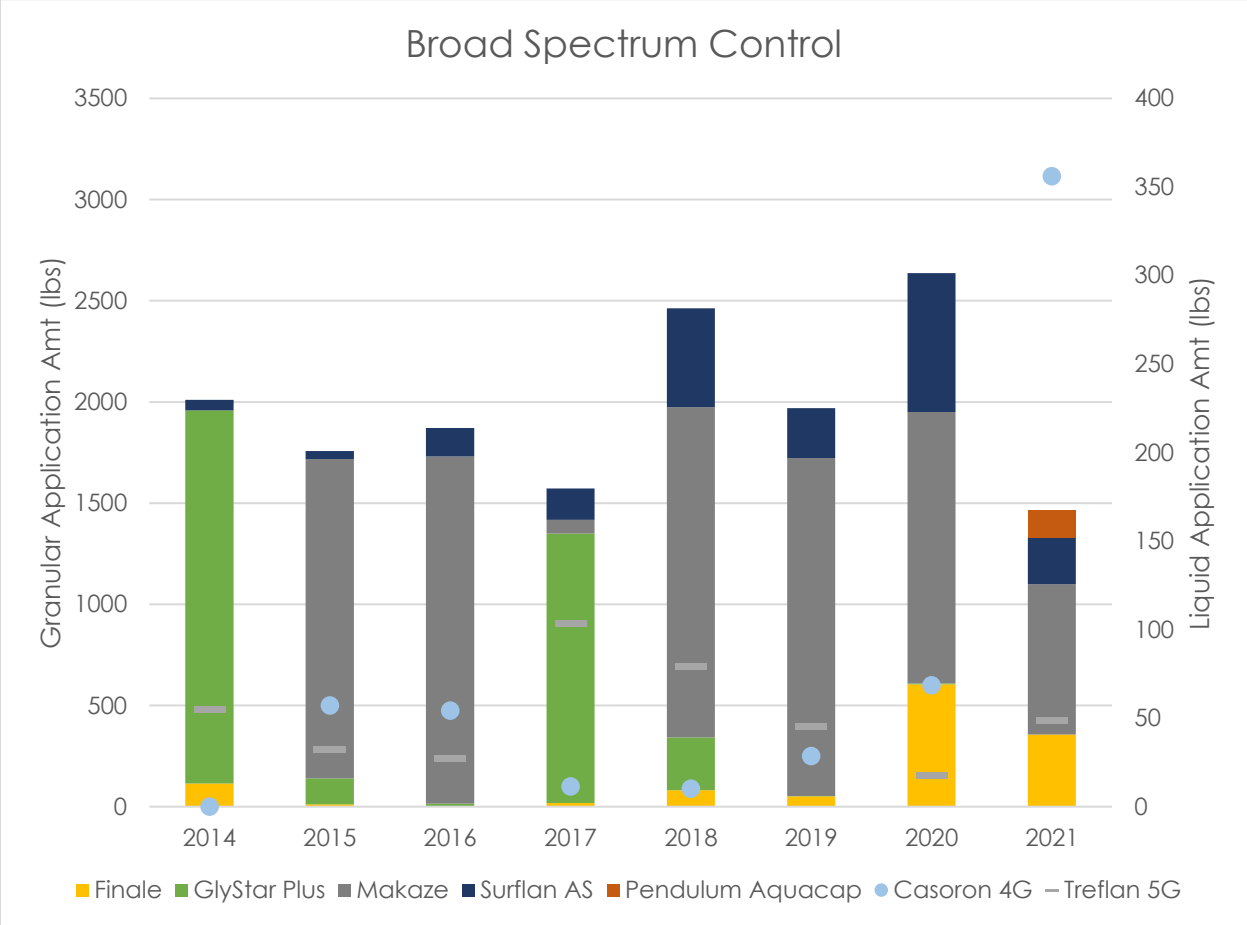

Figure 3: Broad Spectrum herbicide applications. Treflan 5G and Casoron 4G are dry formulated products and are measured in lbs on the left-hand axis. All other products are measured in gal. on the right-hand axis.

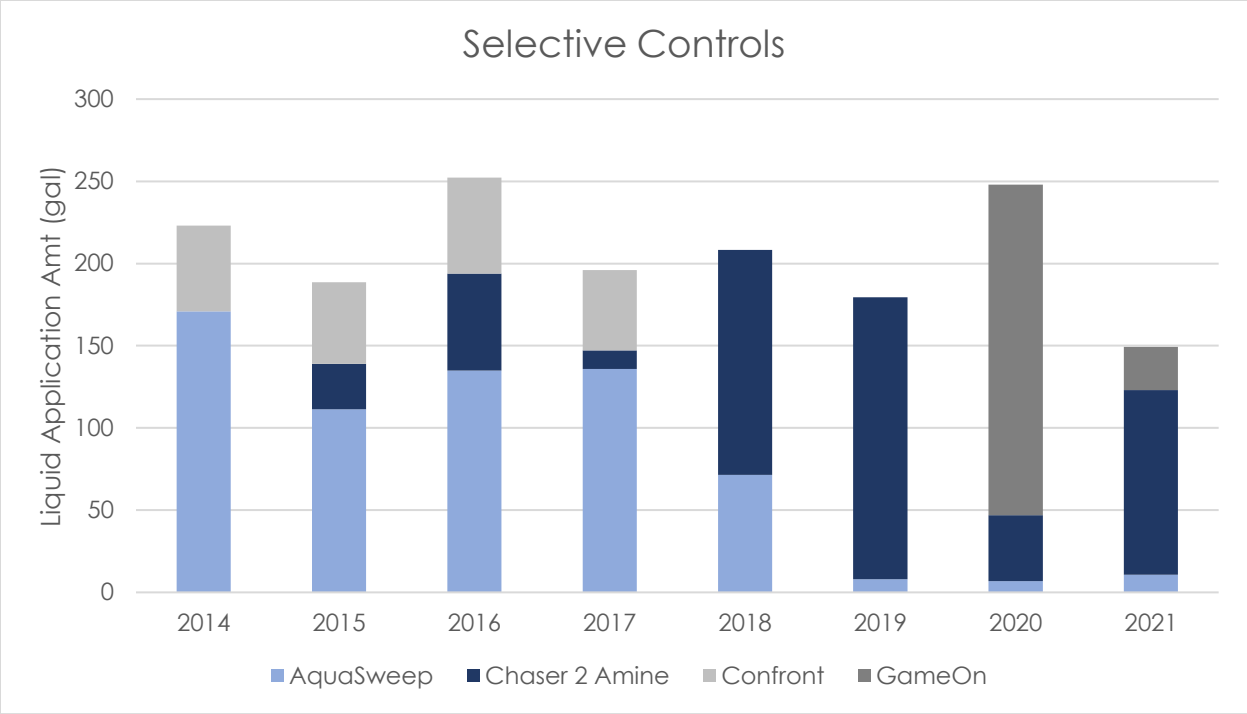

Figure 4: Broadleaf selective herbicide applications. All products are liquid formulated.

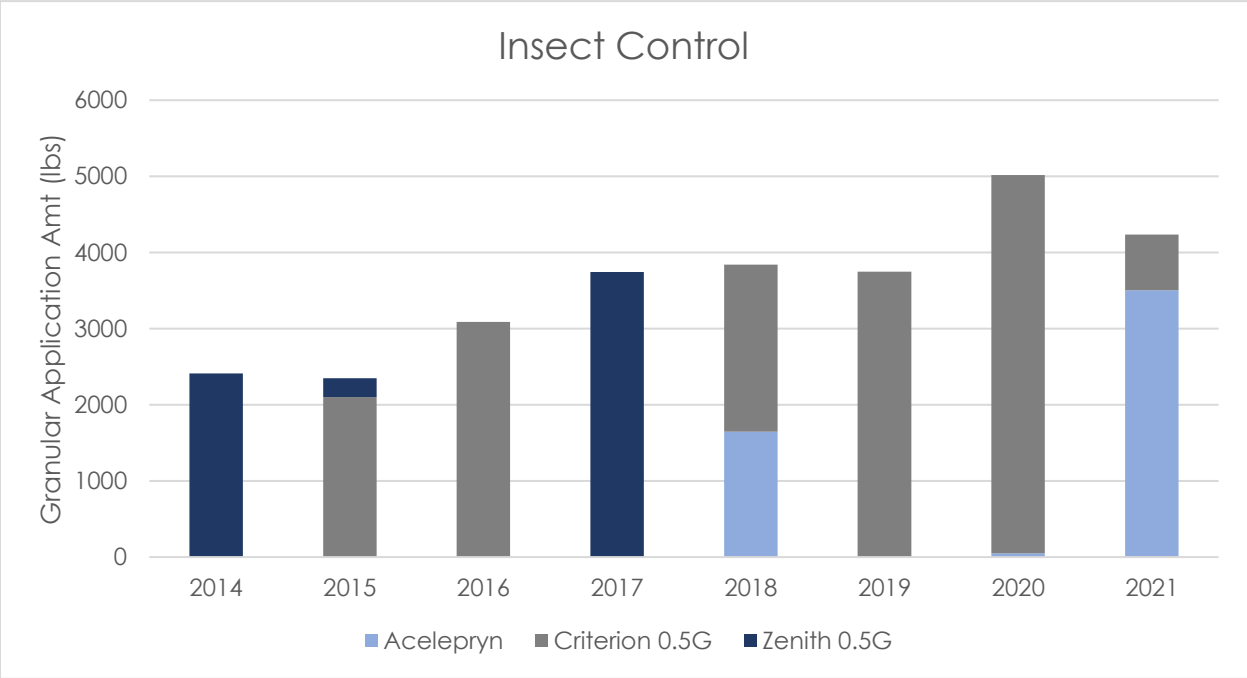

Figure 5: Insecticide application amounts. All products are dry formulated.

Pesticide use for insect control has been trending upwards for the past several years (See Figure 5) but remained steady in 2021. The trend is caused primarily by increased billbug treatments across BPR managed sites. Billbug populations are controlled to avoid damage to turfgrass which is their primary food source. The

decision to implement chemical control of billbug is made on a case-by-case basis according to careful site monitoring when dense populations are found. The cause of increased billbug prevalence at BPR managed sites is unclear but is thought to have two primary explanations. First, between 2013 and 2018, many BPR managed sites were treated as part of the Idaho State Department of Agriculture (ISDA) Boise Japanese Beetle Eradication Program. Japanese Beetle (*Popillia japonica*) is an emergent invasive species to Idaho and is a highly destructive pest to many ornamental and agricultural plants. Japanese Beetle grubs feed on grass roots much like billbug. Adult Japanese Beetle characteristically feed in large groups leaving plant leaves "skeletonized" with only veins remaining. Treatments made through the eradication program had the additional effect of reducing billbug populations until treatments were scaled back in 2018. Second, mild winters over the past several years have been conducive to billbug survival and recovery leading to a rebound in the local population.

LABOR HOURS

Total labor hours spent applying pesticides rebounded slightly in 2021 but remained below average (See Figure 6). A total of 1452 combined hours were spent applying pesticide products in 2021 with only 30% of those hours dedicated to the application of GBH. This is reduced from last year when GBH applications made up over half of total labor hours. It should be noted that the values shown in Figure 6 are indicative of total time spent applying but do not account for time spent training, preparing, mixing, recording, cleaning equipment or any other duties associated with the application of pesticides.

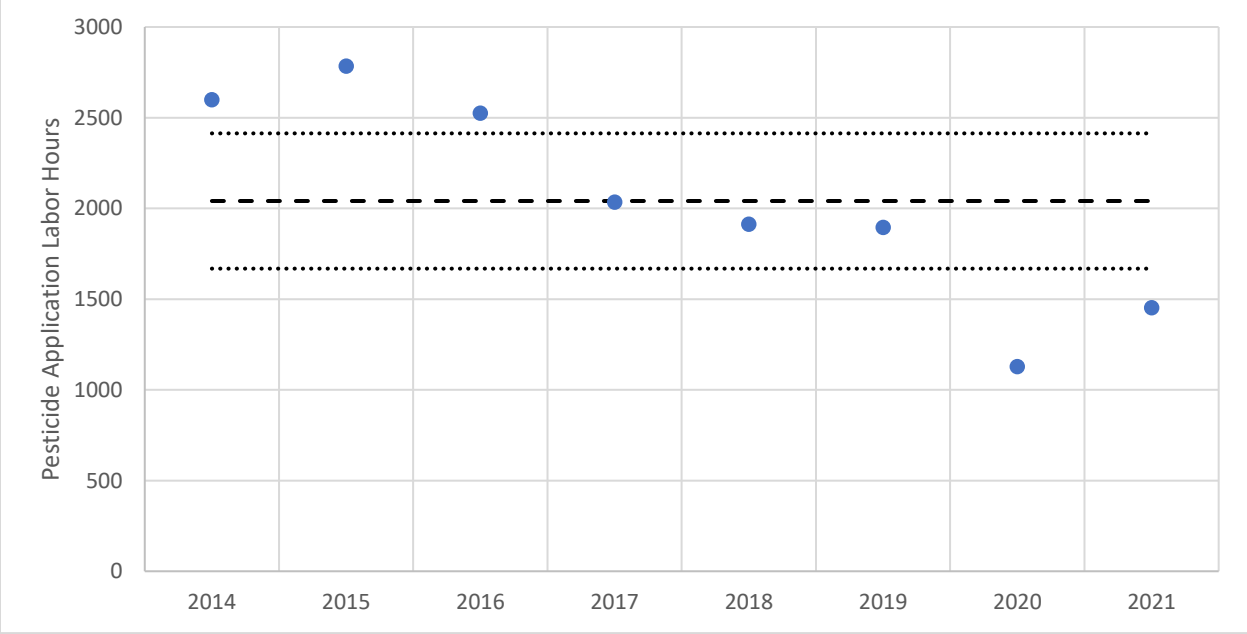

Figure 6: Labor hours spent applying pesticides. Dashed line represents the average hours spent over the 7 data points. The dotted lines represent upper and lower limits of a 95% confidence interval around the mean.

3. Discussion and Future Direction for Pesticide Applications

The proportion of total liquid applications with glyphosate continued to decline in 2021. Additionally, the amount of product applied for control of billbug which has been rising also fell. Finally, the time spent applying pesticides remained lower than average in 2021. In the following sections these aspects of the data are discussed as well as some product substitutions, such as offsetting GBH use with preemergent herbicides and replacing neonicotinoid insecticides with more environmentally friendly options. BPR strongly believes that these are the correct choices for Boise's community and the health of its urban environment, though they come with a significant increase in cost. In 2021 the landscape chemical budget roughly doubled to provide resources for the purchase of more ecologically sound products.

3.1 Reduction in Use of Glyphosate Based Herbicides

There has been a concerted effort within BPR to reduce the amount of GBH applied to managed sites over the past several years. This has been done primarily by increasing the use of other broad-spectrum and preemergent herbicides. The effort has been made more difficult by the adoption waterwise designs for newer sites that incorporate less turf and more planter bed areas which tend to require more broad-spectrum herbicide application due to a lack of vegetative competition for undesirable species. The broad adoption of drip irrigation in planter beds across BPR managed sites has ameliorated this effect somewhat by limiting water to unvegetated areas.

As was discussed in the 2020 Pesticide Application Report, GBH use was significantly offset in 2021 by increasing the use of Casoron 4G, a broad spectrum, preemergent herbicide (Figure 3). BPR also continued to use Finale Herbicide which uses the active ingredient Glufosinate-ammonium preferentially at appropriate sites. It is reasonable to expect the proportion of GBH to continue falling in coming years, but then level off. GBH remain very important in combatting invasive species, performing restoration in open space reserves, and managing pesticide resistance in rights of way and medians.

3.2 Increase in Billbug Activity and Use of Neonicotinoid Insecticides

The increase in billbug activity has been noted at BPR managed sites over the past several years. Potential causes are discussed in Section 3. The industry standard treatment for billbug has been imidacloprid based insecticides for the past 20 years. Imidacloprid is a neonicotinoid insecticide which acts systemically on plants, meaning that, once absorbed into plant tissue, it will translocate throughout the organism. This aids in the control of target pests but is problematic for the protection of beneficial insects such as pollinators.

Pollinator decline has been documented globally (Kluser & Peduzzi, 2007) (Rhodes, 2018) and locally (The Xerces Society, 2021). Emerging research suggests that the way in which BPR utilizes imidacloprid is likely not dangerous to pollinators (Protecting Bees, 2021). However, given the severity of the plight of some pollinators,

BPR discontinued the use of imidacloprid based insecticides in 2021. All leftover stock of imidacloprid based insecticides were used and then applications shifted to chlorantraniliprole based insecticides as the primary chemical control for billbug and other insect pests. Chlorantraniliprole is also systemic but less harmful to pollinators (Williams, Swale, & Anderson, 2020). Some few products remain in BPR inventory that contain imidacloprid. These products are used as needed in places like the Julia Davis Rose Garden. These products will take longer to use to completion, but overall applications of imidacloprid containing products will be very low in the future.

3.3 Labor Hours Spent Applying Pesticides

Labor is the greatest expense associated with the application of pesticides. Labor hours associated with application rebounded slightly in 2021 but remain below average. Total amounts of product applied increased this year which seems counter-intuitive. The specific cause for this is unknown, but it is likely due to the shifting composition of applications. A far greater proportion of all applications were made up of granular, preemergent products in 2021. It is likely that this approach, though it takes careful and considered planning, is more efficient from a labor perspective. Data from future years will hopefully confirm this.

4. Update on Pesticide Use Reduction

2021 saw the continuation of the Pesticide Use Reduction Pilot Program (PURPP). The focus of the PURPP in Year 1 was to investigate routes of reducing GBH use at BPR managed sites. This goal was highly successful and revealed several reduction strategies that BPR plans to implement more broadly upon the culmination of the program. In 2021, reduction of imidacloprid use was implemented across all BPR sites.

Pesticide reduction remains difficult at relatively newer sites with large planter beds or non-turfed areas. At these sites, like Comba Park, a large bank of viable seeds form undesirable plants remains in the soil and there is little vegetative competition. We have also found that maintaining gravel pathways has been problematic with reduction strategies. In the past herbicides were used to control the encroachment of turf into these areas. The installation of concrete paths would be one possible solution.

Because of the circumstances surrounding the first year of the PURPP, BPR has decided to extend the program for one year. This means that the program will now culminate at the end of the 2022 growing season. Per the original proposal, BPR plans to adjust maintenance policies at this time to incorporate lessons learned from the pilot and support pesticide reduction across all managed sites.

4.1 Future for the PURPP

In the 2022 growing season BPR plans to take large steps toward advancing pesticide reduction. As was discussed in Section 3, 2,4-D and glyphosate-based herbicides make up the two most significant portions of overall pesticide use at BPR managed sites. Steps have been taken to reduce the use of GBH. In Year 3 BPR will

trial reductions of 2,4-D. Because it is suspected that reductions in broadleaf control in turf will generate more public interest, BPR feels that it is necessary to trial these reductions outside of the PURPP at as many sites as possible. This will allow BPR to gauge public support for these actions before adjusting policy at the end of 2022.

BPR plans to reduce 2,4-D use by creating a distinction between esthetic and non-esthetic uses of pesticides. Esthetic uses include all uses that are intended for the sole purpose of achieving a specific appearance in a landscape. Esthetic uses serve little to no functional purpose, such as benefitting public or environmental health, and generally promote certain plant types over others based on subjective ideals.

Non-esthetic uses include all uses intended to benefit public health and safety, improve environmental quality, preserve public or private property, or provide some other functional benefit to the property owner. Applications made to maintain the functionality of a landscape for its intended use are considered non-esthetic.

In 2022 only non-esthetic applications of 2,4-D based pesticides will be performed except at sports fields, golf courses, special event sites, rights of way and pools where esthetic applications will be continued. With this approach, it is estimated that 2,4-D applications can be reduced by approximately 40%. Public opinion will be critical to the success of these changes.

References

Kluser, S., & Peduzzi, P. (2007). *Global Pollinator Decline: A Literature Review.* Geneva, Switzerland: United Nations Environment Program.

Protecting Bees. (2021). *Bees and Plant Pests - Help growers manage plant pest outbreaks while minimizing the risks to bees*. Retrieved from protectingbees.njaes.rutgers.edu: https://protectingbees.njaes.rutgers.edu/research/bees-plant-pests/

Rhodes, C. J. (2018). Pollinator Decline - an ecological calamity in the making? *Science Progress, 101*(2), 121-160.

The Xerces Society. (2021, January). *Western Monarchs in Crisis*. Retrieved from xerces.org: https://xerces.org/western-monarch-call-to-action

Williams, J. R., Swale, D. R., & Anderson, T. D. (2020, Aug). Comparative effects of technical-grade and formulated chlorantraniliprole to the survivorship and locomotor activity of the honey bee, Apis mellifera (L.). *Pest Management Science, 76*(8), 2582-2588.

ID	Trade Name	Division	EPA Reg #	Category	Pesticide Actions	Active Ingredients	Formulation	PrimaryTarget
2	Acelepryn G	Parks	100-1500	Insecticide	, Systemic	Chlorantraniliprole, ,	Granular	Billbug, Japanese Beetle
7	Aquasweep	Parks	228-316	Herbicide	Postemergent, Selective	2,4-D (dimethylamine salt), Triclopyr (trimethylamine salt),	Liquid	Annual Broadleaf
15	Casoron 4G	Parks	400-168	Herbicide	Preemergent, Non-selective	Dichlobenil, ,	Granular	Broad Spectrum
16	Chaser 2 Amine	Parks	34704-930	Herbicide	Postemergent, Selective	2,4-D (dimethylamine salt), Triclopyr (trimethylamine salt),	Liquid	Annual Broadleaf
27	Criterion 0.5 G Insecticide	Parks	432-1328	Insecticide	, Systemic	Imidacloprid, ,	Granular	Billbug, Japanese Beetle
28	Criterion 2F Insecticide	Parks	432-1312	Insecticide	, Systemic	Imidacloprid, ,	Liquid	White Grub
35	Dimension 270G	Parks	7001-375	Herbicide	Preemergent, Selective	Dithiopyr, ,	Granular	Crabgrass
40	Enforcer Wasp And Yellow Jacket Foam V	Parks	40849-4	Insecticide	, Contact	Phenothrin, Tetramethrin,	Aerosol	Wasps
46	Finale Herbicide	Parks	432-1229	Herbicide	Postemergent, Non-selective	Glufosinate, ,	Liquid	Broad Spectrum
52	GameOn	Parks	62719-724	Herbicide	Postemergent, Selective	2,4-D (choline salt), Fluroxypyr-meptyl, Halauxifen-methyl	Liquid	Annual Broadleaf
74	Lebanon Treflan 5G Herbicide	Parks	961-405	Herbicide	Preemergent, Selective	Trifluralin, ,	Granular	Annual Plants
78	Makaze	Parks	34704-890	Herbicide	Postemergent, Systemic	Glyphosate (isopropylammonium), ,	Liquid	Broad Spectrum
80	Malice 2F Insecticide	Parks	34704-893	Insecticide	, Systemic	Imidacloprid, ,	Liquid	Billbug
86	Milestone	Open Space	62719-519	Herbicide	Postemergent, Selective	Aminopyralid-tripromine, ,	Liquid	Russian Knapweed
94	Pathfinder II	Open Space	62719-176	Herbicide	Postemergent, Selective	Triclopyr (butoxyethyl ester), ,	Liquid	Russian Olive
101	Plateau Herbicide	Open Space	241-365	Herbicide	Postemergent, Non-selective	Imazapic (ammonium salt), ,	Liquid	Broad Spectrum
102	Podium	Golf	100-937	Growth Regulator	,	Trinexapac-Ethyl, ,	Liquid	
106	Preen The Weed Preventer	Parks	961-280	Herbicide	Preemergent, Non-selective	Trifluralin, ,	Granular	Broad Spectrum
113	Proxy	Golf	432-1230	Growth Regulator	,	Ethephon, ,	Liquid	
115	PT Wasp-Freeze II Wasp & Hornet Insecti	Parks	499-550	Insecticide	, Contact	Prallethrin, ,	Aerosol	Wasps
119	QuickSilver T&O Herbicide	Parks	279-3265	Herbicide	Postemergent, Selective	Carfentrazone-Ethyl, ,	Liquid	Canada Thistle
144	Surflan AS Specialty Herbicide	Parks	70506-44	Herbicide	Preemergent, Selective	Oryzalin, ,	Liquid	Annual Plants
148	Telar XP Herbicide	Open Space	352-654	Herbicide	Pre/Postemergent, Selective	Chlorsulfuron, ,	Dry Flowable	Puncturevine, Russian Knapweed
174	Pendulum Aquacap Herbicide	Parks	241-416	Herbicide	Preemergent, Selective	Pendimethalin, ,	Liquid	Puncturevine, Annual Plants

Appendix B: Amount Active Ingredient Applied by Product

Product	Active Ingredient	Amt Applied (lbs)	% Total
Chaser 2 Amine	2,4-D	320.0765	25%
Makaze	Glyphosate	289.8947	23%
Chaser 2 Amine	Triclopyr	142.2562	11%
Casoron 4G	Dichlobenil	124.628	10%
Surflan AS	Oryzalin	88.75637	7%
GameOn	2,4-D	70.0553	5%
Proxy (Golf Courses)	Ethephon	55.85232	4%
Pendulum Aquacap	Pendimethalin	49.3001	4%
Finale	Glufosinate	38.48819	3%
Aquasweep	2,4-D	30.37482	2%
Treflan 5G	Trifluralin	21.25	2%
Aquasweep	Triclopyr	13.49992	1%
GameOn	Fluroxypyr-meptyl	9.413681	1%
Acelepryn	Chlorantraniliprole	7.0062	1%
Criterion 0.5G	Imidacloprid	3.6625	<1%
Telar XP	Chlorsulfuron	2.879707	<1%
Podium (Golf Courses)	Trinexapac-Ethyl	1.360458	<1%
Dimension 270G	Dithiopyr	1.08	<1%
Quicksilver	Carentrazone-Ethyl	1.064574	<1%
Pathfinder II	Triclopyr	1.022247	<1%
Milestone	Aminopyralid-Tripromine	0.900667	<1%
Criterion 2F	Imidacloprid	0.835603	<1%
GameOn	Halauxifen-methyl	0.459738	<1%
Preen	Trifluralin	0.294	<1%
Omega Gopher Grain Bait	Strychnine	0.15625	<1%
Malice 2F	Imidacloprid	0.055707	<1%
Plateau	Imazapic	0.02337	<1%
Wasp-Freeze II	Prallethrin	0.019133	<1%
Enforcer Wasp & Yellow Jacket Foam	Phenothrin	0.00833	<1%
Enforcer Wasp & Yellow Jacket Foam	Tetramethrin	0.00833	<1%