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Evaluation and Assessment of Rose Health in the Rose Garden

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An independent study project report by The Charles C. Holman Endowed Rose and Flower Garden Intern (2016-2017)

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Disciplines

Horticulture | Plant Pathology

Comments

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INTRODUCTION

Traditionally, roses are among one of the most popular garden ornamentals in the world, and have maintained their popularity over time. However, roses and rose gardens have also gained a reputation for being rather difficult to manage (Manners, 1999). Years of selecting for highly specific traits have left many roses, particularly hybrid tea varieties, with increased susceptibility to diseases (Debener, et al. 2003). Over time, this has resulted in pesticide-heavy management schemes for the control of rose pests and diseases. However, increasing environmental concern linked to pesticide application has shaped a sense of apprehension in both gardeners and the general public regarding heavy pesticide use (Mackay, 2008). This apprehension impacts the Morris Arboretum Rose Garden, and recent attempts have been made to transition toward a more sustainable means of rose management.

Two years ago, Rose Garden Intern Jenny Lauer designed an integrated pest management program specifically for the Morris Arboretum Rose Garden. This program emphasizes utilizing sustainable and ecologically responsible solutions to spot treat pest and disease issues before implementing pesticide-based controls. Specifically, this plan emphasizes the use of precise mechanical or biological pest control prior to the use of broad chemical control. Though this program exhibits a thoughtful and organized design, it lacked a detailed evaluation method to determine the specific impacts of health issues within the Rose Garden.

In order to properly implement the IPM program designed by former intern Jenny Lauer, the goal for this project is to design and implement an evaluation protocol to determine the current state of rose health in the Rose Garden, and to determine a series of recommendations based on the established IPM program and results of the initial health assessment. Furthermore, this project seeks to highlight the most and least successful cultivars within the Rose Garden, in an effort to identify and monitor roses that are naturally more susceptible to common health issues, and potentially replace them with more resilient cultivars in the future.

METHODS

In order to evaluate the Morris Arboretum rose collection, I first designed a rubric based on the EarthKind Rose trial evaluation rubric (Harp, et al. 2008). This rubric evaluates roses based on five parameters of health; blossoms, foliage, growth habit, pests, and disease (Table 1). Each rose is given a rating of 1-5, and each of the categories are added up for a total score, the maximum of which is 25 points. The roses were evaluated once a month from August to October, and the total scores were then used to group the roses into three categories; above average, average, and below average. “Above average” roses are defined by being rated above 20 at least 2 out of 3 months of the evaluation period, and are listed in Table 3. “Average” roses

are defined as rating between 14 and 20 throughout all three months. “Below average” roses are defined as rating below 13 at least two out of three months, and are listed in Table 2.

If during evaluation a rose is found to have a pest or disease, the rubric contained a notes section where the suspected pest or disease was noted. This was then tabulated to determine the most prolific and damaging issues found throughout the Rose Garden during the evaluation period. The Discussion section of this paper then indicates possible causes for these issues. Using the data from this evaluation, I then determined a short-term action plan for next year’s growing season. This action plan highlights some of the largest issues in the Rose Garden, the most susceptible roses, and some mechanical and biological techniques for remediating these issues and improving upon established rose health.

RESULTS

Though various pests and diseases were found throughout the Rose Garden, four major issues were found to impact the rose collection most severely; black spot, insect damage, rose midge, and deer browse. Black spot was the most widespread issue, affecting 84.24% of roses in August, increasing to 95.66% of roses in September, and affecting 97.83% of roses by the end of evaluation in October. General insect damage was similarly widespread, impacting 88.05% of roses in August, 79.35% of roses in September, and 83.7% of roses in October (Figure 1).

The instance of rose midge in the rose garden fluctuated more so than black spot or general insect damage over the course of the evaluation. No instance of rose midge was recorded in August, but 26.63% of roses exhibited signs of rose midge damage in September. This percentage then dropped to only 0.54% of roses impacted by October. In August, 8.7% of roses showed signs of deer browse, which dropped to 1.08% in September. The percentage of roses impacted by deer browse increased to 84.73% by the end of evaluation in October (Figure 1).

Though each monthly evaluation was as detailed as possible, there were some issues that were missed as a result of the evaluation’s focus on easily identifiable pest and disease issues and aesthetic value. It was not until after evaluation was completed in October and fall clean-up work began in the Rose Garden that I noticed the extent of vole damage at the base of a few accessioned roses. Though there is no data to reflect the impact of vole damage, potential causes and mitigation efforts will be touched on in both the Discussion and Action Plan sections.

Utilizing the compiled total scores for each rose throughout the three months of evaluation, the roses were separated into three groups. Out of the 184 roses evaluated in the Rose Garden, 26.6% scored Above Average, 66.9% scored Average, and 6.5% scored Below Average (Figure 2). A complete list of roses that scored Below Average and a complete list of roses that scored Above Average can be found in Table 1 and Table 2, respectively.

DISCUSSION

Black Spot

The most widespread issue found in the Rose Garden was black spot, which is caused by the fungus *Diplocarpon rosae* and is widely considered the most widespread and destructive disease of roses (Hagan, 2005). By the end of the evaluation period, over 97.83% of roses were affected by black spot to some degree (Figure 1). Black spot development is encouraged by warm weather and wet conditions, with fungal spores being spread primarily via water droplets. Additionally, fungal spores can overwinter on leaf litter remaining in garden beds (Kansas State Extension).

Pennsylvania experienced above average temperatures across all four seasons of 2016, which likely exacerbated the widespread black spot damage noted during evaluation (National Oceanic and Atmospheric Administration). Furthermore, according to Rosarian Vince Marrocco, leaf litter and mulch was not cleared out of the beds in much of the Rose Garden in the fall of 2015 due to busy schedules (Vince Marrocco, personal correspondence). Black spot spores likely overwintered in the Rose Garden beds, and were spread throughout the Rose Garden during the 2016 growing season by rainfall, consistent irrigation, and higher than average temperatures.

Deer Browse

Pennsylvania also experiences widespread browsing cause by the over population of deer, often leading to decreased species richness and diversity across the Eastern Deciduous Forest (Kain et al. 2011). The Morris Arboretum is no exception to the effects of over browse by deer. Despite the presence of a deer fence around the perimeter of the Rose Garden, instances of deer browse increased from impacting 8.7% of roses in August to 84.73% of roses by the end of evaluation in October (Figure 1). After implementation of a motion sensitive deer camera, it was determined that the deer were stepping through the openings of the gate at the top of the garden, and were also pushing their way underneath the plastic netting fence at the bottom of the Rose Garden. After installing additional deer fencing across the openings of the top gate, and staking down the netting at the bottom of the garden, instances of new deer browse was noticeably reduced (Figure 3).

Rose Midge & Insect Damage

An outbreak of rose midge was observed during the September evaluation, affecting 26.63% of roses (Figure 1). Rose midge is a fly that lays its eggs in the buds and shoots of roses, which hatch and feed on the rose bud, destroying the emerging growth. At the end of the season, rose midge larvae overwinter in the first few inches of mulch and remerge in the spring (Oregon State Extension). Despite multiple applications of horticultural oil, which is known to be effective against rose midge, the outbreak of rose midge occurred in September, and evidence of

rose midge damage persisted into October. This may be due to a small group of roses located on the wall above the main Rose Garden, adjacent to the Knockout Rose quadrant, which, according to Vince Marrocco, have never been treated with any pesticide applications. Due to the lack of treatment, it is possible that a rose midge outbreak went unnoticed in these roses, persisted in the untreated soil during the winter, and spread into the adjacent garden beds over the course of numerous growing seasons.

Despite widespread insect damage throughout the Rose Garden, it seemed that insect damage was more harmful to the aesthetic aspects of the roses, rather than their health. Some roses did experience premature defoliation, but that was likely due to extensive black spot rather than insect damage. Furthermore, aside from the characteristic rose bud damage caused by rose midge, it was incredibly difficult to discern the different types of damage caused by different insects.

Voles

Though not observed during evaluation, damage caused by voles was heavily prevalent throughout the Rose Garden at the end of the growing season. Most of the damage occurred at the base of perennials, as voles tend to create tunnel systems in the soil and eat away at the root systems of plants (Penn State Extension). The vole issue was likely exacerbated by the overgrowth of perennials in the Rose Garden, as cut back after the 2015 growing season was very minimal (Vince Marrocco, personal correspondence). The lack of perennial cut back likely allowed some of the voles to overwinter, leading to larger populations in the spring and subsequent damage to plants. Additionally, vole populations fluctuate rather rapidly, and experience a peak roughly every four years (Penn State Extension). The severe damage caused by voles in the 2016 growing season may have been in part due to a peak in vole population, which will likely not happen again for another few years.

Rose Performance

Out of the 184 roses evaluated in the Rose Garden, 26.6% scored Above Average, 66.9% scored Average, and 6.5% scored Below Average (Figure 2). Though 12 roses scored Below Average, this rating did not immediately result in their removal from the Rose Garden. Rather, a list of Below Average roses has been included for the purpose of comparing the current performance of these roses to their future performance (Table 2). Similarly, a list of Above Average roses has been included to compare to future evaluations of performance and to determine which roses perform best consistently over time (Table 3).

RECOMMENDATIONS

Utilizing the IPM program developed by former intern Jenny Lauer, along with the results of my own research, I have developed a list of potential short term solutions for each major issue for the Rose Garden, designed to help mitigate and prevent health issues throughout the 2017 growing season. The predominant issues were determined to be deer browse, vole damage, rose midge, and black spot, which are therefore the main focus of this plan (Figure 1).

Deer Browse

Though deer exclusion via fencing is an effective method of preventing excessive and damaging over browse, fencing must be continually maintained to ensure that the fence is working effectively (Kain et al., 2011). Steps are already being taken to improve the gates at the top and side entrances to the Rose Garden, as deer have been using the spacing between the bars as an entrance (Figure 3). In the future, I also recommend periodically inspecting the perimeter of the Rose Garden to ensure that there is no damage to the fence that would limit its effectiveness.

Voles

Vole populations tend to peak about every four years, so I predict that the Rose Garden will not experience such prolific vole damage as it did during the 2016 growing season (Penn State Extension). However, precautions should still be taken in order to further reduce the vole population. Specifically, perennials should be periodically cut back to prevent them from providing areas for voles to nest. This will additionally prevent perennials from sprawling onto the roses, which decreases airflow and increases susceptibility to disease.

Steps have already been taken toward installing screech owl boxes within proximity of the Rose Garden. Screech owls are predators of voles and other small rodents, and encouraging the establishment of a screech owl population will in turn promote predation of voles (Hungry Owl Project). The combination of perennial cut back and predation via screech owls or barn owls will likely decrease the vole population to a more manageable size.

Rose Midge & Insect Damage

The rose midge lays its eggs in the buds and shoots of roses, often causing damage characterized by blackened or dead rose buds. In order to control future populations, rose midge should ideally be scouted for on a biweekly basis during the growing season, during which time damaged rose buds should be removed and discarded. This will prevent adults from emerging and continuing their lifecycle, therefore reducing the potential rose damage. Additionally, rose midge larvae often overwinter in the top few centimeters of soil. In order to reduce spring emergence, each bed in the Rose Garden should be raked out at the end of the growing season (Oregon State Extension).

Though insect damage was not particularly harmful to the health of most of the roses, in some cases it certainly detracted from the rose's overall appearance. Should this damage continue to detract from the Rose Garden's aesthetics during future growing seasons, a more intensive evaluation may be called for to determine other damaging insects. Once it is determined what is causing the damage, then a course of action under the Rose Garden's IPM guidelines can be determined.

Black Spot

Though black spot is a prolific disease in the Rose Garden, there is not much that can be done in addition to the spray regime that is currently in place. However, black spot spores are capable of overwintering on leaf litter in garden beds, therefore rose midge and black spot outbreaks could be potentially reduced by raking out each bed at the end of the growing season, and disposing of the debris (Kansas State Extension).

CONCLUSION

Ultimately, the continued evaluation of the Morris Arboretum Rose Garden is an integral part of the Rose Garden IPM program. Monthly evaluation allows the staff to pinpoint pest and disease outbreaks, and allows for more precise means of control. Not only does this present an opportunity for researching and implementing various means of treatment, it also decreases our dependency on pesticide-based management schemes by allowing the staff to treat problems as they arise.

Furthermore, continued evaluation over time will allow the Morris Arboretum to build a record of rose performance in the Rose Garden. I hope that in creating this evaluation protocol that I have also aided in creating a resource that future interns can contribute to and build upon for years to come. Maintaining records of rose performance will ideally assist current and future staff members in maintaining current rose plantings, as well as aiding in determining which roses may work best in the Rose Garden in the future based on what has been successful in the past. The ability to spot treat rose health issues and reference successful cultivars from past years will ideally contribute to keeping the Rose Garden healthy and beautiful for years to come.

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TABLES AND FIGURES

Table 1. Evaluation rubric.

Rating	Foliage	Blossoms	Growth Habit	Disease	Pest
5	100% coverage, dark green	90% or more coverage	Symmetrical in all directions, consistent branch size	No disease	No pest
4	90% or more coverage, green, no chlorosis	75 to 90% coverage	Symmetrical in most directions, consistent branch size	<10% of blossoms/leaves infected	<10% of leaves/blossoms w/ insect damage
3	75 to 90% coverage, green, up to 25% leaves chlorotic	50 to 75% coverage	Symmetrical in only one direction, one branch w/ irregular growth	10 to 25% of blossoms/leaves infected	10 to 25% of leaves/blossoms w/ insect damage
2	25 to 50% coverage, light green, 25 to 50% chlorotic	25 to 50% coverage	Asymmetrical growth, two or more irregular branches	25 to 50% of blossoms/leaves infected	25 to 50% of leaves/blossoms w/ insect damage
1	<25% leaf coverage, yellow, >50% leaves chlorotic	<25% coverage	Inconsistent and irregular growth over entire plant	<50% of blossoms/leaves infected	<50% of leaves/blossoms w/ insect damage
0	Plant dead	Plant dead	Plant dead	Plant dead	Plant dead

Table 2. Below Average roses.

BED	**ACC_NUM&QUAL**	**COMMON_NAME caps = TRADE NAME**
Bed B	2015-074*A	GRAND AWARD rose
Bed C	2000-085*A	Baronne Prevost rose
Bed D	1998-226*A	Father Hugo rose
Bed D	2015-077*B	Peace rose
Bed Fb	2003-100*A	Buff Beauty rose
Bed K	1999-064*B	SCARLET STAR rose
Bed L	2005-076*A	Ferdinand Pichard rose
Bed L	2005-089*A	cabbage rose
Bed P	2005-074*A	Belle Isis rose
Bed Q	2005-078*A	Jacques Cartier rose
Bed R	2005-084*B	Veilchenblau rose
Bed R	2005-089*B	cabbage rose

Table 3. Above Average roses.

BED	**ACC_NUM&QUAL**	**COMMON_NAME caps = TRADE NAME**
Bed A	1994-258*A	ICEBERG rose
Bed A	2001-158*B	KENT rose
Bed A	2007-019*A	WHITE OUT rose
Bed B	2001-241*A	RUBY MEIDILAND rose
Bed B	2007-020*A	HOME RUN rose
Bed C	2013-097*A	CAREFREE BEAUTY rose
Bed C	2013-092*A	La Marne rose
Bed C	2005-094*A	CAREFREE WONDER rose
Bed C	2005-096*D	THE PINK KNOCK OUT rose
Bed D	2002-096*B	CAREFREE SUNSHINE rose
Bed D	2006-018*A	THE SUNNY KNOCK OUT rose
Bed D	2006-018*B	THE SUNNY KNOCK OUT rose
Bed E	2003-094*D	Albertine rose
Bed E	1992-151*D	WHITE COCKADE rose
Bed Fa	2013-087*A	Mt. Vernon Purple Noisette rose
Bed Fb	2003-110*C	JUDE THE OBSCURE rose
Bed Fb	2003-107*B	GRAHAM THOMAS rose
Bed Fb	2014-229*A	WINNER'S CIRCLE rose
Bed Gb	2016-126*A	Frau Dagmar Hartopp rose
Bed H	2011-047*A	JULIA CHILD rose
Bed Ic	2007-015*B	CAREFREE CELEBRATION rose
Bed Ic	2010-082*A	WINNER'S CIRCLE rose
Bed Ja	2003-118*B	Prairie Harvest rose

Bed Ja	2003-118*D	Prairie Harvest rose
Bed K	1994-169*B	AMERICA rose
Bed K	2015-082*A	WINNER'S CIRCLE rose
Bed K	2015-082*B	WINNER'S CIRCLE rose
Bed M	2005-071*A	Alfred de Dalmas rose
Bed M	2005-088*B	Marie Pavie rose
Bed M	2005-096*A	THE PINK KNOCK OUT rose
Bed N	1994-239*A	Chrylser Imperial rose
Bed N	2005-087*A	Great Maiden's Blush rose
Bed O	1994-239*B	Chrylser Imperial rose
Bed P	2005-096*B	THE PINK KNOCK OUT rose
Bed Q	2005-072*A	Ballerina rose
Bed Q	2005-096*C	THE PINK KNOCK OUT rose
Bed S	2005-095*A	THE KNOCK OUT rose
Bed S	2005-093*B	THE BLUSHING KNOCK OUT rose
Bed T	2005-095*B	THE KNOCK OUT rose
Bed T	2005-093*C	THE BLUSHING KNOCK OUT rose
Bed U	2005-095*C	THE KNOCK OUT rose
RGE Bed 1	2014-169*A	BONICA rose
RGE Bed 1	2014-164*A	HOME RUN rose
RGE Bed 3	2014-164*D	HOME RUN rose
RGE Bed 3	2014-164*E	HOME RUN rose
RGE Bed 4	2016-124*A	CRIMSON MEIDILAND rose
RGE Bed 4	2014-164*G	HOME RUN rose
RGE Bed 5	2014-170*A	New Dawn rose
RGE Bed 5	2014-171*B	Snow Pavement rose

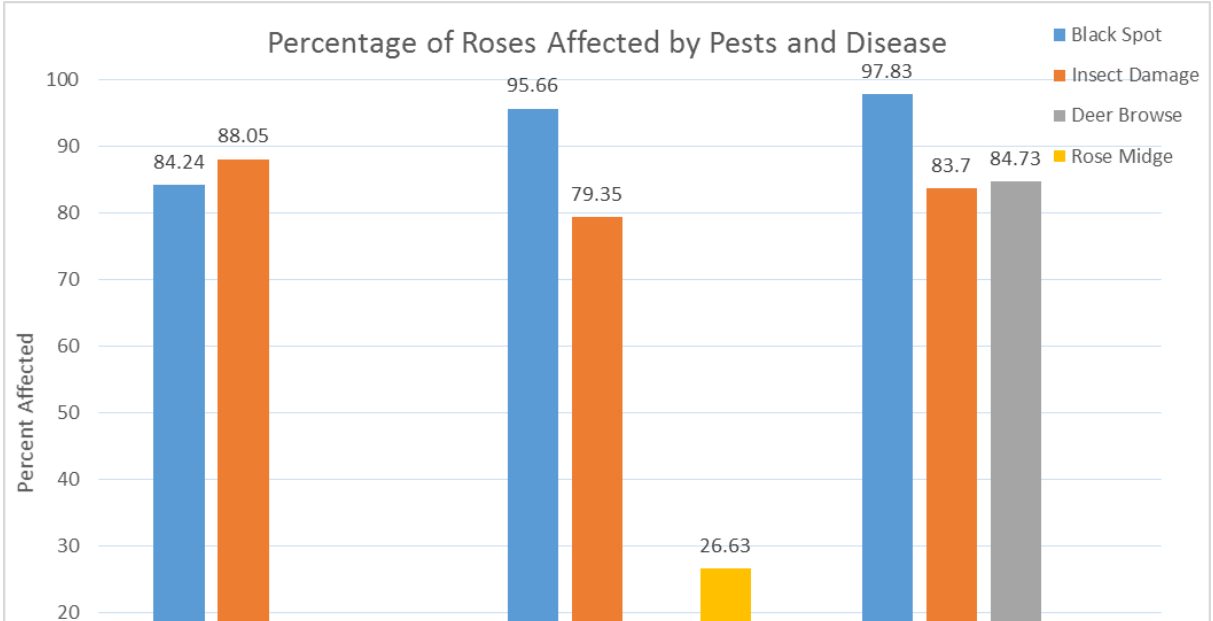

Figure 1. Percentage of roses affected by black spot, insect damage, deer browse, and rose midge each month during evaluation.

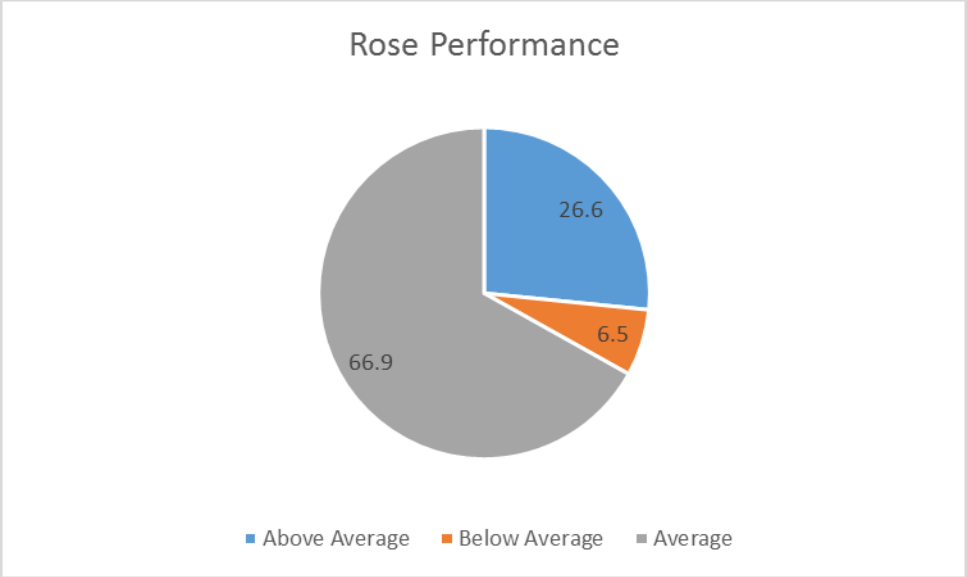

Figure 2. Percentage of roses rated Average, Above Average, and Below Average.

Figure 3. Still image of a deer attempting to enter the Rose Garden through the bars of the top gate.