



Consulting Rosarian Manual

4th Edition, October 2019
Last Revised, March 2021
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This manual is dedicated to
Louise Coleman and her committee
who were the pioneers of its creation.

Dave and Gerry Mahoney

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Introduction

In the early days of the transition of the American Rose Society from an organization of nurserymen to a society serving the general public, Dr. Robert Huey conceived the idea of providing a bureau of information for rose growers. In 1920, this group was formalized as 32 past presidents of ARS, hybridizers, nurserymen, scholars, and other noteworthy rosarians were designated “Consulting Rosarians,” and the CR program was born. In 1949, the ARS Board of Directors greatly broadened the scope of the service by deciding that Consulting Rosarians would be appointed by each district, following guidelines approved by the board. This made the knowledge of CRs available nationwide. To ensure further that Consulting Rosarians were well qualified, in 1996 a system of CR schools and exams, run by the districts, was established.

The American Rose Society is primarily an educational institution, and the Consulting Rosarian program is an important element in helping the Society carry out its educational mission. Hence, it is essential that every CR be qualified to give advice on rose culture. It is also important that every CR take an active part in the American Rose Society, in its districts, and in local rose societies. Consulting Rosarians are expected to inspire love and appreciation of roses. They should help recruit new members for both the ARS and local societies. Above all, they should be knowledgeable in all aspects of rose culture and should share this knowledge willingly and cheerfully.

The *Consulting Rosarian Manual* is intended as a tool to help Consulting Rosarians fulfill their duties. The first edition, published in 1995, was a “work in progress.” The second edition was produced after five years of use in the field. The third edition was compiled under the leadership of Mary Peterson, National CR Chair. The fourth edition was compiled by the ARS Consulting Rosarian Committee, (made up of all District CR Chairs), under the leadership of Dave and Gerry Mahoney, National CR Co-Chairs, and from the comments and recommendations of those who knew the manual best — the many Consulting Rosarians from across the country. We hope that suggestions and recommended additions will continue to be received, as the science of rose culture and the needs of our members evolve. This manual will also be a “work in progress,” as ARS strives to provide the most current information to our Consulting Rosarians and members.

The American Rose Society is not responsible
for any recommendation made by a Consulting Rosarian
that is contrary to this manual.

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Notes

Chapter 1 – The Consulting Rosarian

The Consulting Rosarian (CR) Program is an integration of persons knowledgeable in the culture of roses who serve the American Rose Society in a variety of capacities. There are several levels within the program, all of which are important for a smoothly running operation.

The levels of the Consulting Rosarian (CR) Program include the CRs, Master Rosarians (MRs), the National CR Chairman, National CR Committee, District CR Chairs, and Local Society CR Coordinators. Each level assists the other levels and the local societies.

The CRs and MRs are the ambassadors and representatives of the American Rose Society (ARS). They represent the ARS in direct interactions with the public. Each District has a CR Chair who is automatically on the National CR Committee. The District CR Chairs represent the District for all proposals and changes to the CR program.

Qualifications to Become a Consulting Rosarian

Any member of the American Rose Society qualifies as a Consulting Rosarian provided; they meet the following:

1. Are at least 18 years of age.
2. Have been a regular or associate member of the American Rose Society for two consecutive years.
3. Should have email, if possible.
4. Be an active member of a local rose society.
5. Have grown a variety of roses for at least five years.
6. The candidate must be knowledgeable of equipment and materials related to rose culture.
7. Attend an approved ARS School for Consulting Rosarians and complete and pass an open book exam based on the material contained in the *Consulting Rosarian Manual* with a score not less than 75%.
8. Sends a completed CR Candidate Form to the candidate's District CR Chair at least thirty days before the CR School.
9. Attend all programs presented at the school.
10. Must know and be willing to live up to the Consulting Rosarian Code.
11. Is willing to attend no less than one Consulting Rosarian School/Seminar every four years or accrue four Continuing Education (CE) credits (**one of which is chemical safety**) in four years by attending seminars approved by the National CR Chair. It is possible to accrue Continuing Education credits by accumulating four Continuing Education credits approved by the District CR Chair with one being Chemical Safety.
12. Exhibits a continuing willingness to share knowledge and an enthusiasm for the rose and the American Rose Society ideals.
13. Filing a Roses In Review (RIR) report yearly is expected.
14. A completed CR activity report form (if required by the District) must be submitted to the District CR Chair by the date designated by the District CR Chair.

15. After passing the open book written exam, the CR then receives a date for the completion of their next four-credit audit. CRs are required to accrue four CE credits (**one must be chemical safety**) in four years by either attending approved seminars for CE credits or by participating an approved CR School/Seminar by December 31st of their audit year.

A Consulting Rosarian ribbon badge is available from ARS Headquarters for those who have met the school and test requirements. School receipt certificates are required to obtain this badge.

Maintaining Your CR Certification

A Consulting Rosarian is required to maintain their certification by earning/accruing four CE credits (one of which MUST be on chemical safety) by December 31st of their expiring year.

Example:

A person becomes a CR on May 1, 2019 – to maintain their CR Certification, they must earn four CE Credits between May 1, 2019, and December 31, 2023 (their next audit year).

The District CR Chair and the individual CR track CE credits and the District CR Chair notifies the ARS when a CR has completed their requirements.

In addition to earning the four CE Credits a CR must:

1. Needs to maintain an active membership with the ARS.
2. Needs to maintain membership in local society.
3. Does not refuse/agree to have their name and method of contact listed in any rose related reference.
4. Exhibits a continuing willingness to share knowledge and an enthusiasm for the rose and the American Rose Society ideals.
5. Where applicable – Complete and submit a CR activity report form to the District CR Chair by the date designated by the District CR Chair.
6. Is expected to participate yearly in the Roses in Review (RIR).
7. Consulting Rosarians should be willing to support all the activities of the American Rose Society.

Consulting Rosarian Code

Every Consulting Rosarian, on accepting the appointment, should be fully cognizant of the Consulting Rosarian Code and should wholeheartedly be willing to live up to the code:

“I, _____, accept the honor of the official appointment as a Consulting Rosarian of the American Rose Society for the _____ District. I pledge my earnest efforts toward the increase and stimulation of membership in the American Rose Society, in cooperation with the District Director. I shall uphold the highest standards of our American Rose Society in inspiring a love and appreciation of roses, their culture, and exhibition. The aims and purposes of the American Rose Society shall be foremost in my mind in promoting and forming new rose societies, securing new members, and serving present members and anyone interested in roses. I recognize and accept the responsibilities of this post, as well as the privilege of service.”

Consulting Rosarian Guide

It is incumbent upon all Consulting Rosarians to exercise every effort to further a greater interest in the rose. They should SHARE their knowledge with anyone requesting information on the care of roses. The Consulting Rosarian should not wait to be asked but should share knowledge voluntarily and willingly help others. They should be available to help friends, neighbors, and rose society members in any way possible.

Being an active Consulting Rosarian is more than an obligation to share technical knowledge concerning roses; it is a call to service. It involves participation in every aspect of the rose society, to which they belong. The object is to HELP others and to stimulate greater interest in growing roses and rose culture. Each Consulting Rosarian should further the growth and scope of the local rose society to which they belong. On the broader level, Consulting Rosarians should be active in promoting the cause and interests of the American Rose Society in whatever way they can:

In Their Own Garden

They grow a variety of roses; such as hybrid teas, floribundas, grandifloras, climbers, miniatures, minifloras, shrubs, polyanthas, and old garden roses. There is no need to have acres of each type of rose, but there should be a few of each. The roses in their garden should include the most popular of the new introductions and roses that do well in their climate, so they are better able to answer questions concerning them.

Consulting Rosarians should be acquainted with what is NEW in rose culture; be it a new type of sprayer, a new insecticide or fungicide. They should be familiar with state and federal laws and regulations about the use of chemicals in the garden as it pertains to their District. They should know the proper application of garden chemicals and how they should be used, safety precautions to follow, and the safe storage and proper disposal of containers.

The rose garden of any Consulting Rosarian should be open for all to enjoy and admire, and the roses should be of the quality to inspire and encourage others to grow roses.

The Consulting Rosarian should be familiar with chemical and nontoxic approaches to growing roses. Regardless of the method, a Consulting Rosarian takes in their gardens; it should involve a decision-making Integrated Pest Management (IPM) process to take the appropriate action, whether it be with synthetic chemicals, natural chemicals, or no chemicals. **It is essential to be knowledgeable and supportive about any pest control methods when discussing these processes with other rosarians and the public.**

In the Local Rose Society

Consulting Rosarians should not have to be asked to help. They should meet with other Consulting Rosarians to share knowledge and information. They should volunteer to help wherever and whenever needed. They should be willing to hold an office, serve on the board of directors, head a committee, or perform any other task, which furthers the interests and growth of the society.

In the American Rose Society

1. Assist members and non-members with problems relating to the rose and rose culture.
2. Obtain new members for the American Rose Society.
3. Work together in organizing and assisting new rose societies.
4. Encourage each organized rose group/society to sponsor at least one rose show per year.

5. Attend the Consulting Rosarian portion of the district meeting each year
6. Be a member of the District Public Rose Garden Committee where one exists.
7. Complete and submit the annual Roses in Review survey each year, and the Quinquennial Survey every five years.
8. Attend local rose shows, answering questions when asked.
9. Ensure American Rose Society membership information is available at the show.
10. Have a willingness to share knowledge and an enthusiasm for the joys of growing roses

Active Consulting Rosarians are willing to give of themselves and have time to help others – members and non-members alike by sharing rose growing advice. An active Consulting Rosarian **must** convey to others that growing roses is a hobby with the potential for enjoyment and satisfaction. It increases with the love of roses and sharing knowledge.

Honorariums and Fees

It is against the principles of the Consulting Rosarian Program to charge a fee for advice on roses and rose culture. The only exception is when a CR is also a professional nurseryman or landscape designer and derives his/her livelihood from such pursuits.

An Honorarium may be graciously accepted for mileage and travel expenses when offered by the host or redirected to the ARS, their District or local society for any program presented by a Consulting Rosarian.

Notes

Updates

10/03/19 Entire Chapter 1 page 1-1 to 1-4

Notes

Chapter 2 – The Consulting Rosarian Program

The National Consulting Rosarian Chair and Committee

The President of the American Rose Society appoints a National Consulting Rosarian (CR) Chair who serves at the pleasure of the President for a concurrent term of that President. The National CR Chair shall review all links in the *CR Manual* in January of each year. The National CR Chair appoints a select committee to help conduct the mission of the CR Program. The District Consulting Rosarian Chairs are automatically members of this committee.

The National Lead Cyber Rosarian

The National CR Chair appoints a Lead Cyber Rosarian who serves concurrently with them. At the end of National CR Chair's three-year term, the Lead Cyber Rosarian may be reappointed by the incoming National CR Chair for an additional three-year term. However, the Lead Cyber Rosarian is limited to six consecutive years without a break in service.

The District Chair of Consulting Rosarians

Each District Director appoints a District CR Chair who serves concurrently with them. Qualifications for the individual appointed are: they served a minimum of six years as a Consulting Rosarian, they are active in District affairs for six years, and they have held membership in the American Rose Society for six consecutive years. Permission of the National CR Chair may allow exceptions.

Duties of the District Consulting Rosarian Chair

1. At the beginning of their term, the incoming District CR Chair shall obtain from the outgoing District CR Chair the names and statuses of active CRs in the District. The District CR Chair is responsible for exploring any questions related to all required criteria, including the required membership in ARS. ARS Headquarters shall provide membership verification.
2. Coordinate and assist, as requested, Local Society Consulting Rosarian Coordinators in obtaining and disseminating information about the District's CR activity at the local level.
3. Coordinate the submission of any reports and surveys requested by ARS National Committees and all other programs of the American Rose Society, which may benefit from Consulting Rosarian participation. Complete any report using a computer, typewriter, or legible printing. All national CR forms are available in fillable pdf format on the ARS website and from ARS Headquarters. Illegible paperwork is subject to rejection.
4. The District CR Chair, in cooperation with the District Director, should consider organizing and conducting a Consulting Rosarian School or Seminar each year during a district or local society meeting for Continuing Education (CE) credits.
5. The District CR Chair may approve one (1) hour seminars for CE credits.
6. The District CR Chair tracks these credits for their District CRs.

Consulting Rosarian Schools & Seminars

Objective

The objective of the School is twofold: the education needed to certify new Consulting Rosarians and to provide/update the knowledge base of existing CRs in rose culture, management of fertilizers, pesticides, soil amendments, nutrients, insects, and diseases of roses. A CR School helps reinforce the public relation's focus of the program.

District Chair's Responsibility for CR Schools

The District CR Chair directs all Consulting Rosarian Schools. Schools should be scheduled periodically in different areas of the District to make them accessible to the highest number of CRs.

The District CR Chair must notify ARS Headquarters of the date and location of any School in their District 60 days before the School. Upon School approval, ARS sends out the School package to the District CR Chair. The packet includes one copy of the necessary forms and the CR exam. The District CR Chair is responsible for making sufficient copies for the School.

The District CR Chair appoints qualified instructors for the School and advises the National CR Chair of the agenda and instructors 60 days before the School.

The District CR Chair provides candidate forms to new CR candidates 60 days before the School. The District CR Chair verifies the ARS membership requirement (two years) of all candidates with ARS upon receipt of the candidate form. (Candidates attending a School out of their District should notify their home District CR Chair.) If a candidate is attending a School out of their home District, the candidate must present this notification to the Chair of the School.

The District CR Chair shall provide attendance sheets for the School – both for the candidates and for existing CRs who are attending the School. After grading the exams, the District CR Chair notifies the Chair of the School, the candidates, and ARS, which candidates passed the exam and are recommended as new CRs. The District CR Chair reports to ARS existing CRs who completed the School for requalification and completion of their CE requirements. The District CR Chair also notifies the home District CR Chair of any students that completed the School and passed the exam for the out of District CRs in attendance. The District CR Chair is responsible for ensuring the CR Exam is graded on the day of the School, and the District CR Chair records NP (New Passed) for new CRs, E (Existing) for existing CRs, or RP (Reinstated Passed) on the School/Attendance form.

Qualified Instructors Might Be:

- Instructors from universities, colleges, specialized horticulture schools (e.g., nursery workers, professors), Master Gardeners, Master Rosarians, or professionals in the field, which they are teaching.

CR School Procedures – Requirements & Suggestions

- The School should be open to all who wish to attend; therefore, one should choose a venue of sufficient size.
- The **Minimum** duration of a School is four hours. Six to eight hours is better with a break for lunch. Each CORE topic covered should be one hour (45 minutes presentation and 15 minutes Q&A).

Chemical Safety

Soil & Water

Fe**R**tilizers

Ins**E**cts & Disease

- The agendas should be structured to follow the subjects in the text portion of the *CR Manual*.
- The principle of being helpful but keeping it simple is paramount.
- The Pesticides section should stress safety.
- The candidates should be advised that exam questions only include information in the text portion of the *Manual*.

- CR candidates may use a printed *Consulting Rosarian Manual* or an electronic device such as a laptop, tablet, or smartphone as a reference to take the CR exam. The exam room may or may not have internet, so please prepare your device before the exam. No sharing of a *Manual* or electronic device is permitted.
- Only CR candidates that have provided documentation can take the exam. Non-candidates should leave the area. Candidates taking the exam must score 75% or better for a passing grade. For ***in-person*** CR Schools, the District CR Chair should ensure the candidate knows which question(s) they missed reviewing the material. Each candidate is entitled to a CR Certificate. While it is recommended Districts pay for the Certificate, some Districts may choose to have individuals pay for the Certificate. When individuals pay, either the District CR Chair or CR School Chair collects the CR certificate fee of \$10 paid by check made out to the American Rose Society from the candidates at the School. The person collecting the payments forwards them to ARS Headquarters.
- Each candidate receives a Certificate of Attendance after completing the School and exam. Mailing the Certificates to all attendees is an option.
- At the option of the Chair of the School, existing CRs can be allowed to take the exam questions without using the *Manual*. The questions are then reviewed as a group, while the CRs self-correct their exams. Correcting exams this way is an excellent learning tool. When self-correcting the exam, the new CR candidates must take their exam in another location.
- If time permits or the school runs two days, a discussion of local rose-growing culture can be covered and encouraged but stressed that this is additional information and is not on the exam.

School Agenda *(this is a suggested agenda only, and may be arranged to suit the needs of the school)*

- Consulting Rosarian Program
- Consulting Rosarian Code
- **Soil and Water***
- BREAK
- **Fertilizers***
- LUNCH
- **Chemical Safety***
- **Insects and Diseases***
- Review Questions

****These are core topics and must be covered!***

Seminars/Workshops/Programs for Existing CRs

Seminars/Workshops/Programs for existing CRs should be promoted and considered at the National, District, and Local levels to encourage existing CRs to renew their CE credits in a timely fashion.

A Newsletter Article Review Committee should be formed to approve CE credits for articles appearing in local newsletters, district newsletters, and in the *American Rose* magazine (after notification of article acceptance by newsletter editors or by the magazine staff). A topic on Chemical Safety receives no credit. The Newsletter Article Review Committee should have a minimum of two newsletter editors, with the District CR Chair as an ad hoc member. This Committee may grant CE credits for articles appearing in these publications.

To facilitate obtaining CE credits, the District CR Chair may approve CE credits for topics presented at local, district, or national events. While not limiting the scope of these topics, the highest priority is topics that relate to roses, rose care, and safety.

Other topics, other than the CORE topics covered in a School, that are related to roses and rose culture can be considered and presented by a knowledgeable and experienced faculty. For four CE credits to be made available at such a Seminar, a program on Chemicals and Garden Safety **is mandatory**.

Topics to be covered should be one hour in duration, allowing for 15 minutes of Q&A. Such a proposed four CE credit program must be reviewed and approved by the National CR Chair before ARS Headquarters ships Seminar packets.

A Seminar/Workshop can be promoted via the ARS website and in the *American Rose* magazine (if there is a 90 days' lead time).

Possible Seminar Topics

Advanced information on soils, fertilizers, insects & diseases not covered by the <i>CR Manual</i>	Hybridizing	Rootstocks for Roses
Anatomy of the Rose	Landscaping with Roses	Rose Classes
Beyond Hybrid Teas	Miniature & Miniflora Roses	Rose Photography
Climbers, Scramblers, Ramblers & Ground Covers	Mulches & Ground Covers	Roses of the Middle Ages
Companion Planting with Roses	New Rose Introductions	Shrub Roses for Your Garden
Constructing a Watering System	OGR & Heirloom Roses	Shrubs in Landscape Design
Containerized Roses	OGRs & Shrub Roses for Small Gardens	Species Roses and their Influence on Modern Roses
Earth Kind Roses	Planting & Transplanting Roses	Structures & Supports for Climbing Roses
Fabulous Floribundas	Predator Abatement	Sustainable Rose Gardens
Green Fertilizers	Pretty Polyanthas	Tender Roses for Tough Climates
Hanging Rose Baskets	Privacy Hedges	Trellises, Arbors, Arches, Pergolas & Gazebos
Hardy Roses from the Explorer & Parkland Series	Propagation	Winter Rose Protection
Hardy Roses of Buck & Brownell	Pruning Roses	21st Century Roses
History of the Rose & Historic Roses	Raised Beds & Terracing	World of Hybrid Rugosas

District CR Chair Responsibilities for Seminars

1. The District CR Chair is responsible for requesting approval for all Four Credit Seminars using the Four Credit Seminar Request form.
2. Each District CR Chair gives each attendee at a Seminar an Individual Certificate of Attendance form at the end of the Seminar.
3. The District CR Chair is responsible for verifying attendees using the School/Seminar Attendance form.
4. The District CR Chair is responsible for submitting records of attendees. **(Suggested maximum time limit is ten working days after the School.)**
5. Each attendee is given the CR School/Critique form for feedback on the event.

ARS Headquarters Responsibilities

- ARS sends out one School packet to the District CR Chair at least 30 days before the school.
- ARS verifies the two-year membership requirement **(no exceptions)** for new candidates and a reply sent to the requesting District CR Chair immediately.
- ARS sends CR certificates for new CRs to the District CR Chair once the District CR Chair notifies ARS of those who completed the school and passed the exam.
- Periodically during the year, ARS sends the National CR Chair and District CR Chairs a report of requalified CRs and new CRs in each District. ARS sends a final report of all District CRs at the end of each year.

Attending a School for CR Recertification

A Consulting Rosarian may sometimes be removed from the rolls due to a lapse in ARS dues or failing to earn their CE credits. Once removed from the rolls, a CR may be recertified and placed on the rolls again by:

- Attending an accredited CR School.
- Must attend all programs presented at the School.
- Must sign the Attendance Sheet.
- Must retake the CR Exam (should the CR be off the rolls for two years or more).

After attending the School, the reinstated CR receives a new certification date from their District CR Chair. This date represents a new target for the completion of their next four-point CE requirement. Refer to page 1-2 for more information on maintaining CR certification.

A Consulting Rosarian ribbon badge and certificate are available from ARS Headquarters for those who have met the School and exam requirements.

The Typical CR Seminar

The CR Seminar is an effective way of presenting educational information to the public and for local area CRs to earn CE Credits. These seminars take the place of attending a CR School.

A local society may ask a qualified individual to present one of the core CR topics as a program at one of their local society meetings. These core topics are:

- Chemical Safety
- Soils and Water
- Fertilizers
- Insects and Diseases

District CR Chairs may approve one-hour seminars on Chemical Safety and the suggested Seminar Topics on page 2-4. Additional topics on rose culture can also be considered. Each CR may earn four CEs each four years with this method.

Advertising Seminars at local society meetings, to the public, other CRs, and other horticulture society members often increases attendance.

The seminar consists of 45 minutes for presentation/15 minutes for questions and answers.

Just as with a CR School, the District CR Chair receives the Attendance sheet and records the CE credit earned for each attending CR. Once the CR reaches their four CE credits, the District CR Chair notifies ARS that the CR has completed their renewal requirement. Refer to page 1-2 for more information on maintaining CR certification.

CR Records

The District CR Chair keeps the records of the CRs in the District and passes them to their successor. District CR Chair responsibilities are:

- Recording CR contact information.
- Track individual CR CE credits when earned.
- Notify ARS and the National CR Chair when a CR has completed their CE credit requirement.
- Send any appropriate certificates to the CRs as needed.
- Track Roses In Review participation.
- Record the individual Annual CR Reports (if required by the District).

If a Consulting Rosarian fails to accrue their four CE credits before the end of their recertification year, the CR becomes lapsed in their accreditation. When a CR is considered lapsed, the District CR Chair, along with the National CR Chair, discuss methods and actions to reinstate such CRs.

The District CR Chair shall consider, with the concurrence of the District Director, the removal of any Consulting Rosarian who is no longer a member of local a society, or who refuses to have their name and contact information listed in rose reference materials. Exceptional circumstances receive consideration.

The District CR Chair shall exchange useful information and program materials with the National CR Chair for publication in national, district, and local bulletins.

The District CR Chair shall provide each CR in the District, through the Local CR Coordinators, all guideline materials relating to their duties. Each District has the option of developing its own District Annual Report.

Outstanding Consulting Rosarian Award

The District CR Chair chairs the Outstanding Consulting Rosarian Award Committee. The committee consists of the District CR Chair, the District Director, and the District Chair of Awards. This committee is not eligible for the award.

The Outstanding CR Award is the highest District award for CR work awarded by the ARS.

Criteria include, but not limited to:

- Nominees should have been an active CR for at least ten years.
- Nominees must be ARS members in good standing.
- Nominees must be members of the District. If the nominee has moved out of the District, they must have lived within the District for at least six months of the previous year.
- The award can be given posthumously, provided the nominee lived within the District for at least six months of the previous year.
- Participation in local society activities (such as rose clinics, speaking at meetings, writing articles for the newsletter).
- Demonstration of competency in all knowledge areas of local rose culture.
- Served as a faculty member of a CR School, Seminar, or rose culture Workshop.
- Willingly shares their knowledge with people who exhibit interest in growing roses.
- Wholeheartedly supports the ARS.
- The OCR Award should be considered a lifetime achievement and only awarded to an individual once.
- Each District CR Chair should call for nominations at the beginning of each year. They should consult with their local Boards of Directors and local CRs for suggested nominations.
- Nominations are received back, compiled, and the District CR Chair checks for eligibility.
- Prizes and Award Committee members and appointed District Board members are eligible for the award provided they are CRs.
- The District CR Chair presents the OCR Award to the recipient at the next suitable occasion.

Permission for deviation from the guidelines due to operational and geographic problems requires approval by the National CR Chair.

The Local Society Consulting Rosarian Coordinator

The Local Society CR Coordinators are the bridge between the local CRs' activities and the District CR Chair. Each local society should have a CR Coordinator, and this person should be a knowledgeable rosarian who has at least three years of experience as a CR.

At the request of the District CR Chair, the President of the local society shall appoint a Local CR Coordinator. This CR Coordinator's term runs concurrently with the Local Society President's term.

The Local Society President notifies the District CR Chair of this appointment. The Local Society CR Coordinator organizes the activities of Consulting Rosarians within their local society.

Duties of the Local Coordinator

The role of the Local CR Coordinator is essential. The Local CR Coordinator should:

1. Organize the CR activities of all the CRs within their local society.
2. Ensure that local CRs submit all necessary forms, Annual Reports (if required), and ensure the District CR Chair receives them.
3. Assist local CRs completing annual RIR Reports on time.
4. Assign CRs to new local society members (not just ARS members) to 'mentor' these members who would then feel free to call to ask questions or seek assistance. The Local CR Coordinator should divide newer members in their society into small groups and assign one of the Consulting Rosarians to each group to answer questions and offer advice.
5. Assist in setting up a CR information table at meetings, rose shows, fundraisers.
6. Display an "Ask the Rose Expert" sign to encourage "newbies" to ask questions.
7. Institute a Consulting Rosarian led program "What Rosarians should be doing in the Garden this Month" segment at each meeting. This short informational presentation would address members' problems and encourage interaction with new members.
8. Chair meetings of Local CRs and encourage their participation in all local, district, and national events (when possible).
9. Introduce the CR Program to the general public. The Local CR Coordinator should organize events at local nurseries, garden clubs, public gardens, where CRs can meet and be of assistance to the general public. Consulting Rosarians should attend and be present at the local rose show.
10. Create opportunities to introduce CRs to the public.
11. Seek new ARS members by describing all the benefits of membership and encouraging qualified rosarians also to become CRs.

Please remember that CRs are the representatives of the ARS. They need to be available, recognizable, and eager to help further the goals of the local society, the District, and the ARS.

Local society officers are encouraged to support their Local CR Coordinator and all CRs. The officers should lend their assistance to promote and sustain this critical work.

Consulting Rosarian Emeritus

The ARS Board of Directors approved Consulting Rosarian Emeritus in June 1994. The honor is for those who have served as a CR for at least ten years and no longer wish to be active.

A CR who qualifies may request Emeritus status through the District CR Chair. The District CR Chair may suggest this status to a Consulting Rosarian in declining health if the Consulting Rosarian qualifies.

Upon approval of the request by the District and National CR Chair, the District CR Chair presents each new Consulting Rosarian Emeritus with a certificate of appreciation for past service. The District CR Chair presents the Emeritus designation to the recipient at the next suitable occasion.

The District or Society making the request pays for the certificate. Listing a Consulting Rosarian Emeritus' name requires name only (no contact information) and marked as Emeritus.

Master Rosarian Designation (MR)

Consulting Rosarians are among the most knowledgeable and active people in the American Rose Society. The ARS needs a well-motivated and educated group of CRs if the ARS is to continue to succeed in its mission. The MR designation was created to recognize those CRs who have made outstanding contributions as CRs over a significant period.

The MR is a CR who:

1. Demonstrates knowledge of roses and their culture.
2. Shows a strong and demonstrated willingness to share this knowledge with other rosarians and the general public.
3. Exemplifies the ethical behavior of the CR Program. The achievement of the MR designation by a CR is intended to recognize their outstanding contributions.

Basic Requirements

1. A minimum of ten years of continuous service as an active CR.
2. They demonstrate outstanding performance (documented in the nomination form).
3. They are an active accredited CR at the time of the nomination.
4. They show a willingness to continue to serve as a CR.

Nomination, Selection, and Communication Process

The District CR Chair creates a Master Rosarian Review Committee to review nominations for Master Rosarian. The Committee consists of the District CR Chair, the District Director, and at least one other person. The District CR Chair should serve as the Chair of the Committee and facilitate the process.

1. Each spring ARS announces the complete rules and procedures by sending each District CR Chair the necessary forms to use for publication on their District website and in the local and District newsletters.
2. The District CR Chair places an announcement for solicitations for Master Rosarians in local society newsletters, the District newsletter, on the District Website, and via email communication systems. The District Director and the local society presidents inform their memberships of the nomination and selection processes. There are no limits to the number of yearly selections of MRs within a District. If there are questions about a nominee's qualifications, the Master Rosarian Review Committee may request additional information from the author of the nomination or the nominees themselves.
3. Nominations are submitted on the official Master Rosarian Nomination form available from ARS Headquarters and on the ARS website. CRs may nominate themselves; be nominated by other ARS members; or be nominated by a Committee of their local rose society or the District.
4. Each nomination form must be completed in its entirety. While every question may not be relevant to every nominee, a Master Rosarian should excel in at least several areas. If additional documentation is needed or requested, the person completing the nomination should ask the nominee. An incomplete form weakens the overall nomination. A 'yes' response is not sufficient.

5. The District CR Chair receives the completed nomination forms. The Master Rosarian Review Committee reviews the nominations for approval. The basis for selections relies on information provided in the nomination form and from personal knowledge of the candidates' credentials. Special consideration should be afforded to the nominee for filing Roses In Review (RIR) and District Annual reports (if required). Permission for deviation from the guidelines due to operational and geographic problems requires approval by the National CR Chair.
6. The National CR Chair reviews the decisions of the Committee and announces the final selection. The National CR Chair resolves any disagreements. Districts should acknowledge the new MRs at the district meeting or some other suitable event. All new MRs receive the MR Certificate from ARS Headquarters when paid by the district. An optional MR pin is available for purchase. If there is no appropriate District meeting, the announcements may be at the local society level.
7. Local societies and Districts are encouraged to publicize the names of those who have achieved the Master Rosarian designation.

Notes

Updates

10/03/19 Entire Chapter 2 page 2-1 to 2-9

8/27/20 page 2-3 electronic devices permitted

Notes

Chapter 3 – The Consulting Rosarian Mission

The Right Attitude

Consulting Rosarians are respected members of local, district, and national rose societies. As such, it is vital to maintaining the right attitude. Earning this title is not the end but the beginning. Keep in mind that you are a representative of the American Rose Society and obligated to further its goal “. . . to educate the public about roses in order to foster and promote the growing and the love of roses.” Consulting Rosarians should be visible in the local rose society and the community by their willingness to help. Consulting Rosarians are usually more knowledgeable than those who seek their help, but this knowledge should be shared in a friendly, non-offensive way. Remember, the common bond is the love of roses.

When a fellow rosarian asks for advice it should be given with a helpful attitude, trying to solve the problem rather than showing off. A willingness to give time and information to help another rosarian successfully grow roses is a Consulting Rosarian’s duty. We can do this by:

Qualifications to Become a Consulting Rosarian

Any member of the American Rose Society qualifies as a Consulting Rosarian provided; they meet the following:

- Encouraging others to grow roses.
- Keeping abreast of new varieties, new chemicals used to treat roses, and common problems in their area (as well as the solutions).
- Know which varieties perform best in their area and recommend these roses to them.
- Willing to write articles for their local bulletins that are helpful to others.

No one can know everything. Thus, Consulting Rosarians should attend workshops and seminars, and not be embarrassed to ask other Consulting Rosarians for advice. There are so many aspects to growing roses that learning should be an ongoing process.

Remember, K.I.S.S. (keep it super simple) when talking to a new rose grower. Don’t turn a simple question into a complicated explanation. This is discouraging and makes rose growing seem too difficult. Most new growers need to know the basics. As their gardens improve, they will seek more knowledge. Stress the pleasure and fun of the hobby rather than the problems they may encounter. Offer to be there as unfamiliar problems arise.

Be positive about roses, their culture, and the American Rose Society.

Connecting with the Public

It doesn’t make sense to be a Consulting Rosarian if there is no one to consult with or advise. Meeting with the public to make them aware that there are Consulting Rosarians ready, willing, and able to help them grow better roses is especially important. Here are a few suggestions for the Consulting Rosarian:

- Be involved in the public activities of your local society. Be sure provisions are made for a Consulting Rosarian table where people can ask questions and get information, especially at a rose show. The Consulting Rosarians who serve at these tables have the opportunity to answer questions and help the public.
- If your local society’s only public activity is a rose show, organize other activities, such as pruning demonstrations, garden tours, programs at local public gardens, etc.

- Contact garden clubs, beautification committees, and other organizations and offer to put on a rose program about roses. Outline the basics of good growing practices in these programs and keep it simple. Follow the program with a question and answer period. Pass out information on your local society and the American Rose Society. Be sure to include your name, email address, and phone number. Let them know you are available to help them with their roses. Consulting Rosarians are not expected to speak at a group where they have personal philosophical differences, and they should never get involved with the club's internal policies or politics. If you talk at one of these meetings, just talk roses and their rose culture.
- Visit your local nursery and let them know you are willing to help them with their roses. You can advise them on the best varieties to order and help if they need it. Ask the nursery to post information on your local rose society for their customers, as well as a list of available Consulting Rosarians. Offer to do a rose day (with a few other Consulting Rosarians). This gives you the opportunity to meet and advise people on buying and growing roses.
- When contacting the public, let them know you are a volunteer, representing the local rose society and the American Rose Society, and not the nursery, sales company, etc.
- As a fundraiser and an opportunity to meet the public, consider selling roses at a local fair or flea market. Provide information on growing roses, the local rose society, the American Rose Society, and the local Consulting Rosarians.
- Offer to write articles for the local newspaper or do a program on local public TV/radio. These articles/programs reach many people and may result in the public contacting you for advice.
- If possible, grow some roses in your front yard. This attracts attention and affords an opportunity to talk to passersby about roses. You will become known as a rose grower in the local community, and people will seek you out for advice.

Helping New Rose Growers

Membership is the key to our future, both in the local rose society and the American Rose Society. Dealing with new rose growers who seek help is especially important. They may be potential new members and should be treated with respect and dignity.

Take the time to visit their garden, but never criticize it. Instead, make helpful suggestions for proper cultural practices. Follow the K.I.S.S. system and "Keep It Super Simple." Don't overwhelm them with so much information they get discouraged and NEVER be an "Insulting Rosarian." Make up a list of roses that grow well in your area to have on hand for new growers. Have a list of nurseries that provide quality stock. Many new growers get discouraged because they have limited success when they choose the wrong roses for their area and growing ability, plant inferior stock, or plant them their roses incorrectly for their area. Offer to show them how to prune, plant, etc. Invite them to a rose meeting and introduce them to other members. Keep in touch to see how their roses are doing.

Don't always wait to be asked; if you see a few roses, ring the bell and introduce yourself as a fellow rose lover. If you are shy, write a note to introduce yourself and invite them to the next society meeting.

It may be possible to become the community's rose expert by writing a regular column about roses for your local paper. Your expertise as to the specific cultural needs of roses in your area can easily lead to many opportunities to meet local rose growers.

Have a newsletter circulated to the local nurseries so that they can copy it and have it available to their customers. If having a newsletter distributed to the nurseries is beyond your control, individual information sheets that also advertise your local society can be used very effectively. Your local nurseries may welcome these efforts on your part.

The Last Word

Keep your enthusiasm; share your knowledge with others; be involved in your local society; participate in rose activities, and use this reference manual to help others and promote the love of the rose.

Remember to Keep It Super Simple (K.I.S.S.) and Positive when Advising Others.

Notes

Updates

8/27/20 Entire Chapter 3 page 3-1 to 3-4

Chapter 4 – Basic Rose Culture

This chapter covers basic information and culture for review and reference by Consulting Rosarians. The information is not regional but instead includes most of the elements that are the foundation of growing good roses anywhere. A well-informed and knowledgeable Consulting Rosarian can better help others to successfully grow good roses, thus promoting the love of the rose!

Types of Roses

Roses are divided into several types or classes based on flower size, inflorescence, and growth habit.

Hybrid Teas

The most popular, readily available, and widely grown roses are hybrid teas. Hybrid tea roses are usually fair-sized bushes with long canes topped with one well-formed bloom. At times hybrid tea roses can form sprays.

Floribundas

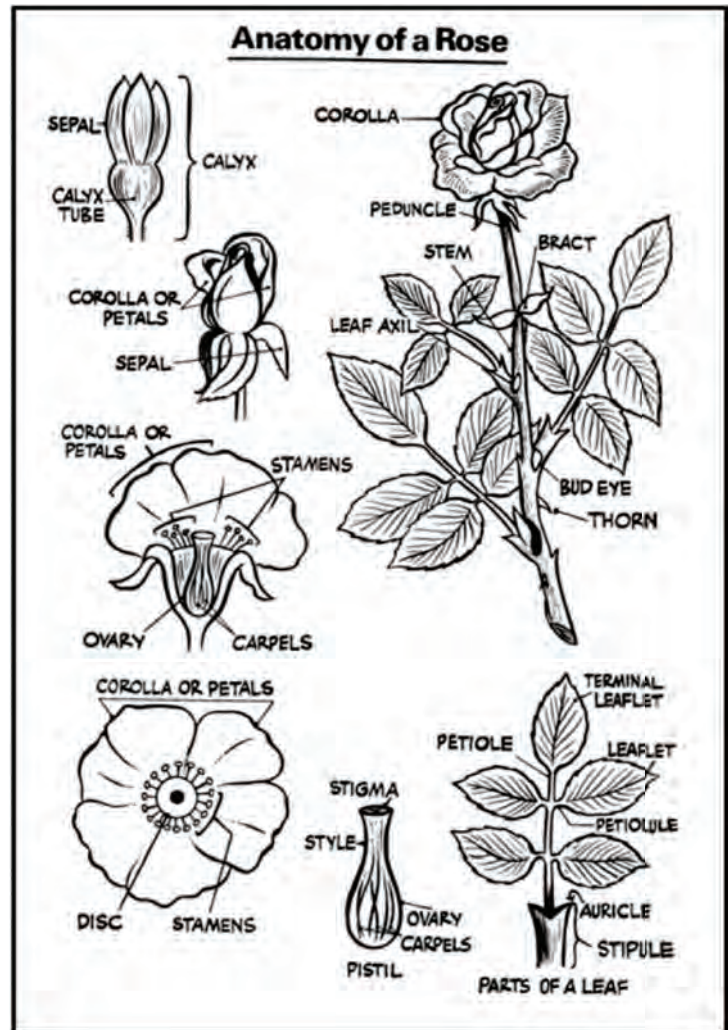
Floribundas are usually smaller-sized bushes than hybrid teas, with smaller blooms that come singularly or in sprays. Floribundas often make ideal landscape roses.

Grandifloras

Grandifloras have characteristics that can be one-bloom-per-stem canes along with sprays. They are generally taller bushes than hybrid teas with smaller blooms that are larger than floribundas.

Climbing Roses

Climbing roses do not actually “climb” in the sense that other plants do. They do not twine or have tendrils. Climbing roses are roses that have a very vigorous growth habit. Climbing roses consist of three general types. Large-flowered Climbers and Hybrid Giganteas, which often have tall, stiff canes that repeat bloom with single blooms and sprays. There are rambler-type climbers (Hybrid Wichuranas) that have long flexible canes that require support, and have sprays with small blooms, that generally do not repeat. There are also sports (mutations) of hybrid teas, floribundas, miniatures, etc., which resemble their bush counterparts except for their climbing growth habit.



Credit: *Guidelines and Rules for Judging Roses*, American Rose Society, 2012

Polyanthas

Polyanthas are low-growing bushes with small flowers borne in large clusters. Polyanthas make excellent landscape plants and can be used in the front of larger planting beds and for borders.

Miniatures

Miniature roses are roses that are smaller in plant height, foliage, and bloom size. They are bred to stay small in size and range from the smallest roses with blooms as little as a one quarter inch in diameter to about two inches in diameter.

Minifloras

Miniflora roses are plants that are larger than miniature roses but not as large as floribundas. Bloom size is generally between two and three inches in diameter.

Old Garden Roses

In 1966, the American Rose Society defined old garden roses as those types that belong to classes of roses that existed before 1867 (the assigned year of introduction of what was thought to be the first hybrid tea, 'La France'). Several popular subdivisions exist based on natural, historical developments, and other characteristics. The flower form can be quartered, cupped, expanded, reflexed, globular, or compact. After an initial spring flush, many old garden roses do not produce any more flowers for the rest of the year, but their hip production often adds a different dimension to the garden. The beauty and charm of old garden roses often lie in the heavy fragrance they can impart to the garden.

Shrub Roses (Classic & Modern)

Shrub roses are roses that do not fit well into the other classes of roses. There are Classic Shrubs and Modern Shrubs. Classic Shrubs are shrubs that are often defined by their parentage. There are four different classes of Classic Shrubs that include: Hybrid Kordeii, Hybrid Moyesii, Hybrid Musk, and Hybrid Rugosa. The fifth type of shrub rose is a modern Shrub, which is a mixture of different lineages. Shrub roses often can sprawl and grow from five to fifteen feet (or more) in every direction. They can also be low and spreading or upright. Shrub roses are often noted for their disease-resistance and hardiness, and many produce massive quantities of cluster-flowered blooms. There is also a group of roses hybridized by David Austin (often called English Roses) that are modern Shrubs. These roses resemble old garden roses in shape and form but are mostly recurrent bloomers (and often have excellent fragrance).

Planting Roses

When deciding to add a new rose to your garden, the first decision you should make is where you are going to plant the rose. These considerations need decisions:

Location

1. Does the location receive six to eight hours of sunlight daily?
2. Does the location provide good drainage?
 - a. Roses need well-drained soil. While they require a great deal of water, a wet, waterlogged soil retards their growth, and can outright kill them.
 - b. Digging deep planting holes usually provides adequate drainage.
 - c. Sometimes installing raised beds or tile drainage systems in low-lying areas may be necessary.
 - d. A well-prepared hole, deeply dug, provides a drained environment for the roots in most cases.

Timing

1. When is the best time to plant a new rose?
 - a. In most of the United States, early spring, when the soil becomes workable with mild air temperatures is the best time to plant roses.
 - b. Late autumn is also an appropriate time to plant roses in some areas and favored by many rosarians. It is preferred because the soil is still warm, although the air temperature is dropping. The warm soil allows the rose to develop a healthy root system, while the top growth is slowing down. When spring returns, the established rose is ready to explode with new growth and blooms.

After addressing these considerations, it is time to address site preparation, including digging a hole.

Hole

1. Dig a hole about two feet in diameter and at least two feet deep.
2. Digging a depth of two feet is done to ensure the loose soil below the root growth area allows for proper drainage.
 - a. There are also good chances that the soil in the bottom third of the hole is heavy clay. This extra clay material from the bottom of the hole is tossed away and the remaining soil is mixed with a comparable volume of organic matter (such as peat moss, cow manure, or compost). Rose roots thrive and do their best in a light and airy clay that has been modified by the addition of organic matter.
 - b. If the soil is all a very heavy clay, add five or six handfuls of gypsum. This gypsum will alter the balance of calcium, sodium, and other mineral nutrients in the soil. Gypsum mixed with clay soils helps break the clay up, keep it porous, and lets the organics do their job. After applying gypsum for three years to a heavy clay soil, an improvement should be seen.

After preparing the hole, attention turns toward the rose.

The Bud Union

1. See figure 1 on how to identify a bud union on a grafted rose. If your rose does not have a bud union, it is an own-root rose and should be planted at the same level it was at previously.
2. Position the bud union appropriate for your zone.
 - a. In warmer climates (USDA Zones 9 and above), place the rosebush in the hole, so the bud union is at or one inch - two inches above ground level.
 - b. In temperate climates (USDA Zone 8), place the rosebush with the bud union at ground level.

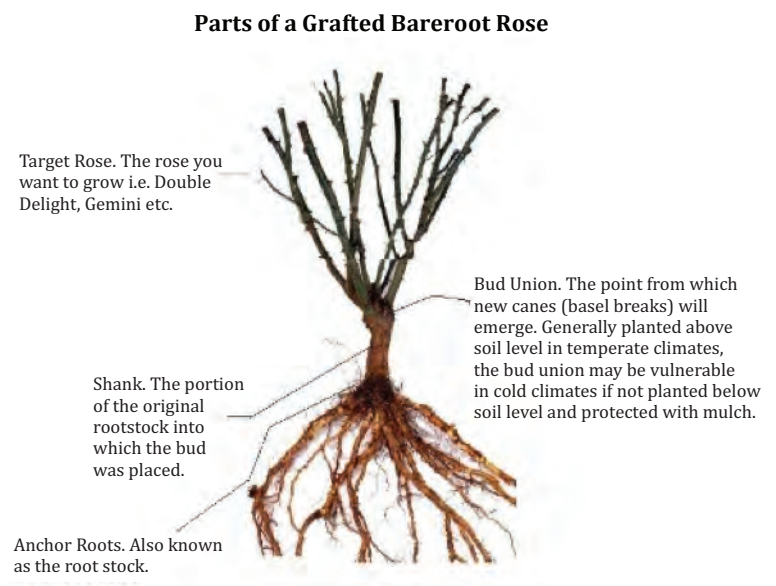


Figure 1

Credit: *All About Roses*, Dr. Tommy Cairns, Meredith, 1999

- c. In colder climates (USDA Zones 7 and lower), place the rosebush with the bud union three inches - four inches below ground level. Placing the bud union below ground level helps to protect the bud union during cold winter months.

Bareroot Roses (See Figure 2)

1. It is essential that bare-root roses be moist and not be allowed to dry out. Fully immerse the plants in a container full of water and let them soak in water for several hours before planting. Bare root roses are dormant and are not actively growing. They require less care than actively growing plants. Soaking does not harm them. On the contrary, it ensures the roses are well hydrated for planting.
2. Roses are available as either own root or grafted. Rooting cuttings/layering produces "own root" roses. All parts of the plant are the same, and if the plant dies back to the ground, the rose will come back from the roots true to form. Joining two different roses creates grafted roses. The desired rose on top joins the bottom rootstock by grafting. Where the two parts connect creates a knob. This knob is known as the bud union. Both own root and grafted roses are available as bare root or potted. By knowing if your rose is grafted or own root determines your planting depth.
3. It is often necessary to trim the roots on a bare root rose before planting. With pruning shears, remove any broken roots and cut the roots to a length that will conveniently fit into the hole. Roots eight to ten inches are long enough. Do not try to stuff long roots into the hole by wrapping them in a spiral. Properly pruned roots sprout plenty of new rootlets as the bush becomes established.

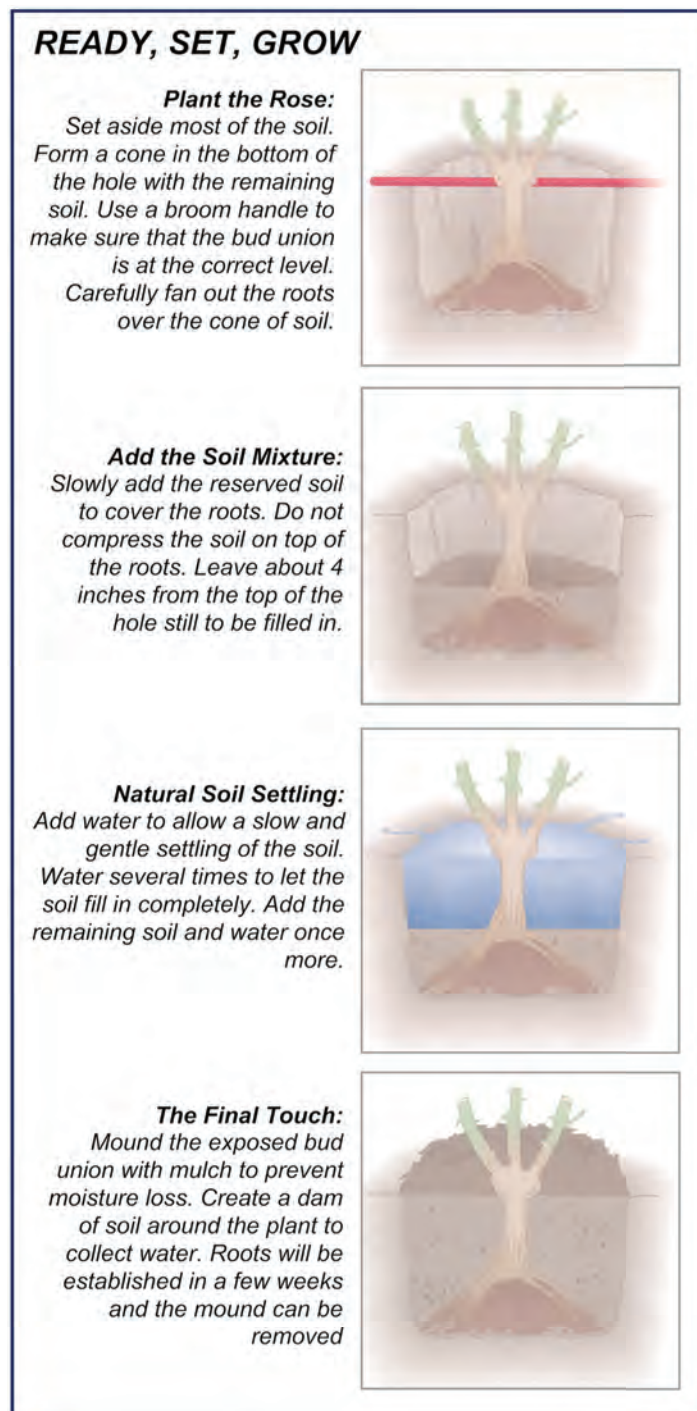


Figure 2

Credit: *All About Roses*, Dr. Tommy Cairns, Meredith, 1999

4. Start refilling the hole with the soil mixture. It is a good idea to toss a quarter cup of superphosphate fertilizer or bone meal into the hole and mix it with the soil surrounding the roots. This fertilizer is the only fertilizer added during planting. Any other fertilization should wait until the bush shows sprouting leaves and new canes. The phosphorus added at planting time stimulates root growth (a newly planted rosebush's most immediate task). Phosphorus also moves slowly through the soil, and by adding it now helps to insure it is available when needed.

Container Grown Roses (see figure 3)

1. Remove the bottom of the container.
 - a. Lay the container on its side and remove the bottom, being careful not to damage the roots. If the container is plastic, slice the sides and remove the root ball from the container.
2. Place the rose in the hole. Be sure the bud union is at the proper depth for your climate zone.
3. For a compressed fiber-pot, slice the sides and remove altogether.
4. Continue filling the hole.

Filling the Hole

1. Continue to add soil mixture, keeping the bud union at a level consistent with the area in which you live.
 - a. Using the fingers of your gloved hands, poke the soil in and around the roots or root ball until the hole is about three-quarters full.
 - b. Add a couple of gallons of water to the hole to seat the soil particles around the roots and to moisten them. The soil in the hole will settle a bit after the water has drained away.
 - c. When the water has completely drained, finish filling the hole with the rest of the soil. Do not compress it by stamping on it.
 - d. Continue to mound up the soil over the canes to a height of six inches (or more).
 - e. This mound is gradually removed two to three weeks after planting. Gradual removal of the mound helps to protect the newly planted rose, while it begins to establish a new root system and keeps the plant from drying out.

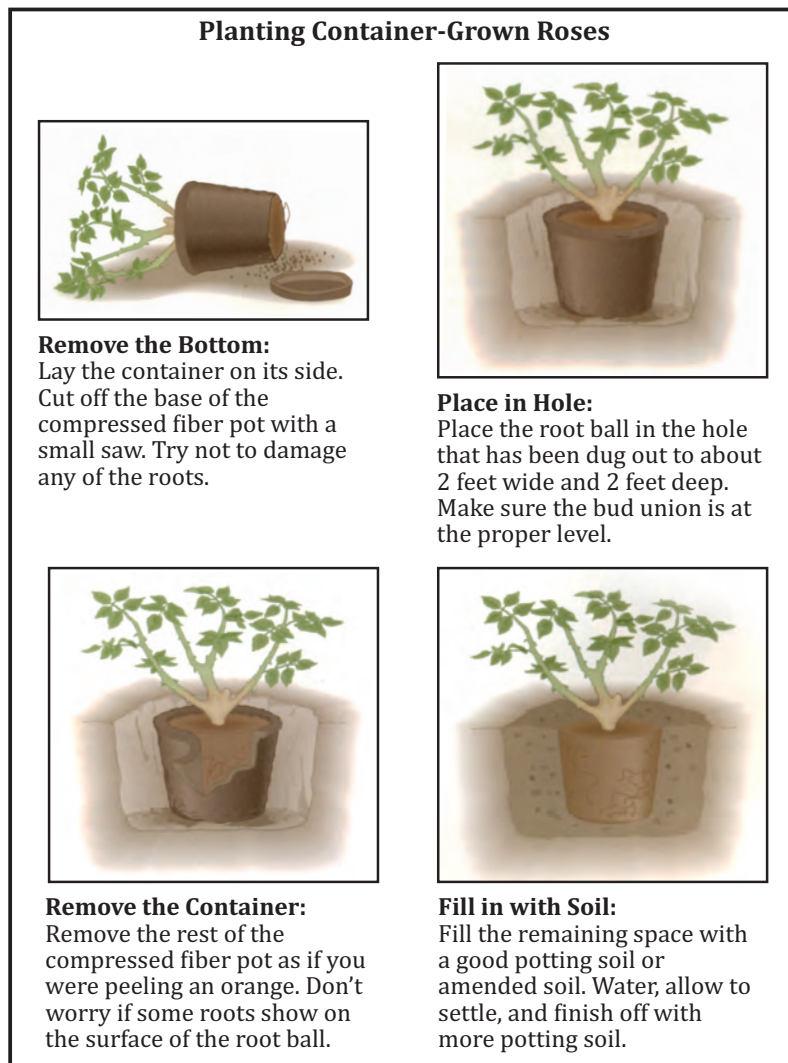


Figure 3

Credit: *All About Roses*, Dr. Tommy Cairns, Meredith, 1999

Building a New Raised Bed

Roses do well in beds at ground level if the site has excellent drainage and is not waterlogged from heavy rains. For many growers, raised beds, built four to twelve inches above the surrounding ground is best. Winter protection in severe climates can be more difficult with raised beds, but soil moisture control is much simpler. In areas of heavy rainfall and hard soil, raised beds often provide better drainage and planting success.

Materials

A raised bed must have an edging material to hold the soil in place. A wide variety of materials are available for this purpose: concrete blocks, bricks, and treated timbers. The edging material must not interfere with drainage. For instance, bricks, if laid with mortar, must have drain spaces at frequent intervals to allow excess water to drain. Landscape timbers often provide considerable flexibility in the design of raised beds.

Design

Your design is only limited your imagination. However, the most common construction is a rectangular bed, four to five feet wide, by about twenty feet long with the timbers two to three feet high.

In areas with longer growing seasons and larger plants, a bed this size provides room for a double row of fourteen to fifteen hybrid teas.

In shorter-season areas, the roses are planted closer together. *A word of caution: Do not use cross ties or old railroad ties coated with creosote. The creosote will kill the roses.*

Composting

Composting is the decomposition of plant remains with other once-living materials that makes an earthy, dark, crumbly substance that is excellent for adding to houseplants or enriching garden soil. It is a way to recycle your yard and garden waste and is a critical step in reducing the volume of garbage needlessly sent to landfills for disposal.

Composting is not a new idea. In the natural world, composting is what happens as leaves pile up on the forest floor and begin to decay. Eventually, the rotting leaves return to the soil, where living roots can finish the recycling process by reclaiming the nutrients from the decomposed leaves.

Composting Fundamentals

Good composting is a matter of providing the proper environmental conditions for microbial life. Billions of microbes (fungi, bacteria) digest the yard and kitchen food wastes provided to them to make compost. If the pile is cool enough, worms, insects, and their relatives help the microbes break down these wastes. They slowly make compost out of your yard and kitchen wastes under pretty much any condition. However, like people, they are living things that need air, water, and food. As you maintain your pile to provide for their needs, the microbes will turn yard and kitchen waste into compost much more quickly.

There are a tremendous number of options for containing compost. Some people choose to go bin-less by merely building a compost pile in a convenient spot on the ground. Other people make bins from materials such as recycled pallets, two-by-fours, and plywood. Wire fencing, looped into a circle three feet/ four feet in diameter, is an easy-to-construct bin that does not decay in time like wooden bins and, of course, there are many commercial bins available. Keep in mind the following basic ideas when building a compost pile:

Air

Composting microbes are aerobic – they cannot do their work without oxygen. Without oxygen, the anaerobic (non-air needing) microbes take over the pile. While these anaerobic microbes do cause slow decomposition, they tend to smell like putrefying garbage as they do!

For this reason, it is essential to make sure that there are plenty of air passageways into a compost pile. Green grass clippings or wet leaves mat down very quickly into slimy layers that air cannot penetrate. Other ingredients, such as straw, do not mat down quickly and help allow air to penetrate the center of the pile. To make sure that a compost pile has the adequate air ratio for your pile and its microbes, thoroughly break up or mix in any ingredients that might mat down not allow air to penetrate. The pile can also be turned to allow air to penetrate (turning a pile is done by completely breaking the pile apart with a spade or garden fork and then piling it back together in a more ‘fluffed up’ condition).

Water

To fit the needs of compost pile microbes ideally, the pile should be as moist as a wrung-out sponge. When the pile is at this moisture level, there is a thin film of water coating every particle in the pile, making it quite easy for bacteria to live and disperse throughout it. If the pile is drier, it is not an ideal microbial habitat, and composting slows significantly. If the pile is a great deal wetter, the wet ingredients get so heavy that they tend to mat down and exclude air from the pile, thus slowing the composting process (and creating the anaerobic condition and odor problem). When dry ingredients, such as autumn leaves or straw are used, they need to be moistened as they are added to the pile. Kitchen fruit and vegetable wastes have plenty of moisture, as do fresh green grass clippings and garden prunings. Be sure to watch out for far-too-soggy piles in wet climates (a tarp often helps to keep the rain off during wet weather).

Food

In broad terms, there are two significant kinds of food that composting microbes need.

- **Browns** – Browns are dry and dead plant material such as straw, dry brown weeds, autumn leaves, wood chips, or shredded wood products. These materials are mostly chemicals that are just long chains of sugar molecules linked together. These items are a source of energy for the compost microbes, and they tend to be dry. Browns often need to be moistened before placing them in a compost system.
- **Greens** – Greens are fresh (and often green) plant materials such as green weeds from the garden, kitchen fruit and vegetable scraps, green leaves, coffee grounds, tea bags, and fresh horse manure. Compared to browns, greens have more nitrogen in them. Nitrogen is a critical element in amino acids and proteins. It is a source for protein for the billions of multiplying microbes.

The right mix of browns and greens is the best nutritional balance for microbes. This mix also helps out with the aeration and moisture content. Browns, for instance, tend to be bulky and promote proper aeration. Greens, on the other hand, are typically higher in moisture and balance out the dry nature of the browns.

Other Things to Consider

In colder climates, a compost pile goes dormant in the winter. This is not a problem as the pile starts back up again when the springtime thaw comes.

Compost piles do not have to be hot for success. With good aeration and moisture, and the proper ingredient mix, your pile will decompose well at temperatures of 50°F and above. Hotter piles do decompose a bit faster, however. One way to understand this is to realize that the heat in a warm pile is the result of the combined body heat of billions of microbes that are busy digesting the ingredients in a pile. Generally speaking, a hotter pile means more bacteria and conditions that allow the microbes to have faster metabolisms, with a faster-composting process.

For a pile to get hot and stay hot for an extended period of time, the typical minimum size for the pile is one cubic meter (a cube is one meter, or about three feet per side). A cubic meter-size pile has plenty of mass in which those billions of heat-generating microbes can live, yet it is also large enough that the center of the pile is well-insulated by the material surrounding it. Smaller piles cannot insulate themselves adequately to remain hot for long (if at all). Additional insulation can be provided to a pile by stacking bales of hay or straw, and bags of dry autumn leaves around your bin. This insulation composts over time.

When is Compost Finished?

Finished compost is dark in color and has an earthy smell (like the smell of soil). It is usually difficult to recognize any of the original ingredients, although bits of hard-to-decompose materials (such as straw) sometimes can be seen.

Compost never finishes – it is a bit more subjective than that. In many outdoor garden applications, for instance, the compost still has a few recognizable bits of leaves or straw – this unfinished compost finishes rotting in the soil. If compost is used in seed-starting mixes, it is best to have a well-finished compost. The decomposer microbes in the unfinished compost will attack seedling roots.

Compost as Soil Amendment

Compost is used as a soil amendment in one's garden soil by digging it in before spring planting. A compost is sometimes used as a 'top dressing' on the soil during the growing season. When used as a top dressing, it is added in and around the bases of plants, where irrigation, microbes, and organisms slowly incorporate the compost into the soil.

Compost as Mulch

Compost is used on the soil's surface as mulch around landscape and garden plants. Compost is the same as a 'top dressing' application, described above, but mulches typically cover all the soil around the plants. Mulches protect the soil from erosion. They also save water by shielding the soil from the drying effects of the wind and sun. As mulches decompose, they add nutrients to the soil, and if made up of small enough particles, worms will slowly eat the mulch and incorporate it into the soil.

Compost as Tea

Compost tea is made by combining equal parts of compost and water and letting it sit for a while. The liquid often helps to provide a 'quick boost' to houseplants or young seedlings and transplants. The same compost is used to make several batches of tea. When finished making compost tea, the murky dregs can be used as mulch in the garden or landscape.

Compost benefits the soil by adding organic matter, which improves the way water interacts with the soil. In sandy soils, compost acts as a sponge to help retain water in the soil, that would otherwise drain down below the reach of plant roots (in this way, it protects plants against drought). In clay soils, compost helps to add porosity (tiny holes and passageways) to the soil, making it drain more quickly, so that it does not

stay waterlogged and dry out into a brick-like substance. Compost also inoculates the soil with vast numbers of beneficial microbes (bacteria, fungi) and provides the habitat that the microbes need to live. These microbes can extract nutrients from the mineral part of the soil and eventually pass these nutrients to the plants. A wide variety of waste can be composted, saving them from a one-way trip to the landfill and turning them into valuable soil amendments for home use.

What *Not* to Compost

Please put in		Please do not put in	
Fruit scraps	Tea bags	Meat	Fats
Vegetable scraps	Nutshells	Chicken	Oils & dairy
Non-greasy food scraps (rice, pasta, bread)	Cut or dried flowers	Fish	Chemically treated woods or diseased plants
Coffee grounds & filters		Greasy food scraps	Human and pet wastes & weeds

Mulching

Roses grow better when thick, porous mulch covers the beds. Roses can be grown without mulches, but mulches offer many advantages in the garden.

A good mulch helps to conserve moisture in rose beds. In most areas, roses do not get enough water for their best growth. Constant moisture in the soil keeps the plants well fed and growing. Well-mulched beds require less frequent watering and stay more uniformly moist.

As organic mulches break down, they supply a continuing source of essential nutrients. These nutrients include some of the trace elements necessary for proper growth. A two to four inch layer of mulch is best added after spring pruning and is refreshed in the fall.

A good mulch, if chosen wisely, aids with weed control. Some manures contain weed seeds that germinate and add to the weed problem. If the mulch is from a weed-free source, it is an excellent material to smother weeds. Weed-free mulches such as cottonseed hulls, pine needles, leaves, straw, bark, and aged wood chips, can go a long way towards relieving part of the tedious chore of weeding.

Mulches can interfere with sanitation for those who try to keep their beds free of fallen black-spotted leaves, but mulches often minimize the splattering of rain-borne black spot spores. Mulches hinder, rather than promote, disease spread.

Good mulches can keep the ground as much as 10° - 15° cooler in the summer. Mulch may also prevent root damage from an unexpected early freeze in the fall. Air trapped in the space between mulch particles creates an air insulation blanket and is one of the best insulators available.

When using manures as mulches, there are some precautions to be observed. Some fresh manures can burn roses and should be kept off the bud union until the manure has aged. Rabbit manure is the safest manure to put on roses, and fresh chicken manure is the most likely to cause burns. All manures are valuable fertilizers and good mulches.

Grass clippings are an excellent short-lived mulch, but the clippings should be spread thinly after each mowing. Grass clippings tend to mat and sometimes require stirring to allow water to penetrate. Clippings from lawns sprayed with herbicides or weed and feed fertilizers can kill your roses. Do not use herbicides or weed and feed fertilizers anywhere near rose beds.

Leaves make fine mulches when one takes precautions to avoid packing. Oak leaves are okay. Maple leaves tend to pack unless shredded. Leaves mixed with chips or straw are good mulches, provided one uses a mixture of fine and coarse particles. Most leaves give an acidic reaction as they decay, and many areas profit from the addition of granular limestone. In areas where the soil is alkaline, limestone is unnecessary. Do a pH test *before* adding limestone to determine if necessary.

Bark provides a good mulch and can also be decorative. Pine needle mulch is an excellent material provided you use enough.

Regardless of material, most people grow better roses when a good, thick mulch is used on their beds.

Winter Hardiness and Damage

The winter hardiness of a rose is subject to many variables: the type of rose, the microclimate of the garden, the condition of the rose going into winter, and the weather. Winter damage is caused by water freezing and expanding in a plant's cells. This expansion ruptures the cells, damaging them, and killing the rose in the process. In cold climates, pruning roses in the fall often makes them more subject to winter damage as it encourages the sap to rise while forming new tender growth. This sap freezes and the plants are damaged in the process.

The drying out of canes exposed to cold winds at low humidity is another cause of winter damage. The roots of roses are dormant and cannot supply moisture to the canes and damage results.

Winter survival often depends as much on the condition of the plant in autumn as with any added winter protection. Sickly bushes may not make it through the winter, no matter what protections may be used. Bushes heavily infected with black spot or mildew and those without sufficient water are at a greater risk of severe damage than healthy bushes.

Some varieties can withstand winters better than others. These varieties can convert water in their cells so that it does not freeze. This water conversion is an inherited characteristic that makes a variety hardy. For roses that are not hardy in cold climates, winter protection may be needed. It should not be applied until after a hard freeze to discourage rodents from taking up residence in the rose beds.

Winterizing

Bushes planted near the house are afforded some protection from the elements. Spots in the garden that are sheltered from icy winds by shrubs or walls also may require little (or no) protection. However, bushes out in the open (especially those in lower areas in the garden) may require protection.



Credit: *All About Roses*, Dr. Tommy Cairns, Meredith, 1999

Miniature and Miniflora Roses

Miniature and Miniflora roses are the easiest type of roses to winter protect. Once miniature and miniflora roses are completely dormant, they should be covered with several inches of leaves. These leaves help to keep the roses from the damage due to fluctuating temperatures and from drying out.

Full Size Roses

Hybrid teas, grandifloras, floribundas, and many other full-sized roses (except climbing roses) should be pruned to about five feet high to prevent them from rocking in the wind. Some plants may need to be tied and staked to keep them from swaying in the winter winds. They should be hilled as necessary.

Hilling

The oldest method of protecting roses is by hilling the roses ten to twelve inches with mulch, compost, or soil from another area in your garden. The soil should never be scooped up from around the bushes as the roots could become exposed.

Collars

Another popular method of winterizing is the creation of a “collar” around each rose and filling it up with soil, compost, or mulch. Gutter screening, commercial collars, good old newspapers (several layers folded in “halo”), or wire mesh can be used to hold this filling material in place.

Minnesota Tip Method

Another popular method of winterizing is the “Minnesota Tip” method of winter protection. The plant is pruned and tied up to be more compact. The soil is loosened around the base of the rose. A trench is dug next to the rose, the plant is lowered in the trench, and buried.

Climbing Roses

Climbing roses should be taken off their supports and wrapped up with burlap, construction blankets, or other appropriate covering.

Pruning

“Pruning a rose bush is not unlike giving a home haircut to a small child: you do the best you can, secure in the knowledge that if it turns out odd-looking, new growth will quickly hide your mistakes.”

–LIZ DRUITT, *The Organic Rose Garden*

Most types of roses benefit from annual or seasonal pruning. Pruning improves the quality of blooms, regulates the size and shape of the plant, and removes diseased, damaged, dead, crisscrossing, and old, weak, spindly canes. If a rose bush goes for several years without proper pruning, it becomes old and woody with very few new green canes. The blooms become smaller and are produced at the top of the plant. Pruning forces the rose bush to renew itself and remain “young,” vigorous, and productive.



Credit: *All About Roses*, Dr. Tommy Cairns, Meredith, 1999

There is always a question about when and how much to cut back a rose bush. The time and amount to prune depends on the type of rose, its use, variety, location, and vigor.

In warmer climates of the Southern and Western United States, pruning is done during the winter months, between December and April. Pruning in winter allows the bushes to go dormant and provides a good crop of blooms in the spring. Some winter protection and pruning may be necessary for colder and higher elevation regions and may delay subsequent winter pruning. The further one travels north, and to higher elevations, the longer the pruning delay. Winter pruning is generally not a concern in areas that do not have winters (e.g., Florida, Hawaii). Pruning is usually done throughout the year by deadheading the roses (cut just above a five-leaflet leaf, where the bud eye is located, at a slight angle away from the bud eye).

In colder regions of the Northern, Central, Midwest, and Eastern United States (and Canada), a two-step pruning process to winterize roses may be necessary. Around October or November, roses are pruned down to a few feet tall to allow winterizing techniques to protect the rose crown. Uncovered rose canes can die back in the cold because of wind, thaws, and freezes. In some areas, “When the forsythia blooms” is the right time to prune from March to June. The roses are uncovered and pruning begins by removing the deadwood so the roses can start with all new growth in the spring.

The basic technique for pruning is to cut the cane with clean, sharp, bypass pruning shears or loppers. The cut is made roughly a quarter inch above a healthy bud or eye facing in the desired direction of growth, usually away from the center of the bush. The cut is angled slightly so that its lower end is on the inside of the cane, opposite the bud eye. The eye looks like a smile or slight swelling on the cane’s surface. New growth will come from the bud. The cut is made with the thin blade of the pruners or loppers nearer the bud eye to minimize damage to the retained portion of the cane.

Clean pruning cuts are essential, and pruners and loppers must be kept sharp. If the initial cut does not reveal healthy white pith, cut down as far as necessary to buds further down the stem until a healthy white pith is reached. If a stem is snagged or a rough cut is made, a second cut further down the stem is made to the next healthy bud. A pruning saw is used for canes more than about one inch thick to avoid crushing the cane with loppers. If a cane is old, gray-colored, and scraggy-looking with spindly growth, it should be removed. Loppers or a pruning saw are used to cut it flush with the crown or bud union.

Hybrid Teas and Grandifloras

Hybrid Tea and Grandiflora roses might need pruning in late winter. Bushes pruned in late fall or early winter may be injured by cold and require further pruning in late winter, resulting in more severe pruning than desired. Early pruning also induces rapid cane growth that is subject to spring freezes. Roses love sunlight and need to have open centers so light and air can penetrate easily and help reduce the severity of fungal diseases. All spindly stems less than the diameter of a pencil are removed since they do not flower well, are prone to disease, and are unlikely to support large blooms. Four to six of the newest healthy canes are selected and their top one third to one half is removed, cutting to outward facing bud eyes. Exhibitors may choose to select fewer canes and prune lower. Higher pruning will produce more blooms early, while lower pruning produces fewer but larger flowers later. During pruning (and any other time), “suckers” that originate from the rootstock should be identified and removed completely. These suckers are likely to be stronger than the grafted rose and may dominate and eventually take over the rose. The sucker is traced to its point of origin, grasped firmly, and pulled away with a sharp tug. It is less likely to regrow if removed this way than if it is cut off.

Floribundas

Floribunda roses produce dense clusters of flowers – their real beauty. Floribundas are pruned in the same way and at the same time as Hybrid Teas, but usually not as hard. Be sure to remove dead, damaged, and diseased canes; weak and spindly canes; and the weaker of two canes that are crossing. Stems that tend to grow sideways rather than up are removed, as well as suckers from the rootstock. The tops are thinned and cut back just enough to stimulate the development of new growth. When it is challenging to identify suitable bud eyes for pruning cuts, the canes are cut back to the desired height (e.g., waist-high); laterals (side shoots) are shortened to within two or three buds from its main stem, and the cuts are made to outward-facing bud eyes. The number of canes remaining after pruning is higher than it is for Hybrid Teas. Occasionally older canes are removed to encourage new ones to take their place.

Miniature and Miniflora Roses

Miniature and Miniflora roses are mostly small-flowered counterparts of larger bush roses. As long as they are growing and flowering well, they need only light pruning. Tip prune the main stems and cut back side shoots to within two or three buds from its main stem. Cut out the oldest stems at the base of the plant to reduce crowding. If the plant is not growing and flowering well, consider pruning it hard by removing all but the most vigorous stems and cutting them back by one-half to two-thirds. Most miniature and miniflora roses are own root, so there is little to no concern regarding suckers originating from the rootstock.

Once-Blooming Climbing and Old Garden Roses

Before pruning, it is essential to know if the rose repeat-blooms or produces one bloom cycle. Once-blooming Climbing and Old Garden Roses should have the dead and diseased wood removed before they bloom, but no other pruning until the first bloom cycle is complete. After flowering, prune canes to desired length and shorten flowering stems by two-thirds. It is essential to prune once-blooming roses right after the bloom cycle so that the plant will have time to produce new wood for the following season.

Repeat-Blooming Climbing and Old Garden Roses

Most repeat-blooming Climbing and Old Garden Roses produce long canes that can be trained to grow horizontally so that the buds along the canes will send up flowering stems. When pruning these types of roses they benefit from the removal of dead or diseased wood early in the spring.

Repeat-blooming Climbing and Old Garden Roses can be pruned entirely in the early spring before they bloom. After removing any dead, diseased, or damaged wood, remove spindly or leafless growth and shorten the flowering stems by one third to one half their length.

Shrub Roses

Shrub roses are generally lightly pruned. Dead, damaged, diseased, and crossing stems are removed. Side shoots at the outer edges of the plant should be tip pruned. If the bush is overcrowded, one or two of the oldest, unproductive canes should be removed at the base of the plant.

Some rosarians use a wire brush to scuff the woody bark from the crown or bud union to assist the plant in generating basal breaks – new canes from the bud union. Be careful while brushing and try not to remove any potential bud eyes or emerging basal sprouts. Remember, there is little you can do wrong when pruning a rose.

Final Cleanup

Any remaining leaves from the previous season are removed. Leaves, dried petals, canes, stems, and other debris on the ground around the bushes are cleaned up and hauled to the trash. These old leaves and other debris provide hiding places for over-wintering fungus and insects that are waiting to attack the green new growth and delicate blooms.

Tetanus

All gardeners should be aware of some basic facts about tetanus and make certain their tetanus immunizations are current. The natural habitat of the bacterium responsible for this infection (*Clostridium tetani* – a cousin of the botulism organism) is the soil. However, the spores it produces are widely distributed, both in the soil and elsewhere. When growing, tetanus produces a toxin 50 times stronger than cobra venom. It is this toxin that is responsible for the disease. A wound no larger or more painful than a pinprick can harbor enough bacteria to produce sufficient poison to kill an unvaccinated human.

The bacterium is an anaerobe; it grows only in the absence of oxygen, a common condition with puncture wounds. Buried rusty nails are common dwelling places. Anyone stepping on them can become a victim of this disease. Tetanus immunization is a necessity for those who may have skin breaks and frequent contact with soil, such as gardeners and children. Animal feces (manure) can also frequently harbor the microbe.

The following points are from a background paper published by the National Institutes of Health:

- This ancient and dreaded disease develops as the result of an infected wound, usually a puncture or laceration. However, even a superficial scratch is susceptible to infection by tetanus bacteria. When tetanus infection does occur, it is highly lethal. An amount of purified tetanus toxin weighing no more than the ink in the period at the end of this sentence would be enough to kill 30 grown men.
- Though these bacteria produce one of the deadliest poisons known to man, a tetanus immunization injection given every ten years (five years for gardeners) prevents its lethal effects.
- The organism is an ever-present bacillus found in soil, dust, manure, clothing, and the digestive tracts of many animals (including man). A paper cut can sometimes be as lethal as a knife wound.
- The prognosis for an unimmunized person who develops an infection is grim. Fatality rates run from 45 to 55 percent, even with the best hospital care.
- As an anaerobe, the bacterium typically does not cause trouble unless introduced into a wound where it has no oxygen. Although the tetanus bacteria can begin to multiply and produce toxins immediately upon finding the right airless environment. Its spores are very hardy, they can remain dormant for a long time (often tens to hundreds of years).

Rose Thorn Disease

Sporotrichosis is an infection caused by a fungus called *Sporothrix schenckii* found in vegetation. It usually infects the skin of people who manage thorny plants, sphagnum moss, or baled hay (or a combination of these). Outbreaks occur among nursery workers, rose gardeners, children, and greenhouse workers. The fungus enters the skin through small cuts or punctures from thorns, barbs, pine needles, splinters, or wires from contaminated sphagnum moss, moldy hay, other plant materials, or soil.

The infection appears as small painless lumps or bumps resembling an insect bite one to twelve weeks after exposure. Usually, the first appearance is within three weeks after the initial infection. The lumps can become open sores. These ulcers sometimes fail to heal, and the disease's microorganisms can move along the lymphatic system, eventually infecting lungs, joints, and the central nervous system.

A doctor makes a diagnosis by swabbing or doing a biopsy of a freshly opened bump and sending a sample to a laboratory for fungus culture. With a proper diagnosis, treatment starts immediately.

The rosarian needs to be vigilant when working with soil amendments that can carry the disease. Gloves and long sleeves are worn when managing wires, rose bushes, hay bales, pine seedlings, as well as other materials that might cause even minor skin breaks. It is also advisable to avoid skin contact with sphagnum moss, which is a source of the fungus.

Notes

Acknowledgements

Diagrams used with Permission from:

Guidelines and Rules for Judging Roses, American Rose Society, 2012

All About Roses, Dr. Tommy Cairns, Meredith, 1999

Updates

8/27/20 Entire Chapter 4 page 4-1 to 4-16

Chapter 5 – Soil & Water

Soil Basics

The soil is the home for most plants, and they depend upon soil for water, nutrients, and to hold them in place. Soil is complex. It is a combination of inorganic and organic chemistry along with a wide variety of living organisms and biological systems.

What is Soil?

Good soil consists of four major components:

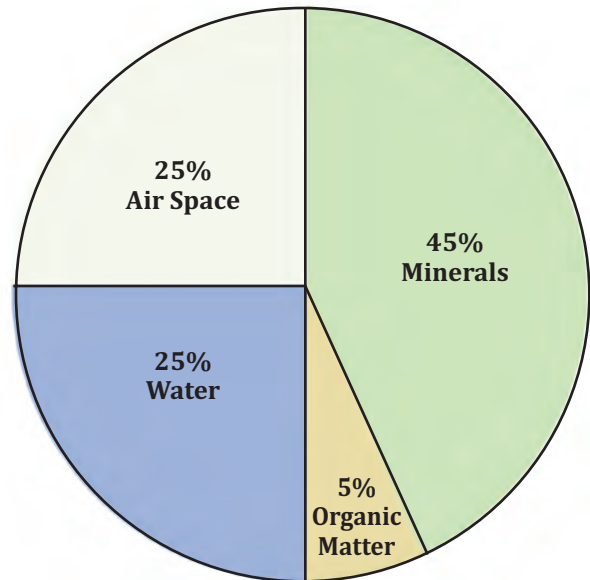
- Inorganic materials comprise about 45%.
- Organic materials comprise about 5%.
- Air comprises about 25%.
- Water comprises about 25%.

Soil Texture

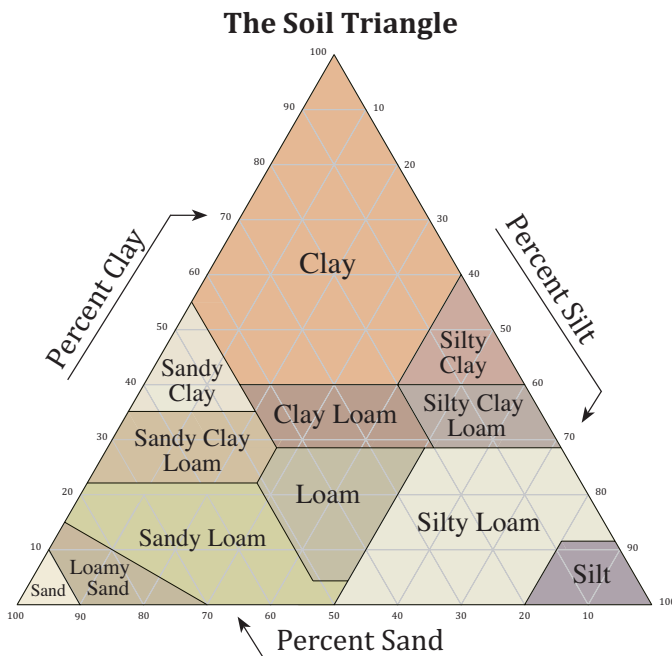
The inorganic part of the soil determines its texture. It is composed of a combination of sand, silt, and clay.

- Sand is a large particle – 1/20 mm to 2 mm in diameter.
- Silt is a medium-sized particle – 1/500 mm to 1/20 mm in diameter.
- Clay is a very small particle – less than 1/500 mm in diameter.

Soil Components



Credit: Andy Vanable



Credit: Andy Vanable

The proportions of sand, silt, and clay can be plotted on a graph referred to as a soil triangle. Each area on the soil triangle has a specific name. **Ideally, roses prefer a sandy loam soil texture** that is about 60% sand, 20% silt, and 20% clay.

The texture determines many of the properties of the soil. For example, sandy soils require more frequent watering and fertilizing because the water flows through quickly and leaches the nutrients from the soil. Clay soils tend to have extremely poor drainage but require less fertilizing and watering. Loam soils have the best properties with both good water retention and drainage, while also retaining nutrients.

Soil Texture Test

To determine your soil texture, collect a cup of soil from your garden. Remove rocks and organic material such as mulch. Place the soil in a quart jar with straight sides like a canning jar or mayonnaise jar. Fill the jar with water and a couple of drops of dish soap to aid in mixing. Put a lid on the jar and shake it thoroughly then let the contents settle until the water clears. You will see that the soil particles have settled by size: sand on the bottom, silt in the middle, and clay at the top. Using a ruler, measure the total height of the sediment, and the height of each layer. Then determine the percentage of each layer. Use the soil triangle to determine the classification of your soil.

Changing Soil Texture

Changing soil texture is a misunderstood process. Just throwing together the proper mixture of materials is not the same as a rich sandy loam that has developed over many years.

- The ideal properties of loam come from how the sand, silt, and clay particles interact. Much of this structure comes from years of weathering, chemical reactions, and the interaction of living organisms in the soil.
- There is no practical way to figure out how much of each size particle to add. Randomly mixing sand and clay can give you cement!
- Placing the new mixture back in the ground surrounded by the old soil will create soil stratification problems. Water (and root growth) does not move easily across soil type boundaries. For example, putting potting soil in a hole dug in heavy clay soil will create conditions similar to planting in a sealed clay pot. Soil in the upper part of the pot will tend to dry out (thus killing the roots), and soil in the lower part will be standing in water (thus killing the roots).
- If soil texture changes are necessary, it is better to dig a large planting hole and create a gradual change from old to new soil. Start with a mixture of 25% potting soil or compost and 75% native soil in the outer part of the hole, then a 50/50 blend, then a mixture of 75% potting soil or compost and 25% native soil closest to the roots.

Organic Material

The organic part of soil consists of living and dead organisms.

The dead organic part of the soil is made of decomposing organic matter called humus, which produces humic acid. Humic acid plays several important roles in the soil:

- Humic acid aids in converting inorganic materials into available nutrients. Laboratory tests have shown this chemical change is about 20 times faster in the presence of humic acid.
- Humic acid and clay particles create the Cation Exchange Capacity (CEC) of the soil, which is a measure of how well the soil holds nutrients.
- Humic acid plays a key role in soil aggregate formation processes. The formation of these aggregates (called peds) is critical to good soil structure.
- Humus and organic material increase the soil's ability to hold water so it is available to plant roots. At the same time, it also improves drainage in heavy soil.
- For best results, use organic material that is already broken down, such as aged manure or composted plant materials. The decomposition of fresh organic matter removes nitrogen from the soil which can cause nitrogen deficiency in your roses.

The living part of the soil includes a wide variety of organisms that range from microscopic size to large animals. The major groups are:

- Bacteria – about 100 million per teaspoon of soil.
- Actinomycetes (look like fungi but are bacteria) – about 12 million per teaspoon of soil.
- Fungi – about 450,000 per teaspoon of soil.
- Algae – about 250,000 per teaspoon of soil.
- Nematodes – about 200 per teaspoon of soil.
- Arthropods – mites, millipedes, centipedes, pill bugs and insects, etc.
- Earthworms – about 200-1000 pounds per acre.
- Mammals – rodents, moles, and other ground-dwellers.

There are several positive effects of the living organisms in the soil.

- They till the soil creating air spaces, bringing organic material into lower soil levels, and mixing the soil components.
- They break down organic matter into nutrients the plants can use.
- They help create soil aggregates (peds) that act like glue to hold the soil structure together.

Mycorrhizal Fungi

Many rosarians are finding that adding these fungi as a soil amendment has shown positive effects on their rose plants.

- Research in the past 40 years has shown that the symbiotic relationship between mycorrhizae and plants' roots provide some positive effects. The fungi attach themselves to the outer layer of the host's roots and then grow their filaments, or hyphae, into the surrounding soil from a few centimeters to a meter or more. The hyphae absorb nutrients and water and bring them to the roots of their host plant. The host plant supplies sugar and carbon to the fungus.
- A plant in soil with mycorrhizae can absorb 100 times more nutrients producing better plant roots and healthier plants.
- It is important to note that mycorrhizal fungi can be found naturally in most healthy soils, so it might not be necessary to add it. Applying mycorrhizal fungi amendments is not a substitute for the goal of creating healthy soil with the correct texture and balance of organic material, air, and water.
- Apply fungicides as a soil drench with caution since they may kill these beneficial fungi along with the disease pathogens gardeners are trying to control. Commercial mycorrhizal fungi suppliers maintain lists of fungicides that are safe to use.

Air

Air is important for photosynthesis which produces carbohydrates and for respiration that converts the stored carbohydrates into products for plant growth and metabolism. While air is plentiful above ground, it is more challenging to maintain adequate air supply in the soil. Remember that soil should be 25% air to provide oxygen and carbon dioxide exchange in the roots. Air is also essential for living organisms in the soil.

There are several ways to increase the air supply in heavy, wet soil.

- Add organic matter. Organic matter breaks up heavy soil by improving drainage and creating air space.
- Plant roses higher than the surrounding soil surface or make raised beds.
- Create channels away from plants to allow water to drain away.
- Install a drainage system along the base of rose beds to collect and drain water away.

Water

Plants need water, which they get through their roots. Plants consist of 50% to 90% water, so sufficient water is critical. The major uses of water by the plant are:

- Water is an essential element in photosynthesis, the process by which plants make food.
- Water is used for transpiration to cool the leaves.
- Water is used to transport nutrients and carbohydrates throughout the plant.
- Water makes the cells stiff (turgid) so the plant can remain upright. It is also what gives rose petals their substance.

Water availability in the soil is affected by how close it is to the soil particles. The water molecules closest to the soil particle are held so tightly that plant roots cannot remove the water. Further away from the soil particle, the strength of the chemical bond of the water molecules weakens enough that roots can absorb the water. Even further from the soil particle, gravity will overcome the bond and drain the water away.

Clay soils have a much higher surface area than sandy soils. So, clay soils can hold much more water because there is more space close to the particles. However, because the plant cannot absorb water molecules that are close to a soil particle, much of that water is not available to the plant roots. Light sandy soils allow water to drain quickly past the rose roots, so the water is lost to plant use. Sandy loam soils have the highest amount of water available to the plants due to its mixture of small and large particles. Organic matter also significantly increases the amount of available water in the soil.

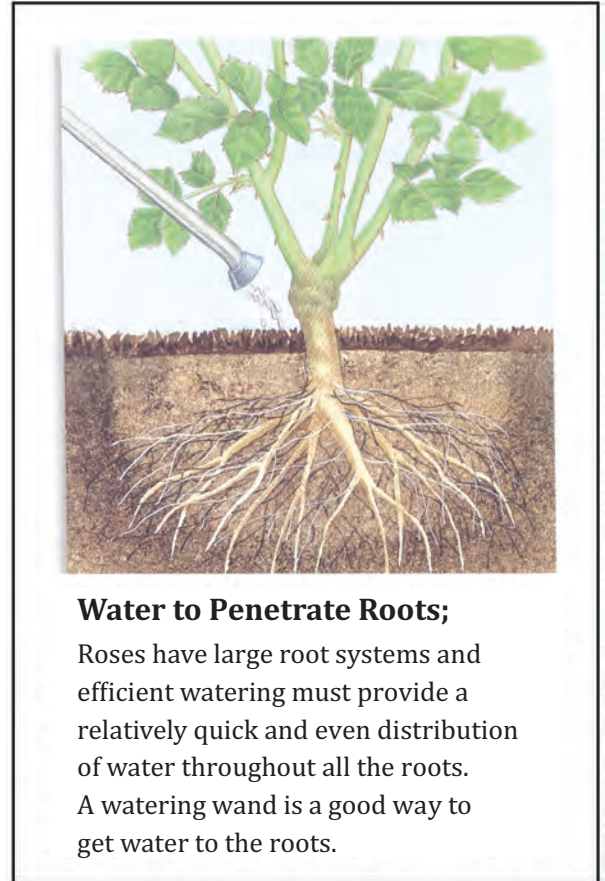
Water and Roses

The general recommendation is that roses need the equivalent of at least one inch of water per week, but they may need more in very hot weather. However, the saying that roses do not like wet feet is also true.

Overhead watering can be beneficial and efficient if done properly. However, it may not supply enough water to penetrate deeply into the soil. It is best to shut off the water early enough in the day to allow the foliage to dry completely before evening. Overhead watering should not be used in areas of high humidity and where fungal diseases are a problem.

Watering at the base of the plant helps prevent disease problems and directs water toward the roots but may be too time-consuming in large gardens. A drip system is another option that keeps water at the base of the plant.

It is best to tailor your watering system to the environmental conditions of your area and the time demands of your garden. Your local Extension office can provide input on what options work best in your area.



Credit: *All About Roses*, Dr. Tommy Cairns, Ortho Meredith, 1999

Water drainage and water retention are equally important. A balanced soil structure is one that allows water to pass through the soil at a rate slow enough to permit nutrients to be taken up by the plant's roots. It is also important that the water continues to drain down through the soil bringing with it the air important to plant life.

Soil with poor drainage fills the small spaces among the soil particles with water, forcing out the air. Soil with poor water retention causes nutrients to pass through the soil so rapidly that roots have little or no opportunity to access them, and additional fertilizer must be used. Two simple tests will approximate the drainage ability of the soil.

Test #1 for Water Retention

To measure the water retention capability of the soil, fill a clay pot with garden soil leaving enough room to add one quart of water. Place the pot over an empty quart jar and pour one quart of water into the pot allowing it to drain through to the quart jar below. Determine the percentage of water retained in the soil after an hour. Water retention should be around 50 percent.

Test # 2 for Water Drainage

To measure the drainage rate of the soil in the rose beds, cut the ends off a one-quart to one-gallon size metal container (such as a coffee can), and push it down about an inch into moderately moist soil. Fill the container with water. If it takes more than an hour for the water to drain, take steps to improve drainage. If the water drains too quickly, add a water retention material, such as peat moss or compost, to the soil.

Well-balanced soil is the answer to many plant problems. It is important to understand soil and the nutrients involved, as imbalances can result in poor growth of rosebushes.

Diagnosing Soil Problems

No Consulting Rosarian should recommend a soil change without learning the results of a soil test. Soil chemistry is complex, and it is easy to come to an improper diagnosis of the problem if you do not have scientific data on the chemistry of the soil in question.

Soil Chemistry

One of the reasons soil testing is so important is the inter-relationships of the many different chemical reactions in the soil. Using plant symptoms to identify nutrient deficiencies is generally not reliable. Only soil or tissue analysis can accurately identify a nutrient deficiency. Some examples:

- Phosphorus deficiency is uncommon in most home gardens, and symptoms are usually related to a soil pH problem. Phosphorus becomes unavailable in both high and low pH soils due to chemical reactions with either iron or calcium.
- Iron deficiency symptoms (interveinal chlorosis) could be caused by low iron levels but are more often the result of other issues such as high soluble salts or high levels of manganese, zinc, or phosphorus. Excessive use of lime (calcium carbonate) can also cause iron deficiency symptoms by raising pH and preventing iron uptake. Real iron deficiencies are rare.
- Calcium and boron must be in balance with each other. Increasing the level of calcium in the soil can control the toxic effects of excessive boron.
- Soils high in sodium tend to have poor structure and drainage problems. Add large quantities of calcium – typically gypsum (calcium sulfate). The calcium in gypsum replaces the sodium allowing it to leach from the soil with large applications of water.

Soil Testing

A soil test can provide useful information about the pH, nutrient levels, and organic matter. Determine the desired breadth and accuracy of the test results, and more importantly, what you intend to do with the test results (implement recommendations, continue with your established yearly regimen, etc.). There are several choices for testing the soil.

- Professional soil testing laboratories or agricultural extension services provide the most accurate and complete way to test the soil. Such tests can measure pH, major and minor nutrients, and organic matter.
- Use a home test kit to measure just pH or pH and major nutrients. The kits can be relatively accurate and reasonably easy to use. However, results can vary based on the technique used and the age of the test reagents. pH measures should include at least one decimal point for dependable accuracy. Unfortunately, most DIY home test kits do not meet this specification. A good calibration is to occasionally take a larger soil sample, send part to an agricultural extension lab, and test the remaining soil using a home test kit. Determine the accuracy of the test kit by comparing results.
- Use an electronic meter to measure soil pH. However, low-cost pH meters that do not use calibration solutions may be inaccurate. Such meters depend upon the conductivity effects of the soil to measure the acidity and are easily fooled by many soil conditions such as moisture level. It is easy to get a highly acidic reading from an alkaline soil and thus aggravate the problem. Better quality meters measure pH more accurately, some to 0.1 pH accuracy.
- pH test strips have several color spots on each strip. For reasonably accurate results, there should be a measuring scale of at least three spots and a pH range of 5 to 10. However, it is unlikely to measure more accurately than one pH unit. This method is low cost, easy to use, and an acceptable quick test.
- There is also a relatively simple, fairly accurate, and inexpensive method for testing soil pH. Take a soil sample and add at least the same amount of neutral (pH 7.0) distilled water. Mix well and allow to settle. Carefully remove the liquid and test it with a swimming pool pH test kit.

Changing Soil Acidity

Nutrient availability is highly affected by soil pH. pH is a measurement of the relative acid or alkaline content of fluids or soil in a range of 0 to 14, with a pH of 7 being neutral. A pH above 7 is alkaline, and a pH below 7 is acidic. With pH lower than 6 or higher than 7, primary nutrients in soil become less available to roses. See Chapter 6 for further discussion of how pH affects nutrient availability.

Soil pH is often determined by the amount of leaching rainfall and by the original material that became the soil. For example, in places where rainfall is much higher than the evaporation rate, such as in the eastern part of the United States, excess water leaches alkaline materials from the soil, and the resulting soil is acidic. Where rainfall is closer to the evaporation rate, such as in a desert area, alkaline materials do not get leached from the soil, and the resulting soil is more alkaline. Soil originating from limestone tends to be alkaline due to the calcium carbonate in the parent rock. Granite-based soils tend to be more acidic.

“H” is the chemical symbol for hydrogen. A pH of 7 is neutral because the concentration of hydrogen ions (acidic) exactly equals the concentration of hydroxide ions (alkaline). A pH of 1 is a strong acid (such as concentrated sulfuric acid), and a pH of 14 is highly alkaline (such as caustic lye).

The “p” is mathematical shorthand for inverse logarithm. It comes into play when comparing units of pH. Soil with a pH of 6 has 10 times the concentration of hydrogen ions (acidity) as soil with a pH of 7. Soil with a pH of 5 has 100 times the acidity of soil with a pH of 7. A reduction of two pH units does not make soil twice as acidic. It makes it 100 times more acidic and is why pH testing is so important.

Changing the soil pH is a slow and usually continuous process because, within a large area, the soil may tend to revert to its original pH. In alkaline conditions, lower the pH by adding sulfur to the soil. In acidic conditions, raise pH by adding limestone. The type of limestone to add depends upon the level of magnesium in the soil. If the soil is low in magnesium, use dolomitic limestone. If magnesium levels are sufficient, then use calcitic limestone. Any attempt to change soil pH should be based on recent soil test results and recommended action provided by the soil testing laboratory.

Most organic amendments will slightly lower the pH but will also increase the tolerance of the soil for the lower pH. So, pH correction may not be needed when using organic fertilizers or mulches. Most chemical fertilizers will lower the pH, some significantly. Avoid highly acidifying fertilizers such as ammonium sulfate for very acidic soils. Calcium nitrate would be a better choice on acidic soils since it raises pH, while ammonium sulfate would be a suitable choice for alkaline soils.

Notes

Acknowledgements

Diagrams used with Permission from:

Andy Venable

All About Roses, Dr. Tommy Cairns, Ortho Meredith, 1999

Updates

10/11/20 Entire Chapter 5 page 5-1 to 5/7

Chapter 6 – Fertilizers

This chapter discusses fertilizers, their methods of availability to plants, and problems associated with fertilizer deficiencies and excesses. As stated previously in chapter 5, CR 's should recommend a soil test before making any recommendations on adding nutrients to the soil that will change the soil chemistry. Additionally, it may be beneficial to recommend a plant tissue analysis.

Plant Tissue Analysis

Soil tests determine the levels of nutrients available in the soil but do not provide any information about the plant's ability to use those nutrients. Plant tissue analysis, in combination with soil test information, is a tool for diagnosing nutrient deficiencies and determining fertilizer requirements. Plant tissue analysis identifies essential nutrient concentrations in sampled plant tissues. It complements a proven soil testing plan and helps identify ways to use nutrients more efficiently.

Not all abnormal appearances are due to a deficiency. Some may be due to too much of certain elements. Also, symptoms of one deficiency may look like those of another. A plant tissue analysis can pinpoint the cause if it is nutritional. Plant tissue analysis is of little value if the plants come from beds that are infested with weeds, insects, disease organisms; if the plants are stressed for moisture; or if plants have some mechanical injury.

The most important use of plant tissue analysis is as a monitoring tool for determining the adequacy of current fertilization practices. Sampling a plant periodically during the season or once each year provides a record of its nutrient content that can be used through the growing season or from year to year. With soil test information and a plant tissue analysis report, a rosarian can closely tailor fertilization practices to specific soil-plant needs.

It also may be possible to prevent nutrient stress in a plant if the tissue analysis indicates a potential problem developing early in the season. Corrective measures can be applied during the season. Combined with data from a soil analysis, a tissue analysis is an important tool in determining nutrient requirements of a plant. Such an analysis can determine levels of major and some minor nutrients.

Plant Metabolism

A plant is a live growing thing that takes carbon dioxide from the air, water from the ground, and, in the presence of sunlight (energy), makes sugars. These building blocks of plants are technically known as carbohydrates, a word that means carbon with water. The plant does not need the oxygen in carbon dioxide and releases it back to the atmosphere. This process is known as photosynthesis. The reverse process is called respiration. During respiration, the plant absorbs oxygen, mostly from the soil, and produces carbon dioxide. The process allows the plant to convert sugars into energy, which they need for growth

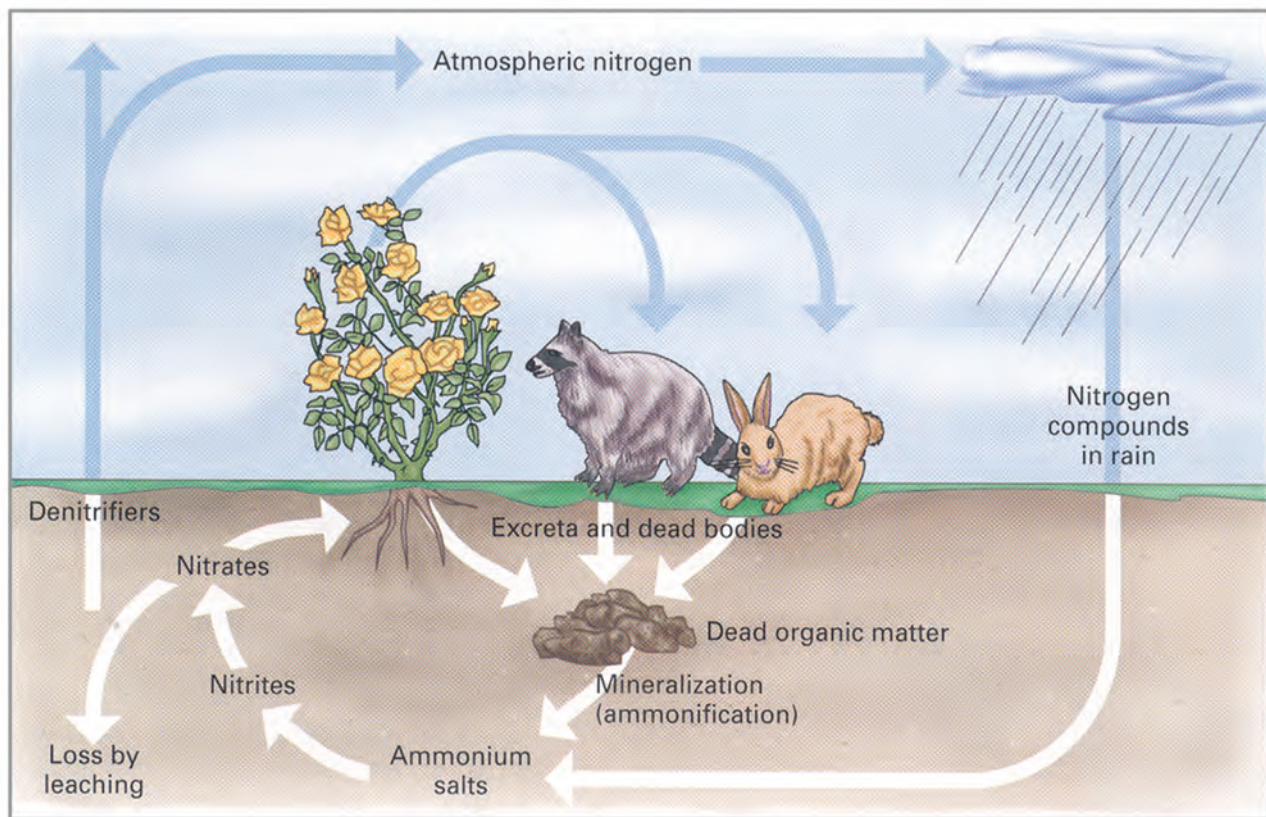
Plant Nutrients

Plants, like most living things, are predominantly water. Most of the solid parts of plants are sugars, starches, or derivatives. Some of the nutrients in plant tissue (carbon, hydrogen, and oxygen) come from the air and water. All the remaining nutrients come from the soil. The six most abundant nutrients are referred to as macronutrients.

- Nitrogen (N)
- Potassium (K)
- Calcium (Ca)
- Magnesium (Mg)
- Phosphorus (P)
- Sulfur (S)

The elements needed by plants in lesser amounts, and rarely absent in most soils, are called micronutrients.

The Nitrogen Cycle



Credit: *All About Roses*, Dr. Tommy Cairns,
Ortho Meredith, 1999

The Main Macronutrient Elements

Nitrogen (N)

Nitrogen is the most abundant element in the earth's atmosphere comprising 78% of the total volume. Its normal state is a colorless, odorless gas, composed of two nitrogen atoms bound together. Although plants only contain about 2% nitrogen by weight, it is critical for a plant's growth and survival.

Nitrogen in its gaseous state is inert, so it must be converted, mainly in the soil, into a form that is available to the plant. This process, called fixation, produces nitrates that the plant can use.

Nitrogen is the nutrient that stimulates growth. Tall, strong canes, good blooms and rich dark green foliage are evident when nitrogen is in balance in the soil. A lightening of the green color and in extreme cases yellowing of leaves indicate a lack of nitrogen. Excesses of nitrogen can be even more harmful, resulting in weak, soft canes, small blooms, and decreased plant resistance to disease. Nitrogen converts to amino acids and produces enzymes that control the plant's functions, such as photosynthesis, metabolism, and respiration.

Nitrogen generally exists in four forms for the gardener:

- **Nitrate Nitrogen** is available to the rose without going through any change in the soil. Nitrate nitrogen is the most available form of nitrogen.
- **Ammonia Nitrogen** is slightly available to the plant and can be changed in the soil to nitrate nitrogen for plant uptake.
- **Urea Nitrogen** is the slowest available nitrogen form, as it must undergo biologically induced chemical transformation to be available to the plant.
- **Nitrite Nitrogen** is rarely used in fertilizers as it is costly.

The fixation of nitrogen is aided by biological activity in the soil. For example, nitrogen added to the soil is converted by fungi and bacteria to ammonia, then to nitrite, then to the plant absorbing form, nitrate. Soil temperature, moisture, and acidity influence these transformations. Soil temperature also has an essential effect on the conversion of nitrogen to ammonia or nitrate (readily available). Higher soil temperatures increase this conversion rate, making more nitrogen available to the plant.

Adequate drainage is highly desirable in increasing the availability of nitrogen for the plant. Some nitrogen compounds from liquid fertilizers are very soluble in water, so they pass through the soil quickly if drainage is too fast.

Restricted drainage in the soil may cause a process known as denitrification, changing nitrate to free nitrogen, which will be lost from the soil, thereby decreasing the nitrogen content. Denitrification explains the importance and benefit of a loose friable soil structure.

Phosphorus (P)

Phosphorus is a naturally occurring nutrient in the soil and makes up only 0.5% of the plant's weight.

Phosphorus stimulates root growth to produce quality plants and big blooms. It may also hasten plant maturity, adding to winter hardiness. It is a critical element in the regulation of energy transfer in the plant. The most critical factor controlling the availability of phosphorus is soil acidity. At a pH of 6.0 to 7.5 the phosphorus remains in a form available for the plant. At a pH higher than 7.5, the availability of phosphorous decreases slightly. Phosphorus moves very slowly through the soil, so many rosarians will add phosphorus (usually superphosphate) to the soil as they plant a rose so it will be in contact to the feeder roots.

The northwest, west and northern areas of the United States generally have high levels of phosphorus in the soil. The southern United States typically has low concentrations, and with heavy clay soils, it may not be available to the plants.

Potassium (K)

Potassium is a naturally occurring nutrient in the soil and makes up about 2.4% of the earth's crust. Most of it is in an unusable form for plants and requires transformation.

Potassium promotes root growth, vigor, and bloom color. It also counteracts the harmful effects of excessive nitrogen and exerts a balancing effect on both nitrogen and phosphorus. It supports photosynthesis, which is essential for starch formation and the development of chlorophyll. Potassium readily leaches out of the soil and the level should not be allowed to drop too low.

An excessive amount of potassium interferes with the intake of magnesium and calcium, causing serious problems for the plant. A deficiency causes brown leaf margins, weak stems, and blind shots. Many things affect potassium in the soil, and the minerals in the soil have a marked influence on potassium availability. These minerals may be added in the form of fertilizer or may already be present in the soil. The type of clay mineral in the soil has a marked influence on potassium availability. Certain types of clay in soil expand and contract. This entraps potassium and makes it less available to the plants.

Sulfur

Sulfur is used by the plant in the development of essential organic compounds of proteins, vitamins. Sulfur is present in organic material and is converted by bacteria to sulfates, which are very soluble and can be leached quickly from the soil. A soil test will determine the sulfur content of the rose bed.

Calcium and Magnesium

These two nutrients are present mainly in the plant's leaves. One of the critical functions of these minerals is to neutralize certain toxic acids, that form as a by-product of metabolism. Deficiencies of magnesium are common in sandy soils of the southern United States and are caused by too much calcium in the soil. Magnesium is the center molecule for chlorophyll. Chlorophyll absorbs red and blue light efficiently leaving green light to be reflected back. This accounts for the color of green plants. Therefore, a magnesium deficiency will show the lack of a green color.

Minor Micronutrients

Iron, manganese, boron, zinc, copper, molybdenum, and chlorine are usually sufficient in a well- prepared fertile soil. In a soil with a high pH, boron deficiency may occur because of unfavorable calcium content. Acid soils may be low in molybdenum. Iron will be unavailable in an alkaline soil until the pH is adjusted to just below 7.0. A rose diet requires only small amounts of trace nutrients but a lack of one or more may impact the availability of major nutrients.

Nutrient Summary

- **Nitrogen** – stimulates growth of tall, strong canes, good blooms, and rich dark foliage.
- **Phosphorus** – stimulates root growth, produces quality plants and big blooms. Also hastens plant maturity adding to winter hardiness.
- **Potassium** – promotes root growth and bloom color.
- **Calcium** – holds cell walls together and promotes stability and early growth, sturdier plant.
- **Magnesium** – promotes chlorophyll formation produces greener foliage and healthy, disease-resistant plants.
- **Sulfur** – provides the raw material for amino acids and proteins needed for plant health. Also lowers pH.
- **Zinc** –stimulates stem growth and flower bud formation.
- **Iron** – aids chlorophyll formation and creates sugar burning enzymes, which activates nitrogen fixation.
- **Manganese** – aids chlorophyll formation and activates other enzymes, helps in photosynthesis, respiration, and nitrogen metabolism.

- **Copper** – enzyme activator for vitamin A-forming enzymes; stimulates stem development and pigment.
- **Boron** – helps move sugars from cell to cell, controls starch formation, stimulates cell division, flower formation and pollination.
- **Molybdenum** – needed for nitrogen fixation and nitrogen use in the plant. Specifically, it is needed to make amino acids to stimulate plant growth and vigor.
- **Carbon, Hydrogen, and Oxygen** – necessary for any plant life; roses obtain them from the atmosphere. A loose, friable soil allows these essential elements to flow through the soil.

Availability of Nutrients

Nutrient availability is profoundly affected by soil acidity. The acidity of the soil is measured by the pH on a logarithmic scale running from 0 to 14. A pH of 0 is very highly acidic (think battery acid) and a pH of 14 (think lye) is very highly alkaline (basic). A pH of 7.0 is considered neutral. (Logarithmic scale: For every change of 1 pH unit up or down the concentration of H⁺ decreases or increases by ten times).

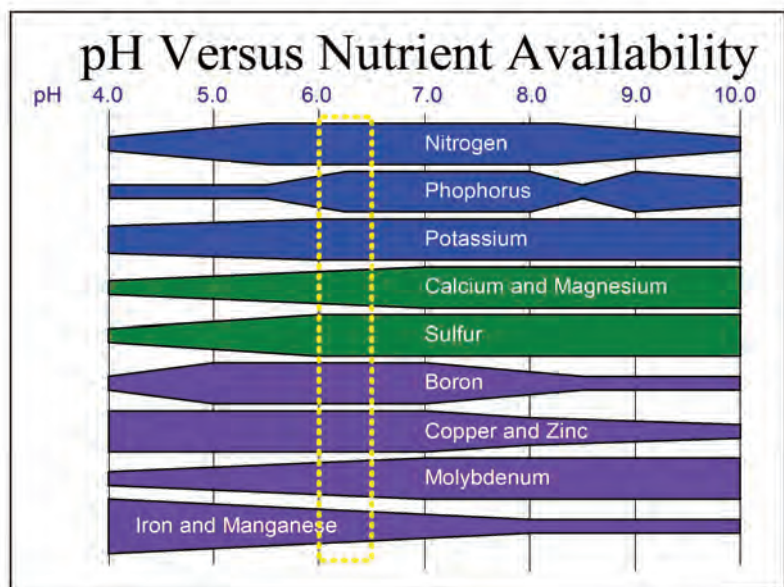
- A soil may have sufficient levels of nutrients, but if the soil pH is very far from the ideal pH for roses (6.0 - 6.5), the nutrients may not be available to the plant. This is because in certain pH ranges, nutrients will react with each other and form.

Storage and Movement of Nutrients

Many nutrients exist in the soil as positive ions known as cations. Clay lattice and humus in the soil are negatively charged, because opposites attract, the nutrients stick to the soil. How well the soil can hold these nutrients is referred to as the Cation Exchange Capability (CEC) of the soil. The type of clay lattice and the amount of humus in the soil affects the CEC of the soil. The higher the CEC, the better the soil can retain nutrients.

Nutrients exist in the soil in several possible forms:

- As organic matter. Typically, 97-99% of the nitrogen, 25-90% of the phosphorus and 70-90% of the sulfur in the soil are in organic matter.
- Adsorbed onto clay or humus as cations (CEC).
- Free in the soil as a negative ion. Because the clay or humus does not adsorb them, these ions are subject to leaching from the soil.
- In a complex organic molecule called chelate. Many trace nutrients are more available when chelated.
- Fixed in insoluble compounds. Changes in the soil pH may be required to make these nutrients available.



Credit: Steve Steps

Phosphorus and nitrogen illustrate the issues surrounding the formation of the nutrients. Typically, less than 0.5% of the phosphorus in the soil is in an immediately available form. Most of the phosphorus (25-90%) is contained in organic matter and the rest is fixed in soluble compounds. As a result, soils are rarely deficient in total phosphorus, but frequently deficient in available phosphorus. Phosphorus moves extremely slowly through the soil. Add phosphorus to the hole during planting if the soil test shows a deficiency.

The most available form of nitrogen for plants is the nitrate ion, that has a negative charge. Because a negative ion is repulsed by the negatively charged soil (like charges repel), nitrates move very easily through the soil. This is good when nitrogen is needed because added nitrate can get to the roots very quickly. However, this lack of sticking to the soil by nitrates allows them to leach readily from the soil. Consequently, nitrogen is the most frequently required nutrient in the soil. Ammonium nitrogen will be adsorbed by the soil however, it must be changed to the nitrate form to be available to the plant. The organic form of nitrogen is very stable in the soil but requires the action of soil bacteria to change it into the nitrate form required by plants.

Leaching of nutrients from the soil can be good for the soil. All nutrients can become toxic to the plant if their levels build up. This build up might come from nutrients that are being added faster than the plant needs them (such as fertilizers with excessive amounts of some nutrient) or from nutrients left over from the evaporation of irrigation water. Excessive nutrients are a problem with roses grown in pots with either no drainage or a saucer underneath. Sodium build up is common. Occasional heavy watering will leach out these excessive nutrients.

Note that soils low in organic matter, which reduces the bacteria that convert nutrients into a usable form, and low in CEC (which organic matter supports), will tend to require frequent applications of nutrients. CEC and organic matter contribute to most of the soil's ability to store nutrients, but the problem will be aggravated if the soil pH is incorrect thus locking up many of the remaining nutrients. Soils low in organic matter and with incorrect pH will almost always exhibit nutrient deficiency problems.

Fertilizer Characteristics

SOLUBLE INORGANIC	NATURAL ORGANIC	UREA-FORM
Immediately Available Lasts 3-4 weeks Burns Foliage Leaches from soil No carry-over No Odor High nutrient content High efficiency Concentrated	Readily Available Lasts 4-6 weeks Does not burn Leaches from soil Little carry-over Odor might be offensive Low nutrient content Low efficiency Bulky	Slowly Available Lasts 20-24 weeks Does not burn Does not leach Significant carry-over to next season No odor High nutrient content High efficiency Concentrated

Credit: American Rose Society

Primary nutrients that are added to the soil are fertilizers. They can be synthetic or come from natural sources (organic fertilizers).

Plants use nutrients in their ionic forms, so it does not matter from what source the nutrient originated. Almost all fertilizers (both synthetic and organic) tend to make the soil more acidic. However, the overall effect on the soil and the living things in it can be quite different. As with the use of any chemical, safety is foremost.

Read the product label for required safety equipment and application directions. Synthetic as well as natural fertilizers may contain harmful materials, such as heavy metals or disease-causing chemicals, so care needs to be taken to avoid contact.

Synthetic or Manufactured Fertilizers

Commercial fertilizers contain and list the percentage of the three primary nutrients needed for good growth, nitrogen (N), phosphorus (P), and potassium (K). These nutrients are listed in the order on the label, such as 8-10-8. In general, all synthetic fertilizers are salts - which means they break down to positive and negative ions when dissolved in water. All salts interfere with the ability of the plant to obtain water. Heavy applications of synthetic fertilizers will cause a burn on the leaves similar to not watering a plant during hot weather. The salt index refers to the strength of this effect.

Water rises heavily before and after an application of synthetic fertilizers. The existing salt level in the soil can also contribute to the burning effect of adding synthetic fertilizers. Humus in the soil can reduce the burning effect. **Never apply fertilizer to dry soil.**

In early spring, when the soil is too cool for soil bacteria to become active, synthetic fertilizers provide food for the plants in an easily available form. It is better to use small amounts often rather than large amounts of fertilizers all at one time. As the soil warms up, the addition of organics is beneficial.

As mentioned earlier, the most available type of nitrogen to plants is the nitrate ion. This ion has a negative charge and thus is not held by the negatively charged clay and humus in the soil. As a result, this form of nitrogen can move quickly through the soil. Fertilizing with a nitrate form of fertilizer can have an almost immediate effect on plants. However, nitrates can also continue to move beyond the roots (leach), so this is not a good long-term form of fertilization.

The ammonium form of nitrogen has a positive charge, so it is held by the negatively charged soil and thus does not leach as quickly. Soil biological action can very quickly change ammonium nitrogen into nitrate. In that case use frequent applications of nitrogen fertilizer or a slow release form of fertilizer.

The initials W.I.N. on a fertilizer label stands for water insoluble nitrogen. These fertilizers usually contain organic forms of nitrogen and urea, which must be broken down before they can be used by the plant. W.I.N. fertilizers are referred to as slow release nitrogen sources. Water soluble nitrogen (W.S.N.) fertilizers dissolve readily and are composed of a simple form of nitrogen.

Slow Release Fertilizers

There are three types of slow release fertilizers. The first are materials that dissolve very slowly, such as sulfur. The second type of slow release fertilizer is one that requires action by soil micro-organisms to release the fertilizer in usable form. Urea is a common form of nitrogen that is slowly converted to nitrate form by the soil microorganisms. Coating a fertilizer with a long-lasting substance creates the third type of slow release fertilizer. Most once- or twice-a-year type fertilizers have fertilizer pellets coated with varying thicknesses of sulfur or resins

When fertilizers coated with multiple layers of resin meet water, the layers swell and increase the pore size in the resin and the dissolved fertilizer can then move into the soil. The release rate depends on the coating thickness, temperature, and water content of the soil. There is often a large release of fertilizer during the first two or three days after application. Release time can range from immediate to six or nine months depending on the coating.

Another major advantage of slow release fertilizers is that they reduce the chances of fertilizer burn.

A sudden increase in the salt index could cause plant damage. If the rate at which the fertilizer becomes available in ionic form (salt) is similar to the rate at which the plant uses it, then there is no net increase in the salt level in the soil.

Use caution in timing the application of slow release fertilizers as they may keep the plant growth going late into the fall. This growth will not harden off completely and excessive winter damage may occur. Also, excessive watering will release the nutrients faster and they will not last as long.

Water Soluble Fertilizers

As indicated by the name, these are fertilizers in a form that will dissolve in solution. When mixed with water, the solution can be sprayed on the foliage (foliar feeding) or used as a soil drench.

Different formulations are available, some with equal levels of N-P-K (20-20-20) or some with one of the major nutrients in higher concentration such as 15-30-15 or 18-8-30. Some formulations also contain micro-nutrients, which can benefit the plant.

A water-soluble fertilizer can be used as an addition to a complete fertilizing program. It makes a good tonic for a quick pick-me-up for the plants and as a supplemental feeding during a rainy spell. Water-soluble fertilizers may be more suitable for container grown plants than a granular fertilizer.

For easy application a “proportioner” or an inexpensive hose-on siphon can be used to deliver the fertilizer while watering. Many rosarians advocate small amounts with every watering as a way to deliver a constant supply of nutrients. As always, do not over fertilize and follow the directions on the label.

Organic Fertilizers

Organic fertilizers are those which come from once-living organisms. They can range from animal wastes (manure) to ground up organisms (fish emulsion) to former plant materials (compost). All organic fertilizers have several characteristics in common:

FERTILIZATION Comparison of Slow-Release Fertilizers and Conventional Fertilizers

SLOW RELEASE FERTILIZER	
Advantages	Disadvantages
<ol style="list-style-type: none"> 1. Fewer applications 2. Low burn potential 3. Release rates vary depending on fertilizer characteristics 4. Comparatively slow release rate 	<ol style="list-style-type: none"> 1. Unit cost is high 2. Availability limited 3. Release rate governed by factors other than plant needs
CONVENTIONAL FERTILIZER	
Advantages	Disadvantages
<ol style="list-style-type: none"> 1. Fast acting 2. Some are acid-forming 3. Low cost 	<ol style="list-style-type: none"> 1. Greater burn potential 2. Solidifies in the bag when wet 3. Leaches readily
MANURES OR SEWER SLUDGE	
Advantages	Disadvantages
<ol style="list-style-type: none"> 1. Low burn potential 2. Relatively slow release 3. Contains micronutrients 4. Conditions soil 	<ol style="list-style-type: none"> 1. Salt could be a problem 2. Bulky, difficult to handle 3. Odor 4. Expensive per pound of actual nutrient 5. Weed seeds a problem

Credit: Roses, Inc.

- They tend to be very low in nutrient content. Even a potent organic fertilizer, chicken manure, only has about 4.5% nitrogen. Composts are even lower yet; typically, in the 1-2% range of nitrogen.
- The nutrients tend to be in slow release form, requiring biological action from microbes in the soil to release the nutrients.
- They tend not to release nutrients unless the soil is warm because the required biological action requires warmth.

While breaking down organic fertilizer, the microbes actually use up nitrogen, which may cause a temporary drop in the nitrogen available to the plants. So supplemental quick release fertilizers may be helpful. After the fertilizer is decomposed, nitrogen availability will be restored.

Organic fertilizers (or mulches) slowly add to the level of humus in the soil. As mentioned earlier, humus adds to the soil's ability to store nutrients (CEC), and break down rocks into nutrients, helps build proper soil structure and increases the soil's available water capacity.

A major difference between synthetic fertilizers and organic fertilizers is the long-term effect on the condition of the soil. Constant use of synthetic fertilizers without adding organic material to the soil either as fertilizer or as mulch will deteriorate the soil structure and overall health of the soil. When using synthetic fertilizers as the primary source of added nutrition, organic material also needs to be added to the soil by means such as a top dressing of compost or mulch

Commonly Used Organic Materials

- **Cottonseed Meal** as a fertilizer is somewhat acidic in reaction. Formulas vary slightly, but generally contain 7% nitrogen, 3% phosphorus and 2% potassium. In warm soil, the nutrients are more readily available to plants, but there is little danger of burning. Cottonseed meal is excellent to use in a high pH soil as its acidic action will tend to lower the pH while providing nutrients to the plants.
- **Blood Meal** is dried, powdered blood collected from cattle slaughterhouses. It is a rich source of nitrogen, so rich that it may do harm if used in excess. The rosarian must be careful not to exceed the recommended amount suggested on the label. In addition to nitrogen, blood meal supplies some essential trace elements, including iron.

NUTRIENTS REQUIRED AND DEFICIENCIES

The chart below shows parts per million needed for good growth of each nutrient, excess tolerated, reserve levels, and the deficiency indications. Note the higher needs of roses in relation to lawns.

Substance	Lawn & General Soil	Rose & Garden Soil	Plant Tolerance Levels	Reserve Levels	Deficiency Signs
Figures represent amounts as parts per million (ppm)					
Nitrate	10	40	125		Yellow green leaves with drying & slow growth
Phosphorus	2	5	50	15	Purple leaves, slow growth, poor roots
Potassium	10	20	50	50	Spotting & Streaking w/ curling leaves & dead parts falling out
Calcium	100	150	200		Young leaves not maturing or unfolding
Magnesium	10	10	50		General loss of green color but veins stay green
Sulfate	20	20	450		Young leaves light w/veins lighter
Iron		5	50	25	Chlorotic plants
Manganese		2	25	2	Stunted growth
Aluminum			1		Test for toxic levels
Nitrite			2		
Ammonium	5	7	50		
Chloride			100		Test for toxic levels

Credit: Roses, Inc.

- **Alfalfa Meal** is not only a good organic soil additive, but also contains hormones that stimulate growth. The meal can be incorporated in the soil or used as a tea.
- **Fish Emulsion** is a well-rounded fertilizer. It is a partially decomposed blend of finely pulverized fish. Fish emulsion is a good source of nitrogen and several trace elements. In the spring, when the rose plants have sprouted, an application of fish emulsion followed by a deep watering will boost the plant's early growth spurt. Contrary to popular belief, too strong a solution of fish emulsion **can** burn plants, particularly in containers.
- **Manure** is a complete fertilizer, but low in the amounts of nutrients it can supply. Manures vary in some nutrient content according to the animal source and what the animal ate. A fertilizer ratio of 1-1-1 is common. Manures are best used as soil conditioners instead of nutrient suppliers. The highest concentration of nutrients is found when manures are fresh. As it ages, leaches or is composted, nutrient content declines. Fresh manure should not be used where it will be in contact with tender plant roots as it will burn. Be aware that fresh manure may also harbor bacteria harmful to humans and should be handled with care. Typical rates of manure applications range from 70 pounds to 100 pounds per 1,000 square feet. Steer manure from feeding stations can contain high levels of salt, so care must be taken not to use too much.
- **Sewer Sludge** is the recycled product of municipal sewage treatment plants. Two forms are available, activated, and composted. Activated sludge has higher concentrations of nutrients (6-3-0) than composted sludge and is usually sold in a dry, granular form. It is a general purpose, long lasting, non-burning fertilizer. There is some question about the long-term effect of using sewage sludge products. Heavy metals are sometimes present and may build up in the body if inhaled by the applicator. Heavy metals can also be toxic to the soil and will remain for years.

Nutrient Imbalances

A rose that has either too much or too little of any nutrient will suffer. Diagnose most of the nutrient imbalances using color photographs (See color chart of nutrient deficiencies at the end of the chapter.) There are 16 nutrients that roses need and thus there are 32 possible imbalances of nutrients, plus some other toxicity effects such as too much sodium.

**AVERAGE NUTRIENT ANALYSIS
OF SOME ORGANIC MATERIALS**

	N	P ₂ O ₅	K ₂ O
	%		
Fresh manure with normal quality of Bedding or litter			
Duck	1.1	1.45	0.50
Goose	1.1	0.55	0.50
Turkey	1.3	0.70	0.50
Rabbit	2.0	1.33	1.20
Bulky organic materials			
Alfalfa hay	2.5	0.50	2.10
Bean straw	1.2	0.25	1.25
Grain straw	0.6	0.20	1.10
Cotton gin trash	0.7	0.18	1.19
Seaweed (kelp)	0.2	0.10	0.60
Winery pomace (dried)	1.5	1.50	0.75
Organic concentrates			
Dried blood	12.0	1.5	-
Fish meal	10.4	5.9	-
Digested sewage sludge	2.0	3.0	-
Activated sewage sludge	6.5	3.4	0.3
Tankage	7.0	8.6	1.5
Cottonseed meal	6.5	3.0	1.5
Bat guano	13.0	5.0	2.0
Bone meal ¹	<1.0	12	-

¹ Bone meal values vary widely because of moisture content and processing. Available P₂O₅ 12-14%; insoluble P₂O₅ 14-16%; total P₂O₅ 26-28%

Credit: *Western Fertilizer Handbook*,
California Fertilizer Association

Fortunately, there are only four of these imbalances that are frequently observed, and it is imperative that the Consulting Rosarian is aware of them. These are:

- **Nitrogen Deficiency.** Because nitrogen can leach from the soil (as nitrate), volatilize or denitrification (by bacteria), nitrogen needs to be constantly added to the soil. In roses lacking nitrogen, the leaves will show an overall pale yellow-green color, the plant will be stunted, and stem size will be smaller than normal.
- **Oxygen Deficiency.** This is a lack of air to the roots typically caused by over watering or poor drainage. The veins of the leaf will show chlorosis (yellowing) followed by interveinal chlorosis.
- **Iron Deficiency.** The appearance of leaves on a plant suffering from iron deficiency has the opposite look of oxygen deficiency - the interveinal areas show chlorosis while the veins remain green. Iron is rarely deficient in the soil, but rather it is likely that something is making the iron unavailable. Possible causes are high pH, poor aeration of the soil, high soluble salts or excessively high concentrations of manganese, zinc, or phosphorus. Foliar sprays can give temporary relief if they contain iron.
- **Leaf Burn.** The edges of the leaves turn brown and crispy. The fundamental cause of this is a lack of water getting to the edges of the leaves. This can be caused by anything that either makes water unavailable to the plant or excessively increases the water loss from the plant. Typical causes include over fertilizing with synthetic fertilizers, high salt level in the soil, lack of water, heat stress, spray burn or a combination of the above.

Symptoms of Rose Nutrient Deficiency

It is important to note that many symptoms of a nutrient deficiency are problems with availability rather than supply. The nutrients may be present in the soil but are unavailable because of a pH that is too high or too low. There may also be a nutrient imbalance that prevents absorption of one nutrient thus causing symptoms of deficiency. Many symptoms are similar. Generally, micronutrient deficiencies are rarely seen. The most common deficiencies are nitrogen, iron, oxygen, plus heat stress. *See the Color Plate of Common Rose Deficiencies at the end of this chapter.*

Mature Leaves Affected First

- **Nitrogen Deficiency** – Older leaves turn chlorotic, pale light green to completely yellow on the entire leaf but remains on the plant. Reduced growth with reduced leaf size. Stems weak and spindly, small flowers, lighter in color.
- **Oxygen Deficiency** – Do not mistake oxygen deficiency with a nitrogen deficiency. Though the symptoms look-alike, no amount of nitrogen will correct the symptoms.
- **Magnesium Deficiency** – The first symptom is a reduction of leaf size. The entire leaf is chlorotic with yellow between veins. Plants are stunted with large, necrotic white areas symmetrically distributed on both sides of the leaflet between larger lateral veins of the older leaves. Leaf edges of older leaves cup down. Some varieties may develop dark brown or purplish blotches scattered randomly across the leaflet.
- **Phosphorus Deficiency** – Older foliage drops without turning yellow. Leaves are dull gray green in color. Buds slow to develop; leaf edges of older leaves may cup down.
- **Potassium Deficiency** – Margins of leaf are affected first. Margins become yellow then turn brown, leaves sometimes become purple. Young shoots become hardened and stunted. Flower buds may be distorted.

Younger Leaves Affected First

- **Iron Deficiency** – Chlorosis of young leaves. A general lightening of the green of the leaves. Interveinal areas yellow.
- **Manganese Deficiency** – Interveinal areas yellow but smallest veins remain green, more of a netted appearance.
- **Boron Deficiency** – Shoots often die or are hard. New growth ceases or withers. Leaves do not develop or are distorted. Flower petals become shortened and bullheaded flowers may be numerous with petals rolled inward.
- **Copper Deficiency** – Young leaves develop light edges, apical stem dies resulting in development of many small side branches. Possible to confuse with magnesium deficiency.
- **Calcium Deficiency** – New growth dies without development. In severe cases, plants become defoliated. Many dead roots. (Older leaf edges may cup down).
NOTE: There is a close relation between calcium and boron. Calcium deficiency symptoms may be only a reflection of a calcium-boron imbalance. There must be ample quantities of both, but they must be present in proper balance. Often low pH, high phosphorus and high nitrogen levels, high soluble salts and heat stress create conditions which limit calcium uptake.
- **Zinc Deficiency** - New shoot growth aborted, distorted leaves. Older leaves do not cup down.
- **Molybdenum Deficiency** – Symptoms are similar to moisture stress with youngest growth displaying some wilting. Weak flower stems and leaves drying from the tips and edges are also noticed.

Symptoms of Nutrient Toxicity

Mature Foliage Affected First

- **Spray Injury** – Older leaves drop rapidly with necrotic leaf margins.
- **Zinc Toxicity** – Older leaves do not drop at first, main vein remains green as the leaf first turns yellow then brown, then leaves drop after drooping. Young shoots become stunted; buds may be distorted.
- **Boron Toxicity** – Browning of mature leaves at the leaf edge, separated from the green tissue with a distinctive pink margin, brown, irregular spots, then eventual leaf drop.
- **Manganese Excess** – Small black spots on older leaves. May also cause iron deficiency symptoms to appear.
- **Sulfur Toxicity** – Similar to high salt concentrations, followed by rapid falling off of older leaves.

Younger Plant Parts Affected First

- **Nitrogen Excess** – Younger plant parts are affected first with chlorosis of terminal growth. Buds fail to develop after cutting. Too much urea may cause plant hardening. Often the foliage is increased in size and blooms smaller than normal.
- **Phosphorus Toxicity** – Symptoms of copper, iron and zinc deficiencies will occur with excessive use of phosphorus as it makes these elements unavailable to the plant. This is especially true with a low pH.
- **Potassium Toxicity** – Chlorosis, root loss and wilting of young shoots.

Heat and Moisture Stress

Although not technically a deficiency, heat stress symptoms are similar to nutrient deficiencies and will be covered in this section. Visual symptoms will vary depending on the severity and longevity of the stress.

Soil salts can become a problem in dry soil and cause root injury, which in turn causes wilting of shoots and leaf scorch. Sometimes scorch of the leaf margins may develop on immature or nearly mature leaves; especially those exposed to direct sunlight.

Heat stress is often noticed after a period of cloudy, rainy weather promoting succulent top growth, followed by hot, dry, sunny days. The lack of oxygen in the soil caused by excessive rainfall (and possible poor drainage) puts the plant under stress to withstand the sudden increase in metabolism during hot weather. Wilting of young growth may occur at this time.

Bull nosed bloom formation of roses is essentially a temperature stress problem. Red flowers are more likely to develop bull noses than light colors. The darker pigments absorb more heat during the sunlight hours and re-radiate more heat at night, establishing a greater temperature fluctuation within the bud. Petal edge burn is more noticeable in red flowers and is associated with the buildup of heat in the petals. This is more evident after extended periods of cloudy weather followed by hot, sunny days.

When air temperature is high, relative humidity is low and air is moving across the leaf surface, the demand for water is greatest. Under these conditions, it is essential to provide water to the soil to reduce the total stress on the plant. During the hottest part of the day, it may be beneficial to water overhead. This will reduce the air temperature while providing moisture for the plant.

Effects of Soil Salts

Since roses are usually heavily fertilized, an accumulation of soluble salts is not uncommon. This could result in foliage injury and retarded growth. The effect of such salt accumulation is interference with water availability in the root zone. The higher the salt contents of the soil, the greater the stress on the plant to obtain moisture from that soil. Thus, roses growing in soils having high salt concentrations tend to induce a physiological drought. This effect is intensified as the moisture content of the soil decreases.

All soluble salts do not have the same effect on the soil. Many of the high analysis fertilizer materials commonly used on roses can produce a high salt index. However, when applied in suitable amounts, the salt effect is usually not a problem.

A given concentration of soluble salts may not be injurious if the soil is kept moist and evaporation rates are low. But given the opposite conditions, the same salt concentration can cause root injury, which in turn cause wilting of shoots. All waters, except distilled,

RELATIVE SALT INDEX OF FERTILIZERS					
Fertilizer	N-P-K	Salt Index Per 100 lb.	Salt Index Based per Unit of Respective Plant Food		
			N	P ₂ O ₅	K ₂ O
Nitrate of Soda	16-0-0	100	1.25	-	-
Muriate of Potash	0-0-62	115	-	-	37
Ammonium nitrate	33-0-0	105	63	-	-
Urea	46-0-0	75	33	-	-
Potassium nitrate	13-0-44	74	114	-	34
Sulfate of ammonia	21-0-0	69	66	-	-
Calcium nitrate	15-0-0	68	88	-	-
Sulfate of potash	0-0-50	48	-	-	19
Magnesium sulfate (Epsom Salts)			44	-	-
Di-ammonium phosphate	21-54-0	34	32	-	-
Mono-ammonium phosphate	12-61-6	30	49	12	-
20% Superphosphate	0	8	-	-	-
Calcium sulfate (Gypsum)	0-20-0	8	-	-	-

Credit: American Rose Society

most rain or melted snow, contain some dissolved salts. As the soil becomes drier, the nutrient solution becomes more concentrated. A concentration of dissolved salts, which is safe when the soil is moist, may become toxic when the soil becomes dry. It only takes one drying cycle under these conditions to cause the loss of roots, causing the plant to lose leaves.

The rose grower needs to appreciate the importance of water in the use of fertilizer material capable of inducing high salt effects. Light applications of water tend to dissolve the fertilizers minimally and cause the highest soluble salt concentration possible. Increased applications of water which cause some, but not too much, leaching tend to diminish such materials as sulfates and chlorides with little loss of ammonium or potassium. This minimizes salt increase. Moreover, such watering gives good distribution of applied fertilizers. Never feed roses if the soil is dry, **and water after fertilizing.**

Where water is used conservatively, i.e. sub-irrigation, the salt concentration of the water supply is of the utmost importance. Because this method of watering is highly conducive to salt accumulation, sub-irrigation is not suitable for use with water supplies having more than low to medium amounts of soluble salts. When using drip irrigation, test the water supply for soluble salts. If the analysis is high, consider a watering system that delivers a greater quantity of water at one time. All soluble salts are not equal in the effects on rose plant growth when they are present in excessive amounts. Plants will tolerate relatively large amount of sulfates as salts of calcium and magnesium and even of potassium.

Nevertheless, the treatment for correcting high salt accumulations is the same - flush with water. If drainage is not satisfactory, it may be advisable to add gypsum before leaching. Gypsum tends to improve soil aggregation and consequently the drainage of water. It is also highly effective in displacing or facilitating the leaching of other salts from the soil. The liberal supply of calcium in gypsum exchanges places with other metal ions held in the soil and can be tolerated by plants to an unusual degree.

A high salt index may not be as harmful in winter as in summer. Injury is most likely to result during hot, dry days of summer. However, if your soil test shows a salt index of 1.6 or higher the salts should be leached from the root zone by flushing with water or using a salt leaching solution.

Spray Burn

A common symptom that is misdiagnosed is damage from spray burn. Some pesticides will cause damage naturally or if not used properly.

Before looking into plant diseases and deficiencies, see what the individual is using for pest control

COMMONLY USED MATERIALS IN ROSE FERTILIZERS

Dolomite

Carbonates of magnesium and calcium in equal proportions ($MgCO_3$ - $CaCO_3$) can be thought of as a limestone useful for neutralizing acid soils in the same manner limestone is used. About one million tons are used annually as an ingredient in mixed fertilizers to supply available magnesium as well as render the fertilizer non-acid forming.

Potential basicity: 100B

Salt Index: 0.8

Gypsum

Calcium sulfate with combined water ($CaSO_4 \cdot 2H_2O$) is incapable of neutralizing soil acidity. Reacts with sodium or potassium carbonate to form corresponding sulfates and insoluble calcium carbonate increasing soil permeability.

Potential basicity/acidity: 0

Salt Index: 8.1

Limestone

Generic term for a wide range of agricultural liming materials defined as having a calcium and magnesium content which is in forms that are capable of reducing soil acidity. Are essentially calcium carbonate or a mixture of that with magnesium carbonate (see dolomite). Also provides large quantities of the secondary nutrients, calcium and magnesium.

Potential basicity: 90B

Salt Index: 4.7

Magnesium Sulfate

Very soluble magnesium salt of sulfuric acid. More commonly known as Epsom salt ($MgSO_4 \cdot 7H_2O$) Mixed with most of the ordinary fertilizer to provide ample content of the secondary nutrient, magnesium. Often used to reduce acidity of the soil through replacement of hydrogen ions.

Solubility: 85

Salt Index: 44

Potassium Phosphates

Three compounds, mono- (KH_2PO_4) , di- (K_2HPO_4) , and tri- (K_3HPO_4) , all have excellent prospect as liquid fertilizers. However, high production costs have precluded their entrance into the market place. Wide range of N:P:K formulations is theoretically possible.

Potential basicity/acidity: 0

Salt Index: 8.4

Potassium Chloride

Commercially available as muriate of potash (KCl), it is a salt containing 48 to 62% potash (K_2O), chiefly as chloride.

Potential basicity/acidity: 0

Solubility: 28

Salt Index: 1.16

Potassium Nitrate

Also known as saltpeter or nitrate of potash (KNO_3). Has several advantages; low salt concentration, nitrate nitrogen, favorable N/ K_2O ratio, negligible chlorine content, and alkaline residual reaction in the soil. By AAFPFCO definition, the commercial product shall contain not less than 12% of nitrogen and 44% of potash (K_2O).

Potential basicity: 26B

Solubility: 13

Salt Index: 73

Potassium Sulfate

Known as sulfate of potash (K_2SO_4), the fertilizer grade contains not less than 48% of potash (K_2O)

Potential basicity/acidity: 0

Solubility: 8

Salt Index: 46

Sodium Nitrate

Before the development of synthetic approaches, large quantities were imported from natural deposits in Chile, hence the common name Chile saltpeter ($NaNO_3$). Commercially available as nitrate of soda contain not less than 16.48% nitrogen.

Potential basicity: 29B

Solubility: 73

Salt Index: 100

Sulfate of Potash Magnesia

Term used to describe two possible double sulfate salts of potassium and magnesium ($K_2SO_4 \cdot 2MgSO_4$ or $MgSO_4 \cdot K_2SO_4 \cdot 6H_2O$)— should contain not less than 25% potash (K_2O) nor less than 25% of sulfate of magnesia.

Potential basicity/acidity: 0

Salt Index: 43

Superphosphates

Best described as the product obtained when rock phosphate is treated with either sulfuric acid or phosphoric acid or a mixture of these acids. Three grades available; normal with about 20% P_2O_5 , enriched with a content of 27% P_2O_5 , and concentrated containing 45-46% P_2O_5 .

Potential basicity/acidity: 0

Salt Index: 10

Surfactants

These compounds have the ability to lower the surface tension of liquid when dissolved in them, thereby increasing the penetration in the soil when applied. Most commonly used are the anionic alkyl aryl sulfonate - can be likened to a soap or detergent action.

Urea

Commercial synthetic acid amide of carbonic acid ($CO(NH_2)_2$), it contains about 42% nitrogen. Widely used in both solid and liquid fertilizers. Readily absorbed through the leaves and hence efficiently used as plant food.

Potential acidity: 84A

Solubility: 67

Salt Index: 75

Credit: Dr. Tommy Cairns



Credit: Baldo Villegas, Orangevale, CA



Credit: Baldo Villegas, Orangevale, CA



Credit: Baldo Villegas, Orangevale, CA

Notes

Acknowledgements

Diagrams used with Permission from:

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American Rose magazine, American Rose Society

Western Fertilizer Handbook, California Fertilizer Association, 9th edition, 1990

Roses, Roses, Inc. 1987

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Updates

9/2020 Color plates of rose deficiencies updated and converted to tiff format

Notes

Chapter 7 – Pest Control Basics

Integrated Pest Management

Basic Concepts

Whether a rosarian is growing roses strictly for enjoyment in the garden or for winning trophies at a rose show, the basic concepts of pest control are the same. Whether a rosarian is an "organic" grower or immediately resorts to using every chemical pesticide available, the fundamental decision process is the same. It is only the decision thresholds and selection of choices that are different among rosarians. This decision process is known as Integrated Pest Management (IPM). This term is usually associated with organic growers, but it describes the method used by all rosarians – organic or chemical.

IPM Definition

IPM is a decision-making process that utilizes regular monitoring to determine if treatments are needed. Many factors enter this decision, such as ecological, economic, medical, and sociological consequences. The treatment plan integrates several techniques such as biological control, physical control, habitat modification, and least toxic chemical control.

Decide the choice of treatments based on:

- How disruptive it is to natural controls
- How hazardous it is to human health, and other organisms
- How likely it affects a long-term reduction in habitat necessary to sustain the pest
- How cost-effective it is in the long and short terms

[From *"Common Sense Pest Control XI (3)"*, Summer 1995, *Bio-Integral Resource Center*.]

IPM Basics

IPM consists of four elements:

- Decision whether to treat.
- Decision when to treat.
- Decision on how to treat.
- Evaluation and review of the decisions.

These IPM elements form a spectrum of choices. At one extreme, a rose exhibitor who has no tolerance for any pests on their roses will go through all four elements very quickly. Treatment will be immediate and, in some cases, preventative. For example, they may spray for fungus diseases whether the fungus has been observed or even whether conditions are favorable for fungus growth. The treatment method, which provides the most immediate effect, will be selected, and the evaluation is whether pests are remaining.

A person on the other extreme of the spectrum may be interested in reducing the use of synthetic chemicals. They may spend a significant amount of time going through each of the IPM elements – including a great deal of time evaluating the results of each of the decisions. For example, this rosarian may spend time determining what it is they see on their roses. Is it damaging their roses, having no effect on their roses, or is it helping control other damaging pests? If it is a pest, what is its life cycle? How many of the pest will it take to reach a damaging level? This rosarian may be keeping records on the increasing and decreasing levels of the pest. What is keeping the pest from a major outbreak? What are the natural

predators of the pest? What can be done to tip the balance in favor of the natural predators? Can simple cultural changes ensure future outbreaks of the pest more quickly? For any action taken, this rosarian may be keeping records so that in the future, he or she will know what measures provide the best long-term control of the pest.

Both rosarians are practicing IPM. What differs are the priorities and levels of acceptable damage measured by how quick, cost-effective, and long-lasting the results are.

Decision Whether to Treat

Identification of Pest

Before making any decision about treating a pest, one needs to identify the problem correctly. Stories abound of rosarians repeatedly spraying mummified aphids with pesticides or spraying the beneficial syrphid fly larvae ("kill those worms"). It is just as ineffective to be spraying fungicides on a bush suffering from a lack of water – it will only decrease the health and appearance of the plant.

Correct identification of insects should include whether the insect is damaging, helpful, or neutral. Information on the insect's life cycle is crucial for making decisions as to when to treat and how to treat. Even the decision to treat has many other factors beyond whether it is a good bug or nasty bug. Every decision carries consequences.

Consequences of Treatments

The first four of these consequences are the "3 R's and an S."

Pesticide Residue.

If not all the pesticide reaches the target pest, what happens to the rest of it? Will household members or pets encounter the residue? How long does the pesticide remain active? Will it get into the groundwater? If it is windy, where will the pesticide drift? Will it impact other plants or other people's yards?

Pest Resistance to Pesticides.

The first known pesticide resistance buildup was to sulfur in 1914. However, the increased reliance on chemical pesticides after World War II has led to resistance buildup in almost every pest. Frequent sprayings with dilute solutions will increase the rate of pesticide resistance buildup.

Pest Resurgence following pesticide use.

Most pesticides kill the predators as well as the pests. Because pests can usually rebuild populations faster than the predators, it is common to see increases in pest levels (resurgence) a few weeks after applications of pesticides. Even the use of nonspecific beneficials can decrease overall predator levels and thus allow an upsurge of pest levels.

Secondary Pest Outbreaks.

Treatment of one pest may result in an increase of another pest by accidentally killing the beneficials, which had the secondary pest under control. Spider mites are rarely a problem in yards where there are no pesticides used. Spider mites were generally only a problem for greenhouse-grown roses until the widespread use of DDT and more modern pesticides reduced the spider mite predators. Often high infestations of spider mites are seen in gardens where there is a regular use of broad-spectrum insecticides.

Health Hazards.

Will people and especially children, encounter your roses while the pesticides are still active? The National Research Council, in their 1993 study called “Pesticides in the Diets of Infants and Children,” warned that because of their size and diet, infants and children are at higher risk for pesticide residues. The study warns: “Some pesticides, dependent on dosage, can cause a range of adverse effects on human health including cancer, damage to the nervous system, lung damage and reproductive dysfunction.”

Social factors.

Are your neighborhood and town supportive or intolerant of pesticide use? Will frequent spraying of your roses cause others to avoid growing roses?

Cost factor.

What is the economic cost of a spraying or beneficial release? What benefit will it provide versus waiting for natural checks and balances to control the pest?

Decision When to Treat Pest

Pest Monitoring & Threshold levels for action: “No pest is an island, alone to itself.” Instead, all pests are part of a complex system, which is why pest levels tend to fluctuate. Certain conditions (such as hot or wet weather) allow for rapid increases in pest levels while other conditions (such as humidity or predator levels) cause rapid decreases in pest levels.

Based on economic or other reasons (for example, rose shows), a “damaging limit” establishes a threshold for each pest. Then a level can be chosen below that as an “action threshold.” When a pest level exceeds the action threshold, then treatment action is taken to avoid allowing the pest to exceed the damaging threshold.

The best method for determining when to treat for pests is through careful monitoring and recordkeeping of pest levels, beneficial levels, and other environmental conditions. For example, records might indicate that even if aphid levels are quite high, no treatment is required if there appear to be syrphid fly eggs present in most aphid colonies. When there are too few beneficials, action is needed.

Likewise, records may show that rust is only a problem during extended periods of rain when the weather is relatively cool. If so, preventative spraying during dry spells may not be required at all. Only if the forecast calls for a period of cold and rain should fungicides for rust be applied.

Decision How to Treat Pest

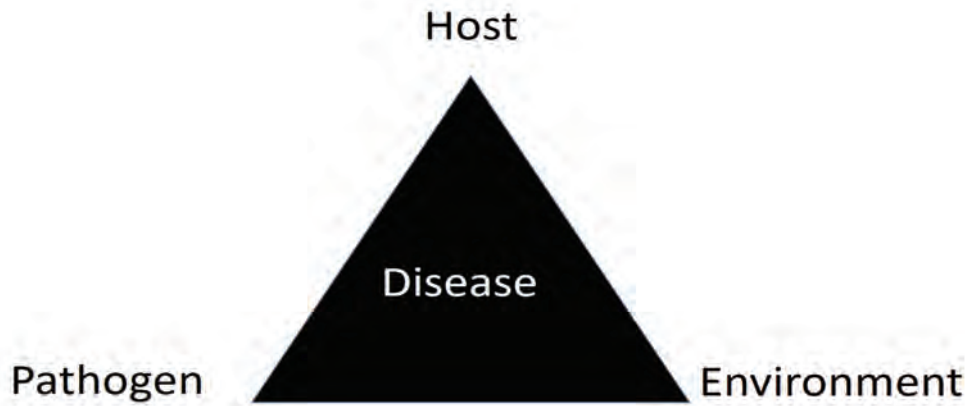
A useful concept for determining how to handle the problem uses the pest triangle. While it usually applies to fungus diseases, it works for other insects and other pests.

Pest outbreaks occur when all parts of the triangle are favorable. Of course, the pest must be present, along with an appropriate host and a favorable environment. The use of the triangle leads to possible controls for the pest by attacking one or more parts of the triangle. For example, one could avoid light-colored roses (host) to reduce thrips problems; one might use mulches (environment) to interfere in the thrips’ lifecycle, or one could spray a pesticide directly onto the thrips. Overall, these lead to the following set of choices in pest control.

Pest Control Choices

Cultural Controls

The Disease Triangle



For disease to develop, a susceptible host, virulent pathogen, and a conducive environment conducive for disease development Credit: Dr. Mark Windham

- Crop rotation – not especially useful for perennials like roses.
- Cover crops – protects the soil, adds nutrients to the soil and may host beneficials.
- Soil solarization – kills weed seeds and fungi.
- Cultivation – useful for controlling weeds and some pupating pests.
- Plant selection – avoid varieties very subject to common fungi.
- Crop residue destruction – for control of overwintering insects and fungus.

Physical and Mechanical Controls

- Barriers – copper barriers (for snail control), screens, or nets.
- Traps – a pheromone, bait, sticky or light traps; temperature or humidity manipulation typically used in greenhouse situations.
- Electric current – electric fence for deer or copper strips for snails.
- Mechanical action – machinery such as vacuums used for pest control.
- Manual removal – hand picking of pests.

Biotic Control Agents

- Predators – beneficial insects that hunt down and eat pests.
- Parasitoids – beneficial insects that lay eggs in pests
- Pathogens – virus, fungi, bacterial microbes, and protozoa, e.g., milky spore bacteria for control of Japanese beetles.

Biological Control Methods

- Importation – non-native natural enemies released to control a pest.
- Conservation – avoiding the use of pesticides for control of other pests, which might reduce beneficial insect levels.
- Inoculation – releases of non-overwintering beneficial insects to start the natural process.
- Augmentation – releases of already existing beneficial insects to increase their levels.

Least Toxic Chemical and Microbial Control

- BT (*Bacillus thuringiensis*) – protein crystals that act as stomach poisons.
- Pheromones (confusants) – used to disrupt insect mating.
- Pheromone attractants – used to trap insects.
- Insect growth regulators – chemicals that disrupt insect metamorphosis process.
- Botanical pesticides – plant-derived pesticides (e.g., Neem).
- Insecticidal soaps – soaps that break down insects' outer covering.
- Chemical control – Selective pesticide – a pesticide that only affects a limited population of pests and is less likely also to damage beneficial insects.
- Broad range pesticide – A pesticide that kills everything – good or bad.

Evaluation and Review

Evaluate the results of each decision (what, when, and how to treat a pest). The evaluation determines how effective the choice was and what the consequences were. For example, one may have decided not to treat an outbreak of aphids before a rose show, and the result was damage to the roses. What went wrong? Were there not enough predator eggs present, or did some other factor (for example, spraying a fungicide with oil) cause the eggs not to hatch?

Is there a correlation between various actions? For example, do you always have spider mite outbreaks after spraying your roses with Orthene® for control of thrips? Could you change your spraying program to mist the blooms instead of spraying the whole plant? Does this control the thrips while not allowing a spider mite outbreak?

Summary

IPM may seem to be a complicated process, but it does not have to be. The key concept to keep in mind is that all pests live in an environment of checks and balances. Every action (or inaction) taken affects the checks and balances. It is just a matter of observing these causes and effects and using them to one's advantage.

Notes

Acknowledgement

*Diagram used with Permission from
Dr. Mark Windham*

Chapter 8 – Pesticides & Garden Safety

The approach to using pesticides is changing – rose lovers interested in protecting our precious resources and being good environmental stewards are shifting from routine, preemptive use of potent pesticides, to a selective, integrated pest management approach using pesticides when needed as an aid to growing their favorite flower.

Pesticides can be useful tools when used appropriately, but incorrect or careless use can result in undesirable effects; elimination of beneficial insects and pollinators, toxic exposure to humans and pets, and accumulation/contamination of local environments being the most common.

Before using any pesticide product, be prepared – become knowledgeable about the pesticide you choose to use, how to use it correctly and what to do in the event of accidental poisoning, exposure or a spill. By following the basic guidelines listed below, you can be confident in using garden pesticides safely and effectively.

Safety First

Most chemical accidents result from carelessness or ignorance. To safeguard human and animal health and the environment from pesticide injury, learn safe procedures. Practice them, and as a Consulting Rosarian, teach them to others.

The U.S. Environmental Protection Agency (EPA) and individual states register or license pesticides for use in the United States under the authority of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). States are authorized under both FIFRA and state pesticide laws and may place more restrictive requirements on pesticides than the EPA.

Before using any pesticide it's important to **read the product label**. Federal law strictly defines what information manufacturers must put on pesticide labels. The label is a legal document required for every pesticide registered in the United States and is the main source of information on how to use the product correctly, safely, and legally.

Exposure

Pesticides are designed to kill living organisms that are considered "pests." Because they are toxic by design, many pesticides can pose health dangers to people and pets. Pesticides can enter the body in various ways:

- **Oral:** taken in while eating or smoking during mixing or during and after spraying.
- **Dermal:** absorbed through the skin through clothing wet with chemicals or direct contact with the skin while mixing, especially in concentrated form.
- **Inhalation:** dusts, spray mist or fumes can be drawn into the lungs.

The dermal (skin) and inhalation routes of entry of pesticides into the body are generally more dangerous than the oral route. The most common cause of pesticide poisoning by users is through skin contact, with pesticide concentrates being especially dangerous. Most chemicals spilled on the skin are absorbed in the first few minutes. If this should occur, wash it off immediately.

Personal Protection

Before using any pesticide, plan ahead, and wear the appropriate protective gear described on the product label. That protection should be used from the time you begin handling the pesticide container, to your final cleanup. Refer to guidelines below on specific recommendations for personal protection.

Environmental Protection

Any pesticides used on your roses or garden can contaminate groundwater or travel through storm drains and contaminate creeks, lakes, and rivers. Keep pesticide use in your garden; avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down sink, toilet, or outside drains. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways. Follow directions on the label for appropriate method of disposal. See section below on pesticide disposal for more information.

First Aid

Before You Begin, read the product label for instructions on what to do if the product is swallowed, inhaled or contacts your eyes or your skin. Look at the emergency and first aid measures to take if someone has been exposed. ALWAYS call a physician or a poison control center for further treatment advice. Remember to have the pesticide container with you.

If someone has swallowed or inhaled a pesticide or gotten it in the eye or on the skin:

- Call 911 if the person is unconscious, having trouble breathing, or having convulsions.
- Check the label for directions on how to give first aid.
- Call the Poison Control Center at 1-800-222-1222 for help with first aid information.
- Contact the National Pesticide Information Center (NPIC) (1-800-858-7378) for information about pesticide products and their toxicity.

About Pesticides

Caution Should Always be used when handling pesticides.

Never make recommendations for use of pesticides

Other than those listed on the label.

Never recommend the use of restricted chemicals!

Definitions

The term pesticide was coined in 1939 from the English word pest and -cide, from the Latin cidium “a killing,” and caedere, “to cut down, kill.” Many people associate pesticides with chemicals, but a pesticide is any material used to control, prevent, kill, suppress or repel pests.

Types of Pesticides

There are many different types of pesticides, each focused on the group of pests they are designed to control. Some of the most common include:

- **Biocide:** kills microorganisms.
- **Fungicide:** kills fungi that may infect and cause diseases in plants, animals, and people.
- **Herbicide:** kills weeds and other plants that grow where they are not wanted.
- **Insecticide:** kills insects and other “bugs.”
- **Miticide:** also called acaricides, kills mites that feed on plants and animals.
- **Molluscicide:** kills snails and slugs.
- **Nematicide:** kills nematodes (microscopic, wormlike organisms that feed on plant roots).
- **Ovicide:** kills eggs of insects and mites.

Mode of Action – How Pesticides Work

Every pesticide will have a specific “mode of action” – how the pesticide works on the targeted pest.

- **Selective:** products kill only a few closely related organisms.
- **Broad spectrum (non-selective):** kills a range of pests and also non-target organisms.
- **Contact:** kills when it touches the external surface of the target organism.
- **Systemic:** carried through the internal system of treated animals or tissues of treated plants.
- **Residual:** remains toxic to pests long after application.
- **Fumigant:** volatile enough to be inhaled by the pest in lethal doses.
- **Repellent:** distasteful to pests making them avoid treated areas.

Additional Terms Applicable to Fungicides

Some additional terms applicable to fungicides include:

- **Protectant:** applied before infection.
- **Eradicant:** applied after infections appear and kills on contact.
- **Multi-site, broad-spectrum surface protectants:** do not enter the leaf; the active ingredient remains on the leaf surface.
- **Single-site, mostly locally systemic:** do enter the leaf; the active ingredient penetrates to the interior of the leaf (upon entering the leaf, the fungicide is carried by the xylem stream out to the ends of the leaf, it is not translocated upward to subsequent new growth).

Origins – Where Pesticides Come From

The origin of a pesticide may be natural or man-made, and produced from organic (carbon containing) materials or inorganic (do not contain carbon) materials like arsenic, copper or sulfur. Natural and organic do not automatically mean that the material is safe; some are as toxic, or even more toxic, than synthetic chemical pesticides.

Pesticide Formulations

Pesticides are available in many different forms. They are generally mixtures of one or more active ingredients (the component in the product that kills or otherwise controls the target pest) and other inert materials; the inert components may make the pesticide more convenient to use or enhance its effectiveness.

The amount of an active ingredient is listed on the label as a percentage by weight. It can be listed either by the chemical or the common name. Inert ingredients do not need to be specifically identified, but the label must state their percentage of the total contents.

Inert does not mean that the ingredient is harmless; it may be more hazardous than the active (pesticide) ingredient itself. Information on hazardous ingredients in a pesticide formulation can be found in the Material Safety Data Sheet (MSDS) for the product. Go to the www.greenbook.net website for more information on labels and MSDS's.

The formulation determines how the product will be applied or mixed before application. Some of the more common formulations are:

- **Solution (S):** liquids in a ready to use or concentrated form.
- **Emulsifiable concentrates (EC or E):** an active ingredient mixed with an oil base that is diluted with water before application; it must be continually agitated to keep it in solution.

- **Aerosols (A):** low concentration solutions that are applied as a fine spray.
- **Soluble powders (SP):** powders dissolved in water before application.
- **Wettable powders (WP or W):** an active ingredient combined with a fine powder that is mixed with water before application.
- **Baits (B):** an active ingredient mixed with an edible or attractive substance.
- **Granules (G):** an active ingredient mixed with coarse particles of inert material that are applied directly.
- **Dusts (D):** an active ingredient added to a fine inert clay or talc that is applied directly.

Pesticide Toxicity

Commercially available pesticides all have some level of toxicity as defined by the EPA. Toxicity is a measure of how poisonous a material is. The commonly used measure of oral and dermal toxicity is LD₅₀ (the lethal dose to kill 50% of the study population). The lower the LD₅₀ the more poisonous the chemical is. LD₅₀ is usually expressed in milligrams (mg) of material per kilogram (kg) weight of target.

In order to provide a rapid identification of the dangers of a chemical, there are warnings on all product labels – a numeric category and a signal word used to describe the toxicity level. The category and signal word for all pesticides is listed below along with a general indication of the probable oral lethal dose of a pesticide for a 150-pound (approximately 68 kg) person:

I – Danger Poison: highly toxic, taste to 1 teaspoonful.

I – Danger: highly hazardous; pesticide specific (see label).

II – Warning: moderately toxic or hazardous; a teaspoon to an ounce.

III – Caution: low toxicity; more than an ounce, less than a pint.

IV – Caution: low toxicity; over a pint.

A skull and crossbones on the label indicates a highly toxic pesticide. DANGER without a skull and crossbones symbol shows the pesticide is a potent skin or eye irritant.

Product Identification

Before you purchase or use a pesticide, learn all you can about the pest you want to control and make sure the pesticide is registered for use on the particular type of plant or site you plan to treat as pesticides can seriously damage some plants.

Pesticides carry three different names: their product, trade or brand name – the name on the container you purchase; the common or active ingredient name and the proper chemical name. Roundup® is the brand name for glyphosate (the common name of the active ingredient); its proper chemical name is N-(phosphonomethyl) glycine. Common names are generally easier to identify than chemical names. Several companies may sell the same pesticides using different brand names, but the labels will have the same common or chemical name.

Pesticide Labels – Read Before Use!

All pesticides legally marketed in the U.S. must have a label approved by the EPA. It is a legal document that is required for registering a pesticide. Pesticide product labels provide information on the safe handling and use pesticide products. The directions on the label help you achieve maximum benefits from the product with minimum risk.

Information contained on a pesticide label includes:

- Trade name or brand name
- Active ingredients and their percentage by weight
- Types of plants or sites where pesticide may be used
- Pests targeted
- How much to use
- How and when to apply
- Required protective clothing and equipment
- Signal words
- Precautionary statements defining hazards to people, domestic animals, or the environment
- Emergency and first aid measures to take if someone has been exposed
- Proper storage and disposal of the pesticide and empty containers.

Read the label before buying the pesticide. You may have forgotten part of the label instructions or they may have changed since the last time you purchased the product. Use of any pesticide in any way that does not comply with label directions and precautions is illegal. It may also be ineffective on the pests and, even worse, pose risks to users or the environment.

Using Pesticides Safely

What to Use

Before using a product, check the label to make sure it has an EPA registration number. Due to their toxicity and potential environmental danger, some pesticides are restricted for use only by licensed and trained professionals. Homeowners should never use these chemicals!

- Identify the problem you wish to control and use the proper chemicals.
- Select the least-toxic pesticide; **read the label** and MSDS sheets and choose products with the signal word Caution if possible.
- Choose an effective product that is labeled for use against the pest you want to control. Never make recommendations for use of pesticides other than those listed on the product label.
- Select the best formulation; carefully consider risks of human exposure, environmental impact and effectiveness when determining which formulations (liquid, granular, dust, etc.) to use.
- Buy only the amount of pesticide for the current season and always store it in the original container in a dry, dark place.
- Don't use restricted pesticides unless you have a Certified Pesticide Applicator's license. It's not only against the law, it is dangerous.
- Don't use additives to spray materials unless recommended by the manufacturer; vinegar, buffers and other additives may interact with the chemical and cause plant damage.
- Use a spreader sticker only according to label information to prevent plant damage; many liquid chemicals already contain a spreader sticker.
- Don't move or split a pesticide and store part of it in an unmarked container. This is not legal and dangerous since the pertinent label information is no longer with the pesticide.

The application method for pesticides varies with the type of pesticide, its physical form, and the location in which it is used. Common application methods include:

- Sprayers (aerosol, trigger, compressed air, trombone, hand, or garden hose)
- Pumps (hand, compressed air, bucket, or garden hose)
- Dusters and foggers
- Rotary and drop spreaders.

Homeowners can use any of these application methods. Introducing pesticides through an irrigation system is generally prohibited – **read the pesticide label** for specific guidance.

Never use equipment to apply a pesticide if it has used for the application of an herbicide as any residual herbicide in the equipment may result in injury to plants.

Example of a Pesticide Label

**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND
DOMESTIC ANIMALS**

CAUTION: Harmful if absorbed through the skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

FIRST AID

IF ON SKIN: Wash with plenty of soap and water. Get medical attention.

IF IN EYES: Flush eyes with plenty of water. Call physician if irritation persists.

User Safety Recommendations:
Users should:
• Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
• Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS


Do not apply directly to water. Do not contaminate water when disposing of equipment washwaters or rinsate.

BEE HAZARD

This product is toxic to bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treatment area.


PHYSICAL AND CHEMICAL HAZARDS

Do not use or store near heat or open flame.



Triple Action Neem Oil

**Broad Spectrum Fungicide/Insecticide/Miticide
For Indoor/Outdoor Use on
Ornamental Flowering Plants,
Trees, Shrubs, Foliage,
Vegetables, Fruits, Nuts and
Home and Residential Landscapes**



ACTIVE INGREDIENT:
Clarified Hydrophobic Extract of Neem Oil ... 70%

INERT INGREDIENTS: ... 30%

TOTAL ... 100%


Neem Oil is a registered product of Certis USA

**KEEP OUT OF REACH OF CHILDREN
CAUTION**

See Side Panel for additional PRECAUTIONARY STATEMENTS

Distributed By:
Southern Agricultural Insecticides, Inc.
Palmetto, FL 34220 Hendersonville, NC 28793 Boone, NC 28607
E.P.A. Reg. No. 70051-2-829 J1 E.P.A. Est. No. 829-FL-1

Net Contents Liquid: 1 Pint (.474liters)



0 51538 08722 3

Controls Fungal Diseases Including Black Spot, Mildews, Rusts, and Scab. Kills Mites and Insects Including Whiteflies, Aphids, and Scales.

The specific Directions for use of this product are located inside of label. Follow directions on side of label to open.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal

Pesticide Storage: Keep in original container. Store in a dry place away from direct sunlight, feed, or food-stuffs. Keep container tightly sealed when not in use. Do not store below 40° F (4°C).

Pesticide and Container Disposal: Do not reuse empty container. Securely wrap original container in several layers of newspaper and discard in trash.

Keep unprotected persons out of treated areas until sprays have dried.

TANK MIXING

Neem Oil has been found to be compatible with most commonly used fungicides, insecticides, and fertilizers. Physical compatibility should first be checked with other products before mixing by using a jar test. Using a quart jar, add the proportionate amounts of the products to 1 quart of water. After thoroughly mixing, let mixture stand for at least 5 minutes. Growers should tank-mix combinations for phytotoxicity on a sample of plants prior to use. Due to the wide variation in climatic conditions, cultural practices, and other factors, the User assumes full responsibility for any crop damage or other liability resulting from the use of Neem Oil in a tank mix combination. Avoid tank mixes with Captan, Sulfur, Bravo/Echo or other chemically similar products as unpredictable results or leaf burn may occur.

DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

Do not apply this product through any type of irrigation system.

General Information:

- Do not add adjuvants (spreaders, stickers, extenders, etc.) to Neem Oil.
- Stops powdery mildew in 24-hours.
- Kills eggs, larvae, and adult insects.
- Prevents and controls black spot on roses, anthracnose, rust and powdery mildew.
- Shake well before using.
- For best results, maintain constant agitation in spray equipment.
- Neem Oil is most effective when applied in early to mid-morning or late afternoon when adult pests, such as whiteflies are normally sedentary on the undersides of the foliage.
- Spray solutions should be used within several hours of preparation for maximum effectiveness. Do not store diluted solution for later use.
- Do not apply to wilted or otherwise stressed plants, or to newly transplanted materials prior to root establishment.
- Do not apply to known sensitive plant species, such as impatiens flowers, fuchsia flowers, hibiscus flowers, some rose flowers, ornamental olive trees, or some carnation varieties without prior testing.

As with other oil-based products, care should be exercised in timing applications to early morning/late evening to minimize the potential for leaf burn.

- Use with care on plants with tender tissue. Check for leaf burn in small scale trials prior to use.

Thorough coverage is necessary to provide good disease and mite control. Neem Oil prevents fungal attack of plant tissue and contact activity to mite pressure on the plant. Avoid excessive runoff of spray material for maximum control.

Keep unprotected persons out of treated area until sprays have dried.

Credit: Southern Agricultural Insecticides, Inc.

Pesticide Resistance

Pesticide resistance is the ability of a life form to develop a tolerance to a pesticide. It develops when pesticides are used too often and when the same pesticide or similar pesticides are used over and over again. Pests that become resistant to a pesticide will not be affected by the pesticide, and are more difficult to control. Using an integrated pest management approach can help guard against pesticide resistance. Also consider:

- Using selective pesticides that break down quickly.
- Using pesticides that have different sites of action.
- Alternating different pesticide groups, if there is more than one generation of pest.

Pesticide Incompatibility

Applying mixtures of different pesticides, or pesticides in combination with various spreader / stickers or fertilizers might be a time-saving approach, but it can also be a recipe for disaster. Mixing of two or more chemicals that do not physically or chemically suit each other can result in incompatibility. Physically incompatible pesticides may become unstable forming crystals, flakes, or sludge while chemically incompatible products may have their composition altered through chemical reactions. The results of this incompatibility can result in:

- Reduced effectiveness of one or both products.
- Precipitate in the tank, clogging screens and nozzles in the sprayer.
- Plant phytotoxicity or stunting.
- Excessive residues.

Before mixing any chemicals, read the product label and identify the specific recommendations for each product's compatibility.

When to Use

Timing is everything; before using any pesticide, confirm you are applying it at the right time (time of year, time of day, growth of plant, growth stage of pest, etc.). Also,

- Make sure roses are well watered before spraying as damage may result.
- Never spray in the strong sun or when temperatures are above 80°F; plant damage may result.
- Don't apply pesticides just prior to rainfall or on a windy day.

Where to Use

Pesticides should be applied uniformly no more than three to four feet to the side of the person doing the application and pattern should be directed so that the person applying the pesticide does not walk through it. Application should be continuous and uninterrupted, giving uniform coverage with a minimum of overlap (overlapping can cause an excess of pesticide in certain areas).

- Check pesticide labels for warnings regarding use near bodies of water such as streams, rivers, and lakes.
- Avoid applying pesticides to hard surfaces such as sidewalks or driveways, where they can easily be washed off.
- Use caution when spraying around contained sources of water – ponds, swimming pools, fountains and birdbaths, to prevent inadvertent contamination.

How to Use

Follow label use instructions precisely, including mixing and dilution directions. Take the time to work out the conversion arithmetic if your application equipment is a different size from the example on the label.

Before Use

- **Read the pesticide label before using a pesticide.**
- Confirm product compatibility before mixing more than one pesticide or related product.
- Put on the proper gear before opening the pesticide container.
- Cover up pet dishes, sandboxes, plastic pools, etc. before spraying.
- Bring children and pets indoors when applying pesticides.
- Warn neighbors that live close by before spraying so they will have the opportunity to close windows and bring in children and pets.

Personal Protection

- Follow label requirements for protective clothing.
- Wear clean clothing that provides full skin coverage (long pants, a long-sleeved shirt, socks, closed shoes and gloves).
- Don't wear leather shoes, boots, or gloves while handling pesticides as they cannot be decontaminated easily.
- Don't wear shoes made of canvas or other porous materials.
- Cover the head to prevent pesticide being absorbed through the scalp.
- Remove rings and watches because spray material may concentrate there.
- Wear waterproof gloves with long, tight-fitting wrists.
- Use a respirator when using air blast sprayers to protect from spray drift.

Equipment

- Equipment should fit the job; keep it in good working order.
- Consider using separate, dedicated pesticide equipment to prevent residual contamination.
- Use the type of nozzle that gives the largest but still effective droplet size.
- Check the sprayer before beginning application to be sure there are no leaks in sprayer or hose connections.
- Clean the respirator after each use.

Mixing

- **Re-read the label** before using or re-using a pesticide, don't rely on your memory.
- Open, mix and dilute the pesticide outdoors or in a well-ventilated area.
- Use care when opening containers; don't use the same knife or scissors to open the bags that you use with food.
- Avoid creating dusts or splashes when opening a container or pouring liquids.
- Use measuring cups and containers that are dedicated for pesticide use; don't use for other purposes.

- Mix the pesticide at the recommended rate and amounts; don't "guess" with the measurements.
- Mix only what you need.
- Fill tank with water until about one-half full.
- Add concentrate gradually while water is swirling; don't add water to concentrate.
- Rinse measuring containers three times, adding rinse water to the tank.
- Consider ready-to-use products to avoid the hassles/hazards of mixing.
- Use care when filling the sprayer to avoid splashes.

Applying

- Apply at the recommended rate for the application method used (e.g. delivery rate of sprayer).
- Don't eat, drink or smoke while applying pesticides.
- Avoid pesticides coming into contact with your eyes, mouth, skin or breathing spray mists.
- Don't use your mouth to siphon liquids from containers or to blow out clogged lines, nozzles, etc.
- Minimize drift by reducing the distance between the nozzle and the target area.
- Spray the undersides and tops of the leaves for the best results.

Clean-up

- Keep pets and children out of the area until the pesticide dries.
- Wash off any furniture, play equipment, etc., that may have been exposed to the spray.
- Wash gloves with soap and water before removing them.
- Wash hands and face immediately after spraying and before drinking, eating or smoking.
- Remove clothing worn during spraying and wash in a separate load before wearing them again (run an empty "rinse cycle" before washing other clothing).
- Wash eyeglasses and goggles.
- Shower after spraying.

Spills

- Wash and change clothes immediately if concentrated pesticide is spilled or splashed on clothing.
- Use cat litter, sawdust, soda ash or an absorbent cleaning compound to soak up spilled pesticide on the floor or ground.
- Sweep or shovel absorbent contaminated material into a plastic bag; dispose of contaminated material following the requirements of your local waste management authority.

Pesticide Storage

- Buy only enough pesticide to carry you through the use season; check expiration dates on the label (applicable to products with active ingredients that may not be stable over time).
- Store pesticides in their original containers; don't reuse an empty pesticide container.
- Never store pesticides in unmarked containers.

- Store pesticides out of reach of children and pets, in a dry, dark, well-ventilated location.
- Store flammable liquids outside your living area and away from ignition sources such as a furnace, vehicle, outdoor grill, or gas-powered tools.
- Store containers in an area protected from flooding or where they might spill or leak into wells, drains, ground water, or surface water.
- Put pesticides away immediately after use; be sure to close containers tightly.

Pesticide Disposal

- Never dispose of pesticides in storm drains or sewers, dry wells, sinks, or toilets.
- Clean pest control equipment in a location where rinse water cannot flow into gutters, storm drains or sewers, or open waterways.
- Rinse the pesticide container carefully three times and drain the rinse water back into the sprayer or the container used to mix the pesticide. Use the rinse water as a pesticide, following label directions.
- If you cannot finish using a pesticide, check with your local waste management authority for appropriate pesticide disposal procedure. You can also call 1-800-CLEANUP.
- Empty, triple-rinsed pesticide containers can be recycled but not reused; check with your local recycling program to confirm local ordinances.

Pesticide Choices

Pesticides Allowed for Use on Roses

The changing environment of pesticide regulation at both the federal and state level, make it challenging to provide a comprehensive printed list of pesticide products that are approved for use on roses. When selecting pesticides always read the label carefully to determine if roses are in the plant list and the product works for the pest or disease that you are treating. **For further advice regarding specific pesticide use requirements/restrictions within your state or local area, please contact your county Extension office or state Environmental Quality department.**

Non-Toxic Approaches to Pest Control

Beneficial Insects: green lacewings, ladybugs, trichogramma parasite and beneficial nematodes are some of beneficial insects that can be purchased and brought into the garden.

Low Toxicity Pesticides

Biologically-based pesticides such as microbial pesticides are becoming increasingly popular and often are safer than traditional chemical pesticides. Biological control agents (except for certain microorganisms) are exempted from pesticide regulation by EPA. Products which contain certain lowrisk ingredients like garlic and mint oil are also exempt from Federal pesticide registration requirements, although State regulatory requirements may still apply.

- **Anti-transpirants:** used to prevent most fungus diseases. Anti-transpirants were developed to protect plants from frost, but have been found to reduce infection of fungal diseases. The antitranspirants place a film between a fungal spore and the plant cells, providing a mechanical means of preventing fungal infection. It is important to reapply as new growth occurs.
- **Diatomaceous earth:** Highly effective fine dust produced from the fossilized remains of single shell aquatic plants. Soft-bodied insects come into contact or ingest these sharp edges, interfering with

breathing, digestion and reproduction. It is especially good for slugs. Dust mask should be used; may contribute to pulmonary fibrosis. Signal word – Caution. Oral LD₅₀ is 22,500 mg/kg.

- **High purity horticultural oil:** Won't harm plants, wildlife or the environment; kills primarily by suffocating insects and their eggs. It also repels insects for as long as a week. It can be used throughout the growing season but can burn foliage in hot weather.
- **Insecticidal soap:** A very safe product made of the salts of fatty acids. It controls soft-bodied insects that come into contact with the wet spray and breaks down quickly with no residue. Signal word – Caution.

Biological/Mineral Pesticides

- **Copper:** controls common leaf spots, rust, downy mildew, anthracnose and scale. Signal word – Caution as 7% CuSO₄. Oral LD₅₀ is 300 mg/kg.
- **Neem Oil:** made from the extract of the seed of the Neem tree, this insecticide disrupts the hormonal balance of juvenile insects, inhibiting the desire to feed, causing death. It has a very low toxicity rating and not harmful to earthworms and animals. (Not for use on edible crops.) Signal word – Caution. Oral LD₅₀ is 5,000 mg/kg, dermal LD₅₀ is 50-2,000 mg/kg.
- **Pyrethrum:** general-purpose insecticide from chrysanthemums. Signal word – Caution, oral LD₅₀ is 75 mg/kg.
- **Rotenone:** general-purpose insecticide made from the roots of tropical plants. It comes in various strengths and both liquid and dust. Signal word - Danger/Caution, oral LD₅₀ is 132-1,500 mg/kg.
- **Ryania:** An insecticide that is a stomach poison made from a South American shrub. It is very toxic to dogs, signal word – Caution. LD₅₀ is 1200 mg/kg.
- **Sabadilla:** A broad-spectrum contact poison – dust or spray that controls hard shell insects by affecting the nerve cells of insects, causing paralysis and death. It degrades quickly in air and sunlight. Highly irritating to the eyes and can produce sneezing if inhaled. Toxic to bees. Signal word – Caution. Oral LD₅₀ is 500-5,000 mg/kg.
- **Spinosad:** produced from the fermentation of the soil microbes; a fast-acting insecticide that is effective at low concentrations. Signal word – Caution.
- **Sulfur:** remedy for fungus diseases. It comes in a dust form or liquid and is especially effective in a combination formula with lime. Signal word – Caution.

The American Rose Society is not responsible for any recommendations made by Consulting Rosarians that are contrary to the Consulting Rosarian Manual.

The American Rose Society cautions all Consulting Rosarians to abide by their state and federal laws concerning chemical control.

The changing environment of pesticide regulation at both the federal and state level makes it challenging to provide a comprehensive printed list of pesticide products approved for use on roses. When selecting pesticides always read the label carefully to determine if roses are in the plant list and the product works for the pest or disease that you are treating. For further advice regarding specific pesticide use requirements/restrictions within your state or local area, please contact your county Extension office or state Environmental Quality department.

Material Safety Data sheets may be found at <https://www.greenbook.net>.

Notes

Acknowledgements

The fungicide use article was written by G. R. "Dick" Barse.

Diagram Reprinted With Permission from

Southern Agricultural Insecticides, Inc.

Chapter 9 – Major Insect Pests

Identifying insects by the damage they do is an essential first step in dealing with the problem. Most chewing and sucking insects such as aphids, rose chafers, leafhoppers, etc., are easily identified by the damage they do.

However, there are a few insects that are more difficult to identify and may require specific treatment to control or eliminate. If there is an insect that presents a problem in your area, learn about it to share that knowledge with others.

Some insects are very localized and not in this Chapter. The insects mentioned here are those that affect roses and are prevalent across most of the United States. If you have an insect you are not sure about, contact the local entomologist at your county or state agricultural extension department for identification. There are also several excellent websites on the internet with photos of rose pests. See the IPM Table on Rose Insects and the Color Plates throughout this Chapter.

As described in Chapter VII, *Pest Control Basics*, the progressive approach to managing the major insect pests of roses begins with the least toxic method and moves up the pyramid – cultural, mechanical, and physical, biological, and finally, chemical methods.

Approaches for Managing Sucking and Chewing Insect Pests

Cultural Methods

- Maintain healthy and vigorous plants through proper soil health and cultivation, watering, fertilizing, pruning, mulching, and adequate garden sanitation.
- Go light on chemical fertilizers high in nitrogen - lush new growth is an attractant to both sucking and chewing pests; use less soluble forms of nitrogen and apply it in small portions throughout the season rather than all at once.

Mechanical and Physical Methods

- Knock soft-bodied insects to the ground with a blast of water.
- Prune damaged areas out of the plant and dispose of them.
- Handpick adult forms of pests and drop them in a container with soapy water.
- Put a band of sticky material (e.g., *Tanglefoot* or Teflon products) around the base of the plant to prevent the ants from getting up.

Biological Methods

- Improve the habitat for natural enemies – predatory insects such as ladybugs, soldier beetles, green lacewings, and parasitoid insects that lay eggs in pests.
- Create or enhance habitats for birds, lizards, and toads.
- Use microbial-based products such as *Dipel DF*; they contain bacteria (*Bacillus thuringiensis*) pathogenic for caterpillars, leafrollers, and Japanese beetles.
- Beneficial nematodes may offer control for some types of caterpillars, leafminers, and rose chafers.

Chemical Methods

- Apply a dormant spray with horticultural oil to help reduce pests from overwintering.
- Use an insecticidal soap that contains potassium salts of fatty acids as the active ingredient to manage soft-bodied pests.
- Try products made from neem seed (with the active ingredient azadirachtin); they control a range of insects when in the larval, pupal, and nymphal stages; the active ingredient is a growth regulator/inhibitor and does not affect beneficial insects.



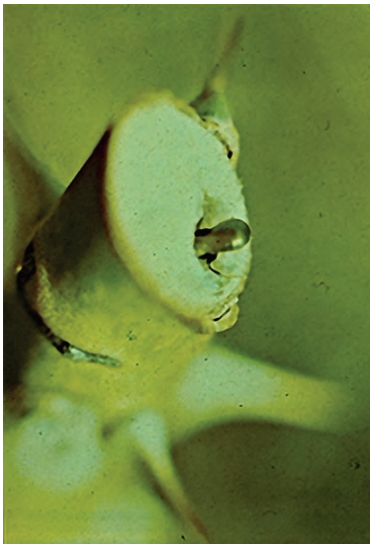
Credit: Aphids
Courtesy: Baldo Villegas,
Orangevale, CA

Aphids – Aphids are small insects about 1/8-inch long and may have wings, about 1/8-inch long. There are a variety of shades from lemony yellow through greens into pinks and reddish-brown. They are the most common of all rose insects and appear throughout the spring and fall. They suck the plant juices from tender parts of the plant, with new foliage, buds, and peduncles being the most common locations.

Aphids are on other plants. They excrete honeydew, a sweet sticky substance that attracts ants and favors the growth of sooty mold. They are prolific breeders and multiply rapidly in warm weather.

Symptoms: Damage is minor compared to other insects. The sticky honeydew makes foliage unsightly, and the mass of aphids on a plant is just as repulsive.

Control: Aphids are easy to manage; washing the plant with a stream of water will knock the aphids off the plant, and since most cannot fly, they will not be able to return to the plant. [Rose aphid -*Macrosiphum rosae*], cotton aphid - *Aphis gossypii*, potato aphid - *Macrosiphum euphorbiae*]



Credit: Cane Borer
Courtesy: Baldo Villegas,
Orangevale, CA

Cane Borers

There are several wasps and bees that nest in the pith of cut rose canes. These insects bore a hole down the middle of the pith to make their nests; thus, they are often called “cane borers.” The two most common “cane borers” are small wasps. They bore their nests in cut rose canes from spring through early fall.

Symptoms: Damage from the borer is easy to see. Even a casual observer will notice the hole in the center of a cut cane. The hole may only be a few inches deep or down to the crown of the plant.

Control: “Cane borers” are predators of aphids and use them as food for their young in the nest. If you keep aphids under control, you remove the food source, and the wasps will go somewhere else where there is plenty of food to supply their nests. In the meantime, damaged canes should be cut below the nest to prevent a new crop of twig nesting wasps from maturing.

It makes more sense to restrict the borer damage by sealing each cut cane with a waterproof product. Many rosarians find waterproof wood glue useful with no damage to the cut cane. Pruning paint may cause damage and is unsightly, so test it on a few cuts first. [Flatheaded borers –*Chrysobothris* spp., raspberry horntail – *Hartigia cressoni*]



Credit: Chilli Thrips Underside of Leaf, Courtesy: Carolyn Elgar

Chilli Thrips

The chilli thrips or yellow tea thrips is a hugely successful invasive species of pest that have expanded rapidly from Asia over the last twenty years and is gradually achieving global distribution. It is a pest of economic significance with a broad host range, with prominent pest reports on pepper, mango, citrus, strawberry, grapes, cotton, tea, peanuts, and roses.

Symptoms: Chilli thrips appear to feed preferentially on new growth, and infested plants usually develop characteristic wrinkled leaves and distinctive brown scarring along the veins of leaves, the buds of flowers,

and the calyx of fruit. Feeding damage from pests in sufficient numbers can kill plants already aggravated by environmental stress. Chili thrips are involved in the transmission of three tospoviruses. However, there is some controversy over its efficiency as a vector. With its rapid life cycle, it can develop from egg to adult in slightly less than two weeks under optimal weather conditions.

Control: Without a suitable control strategy, chili thrips can be a tricky pest to manage. There are several insecticides available to control this pest. Foliar applications of systemic insecticides have proven more effective in controlling this pest than soil drenches. Since chili thrips feed on new growth, it is essential to spray when the plant is actively



Credit: Chilli Thrips Bud Damage
Courtesy: Carolyn Elgar

growing. The thrips are generally not present on older damaged leaves. Thus, the pruning of infected plants stimulates new growth. You should apply systemic insecticides as a foliar spray.



Credit: Western Rose Thrips
Courtesy: Baldo Villegas,
Orangevale, CA

The use of resistance management strategies work. Such systems may include but are not limited to, rotation of products with different modes of action, avoid treatment of successive generations with the same products. Treatment of severely infested plants requires an initial spray program that may include treatment with a spinosad product. Then followed seven to ten days later by a neonicotinoid. And again seven to ten days afterward by the application of an organophosphate. Recommended non-chemical alternatives such as beneficial arthropods and various cultural practices work. [Chilli thrips or yellow tea thrips – *Scirtothrips dorsalis* HOOD]

Flower Thrips – Flower thrips are highly active, tiny, slender brownish-yellow winged insects, just visible with the naked eye. They hide inside buds and unopened blooms and damage the petals with their rasping mouthparts. They seem to prefer lighter colored blooms and attack the bloom when it is still a bud.



Credit: Rose Thrips Damage
Courtesy: TRIG/Shutterstock

Symptoms: Damage to the petals caused by the rasping mouthparts of thrips as they suck sap from the petals. On examination, the small, slender insects are inside the flower.

Control: When using an insecticide, spray the buds and foliage.

Western flower thrips - *Frankliniella occidentalis*, Madrone thrips - *Thrips madroni*



Credit: Katydid Damage
Courtesy: Baldo Villegas, Orangevale, CA

Grasshoppers or Katydids

Grasshoppers chew holes as they feed on new rose foliage. Longhorned grasshoppers or katydids are most common on roses from young psychedelic-looking nymphs to adults. Their green color makes them difficult to see on rose foliage, but, as with other grasshoppers, they hop from one leaf to another from spring to fall months.

Symptoms: Large irregular sections of leaf edges removed.

Control: Grasshoppers are better controlled by handpicking, birds, and animals than spraying for them. [Grasshoppers – too many species to list]

Japanese Beetles – The Japanese beetle, came from Japan in the early 1900s and was discovered first in New Jersey. Today it is found in more than half of the states, mainly in the eastern half. It is a medium-sized, beautiful insect until you see many of them clustered on a rose bloom. They feed on many plants besides roses and appear from June through August. They will feed on rosebuds, blooms, and leaves with a great appetite.

The female lives 30 to 45 days and lays 40 to 60 eggs, mostly under grassroots in lawns. The grubs hatch in 10 to 12 days, feed on grass roots until cold weather, then move down in the soil 8 to 10 inches to avoid freezing. They move upward in spring, feed on grass roots until pupation, and then mature. The grubs are



Credit: Japanese Beetle
Courtesy: Baldo Villegas, Orangevale, CA

grayish-white with brown heads and found in a curved position. When the weather warms up in June - July, they emerge from the soil to devour flowers and foliage.

Symptoms: Dead spots in the lawn may be an indication of a colony of Japanese beetle grubs. Treat these spots. The beetles are visible during the day, feeding on the foliage and blooms.

Control: The milky bacterial diseases, *Bacillus popilliae* Dutky, has been quite effective at controlling the grubs in some regions of the eastern United States. The spore count must build-up for two to three years to be useful,



Credit: Japanese Beetle
Courtesy: Baldo Villegas, Orangevale, CA

and during this time, you should not use an insecticide against the grubs needed to complete the bacterium cycle. In Ohio and Kentucky, test trials have not produced satisfactory results. Additional experiments are required to determine the lack of efficacy of milky disease in these soils.

Insect parasitic nematodes are commercially available. Products that contain strains of *Steinernema carpocapsae* have been marginally effective against white grubs in turf. Preparations containing *Heterorhabditis* sp. seem to be more productive. Apply the nematodes when the white grubs are small. Irrigate before and after applying the nematodes.

The grubs are best controlled when they are small and actively feeding near the soil surface, usually late July to mid-August. (e.g., control of grubs in late-fall or early-spring can be difficult because they are large and may not be feeding. The key to reasonable control is to make even applications and then water thoroughly.)

Japanese beetles are members of the scarab beetle family. There are localized members of this family, such as hoptia beetles, which are indigenous to the Sierra foothills in California. Other scarab beetles are the southern and northern rose chafers, Chinese rose beetles (Hawaii), and Asian garden beetle. [Japanese beetles - *Popillia japonica*]



Credit: Leaf Cutter Bee Damage
Courtesy: Baldo Villegas, Orangevale, CA

Leaf Cutter Bees

The rarely seen Leaf Cutter leaves signs of foliage damage behind. They cut sections out of rose foliage and use it to line their nests. About the size of a honeybee, these bees are excellent pollinators of crops and roses.

Symptoms: Perfectly cut semi-circles on leaf edges. Little other damage; more aesthetic.

Control: These insects are difficult to control. Often, they prefer the leaves of a particular rose. Control by insecticides is questionable. [Leafcutter bees - *Megachile* spp.]



Credit: Leafhopper, Courtesy: Wildlifemacro

Leafhoppers

These tiny hopping insects are about 1/4-inch long. They suck juices from the undersides of rose foliage.

Symptoms: Small white or brown stippled areas show on the top leaf surfaces as leafhoppers mainly feed underneath the leaves.

Control: Spray roses with a systemic insecticide. When using a contact insecticide, make sure to cover the undersides of the leaves. [Rose leafhoppers - *Edwardsianna rosae*]



Credit: Rose Midge Damage,
Courtesy: Baldo Villegas,
Orangevale, CA

Rose Midge

The rose midge found in gardens in the early 1900s and now throughout many states. The adult is minute (less than 1/8 of an inch long) and lays eggs on lush new growth and under sepals of flower buds. In two days, they hatch and feed on the new growth causing it to turn brown and die, preventing the development of a bud. Midges reach maturity in about a week and fall to the ground to pupate in tiny cocoons. In three to seven days, new adults emerge to start the cycle over again. A garden infested with midge will have few if any blooms, as most immature buds will be destroyed.

Symptoms: The telltale sign, a tiny crisp, burnt-like bit of foliage at the tip of new growth, is often the first sign of a midge infestation.

Control: Weekly examination (monitoring) of the rose plants in the early spring is essential in areas known infested with rose midge. At the first indication of midge, it is advisable to treat the rosebeds and roses with insecticidal treatments recommended on the product label for rose midge. [Rose midge - *Dasineura rhodophaga*]

Rose Slug

Rose Slugs are the larvae of primitive plant feeding wasps called sawflies. Rose slugs look like caterpillars, but they are not. When fully grown, they are about half-inch in length.

There are two leading members of this family, the bristly rose slug has small hair-like bristles, and the European rose slug, which is smooth and greenish-yellow in color. Depending on the species, they may skeletonize the rose leaves and may chew holes on the leaves when fully grown. They are among the earliest of the insects to emerge in the spring.

Symptoms: The larvae of the European rose slug feed on the upper surface of the leaves, causing skeletonizing damage where they eat away green tissue. Larvae of the bristly rose slug occur on the undersides of the leaves where they skeletonize the leaves in the early stages and cause holes on the leaves when the larvae are larger.

Control: Act quickly to stop their extensive damage. Most contact insecticides are particularly useful when the foliage is thoroughly sprayed. [Rose slug - *Endelomyia aethiops*, bristly rose slug, *Cladius difformis*]



Credit: Rose Slug, Courtesy: Baldo Villegas,
Orangevale, CA



Credit: San Jose Scale,
Courtesy: Baldo Villegas,
Orangevale, CA

Scale

Scale insects do not look like typical insects but more like a disease. Several species attack roses. They are round, hard, dirty white, gray, or brown shell-covered insects that suck sap from the stems and foliage of roses.

Symptoms: They are evident singly or in clusters on mature rose stems and may cause stem discoloration, wilting of foliage, and a general weakening look.

Control: Prune out and destroy all infested stems and leaves. If this is a severe problem in your area, horticultural oil sprays can be handy.

There are numerous members of this family; they range from the virtually harmless cottony cushion scale to the devastating San Jose scale. Proper identification is critical here. [Cottony cushion scale, *Icerya purchasi*, rose scale – *Aulacaspis rosae*, San Jose scale – *Quadraspidotus perniciosus*]



Credit: Spider Mite Damage
Courtesy: Baldo Villegas, Orangevale, CA

Spider Mites

Spider mites are not insects, but relatives of the actual spider (arachnids). The two-spotted spider mite is the most common species found on roses. They are especially prevalent in hot, dry weather and difficult to control if they get a foothold. They feed by sucking sap from leaves and other tender parts and can eventually defoliate the plant. It is essential to recognize the symptoms and deal with the problem before the infestation gets out of hand.

Symptoms: The first sign will be a lightening of the lowest foliage as the mites suck the sap. If you shake the affected leaves over a piece of white paper, the tiny spider mites show as small dots. Under a microscope or a strong magnifying

glass, two dots show on the mite's back. Many little webs (webbing) and eggs are on the underside of the leaf.

Control: You may control a light infestation with a forceful spray of water to the undersides of the leaves. Spray with water three to four times per week for adequate control. There are several miticides available, some more effective than others. Miticides that do not kill the spider mite eggs must be sprayed at frequent intervals for three weeks to eliminate the mature and hatching mites. Eggs will hatch in two to three days at 75 degrees and above and in 21 days at 55 degrees.

Insecticidal soap and insecticidal oils also work for the control of spider mites. Still, since they have contact action, they need to be sprayed toward the lower surfaces to cover the spider mites. It helps to remove the affected foliage before spraying. Direct the spray material to the underside of the foliage.

Mites can become resistant to a chemical, and it may be necessary to change miticides from time to time. Spraying before applying winter protection is advisable as mites' winter over in sheltered spots in the garden. Many plants can serve as alternate hosts for spider mites. Check and treat if necessary, to keep spider mites under control. Because insecticides used for other rose pests also kill the natural enemies of

spider mites, diminish the use of broad-spectrum insecticides and only spray insecticides when necessary. [Spider mites -*Tetranychus* spp. include two-spotted mite, Pacific mite, and strawberry mite.]



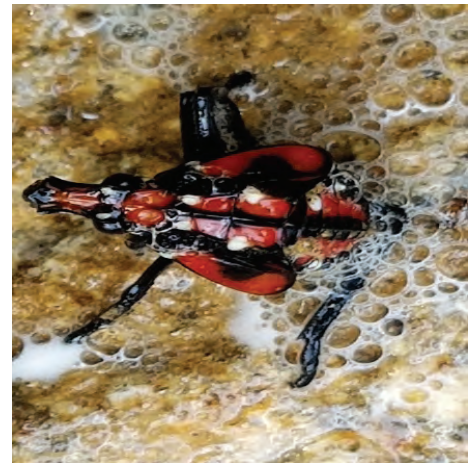
Credit: Spotted Lanternfly Adult
Courtesy: Tom Mayhew, Langhorne PA

Spotted Lanternfly (SLF)

The Spotted Lanternfly is an invasive planthopper (a type of insect) in the U.S. It is native to certain parts of Southeast Asia. SLF was discovered in Berks County, Pennsylvania, in 2014. SLF could eventually become established in parts of New England, most of the Mid-Atlantic States, most Ohio Valley states from Ohio to Missouri, Coastal and Central Valley of California, and Columbia River valley of Oregon and Washington. The most crucial factor in predicting SLF establishment is the mean temperature of the driest quarter of the year; it cannot be too hot or too cold, about 0 degrees C plus or minus 7 degrees C (a temperature range between 19- and 45-degrees F)

Symptoms: The favorite host plant for this insect is *Ailanthus altissima* or “Tree of Heaven.” An invasive plant from Southeast Asia. The spotted Lanternfly uses its piercing-sucking mouthpart to feed on sap from over 103 different species, native, non-native and cultivated plants, many of which are economically significant. As SLF feeds, the insect excretes honeydew (a sugary substance), attracting bees, wasps, and other insects. The honeydew also builds up and promotes sooty mold (fungi), covering the plant, patio furniture, cars, and anything else found below SLF feeding.

Control: At present, the primary control is government-enforced quarantines, removal of egg masses from trees or whatever object you find them, and contact spraying with chemicals. The egg masses should be sealed in a plastic bag or directly into hand sanitizer or alcohol to kill them before disposal. Nymphs can be controlled by using Ortho® Home Defense® Insect Killer. Removal of “Tree of Heaven” reduces the number of host plants. Adults may be killed with the Ortho® Home Defense® as well when contact sprayed. Penn State Extension cautions against the use of home remedies that often include household items such as dish soap, vinegar, salt, boric acid, vegetable oil, garlic, chili/cayenne peppers, etc. These suggestions, often found on the internet, may have the potential to harm humans. Dinotefuran chemicals appear at present to be the best; see Safari® 20SG Systemic Insecticide with Dinotefuran available from domyown.com.



Credit: Late Stage Nymph in Soapy
Water-Vinegar Mix
Courtesy: Tom Mayhew
Langhorne, PA

Penn State Univ Entomology Dept has developed a biopesticide containing Beauveria fungus. The product is called Aprehend®, which is EPA approved and available also from domyown.com. This product appears to have much potential to help control the SLF. The use of sticky bands around trees will catch nymphs when they climb the tree. The nymph cannot fly, and only the adult can fly but not further than a football field. The SLF spreads mainly by laying egg masses on cargo or vehicles when moved to another area.

Most people only recognize the insect in its adult form with its bright red body and spotted wings. The egg masses look like somebody padded clay to a surface, and the SLF lays egg masses from September to

December, and the nymphs appear next May to June. Make sure to squish or collect any red or black nymphs about the size of a chocolate chip. That is the pesky SLF in an earlier form of life as a nymph from instars one to four. Instars 1, 2, and 3 are black and get progressively larger with each instar. Instar 4 is red. That is the pesky Lanternfly in an earlier form of life.

Before using any pesticide suggestion made in this manual, check with your state EPA or county agriculture department for restrictions.

INSECT PROBLEMS

SYMPTOM	CAUSE	REMEDY
Masses of bugs on the buds and leaves	Aphids - green, red or black soft bugs, about 1/8" long, found clustered mostly on new growth. They appear in spring and can remain all summer	Most insecticidal sprays, including insecticidal soap, are effective. Aerosol insecticides labeled for plant pests will also work: spray up-wind and allow the mist to drift through the plant. Or simply hose off the insects when you water
Blooms are shredded, discolored or buds distorted	Thrips -light brown insects, very slender, about 1/8". Squeeze an open bloom and watch the inside of the petals for movement Thrips move quickly. They are spread by wind	Apply systemics containing acephate at disulfoton when 1" or more of new growth has occurred in spring. Contact treatments of pyrethrins, pyrethroids or other pesticide types can be used on a rotational basis when buds are pea-sized.
Leaves stuck together, unopened buds with holes bored into them	Omnivorous leaf roller - a moth larvae that makes a cocoon-like structure with leaves	Use B.t. (<i>Bacillus thuringiensis</i>) or systemics as previously explained for thrips
Leaves appear fuzzy yellow on surface, under-side has small red specks, webbing or spider-like insects moving about. (Best seen with a magnifying glass.)	Spider-mite (red spider or 2-spotted mite). Microscopic in size, but visible to the naked eye. Hot weather is prime spider-mite season. Activity increases or decreases with temperature changes.	Apply insecticidal soap, spray oils, miticides or high pressure hose water. All treatments must be applied to the underside of leaves in order to come in contact with the mites
Circular pieces cut from leaf margins.	Leaf cutter bees - they use the circular leaf pieces for egg partitions inside the burrowed cane	Controlled by applying white glue to the cane ends. NOTE: Leaf cutter bee is a beneficial, effective garden pollinator. Our suggested damage prevention measure is preferable to eradication.
Leaves have been eaten leaving either skeleton structure or mid-ribs. Unopened flower chewed and open buds dammed.	Beetles - most notorious is the Japanese beetle, metallic brown with a green head (Caterpillars can also cause the same symptoms).	Sprays, dust and 'shaking'. Sprays of Carbaryl (Sevin) or Rotenones are somewhat effective. Apply Bp (<i>Bacillus papilliae</i>) or 'milky spore' when the problem is first detected in spring or late summer. Neem oil, a new natural insecticide, or its derivative Azadirachtin, has shown some limited control. A practical, yet effective approach is to spread cloth or plastic on the ground and shake the beetles off the plants. Traps can also be effective if placed away from your roses.
Drooping, unopened buds, accompanied by a small discolored stem slightly below the bud.	Rose Midge - a small fly that pupates in the ground below the bush, then flies up and lays eggs in the soft upper stem. The hatched larvae eat the stems and cause breakage. The worm then drops to the ground to complete the last stage of metamorphosis into a fly.	Spread systemic granules on the ground below the bush to control this pest. Sprays are of limited value here because of midge life stages in the ground.

Credit: *Root of the Problem*, Jackson & Perkins, 2001

IPM OF THE COMMON INSECT, SPIDER MITE, AND MOLLUSK PESTS OF THE ROSE GARDEN

PEST	CHEMICAL CONTROL MEASURES	OTHER ALTERNATIVE CONTROL MEASURES
<p>Aphids - several species may be involved depending They feed on tender plant growth throughout the growing season. They are most common during the spring months.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with insecticidal soaps or botanical insecticides like pyrethrum as needed. 2. Spray with contact or systemic insecticides for longer residual control. 	<ol style="list-style-type: none"> 1. Physically dislodge them by hand or with water sprays as needed. 2. Control ants that may interfere with beneficial natural enemies. 3. Conserve and augment native natural enemies e.g., parasitic wasps, lady-bugs, predaceous flower flies, etc. 4. Biological control, e.g., lacewings.
<p>Spittlebugs - immature stage of a brown leafhopper-like insect makes the unsightly spittle-like froth. They appear to cause very little damage to the plant and might not need to be controlled.</p>	<p>If control is needed, wash spittle/froth with water spray; then either spray with a) insecticidal soaps or botanical insecticides or b) contact or systemic insecticides for longer residual control.</p>	<p>Wash spittle/froth and immatures off the plants with water spray.</p>
<p>Leafhoppers - several species may be involved. Immatures and adults suck sap from the stems and leaves; immatures are usually found on the undersides of the leaves.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with insecticidal soaps as needed. 2. Spray with miticides for longer residual control. 	<p>Conserve and augment native natural enemies e.g., parasitic wasps, and predaceous insects (e.g., small pirate bugs, big-eye bugs, predatory thrips, etc) and predaceous mites.</p>
<p>Scale insects - several species may be present and feeding on stems and leaves. In general scale insects take several seasons to build up populations high enough to cause death of rose canes. Sudden increases may be due to the presence of ants that interfere with natural biological control. Some common scales includes: rose scale, San Jose scale, black scale, soft-brown scale, cottony-cushion scale, etc.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with a dormant oil spray. 2. Spray infested plants with insecticidal soaps or botanical insecticides like pyrethrum as needed. 3. Spray with contact or systemic insecticides for longer residual control. 	<ol style="list-style-type: none"> 1. Physically dislodge them by hand as needed. 2. Control ants with ant baits, sticky bands, or contact insecticides. Ants may interfere with natural control by beneficial natural enemies. 3. Conserve and augment native natural enemies e.g., parasitic wasps and flies, some species of lady beetles, etc. 4. Depending on species involved, biological control methods can be used.
<p>Two-spotted spider mite - most common from May through fall; however, they may be endemic in the garden. They suck the sap from individual cells creating a bronzing appearance of the foliage. Spider mites produce distinctive webbing material on the under side of the leaves.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with insecticidal soaps as needed. 2. Spray with miticides for longer residual control. Check the label of contact and systemic insecticides for miticidal action. Note: Certain insecticides like carbaryl (Sevin) and acephate (Orthene) have been recorded as inducing spider mite outbreaks. If you use these insecticides, monitor closely for spider mites. 	<ol style="list-style-type: none"> 1. Monitor garden for mite activity by checking the underside of leaves on a weekly basis. 2. Wash off the underside of the foliage with a water wand about three times per week or as needed. 3. Effective natural enemies are available commercially, but they need to be introduced into the garden early in the season.
<p>Thrips - Immatures and adults feed by rasping petals of light colored roses. They may also feed on stems and foliage.</p>	<p>Same controls as above.</p>	<p>Same controls as above.</p>
<p>Snails and Slugs - stem and foliage feeders; they walk on their stomach and are active at night leaving a distinctive silver trail. During the day they hide in dark, moist protected areas. <ol style="list-style-type: none"> 1. Brown Garden Snail 2. Slugs - various species </p>	<p>Apply available slug and snail pesticides. Molluscicides like Sluggo appear to be the safer than those containing metaldehyde like Deadline.</p>	<ol style="list-style-type: none"> 1. Place physical barriers around rose beds, trunks, and even pots; Copper bands and a new stickum containing Copper Sulfate are available. 2. Decollate snails can be used as a biological control agent of brown garden snails in some areas. 3. Trap and dispose of them.
<p>Leaf-cutter bees - these bees damage the rose leaves by cutting pieces of leaves from the margins from June through August.</p>	<p>No chemical control recommended as these insects are considered beneficial natural enemies.</p>	<p>No alternative controls known.</p>

<p>Rose Midge - Very tiny gnat-like insect found mainly in The NE United States, WA, OR, and now CA. Larvae feed on Immature buds of roses, turning the tips brownish. Several generations per year. Rose midge pupae are found on the soil near the rose plants.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with botanical insecticides like pyrethrum as needed. 2. Spray with contact or systemic insecticides for longer residual control. While spraying, direct some of the spray toward the soil around the drip line of the rose plants to kill emerging adults. 	<ol style="list-style-type: none"> 1. Monitor/check the growing tips of roses containing the immature buds for sign of rose midge in early spring. Rose midge damage looks as if the growing tips were burned. Small rose midge larvae kill the immature buds. Yellow sticky traps may be used for monitoring adult emergence from the soil. 2. Monitor emergence dates of adults and larval activity on the immature buds for 2-3 years; apply soil sprays 2-3 weeks prior to adult emergence in the spring; time sprays with the presence of larval activity in the immature buds thereafter; do not apply sprays based on calendar dates.
<p>Beetles - there are several beetles that may be pests of roses depending on the area. Not all of them occur in the same growing region.</p> <ol style="list-style-type: none"> 1. Hoplia beetles - present only from late April through June. 2. Spotted cucumber beetles - occasional from May through fall. 	<ol style="list-style-type: none"> 1. Spray infested plants with botanical insecticides like pyrethrum as needed. Inorganic insecticides such as <i>Kryocide</i> may be another less toxic alternative. 2. Spray with contact or systemic insecticides for longer residual control. 	<p>Physically dislodge them from the flower petals by hand and crush them as needed.</p>
<p>Rose Curculio [Rose weevil]- April through June. Adults drill feeding and ovipositing holes on buds; larvae feed on petals then fall to the ground to overwinter and pupate. This weevil may be a big problem among rosarians who don't cut back spent bloom.</p>	<p>Same chemical controls for hoplia and cucumber beetles apply to rose curculio.</p>	<ol style="list-style-type: none"> 1. Physically dislodge them from the flower petals by hand and crush them as needed. 2. Conserve and augment native natural enemies e.g., predaceous thrips, black hunter bugs, etc. 3. Parasitic nematodes might be used as a biological control. Rose curculio overwinters as larva/pupa in the soil. This is an alternate control strategy in rose gardens with endemic population of this weevil.
<p>Caterpillars - several species may be involved depending on the season and region. They feed on stems, foliage, and flowers..</p> <ol style="list-style-type: none"> 1. Fruit-tree leafrollers - late March - April. 2. Tobacco budworms - occasional from mid April through fall 	<ol style="list-style-type: none"> 1. Spray infested plants with microbial insecticides containing <i>Bacillus thuringiensis</i> or with botanical insecticides like pyrethrum as needed. Inorganic insecticides such as <i>Kryocide</i> may be another less toxic alternative. 2. Spray with contact or systemic insecticides for longer residual control. 	<ol style="list-style-type: none"> 1. Dormant sprays on fruit and shade trees may have some control on overwintering egg masses of fruit-tree leafrollers. 2. Monitor/check rose bushes near fruit and shade trees from mid March - April for leaf-folding or leafroller activity. 3. Time sprays with the presence of caterpillar activity in the rose garden; do not apply sprays based on calendar dates.
<p>Rose Slugs/Rose Sawflies- The larvae of these sawflies are commonly called roseslugs. They look like caterpillars and feed on foliage making holes on the leaves and skeletonizing them. There are three species - bristly roseslug; Euro-pean roseslug; and curled roseslug. The adults are called sawflies; they are primitive wasps.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with botanical insecticides like pyrethrum as needed. Inorganic insecticides such as <i>Kryocide</i> may be another less toxic alternative. 2. Spray with contact or systemic insecticides for longer residual control. 	<ol style="list-style-type: none"> 1. Monitor/check rose foliage, especially lower leaves in early spring for roses-lug activity. 2. Time sprays with the presence of roseslug activity in the rose garden; do not apply sprays based on calendar dates. 3. Physically dislodge them from the flower petals by hand and crush them as needed.
<p>Raspberry Stem Sawfly Wasps - active in late April through June. Female wasps lay eggs on tender canes about 4- inches from their tips. The larvae girdle the cane and the cane tip droops over due to lack of liquids from the base of the cane.</p>	<ol style="list-style-type: none"> 1. Spray infested plants with botanical insecticides like pyrethrum as needed. 2. Spray with contact or systemic insecticides for longer residual control. 	<ol style="list-style-type: none"> 1. Check plants for distinct egg punctures 4- inches from the tips of tender canes. The egg punctures look like raised blisters on the stems. The eggs can be punctured with a needle. 2. Time insecticide applications with the first sign of drooping canes. Systemic insecticides appear to give a better control than contact insecticides. The shorter spray interval on the insecticide label may be needed for adequate control.
<p>Cane-borers [Twig-nesting wasps/bees]</p> <ol style="list-style-type: none"> 1. Aphid predators - March through fall 2. Fly predators [<i>Ectemnius</i> spp.] - May through fall. 	<p>No chemical controls recommended as these insects are considered beneficial natural enemies.</p>	<p>This type of "cane borers" can be discouraged from coming into the rose garden by keeping the aphids under control. Without food, these wasps will go to somebody else= rose garden that has lots of aphids and plenty of rose canes that can be used as nesting substrates. You can also exclude these twig nesting wasps by sealing the ends of recently pruned canes during a sunny day.</p>

Credit: Baldo Villegas, Orangevale, California

Notes

Acknowledgements

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*IPM Table Courtesy of Baldo Villegas, Orangevale, CA
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Chapter 10 – Diseases

Rose Diseases and their Management

Where to start

The first step for disease control is a proper diagnosis of your problem. Use the following key to aid you in your diagnosis. If you use the key and the corresponding disease descriptions and are not confident in your diagnosis, contact an ARS Consulting Rosarian or your local county Extension office for more information.

Key to Rose Health Problems

1. White powdery substance on upper leaf surfaces and perhaps on young flower buds. Leaves may be reddish and distorted – **Powdery Mildew**.
2. Spots on the leaf surface
 - a) Spots brown to black, edges of spots are feathery and diffuse into the green tissues. Leaves or parts of leaves may be yellow and falling off the plant – **Black Spot**.
 - b) Spots are angular (limited by veins) and may be red, maroon, purple, or black. Plants may defoliate rapidly, even at the onset of the disease. There may be areas on the stem that are red or are red and have a small stem split in them – **Downy Mildew**.
 - c) Spots have defined borders and are roundish. Spot borders may be maroon to purple. The center of spots may be dead tissue (brown to gray centers).
 - i. If the disease is occurring during hot, humid weather – **Cercospora Leaf Spot**.
 - ii. If the disease occurs in late fall/winter in the Deep South or cool weather in late spring to early summer in western or northern locations – **Anthraco**se.
 - d) Faint yellow/orange spots on top surface; lower surface spots are yellow/orange and powdery. A white tissue rubbed on the lower surface will come away with a yellow/orange powder – **Rust**.
3. Blighted (rotted) or spotted petals. Petals are turning gray, brown, or tan, often with fine gray spores – **Botrytis Blight**.
4. Cankers present
 - a) Cankers found on stems usually begin during the winter months and grow to two or more inches long by spring. Cankers are often brown, sometimes with a greenish-brown leading edge on the canker's lower side – **Stem Canker**.
 - b) The canker leading-edge is a bright yellow and may have moved into the cane from a leaflet's petiole or a smaller branch. The canker moves quickly downward. Most common in the Deep South – **Cane Blight**.
5. The plant dies quickly, usually during periods of stress due to drought. It has tan to brown mushrooms at the base. White fungal growth may be present on roots or in the crown of the plant (where the canes meet the soil); use a knife to scrape off the outside bark – **Armillaria Root Rot**.
6. Plants are stunted and may wilt in hot weather (even if the soil is moist). Leaf edges may be necrotic. May produce canary yellow leaves that turn yellow and defoliate from the ground upward. Root systems are dark brown to black, generally lack fine feeder roots, and roots break easily – **Phytophthora Root Rot**.
7. Galls (tumors) live in foliage, stems, or roots. They range in size from a marble to a ping-pong ball and larger. Older galls may be dark and appear woody – **Crown Gall**.

8. Leaves have bright yellow to white line patterns, ring spots, or mosaics. Symptoms may disappear in the heat of summer and reappear later – **Rose Mosaic**.
9. Plants with reddish thickened stems, increased thorniness, strapped leaves (usually long and thin) distorted flowers, and rosettes (bunches of short stems coming from the same area on a stem (cane). Often the affected part of a rose is reddish. The affected stem or whole bush dies after overwintering – **Rose Rosette**.



Signs and Symptoms of Powdery Mildew

Powdery Mildew

The causal organism for powdery mildew is *Sphaerotheca pannosa*.

Symptoms: The first symptoms appear as slightly raised blister-like areas on the upper leaf surfaces. Later, the young expanding leaves become twisted, distorted, and covered with a white powdery mass of mycelium and spores. Young

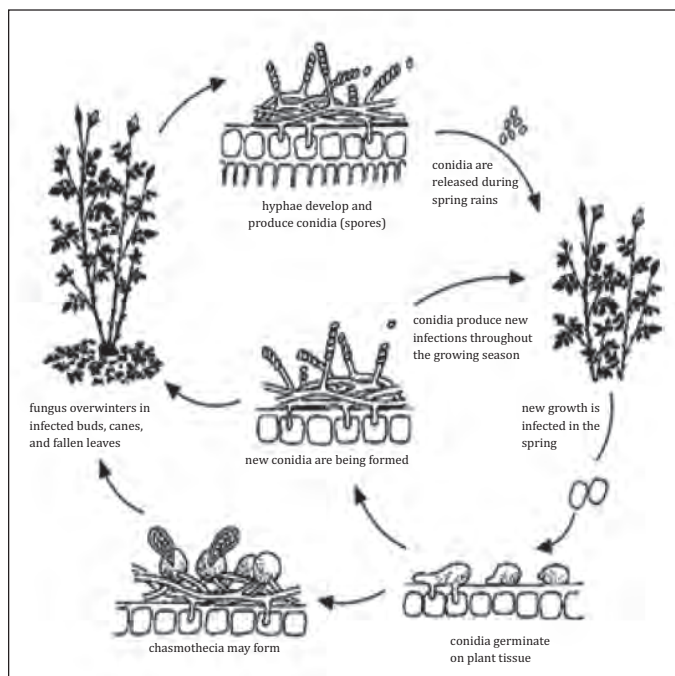
peduncles, sepals, petals, and stems distort. Growing tips and buds are killed. Infected older leaves and stems may remain symptomless.

The fungus can overwinter as spores on infected stems or leaves. As conditions warm in the spring, dormant spores become active. The white fuzzy growth on the leaf surface contains thousands of fungal spores. The wind carries these spores to young leaves, causing more infections. Optimum conditions for spore germination are 71°F and 98% relative humidity. Temperatures above 90°F will inhibit spore germination. After spores germinate, they penetrate the leaves' surface, forming a fungal structure that takes the plant's nutrients. Successful infection will result in the further development of the disease.

Air movement is vital in the dispersal of the spores. Closely planted gardens with some air movement are ideal conditions for the spread of this disease. Spore maturation and release usually occur during the day when relative humidity is low. At night, an increase in relative humidity favors spore germination and penetration of the fungus. Cool, damp nights and warm sunny days favor the development of powdery mildew.

Control: Dormant pruning and cleaning up old leaves can remove substantial amounts of primary inoculum. Sanitation should always be the initial means of control. When roses are pushing new spring growth, the conditions for

Life Cycle and Stages (magnified) of *Sphaerotheca pannosa* infecting a Rose



Credit: Adapted from IPM for Floriculture, Oakland: Univ. Agric. Nat. Res. Pub. 3402

disease development are also favorable. At this time, protection comes from fungicidal sprays applied at seven to ten-day intervals. Removal of diseased foliage can be useful under certain conditions. Fungicides in a wettable powder formulation may provide better coverage if used with a spreader sticker; most flowable formulations already have this property. While the old standby lime sulfur is a good protectant fungicide, it may burn foliage under warm conditions. Several new fungicide products now claim to have systemic and eradivative properties but do not expect to cure a severe disease situation. Fungicides will work best in the initial stages of disease development, not after a massive infection has already taken place. Remember, fungicides are chemicals with a degree of toxicity and should only be used when needed and strictly according to the label.



Black Spot

Black Spot

The fungal pathogen *Diplocarpon rosae* causes black spot.

Symptoms: These show as black to brown spots with diffuse (feathery) borders. Spots can coalesce and cause leaf blotches and blights. Leaves often turn chlorotic (yellow) before defoliating. After defoliation, canes may be bare of leaves except at the growing tips.

Early in the season, spotting occurs on older leaves near the bottom of canes and progresses up the canes during the growing season. After dropping most of their leaves, susceptible plants may refoliate only to have the leaves

drop off again after black spot symptoms appear on the new leaves. The defoliation/refoliation cycle can occur several times during the growing season. Purple to black lesions form on the canes in the fall. Stunted plants with severe symptoms show smaller and fewer flowers. After several years of severe symptoms, stunted plants may die.

Spores of *D. rosae* require at least six hours of free water to germinate and plants to become infected. Therefore, warm, wet weather favors black spot. High humidity that prevents foliage from drying quickly in the morning will also favor the disease. The fungus will also sporulate (produce spores) on defoliated foliage lying at the plant's base. This location is one reason why the disease seems to spread from the base of the plant upwards.

Resistance to black spot in modern rose cultivars is becoming more common since rose companies have made black spot resistance a breeding priority. Caution should be used when a plant claims to be resistant. The University of Tennessee AgResearch tested over 200 cultivars for black spot resistance marketed as disease-resistant claimed by rose companies. Only about 10% of the cultivars displayed acceptable levels of resistance in the multi-year study. Since the study's completion more than a decade ago, some highly rated roses have failed in studies in other parts of the country. The most likely reasons are the black spot pathogen's ability to make genetic changes and different environmental conditions. Many races of the black spot pathogen exist in the United States; the list of new strains of *D. rosae* keeps growing.

Control: Cultural controls for black spot include sanitation (cleaning of defoliated debris in late winter, early spring), proper pruning to ensure good air movement through the canopy, and watering so that the length of time foliage remains wet is reduced. Use drip irrigation to reduce the length of time that foliage is wet.

In parts of the U.S. where black spot severity is high, use fungicides to grow many cultivars of roses successfully. These fungicides will be most effective if used preventatively, since the pathogen is known to change rapidly.



Downy Mildew

Downy Mildew

Peronospora sparsa, which causes downy mildew, is a widespread disease of roses that occurs under moist cloudy conditions. Its range is throughout the United States, Europe, and South America. All species of cultivated and wild roses seem to be susceptible.

Symptoms: Foliar symptoms of downy mildew vary depending upon cultivar. Under cool and moist spring conditions, young leaves, stems, and flowers may manifest purple to red or brown irregular spots. As the disease advances, lesions on leaves become angular and black with white mycelium's possible appearance on the leaf's underside. Advanced infections will have yellowing of leaves with brown necrotic areas and noticeable leaf abscission. The scars tend to form between the interveinal areas. As the scientific name indicates, spore production is sparse, and therefore this disease is difficult to diagnose. Along the coast of California, where moist cloudy conditions persist through summer,

the disease is severe and can occur on large canes as purple irregular blotches. One of the primary symptoms of downy mildew is that leaf drop begins at the top. No other disease seems to damage roses in this manner.

The fungus overwinters as spores in or on plant parts. Germinating spores swim in free water on the plant surfaces until re-infecting the plant. The infection progresses toward the development of new outbreaks. Cool, wet, high humidity weather favors downy mildew development. Dense canopy growth and tight plant spacing encourage downy mildew spore production on the lower leaf surface. Splashing water from overhead irrigation or rainfall not only splashes downy mildew spores from leaf to leaf and from plant to plant, but also provides the wet leaf surface required for downy mildew spore germination.

Control: Meticulous garden cleanup is necessary to reduce the reinfection of plants. This disease can be especially severe on greenhouse-grown roses, where humid conditions exist for extended periods. Ventilation and reducing humidity below 85% will reduce disease development. Sanitation in the garden will reduce the primary source of inoculum. Where damp, humid conditions exist, systemic fungicides containing metalaxyl will give some control. When using fungicides, the material's persistence through wet periods or rain is vital to maintain protection.



Cercospora Leaf Spot

Cercospora Leaf Spot (CLS)

Cercospora rosicola causes foliar leaf spot disease. In some states, CLS may be as severe as black spot.

Symptoms: CLS symptoms include purple, maroon, or black lesions on the upper surfaces of mature leaves. The spots may enlarge and have brown to gray necrotic centers. Some cultivars may defoliate with heavy disease pressure. This disease may be confused with black spot and anthracnose. However, these diseases can be easily separated. Black spot lesions have diffused (irregular or feathered) borders,

whereas CLS lesions have discrete borders. Separate Anthracnose from CLS by season. Anthracnose is a cool-season disease, and CLS is a hot-season disease.

Control: CLS responds to the same controls as used for black spot. Fungicides that are effective for black spot are also useful for CLS. Since this disease is becoming more prevalent, rose breeders have started to focus on creating CLS-resistant plants.

Anthracnose

Anthracnose is a fungal disease caused by *Sphaceloma rosarum*. This disease is common in the northern half of the country and in the Deep South, where roses may hang on to foliage into winter months. Splashing rain



Anthracnose
Photo Courtesy of Clyde Graves

spreads the spores of the pathogen.

Symptoms: Symptoms of anthracnose in northern areas occur in the spring and include leaf spots on upper leaf surfaces with red, maroon, or purple borders. Lesion centers often turn brown or gray and may drop out of the lesions giving the leaflet a shot-hole appearance. In severe cases, leaf drop may be severe. The disease may move out of the leaf into the petiole and into the cane, where it may rapidly form a bright yellow canker.

Control: Having plants well-spaced and use of drip irrigation may slow the spread of this disease. Fungicides approved for black spot and CLS are effective.

Botrytis Blight

Botrytis blight, also called gray mold, is a fungal disease caused by *Botrytis cinerea*. The disease is common on petals of older flowers near or beginning to drop petals but can be found on flower buds and leaves (especially when leaves are touching each other) following periods of cool, wet weather. Rose blooms with high petal count may have lower petals affected by this disease, because blooms may hold water between the petals for protracted periods.

Symptoms: Signs of the pathogen (greenish to grayish fuzz) are often visible with a hand lens on blighted petals and leaves early in the morning when humidity is high.

Control: Management of botrytis blight during rainy weather may be difficult. Prune out any blighted foliage or blooms as soon as possible to reduce the number of spores. Deadheading (pruning of blooms) bushes regularly prevents older blooms from serving as a fungus source.

Companion plants grown with roses are becoming more common. Avoid 'self-cleaning' plants such as geraniums as these plants are a typical host of Botrytis. Fungicide resistance is a problem for greenhouse-grown roses. Rotate fungicides with different modes of action.



Cercospora Leaf Spot



Botrytis showing on lower petals



Rust on upper side (left) and lower side (right)

Rust

Rust is caused by the fungus *Phragmidium mucronatum* and *P. tuberculatum*. This disease is a common problem in the Western U.S. and occasionally a problem in the East. Rust is most severe in humid, cool weather. Although rust can be severe in western states bordering the Pacific Ocean, most of the country is spared consistent outbreaks of this disease due to hot temperatures in the summer and freezing temperatures in the winter, which inhibit rust survival. Rose rust is monoecious (only one host).

Symptoms: Symptoms include faint yellow spots on upper leaf surfaces; signs are yellow-to-orange pustules on the lower leaf surface. The green halo known as the green island effect surrounds the yellow spots. Some rose cultivars tolerate rust; intolerant cultivars may completely defoliate with only one to a few pustules on leaves.

Control: Remove infected leaves and canes with pustules. In locations with a history of rust, preventive fungicide sprays may be necessary. Some cultivars are more resistant or tolerant to rust than others.



Stem Canker

Stem Canker

Stem canker on rose canes (stems) is caused by several fungi, including *Cryptosporella umbrina* and *Coniothyrium* species.

Symptoms: Initially, small red to purple lesions on canes enlarge to 1-to-3-inch tan to brown cankers on stems. Canes may die rapidly above the canker. Signs of pathogens are small gray to black fungal fruiting bodies on canker tissue. Brown stem canker often occurs during the winter months and can destroy the entire rose bush.

Control: Prune out cankers as soon as detected. Cankers tend to grow to a node base, so make pruning cuts as close to the top of a node as possible. Pruning cuts should also be at a slight

angle to prevent water from sitting on top of the cane. Do not use dull pruners or anvil-style pruners as crushing wounds from these pruners take longer to heal. Fungicides are not useful for the management of canker diseases.

Armillaria Root Rot (ARR)

Several species of the fungus *Armillaria* can cause ARR of rose. This disease is becoming more prevalent in gardens across the U.S. ARR is often found in rose beds near a tree removal site. Stump grinding may not be sufficient, since large roots will remain below the soil line.

Symptoms: Symptoms include rapid bush decline. Brown to honey-colored mushrooms will often be seen sprouting from the mulch at the base of the dying plant.

Control: Control of this disease can be extremely difficult. *Armillaria* species are soil inhabitants (live indefinitely in soil), and the fungus will invade a more extensive area each year. When this happens, roses

may die throughout the rose bed as the fungus moves out from its origination site. The only known way to stop the advance of ARR is to dig a small width trench four feet deep between where ARR is known to exist and the healthy plants nearby. Place a four-foot-high piece of sheet metal in the trench before backfilling. However, this method is impractical for most gardeners. Often affected beds are returned to grass or used to plant herbaceous ornamentals.

Phytophthora Root Rot

More than one species of *Phytophthora* can cause this root rot. The disease may occur in roots or at the soil collar.

Symptoms: Symptoms include dark brown roots and stunted root systems. Above-ground symptoms include stunted plants. If root rot is severe, foliage may wilt. Although *Phytophthora* species are not true fungi, they are known as water molds. This disease is much more severe in poorly drained soils.



Phytophthora Root Rot

Control: If drainage is a problem, use raised beds with soils that drain well (sandy soils). Do not overwater rose beds. If *Phytophthora* root rot is severe, discard the plant. Planting back in the same hole may be futile if drainage issues are not corrected.

Crown Gall

Crown gall is a bacterial disease caused by *Agrobacterium tumefaciens*.

Symptoms: Symptoms are tumors located in aerial parts of stems (often near pruning cuts), at the soil line, or on roots. Some cultivars can tolerate large

or numerous galls without loss of vigor. Other cultivars are very intolerant and may decline rapidly with only one small gall (a marble size). As galls age, they can harden and appear to be woody (turn brown to black).

Agrobacterium tumefaciens is a soil inhabitant (the pathogen's population is stable in the soil indefinitely).

Control: Remove the infected plant and discard. Crown gall can also be spread by pruning with bacteria-contaminated pruners. If you have had crown gall problems in the past, thoroughly clean pruners with a sanitizer such as 70% isopropyl alcohol, Lysol®, etc., between pruning rose bushes. Bleach (20% - 50% aqueous solution) is an effective sanitizer but may corrode metals and dull pruners.



Crown Gall - Photo Courtesy John Olive



Armillaria Root Rot



Symptoms of Rose Mosaic Virus

Rose Mosaic Virus

There are more than 30 viruses known to infect roses. Only half of these viruses cause symptoms or affect the growth of infected roses.

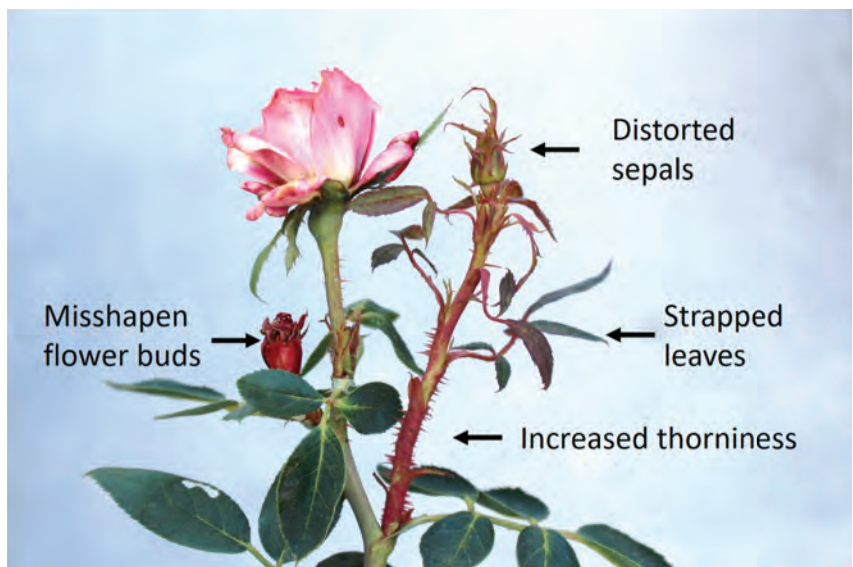
Symptoms: Virus infection symptoms include mosaic, mottled leaves, line patterns, ring spots, leaf curl, or witch's broom (rosette). Rose mosaic may be caused by one or more viruses in this group: Prunus Necrotic Ringspot Virus, Apple Mosaic Virus, and Arabis Mosaic Virus. Roses infected with a virus associated with rose mosaic may produce fewer blooms with shorter stems.

Control: Most rose viruses are not spread by pruning or by vectors. They disseminate through the propagation of infected plants. Inspect plants before purchase; do not bring symptomatic plants home. If the rose is infected, there is no reason to remove it. Other roses in the garden are not affected by the virus.

Rose Rosette Disease (RRD)

Rose Rosette Virus causes this lethal disease of roses. The eriophyid mite, *Phyllocoptes fructiphilus*, transmits the virus. These mites are the size of dust particles and only visible with a microscope (>40X). The mite is wingless, has four legs, and no eyes. The mite and virus's most significant source is extensive plantings of roses infested with *P. fructiphilus*. When temperatures reach the mid 80's, mites will release themselves from their host plant and float in air currents (called ballooning). Mites can survive up to five days off a host and blown a considerable distance from the source plant. When *P. fructiphilus* females hatch, they lay eggs that yield only males if they are unfertilized. Once fertilized, females lay eggs that yield only females. During summer months, large populations of mites can develop on rose plants, and plants symptomatic for RRD may have as many as forty-fold more mites than healthy roses. Rose rosette disease can also be spread from one location to another by the movement of diseased plants. Infected plants may remain without symptoms (asymptomatic) for up to one year, and these plants are tough to detect until they display symptoms of RRD.

Symptoms: The virus's symptoms are variable and include mosaics, strapped leaves (usually thin), a profusion of shoots with short internodes on one cane (witch's broom or rosette). Other symptoms include hyperthorniness (profusion of thorns), thickened stems, reddened foliage and stems, distorted buds and flowers, stem (cane) death, and plant death. Some large shrub roses can survive with



Symptoms of Rose Rosette Disease

the disease for many years. However, most plants symptomatic for RRD will decline and die in 3-5 years. Young plants may die in the first year of symptoms.

Control: When plants with symptoms are detected, the prudent approach is to bag the bush's top to prevent mites' movement and cut the bagged bush off at the soil line. The root ball should be dug and discarded. Root systems do not have to be bagged, as the mites do not live in the soil. Pruning symptomatic foliage from an infected plant will not save a plant. When a symptomatic plant is removed, a new plant can be placed in the same location one week later. Adjacent plants should be watched for several months to make sure they were not infected as well. If a neighboring plant displays symptoms, remove it. Quick removal of infected plants will aid in keeping mite populations low and reduce movement within the garden. If a rose garden is free of symptomatic plants, but a population of symptomatic plants is upwind from the location, a barrier such as a privacy fence or tall vegetation will impede mite dissemination and aid in reducing the threat to the garden. There are no rose cultivars known to be resistant to RRD at this time. Although RRD has killed thousands of roses in eastern states, the disease is manageable. One of the weak links in the disease cycle is the mite vector. It cannot see a rose bush, nor can it intentionally fly to one. It relies on large numbers floating in the air and landing on a rose by chance. In the rose garden, the following steps can reduce the threat of RRD significantly.

The first steps are:

1. Know the symptoms associated with RRD.
2. Remove any bush at first symptoms to prevent mite populations from building on the bush to levels where mites are ballooning to other bushes.
3. Wait one week and transplant another bush into the hole left from the plant removal in step 2.
4. Carefully monitor bushes around the removed plant's location to ensure you stopped the disease in its tracks.

Many gardeners have followed these steps and have successfully managed this disease.



In urban areas, commercial beds of shrub roses can serve as reservoirs of Rose Rosette Virus and eriophyid mite vectors.

Notes

Acknowledgements

*Entire chapter adapted with permission from
“A Guide to Rose Diseases and Their Management”
by Mark Windham, Alan Windham, and Alan Henn.*

*Photos credits to Baldo Villegas, Clyde Graves,
John Olive, Katherine Solo, Gary Bauchan,
and Ann Peck*

Chapter 11 – Appendix

The following information is presented in this section for ease of use. While the links listed are updated annually, and every effort is made to provide the most accurate and up-to-date links, the ARS cannot guarantee that the links will remain active, will work on every computer, and with every internet browser.

- ARS Endorsed Products
- Rose Grades (see American Hort® link)
- Computer Internet Links
- Consulting Rosarian Information and Forms

ARS Endorsed Products

Check the ARS website, <https://www.rose.org/>, for current product endorsements.

Rose Grades

The grades of roses have changed – see <http://www.americanhort.org/page/standards>.

Computer Internet Links

- American Rose Society <https://www.rose.org/>
- District Pages and Local Societies <https://www.rose.org/>
- International (World Federation of Roses) and International Rose Societies <http://www.worldrose.org/>
- USDA government site for hardiness map <http://planthardiness.ars.usda.gov/PHZMWeb/>
- American Hort® Plant Heat-Zone Map <http://solanomg.ucanr.edu/files/245158.pdf>
- Rose Hybridizers Association – site for rose hybridizing information <http://www.rosebreeders.org/>
- Help Me Find – site for finding information about roses and where to buy roses www.helpmefind.com/roses
- Earth Kind Roses <https://aggie-horticulture.tamu.edu/earthkindroses>

MSDS Sheets

Material Safety Data Sheets (MSDS) are full reports on every chemical manufactured. These sheets are required by federal law. All pesticides have MSDS sheets available from either the manufacturer, distributor, or seller (or available on the internet). The sheets contain chemical names, safety precautions, special handling, mixing, and instructions on what to do in case of accidental poisoning. It is highly recommended for every rosarian to have MSDS sheets for every chemical that they use. In some states, it is required to have MSDS sheets available, when you have a commercial spray permit.

Labels/MSDS information is available at <http://www.greenbook.net> or additional health and safety information can be found in the Material Safety Data Sheets (MSDS). Alternatively, contact the National Pesticide Information Center (NPIC – 1-800-858-7378; npic@ace.orst.edu) for information about pesticide products and their toxicity. Material Safety Data Sheets are available on manufacturers' websites or by calling the 800 numbers on the labels.

Pesticide disposal: Check with your local waste management authority for appropriate pesticide disposal procedure or go to <http://npic.orst.edu/health/disposal.html>.

Consulting Rosarian Information and Forms

The following Consulting Rosarians information, forms, are available as fillable pdf files on the ARS website, <https://www.rose.org/>

1. CR Candidate Form
2. CR Emeritus Application
3. CR School/Seminar Attendance
4. CR School Request Form
5. Critique of CR School/Seminar
6. Individual Certificate of Attendance
7. Master Rosarian Application
8. Outstanding Consulting Rosarian Nomination Form
9. Seminar Request Form – Four Credits
10. Seminar Request Form – One Credit

Notes

Updates

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Notes