# Integrated Pest Management and Chemical Safety

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**Slide 1 – Intro - Integrated Pest Management and Chemical Safety**

**Slide 2 – Acknowledgements**

- Several charts and graphs obtained from the internet
- Credits listed where available
- All photos by authors, except where credits are given
- An excellent source – *Consulting Rosarian Manua*l, from The American Rose Society, where in Chapter 7 we can read the basic concepts of Integrated Pest Management, or simply known as IPM

The approach to using pesticides is changing – it wasn't too long ago that most rosarians were on a routine use of pesticides, loading up the spray tank with a fungicide and a compatible insecticide every 10 to 14 days or so as a preventative. But nowadays most rose lovers want to be good environmental stewards and are shifting from this fixed routine of using pesticides, to an integrated pest management approach using pesticides only when needed.

Pesticides can be useful when used correctly, but with the 10 to 14-day routine, a lot of beneficial insects and pollinators were gone from our gardens.

**Slide 3 – Pest Control Basics**
*Note: Mouse click brings in each line.*

- Basic concepts
  - Whether a rosarian is growing roses for enjoyment or for a 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 basic 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 or IPM

**Slide 4 – Integrated Pest Management**
*Note: Mouse click brings in each line.*

- IPM Definition
  - IPM is a decision-making process that uses regular monitoring to determine if treatments are needed.

- Many factors enter this decision, but probably the basic one is can you tolerate the pest? How disruptive is it to you? Can you live with it?
- Then if you decide to treat, options can include the following controls: cultural, physical & mechanical, biological, and the least toxic chemical – let's take a quick look at some things they might include…….

**Slide 5– Pest Control Choices**
*Note: Mouse click brings in each line.*

- Cultural Controls
  - Grow healthy plants
  - Fertilization – use good balanced fertilizer
  - Allow adequate space for good air circulation
  - Choose disease resistant varieties
  - Get rid of weeds
  - Watering – no overhead watering, if possible

**Slide 6 – Pest Control Choices (Cont.)**
*Note: Mouse click brings in each line.*

- Physical and Mechanical Controls

  Good pruning techniques – remember the 4 "D's" – Dead, Diseased, Dying & *Dysfunctional
  - Mulching for weed control and water conservation
  - Manual removal – hand picking of pests
  - Hosing for control of aphids and spider mites
  - Traps – bait, sticky or light traps to capture insects
  - Barriers – copper barriers for slugs, snails, etc.

*Note – * Dysfunctional includes crossing branches, small twiggy stems, etc.*

**Slide 7 – Pest Control Choices (Cont.)**
*Note: Mouse click brings in each line.*

- Biological Controls
  - Predators – beneficial insects that hunt and eat pests - (lady bugs, lacewings, etc.)
  - Parasitoids – beneficial insects that lay eggs in pests – (parasitic flies and wasps)
- Least Toxic Chemical Control
  - Insecticidal soaps – soaps that break down insects' outer covering
  - Botanical pesticides – plant-derived pesticides (e.g., Neem oil)

**Slide 8– The Basic Elements of IPM**

We realize that there are some rosarians that choose not to use pesticides.
There are many beneficial insects that will keep the ones that can destroy a rose under some semblance of control. *This is a personal decision based on what you will accept in your garden.*

*Note: The following clicks bring in each of the next 9 lines.*

- Before making any decision about treating a pest, be sure to **identify** the pest or problem correctly! Then proceed, considering;
    - A decision whether to treat
    - A decision when to treat
    - A decision of how to treat
    - Evaluation and review of the decisions made

- These elements form a spectrum of choices, at one extreme – one that has no tolerance for any pests and will quickly make the decision to spray and eliminate the threat!
- A person on the other extreme may be interested in reducing the use of synthetic chemicals, and will use only if needed, or not at all!
- Both are practicing IPM, what differs will be the results. So, if you are going to spray for whatever reason, let's take a look at using pesticides from the *safety aspect*!

Before deciding on using any pesticide product – be sure to identify the pest or problem correctly, then become knowledgeable about the pesticide you choose to use, read the label about how to use it correctly and what to do in the event of accidental poisoning, exposure or a spill. So, if you are going to use a pesticide, let's take a few minutes and talk about using them effectively and more importantly - ***safely.***

***Click for Slide 9***

***Let's say you see this on a rose leaf in your own garden or, if you are a CR, on a visit to someone's garden***

**Slide 9 – You see this on a Rose Leaf**
*Note: Mouse click brings in each line.*

- What are you looking at? ***(Comes in with a 3 second delay -pause for discussion)***
- If you said downy mildew, you are correct
- Once seen, it is generally too late to prevent severe leaf drop
- Can defoliate a plant in a day or so

- So, what are you going to do? ***(Comes in with a 3 second delay - pause for discussion)***

***Note: You will quickly go thru those IPM steps and get the spray tank out!***

- Severely prune heavily infected and defoliated plants
- Destroy all cut material, spores can live for a month
- Treatment generally requires a very potent and costly fungicide for several days

*Note: The key is that you may see purple to red or brown irregular blotches that* ***tend to follow the leaf veins***

*Note:* ***I do not know of any treatment for this disease other than a chemical spray IF you want to keep your roses!***

*Note – A chemical that does work is* ***Aliette****, but uses of spray adjuvants (e.g., stickers, spreaders, wetting agents) are not recommended with it.*

***So, if you have this disease and want to keep your roses, you are going to have to spray, so let's take a look at what you need to do to do it safely!***

**Slide 10 – Types of Garden Chemicals**

It's always good to take a look at the definition of what we are going to talk about. As rosarians, the types of chemicals that we mainly use are called pesticides. In this case, Webster defines **pesticide** as "any chemical used for killing insects, weeds, etc."

Sounds pretty simple – doesn't it. But that's what we are going to do, but not as if you are in a chemistry class, but rather the aspects of safety when using these chemicals.

*Note: A click brings in the 'cides' – ALL of these are pesticides! However, many folks think of only the insects as pests – not true……*

You can see that the term pesticide is generic and comprises all the rest of the –cides. "-cide" means, "to kill". There are many, here are a few;

- Insecticide – kills insects
- Fungicide – kills fungi
- Miticide (Acaricides) – kills mites
- Herbicide – kills weeds and plants (a common one is Roundup)
- Rodenticide – kills rodents

**Slide 11– First Read The Label**

The three most important words in dealing with chemicals – READ THE LABEL! Do this before you start! An important one is the signal word – this one is danger! We will talk more about the meaning of the signal word shortly.

*Note: Mouse click waves the intro line*

**Slide 12 – Let's Look at an Aliette Label**

We just mentioned Aliette as a chemical that we have used for downy mildew – a broad-spectrum systemic fungicide - take a good look at all the information given here.

*Note: WDG - Wettable Dispersible Granule*

**Slide 13 – And on the back side**

Here on the back of the container is more information regarding this product, including first aid, hazards to humans and domestic animals, environmental hazards and the directions for use. One of the items to look for is **what personal protective equipment (PPE) to wear** when using this product.

***Note: A respirator is not mentioned under the PPE section, but there in the hazards to humans, it mentions harmful if inhaled. So, shouldn't that indicate a respirator?***

**Slide 14 – Mode of Action – How Pesticides Work**
*Note: Mouse click brings in each line*

Every pesticide will have a specific "mode of action"- how the pesticide works on the targeted pest. There are some different types – here are two of the more common;

- Contact: designed to be sprayed or applied directly to the unwanted pests – kills on contact, does not enter the leaf
- Systemic: the active ingredient does enter the leaf and is carried through the internal system or tissues of treated plants

**Slide 15 – How Pesticides Enter The Body**

The main routes of exposure to the human body. All are dangerous, but proper clothing and equipment will help minimize exposure.

**Slide 16 – How Pesticides Enter The Body (cont.)**
*Note: Mouse click brings in each line*

A bit more explanation of the main routes of exposure. **Dermal and inhalation (respiratory) routes of entry are more dangerous than oral.** Very dangerous when chemicals are in a concentrated form when mixing! As shown on this slide, Ocular exposure is not specifically mentioned in CR manual, but some fungicides can cause permanent eye damage. The manual probably considers it as a form of dermal. Be sure

you are protected from the start! The label will usually tell you what protective equipment to wear.

**Slide 17 – Toxicity Of Pesticides**

*Note: 1st mouse click – the lead in stat.*
Toxicity means "how poisonous". It is very important to understand what is meant by LD-50, and the toxicity of the materials that you use.

*Note: The following clicks bring in each of the next 5 lines.*

LD-50 is the commonly used term, which is the lethal dose to kill 50% of the study population (typically rats). **The lower the number, the more toxic.** LD50 values usually are not given on the pesticide label; rather, the relative toxicity of a pesticide product is reflected by one of three signal words: ***DANGER, WARNING, or CAUTION.*** You can find the LD-50 value on the Material Safety Data Sheet (MSDS), which are now called just Safety Data Sheet (SDS).

*Note – a good place to get the SDSs is Oregon State University (OSU). Here is a link to their website* - https://ehs.oregonstate.edu/hazard-communication-global-harmonizing-system

The purpose of signal words is to alert the user to the level of toxicity of the product. The signal word is assigned based on the pesticide's oral, dermal or inhalation toxicity, **whichever is the most toxic.**

**Slide 18 – Signal Words & LD-50 (dermal)**

The label warnings are there to alert users to the dangers. Here are the signal words that are listed on most pesticides and their LD-50 range. Make sure you know and understand the difference between each one of them. The label tells you this signal word and generally what precautions to take, including protective clothing, when working with this pesticide.

- Danger and Poison – Highly toxic
  - 0-200 mg/kg
- Warning – Moderately toxic
  - 200 – 2,000 mg/kg
- Caution – Slightly toxic
  - 2000 – 20,000 mg/kg
- Caution – Low toxicity
  - Over 20,000 mg/kg

**Slide 19 – One of the Least Toxic Pesticides**

Safer Insecticidal Soap, yet note that it does have the signal word of WARNING.

*Note: Mouse click brings in arrow pointing to Warning*

**Slide 20 – Safe Storage**
Locked storage cabinet– the correct way.

- Try to buy quantity needed for season
- Don't split with friends
- Keep chemicals in original container!
- Never recommend a restricted chemical
- Never reuse an empty pesticide container
- Store in a secure, dark, dry, well-ventilated location - away from children and pets
- Store containers in an area protected from flooding, or where they might leak into drains, ground or surface water

Some proper ways to handle chemicals. As chemicals age, they do lose some effectiveness so try to buy only what is needed for the season. Always keep chemicals in their original container. You are missing all of the label data! Store in a secure, dry location! Some chemicals can only be used by licensed applicators and are restricted for general use. Because some chemicals are expensive or a person could never use the full amount in a lifetime, some rosarians will share the chemical with friends. Do **not** do this!

Here are a few that I still use;

**Slide 21 – A Few That I Still Use When Needed – Note Their Signal Words**

Banner Maxx – Propiconzole – excellent fungicide (caution)
Daconil - Clorothalonil - used for first spray after spring pruning (warning)
Acephate (Orthene) – mainly used in greenhouse for gnats (caution)
Minx – Abamectin - this is the generic version of Avid for spider mites (warning)

*Note - Two of these carry the signal word of caution and two are warning*

**Slide 22 – Fungicide Types**
*Note: Mouse click brings in each line*

- Broad spectrum - multi-site surface protectants, which **do not** enter the leaf.
  - Primary use is to limit further spread of infection as spores germinate
  - Some common ones– Daconil ®, Bravo®, Neem Oil, etc.
  - These are our **contact** fungicides

**Slide 23 – Fungicide Types (Cont.)**
*Note: Mouse click brings in each line*

- Single Site - locally **systemic** which **enters** the leaves to prevent infection.
  - Chemicals penetrate as long as leaf is wet

- Single target site of fungal activity
- There is not one that will do it all. Some effective for one, some for others
- Some common ones – Banner Maxx®, Aliette®, Immunox®, etc.

Remember, there is no one fungicide that will do it all. Some are effective for one, some for others. The same single site fungicides should not be used time after time, as there can be a resistance problem. Many rosarians use a single site systemic fungicide along with a contact fungicide in the same tank and alternating with several during the season. Be sure to read the label to determine that they are compatible.

<u>But there are now more rosarians that are always looking for some chemicals to use that they consider to be not so toxic.</u>

**Slide 24 - An Organic One To Try**
*Note: Mouse click brings in each line.*

- Contains Spinosad
- It is advertised to control;
    - Thrips
    - Spider mites
    - Leaf miners
    - Tent caterpillars
    - Sawfly larvae
    - Gall Midges
    - Gypsy moth
    - Etc.
- **Is toxic to bees** exposed to treatment for a period of 3 hours
- This is the first pesticide that I have encountered that **does not have on the label a signal word or anything about using PPE** when spraying this product.
- However - the Safety Data Sheet (SDS) has a signal word of Warning and gives some PPE information.

**Slide 25 - Some Slightly Toxic Chemicals**

Here are a couple of the most common pesticides available to the general gardener, and which you might have in your storage locker. Both carry the Caution signal word. When you purchase a chemical, read the label and be aware of this signal word. Both of these are listed by OMRI – the Organic Materials Review Institute as approved for organic production.

**Slide 26 – Modes of Action**
*Note: Mouse click brings in paragraph*

- **Neem Oil** is listed as a broad-spectrum contact fungicide/insecticide/miticide.

- As an insecticide/miticide, it forms a coating on the insect's body, blocking the breathing openings and *suffocating* the insect.
- As a fungicide, it coats the leaf surface, which in turn prevents the germination of the fungal spores.

- **Green Cure®** is a broad-spectrum contact foliar potassium bicarbonate-based fungicide that kills mold / mildew spores within seconds of contact by causing an immediate dehydration of the spores and destruction of the cell walls.
- The claim is that it **is 25 to 35 percent more effective** than sodium bicarbonate (baking soda).

**Slide 27 – Some more Info on Neem Oil and Green Cure**

*Some Neem Oi Info*
**Toxicological Information:**
Avoid breathing spray mist. Causes moderate eye irritation. Harmful if absorbed through the skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Wash clothing separately before reuse.

**Environmental Hazards:**
Do not apply directly to water, or to areas where surface water is present..

**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.*

*Some Green Cure Info*
**Toxicological Information:**
Wear skin, eye and respiratory protection. Immediately flush eyes with clean lukewarm flowing water, occasionally lifting upper eyelids. Seek medical attention if irritation persists. Avoid breathing spray mist. If on skin, flush exposed areas thoroughly with water. If irritation persists, get medical attention.

**Environmental Hazards:**
Do not apply directly to water. Do not contaminate water when cleaning equipment or disposing of equipment wash water.

***Note : Neither chemical has a PPE section on the label but given this toxicological information you can see that you need a respirator, some type of safety glasses and have your body covered. The SDS does mention a respirator, safety glasses and gloves.***

**Slide 28 – Handling and Mixing Chemicals**
*Note: Mouse click brings in each line*

- First - Read the label!
- Use only dedicated measuring spoons and cups!

- Mix what is needed & to directions!
- Avoid mixing more than one chemical unless compatible – read the label!
- Wear protective clothing including rubber gloves (I prefer the nitrile gloves)
- Mix in well-ventilated area
- Skin contact with concentrates is especially dangerous
- Know first aid treatment before you start!
- **Read the label again to be sure!**

*Be sure to wear your protective gear and work in a well-ventilated area. Skin contact with the concentrated chemical before and during mixing is especially dangerous. Remember the dermal way that pesticides can enter the body a few minutes ago?*

**Slide 29 – Personal Protection When Spraying**
The label will usually tell you this, but this is most commonly called for; cap, safety glasses, respirator, waterproof gloves *(I prefer Nitrile),* long sleeve shirt, pants (no shorts), sturdy closed shoes (no sneakers, or flip-flops) Rubber boots are the best.

*Note: After you finish spraying you should either remove the cartridges and store them in a tight plastic bag or, if you prefer, place the entire respirator in a sealable bag. If left in the open the cartridges continue to absorb moisture thus reducing their effectiveness, as they are filled with specially treated activated carbon designed to absorb chemical vapors.*

*A pair of them costs about $15 on Amazon, so the cartridges should be replaced when a chemical odor becomes apparent, or when breathing becomes difficult.*

*As a minimum, new cartridges should always be installed at the start of the pesticide application season.*

**Slide 30 – More on Personal Protection……..**
*Note: Mouse click brings in each line*

*Note: Photo comes with a 2 sec delay after third line*
*Second photo of a NIOSH approved respirator comes in after last line*

- I have talked about PPE for years in this program and explained it in detail
- By now all of you have an understanding of what it means……
- But not the N95 that we all have been using during the pandemic! However, as PPE it does not provide any protection with chemical sprays – **do not use this one** for when you breathe in the chemical vapors come thru and are trapped inside the mask
- I know it is confusing….. but it does NOT provide any protection when we spray!
- You might have heard there is a version of the N95 that can protect against some pesticide dusts, but they don't protect against all pesticides or pesticide vapors, which is what we have when we spray! **Don't use this one either**!

- Be sure that any respirator you choose for protection against pesticides is certified by the National Institute for Occupational Safety and Health (NIOSH), like this one.

**Slide 31 – Spraying Chemicals**
*Note: Mouse click brings in each line*

- Identify problem - use proper chemical (least toxic)
- Read the label!
- Water well before spraying as damage may result – reduce plant stress
- Protect children and pets
- Never spray on windy or very hot days
- Spray undersides + tops of leaves for best results
- Wash hands and face immediately after spraying!
- Clean and store equipment
- Be a good neighbor

*Some do's and don'ts of spraying. You can get the most effective use of a pesticide if you spray both the undersides and tops of the leaves. Be sure to wash your hands and face immediately after spraying! Take a shower soon, and wash clothes separately. Remember to wash your eyeglasses too!*

**Slide 32 – Questions?**
Remember – What you have read and heard. Protect yourself and be safe! Thank You.