Lecture (7)

Compatibility of pesticides and obsolete pesticides

Tank mix: It is a common practice to combine multiple crop protection products into a single spray application. This practice is called tank mixing. The primary benefits of tank mixing are efficiency and convenience. Tank mixing may also:

1- Permit applicators to make more timely applications based on weather conditions and crop or pest life stages
2- Improve the control of certain pests
3- Broaden the spectrum of the target pests controlled
4- Allow products to be applied with fertilizer, bio-stimulants, and plant growth regulators
5- Reduce expenses by decreasing input costs —including labor, passes across a targeted area, and equipment wear.
6- Reduce crop damage and soil compaction that can be associated with making multiple applications.
7- Decrease the likelihood of pesticide resistance by applying products with multiple modes of action together.
8- Enhances efficacy of ingredients by adding spray adjuvants.

Physical Incompatibility

Tank mixes with physical incompatibility problems may separate into layers (that is, oil and water), and solids may settle faster than normal. In severe cases, physical incompatibility may cause the solution to form gels or cause solids to clump. When these things happen, operators may have to drain and flush the tanks, and then remove and clean all filters, screens, and nozzles.

Examples of physical incompatibility include:

• Dry products fail to disperse or suspend properly in the solution. When this happens, sediment can form a cake-like layer that accumulates on the bottom of the tank or that can form particles that can clog screens.
• Un-dissolved materials that clog screens and nozzles.
• Liquid solutions curdle and thicken into a paste or gel that makes it difficult to clean the tank.

• Oil residue coatings or films that collect on tank walls and rubber hoses.

• Active ingredients that separate into distinct layers in the spray tank.

• Excess foaming from trapping air in the tank mixture.

Physical incompatibility can cost you time and effort while you clean out gels, solids, and hard-packed sediments. Additionally, it can be expensive to remediate or safely dispose of the residues and any rinsates you generate while cleaning the sprayer. In severe cases, if you don't clean out the equipment completely, you can damage the crop.

Chemical Incompatibility

Chemical incompatibility can negatively affect spray quality, product uptake, and plant surface retention of the application. The effect of a chemically incompatible tank mixture may not always be obvious. Visible crop injury (phytotoxicity) may occur a few hours to several days following an application. Sometimes, reduced efficacy is the only observable effect of chemical incompatibility. This may require additional applications, and can decrease yield, harm crop quality, or both.

Most chemical incompatibilities arise from surfactants in the tank mix that are not compatible in mixtures. For example, an oil adjuvant added to an herbicide can increase cuticle penetration, but it also can impact herbicide activity that may result in scorching or bleaching on crops that might not otherwise be affected by the active ingredient.

Factors leading to incompatibility:

- Common tank mixing mistakes include:
- Combining formulations that have not been tested.
- Applying new tank mixtures using multiple products (especially mixes that contain oil adjuvants)
- Not following label instructions.
- Mixing products in the wrong sequence
- Adding products when there is insufficient water in the spray tank.
- Adding products to the tank mix before previous products have time to dissolve and disperse.
- Mixing with too much agitation — which can cause foaming with liquid flowables — or too little agitation — which can cause dry formulations to not dissolve.
- Not considering compatibility when substituting water with fertilizer.
- Not considering slower mixing times due to cold water.

When Are Pesticides Obsolete?

Obsolete pesticides are stocked pesticides that can no longer be used for their intended purpose or any other purposes and, therefore, require disposal. Common causes of this situation include the following:

Use of the product may be prohibited or severely restricted for health or environmental reasons (e.g., it may be banned, its registration withdrawn; or its status affected by other policy decisions by the Ministry of Agriculture or other authorized ministries).

The product may have deteriorated as a result of improper or prolonged storage and can no longer be used according to its label specifications and instructions for use, nor can it easily be reformulated to become usable.

The product may not be suitable for its intended use and cannot be used for other purposes, nor can it easily be modified to become usable.

What Constitutes Obsolete Stocks?

Obsolete pesticide stocks comprise the following four major categories:

1. Pesticides in the form of liquids, powders, granules, emulsions, gases, etc.

2. Empty and contaminated pesticides containers (millions of these are left at the farm gates each year, with little or no attention paid to their potential impact on the environment and human health unfortunately, most end up being used for domestic purposes such as water or food storage).

3. Contaminated soil either at storage site or in the open.

4. Buried pesticides either in engineered landfills or in shallow open or closed pits. As burial is a temporary solution, almost all buried pesticide stocks subsequently need to be excavated and disposed of in an environmentally safe way, but often at much higher cost.

Oils:

Oils are chemical substances composed essentially of carbon and hydrogen. Various types of oils such as petroleum oils, glyceridic fixed plant and fish oils, volatile or ethereal oils, and synthetic silicone and polybutene oils are being used to control a variety of pests in field and garden crops. Petroleum oil and neem oil have

been in use against insects and mites for centuries. Today, with the availability of highly refined petroleum oil and neem oil safe for use on plants, there are renewed efforts to use oils in various integrated pest management (IPM) programs.

Why oils for pest control

Arthropod pests and diseases incur 10–30% losses annually in various crops. Undoubtedly, the indiscriminate use of synthetic pesticides has increased the problem of insect resistance, environmental contamination, health hazards, and outbreaks of secondary pests, thus leading to their ban or regulation all over the world. Oils, on the other hand, are safe, eco-friendly, and biodegradable with minimal effects on the natural enemies. No species of insect has developed resistance to oils even after many decades of their continuous use. Oils therefore can safely be applied to complement chemical, biological, and cultural methods of pest control to combat insect resistance, environmental pollution, and the emergence of secondary pest problems in a variety of field and garden crops.

Oils in winter and summer management of pests

Oils as such are broad-spectrum pesticides that are phytotoxic. The efficacy of oils depends on the type of oil available, the host plant and its stage, and the insect and its stage where control is to be achieved. Environmental factors also affect pesticidal activity as well as the phytotoxicity of oil. Broadly, oils can be used for insect and mite control as winter and summer season applications.

In winter a single application of oils is used as high- volume sprays, with heavy grades at higher concentrations in early dormancy and with lighter grade oils at lower concentrations in delayed dormancy against the overwintering stages of insects and mites mostly on deciduous trees and rarely on evergreen trees, Delayed dormant applications are more effective as high mortality is achieved. Applications in winter are easier to apply, are safe to the natural enemies and have low or no residue hazards.

In summer or the growing season, repeated applications with highly refined petroleum distillates are done at low concentrations (0.5–1% oil) as high volume sprays on all kinds of tree and crops except for the oil sensitive plants. In the growing season, moderate to low mortality is achieved and chances of toxicity to natural enemies are higher. Oils provide direct control of certain pests and supplementary control to others. Thus, oils should be used in IPM packages with other components such as cultural

practices and biological control.

Challenges in the use of oils for pest control

Oils, a valuable tool in pest management systems, should be judged from their merits and properties that are different from the conventional pesticides. Major limitations in the use of petroleum oils in pest control include their low pesticidal efficiency, phyto-toxicity, sensitivity to the environment (low and high temperature and high humidity), and various technological challenges associated with their refining and formulation (high paraffinic characteristics). Vegetable oils a renewable source are least exploited with regard to their refining techniques for making them safe to plants as well as for enhanced pesticidal activity.

Similarly, various obstacles limiting the use of neem oil include the lack of characterization of neem plant ecotypes for different environmental conditions, variations in neem formulations, poor shelf-life, phytotoxicity, wide variations in recommended doses, slow action and limited persistence, moderate mortality (as a result, required degree of control is not achieved).