

## Formulations (4) and Planning the Pesticide Application (10)

Name: \_\_\_\_\_

### Tank Mixing and Incompatibility Activities

#### Learning Objectives:

1. To illustrate the need for compatibility testing.
2. To demonstrate examples of incompatibility.
3. To discuss why some combinations are incompatible.
4. To learn how – and when and why – to do a 'jar test'.
5. To interpret the results of compatibility 'jar test'.

#### Terms to Know:

*Formulation* - A pesticide product as sold. Usually, a formulated product contains both active and inert ingredients. (Many formulations also contain one or more adjuvants - chemicals added to increase the effectiveness or safety of the product.)

*Tank Mix* - Combining two or more crop production chemicals (pesticides, fertilizers) in one tank.

*Incompatible* - A combination that is not usable, safe or effective. Incompatibility may be due to physical properties; for example, one material may not form a solution or remain in suspension when another is present. Incompatibility may also result because the ingredients react chemically to form new (and unlabeled / unknown) substances.

*Precipitate* - A precipitate is an insoluble, solid substance that forms as a result of a chemical change. In one of these demonstrations, a reaction between two water-soluble chemicals forms a new substance that is not water soluble. The starting materials were clear solutions, but the reaction forms a cloudy suspension. Then, the newly-formed water-insoluble substance precipitates, or settles out of solution.

#### Introduction:

People generally try to work smarter, not harder. Many times they mix several pesticides together to reduce the time, effort, and cost of application. If a product label does not specifically describe tank mixing with other pesticides (and/or fertilizers), then a jar test must be performed to check for compatibility. Otherwise, mistakes costing time, pesticide, money, and ruined equipment can occur.

## Overview:

Incompatibility is a result of the physical or chemical interaction of the substances in a tank mix.

*Physical incompatibility* occurs when the properties of one substance will not allow it to mix with or dissolve in another. This prevents making a usable or sprayable mixture.

*Chemical incompatibility* occurs when two or more substances react. One or more new products are formed as a result of the reaction. If a chemical change occurs during a compatibility test for a mixture of agricultural chemicals, the mixture should NOT be applied.

Signs of a chemical change—new product(s) with different characteristics formed—include:

- heat released by the reaction
- color change
- production of a gas (bubbles)
- formation of a precipitate (insoluble particles)

Signs of a physical change—change (only) in size, shape, or state—include:

- layering/separation line (indicating one substance will not dissolve in another)
- oily droplets

General information about compatibility testing may be found in the National Core Manual (Units 4 and 10).

Product-specific information about compatibility, including substances and other products known to be incompatible, tank mix instructions, and precautions may be found on pesticide labels.

**Label Exercise:**

Choose a pesticide product label.

(You'll have more luck if you choose a "professional product" vs. a homeowner product. I suggest that you choose a product that you will use in your planned profession—or one you are currently using on your farm or "on the job".)

You can access labels on the Internet at:

<http://www.cdms.net/pfa/LUpdateMsg.asp>

<http://www.greenbook.net/>

Record the name of the product: \_\_\_\_\_

Record the name of the product's formulation: \_\_\_\_\_

Copy or print the first page (front) of the label, showing the:

- product name and formulation (name, symbol, or clue),
- net contents / ingredient statement,
- signal word, and
- use patterns (if given).

Copy or print and submit the section(s) dealing with incompatibility.

Do you find them helpful? Explain:

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## Incompatibility Activities:

### A. Oil and Water:

1. Fill a jar 1/2 full of water. Add oil until a 1/4 - 1/2 inch oil layer sits on top of the water. Put on lid and shake.

Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_

IF incompatible (No), physical or chemical? \_\_\_\_\_

Clue(s)? \_\_\_\_\_

2. Add several drops of liquid soap. Put the lid back on, and shake. Observe right away, and again after +/- five minutes.

Describe what (if anything) changed: \_\_\_\_\_

Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_

IF incompatible (No), physical or chemical? \_\_\_\_\_

Clue(s)? \_\_\_\_\_

What brand of liquid soap did you use? \_\_\_\_\_

### B. Starch-Water Solution + Iodine:

1. Put about one cup of water in a jar. Add a few teaspoons of soluble starch (cornstarch). Shake or stir to mix.

Did you see any sign of a physical or chemical change? (Yes/No): \_\_\_\_\_

Compatible? [Could you spray this solution or mixture?] (Yes/No): \_\_\_\_\_

Clue(s)? \_\_\_\_\_

2. Add a few drops of Iodine (Betadine) solution. Shake or stir to mix.

Describe what (if anything) changed: \_\_\_\_\_

Did you see any sign of a physical or chemical change? (Yes/No): \_\_\_\_\_

Compatible? [Should you spray this solution or mixture?] (Yes/No): \_\_\_\_\_

IF incompatible (No), physical or chemical? \_\_\_\_\_

Clue(s)? \_\_\_\_\_

(continued)

C. *Tea (Solution) + Milk + Lemon:*

1. Make a strong cup of tea. (This will be easier to see and evaluate if you make the tea in a clear glass instead of a porcelain cup.) Add a few teaspoons of whole milk or cream. Stir to mix.

Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_  
IF incompatible (No), physical or chemical? \_\_\_\_\_  
Clue(s)? \_\_\_\_\_

2. Add a few drops of lemon juice (or vinegar). [Note: both lemon juice and vinegar are weak acids.] Stir to mix. Wait and watch for +/- five minutes.

Describe what (if anything) changed: \_\_\_\_\_  
Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_  
IF incompatible (No), physical or chemical? \_\_\_\_\_  
Clue(s)? \_\_\_\_\_

D. *Baking Powder and Water + Vinegar:*

1. Put about one cup of water in a jar. Add a tablespoon of baking powder. Shake or stir to mix.

Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_  
IF incompatible (No), physical or chemical? \_\_\_\_\_  
Clue(s)? \_\_\_\_\_

2. Add 1/4 to 1/2 cup of vinegar.

Describe what (if anything) changed: \_\_\_\_\_  
Did you see any sign of a physical or chemical change? (Yes/No): \_\_\_\_\_  
IF incompatible (Yes), physical or chemical? \_\_\_\_\_  
Clue(s)? \_\_\_\_\_

E. *Gelatin and Water:*

1. Put about one cup of (warm) water in a jar. Stir in two packets of unflavored gelatin. Allow to stand undisturbed for +/- one hour.

Describe what (if anything) changed: \_\_\_\_\_  
Compatible? [Could you apply this mixture with a sprayer?] (Yes/No): \_\_\_\_\_  
IF incompatible (No), physical or chemical? \_\_\_\_\_  
Clue(s)? \_\_\_\_\_

