Spray Mixing Instructions Considering Tree Row Volume

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Plant Growth Regulator response is a function of the amount of chemical deposited on the leaves of the tree. The amount of chemical that is sprayed per acre should consider tree size to not over-apply chemical to small trees and under-apply chemical to large trees.

Tree size can be used to adjust the amount of chemical added to the spray tank by calculating the size of the tree canopy (tree row volume). The tree row volume (TRV) of an orchard is defined as the volume of water needed to spray the trees to drip point, which is termed a full dilute spray.

The amount of chemical can then be adjusted to the size of the trees with fully-grown trees receiving a full amount (100% dose) and smaller trees receiving an appropriate fraction of a full dose.

The volume of water used to carry the chemical to the leaves can be less than the full dilute volume, but if less than the full dilute volume is used then the amount of chemical in the tank must be concentrated to allow the proper amount of chemical to be applied to each tree.

The concentration factor is determined by dividing the full dilute volume of water (TRV) by the actual amount of water to be sprayed.

First Step is to Mix the Tank Properly

This process can be broken down into 3 easy steps:

1. Calculate Tree Row Volume (Tree height X Tree width X 43,560 X 0.7) / (Between row spacing X 1000)
   - Example of a Tall Spindle Orchard – for many mature Tall Spindle Orchards this is ~200 gallons/acre. Example (11' X 7' X 43560 X 0.7) / (12' X1000) = 196 gallons/acre (rounded to 200GPA).
2. Then set up the sprayer for less than the full TRV amount
   - For the example of the Tall Spindle trees lets assume you set up the sprayer to spray ½ of Tree Row Volume which would be100 gallons/acre. Thus this is a 2X application on TRV trees of 200GPA (200/100=2).
3. Concentrate the chemicals in the tank
   - Multiply the recommended rate for 100 gallons dilute TRV basis X 2 for each chemical (except oil or surfactants).

We suggest that for each orchard block, you calculate tree row volume with the formula above and set up your sprayer for some fraction of TRV and then calculate YOUR own concentration factor. **Note**- Old semi dwarf trees may be 300GPA+ however, these older bigger trees with more vigorous rootstocks, thin easier, so set your maximum TRV at 200 GPA max, never 300. However younger trees in tall spindle blocks may be only be 150, 125 or 100 GPA TRV on younger trees. We strongly recommend that you calculate the actual TRV with the formula in #1 above and then adjust the chemical rate based on how many gallons you spray per acre.

Next Step is Adjusting the Spray Pattern

Often the bottoms of trees show over-thinning while the tops of trees show under-thinning. Our standard recommendation is to nozzle the sprayer so that 2/3 of the spray volume is directed to the top half of the tree and only 1/3 is directed to the bottom half of the tree. Recent studies have shown that this still gives 65% of the fruit in the top half of a tall spindle trees and only 35% of the fruit in the bottom half of the tree. To overcome this imbalance of crop load and ensure fruit

on the entire tree uniformly, our new recommendations are in two parts:

1. Bloom and petal fall sprays
    - Adjust nozzles so that spray pattern directs 2/3 of the spray to the top of the tree and 1/3 to the bottom of the tree.
2. Sprays from 10-18mm
    - Completely shut off the bottom half of the nozzles, so that all of the spray is directed to the top half of the tree and no spray be directed to the bottom half of the tree.

These recommendations are based on three years of research with Terence Robinson and Andrew Landers and the last 3 years with Poliana Francescatto and Jaume Lordan. Turning of the bottom half of the nozzles and adjusting the chemical rate up produced the most uniform fruit set overall. The reason this works is that the upper part of the tree gets so much sun light and therefore produces more carbohydrate. Fruit on top receive a greater carbohydrate supply making fruits are harder to thin, as compared to the fruit located on the bottom of the tree where you have more shade. The harder to thin fruit on tree tops need the extra chemical (PGR) to assist in thinning fruit.

Please note that when you shut off the bottom half of the nozzles you need to adjust up your rate of chemical per acre you add to the tank since the volume of water applied per acre is less. We still want to keep the same amount of chemical per acre, even though you are spraying only the top of the trees. The bottom part of the trees will get some drift and do not need to be directly sprayed in 8-14 and 18mm sprays. Therefore, if we turn of 50% of the nozzles and reduce the GPA by 50% you need to recalculate the concentration factor and increase amount of chemical you add to the tank. More chemical has to go in the tank to account to the factor you shut off nozzles and less water is applied to the acre.

For example, if you reduce the water per by 50%, instead off covering five acres with one tank it now covers ten acres. The way to think about this is how many acres will your tank be covering, this determines how much chemical per acre you need to add. (If you just want to try shutting of 30% of the bottom nozzles that's ok to start, and adjust the chemical you add per tank accordingly.)

Note: one important item, you will have to know the output of the nozzles you turn off, to calculate the water reduction in gallons per acre. Often growers have already have smaller nozzle sizes on the bottom. Calculate the total output for each nozzle turned off on each side x 2 sides, and subtract from your GPA to get your actual GPA output.

Example 1. Calculations for bloom or petal fall spray of Maxcel+Sevin with all nozzles on. Standard rate of Sevin XLR at 1 pint per 100gal TRV basis+ Maxcel at 48 ounces per 100 gallons TRV basis:

- Mature Tall Spindle Orchard (11' X 7' X 43560 X 0.7) / (12' X1000) = 196 gallons/acre (rounded to 200GPA)
- Sprayer calibrated at 100GPA (1/2 TRV)
- Concentration factor = 2X (200/100=2)
- The dilute rate for Sevin is 1pt/100 but the orchard needs 200 gallons for full coverage so each acre should receive 2pts.
- The dilute rate for Maxcel is 48oz/100 but the orchard needs 200 gallons for full coverage so each acre should receive 96 oz.
- Calculation: 1pint Sevin x 2X= 2pt Sevin per 100 gallons of spray
- + 48 ounces Maxcel x 2X=96 oz. Maxcel per 100 gallons of spray
- If your tank is 500 gallons you would times chemical by 5
- 5 x 2 Pints of Sevin XLR= 10 pints per 500 gallon tank+
- 5 x 96 ounces Maxcel=480 ounces per 500 gallon tank and sprayer will cover 5 acres

Example 2. Calculations for 12mm or 18mm sprays of Maxcel+Sevin with bottom nozzles turned off. Standard rate of Sevin XLR at 1 pint per 100gal TRV basis+ Maxcel at 48 ounces per 100 gallons TRV basis:

- Mature Tall Spindle Orchard (11' X 7' X 43560 X 0.7) / (12' X1000) = 196 gallons/acre (rounded to 200GPA)
- Sprayer calibrated at 50GPA (1/4 TRV since bottom half of nozzles turned off)
- Concentration factor = 4X (200/50=4)
- The dilute rate for Sevin is 1pt/100 but the orchard needs 200 gallons for full coverage so each acre should receive 2pts.
- The dilute rate for Maxcel is 48oz/100 but the orchard needs 200 gallons for full coverage so each acre should receive 96 oz.
- Calculation: 1pint Sevin x 4X= 4pt Sevin per 100 gallons of spray

- + 48 ounces Maxcel x 4X=192 oz. Maxcel per 100 gallons of spray
- If your tank is 500 gallons you would times chemical by 5
- 5 x 4 Pints of Sevin XLR= 20 pints per 500 gallon tank+
- 5 x 192 ounces Maxcel=960 ounces per 500 gallon tank and sprayer will cover 10 acres

Example 3. Calculations for bloom or petal fall spray of NAA+Sevin with all nozzles on. Standard rate of Sevin XLR at 1 pint per 100gal TRV basis+ NAA (Fruitone) at 10ppm or 4 ounces per 100 gallons TRV basis:

- Mature Tall Spindle Orchard (11' X 7' X 43560 X 0.7) / (12' X1000) = 196 gallons/acre (rounded to 200GPA)
- Sprayer calibrated at 100GPA (1/2 TRV)
- Concentration factor = 2X (200/100=2)
- The dilute rate for Sevin is 1pt/100 but the orchard needs 200 gallons for full coverage so each acre should receive 2pts.
- The dilute rate for Fruitone is 4oz/100 but the orchard needs 200 gallons for full coverage so each acre should receive 8 oz.
- Calculation: 1pint Sevin x 2X= 2pt Sevin per 100 gallons of spray
- + 4 ounces Fruitone x 2X=8 oz. Fruitone per 100 gallons of spray
- If your tank is 500 gallons you would times chemical by 5
- 5 x 2 Pints of Sevin XLR= 10 pints per 500 gallon tank+
- 5 x 8 ounces Fruitone=40 ounces per 500 gallon tank and sprayer will cover 5 acres

Example 4. Calculations for 12mm or 18mm sprays of NAA+Sevin with bottom nozzles turned off. Standard rate of Sevin XLR at 1 pint per 100gal TRV basis+ NAA (Fruitone) at 3 ounces per 100 gallons TRV basis:

- Mature Tall Spindle Orchard (11' X 7' X 43560 X 0.7) / (12' X1000) = 196 gallons/acre (rounded to 200GPA)
- Sprayer calibrated at 50GPA (1/4 TRV since bottom half of nozzles turned off)
- Concentration factor = 4X (200/50=4)
- The dilute rate for Sevin is 1pt/100 but the orchard needs 200 gallons for full coverage so each acre should receive 2pts.
- The dilute rate for Fruitone is 3oz/100 but the orchard needs 200 gallons for full coverage so each acre should receive 6 oz.
- Calculation: 1pint Sevin x 4X= 4pt Sevin per 100 gallons of spray
- + 3 ounces Fruitone x 4X=12 oz. Fruitone per 100 gallons of spray
- If your tank is 500 gallons you would times chemical by 5
- 5 x 4 Pints of Sevin XLR= 20 pints per 500 gallon tank+
- 5 x 12 ounces Fruitone=60 ounces per 500 gallon tank and sprayer will cover 10 acres