

## GROWER FIELD GUIDE, April 2011

Well here we go again, the weather is uncooperative and the time is ticking. Most of you are trying to get some sprays on and Mother Nature is not allowing it. It is very hard to get into orchards and keep up with these soggy conditions. We will keep working on it. Speaking of Mother Nature, I have looked at many fruit buds this winter and there is some hit and miss out there. Make sure you are paying attention to what you have in your orchards. It will be important in your decision making process in thinning. So don't shoot the messenger!

Once again, I am happy to say that we have an improved line of fertilizer and weed/fertilizer control products for you and your lawns. These products are available at all Northwest Wholesale, Inc. branches. Please stop by and have the guys show you what these products are and how to use them. I think you will be happy with the results!

**Chemical thinning** will be one of your most important tasks beginning late this month. Accurate **sprayer calibration** can save you money and improve your results. If you want to check the nozzle arrangement you already have or recalibrate to a different gallonage or speed, contact your fieldman. We'll help you do it.

The formulation of your **foliar nutrition** materials and their performance can make a difference in your final cost. I've included an article to help you decide whether you should use chelated materials when they're not being applied to the soil.

Pesticide container recycling will be the same as last year. Bring in your empty, rinsed containers anytime during normal business hours. Northwest Wholesale will accept properly rinsed containers at all locations except Tonasket (Don doesn't have the room). The warehouse personnel will inspect them before acceptance. The container must be clean and dry, some staining is allowed. The plastic labels must be slipped off, the jug cap removed and any instruction booklet removed. We will also accept plastic containers up to 30 gallons in size. There is a poster on display at all participating locations with pictures and detailed instructions on container cleaning.

**Bring back those empty barrels and shuttles, please!** I frequently see empty oil drums or shuttles setting behind storage sheds late in the summer. You cleaned them, planned to bring them back the next time you came to town, but somehow forgot to. Then they got set out of the way (temporarily, of course) and they're still there this spring. Now would be a very good time to load them up and bring them in. We never have enough drums during dormant oil season, besides you've paid a sizeable deposit you could be using for something else, like taking your wife out to dinner?

**One Important note.** Saturday morning delivery out of the Wenatchee location will not be available again this year. Please try to schedule requested deliveries for Friday or Monday. Remember we are a Cooperative, its your money were saving by operating efficiently.

I have freely copied and adapted information from various Research and Extension personnel and publications plus the experiences of the Fieldstaff at Northwest Wholesale for the information presented in this **GROWER FIELD GUIDE**. All opinions expressed and any errors in presenting that information to you are entirely mine, I would appreciate being notified of any errors so that they will not be perpetuated.

All material usage information supplied in this bulletin is believed to be in compliance with current labels. It is the responsibility of the grower to insure that use of any material is in compliance with the label on the product in his possession! All material rates in this bulletin are shown per acre except those products where concentration of material is important; those rates are per 100 gallons.

All of the monitoring aids mentioned in this bulletin and research information on most of the insects and diseases mentioned are available through any Northwest Wholesale warehouse.

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This and all past GROWER FIELD GUIDES plus the complete spray programs are posted on our website [www.nwwinc.com](http://www.nwwinc.com)

## Blossom time insect damage

**Campyloomma** and **Western Flower Thrip** should be monitored closely in the prebloom to post petal fall time period to prevent fruit marking. *Campyloomma* most easily damages Golden and Gala; Western Flower Thrip damages Granny Smith, Braeburn and nectarines. See pages 8 and 9 of the March 2009 GROWER FIELD GUIDE for monitoring and control information. Copies are available on the Internet or by request at any branch.

## Fireblight modeling

If you have pears or any of the **Fire blight** susceptible varieties of apples, you need a copy of Tim Smith's **Cougarblight 2000F** to help you determine if and when to apply a preventive spray. You can get Tim's latest version at the Chelan County Extension web site, <http://www.ncw.wsu.edu/models.htm>. Decision Aid also has information on fire blight that is updated daily.

Why should you use the Fire Blight model instead of just spraying every three days? Well for one thing, the effectiveness of Mycoshield or Flameout will last a **LOT** longer. We applied streptomycin (Agri-mycin) every three days during bloom before we had a model to go by. That material has not been considered useful in pear orchards in North Central Washington for quite a few years because the bacterium rapidly developed resistance to it. Bob Shanks, Syngenta Product Development Manager explains we can still effectively use Agri-mycin provided we don't use it any more frequently than once every seven years.

Secondly, the industry recently had to fight to retain the use of Mycoshield on pears because of concerns by National and World health organizations that environmental (agriculture) use of antibiotics will transfer resistance to human and animal pathogens. A major factor in our favor was our declared use of the CougarBlight model developed by Mr. Tim Smith, WSU Extension.

Third, the apple industry has annually requested a section 18 label to allow use of Mycoshield on apples, again telling the WSDA and EPA that apple growers would only use the product if and when the CougarBlight model predicts a fireblight infection period. If the WSDA determines that the use pattern is in fact substantially driven by the calendar and grower convenience instead of a predictive model, there is a possibility that future requests for a section 18 for apples will be denied.

Fourth, there is no other proven antibiotic material available for apples or pears. Some researches have said they don't think another antibiotic label for agriculture will ever be granted because of concerns for human health use. Broad-spectrum fungicides, i.e., coppers and Dithane are known to reduce fireblight strikes, but frequently contribute to fruit marking.

If you want some assurance that you will have an effective fireblight material to protect your pears and the new apple varieties you're planting, get and study a copy of Tim Smith's Cougarblight Risk Assessment Model. Then follow it. Don't use up the only effective material that you currently have by using it inappropriately, i.e., every third day during bloom regardless of the weather conditions.

## Determining Biofix for Codling Moth

Codling moth biofix cannot be established inside a mating disrupted block. Before king bloom of Red Delicious, place your codling moth trap in an untreated area that is most likely to be populated with over wintering larva based on your orchard history. Monitor every two to three days during the blossom and petal fall period, more frequently if the evenings are above 55 degrees. First moth flight normally occurs near full bloom on Red Delicious. When you catch the first moths, you have determined biofix. If your codling moth population is so low that you have difficulty catching any, you probably should assume full bloom on Red Delicious is biofix. Hold the phone! The Decision Aid System has made this task much easier. <http://das.wsu.edu/index.php>

Some of the newer control materials such as Esteem, Rimon or Intrepid are applied sooner than this extension bulletin indicates. Read those labels of the proper timing.

## Get them up there!

We all know most codling moth activity takes place in the upper half of the tree. To accurately monitor what's going on that's where your trap needs to be also. Here's a cheap, easy way to put it there, check it easily and keep both feet on the ground while you're doing it. All you need is a roll of electrical tape and a six-foot bamboo pole. Tape about 4 inches of the trap wire to the end of the pole as shown. I used two layers of tape; I want it to last all season.



Bend the wire in a U and hang the assembly over a convenient branch in the upper part of the tree. The weight of the bamboo keeps your sprayer from blowing the trap out of the tree. It works; I converted all of the traps I monitor to this method last year. You might want to tie some colored tape to the handle in case you forget which tree you hung the trap in. This application was Herb's, and I think it is still the best application out there!

## Codling Moth Mating Disruption

To understand if it will work for you, consider the following items. What has been your moth pressure? What size and shape is the area to be controlled? Is it a windy site? Does it have a 'hang on to the tractor fender' degree of slope or is it fairly level and uniform? Are the trees uniform in size and density or is it a replanted block with several sizes and some open spaces? The pheromone dispenser must be in place before the first flight, which is normally at Red Delicious bloom. If you are interested refer to the article beginning on page 4 in the March 2010 GROWERS FIELD GUIDE or contact your Northwest fieldman for advice on your situation.

## Leafroller Monitoring and control

Monitoring and control of leafroller, either Pandemis or Obliquebanded should be based on the understanding that first generation control (1/2" green through petal fall) is the least expensive program available. Skimping to save money now will cost you a lot more for control of the summer generation. (See the apple spray program in this issue for rates and materials.)

A delayed dormant oil and Lorsban spray is the foundation of your control. Complete coverage of the top of the upper branches is essential. That's where most of the larva will be. This first spray should have been applied in most areas by the time you read this.

A Leafroller larva is difficult to see before tight cluster, monitoring before then has little practical value in most orchards. Most fieldmen will recommend a full control schedule of pre and post bloom applications on the overwintering generation if there has been any damage noticed at harvest or in the cull analysis. If you want to monitor, start after the oil/Lorsban application at 1/2" green tip and pink, look for clusters that are 'weeping' a dark sap or don't appear to be unfolding normally. Examine these clusters closely for larva or the webbing that is characteristic of leafroller. Old Lygus bug feeding sites will sometimes continue to weep but will not have any webbing or chewing injury. You must look in the top 1/2 of the larger trees, concentrating on the spurs closest to large wood. Up to 80% of the pandemis will be located there. Not finding larva in the lower portion of the tree is not a reliable indicator of a low population. Look at several trees scattered throughout the orchard, small leafroller populations are very spotty. If you find 1% - 2% of the clusters with live larva, you need to decide whether to apply a prebloom and petal fall BT (Dipel, ) or wait until petal fall and use **Intrepid** or **Success**.

Leafroller larva must be actively feeding for the BT compounds to be effective, if you don't have daytime temperatures of 65 degrees or more you are wasting your time and money. Worse, a sub-lethal dose will cause the leafroller larva to stop feeding and growing for 7 - 10 days making them much harder to control with later sprays. Wait for warm weather, be sure all factors effecting coverage, (calibration, ground speed, wind speed, fan capacity etc.) have been considered and are favorable. Poor control now will cause you major headaches later in the summer.

Ten to fourteen days after the petal fall application go back to the area where you found the highest population pre bloom and search for survivors. By now the larva will be webbing the larger spur leaves together and will be easier to spot. Larva counts now will help you decide if second generation controls will be needed. (More in the June issue)

Further information on the life cycle and identification of leafroller is available at your Northwest Wholesale warehouse.

## Spring weed control

Residual herbicides require 1/4" or more of water to incorporate them into the soil, just prior to your first irrigation is a good time to apply any residual herbicide you missed last fall. Spring applied residual herbicides typically do not last as long as a fall application but will give you much longer control than a contact application alone. A contact herbicide alone applied in early May with lots of weed seeds in the ground may give you three weeks of control, the addition of residual compounds should give you about eight weeks of control. Casaron will **not** give satisfactory control when spring or summer applied without specific treatment; contact your nearest Northwest Wholesale warehouse for instructions. Control of growing weeds will require the addition of **Glyphosate** or **Gramoxone plus a surfactant** to the mixture. Avoid spraying the trunks of trees smaller than 2" in diameter with Roundup to avoid damage.

## Foliar nutrition

As the first recommendations for the year are written and some nutrient combinations are included, frequently questions arise. What's that? Do I really need it? What's the benefit? What's it doing to do the rest of the material in my tank?

From my perspective and experience, here are some generalized answers.

The need for zinc in fruit growing has been documented for years. For a long time the fruit industry in the northwest has struggled to develop effective ways to move zinc into the trees, including cover cropping, zinc nails in the tree, even zinc pellets in shotgun shells. Applying a dormant zinc sulfate in a spray sounds simple by comparison. In recent years more material options have become available. Now zinc deficiency or zinc maintenance sprays can be applied at almost any time during the growing season to supplement or even replace the dormant zinc if necessary.

The ability to apply other forms of zinc outside the dormant period can be very beneficial on peaches and nectarines. The materials we currently use for Green Peach Aphid are combined with oil and must be applied very early in the season, about the same time we would like to be applying zinc sulfate. In this case other forms of zinc that are compatible with many other materials should be applied later after foliage is present to adsorb it. Do **not** however, mix zinc or any other metallic nutrient with calcium chloride. **Zinc sulfate forms available now need to be buffered if your water ph is higher than 7.**

Boron is an element that is essential, but only in relatively small amounts. Tim Smith says that boron in drought situations is more important than normal case scenario, (Food for thought). Soil levels of boron are rarely adequate; the material is water soluble and leaches readily. A common practice had been to apply 3 lbs. of boron per acre every 2 - 3 years and then supplement that with early season spray applications to increase the boron level in the flower parts. The new formulation of Granubor is very soluble however and does not last much longer than the season of application. It has become a fairly common practice to apply three pounds of B-17 or Solubor twice in the prebloom and pink timing and another five or six pounds in the fall and dispense with ground application altogether.

If you use an alkaline form of boron (Solubor, Borosol, etc.), acidify the solution to a pH reading of **8** or less before adding any pesticides that are to be used to avoid the possibility of destroying some of the effectiveness of the pesticide. Dry boric acid (B-17,) is slightly acidic and does not require additional buffering

Calcium is a major component of the cell wall and plays an important role in fruit quality. Fruit with high flesh concentrations of calcium generally have less fruit disorders in the field, (bitterpit, cork spot, etc.) are firmer, and generally store better. (*see foliar calcium article following this*)

Tree and fruit growth, i.e. cell division, is very rapid in the early part of the growing season. The soil is generally cool to cold, frequently too moist for optimum growing conditions and many of the nutrients move relatively slowly once the roots pick them up. Most of the early season growth utilizes nutrients already stored in the spur and shoots. The closer to the growing point a needed nutrient can be placed; the easier it is for the tree to properly utilize to maintain a rapid rate of growth.

Low levels of phosphate early in the cell division period (tight cluster through six weeks after bloom) have been associated with low return bloom, even when thinning seemed adequate. Don't apply foliar potash such as KTS unless

you have documented a shortage. High levels of potash are frequently associated with bitterpit and early fruit softening in storage.

The nutrients recommended during this early part of the season are usually a combination of the major elements that are used in relatively large amounts, (N-P-K-Ca etc.) and some of the minor elements that are essential to growth (zinc, boron, sulfur, iron, magnesium, etc.). The objective is to avoid any crop reducing shortage that might be imposed by less than ideal growth conditions, or to raise the level of an essential nutrient at a time when we know it is critical to fruit or tree development by placing nutrients on the new leaves and moving them rapidly into the tree to be utilized.

If foliar nutrients are really beneficial, shouldn't I be applying them all season long? No. Continued application of some materials past their primary use period could cause serious problems. For example, mid to late summer applications of nitrogen will give you softer, later maturing, poor coloring fruit. Boron applied during the summer could cause fruit to ripen early and unevenly. High levels of potassium applied late in the growing season may induce early maturity and aggravate bitterpit. Calcium levels, a nutrient important for long storage that we do apply during the summer, will be negatively affected with aggressive applications of potassium or magnesium.

There is an appropriate time for growth promoting foliar applications. Cell division in the fruit ceases between 6 and 7 weeks after full bloom. At that time the maximum size potential of the fruit is determined, no amount of fertilizers, growth enhancers, etc.; that we now know of will have any material effect on the maximum size potential after this time. Your job as grower after cell division is over, is to manage the orchard in a manner that avoids tree stress, (overcropping, deficit irrigation, weed competition, heat, etc.) and harvest as much of the size and quality potential the fruit developed during cell division as possible.

Smaller summer applications of some nutrients are being investigated to determine if they will reliably give positive effects on color, firmness, etc. Some positive results have been observed, such as increased red color when copper levels are increased to above 12 ppm and potash levels are adequate.

Bottom line message, foliar application of nutrients from delayed dormant through the cessation of cell division is a standard practice that should have a beneficial effect in supplementing, but not replacing, other good orchard practices aimed at maximum production of high quality fruit.

### **Do you need Calcium for Quality Fruit?**

A large number of calcium related disorders are well recognized in fruits and vegetables. You know the most common symptoms in fruit as bitterpit in apples or corking and alfalfa greening in pears. Applying foliar calcium has proven beneficial in reducing fruit loss from these disorders.

Calcium in adequate amounts is important for the formation of strong cell walls. If adequate calcium is not available early in the growing season when cells are being formed the fruit will be more likely to develop bitterpit or corking symptoms later in the season if they are subjected to heat stress. At maturity, with cell walls fully stretched, fruit deficient in calcium will have less firmness and begin to show internal disorders more rapidly than fruit with adequate calcium. Fruit with high calcium is normally firmer and retains good eating quality in storage longer.

But there is a real risk that fruit will be low in calcium during cell division. Here's why.

Cell division and development takes place early in the season when soil temperatures are cool and tree roots are not very active. Very little calcium is being picked up from the soil.

Calcium is highly immobile in the tree; the rapidly growing fruit has only the calcium that has been stored in nearby bark and cambium available to it during the bloom and immediate post bloom period when it needs it most for development of strong, healthy cell walls.

After the soil warms up and the roots begin to actively support growth, most of this newly available calcium from the soil is passively transported to the most actively growing parts of the tree, leaf expansion and shoot growth, not the more slowly expanding fruit cells.

In today's fruit industry, top quality is not an option — it is a requirement. You must deliver the best type, size and finish you possibly can, with the least amount of defect possible. Nothing less will do.

You've historically gone to great lengths to enhance your fruit quality by applying gibberellins and cytokinins at bloom and shortly after to stimulate cell division and growth. You do this to increase Red Delicious type, increase the size of Gala and Fuji, and reduce russet on sensitive apple and pear varieties. But have you considered adding calcium at that same time to support the growth you are stimulating? Cells can't develop and expand to their full potential if they are

deficient in calcium. Fruit will not store well if cell walls are deficient in calcium. And there is no substitute that the tree can use in the place of calcium. The best time to insure strong cell walls and firm, high quality, storable fruit is by applying calcium during bloom and immediately post bloom while rapid cell formation is taking place.

### Which calcium should you use?

Mid summer trials comparing MIRACAL<sub>sp</sub> with calcium chloride are ignoring the potential benefits of early season calcium applications when calcium chloride is not an option because of potential fruit damage. Calcium chloride's efficiency at penetrating the wax layer on the fruit may have some affect on the increasing lenticel damage the industry has been experiencing the past several years.

Chelated calcium and calcium nitrate based materials have been used without fruit damage. The analysis of these materials typically runs in a range of 6 – 8%. You could be paying more than \$45.00 per pound for the actual calcium in some of these products and applying less than one pound of calcium per acre at the usual recommended rates.

TECH-GRO MIRACAL<sub>sp</sub> is a 30% soluble powder calcium product, with no chloride, no nitrogen, or any other salt. It is safe, effective and economical for supplying immediately available calcium for the critical rapid growth stages during bloom and immediately post bloom. MIRACAL<sub>sp</sub> may be combined with all of the plant growth regulators (PGRs) and pesticides commonly used at this growth stage. You pay about 1/6<sup>th</sup> the cost of a chelated product. Are you getting a 6 to 1 efficiency advantage from the chelation? I don't know of any replicated study that says you are.

Get the most value possible for your money. Use MIRACAL<sub>sp</sub> this year beginning prebloom. Then add it to your fruit finish and thinning sprays also. The rate is 3 to 5 pounds per acre per application.

## Apples

### Pheromone Based Codling Moth Controls

- NoMate CM 400 per acre
- Isomate C 400 per acre
- CHECKMATE CM-F 10 – 20 grams per acre
- Checkmate XL1000 200 per acre

CHECKMATE CM-F is a micro-encapsulated sprayable Codling moth pheromone that may be tank mixed with other pesticides, growth regulators and nutrients. The 10-gram rate is designed to last 14 days during the first generation, the 20 gram rate for 28 days. We are recommending the 10-gram rate at no more than 14-day intervals during the first generation because of the normal frequency of applications made of other material during that time period. The interval should be shortened by about 25% during the second generation because of higher temperatures.

Supplemental sprays are normally required for all pheromone based control programs during the first generation.

(see *Mating Disruption for Codling Moth* March GROWERS GUIDE for monitoring and trapping methods.)

## Apples

### PRE-PINK TO PINK (Apple scab\*, Apple mildew)

Strobilurin plus protectant program:

- Flint 3 oz./acre  
or Lime-Sulfur Solution 10 – 12 gal. /acre.
- Penncobez (scab only) 6 lbs./acre  
or Vangard (Scab only) 3 - 5 oz./acre  
or Ziram 76 WDG (Scab only) 5 lbs./acre.



Other Mildew options:

- Rally 5 oz./acre
- Procure 480 SC 8-16 oz./acre

Apply the second mildew spray on susceptible varieties (Golden, Jonathan, Granny Smith, Gala, Fuji, Braeburn, and Jonagold, etc.) at pre-pink to pink. In light mildew pressure conditions, micronized sulfur before and after bloom may be sufficient, if an SI such as Rubigan or Procure was used with the delayed dormant spray.

**\*Scab** infections may occur any time in the spring when there is green tissue and a wetting period occurs. If scab was present the preceding year, sprays should begin as soon as possible after an infection period has occurred as determined by the Mills wetness chart. Rally, Rubigan, and Procure are eradicant type sprays with "kickback" action, whereas, Lime-Sulfur, Dithane, Ziram are all protectant type fungicides. Vanguard performs as a protectant at 3 oz. per acre, but performs as both eradicant and protectant at 5 oz. per acre. The safest procedure is to combine both protectant and eradicant materials for scab control during this time period. Inspire super is a new product that could be used too. The rate is 12 oz. per acre.

Procure applied by air has worked satisfactorily. Under situations where ground application is not feasible, use 10 oz. per acre with a protectant.

**PRE-PINK TO PINK** (Pandemis leafroller) If you had any leafroller population in the orchard at all last summer it is important the overwintering generation be completely controlled. Most programs have shifted to a petal fall Intrepid, Success or Bt because the weather is frequently too cool for prebloom Bt to work well at Pink.

- Micronized sulfur\* 10 – 12 lbs./acre
- Or
- Micronized sulfur\* 5 – 6 lbs./acre
- Plus Serenade Max\* 3 lbs./acre
- Dipel (BT) 1 - 1 ½ lbs./acre
  
- Nufilm 17 8-oz. /100 gal.
- Tech Spray MG 4-oz./100 gal.

See note on Zeta Zinc in the previous section.

\*Add for mildew susceptible varieties unless the full program outlined above has been applied.

Dipel will control pandemis leafroller with good coverage and warm nighttime temperatures. Daytime temperatures should be 65 degrees or higher. Control will be poor under cool or wet conditions, wait until the petal fall spray under cool conditions. Two or more applications of these materials may be needed during the pre-bloom to 1/2-inch fruit stage if the weather is cool for good control of the first generation if leafroller or leafroller damage was easy to find the previous harvest.

Nufilm 17 with Dipel will both help with coverage and provide some sunscreen protection for the Bt. Guthion should not be used at this time for mealybug control, total season usage has been reduced to 8 lbs. on apple and 6lbs.on pear.

**RUSSET REDUCTION**

In addition to the materials that are recommended in the Fruit Finish Program (many of which may be combined with insect control applications) it is important to be properly calibrated to avoid uneven application of material to the tree. Current and forecast weather conditions must be taken into account. Frosty or near frosty conditions, prolonged rainy periods, slow drying of spray applications make fruit russet a high risk. Avoid spray applications during these periods.

**PINK TO PETAL FALL** (Western flower thrip, Campylomma)

- Carzol SP \* 1 lb./acre
- Or
- Success 8 oz./acre
- +Tech Spray Mg 1/4 pint/100 gal.
- Assail 2.8 oz. /acre

\* Carzol may not be used past petal fall anymore in apples! Carzol is ph sensitive.

If blossoms are open, apply **Carzol** at night or while bees are not working in blooms. Repeat application as needed. **Success** at this timing will control thrip but not Campyloomma. This timing is also good for leafroller, but complicates good stewardship of the material for resistance management. See **Intrepid** note in the next section.



**PETAL FALL** (Bull’s eye rot, Leaf hopper, Leaf roller, aphid, mildew)

- Intrepid 2F\* 16 oz./acre  
Or Success 6 – 8 oz./acre  
Or Proclaim 4 oz./acre
- Ziram 76WDG 5 lbs./acre
- Pasada\*\* 4 – 6 oz./acre
- Thiodan 50WP\*\*\* 4 lbs./acre
- Flint\*\*\*\* 2.5 oz./acre  
Or Lime Sulfur 2-½ gal. /100 gal

Apply at petal fall on older trees, especially if overhead irrigation is used unless an Apple Scab program has been followed through the bloom period. Application must be made before the calyx closes. An additional protective spray should be made mid to late August in any block with a history of Bull’s eye decay in the pack out.

\* **Intrepid** will work better at petal fall than it will later in the summer on leaf roller, timing and coverage are easier to control. Use the full rate of Intrepid for residual control of both codling moth eggs and later hatching Lacanobia. **Success** has proven to be effective during the summer on a broader range of insect pest. If mating disruption is being used, time the Intrepid application for Codling Moth at 150 – 250 DD (late petal fall) after biofix.

\*\* Required if Rosy Apple Aphid are present. Use 1 oz. of Silwet/100 gallons for good contact in curled leaves.

\*\*\* Apply only if there will not be an application of Sevin used as a post bloom thinner, Sevin (carbaryl) will give you leaf hopper control. **NOTE:** You may not use more than 3 lbs. (4 quarts EC or 6 pound WP) of active ingredient per year. **Do not apply Thiodan within 300 feet of any lake, stream or pond.**

\*\*\*\* Apply to mildew susceptible varieties.

Esteem can be added in this for Scale control if Delayed Dormant Oil and Chlorpyrifos wasn’t used.

Ziram may be combined with most nutrient programs and with Calcium Chloride in the August application.

## Apple Scab

The key to controlling the disease lies in preventing the microscopic scab ascospores, which overwinter on dead leaves on the orchard floor from establishing new or ‘primary’ infections on emerging leaf tissue. If not controlled, each ascospore-induced infection will produce hundreds of thousands of new spores, called conidia, capable of infecting other leaves and the developing fruit.

The cycle begins whenever last season’s leaves have been sufficiently wetted by spring rains. The ascospores are released and an infection period begins, requiring a fungicide application.

The decision to spray or not depends on the amount of scab inoculum present in the block and the moisture and temperature conditions experienced during the wetting period. Climatic conditions can vary dramatically within relatively short distances, it is essential that you monitor temperature and wetness conditions in your orchard.

**When in doubt about the severity of an infection period, make the application.** Eradicating an established infection will cost you a lot more than the savings you may have gotten from a skipped; “maybe I don’t need it” spray! Good coverage is essential, spray as soon after the infection period as possible for the best disease control, the foliage and fruit must be dry to minimize the risk of fruit marking.

In northern Okanogan County or any other location where Apple Scab is a fact of life every spring, you should have a protectant on prior to the blossom period to avoid the need to spray right at full bloom.

## Fruit Finish

Fruit russetting has been directly associated with damage to the cuticle for nearly 80 years. During the past 25 years or so many researchers have published their findings on the role of the wax cuticle on fruit russet. In simple, unscientific terms, the sooner the wax forms and the more uniform the layer of wax remains, the less russet that will develop on your fruit.

A uniform, unbroken layer of wax on the cuticle of your apple or pear protects the tissue of your fruit from direct contact with moisture, yeast, bacteria and other “nasties” that, given the opportunity will damage the surface of your fruit, causing russet.

You’ve probably guessed by now that the varieties we consider to be prone to russet don’t develop a heavy, durable wax layer as quickly as those varieties that seldom russet.

As your fruit grows it stretches the surface wax layer as the fruit cell divide beneath it. If your fruit grows more rapidly than the new wax development can accommodate, it cracks exposing the fruit tissue to any damaging factors that are present. After last year we also know that severe heat in this period stretches or thins this layer too!

Most of you know me well enough by now to suspect that I am working up to something — and you are right. I firmly believe that quality does not cost a grower, it pays!

Just as I strongly urged you to consider using CYTOKIN in your fruit shape and size enhancing programs in order to produce the best possible size and shape to take to a crowded market place, now I am also urging you to maintain a strong foliar nutrient program also, partly to lower the risk of russet developing on your fruit.

The list of known and suspected causes of fruit russet is lengthy, i.e., mildew, frost, water, yeast bacteria, etc. It is possible that some of the russet from these or other factors could be avoided if they were denied contact with the tender surface of your fruit by a well-formed wax layer.

Many studies throughout the world during the sixties focused on the causes of russetting. There were no definitive answers; many of the causes of russetting are not controllable. Two factors were identified that you do have some influence on, the rate of fruit growth and the formation of cuticle wax.

A nutrition program that is relatively high in phosphate has been shown by Australian research to produce fruit that is more resistant to russet than programs that are low in phosphate. The individual cells in high phosphate fruit are smaller, therefore less likely to rupture the cuticle during the cell division. In the same study, trees on a high nitrogen program were found to produce large cells, more likely to rupture during cell division, forming cork tissue (russet) as they healed. In an April 1998 newsletter, Dr. Lester McNall, President, NUTRIENT TECHNOLOGIES wrote “Application of a well designed foliar program during the post bloom period can promote an evenly controlled, steady rate of cell enlargement and division without the growth spurts that initiate cuticle cracking. Calcium and Boron are both important elements in cell division and growth. ... Molybdenum plays a role by minimizing bursts of growth due to fluctuations in utilization of Nitrogen.”

On the subject of cuticle wax development, which he has researched since 1982, Dr. McNall states, “It is known from empirical observations on a number of crops, ranging from onions to deciduous fruits, that certain TECH-FLO formulations positively enhance the formation of wax.” Dr. McNall continues with the proper technical words to describe how the wax is produced by the plants, finishing with “Zinc and Manganese serve as coenzymes for these (wax forming) types of reactions.”

In summary Dr McNall states that russet is the obvious result of damage to the cuticle in the early stages of fruit formation. It is influenced by a number of factors; primarily cultivar, environmental exposure, and cultural practices, the latter being the only one that you have any degree of control over.

A nutritional program consisting of 2 quarts of TECH-FLO BETA (phosphate, manganese, zinc), plus 2 quarts of TECH-FLO CALBOR+MOLY (calcium, sulfur, boron, molybdenum) plus 10 pounds of ALPHA DF (phosphate, calcium, zinc) at petal fall and again 14 to 21 days after petal fall will supply those nutrients that have been connected with smaller cell formation and accelerated wax development, both factors in reducing fruit russet.

If you have questions concerning your ability to tank mix these materials with your insect and diseases spray program, check with any NORTHWEST FIELDMAN, or Rick Wright of NUTRIENT TECHNOLOGIES, cell phone number 509-421-1807, or call me at the number provided near the front of this GROWERS GUIDE.

## Pollination management

Well-pollinated fruit is larger, better shaped, and holds up better in storage, don't take good pollination for granted.

Wild bees are becoming less and less of a factor in fruit pollination because their colonies are being decimated by parasitic mites and diseases. If you have depended on wild bees in the past, you may be unpleasantly surprised by their absence. Make arrangements early in the season to have adequate hives delivered to your orchard. Adequate is subjective, one hive per acre would probably suffice in good weather conditions for apples, while cool weather and pears would require three hives per acre. Apricots, cherries and peaches will fall somewhere in between.

For the long term your orchard should be designed with adequate and reliable pollinating varieties distributed throughout the orchard. Short-term solutions to an inadequate pollen supply include cutting bouquets and using pollen inserts.

Bouquets used for pollination should be renewed as they begin to fade, they also should be placed in the orchard near the variety to be pollinated. Placing them near the hives may make the bees happy, but doesn't do much to insure good pollen transfer to your cropping variety.

Pollen inserts should be placed in the hives the day before you intend to use them. All alternative entrances to the hive should be blocked to prevent large numbers of bees avoiding the insert. One level teaspoon of pollen should be placed in the insert during the peak flight hours of the day at about 1-hour intervals.

A single bee visit to the blossom is not enough to give you fruit with a full seed count. Several visits are needed for well-pollinated fruit, up to 50 visits per blossom according to Dr. Dan Mayer of WSU.

Pheromone bee attractants will increase the bee activity on the blossoms. The first application should be made at 10% open king bloom, with a second application at 80% open king bloom if the weather has not been ideal. Turning off the lower sprayer nozzles or spraying every other middle will lower material costs, reducing the application gallonage to 60 to 80 GPA will reduce loss by runoff. Using a pheromone will also help to keep your bees "at home".

Unfortunately there is no cure for bad weather during blossom time, but you should be doing everything possible to get the most out of your bees during the weather they can work in.

Here is Dr. Mayer's checklist to assure bees are working at optimum levels in your orchard:

- 1.) Determine how many bees are foraging per tree per minute on 10 trees at different times of the day, when temperatures are 65 degrees or higher and for several days during bloom. In mature orchards, there should be a minimum of 20 bees per tree per minute for maximum pollination.
- 2.) Determine if bees work all varieties equally well in the orchard, using the bee per tree per minute method of counting. Bees should work main and pollinizer varieties in more or less equal numbers.
- 3.) Determine if bees are evenly spread throughout the orchard by counting bees per tree per minute in different parts of the orchard. Uneven numbers of bees in the orchard could lead to poor pollination.
- 4.) Determine if most bees accomplish pollination by observing if bees visiting flowers touch the stigma. If more than 50 percent of the foraging bees don't touch the stigma, pollination may be inadequate.
- 5.) After the fruit begins to develop determine the amount of fruit on main variety trees next to pollinizers versus trees some distance from pollinizers. The amount of fruit should be the same.
- 6.) Determine if the crop is mainly king bloom fruit. Lack of king bloom set could be due to insufficient pollination.
- 7.) Determine the amount of seeds per fruit by cutting open a minimum of 25 apples in five different locations in the orchard. If most apples don't have at least five to six seeds per apple, poor pollination was probably the cause.
- 8.) Determine the number of seeds per carpel in the cut fruit. If all carpels don't have a seed, pollination may be a problem.

Pollination problems can be overcome Mayer said, by renting more honeybee colonies, using reliable bee attractants, planting more pollinizers, or using supplemental practices such as beehive pollen inserts.

## Fruit Shape (see next article)

**Promalin or Typy** (GA<sub>4</sub>, GA<sub>7</sub>, 6-BA) applied to varieties other than Red Delicious generally lengthen the fruit resulting in a tonnage increase and in some cases a more attractive apple. It will not cause lobes to develop on fruit with a smooth calyx. Many acres of Gala and Golden have been treated with Promalin over the years with good effect. Reduced fruit russetting has also been reported.

Any of these materials may be applied from 10% of the king bloom open to petal fall, but it must be applied when the weather is warm enough to support active cell division or the results will be disappointing. Daytime temperatures must be above 60 degrees, 70 degrees is better. Late petal fall applications with warm weather will give you equal or better results than earlier applications made with cool weather.

Apply 1 1/2 to 2 pints in 100 to 200 gallons of water per acre. The material must be absorbed by the fruit to be effective, application under slow drying conditions will give you the best performance. The use of Nufilm 17 at the rate of 1 pint per acre in place of Regulaid or other surfactants has allowed spraying under normal daytime drying conditions with results equal to or exceeding the slow drying conditions of either early morning or night spraying. Rainfall within 6 hours after an application may reduce the effectiveness of an application made without Nufilm 17. I do not recommend the addition of silicone based surfactants; they may increase the runoff of the material if overused or accelerate the drying time, neither of which is desirable.

In prolonged bloom situations it may be advisable to split your applications by spraying alternate rows at early bloom and then spraying the untreated middles two to three days later. This allows more bloom to be covered at optimum timing.

Many combinations including Liquibor; Sorba Mg; Tech-Flo Mg; Dithane M-45, MIRACAL<sup>sp</sup>; micronized sulfur; Sterol Inhibitors; Cal-Bor+Moly; and Bt's + Coax have been used successfully in combination with both **Typy** and **Promalin**. Put the nutrient and fungicide materials in the tank first then buffer to a pH of 7 or below before adding the plant growth regulator material

A less costly treatment that has been field tested over the last 6 to 7 years is to use a 50/50 mix of **Promalin** or **Typy** and **Cytokin** at the same total material rate as you would normally use Promalin alone. See the next article for details.

## Being shapely isn't just for Bikini wearers

Northwest Wholesale wants you to grow the best-shaped Red Delicious in the market place this year at the least cost possible.

An oversupplied market has always demanded "better" quality; this coming year is shaping up to be a big crop year. An orchardist must be able to produce top quality fruit to survive. One very important measure of quality of your Red Delicious is shape (type).

As an experienced Red Delicious grower, you understand that weather during bloom and for about a month afterwards as the apple is forming has a very strong influence on fruit size and shape. For the past twenty years or more you have been applying Promalin, a mixture of gibberellins and 6-benzyl aminopurine —6-BA for short—to insure that during those years when conditions were not optimum for the tree to manufacture its own growth regulating substances, there would be adequate levels for the fruit to continue to grow normally.

A less costly treatment that has been field tested over the last 6 to 7 years is to use a 50/50 mix of **Promalin** or **Typy** and **Cytokin** at the same total material rate as you would normally use Promalin alone. See the next article for details.

The additional plant growth regulators (PGRs) you applied to the green tissue or flower parts stimulated the desired fruit growth, resulting in more uniform shape or typiness for your fruit from year to year in spite of weather variations.

This resulted in higher-grade packout from uniform, well shaped fruit — higher yield from increased fruit size — higher returns per acre!

You have done this successfully for years. I know that there are some years when you have wondered if the material really did any good, when it was nearly impossible for you to see any difference between fruit that had been treated and fruit that had not been treated.

The apple tree produces the same types of PGRs that you are applying with your sprayer. When weather and soil conditions are optimal, this natural PGR production is adequate to produce fruit of exceptional shape and size. The tree

cannot utilize the additional amount you are applying. You can't see any difference because there isn't any difference to see!

However, when weather conditions are just slightly less than the best for fruit growth, the additional PGR material you apply to the tree is utilized to continue growth as if conditions were optimum. The resulting fruit shape is excellent, the size good. That year you can see the difference between the fruit that was treated and that which was not, provided you left a few trees untreated for comparison. You have better, more consistent type and better size.

You also remember the occasional year when the weather was lousy. Growing conditions during and after bloom were not good for fruit growth at all. Your fruit shape those years ranged from maybe OK to not very good at all. Did Promalin do you any good that year? Probably more than you realize. True, the cold weather overwhelmed the ability of the tree to fully utilize the applied material and promote the growth and shape that you wanted, but I am willing to make a strong bet that there was much better and more consistent shape in the fruit that was treated than there would have been if you hadn't applied Typy or Promalin.

One fruit researcher that I know has had the statement attributed to him that growers get the most benefit from Promalin, relatively speaking, in those years that do not naturally produce good type. The same year that you are complaining loudest that it did not work!

You know all of this already from watching your fruit in the bin at harvest, so why am I using up so much paper?

I want to make the point that Promalin (or Typy) is an insurance policy. Insurance that you will produce the best fruit shape possible for the existing weather conditions every year. A quality measurement that the market place will use to value your crop in relation to everyone else's.

You can't predict what the weather will be during the crucial cell division growth period during and after bloom. This is the growth period that will nearly totally determine what your fruit size and shape will be.

And after you know that the weather was too cool for good growth and type, it will be too late for you to do anything about it.

The highly active natural PGR effects from CYTOKIN<sup>®</sup> Bioregulator Concentrate (*hereafter referred to generally as CYTOKIN for easier reading*) will augment the less active synthetic 6-BA contained in Promalin. Reduce the Promalin, replace that with CYTOKIN. — it will cost you less money per acre than the full recommended rate.

Retired Miller Chemical & Fertilizer Company representative Norm Hilbert ran trials and measured fruit beginning in 1993 in Washington and Oregon using various mixtures of Promalin and CYTOKIN. He has proven that you can use 50% Promalin and 50% CYTOKIN and still expect results equal to the normal 2 pint per acre Promalin treatment. This treatment produced equal or better fruit shape in 9 trials out of 10 —90%. Sounds like awfully good odds to me!

Experience from these several years of work has proven that you may substitute 1 pint of CYTOKIN for 1 pint of your normal 2-pint rate of Promalin or Typy, and expect the same size and type response from your fruit as you would from your normal application.

Young Red Delicious trees are noted for producing very poor type. In this situation a full rate of 2 pints of Promalin plus 1 pint of CYTOKIN is needed to achieve the same fruit response as you would get from a single pint of each on mature Red Delicious trees.

CYTOKIN is not a miracle compound that will compensate for poor tree nutrition — it will not suddenly release “hidden nutrients” in the soil or tree. CYTOKIN will however, help in your early season foliar nutrition program. Unlike 6-BA, CYTOKIN is fully systemic. It moves freely in the tree and will aid in the utilization of any nutrients that you apply along with it.

Additional cell division will be stimulated by a second application of CYTOKIN 10 to 14 days following bloom, enhancing fruit size.

### Size increase on apple

Maxcel, a plant growth regulator (PGR), is a mix of cytokinin and gibberellins. Maxcel may be tank mixed with Promalin if the application is appropriate, do not mix with or use before or after NAA. Other tank mix compatibilities are unknown at this time but no difficulties have been reported. Similar compounds such as Promalin, Provide and ProGibb are compatible with most pesticides and nutrients.

The intent of Maxcel is to increase the fruit size. To be effective, application must be made under conditions that enhance cell division, i.e., 65 degrees or more, optimum is 70 to 80 degrees. The material is metabolized quickly, 85% in three days, you can't put it on in cool weather and wait for the weather to improve. Tim Smith has measured size increases of up to 1 1/2 box sizes on Gala apples.

Three applications of 21 ounces of material per acre are made. The first application is the same time as Promalin and with the same weather conditions. The second application is 5 to 7 days later if the weather conditions are right, the third is another 5 to 7 days, again consider the weather conditions. Some growers are using only one application of 2 quarts per acre at petal fall or shortly after. Depending on temps. This application is working well too.

Use enough water to thoroughly wet the fruitlets; do not waste material by running it off the trees. Slower drying will increase the absorption time, therefore the addition of Nufilm 17 @ 1 pt. /acre should be beneficial.

When **Cytokin** is applied for fruit size, the first application should be made at full bloom to 1 week past full bloom @ 1 pt./acre, then again 10 to 14 days later. Combine with Nufilm 17 @ 1 pt. /acre; do not add other surfactants to the Cytokin/Nufilm combination. Cytokin may be combined with all foliar nutrition programs normally used at this time. Cytokin has shown size increase on both Fuji and Red Delicious.

## Chemical Thinning

All reports are that there will be a big bloom this year, and I'll make the bet your budget won't easily stretch to cover a big labor bill for hand thinning. But if the fruit isn't top grade there isn't a prayer of a chance of breaking even, much less making some money. This sounds like a good time for you and me to talk about aggressive chemical thinning this year!

But wait just a moment, you say? What about the risk of losing my crop by overthinning? What about all the horror stories from fieldmen and other growers about the crops they've dropped?

Yes, I've heard the same stories, many times. In fact I've got one of my own I could tell — and that's the point I'm trying to make here. With more than 20 years of chances to damage a crop with chemical thinning, I can remember only one really disastrous experience! And that was from a mistake at the fill station, not the over reaction of an aggressive program

So why are the stories of overthinning so common? I believe there are two very possible reasons.

Whenever a group of growers and fieldmen talk about chemical thinning (and we do several times each spring) before the discussion is over someone will inevitably say, "I used mixture so and so and boy, did that ever overthin my crop!"

The statement may well be true, it probably is. What isn't being said is that happened once, maybe twenty years ago — but the story gets repeated every year making it seem like a common occurrence. It's not!

The other possible explanation goes like this. A good aggressive chemical thinning program has been used. The weather warms suddenly, maybe unexpectedly. Now the coffee shop talk is all about how much fruit is dropping, looks like the crop's really going to be down this year, may not even pick half a crop. "Chemical thinning is just too risky, better back off a little next year!"

That's the headline. What you most likely won't hear, as Paul Harvey likes to say, is the rest of the story. When hand-thinning time comes around that "over thinned" crop is looking much better, and the small hand-thinning bill was a pleasant surprise. Then, as picking started more bins had to be hauled into the orchard because the pre-harvest estimate was too low. The final result at harvest is rarely the disaster it looked like in May. But nobody is talking about thinning then! And unfortunately by next spring the harvest is forgotten, but the anxiety of watching the fruit drop is not -- so the anxious cycle starts all over again.

The next time someone is telling you about their overthinning disasters, ask some questions. How many years has that individual been chemical thinning? And during those years, how many crops were actually reduced — at harvest time?

Then ask this same individual how many years he under thinned the crop and then had a labor bill that made the banker blanch? I think you will find the disasters over counted and overrated and therefore should be generally disregarded. The real economic loss has been the years when chemical thinning under performed and costly hand thinning was required.

Successfully chemical thinning your apples will be the single largest cost saving you can make any year. A good result from chemical thinning is frequently prevented by the fear of overthinning. Overthinning is possible, but it is not a frequent occurrence. Even if you do overthin occasionally, i.e., every fourth or fifth year, you will still be money ahead for two major reasons. You will save labor each year and have a return bloom to work with the following year.

For many years Dr. Max Williams would speak at one or more chemical thinning seminars for growers and fieldmen. He would inevitably say, before the session was over that if you don't occasionally overthin, you're not doing your job! You can't afford the labor bill for hand thinning, so damn the torpedoes and do the job that needs to be done!

Your past experience in your own particular orchard will be your best guide to what you have to do this season. Varieties, rootstocks, amount of pollinizers, weather and even topography may all have a bearing on the performance of thinning materials. If you're happy with what you've been able to do and your labor costs are low, congratulations. If you're not happy and your labor costs are higher than you would like, try swinging just a little harder this year.

Some things you should consider:

The bees. Don't skimp on the number hoping for a lighter fruit set, you need good pollination and high seed counts for large, well-shaped fruit. But get them out of the orchard just as soon as you think the king bloom is set. Karen Lewis has a neat little table in the March 15, 2002 Good Fruit Grower to help you estimate when the king bloom has been set and its time to get the bees out. Unless you've had a serious, bud killing frost you don't need or want any of the side bloom set!

Mean daily temperature °F	41	43	45	46	48	50	52	54	55	57	59
Mean daily temperature °C	5	6	7	8	9	10	11	12	13	14	15
Pollen tube growth index	8	9	10	11	12	14	17	20	25	35	

*"An example using the index in Figure 1 would be:*

*In a five-day period with daily mean temperatures of 50, 54, 50, 50 and 57°F, the corresponding growth index numbers would be 14 + 20 + 14 + 14 + 35. Compounded, the total would be 97, or tube growth is 97% complete. The pollen tube growth requirement in this example would be estimated at five days. If the ovule were healthy and receptive, the EPP would be five to six days.*

*I cannot say that this index has been tried and proven in Washington State, but I do know that progressive growers and field representatives are using this as one tool in manipulating fruit set"*

Gallage and coverage. Any material applied during bloom is directed at physically injuring or killing parts of the blossom to prevent pollination; complete coverage of the opened blossom is essential. That usually requires two or more applications after the king bloom is set and side bloom are still opening. The materials applied after bloom are expected to stress the tree in some manner and cause the tree to abort the smaller, weaker fruit. The rates recommended on the WSU spray guide are based on a slow drying, 400-gallon per acre application. Slow drying increases the reaction of the tree. If you plan to use less gallons than it takes to wet the tree to a full drip, expect to increase the rate of material to get the same reaction as a full dilute spray. The amount of increase needed is the subject of vigorous debate between fieldmen every year!

Normally only the upper portions of the tree are directly targeted with spray. The lower portions are normally lower in vigor and adequately thinned from drift and the drip from the upper part of the tree.

Temperature. Blossom thinning materials must be applied at the appropriate bloom stage regardless of whether the weather is perfect or not. Post bloom thinning materials perform better when the temperature is warm during the day, 70° or more. (I make an exception for the petal fall Amid-Ethrel-Sevin application. Even when the direct effect is minimal it seems to contribute to better thinning by the sprays applied later so make this application as soon after bloom as you can, even if the weather is cooler than you might want.) The maximum weather response is when material is applied during cool weather and it warms quickly. If you have a reliable forecast of warming weather two or three day in the future, don't wait until it's here, start now!

Fruit is easier to thin when:

- Fruit spur are low in vigor, typically lower shaded inside branches
- Bloom is heavy, especially following previous heavy crops
- The variety is poorly pollinated or self-pollinated
- The trees are young and have many vigorous upright branches
- Blossoms and leaves are frost injured before or soon after spray application

Bloom period is short with many flowers open

Fruit is difficult to thin when:

- Spurs are well exposed to the light (tops and outside).
- Bloom and fruit set is light (except on young trees).
- Insects are actively cross-pollinating.
- Fruiting branches are mostly horizontal.
- Biennial bearing trees are in the “off” year.
- Older trees in good vigor have a mature bearing habit.
- Bloom is extended over a long period and fruit is of various sizes.
- Weather ideal for good growth occurs before and after the time for thinning.
- There is no stress on the tree from weather, moisture, etc.

There are now six materials registered for fruit thinning. None will do the complete job in a single application, you must expect to use a program of multiple applications from bloom time until you are satisfied or the fruit has grown beyond the size for effective thinning.

**REX LIME SULFUR SOLUTION** plus Crocker’s Fish Oil or a Mineral Spray Oil. See the lead article for information on obtaining a label and use instructions.

**Sevin. (Carbaryl)** All of the liquid or flowable carbaryls that I am familiar with have petal fall thinning labels. No differences have been reported between brands for either petal fall or fruit thinning. Avoid applications during periods of cool and wet weather; thinning results will not be good. Incomplete fruit abortion may leave a large number of small seedless fruit on the tree at harvest time. Also avoid the use of crop oil or silicone surfactants; they have been connected with fruit damage on Red Delicious at this growth stage.

**K-Salt Fruit Fix 200** (NAA) is very temperature sensitive. It doesn’t thin well below 60 degrees, and will possibly overthin if the temperature exceeds 90 degrees within a few days of application. Misshapen and pygmy fruit has occurred when NAA is used at higher rates under cool weather conditions. Do not exceed an accumulated maximum of 10 ppm per season. The timing is petal fall to 30 days after full bloom on most varieties.

**Amid-Thin** at 3 - 5 mm fruit is useful for removing the late bloom on Golden, Gala, and Fuji and is usually combined with **carbaryl** and sometimes **Ethephon** (Ethrel). Do not use Amid-Thin on Red Delicious. I would not use it on any other distinctly typey apple such as Criterion or Primegold as it will affect the shape.

**Ethephon** (Ethrel) is commonly used to thin and increase the return bloom on Golden, Fuji and sometimes Gala. When return bloom is a concern on these varieties, use it at the 1-pint per 100-gallon rate on Golden and Fuji. If you have difficulty getting good size on Gala, postpone the use of Ethephon until fruit cell division is over, about 6 weeks post bloom. If thinning conditions turn out to be questionable and you are concerned about return bloom you can use Ethephon at 45 – 50 days after full bloom on any variety to increase return bloom without additional thinning. I don’t recommend using Ethephon if your bloom was light to moderate, you will cause even heavier bloom next year and aggravate alternate bearing.

Yes, I know you have listened to presentation about research materials not listed here this past winter. They are not registered as thinning agents therefore the EPA pesticide laws won’t allow us, or the researcher to recommend them for that purpose. So do your fieldman a favor and don’t put him on the spot by asking for rates and timing for research materials!

## **STONE FRUIT SIZE and QUALITY ENHANCMENT**

### **Apricot, Peach, Nectarine (with Cytokin)**

#### **80% BLOOM OPEN**

- |                         |                  |
|-------------------------|------------------|
| • Cytokin               | 16 oz. / acre    |
| • MIRACALsp sp          | 2 – 3 lbs. /acre |
| • Tech-Flo Beta         | 2 qts. /acre     |
| • Tech-Flo Cal-Bor+Moly | 2 qts. /acre     |
| • Tech-Flo Sigma        | 2 qts. /acre     |
| • Urea                  | 5 lbs. /acre     |

**PETAL FALL\*** (10 – 14 day following bloom spray)

- Cytokin 16 oz. / acre
- MIRACALsp sp 2 – 3 lbs. /acre
- Tech-Flo Beta 2 qts. /acre
- Tech-Flo Cal-Bor+Moly 2 qts. /acre
- Tech-Flo Sigma 2 qts. /acre
- Urea 5 lbs. /acre

\* May be combined with insecticide or fungicide spray in the same time period. Use sufficient water to wet the foliage and fruit thoroughly, avoid as much run off as possible.

**APRICOTS**

**PETAL FALL** to first **SHUCK FALL** (Lygus bugs, Grape mealybug, Twig borer)

- Success 8 oz./acre
- Provado 4-8 oz./acre  
or Diazinon 50W\* 4 lbs./acre.  
or Actara\*\* 4 oz./acre

\* If mealy bug control is needed.

Apply at stage 7, before the green fruit stage. Later application will result in poor Twig Borer control.

\*\* Apply only after bees have been removed from orchard.

**SHUCK SPLIT** (Grape mealybug, Coryneum blight, Mildew, Perfection Spot)

- Diazinon 50W\* 4 lbs./acre
- Captan 50W 5 lbs./acre  
plus Orbit 4 oz./acre  
or  
Rally 5 oz./acre.

\*Mealy bug will not be well controlled if this application is delayed beyond petal fall on pears.

Perfections spot has been an increasing problem. This timing and the combination of eradicant and protective materials is critical for prevention of Perfection Spot. A second application 10 to 14 days later is advised if there has been rain or there is a history of fruit marking in the block.

For additional control of Coryneum blight and Perfection Spot apply Captan 50W with Orbit or Rally again preceding or immediately following any rainy period. Be careful not to exceed maximum number of applications as restricted by labels.

**NECTARINE & PEACH**

**PRE-BLOOM THROUGH BLOOM** (Lygus bugs, Western flower thrip)

- Carzol SP \* 1 lb./acre
- Or Success\*\* 8 oz./acre

This application is very important to prevent marking on Nectarines. If blossoms are open apply at night or while bees are not working in blooms. Western flower thrip are not as much of a threat to peaches as they are to nectarines.

Maximum Carzol allowed per season is 1 ¼ lb. per acre. Do not apply after shuck fall.

Success has controlled Western flower thrip in apples; we don't have any information available for peach & nectarine. Application of Success during bloom would serve in place of a petal fall twig borer spray. Success will not control Lygus bugs.

**PETAL FALL SPRAY** (Green Peach Aphid, Peach twig borer, Fruit tree leafroller, Mildew\*, Coryneum blight\*\*)

- Success 2 oz./100 gal.  
or Thiodan 50WP \*\*\* 4 lbs./acre
- Pristine 14 oz./acre.  
Or Flint 2 – 4 oz./acre  
Or Orbit (Tilt) 4 oz./acre.  
Or Summer spray Oil (70 grade)\* 1 gal. /100 gal.  
Or micronized Sulfur 12 lbs./acre
- B-17 (Boric Acid Spray) 3 – 5 lbs./acre  
or Liquibor 2 – 4 qts./acre
- Captan 50WP \*\* 5 lbs./acre
- Actara\*\*\*\* 4 oz./acre
- Provado 4 – 8 oz./acre

Apply this spray at Stage 7, petal fall or post bloom depending on the variety. Later application will result in poor Peach twig borer control.

\* Mildew protection at petal fall and shuck fall is critical to avoid mildew on the fruit. Oil may be combined with Rally, Orbit or Flint for additional control. Do not apply sulfur or oil with 14 days of each other, do not combine oil and Captan!

\*\*Begin Coryneum Blight control at petal fall if the weather has been wet during bloom, otherwise you may wait until the shuck has fallen unless disease pressure is know to be high.

\*\*\* **NOTE:** You may not use more than 3 lbs. (4 quarts EC or 6 pound WP) of active ingredient per year. Do not apply Thiodan within 300 feet of any lake, stream or pond.

\*\*\*\* Be sure all bees are removed from the orchard first.

**CHERRY**



**PRE-BLOOM ▼** (Cutworms, Black cherry aphid, Grape mealybug)

- Diazinon 50W \* 4 lbs./acre
- Tech-Flo Beta 2 qts. /acre
- Tech-Spray MG 1 pt. /acre
- Tech-Flo Cal-Bor+Moly 2 qts./acre
- Miracal sp 5 lbs./acre
- B-17 (Boric Acid Spray) 3 – 5 lbs./acre  
or Liquibor 1 – 2 qts./acre
- Tech-Flo Zeta Zinc 22 2 qts. /acre
- Calcium Nitrate (Spray grade) 10 lbs./acre  
or Urea 5 to10 lbs./acre
- Nu-Cop 50DF\*\* 8 – 12 lbs./acre

\*Apply this spray before first white with no bees in the block. Use Diazinon if grape mealybug is a target. Diazinon used at this timing will not leave a harvest residue and will save the single allowable use per season of Thiodan for shuck fall on Green Soldier Bug. Don't forget about enclosed cab issues with Diazinon!

\*\* If copper was not applied during the dormant time period.

▼Cherry fruit size equals money. Cherries will respond favorably to an aggressive foliar nutrient program that begins prebloom and extends through pit hardening, about two weeks after shuck fall. See the nutrient section for possible additional timing and materials.

**BLOSSOM SPRAY (Brown rot) \***

- Rovral 50W 2 lbs./acre  
or
- Elite 45 DF 8 oz./acre  
or
- Orbit 4 oz./acre  
or
- Rally 40W 5 oz./acre

\* Nutrients may be combined at this timing and at Petal fall.

If brown rot is an annual problem, make the first application at white bud, a second application at 50% bloom, followed by a petal fall spray if the bloom is prolonged or weather conditions are conducive to fungal infections. Where fruit rot has been a problem, preharvest applications are also necessary. Do not apply Rovral more than 5 times per season. Do not apply more than 3 ¼ pounds of Rally 40W per acre per season.

**PETAL FALL TO SHUCK FALL (Pandemis leafroller, Black cherry aphid, Grape mealybug, Stink bug, mildew)**

- Thiodan 50WP \*\*\* 4 lb./acre
- Intrepid 2F\* 10 – 12 oz./acre.
- Tech-Flo Beta 2 qts. /acre
- Tech-Flo Cal-Bor+Moly 2 qts. /acre
- Miracal sp 5 lbs./acre
- Tech-Spray MG 1/4 pt. /100 gal.
- Calcium Nitrate (Spray grade) 10 lbs./acre  
or Urea 5 lbs./acre
- Summer spray Oil (70 grade)\*\* 3 qts. - 1 gal. /100 gal.

Apply this spray shortly after the first mildew infection episode. Consider the first post bloom irrigation to be a mildew infection episode if the temperature is above 50 degrees.

\*Include Intrepid only if leafroller has become a threat to your crop, or there is threat of spread to adjacent crops in the next generation. Success is not listed at this stage. It will be used for Cherry Fruit Fly control where it will control or suppress the summer generation of leaf roller.

\*\* Nighttime temperatures in the mid to high 30's at this growth stage may be contributing to preharvest leaf drop. Consider delaying the oil application until nighttime temperatures are in the 40's. Mildew will not be advancing very rapidly with the cool temperatures and the oil will be an effective eradicator when it is used. Coverage is critical for mildew control.

\*\*\* **NOTE:** Thiodan is the only material effective against the Green Soldier Bug. You may not use more than 3 lbs. (4 quarts EC or 6 pound WP) of active ingredient per year, therefore do **NOT** apply Thiodan at both pre-bloom and shuck fall. Do not apply Thiodan within 300 feet of any lake, stream or pond.

**2011 CHERRY MILDEW PROGRAM**

We now have the ability to predict when cherry mildew will show up in your orchard. It will be seven to ten days after 1/10<sup>th</sup> of an inch of water is applied as irrigation, or falls as rain, with the temperature above 50 degrees. The conditions needed to release and germinate mildew spores are very similar to a light apple scab infection period as measured by the Mills Chart.

More mildew is caused by irrigation than by rain. Delaying your first irrigation until absolutely necessary may cut the amount of mildew present at harvest by 50%. According to Dr. Gary Grove you can delay your first irrigation up to three weeks following normal winter moisture without effecting fruit size or soluble solids. Light soils or young trees may reduce the amount of time you can delay. You're not selling cover crop; let it dry down and quit growing.

Using water for frost control probably does not contribute to mildew unless you let it run late into the next day, temperatures have to be above 50 degrees for the spores to germinate. But if you use irrigation for frost control you should

easily be able to delay actual irrigation until late in the spring, perhaps even past shuck fall. Don't worry about the grass, it will recover. Use your shovel and measure the amount of moisture available for trees at the 12 to 24 inch depth.

**Sterol Inhibitors**, (SI materials) called eradicant compounds because they have the ability to kill or retard established infections. Effectiveness declines after 24 hours; very little control should be expected after 96 hours. **Elite, Orbit, Procure, Rally DF** and **Rubigan EC** are the only SI materials currently registered on cherries. Mildew resistance to Rubigan EC has been documented in some locations, Rally has been reported to have about a 40% cross-resistance factor with Rubigan, Orbit is failing in research comparison plots. Several fieldmen report that Procure in not controlling mildew as well as it did two years ago. Base your material selection on the mildew control history of the orchard in question. Best option is to combine with an appropriate eradicant material.

**Strobilurins**: We now have three materials available in this class, Abound, Cabrio and Flint. These materials perform best as protectants and should be used before mildew becomes well established. Abound must be used with extreme caution, it is highly phytotoxic to some varieties of apples at VERY low concentrations. Use this material only if you can dedicate a spray machine solely to cherries and do not have apples adjacent to your cherry block that are subject to drift. Cabrio and Flint do not have the same phytotoxicity risks.

**Quinolines**; Quintec Use it in a rotation with other materials at GA timing or later. Do not make more than two sequential applications.

**Protectants**; these materials must be in place before the mildew becomes established; they have little to no effect on active mildew. Mineral spray oil, Strobilurin products and Sulfur products are all protectants. **Microthiol Dispers or Kumulus** (micronized sulfur) are most effective when tank mixed with SI materials. Sulfur and sulfur based compounds work best in temperatures above 70 degrees. Do not apply when temperatures are forecast to be above 90 degrees to avoid leaf and fruit burning. A practical sulfur protectant program requires reapplication with light amounts every 7 to 10 days throughout the period when mildew and tree growth is active.

**Mineral Spray Oil** and the carbonates (**Armcarb, Kaligreen**) are mildew **eradicants**. A narrow range, light weight summer oil may be used through pit hardening. Allow a minimum of 14 days between the last oil and a sulfur application. The **carbonates** are most effective when combined with the protectant/post infective kickback activity of an SI material later in the mildew season.

There is some indication that if **oil** is applied during cool weather at petal fall or shuck fall, pre harvest leaf loss may be increased. Delay the first oil application until nighttime lows are in the 40 degree range.

**Do not use Guthion, AzinphosMethyl, Imidan or any other organophosphate in the Cherry Fruit Fly program if you have used oil for mildew control post bloom. Severe leaf drop may result on some varieties!**

**Why use oil?** Cherry growers lose more to mildew control each year than they do to Cherry Fruit Fly. Northwest Wholesale continues to recommend the use of oil as the foundation of mildew control with the necessary adjustment to a Fruit Fly control program. If you use oil for mildew control do not use any organophosphate materials for cherry fruit fly control. This is especially important on the Canadian varieties.

Thorough coverage of all of the foliage is critical for mildew control with oil. Fully developed orchards will require 150 to 200 gallons applied at 1-½ mph or slower for good contact. Do not use wettable sulfur within 14 days of an oil application; do not use micronized sulfur within 10 days of an oil application. For practical purposes this means that no sulfur would be used in the orchard until 14 days after the final oil application. Sulfur is not effective prebloom and early post bloom due to the cooler temperatures and the fact that Cherry mildew is not present and active until 1/10<sup>th</sup> inch water has been applied with temperature above 50 degrees..

**Organic Fatty Acid Salts.** **M-Pede** kills on physical contact the same as mineral spray oil, and carries some of the same risk of fruit marking as oil. Wetting the tree enough to form droplets of excess spray material may mark smoothed skin fruit. Coverage has to be complete and uniform to get control of the mildew, but wetting to run off must be avoided. The most logical application times would be about shuck fall and post harvest to reduce the spoor count for the following year.

## Cherry Mildew Basics

Cherry mildew spores overwinter as cleistothecia in bark crevices and in the leaf duff on the orchard floor. Primary mildew infection occurs when the cleistothecia open with warmth and moisture early in the spring, releasing ascospores to germinate on green tissue. In a short time they become visible as the white, powdery growth we recognize as mildew. Secondary mildew infection occurs when the primary colonies mature and release conidia onto adjacent leaves and fruit to germinate and grow into additional colonies of mildew.

Unchecked secondary mildew growth is exponential, not linear, i.e. one colony of mildew does not mean two new colonies, but could mean 100 or more new colonies of mildew, each one of them ready to release more conidia in a very short time. That is how cherry orchards go from little or no visible mildew to disaster seemingly overnight. Preventing the establishment of the primary infection is critical to acceptable control of the secondary mildew infection.

Ascospore release begins after bud break with enough moisture to keep the cleistothecia wet for 4 hours (.10 inches of rain is generally enough) at about 50 degrees F. The ascospores need another 12 hours of wetness at 50 degrees to germinate and cause infection. This equates to a moderate apple scab infection as measured by the Mills Chart. Don't forget that irrigation releases ascospores and usually wets the tree at least as high as the lowest new sucker growth. Delaying your early season irrigation will lower the amount of infection periods the trees are exposed to.

Complete coverage is essential for mildew control, especially those vigorous young shoots in the center of the trees during the early infection periods. They are closer to the source of infection (cleistothecia in the bark crevices) and stay wet longer than any other part of the tree. 100 gallons per acre has not proven to be adequate on trees old enough to have rough bark.

The soft, new growth in the top center of the tree becomes the major site of new infection and spore multiplication from about GA time through harvest. If you can't properly contact this foliage with the materials you are using, you will lose the battle. Ground speed and proper sprayer calibration are key elements of mildew control!

If you are going to control mildew with an SI fungicide, i.e., Rally, Elite, etc, you must apply as soon as possible after the infection period, preferably tank mixed with an eradicant such as micronized sulfur (Microthiol or Kumulus). The timing of the application is important, control of the infection will decline after 48 hours and there won't be much control from these materials after 96 to 120 hours have elapsed.

Repeat the coverage with alternative SI materials plus micronized sulfur in 12 to 14 days or after the next infection period as measured by the Mills Chart, whichever ever comes first. None of the mildew control materials are systemic, the trees are growing rapidly, and consequently there will be lots of exposed and unprotected green tissue since the last spray. Ignoring subsequent infection periods could be disastrous.

If you plan to use spray oil for your early mildew control the timing is not as critical, oil is an excellent eradicant. Spray at shuck fall and again 14 days later. Coverage is critical; the mildew colony or germinating spore must be contacted to be destroyed. There is no translaminar activity as in the SI fungicides. I recommend 200 gallons per acre on full sized cherry orchards at 1 to 1.5 miles per hour travel speed. Repeat the coverage in 14 days, do not use oil at GA timing or on ripening fruit, there is a risk of fruit marking. Do not use oil within 14 days of a sulfur application. Do not use Guthion or any other organophosphate for Cherry Fruit Fly control when oil is used for mildew control.

Continue this program of coverage immediately after infection periods, or 14 elapsed days, until well past shuck fall when most of the ascospores will have been released. If you can find mildew established on the underside of the leaves in the center of the tree before shuck fall, you could be in serious trouble by harvest time.

Shortly after shuck fall begin monitoring for primary infections on the underside of the leaves that come in contact with the rough bark in the center of the tree. Bing or Van varieties are the best indicators for infection. When primary infections are found, secondary infections will soon begin to appear as tiny reddish purple spots on the enlarging leaves at the tips of the interior shoots 10 to 14 days before they become the white powdery puckered spots that you can see from the ground or from the tractor seat. When these reddish purple spots are found, spray immediately to prevent as much maturation and subsequent conidia production as possible. Rain and high humidity at this stage will increase the spread and germination of a light to moderate infection and make control difficult.

If you find conidia geminating on the shoot tips 10 to 12 days after a spray application, repeat the coverage with an alternate material, the mildew is still active and must be kept to the lowest level possible to prevent fruit infection prior to harvest, especially on Rainier cherries and the later harvested, heavily clustered varieties.

Read the material labels for total season use restrictions and pre-harvest intervals. Check with your packinghouse fieldman for the materials preferred by their program.

## **PEARS**

### **FIREBLIGHT CONTROL MATERIALS**

Apples and Pears

#### **Copper hydroxides, copper sulfates. (NuCop, Kocide, Champ, COCS, etc.)**

8 – 16 lbs./acre per application

Limit the use of these materials to prebloom applications except on Bosc pears or other similarly russeted varieties.

#### **Mycoshield Flameout**

1-lb./100 gallons.

Apply at 50 to 100 gallons per acre as required by the Cougar Blight model. This is the only proven material; avoid unnecessary use to avoid developing resistance. Mycoshield or Flameout are not tank compatible with Blight Ban

#### **Blight Ban**

150 grams/acre

Apply in 100 gallons of water per acre at early bloom. Repeat at full bloom. A third application may be made on rattail bloom. This material is not compatible with Copper based compounds or Mycoshield.

Blight Ban is live bacteria that compete with fire blight bacteria for living space, suppressing that population. When the Cougar Blight model indicates a high risk and moisture is probable, cover with Mycoshield.

#### **Serenade Max**

3 lbs./acre

Apply in 100 to 150 gallons of water per acre. Coverage is critical. Serenade is a biofungicide that is toxic to the fire blight bacteria. Apply at first white to first bloom for improved fruit finish and suppression of fire blight bacteria. Repeat during bloom when it appears fireblight risk is increasing. When the Cougar Blight model indicates a high risk and moisture is probable, cover with Mycoshield.

Serenade is toxic to bacteria and may be substituted for a Blightban program but has the advantage of not requiring colonization before bacterial growth begins.

Serenade will be a valuable resistance management material to prolong the effect of Mycoshield.

## **Ecozin and Oil for Psylla Control.**

Does Ecozin plus oil control Psylla? Yes it does! Do you have to understand how it works and plan your spray program accordingly? Absolutely!

Ecozin is an insect growth regulator, not a strong poison. It has to be applied when the insects are very young. It works best when the weather is relatively warm. It does not have a long residual, frequent applications must be made. I believe slow drying increases the amount of material that is adsorbed into the leaf increasing the residual affect on hatching psylla. I successfully controlled Psylla with 14 to 18 day intervals instead of the more commonly recommended 7 to 10 day intervals. The difference was spraying at 400 gallons per acre instead of 100 gallons per acre. Some testing of intermediate gallonages or applications made during slow drying conditions will be interesting.

If you're not able or willing to use Ecozin at frequent and appropriate intervals you will probably be disappointed in the results.

### Pear Program



**PRE-BLOOM**, (stage 5 or earlier for Pear Psylla, Grape mealybug, Lygus bug, Rust mite, Pear mildew, Leaf roller)

- |                          |                 |
|--------------------------|-----------------|
| • Surround               | 25 lbs./ acre   |
| • Assail or              | 3.4 oz. /acre   |
| • Rimon                  | 32 oz./acre     |
| • B-17(Boric Acid Spray) | 3 lbs./acre     |
| • Procure 480 SC         | 8 oz./ acre     |
| • Penncozeb***           | 6 – 8 lbs./acre |
| • Carzol SP **           | 16 oz./acre     |
| • Saf-T-Cide Oil         | 1 ¼ gal./acre   |
| • MIRA CALsp             | 5-6 lbs./acre   |
| • Zeta Zinc 22%*         | 2 qts./acre     |

▲ Leaf roller control will not be needed at this time if Intrepid or Delegate will be applied at petal fall for Codling moth control. The weather must be warm (65 degree days) for Bt sprays to be effective.

Apply this spray when bud clusters have pretty much separated (stage 5) but before any bloom is open. Do not apply this spray if any blossoms are open or bees are present.

\* Include Zinc in this spray if dormant Zinc was not applied.

\*\* Carzol may not be used past petal fall without a specific written recommendation. Read SLN WA-000028 for details on maximum use rates and reporting requirements.

\*\*\* Dithane at the 8-lb. rate must be applied before petal fall is over; this is also a better timing for Mealybug control than a post bloom spray. Check the Dithane label and use either the Pre Bloom 8 lb. per application rate or the extended schedule 3 lbs. per acre rate. **Do not tank mix oil and Dithane.**

#### PETAL FALL (Alfalfa greening, Fruit Finish, Leafroller)

- |                         |                   |
|-------------------------|-------------------|
| • Surround              | 25 lbs./acre      |
| • Actara                | 5.5 oz./acre      |
| • Agri-Mek              | 20 oz./acre       |
| • Saf-T-Cide oil        | 1 gal./acre       |
| • Flint                 | 2 oz./acre        |
| • Tech Flo Cal Bor Moly | 2 qts./acre       |
| • Alpha DF 24           | 12 lbs./acre      |
| • Miracal sp            | 5 – 6 ¼ lbs./acre |

#### FIRST COVER (Codling Moth, Spider Mites, Fruit Finish)

- |                  |                   |
|------------------|-------------------|
| • Guthion 50WP*  | 2 ½ - 3 lbs./acre |
| or               |                   |
| • Imidan 70 WSB* | 5-7 lbs. /acre    |
| or               |                   |
| • Assail*        | 3.4 oz. /acre     |
| • Delegate**     | 6.5 oz./acre      |
| • MIRACALsp      | 5 – 6 ¼ lbs./acre |

Apply this spray at timing indicated by the Codling Moth model

\*The maximum season rate for Guthion (Azinphos) has been lowered to 4 pounds. The preharvest interval has been extended to 21 days at the 2-pound rate, 28 days if more than 2 pounds are used in the last spray before harvest. The reentry interval for hand labor is 14 days. Imidan REI is 24 hrs, Assail is 12 hrs.

\*\*Check with packing facility for MRL issues for export.

**SUPPLEMENTAL CODLING MOTH COVERS FOR MATING DISRUPTION BLOCKS**

(Codling moth, Leafroller, Mildew, Aphid)

- Intrepid\* 16 oz./acre.
- Or
- Delegate \*\* 6.5oz./acre
- Altacor 4 oz./acre
- Proclaim\* 4 oz./acre
- Esteem WP \*\*\* 5 oz./acre
- Plus summer spray oil (70 grade) 1-2 qts. /100 gal
- or
- Assail \*\*\*\* 3.4 oz./acre
- Plus summer spray oil (70 grade) 1-2 qts. /100 gal

\*Make the first application just before 1-% egg hatch for Codling Moth (150 - 200-degree days past biofix). Use the degree-day model for proper timing. This application will thoroughly control leaf roller.

\*\*Check with packing facility for MRL issues for export.

\*\*\*Use two applications per generation. Esteem must be under codling moth eggs for ovicidal control. Make the first application at the beginning of egg lay (50 – 100 dd), the second 14 to 21 days later. Or you may use an Intrepid/Esteem sequence with a 14-day interval.

\*\*\*\* Assail is normally applied at the same timing as Guthion. It will also provide control of Psylla and Mealybug if the timings coincide.

**GRAPE MEALYBUG**

Grape mealybug infestations may found on both pears and apples, the greatest damage occurs in pears.

Grape mealybug overwinters as eggs or first instar nymphs in sheltered sites, such as under rough bark scales, pruning scars, or in leaf litter. The eggs are a bright salmon-pink color and are found in loose, cottony sacs spun by mature females as they lay their eggs. The dead body of the female can often be found among the cottony fibers. Hatched nymphs are darker and more of a purple color than the salmon-colored eggs.

As temperatures increase in early spring and trees break dormancy first instar nymphs emerge from under the bark and begin migrating to the actively growing parts of the tree. This is the beginning of the “crawler” stage when mealybugs can usually be found in green tip buds. The nymphs emerge over an extended period from about the delayed dormant stage through bloom

The mealybugs feed in tight, semi-enclosed areas of the plant and are frequently found wedged into the leaf axial or, as in the case of the first instars, against the main vein on the underside of the leaf. After finding suitable feeding sites the immature grape mealybug remain where they have settled and feed until they reach maturity. This is normally about mid-June in the case of the first generation. For males the final instar nymph spins a small silken cocoon in which the winged male completes its development.

Females begin laying eggs under bark scales a few days after mating. In high populations females lay eggs nearly everywhere on the tree including on leaves, in sucker scars and even under grafting tape and other artificial surfaces. Each female may produce 50 to 150 eggs before dying. The eggs require about ten days to hatch under normal summer conditions.

New second-generation crawlers leave their bark refuges in search of succulent plant tissue on which to establish a feeding site, and often rapidly migrate into the calyx of developing fruit. The second generation matures about the end of July through early August when egg laying begins again.

There are two main types of damage caused by grape mealybug. Second-generation grape mealybugs often invade the fruit calyx causing cullage and storage rot. In addition honeydew, produced by feeding, is sprayed over leaves and fruits which, in the case of fruit, causes russeting. Grape mealybug-induced russeting is similar to that caused by other sap sucking insects such as aphids and Psylla, although grape mealybug russeting is more evenly distributed over the surface of the fruit and tends to cover more area.

Psylla russeting is distinguished by larger russet spots and characteristic dripping patterns. Black sooty mold often develops on the honeydew increasing cosmetic and storage problems. Heavy honeydew deposits on leaves during hot summer months can also result in transpiration burn characterized by severe browning of leaf edges and leaf abscission.

### **Early season detection of mealybug**

If you are not certain the pest is present in your orchard, remove some of the bark scales on the portion of the tree that would be most sheltered from spray applications, i.e., the inside of the leaders and the centers of the upper sucker crowns, and look for a white cottony material. If you find this and there is green tissue on the tree, look for small crawlers in the unfolding buds or on the back of the leaves next to the mid rib. You will need a magnifying glass to see them easily.

There are a number of factors that make the grape mealybug difficult to control. First, the period of time over which the crawlers emerge from egg sacs onto fruit spurs is prolonged, extending up to three weeks in both early spring and late summer. This makes the effective timing of sprays difficult. The extended spring emergence further spreads out the development of the population such that in July and August all grape mealybug life stages can co-occur. This further complicates the timing of sprays directed against second-generation crawlers.

Second, as previously mentioned, grape mealybug tend to seek out protected sites in which to feed which makes contacting them with sprays more difficult. Third, as grape mealybug mature their protective waxy coating becomes more pronounced and renders them less vulnerable to pesticide sprays. Finally, some grape mealybug populations have developed resistance to some organophosphate insecticides.

Cultural practices can be employed to reduce mealybug populations. Pruning large sucker crowns and high scaffold limbs on older and larger trees reduces overwintering refuges. Mealybug may also overwinter under tapes used to protect young grafts, on fruit bins, in prop piles and on pruned branches. Any steps that reduce or eliminate these sorts of refuges are beneficial.

Early summer removal of watersprouts or suckers will both reduce the grape mealybug population and improve spray penetration.