

**Due to the freeze event(s) of Easter weekend, the Apple Team at North Carolina State University has put together some information for managing apple orchards with a reduced crop. In orchards that fortunately may have escaped significant injury management should proceed as normal. If you have any questions or comments please contact your local county extension agent.**

## **Apple Orchard Management - 2007**

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As a result of the freezing temperatures (19° F at Fletcher, NC), and in many areas high winds, on Easter weekend, when a majority of the apples in North Carolina were in full bloom, the potential for a crop is in question. In commercial orchards of many of the earlier blooming cultivars such as Gala or Red Delicious it is hard to find many flowers that appear to be undamaged and for the most part there is little to no crop. Some of the flowers that appeared to be undamaged initially were examined under a microscope and parts of the flower were damaged making the flower unlikely to be successfully pollinated or fertilized. For later blooming cultivars such as Rome the situation is still somewhat unclear. There were flowers damaged on the trees resulting from the freezing events. However, two weeks later some blocks of Romes were still blooming. The potential for blossoms on these trees to be pollinated and set fruit is still unknown. It is known that there are approximately four “waves” of fruit or flower drop beginning at petal fall. The last two drops are usually referred to as June drop which usually occurs in May in North Carolina. Until we get to that point, it will be difficult to fully evaluate if we have an apple crop in individual blocks and orchards.

So the big question that remains is how should these orchards be managed? If live blossoms cannot be found in an orchard then switching to a reduced management program is probably the most prudent approach. Dr. Turner Sutton, Dr. Jim Walgenbach, Mr. Wayne Mitchem and Dr. Steve McArtney have provided information on the disease, insect, weed and plant growth regulator programs for a lost crop season which is included below. In addition, the fertility program needs to be reduced to minimize the vegetative vigor. In most instances, fertilizers have already been applied, or at least the first application for those using split applications has been made. No further soil applications should be made and no foliar applications should be applied. In addition, summer pruning needs to be strongly considered to eliminate upright vegetative growth to reduce dormant pruning costs as well as to minimize shading this summer which can reduce flower initiation for next year.

However, in orchards where live blossoms and young fruit are being found, management becomes a much more difficult business decision. In a full crop year, 80% of the blossoms need to be removed with a thinning program, and only 15-20% of the blossoms are required for a full crop. Reports of orchards with a significant amount of bloom after the freeze event have been received. However, it is not known whether or not these blossoms will set. If there is a large bloom in some orchards, a thinning program may be required to reduce the crop to an optimal level. This needs to be done before the fruit reach 17 mm in diameter (approx. three weeks after bloom) because it is very difficult to chemically thin fruit after this time. In orchards where there is the potential for a economically viable crop a standard orchard management program should be utilized as if there is a full crop. After the June drop, an informed decision about how the orchard should be managed for the remainder of the season can be made. There is also a concern about bloom on one-year old shoots (rat-tail bloom) being a problem, and in some cases it can be a serious problem. In a normal cropping situation, best management practice would dictate that fruit developing from bloom on one-year-old shoots be removed with a standard chemical thinning program in order to adequately size the primary blossoms that develop into the crop. This minimizes the potential for fire blight in the later blossoms and also eliminates terminal blossoms on one-year-old wood that will weigh down branches and possibly reduce production in the following year. There is also a concern that the fruit that would form from this bloom could be smaller, misshapen and have a lower mineral concentration.

From an economic analysis that Dr. Charles Safley and I put together for the 2007 Southeastern Apple Growers Meeting, it takes approximately \$1,567/acre to grow a crop of processing apples during the season including the cost of pesticide application. It takes approximately \$2,153/acre to grow for fresh market channels which includes the cost of application but not the cost of harvest and packing. We also calculated break even points and for processing fruit sold at \$6.00/100 lb and it takes approximately 1,000 bu/acre for a return of \$400/acre. Fruit sold at \$8.00/100 lb takes 600 bu/acre for a return of \$200/acre. For fresh market packed fruit sold for \$13.00 bu. it will require packing 600 bu/acre to generate a return of \$800/acre and for fruit sold for \$14.00 bu requires packing 400 bu/acre to generate a return of \$215/acre. For direct market sales, fruit sold for \$11.00/bu with a marketable yield of 500 bu/acre will generate \$60/acre whereas if they are sold for \$15.00/bu with 300 bu/acre it will return \$375/acre and 500 bu/acre will generate \$2,060/acre. Thus, growers need to look closely at their individual production costs and marketing channels to determine what is the best decision for their business. **HOWEVER, all this said, if the orchard is covered with a crop insurance policy the grower needs to be sure that they legally comply with the law and the terms of their policy.** They need to make sure they are communicating with their crop loss adjustor to find out what their options are with their particular policy in regard to their level of coverage, fresh fruit option or standard option. The level of coverage and/or options that

they carry will determine how they will be able manage their crop that will benefit them the greatest.

## **Apogee Programs for Reducing Vegetative Growth on Non-Cropping Trees**

*Steve McArtney*

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An Apogee program in a non-cropping situation will need to use high rates (10-12 oz product per 100 gallons) every four weeks during the season, for a total of six sprays. The first application will need to be made when new shoots are 1-3 inches in length. Remember, the maximum allowable amount of Apogee per acre per season is 99 ounces. If you spray at the 12 oz/100 rate each time and apply 100 gallons of spray volume per acre then the total amount per year will be 72 oz per acre and the material cost will be approx. \$250/acre. However, if you spray at the 12 oz/100 rate at a spray volume of 150 gallons per acre then six sprays will put you at a total of 108 oz/acre and you will be over the maximum allowable limit for the season. Apogee is probably not an option for reducing vegetative growth in a non-cropping situation if your trees normally require a spray volume per acre of 150 gallons or more.

If your trees are on M26 rootstock or smaller then you may be able to use lower rates of Apogee. However, I would still suggest the 12 oz/100 rate for the first two sprays, and backing off to somewhere between 6 and 10 oz/100 gallons on the more dwarfing rootstocks.

Once you start an Apogee program you are going to have to keep a close watch on shoot growth to make sure that the four week spray interval is keeping shoot growth in check. If you observe the shoots start growing again you may need to consider applying Apogee every two weeks at a rate of 6-8 oz/100 gallons.

An Apogee program will be expensive, but will reduce the costs of pruning in the coming winter. Remember, if you chose not to use Apogee your pruning costs will probably be higher than they would be in a normal (cropping) year because shoot growth will be much more vigorous this year. Additional benefits from an Apogee program will be reduced susceptibility to shoot blight, and improved spray penetration into the tree canopy. Apogee does not have direct activity against the fire blight bacteria, but it stimulates the biosynthesis of a compound (luteoferol) that has activity against the fire blight organism, however this new compound does not accumulate until 7-10 days after application.

### **Thinning Recommendations for Defruiting Trees**

If you have less than 20 percent of a full crop is it going to be worth the cost of the spray program to keep it free of insect pests and diseases all summer? A thinning recommendation for defruiting trees would be to use carbaryl at 1-2

lb/100 gallons plus Ethrel at 1-2 pt/100 gallons plus Fruitone N at 10-20 ppm + oil or surfactant. **Remember, if you have crop insurance you need to be sure that you legally comply with the law and the terms of your policy.**

## **Insect Management Considerations for 2007**

*Jim Walgenbach  
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In orchards where this year's apple crop was lost due to the recent freeze, growers may wonder if any type of insect management program is required. With only a few exceptions, there is really no long-term consequence of ignoring most insect pests in 2007. With only a few or no fruit on trees, most direct pests (e.g., codling moth, apple maggot, plum curculio) will not be able to complete development in apple orchards and therefore should not build to excessively large numbers for the 2008 season. In addition, the absence (or reduction) of insecticide sprays should encourage larger than normal generalist predator populations, which will help to control many indirect pests.

However, there are three specific pests that growers should keep an eye on, because they can affect either next year's crop or the long-term health of trees.

1. European red mite: A number of orchards had very high overwintering populations of European red mite eggs, which is usually a sign that mite populations will develop to damaging levels relatively early in the season (i.e., mid May to early June). Tree stress caused by severe mite damage, particularly early in the season, can impact next year's crop by reducing the number of buds and suppressing next years bloom. Hence, orchards should be monitored for mites during May and June, and if populations exceed 10 mites per leaf, consider applying a miticide. On Red Delicious, which is susceptible to Alternaria leaf blotch, a lower threshold of 1-2 mites per leaf should be used.

2. Potato Leafhopper: Turner Sutton mentioned in his fire blight comments that some researchers suspect that potato leafhopper can vector or facilitate the spread of fire blight on shoots. Considering that potato leafhoppers feed predominately on new shoot growth, growers may want to apply an insecticide for potato leafhopper (e.g., Provado) if shoot blight appears, particularly on cultivars highly susceptible to fire blight.

3. Dogwood Borer: For those growers concerned about dogwood borer on younger, dwarf plantings of apples, management programs for dogwood borer should continue, because this pest affects the long-term health of the tree.

## **Apple Disease Management in Reduced Crop Years**

*Turner Sutton*

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There is a risk of fire blight following freeze injury. Freeze injury (splitting and cracking of leaves) is much like hail injury. Typically fire blight becomes a problem if a freeze injury is followed by a warm rain. Dead flowers that don't fall off and open over the next week or so are not good hosts for the fire blight bacterium but any blooms that are still alive can become infected, similar to what we see with "rat-tail" infections. Side-by-side, streptomycin is more effective than copper so use it on your most susceptible varieties. Because of the cool temperatures the week following the freeze it does not appear that we had much infection.

Apogee will help shut down trees and reduce the likelihood that fire blight infections, if they occur, will run down infected shoots and into the main branches and trunk. Unless you have had extensive damage to your spur and shoot leaves there shouldn't be any problem with uptake of the Apogee. Apogee applications should have begun when there was 1-3 inches of growth. See the section written by Steve McArtney, above, for more details.

It is important to maintain a least a minimum spray program where blocks have been frozen out. You don't want to lose a significant percentage of leaves since that can affect fruit bud set/strength for next year (especially significant defoliation early to midseason) and predispose trees to winter injury. Presently, scab is the primary disease that is a concern on most varieties and it can completely defoliate trees if left uncontrolled. Fortunately the primary scab season was easy but secondary scab is a risk. Other diseases that can cause significant defoliation or leaf injury during the season are cedar apple rust, Glomerella leaf spot, Alternaria blotch, necrotic leaf blotch on Golden Delicious and powdery mildew. Generally unless your orchard is in an especially high risk area for cedar apple rust (mostly orchards in the Piedmont) cedar apple rust infections are unlikely to be severe enough to cause a lot of defoliation.

As a general maintenance spray consider using copper (0.2 – 0.6 lb metallic copper per acre based on tree row volume) + sulfur (3 to 6 lb/acre depending on brand/formulation) every 10-14 days between now and June 1. The next month is the critical period for controlling secondary scab and powdery mildew. This combination will give some protection against scab, and is effective on powdery mildew. Try to time the sprays just before rain to protect against scab. This is a relatively low rate of copper but will work if the timing is good relative to an infection period. Apply copper under good drying conditions. Alternatively use an EDBC fungicide (3 lb/acre) + sulfur. Remember to stay within the 22.4 lb/acre/season limit. Neither of these programs is going to provide complete scab control but should reduce leaf infections.

The combination of copper and sulfur will not control cedar apple rust where it is a problem. There are a couple of options where cedar apple rust control is needed.

- Use an EBDC fungicide preventatively at 3.0 lb/acre + sulfur every 2 weeks through mid-May. This will control powdery mildew also and provide some scab control.
- Use one of the sterol inhibitors (Nova, Rubigan) + and EBDC fungicide. Nova is probably the most active fungicide on cedar apple rust and you will get good eradicant activity at 5.0 oz/acre applied in one or two well-timed applications. If you use Nova + an EBDC the first application should have been made during the third week of April and a second one about 3 weeks later (mid-May). This will control powdery mildew and should give some scab control. The amount of scab control will depend on whether or not the scab fungus in your orchard is resistant to sterol inhibitors (if you have had problems controlling scab with Nova or Rubigan in the past you probably have resistance). If it turns wet you may need to make an application of copper + sulfur (see above) between the two Nova sprays.

Necrotic leaf blotch can cause 60-75% defoliation of Golden Delicious if not controlled. Apply 1 pint of zinc oxide (39.8%) in three applications about 3 weeks apart beginning in late June. This should keep the defoliation down to 25% or less. Alternatively apply 3 lb/acre of ziram on the same schedule. Copper will also suppress necrotic leaf blotch but you have to be careful to use low rates on Goldens.

Alternaria blotch is primarily a problem on Delicious. It is important to maintain mites at a low level to reduce defoliation from this disease. See Jim Walgenbach's comments above. If you follow a copper + sulfur program on a 3-week interval and use a mid to high label rate of sulfur there may be sufficient sulfur present to suppress the mites. Copper has some activity on Alternaria but isn't as good as the QoI fungicides (i.e. Pristine, Flint or Sovran).

Glomerella leaf spot may become a problem in Gala and some orchards of Golden Delicious and defoliate them if not controlled. Research in Brazil has shown that copper is effective and low rates through the season may suppress the disease. See discussion of copper, below.

## **Copper Compounds for Apple Disease Management**

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Copper compounds are commonly used for control of bacterial spot of peach and Dr. Ritchie has worked extensively with them over the past 20 years. Much of the information presented below can be found on the Southeast Regional Peach Newsletter under copper formulations (<http://commodities.caes.uga.edu/fieldcrops/gapeach/>). The products in the table

below are registered on peaches and most are registered for apples as well. You need to read the labels carefully to be sure. Many are probably registered for use only for early-season fire blight control because of concerns of phytotoxicity. The only copper fungicide that I know that is registered for use for summer disease control on apples is Cuprofix.

For the past several years Jim Walgenbach and I have been funded through Iowa State University to investigate the possibility of producing apples in the Southeast with a cost effective organic program. For the most part the disease control has been very good. The program has been based on the use of lime sulfur, sulfur and a copper fungicide. We have used low rates of copper (0.2 lb metallic copper/acre) in combination with sulfur rotated with lime sulfur + sulfur during the summer. Applications were made on a 7-10 day schedule. Based on the results of this study, I consider copper + sulfur to be a viable alternative for disease control in orchards that have been frozen out or have very small crops. Using this rate of copper we have only minor phytotoxicity even on varieties such as Golden Delicious and Jonagold. With the cost of fuel and labor most of you are not going to want to spray every 7-10 days. A 14-day interval has worked satisfactorily in small plots at MHCRS but I don't have any experience with a 21-day schedule. I suspect it would be satisfactory for what we want to accomplish in frozen out orchards; i.e. it's not going to result in disease-free fruit but should keep things from getting out of hand. Use between 0.2 and 0.6 lb metallic copper per acre, depending on tree-row-volume, in combination with sulfur. These rates are relatively low and you should try to time the sprays just before wet periods. The newer formulations of sulfur are more active and you can use less/acre than the older wettable sulfurs. Copper does tend to build up on fruit and foliage and if you haven't had much rain to wash the residues off, there is a greater risk of phytotoxicity.

Some of you may remember Bordeaux mixture which was commonly used from the early 1900s until some of the newer organic chemicals were developed (i.e. thiram, captan). It is a mixture of copper sulfate (bluestone), lime and water. Typically during the summer 4 to 6 lb of copper sulfate was mixed with 8 lb of lime in 100 gal of water and applied to the drip point with a hand gun, or later with a speed sprayer. The lime was added as a safener for the copper. Simply, it complexes with the copper rendering it less phytotoxic. Copper sulfate is 25.2% metallic copper so approximately 1 to 1.5 lb of metallic copper was used per 100 gal dilute. This is a very high rate of copper compared to the recommendations above and often resulted in phytotoxicity. If you wish to use Bordeaux use the rates of copper and lime above in 100 gal water/acre.

The information below is abstracted from the SE Regional Peach website.

There are numerous copper-containing fungicide/bactericide products and formulations. The amount of “metallic (elemental) copper equivalent (MCE)” in these products ranges from slightly more than 5% to greater than 50%. Thus the amount of formulated product used per acre can vary greatly. To be able to make standard recommendations for these different formulations, recommended rates per acre are expressed as the amount of metallic or (elemental) copper equivalent (MCE) in the product. This approach works well for most copper formulations but not for some of the “liquid-type” formulations such as Copper-Count-N and Tenn-Cop 5E, which contain less than 10% metallic copper.

In TABLE 1, are listed the trade name, copper formulation, the metallic copper equivalent, manufacturer, and the re-entry time of commonly available copper fungicides/bactericides used on peaches (please be aware that some products may not be labeled for use on apples and in all states – always read the product label before using). An important characteristic of copper is that it is protective and not curative, thus to be effective copper must be present prior to occurrence of conditions for infection (ie, the presence of moisture such as rainfall or dew). This also means that good spray coverage of the tree is essential.

**TABLE 1.**

<b>TRADE NAME</b>	<b>FORMULATION</b>	<b>METALLIC COPPER EQUIVALENT</b>	<b>MANUFACTURER</b>	<b>RE-ENTRY INTERVAL (HR)*</b>
BASICOP	53% elemental copper	53.0%	DuPont	24
CHAMP WP	77% copper hydroxide	50.0%	NuFarm Americas, Inc.	24
CHAMP Dry Prill	57.6% copper hydroxide	37.5%	NuFarm Americas, Inc.	24
CHAMP Formula 2	37.5% copper hydroxide	24.4% (3.0 lb/gal)	NuFarm Americas, Inc.	24
C-O-C-S WDG	74.8% copper oxychloride 14.2% basic copper sulfate	50.0%	UAP- Loveland Products	24
COPPER-COUNT-N	Copper ammonium complex	8.0% (0.784 lb/gal)	Mineral Research & Development	12
CUPROFIX DISPERS	36.9% basic copper sulfate	20.0%	Cerexagri, Inc.	24
CUPROFIX ULTRA 40	71.1% basic copper sulfate	40%	Cerexagri-Nisso LLC	12
KOCIDE 101	77% copper hydroxide	50.0%	DuPont	24
KOCIDE 2000	53.8% copper hydroxide	35.0%	DuPont	24
KOCIDE 3000	46.1% copper hydroxide	30%	DuPont	
KOCIDE DF	61.4% copper hydroxide	40.0%	DuPont	24
KOCIDE 4.5 LF	37.5% copper hydroxide	24.4% (3.0 lb/gal)	DuPont	24
NU-COP 50DF	77% cupric hydroxide	50%	AgriStar	24
NU-COP 3L	37.5% cupric hydroxide	24% (3.0 lb/gal)	AgriStar	24
TENN-COP 5E	58.0% copper salts of fatty and rosin acids	5.14%	DuPont	12

## **Weed Management in Apple Orchards for 2007**

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In newly planted and young orchards weed management practices should be used as they would be in any other year. However in bearing orchards weed management programs may need to be modified in a manner to aid with tree vigor management. I think orchards need to be managed to minimize competition in the short term until some decisions can be made by the horticulturalists about long term effects. Assuming the freeze impacted this year's fruit crop and long term tree health is fine weeds may be useful to aid in vigor management. Below are several options you may want to consider.

Option 1 (For orchards where Chateau was applied prior to the freeze): If you have made your initial Chateau application you could not apply the second application and manage weeds with postemergence herbicides as needed through the summer. If you used 6 to 8 oz/A of Chateau you will generally get 60 to 80 days of control before weeds begin to emerge so making the second application will result in summer long residual control.

Option 2: (For orchards treated with a burn down herbicide only or nothing at all): If you have not applied preemergence herbicides so far I would consider using simazine at 2 qt/A or Karmex at 2 lb/A with a burn down herbicide whenever weeds begin to emerge which will probably be in early May if your herbicide strip is clean now. Using the low end rates of these two products will give you some residual control but I expect grasses and some broadleaf weeds to begin to emerging within 6 weeks of application. From then on you may use postemergence herbicides as you prefer.

Option 3: (For orchards treated with a burn down herbicide only or nothing at all): Another option if you have done nothing this spring or at least not applied any preemergence herbicide is to go with a total postemergence program for the summer. This option gives growers the most control in using weeds for vigor management and may be best used on varieties most likely to have extreme vigor with no fruit crop.

No matter how you choose to control weeds in this upcoming year there are a couple of things that need to be avoided. One is allowing weeds to produce seed. If you allow weeds to grow under the trees for vigor management they need to be killed prior to seed production. In late summer glyphosate can not be used due to tree sensitivity therefore if you use paraquat weeds have to be short enough to get good herbicide coverage. Another concern is having a lot of weed residue left under the trees this fall and the impact that could have on rodent populations.