

# 2009 Fungicide Spray Guide for Bell Peppers in NC

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**Bell pepper foliar diseases.** There are a few diseases that attack pepper stems, leaves and fruit during fresh-market production in North Carolina. Some diseases are caused by bacteria, such as bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*); other important stem / foliar diseases are caused by fungi, such as Phytophthora blight (*Phytophthora capsici*) and anthracnose (*Colletotrichum* species) (see Fig. 1).



**Fig 1.** Pepper diseases (from left to right): anthracnose on fruit, bacterial spot on leaves; Phytophthora stem lesion; Phytophthora blight and general wilting; and Phytophthora fruit rot.

**Effective chemicals.** There is no SINGLE product that is effective against all important foliar pepper diseases. For example, the strobilurins give good control of anthracnose, but provide no control of Phytophthora blight. Therefore, it is necessary to use a combination of different products in a spray program to optimize management of the different pepper diseases that might occur. Another important consideration is fungicide resistance management. For example, pathogens may develop insensitivity (resistance) to mefenoxam (Ridomil Gold) or the strobilurins, i.e. Amistar, Cabrio, Quadris or Tanos, if these products are used too frequently. Alternating products in different fungicide groups (Table 1) is highly recommended.

**Volume-based spray schedule.** Labeled rates of products are usually listed on a **per acre basis**, but for staked peppers, these should be applied on a **per volume basis**. The reason for spraying on a per volume basis is that early in the season when plants are small, less volume (and thus, less product) is needed to obtain full coverage, than later in the season when plants are larger and more spray volume is needed to obtain full coverage. To determine your mixing rate, first determine the maximum spray volume per acre for your sprayer for fully-grown plants. Then mix the acre rate for a given product in the maximum spray volume that it takes to cover an acre. For example, pyraclostrobin (Cabrio) is labeled at 12 oz per acre. If the maximum spray volume is 100 gallons per acre for your sprayer when plants are full grown, then mix the pyraclostrobin at the rate of 12 oz per 100 gallons of spray. At the start of the season, it may take only 25 to 30 gallons per acre to obtain full coverage. The volume of spray per acre is then increased as plants grow and spray nozzles are added until the maximum 100-gallon volume per acre is reached at full plant growth.

The purpose of the chemical tables below (Tables 1 & 2) are to provide general spray recommendations, which can be altered depending on disease pressure. Each year, these diseases show up at varying times of the season, often depending on particular rain and temperature conditions.

**Note:** Recommendations for the use of agricultural chemicals are included here as a convenience to the reader. The use of brand names and mention or listing of commercial products does not imply endorsement by North Carolina State University nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Examine a current product label before applying any chemical. For assistance, contact your county North Carolina Cooperative Extension Service agent.

**TABLE 1. RELATIVE EFFECTIVENESS OF VARIOUS CHEMICALS FOR PEPPER DISEASE CONTROL.**

++++ Excellent; +++ Good; ++ Fair; + Poor; - Not effective.			RELATIVE CONTROL RATING					
Pesticide	Fungicide group <sup>1</sup>	Preharvest interval (Days)	Anthracnose (immature fruit rot)	Bacterial spot	Phytophthora blight (root and crown)	Phytophthora blight (fruit and foliage)	Pythium damping off	Southern blight
strobilurins								
azoxystrobin (Amistar / Quadris)	11	1	+++	-	-	-	-	-
femaxadone + cymoxanil (Tanos)	11 + 27	3	+	-	-	+	-	-
pyraclostrobin (Cabrio)	11	0	++++	-	-	-	-	-
dimethomorph (Acrobat, Forum)	15	4	-	-	-	+	-	-
fixed copper <sup>2</sup>	M	0	+	++ <sup>R,3</sup>	-	++	-	-
Fluopicolide (Presidio) <sup>4</sup>	43	2	-	-	-	++++	-	-
mandipropamid (Revus) <sup>4</sup>	40	1	-	-	-	++++	-	-
maneb (Maneb, Manex)	M	5	+	-	-	-	-	-
Mefenoxam <sup>5</sup> (Ridomil Gold SL)	4	NA	-	-	++++ <sup>R</sup>	NA	++++	-
mefenoxam + copper (Ridomil Gold /Copper)	4 + M	14	+	++ <sup>R</sup>	NA	++++ <sup>R</sup>	-	-
streptomycin sulfate <sup>6</sup> (Agri-Mycin, Firewall)	U	0	-	+++ <sup>R</sup>	-	-	-	-
sulfur	M	0	-	-	-	-	-	-

<sup>1</sup> Key to Fungicide groups: 4:phenylamides; 11:quinone outside inhibitors; 14:aromatic hydrocarbons; 15:cinnamic acids; 27:cyanoacetamide oximes; 40:Carboxylic acid amines; 43:benzamides; M:multi-site activity; U:unclassified.

<sup>2</sup> Fixed coppers include: Basicop, Champ, Champion, Citcop, Cuprofix Ultra, Kocide, Nu-Cop, Super Cu, Tenn-Cop, & Tri-basic copper sulfate.

<sup>3</sup> Copper tank-mixed with maneb enhances efficacy to +++ against bacterial spot.

<sup>4</sup> Should always be tank mixed with a protectant (i.e. copper) to provide adequate control.

<sup>5</sup> *P. capsici* becomes resistant to mefenoxam quickly. Ridomil Gold may be applied to pepper at transplanting, but is NOT registered for control of Phytophthora blight; the foliar blight phase of Phytophthora cannot be controlled with foliar applications of Ridomil Gold SL.

<sup>6</sup> Streptomycin may be used on transplants but is NOT registered for field use.

<sup>R</sup> Resistance to this pesticide has been detected in the pathogen population.

**TABLE 2. Amount of product / 100 gallons, assuming a max. of 100 gallons / acre at full plant growth.**

<b>Common name</b>	<b>Product name</b>	<b>Amount/Acre</b>
Fixed copper	Kocide 3000 Cuprofix Ultra 40	0.75 – 1.25 lb 1.25 – 3.0 lb
Fluopicolide	Presidio	3.0 – 4.0 fl oz with 20-50 GPA
Dimethomorph	Acrobat 50WP Forum	6.4 oz 6.0 oz
Mandipropamid	Revus	8.0 fl oz
Maneb	Maneb 75DF / 80WP Manex	1.5 – 3.0 lb 1.2 – 2.4 qt
Mefenoxam	Ridomil Gold SL*	1.0 pt
Mefenoxam + copper	Ridomil Gold /Copper	2.5 lb
Phosphite	Numerous products	See label
Streptomycin sulfate	Agri-Mycin 17 Firewall	1.0 lb 200 ppm
Strobilurin	Amistar Cabrio EG Quadris 2.08F Tanos	2.0 – 5.0 oz 8.0 – 12.0 oz 6.2 – 15.4 fl oz 8.0 – 10.0 oz

\* Must be applied at or before transplanting. Ridomil Gold may cause some yellowing of pepper leaves. Plants already infected with *Phytophthora* can not be cured with Ridomil Gold SL applications.