2018 Fungicide Spray Guide for Tomato in North Carolina

Inga Meadows, Department of Entomology & Plant Pathology, North Carolina State University

Foliar Diseases. There are several diseases that attack tomato leaves and fruit in North Carolina (Fig. 1). Some diseases are caused by fungi such as early blight (*Alternaria linearіae* = *A. tomatophila*), late blight (*Phytophthora infestans*) and Septoria leaf spot (*Septoria lycopersici*); other diseases are caused by bacteria, such as bacterial spot (*Xanthomonas perforans*), bacterial canker (*Clavibacter michiganensis* pv. *michiganensis*), and bacterial speck (*Pseudomonas syringae* pv. *tomato*). The population structure of bacteria attacking field-grown tomatoes has shifted since the early 2000s, and bacterial spot is now considered the most predominant foliar pathogen throughout North Carolina, as well as the Southeastern U.S; however, bacterial speck and canker do occur.

Fig 1. Tomato diseases (left to right): bacterial spot on tomato fruit; bacterial spot on tomato leaf; early blight on tomato leaf; and late blight on tomato leaf.

Effective Chemicals. There is no SINGLE product that is effective against all foliar diseases. For example, mancozeb gives good control of early blight, but chlorothalonil gives only fair control. In addition, copper-based products are effective against bacterial canker, but some strains of speck and spot bacteria are resistant to copper; the use of Actigard has been shown to be effective in reducing all 3 bacterial diseases. Therefore, it is necessary to use a combination of products in a spray program to optimize disease management. It is important to consider that products have different pre-harvest intervals (PHI). A product with a PHI greater than 2 days such as mancozeb (PHI = 5 days) cannot be used when growers harvest 2 or more times per week. It also is important to incorporate fungicide resistance management into a spray program. For example, resistance to the QoI fungicides (most strobilurins; i.e., Cabrio or Quadris) in the early blight fungus has been detected in North Carolina since the 2007 growing season, because it had been used almost exclusively for early blight control.

Volume-based Spray Schedule. The following suggested weekly spray schedule (Table 1) accounts for the above considerations and label restrictions of different products and is based on years of field research in NC. Labeled rates of products are usually listed on a **per acre basis**, but for staked tomatoes, these should be applied on a **per volume basis**. The purpose of spraying on a per volume basis is that less volume (and thus, less product) is needed to obtain full coverage when the plants are small early in the season; later in the season, when plants are larger, more spray volume is needed to obtain full coverage. 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, mancozeb products are labeled at 3 lbs per acre. If the maximum spray volume is 100 gallons per acre for your sprayer when plants are fully grown, then mix the mancozeb product at the rate of 3 lbs per 100 gallons of spray. At the start of the season, it may take only 30 gallons per acre to obtain full coverage, so the amount of the mancozeb product would be 1.0 lb for 30 gallons. The volume of spray per acre is then increased as plants grow and spray nozzles are added until the maximum volume per acre is reached at full plant growth.

The purpose of this schedule is to provide a general spray program, which can be altered depending on disease pressure, weather conditions, and grower preference in products.

NC COOPERATIVE EXTENSION
N.C. A&T STATE UNIVERSITY
NC STATE UNIVERSITY

2018 Fungicide Spray Guide for Tomato in North Carolina (cont'd)

Table 1. Suggested weekly spray schedule and products (and FRAC code) for foliar disease control on tomato in NC

Targets	Week	Products
Before harvest:	1	**mancozeb (M) + copper (M) + Actigard (21)**
(target diseases are:	2	**mancozeb (M) + copper (M)**
early blight,	3	**mancozeb (M) + Inspire Super (3+9) OR strobilurin (11) + Actigard (21)**
bacterial spot,	4	**mancozeb (M) + copper (M)**
or both)	5	**mancozeb (M) + Fontelis (7) OR Endura[z] (7) + Actigard**
	6	**mancozeb (M) + copper (M)**
	7*	**mancozeb (M) + Inspire Super (3+9) OR strobilurin[y] (11) + Actigard (21)**
	8*	**mancozeb (M) + copper (M)**
During harvest:	9	**Fontelis (7) OR Endura[z] (7) + chlorothalonil (M)**
(target diseases are:	10	**Revus Top (3+40) OR Presidio (43) OR Ranman (21) OR Orondis Ultra (49+40) OR Zampro (45+40)**
early blight,	11	**[Inspire Super[x] (3+9)] OR strobilurin[y] (11) + chlorothalonil (M)**
late blight, or both;	12	**Revus Top (3+40) OR Presidio (43) OR Ranman (21) OR Orondis Ultra (49+40) OR Zampro (45+40)**
or gray mold)	13	**Fontelis (7) or Endura[z] (7) + chlorothalonil (M)**
	14	**Presidio (43) OR Ranman (21) OR Orondis Ultra (49+40) OR Zampro (45+40) OR chlorothalonil (M)**
	15	Finish season with **chlorothalonil (M)**

***For late season plantings:** If late blight is in the area, consider chlorothalonil for late blight control beginning Week 7 or 8.
[z]Use high rate of **Fontelis** or **Endura** if conditions are cool and wet just before or during harvest when there is risk of gray mold.
[y]Resistance to **strobilurins** is known to occur in the early blight pathogen in NC; if resistance is suspected, avoid the use of strobilurins and use alternate product.
[x]**Do not use Inspire Super** in Week 11 if the higher rates of **Inspire Super** and **Revus Top** have been used to avoid exceeding the maximum season limit.
Notes: **Actigard** applications should be limited to reduce the risk of **phytotoxicity** and **plant stunting.** Field trials have found that **Regalia, Lifegard, and Serenade Max** have some efficacy against bacterial spot.

Table 2. Amount of product/100 gal, assuming a maximum of 100 gal/acre at full plant growth.

Common name	FRAC	PHI (days)	Product name	Amount/100 gal	Max. amt/ac/season
fixed copper	M	varies check label	Kocide 3000 Cuprofix Ultra 40 Disperss MasterCop	0.75 - 1.75 lb 0.75 - 3.0 lb 0.5 - 3.0 pt	varies; check label
acibenzolar-*S*-methyl	21	14	Actigard 50WG	0.33 - 0.75 oz	6.0 oz
mancozeb	M	5	Manzate Pro-stick Penncozeb 75 DF Dithane F45	0.75 - 3.0 lb 0.75 - 3.0 lb 1.5 - 2.0 lb	22.4 lb 22.4 lb 21 lb
Bacillus subtilis (OMRI)	44	0	Serenade Max	1.0 - 3.0 lb	NA
Bacillus mycoides isolate J (OMRI)	P6	0	Lifegard WG	4.5 oz	NA
Reynoutria sachalinensis (OMRI)	P5	0	Regalia	1.0 - 4.0 qt	NA
difenoconazole + cyprodinil	3+9	0	Inspire Super (GM)	16.0 - 20.0 fl oz	80 fl oz
boscalid boscalid penthiopyrad	7 7 7	0 0 0	Endura Endura Fontelis	LOW 3.5 - 5.0 oz HIGH 9.0 - 12.5 oz 16.0 - 24.0 fl oz	21.0 oz 25.0 oz 72.0 fl oz
fluopyram + pyrimethanil	7+9	1	Luna Tranquility (GM)	11.2 fl oz	54.7 fl oz
pyrimethanil	9	1	Scala	7 fl oz	35 fl oz
cyprodinil + fludioxonil	9+12	0	Switch	11 - 14 oz	56 oz
strobilurin (azoxystrobin)	11	0	Quadris 2.08F	5.0 - 6.2 fl oz	37.0 fl oz
strobilurin (pyraclostrobin)	11	0	Cabrio EG	8.0 - 12.0 oz	96.0 oz
strobilurin (pyraclostrobin) + fluxapyroxad	11+7	7	Priaxor (GM)	4.0 - 8.0 fl oz	24.0 fl oz
strobilurin (trifloxystrobin) + fluopyram	11+7	3	Luna Sensation (GM)	5.0 - 7.6 fl oz	27.1 fl oz
famoxadone + cymoxanil	11+27	3	Tanos	6.0 - 8.0 oz	72.0 oz
mandipropamid + difenoconazole	40+3	1	Revus Top	5.5 - 7.0 fl oz	28.0 fl oz
chlorothalonil + potassium phosphate	M+33	0	Catamaran	4.5 - 7.0 pt	50 pt
chlorothalonil	M	0	Bravo Ultrex, Equus DF Bravo Weather Stik	1.3 - 2.6 lb 1.375 - 2.75 pt	18.3 lb 20 pt
oxathiapiprolin (S) + chlorothalonil	49+M	0	Orondis Opti (pre-mix)	1.75-2.5 pt	10 pt
oxathiapiprolin (S) + mandipropamid	49+40	1	Orondis Ultra (pre-mix)	5.5 - 8.0 fl oz	32 fl oz
cyazofamid	21	0	Ranman	2.1 - 2.75 fl oz	16.5 fl oz
propamocarb (S)	28	5	Previcur Flex	0.7 - 1.5 pt	7.5 pt
fluopicolide (S)	43	2	Presidio	3.0 - 4.0 fl oz	12.0 fl oz
ametoctradin + dimethomorph	45+40	4	Zampro	14 fl oz	42 fl oz

(S) THIS PRODUCT HAS SYSTEMIC ACTIVITY; IT SHOULD BE USED FOR CURATIVE CONTROL OF LATE BLIGHT.
(GM) This product also controls gray mold.
(OMRI) OMRI Approved product

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.*

NC COOPERATIVE EXTENSION
N.C. A&T STATE UNIVERSITY
NC STATE UNIVERSITY