FUMIGANTS AND VARIETIES TO MANAGE SOUTHERN BACTERIAL WILT OF TOMATO

Jim Driver* and Frank Louws, Plant Pathology Dept. North Carolina State University, Raleigh, NC 27695

Southern bacterial wilt, caused by *Ralstonia solanacearum* (*Pseudomonas solanacearum*), is a serious and widespread disease in tomato production regions of North Carolina. Most growers employ methyl bromide to control bacterial wilt, other soilborne pathogens, weeds and insects. In fields where the disease recurs, growers will broadcast fumigate "deep" with chloropicrin in the fall or early spring and use standard fumigation (banded in raised beds) application prior to planting. Recurrent problems with bacterial wilt led us to initiate several trials with alternative fumigants, other novel biological products and tomato varieties that have genetic resistance to *R. solanacearum*.

Fumigant Trial I: Trial I was conducted in 2000 in a commercial tomato field near Marietta, SC where bacterial wilt caused extensive damage in the 1999 crop. All treatments were applied on 11 Apr. Fumigants were injected 8-in. deep with two chisels spaced 8-in. apart, and beds were covered with black plastic mulch in a single pass. Plots were 40 ft long and 27-in. wide, spaced on 5 ft centers. Treatments were arranged in a randomized complete block design with 4 replications. Plants were transplanted by hand on 1 May. Weeds were controlled by cultivation between the beds and soil fertility was managed according to recommended commercial standards. Plots were rated weekly for bacterial wilt incidence beginning 18 May through 14 Aug. Wilted plants were removed from each row after completing counts that same day. Area under the disease progress curve values (AUDPC) were calculated for the cumulative percent of plants that wilted over time. Fruit was harvested on 7 and 13 Jul and 14 Aug. Fruit were sorted into marketable and cull grades.

Results: Bacterial wilt quickly spread throughout the field and final incidence was near 100% in non-fumigated plots (Table 1). Fumigant treatments did not reduce final incidence of bacterial wilt as recorded 14 Aug. Differences in AUDPC were not significant, but methyl bromide and Telone treatments were the lowest. Linear regression demonstrated marketable yields declined as AUDPC values increased ($y = 159 - 0.03X$; $R^2 = 0.86$; data not shown). Methyl bromide treated plots had the lowest incidence, which translated into the highest marketable yields ($P = 0.08$) compared to the control.

Fumigant Trial II: Trial II was conducted in 2000 near China Grove, NC in a commercial tomato field with recurrent bacterial wilt problems and a 30 year history of tomato production. Fumigants were injected on 4 May as described above except a two-row application rig was employed. Plots were composed of 4

raised beds 100 ft long and 27-in. wide, spaced on 5 ft centers. Treatments were arranged in a randomized complete block design with 3 replications. Tomato transplants (Mountain Fresh) were field set by hand on 19 May. Weeds and soil fertility were managed according to commercial standards. Plots were rated four times for bacterial wilt incidence beginning 15 Jun to 27 Jul. Wilted plants were removed from each row after completing counts that same day. All fruit were harvested on 15 Aug and sorted into marketable and cull grades.
Results: Bacterial wilt incidence was over 30% in non-fumigated plots by 27 Jul (Figure 1). Fumigant treatments did not impact the incidence of bacterial wilt nor marketable yield (data not shown).

Fumigant, Product and Variety Trial III: Trial III was located outside Burgaw, NC. The field selected had been in continuous tomato production for 20 years. Bioyield was premixed into transplant mix at a 1:40 ratio and then Mountain Spring and BHN-446 varieties were seeded. Messenger was applied to one tray of Mountain Spring beginning 20 Apr, continuing into the field production phase through 1 Jun on a 14 day spray schedule for a total of 4 sprays. Treatments were arranged in a randomized complete block design with four replications. Plots consisted of single 20 ft rows on black plastic mulched beds 27 in wide on 5 ft centers. Fumigants were injected into the soil using a standard plastic mulch layer with knives set at 8 in below the soil surface. On 1 May tomato transplants cv. "Mountain Spring ", developed at NC State University and "BHN 446" developed by BHN Seed Company located in Bonita Springs, Florida, were planted at the experimental site. Data was collected from 6 plants in each plot. Numbers of plants wilting (due to bacterial wilt) were recorded 8, 12, 18, 26, 29 Jun, 6, 13, and 19 Jul. Fruit harvest began 26 Jun and continued through 19 Jul for a total of 8 harvests. Fruit were sorted by commercial grading standards and numbers and weights of marketable and cull fruit recorded. Standard soil fertility and cultural practices were followed. **Results:** Bacterial wilt pressure was high, reaching levels up to 80% by the end of the season (Figure 2). Linear regression analysis, with R^2 values ranging from 0.857 – 0.988, demonstrated all plots had a similar rate of disease increase except those planted to the resistant variety BHN 446. These plots had a low incidence of disease climaxing at 12.5% incidence.
Summary: Three trials in diverse geographic regions demonstrated that despite the routine use of methyl bromide in *R. solanacearum* infested fields, standard application methods with several fumigants were not effective to limit bacterial wilt incidence. Therefore we also have placed an emphasis on evaluating genetic resistance as a means to limit losses. In Trial III, the BHN 446 tomato line effectively withstood high disease pressure with a low incidence of wilt. Regretfully, the small fruit size and lateness makes it undesirable for commercial production in North Carolina. In 2002 we initiated trials with another line that appears to have superior fruit quality combined with genetic resistance. Developing resistance to bacterial wilt has been a difficult challenge for breeders since such resistance is often linked to undesirable traits. Our studies have shown that standard alternative fumigants and methods of application are not effective and other management strategies must be emphasized.

Table 1: Incidence of bacterial wilt and marketable yield as impacted by fumigant treatment in Trial I, 2000.

Treatments (product/treated acre)	Diseased plants (%) 14 Aug	AUDPC* values	Total marketable yields (lb/plot)
Control	96.9	3926	54.7
Methyl Bromide 400.0 lb	59.0	1935	122.2
Telone C-35 35 gal	84.3	1937	93.5
Chlor-O-Pic 10.5 gal	81.5	2749	87.3
Telone C-35 30.0 gal	83.9	3084	79.8
LSD	NS	NS	45.2
P-Value	0.12	0.11	0.08

* Area Under the Disease Progress Curve

Figure 1: Incidence of bacterial wilt and marketable yield as impacted by fumigant treatment in Trial II, 2000.

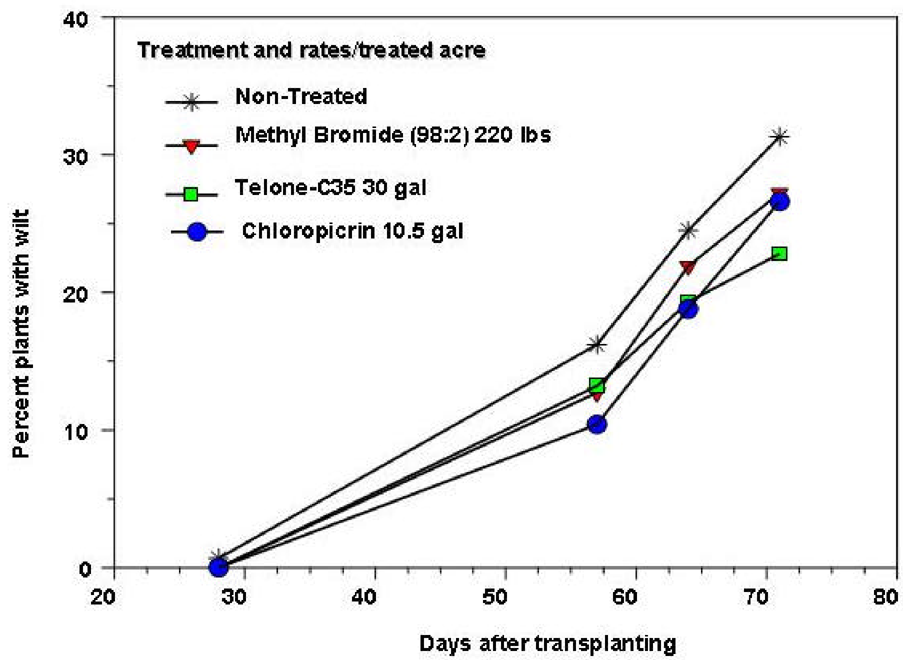

Figure 2: Incidence of bacterial wilt and marketable yield as impacted by fumigant or product treatments and variety in Trial III, 2001.