Development of disease management recommendations for Bailey and other multiple-disease resistant varieties

Barbara Shew, Department of Plant Pathology, North Carolina State University

Executive Summary for 2009

Virgina-type peanut cultivars generally have little resistance to leaf spots, stem rot, Sclerotinia blight, Cylindrocladium black rot (CBR), and spotted wilt. At best, cultivars have moderate resistance to only one or two diseases, while being susceptible to others. The resistance in most cultivars is too low to allow reduced disease control inputs, particularly in challenging situations.

Recently, NC State University released two new disease-resistant cultivars. Bailey and Sugg were bred for resistance to spotted wilt, CBR, leaf spots, and Sclerotinia blight. A surprising result of preliminary field studies was a marked reduction in stem rot in Bailey compared to susceptible Gregory, indicating that Bailey also has stem rot resistance.

Traditionally, we have recommended 5 fungicide sprays for control of leaf spots in NC. Several fungicides used for leaf spot control are also active against stem rot. For the first time, it may be possible to significantly change traditional approaches to disease management by allowing growers to use fewer inputs for leaf spot and/or stem rot control.

The objectives of this research were to 1) develop fungicide programs for use on Bailey, Sugg, or other multiple disease resistant cultivars; and 2) investigate methods to modify existing leaf spot advisories for use on multiple disease resistant cultivars. This was the first year of a two-year study.

In 2009, Bailey was planted at Lewiston, NC and sprayed 3, 4, or 5 times per season according to a calendar schedule. Gregory was planted as a susceptible standard. The 4-spray program was initiated 2 weeks after the 5-spray program, and the 3-spray program was delayed 4 weeks. Each spray schedule had three treatment programs: 1) Tilt-Bravo for all sprays; 2) a leaf spot focused program of alternating Bravo and Headline sprays; and 3) a stem rot focused program of alternating Bravo and Provost sprays. An untreated check also was included.

In 2009, high levels of leaf spots and stem rot developed on the susceptible cultivar Gregory. Unsprayed yield was 4064 lb/a on Bailey and 2666 lb/a on Gregory. The 4- and 5- spray stem rot programs performed markedly better than other treatments on Gregory.

On Bailey, all 5-spray programs gave equal and high yields (mean of 5,021 lb/a).Yield was highest (5,237 lb/a) in the 5-spray stem rot program. All stem rot programs (5, 4 or 3 total sprays) had statistically equal yields. Yields in the 5- and 4- spray leaf spot programs also were not different from the highest yielding program. The 3-spray leaf spot and the 4- and 3-sprayTilt Bravo programs had lower yields and did not differ from the untreated Bailey control.

For the second objective, Bailey was planted in two cooperator farms and sprayed according to 1) advisory starting at R3; 2) calendar sprays starting at R3; 3) advisory at R3 + 2 weeks; 4) calendar sprays at R3 + 2 weeks; and 5) untreated check. All spray treatments controlled leaf spot, but yields did not differ among treatments in the two on-farm trials.

The results to date indicate that growers can save at least one spray a year on Bailey compared to older cultivars and still maintain excellent disease control and yields.

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PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Development of Disease Management Recommendations For Bailey and Other Multiple-Disease Resistant Cultivars**

LEADER: **Barbara Shew**

DEPARTMENT: **Plant Pathology**

REPORT:

For the past several years, Dr. Isleib's breeding program has emphasized the development of multiple-disease resistant lines. The new cultivars Bailey (tested as N03081T) and Sugg (tested as N03091T) are the first virginia-types to have multiple disease resistance. Planting Bailey or Sugg has the potential to significantly change traditional approaches to disease management.

With the support of the NCPGA, we have evaluated resistance and integrated disease control on Bailey and closely related lines including Sugg for the past 4-5 years. We have established that Sclerotinia blight can be controlled on Bailey with 1 or 2 fewer fungicide applications than on other cultivars (including Perry), and have devised modifications to a Sclerotinia blight advisory accordingly.

We also compared full (5 sprays initiated at R3) and reduced (3 or 4 sprays) fungicide schedules for leaf spot control on Bailey in 2007 and 2008. Results of these studies indicated that it may be possible to reduce the number of leaf spot sprays on Bailey without increasing disease or yield loss. However, leaf spot pressure was very light in both years due to drought, so additional testing is needed before firm recommendations can be made. Further reductions in fungicide sprays also could be possible by using the leaf spot advisory, or by modifying the advisory to account for resistance.

A surprising result of the leaf spot control studies was a marked reduction in stem rot in Bailey compared to Gregory, indicating possible stem rot resistance in Bailey. Several fungicides used for leaf spot control, including Provost, Abound, and Headline, are also active against stem rot. Programs that include these fungicides usually increase yields over cheaper fungicides, like Tilt/Bravo, that control only leaf spots. It may be possible to control leaf spots with less expensive fungicides and/or lower application frequency on Bailey or Sugg without compromising stem rot control.

The objectives of this research are to 1) develop fungicide programs for use on the multiple disease resistant cultivars Bailey, Sugg, or other multiple disease resistant cultivars; and 2) investigate methods to modify existing leaf spot advisories for use on Bailey, Sugg, or other multiple disease resistant cultivars. The study in 2009 was the first year of a two-year study.

For the first objective, Bailey was planted at Lewiston and sprayed 3, 4, or 5 times per season according to a calendar schedule. Gregory also was planted as a susceptible standard. The four-spray program was initiated two weeks after the five-spray program and the three-spray program was initiated two weeks after the four-spray program. Each of the spray schedules had three treatments examining different sequences of specific fungicides. These treatments

consisted of 1) a low-cost program targeted at leaf spots only (Tilt-Bravo for all sprays), and programs using combinations of fungicides focusing on 2) leaf spot or 3) stem rot control. An untreated check also was included. Leaf spot incidence, defoliation, and stem rot data were collected. Incidence of spotted wilt and/or Sclerotinia blight was determined as required and yields were compared.

In the first year of this study, high levels of leaf spots and stem rot developed on the susceptible cultivar Gregory. Yield was greatly reduced when fungicides were not applied to Gregory and Bailey's unsprayed yield was 1398 pounds/a higher than Gregory's (Table 1). All 5-spray programs gave equal and high yields on Bailey (mean of 5,021 lb/a). On Bailey, the 4-spray and 3-spray stem rot control programs yielded equal to all 5-spray programs, but the 3-spray leaf spot and Tilt Bravo programs had lower yields.

For the second objective, Bailey was planted in two non-irrigated locations and sprayed according to 1) the North Carolina leaf spot advisory initiated at R3; 2) a calendar schedule initiated at R3; 3) the advisory initiated two weeks after R3; 4) a calendar schedule initiated two weeks after R3. An untreated check also will be included. Leaf spot incidence, defoliation, and stem rot data was collected. Incidence of spotted wilt and/or Sclerotinia blight were determined as required and yields were compared.

In the first year of the on-farm study, advisories indicated the same number and timing of sprays as the calendar schedule. Fungicide application (4 or 5 sprays) significantly reduced disease compared to unsprayed treatments, but yields did not differ among treatments in the two on-farm trials due to relatively low leaf spot and stem rot pressure (Table 2).

Table 1. Disease incidence and yield of Bailey and Gregory sprayed 3 - 5 times with different fungicide programs in 2009

Bailey	All leaf spot		Defoliation		Stem rot		Sclerotinia	Yield	
unsprayed	90.0	a	50.0	a	39	a	2.0	4064	d
5 leaf spot	5.1	d	11.3	d	4	b	2.5	5027	ab
4 leaf spot	1.0	d	11.3	d	7	b	2.5	4840	abc
3 leaf spot	6.1	c	27.5	bc	16	b	0.5	4395	cd
5 stem rot	0.9	d	7.5	d	2	b	2.3	5237	a
4 stem rot	1.1	d	13.1	d	5	b	3.0	4915	abc
3 stem rot	7.0	c	25.6	bc	2	b	0.5	4758	abc
5 Tilt Bravo	1.0	d	10.6	d	12	b	1.3	4800	abc
4 Tilt Bravo	1.3	d	17.5	cd	10	b	0.8	4547	bcd
3 Tilt Bravo	11.9	b	28.8	b	13	b	4.3	4578	bcd
Gregory	**All leaf spot**		**Defoliation**		**Stem rot**		**Sclerotinia**	**Yield**	
unsprayed	96.9	a	80.0	a	59	ab	5.8	2666	d
5 leaf spot	1.3	g	12.5	ef	52	abc	7.0	3087	cd
4 leaf spot	7.5	ef	25.0	d	35	bc	1.8	4108	ab
3 leaf spot	14.9	c	43.1	b	47	cd	2.0	3453	bc
5 stem rot	2.3	fg	11.3	f	17	de	4.0	4435	a
4 stem rot	4.1	efg	19.4	de	7	e	10.5	4580	a
3 stem rot	14.4	cd	35.6	bc	37	bcd	2.3	3610	bc
5 Tilt Bravo	4.4	efg	22.5	d	71	a	4.0	3145	cd
4 Tilt Bravo	8.6	de	18.8	def	43	bc	1.5	3897	ab
3 Tilt Bravo	21.3	b	33.8	c	55	abc	2.0	3576	bc

Leaf spot program = alternating Bravo/Headline

Stem rot program = alternating Bravo/Provost
Tilt Bravo program = full season Tilt Bravo
Means within columns and cultivars followed by the same letter are not significantly different based on Waller-Duncan procedure with K=100. Means cannot be compared across columns or cultivars.

Table 2. Leaf spot and yield of Bailey grown in non-irrigated on-farm trails, and sprayed 4 or 5 times per season for leaf spot and stem rot control

County	Fungicide treatment	Leaf spot %		Yield lb/a
Bertie	none	20.5	a	3394
	4 sprays	1.8	b	3622
	5 sprays	0.9	b	3381
Martin	none	46.9	a	3697
	4 sprays	1.8	b	3800
	5 sprays	2.3	b	4059

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IMPACT STATEMENT

Peanut fungal diseases (leaf spots, stem rot, CBR and Sclerotinia blight) cause yield losses of an average of about 4 -10% annually in North Carolina, or about $38 - 95/a. In addition, growers spend an average of about $80/a for leaf spot and stem rot control; CBR and Sclerotinia blight control can add $30 - $100/a or more to this total. Using control programs optimized for use on resistant cultivars can reduce control costs by 20% or more while reducing the risk of yield loss.