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Final + Summary

PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Reduced cost Sclerotinia blight management with fungicides and disease risk prediction**

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REPORT:

Sclerotinia blight is one of the most important peanut diseases in North Carolina. The primary product for Sclerotinia blight control (Omega) is very expensive, costing between about $50 and $75 per spray, depending on the application rate. In addition to being expensive, Omega is not known to control any other peanut diseases and cannot be applied within 30 days of harvest. Recently labeled group 7 fungicides have some activity against Sclerotinia blight and are somewhat less expensive than Omega. They also are active against leaf spot and stem rot, and most have a PHI of 14 days. In previous work, the group 7 fungicide Fontelis applied at 1.5 pints per acre provided control statistically equal to control from Omega at 1 pint per acre. However, Fontelis did not provide control equal to the full rate of Omega (1.5 pints per acre).

The rate of Fontelis used to control leaf spots and stem rot is only 1 pint per acre, which will not control Sclerotinia blight. It is possible that using the higher rate (1.5 pints per acre) of Fontelis as part of a leaf spot control program, with or without additional applications of Omega, might improve Sclerotinia blight control. Using Fontelis for late season leaf spot control also could reduce the risk of aggravating Sclerotinia blight by replacing a chlorothalonil application, while also providing some Sclerotinia control within 30 days of harvest. In spite of these possible advantages, growers have reported various degrees of satisfaction with Fontelis as a Sclerotinia blight fungicide and have questions about how to maximize its efficacy. This research was conducted to examine the management of Sclerotinia blight with various rates and sequences of Omega and Fontelis.

Experiment 1. This experiment compared Sclerotinia control by Fontelis or Omega applied after an initial application of Omega at the reduced rate of 1 pint per acre. The fungicides were applied according to the North Carolina weather-based Sclerotinia advisory. The purpose of this experiment was to determine whether an application of Fontelis at the Sclerotinia control rate of 1.5 pt/A can extend the protection provided by a single application of Omega. The treatments were planted in 4-row plots of the cultivar Bailey and were replicated four times in a randomized complete block design. Three runs of the experiment were completed: one at Rocky Mount in 2013 and one each at Rocky Mount and Lewiston in 2014. All plots were treated for leaf spots, but no group 7 fungicides were used. Plants with Sclerotinia blight were marked with surveyor's flags and counted. Yield data were collected at harvest.

Results from 2013. In spite of favorable weather for Sclerotinia blight during much of the 2013 season, disease was much less severe than expected. Only one fungicide application was made in experiment 1 due to the late onset of disease. Thus, the experiment compared a single application of Omega at 1 pt/A, a single application of Fontelis at 1.5 pt/A, and no fungicide. Disease appeared to be greater on average in untreated plots than in others, but the differences observed were not statistically significant; that is, they may have been due to chance (Table 1). However, both fungicides increased yield compared to the unsprayed control and yield was highly correlated with the number of diseased plants ($r = -0.637$; $P < .0001$; figure 1). Yields did not differ between the Omega and Fontelis treatments (Table 1).

Results from 2014. In contrast to 2013, Sclerotinia blight began early and pressure continued throughout 2014 at both Rocky Mount and Lewiston. The first application of Omega was made in late July and was followed by an application of Fontelis (1.5 pint/A), 1 pint/A Omega, 1.5 pint/A Omega or Fontelis + 1 pint/A Omega in late August. Disease incidence was lower at Lewiston (Table 2) than at Rocky Mount (Table 3) but similar trends were seen at both locations (Table 4). It was clear at both locations that 1 pint/A Omega applied at early disease onset provided better disease control than any of the other treatments (first spray of Omega vs. no first spray; Tables 2-4). When applied for the first time late in the epidemic, Fontelis was not effective in controlling disease. However, Fontelis was about as effective following an initial application of Omega as was Omega following Omega.

Surprisingly, yields were high at both locations and no significant differences among treatments were found. The factors contributing to variation in yield data are not known. Very little leaf spot, stem rot, spotted wilt or other field or pest problems were observed that could explain the variability in the data.

Experiment 2. This experiment examined whether spraying a high rate (1.5 pints/a) of Fontelis as part of a leaf spot and stem rot control program would improve control of Sclerotinia blight alone or in combination with Omega applications. The treatments were planted in 4-row plots of the cultivar Bailey and were replicated four times in a randomized complete block design. Leaf spot sprays were applied on a two-week schedule after the initial application at R3 + 2 weeks. Fontelis was applied at 1.5 pt/a for the second (August 14) and fourth (September 11) sprays. The plots that were not treated with Fontelis were sprayed with Headline (August 14) and Bravo (September 11; Table 5). The Omega treatments were applied according to the North Carolina Sclerotinia blight advisory on July 30 and August 27. Plants infected with Sclerotinia blight were counted and marked with surveyor's flags and yield data were collected at harvest. The experiment was conducted at Lewiston as designed in 2013 but no Sclerotinia blight developed in the field selected for this experiment. The experiment was conducted at Lewiston in 2014.

Results from 2014. Sclerotinia blight began early and pressure continued throughout the season at Lewiston, resulting in very high incidence of Sclerotinia blight by harvest (Table 6). According to the North Carolina Sclerotinia advisory, at least two fungicide sprays were needed to control disease at Lewiston. Plots that were not treated with Omega had very high levels of disease and incidence of Sclerotinia blight decreased as the rate of Omega increased. When used in a leaf spot program, Fontelis at 1.5 pt/a provided very limited, if any, Sclerotinia control when used without Omega. Application of Fontelis appeared to improve control over Omega alone late in the season (Fontelis vs none on October 3; Table 6), but the difference could not be measured with statistical precision ($P = .1027$). This effect was seen at both the reduced and full rate of Omega (Table 6). In spite of the very high disease pressure present, no effects of treatments on yield were observed.

Taken together, the results of these experiments showed that a single timely application of Fontelis at 1.5 pt per acre may provide Sclerotinia blight control equal to the reduced rate of Omega (1 pint/a) when disease pressure is low, as in 2013. However, under constantly high levels of disease pressure, application of Fontelis alone never provided adequate disease control. Fontelis was effective when it followed an initial application of Omega. It also appeared to extend the period of Sclerotinia control during the 30 PHI period when Omega can't be used, but the effect was slight.

Identifying high-risk fields. Growers currently rely in field history to identify potential problems, but histories can be uncertain due to long rotations, the rotation crops planted, land rental, or weather not favorable for disease in previous seasons. A soil assay for the Sclerotinia fungus could identify risky fields, but the currently available methods are much too time consuming to be used for grower recommendations. This research sought to develop methods that could be used to identify high-risk fields so that growers can plan Sclerotinia blight management programs more effectively.

Soil was sampled in 2013 and 2014 from the field trials Rocky Mount to determine the relationship between the degree of Sclerotinia infestation and the amount of disease present. Results from 2014 are pending. In 2013, soil samples were assayed by the conventional method and the number of sclerotia of *Sclerotinia minor* recovered was counted and plotted against disease incidence.

As described for experiment 1 above, there was a strong relationship between disease incidence and yield in 2013 (Table 1; figure 1). However, there was only a weak relationship between the number of sclerotia and initial disease incidence ($r = .24$; $P=.233$; figure2). The variability in number of sclerotia was low relative to variability in disease. This may indicate that the current assay is not accurate or sensitive enough to pick up differences in numbers of sclerotia. Results from 2014 should help to show whether current methods can be used to identify sites with high levels of Sclerotinia infestation. It is clear that factors other than or in addition to the number of sclerotia (such as the treatments applied) affected the amount of disease that developed. However, repeated observations over years and locations suggest that levels of infestation vary among and within fields. A better understanding of the relationship between the amount of infestation and disease has the potential to help guide management decisions.

Table 1. Effect of a single application of Omega or Fontelis on Sclerotinia blight incidence and yield of peanut in Rocky Mount in 2013

Treatment	Diseased plants/plot before treatment	Diseased plants/plot 4 weeks after treatment	Increase in diseased plants/plot after treatment	Total diseased plants/plot	Yield/A
Fontelis, 1.5 pt/A	3.5 a	17.3 a	13.8 a	20.8 a	5379.3 a
Omega, 1pt/A	4.1 a	16.7 a	12.6 a	20.8 a	5239.9 a
none	4.3 a	21.3 a	17.1 a	25.6 a	4715.0 b
LSD	*2.6*	*9.1*	*8.3*	*10.5*	*503.4*

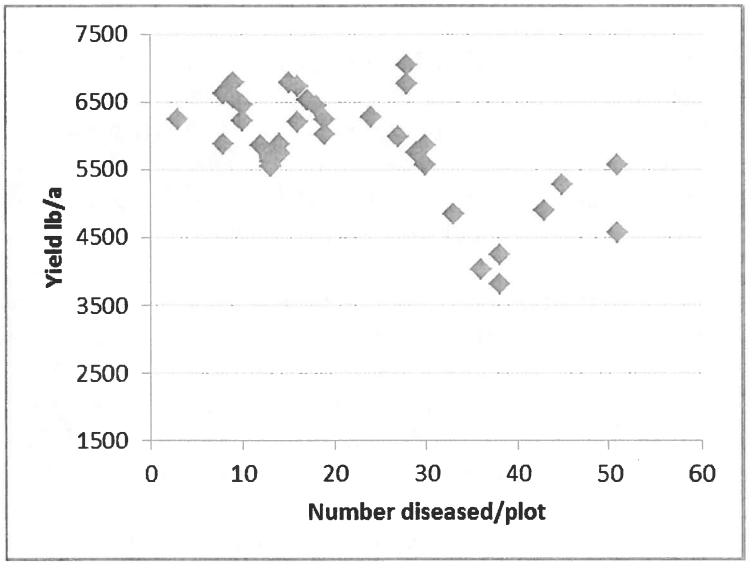

Figure 1. Relationship between yield and final number of diseased plants at Rocky Mount in 2013

Table 2. Incidence of Sclerotinia blight after application with Omega or no fungicide and followed by an application of Omega, Fontelis, or no fungicide at Lewiston in 2014

Treatment and application date		First rating [a] 7-Aug		Second rating 19-Sep			Total SBlight		Yield/A	
30-Jul	27-Aug	Mean	SD	Mean		SD	Mean	SD	Mean	SD
Omega 1 pt	none	5.5	4.7	12.3	b	11.0	17.8	15.6	5028	128
Omega 1 pt	Omega 1 pt	11.0	5.2	17.0	ab	7.3	28.0	12.5	5109	289
none	Omega 1 pt	11.0	3.7	28.8	ab	5.2	39.8	8.7	5018	118
none	Omega 1 pt + Fontelis 1.5 pt	5.8	4.1	20.0	ab	12.2	25.8	16.0	5064	606
none	Omega 1.5 pt	12.5	6.6	27.3	ab	11.2	39.8	17.6	5284	393
none	Fontelis 1.5 pt	11.0	3.6	31.0	a	13.4	42.0	16.1	4783	366
Omega 1 pt	Fontelis 1.5 pt	6.3	2.2	20.5	ab	1.7	26.8	2.2	5175	383
none	none	7.5	5.3	26.8	ab	8.8	34.3	12.7	5000	556
P>F treatment		0.2703		0.1665			0.2505		0.6733	
1st spray Omega vs no first spray		0.2296		0.0142			0.0327		0.8708	

[a] Ratings taken on August 7 reflect the effects of the first Omega application only.

Table 3. Incidence of Sclerotinia blight after application with Omega or no fungicide and followed by an application of Omega, Fontelis, or no fungicide at Rocky Mount in 2014

Treatment and date		Pretreatment rating 28-Jul			First rating 29-Aug			Second rating 3-Oct			Total SBlight			Yield/A	
29-Jul	25-Aug	Mean		SD	Mean		SD	Mean		SD	Mean		SD	Mean	SD
Omega 1 pt	none	1.5	a	1.0	5.8	b	3.5	46.8	abc	17.7	54.0	bc	20.5	5622	417
Omega 1 pt	Omega 1 pt	1.0	a	2.0	5.0	b	1.4	20.5	c	6.2	26.5	c	7.5	5867	627
none	Omega 1 pt	1.5	a	2.4	19.5	ab	10.1	37.0	bc	21.3	58.0	bc	33.4	5295	1488
none	Omega 1 pt + Fontelis 1.5 pt	0.8	a	1.0	15.8	ab	4.1	36.3	bc	12.7	52.8	bc	14.8	6230	741
none	Omega 1.5 pt	1.0	a	0.8	17.0	ab	10.0	20.0	c	20.5	38.0	c	26.2	6294	1220
none	Fontelis 1.5 pt	1.5	a	1.3	31.8	a	10.8	72.3	a	23.4	105.5	a	31.5	6802	1614
Omega 1 pt	Fontelis 1.5 pt	1.3	a	1.5	8.8	b	11.5	33.0	c	21.7	43.0	c	19.9	6348	982
none	none	1.0	a	2.0	19.8	ab	24.6	68.0	ab	36.7	88.8	ab	42.1	5840	610
P > F treatment		NA			0.0737			0.0119			0.003			0.6294	
1st spray Omega vs no first spray		NA			0.0044			0.3314			0.0268			0.6204	

Table 4. Incidence of Sclerotinia blight after application with Omega or no fungicide and followed by an application of Omega, Fontelis, or no fungicide averaged across Rocky Mount and Lewiston in 2014

Treatment		First rating			Second rating			Total SB			Yield/A	
1st spray	2nd spray	Mean		SD	Mean		SD	Mean		SD	Mean	SD
Omega 1 pt	none	5.6	b	3.9	29.5	c	22.9	35.9	cd	25.7	5325	427
Omega 1 pt	Omega 1 pt	8.0	b	4.8	18.8	c	6.6	27.3	d	9.6	5488	607
none	Omega 1 pt	15.3	ab	8.4	32.9	cd	15.0	48.9	bc	24.6	5157	988
none	Omega 1 pt + Fontelis 1.5 pt	10.8	ab	6.6	28.1	c	14.4	39.3	cd	20.3	5647	884
none	Omega 1.5 pt	14.8	ab	8.2	23.6	c	15.8	38.9	cd	20.7	5789	997
none	Fontelis 1.5 pt	21.4	a	13.4	51.6	a	28.2	73.8	a	41.1	5792	1529
Omega 1 pt	Fontelis 1.5 pt	7.5	b	7.8	26.8	cd	15.7	34.9	cd	15.7	5761	932
none	none	13.6	ab	17.7	47.4	ab	33.1	61.5	ab	40.9	5420	702
P>F treatment		0.0277			0.0020			0.0004			0.6595	
1st spray Omega vs no first spray		0.0014			0.0550			0.0028			0.7008	
P>F location x treatment					0.033			0.0145			0.6075	

Table 5. Omega and foliar disease control treatments in experiment 2

	Program and application dates				
Rate of Omega	**Foliar program**	**30-Jul**	**14-Aug**	**27-Aug**	**11-Sep**
None	Fontelis 1.5 pt	Provost 10 oz	**Fontelis 1.5 pt**	Provost 8 oz	**Fontelis 1.5 pt**
None	No Fontelis	Provost 10 oz	Headline 9 oz	Provost 8 oz	Bravo
1 pint/a	Fontelis 1.5 pt	Provost 10 oz	**Fontelis 1.5 pt**	Provost 8 oz	**Fontelis 1.5 pt**
1 pint/a	No Fontelis	Provost 10 oz	Headline 9 oz	Provost 8 oz	Bravo
1.5 pint/a	Fontelis 1.5 pt	Provost 10 oz	Fontelis 1.5 pt	Provost 8 oz	Fontelis 1.5 pt
1.5 pint/a	No Fontelis	Provost 10 oz	Headline 9 oz	Provost 8 oz	Bravo

Table 6. Effect of high rates of Fontelis on Sclerotinia blight when used in a foliar disease control program with and without application of Omega in 2014

Omega treatment 7/30, 8/27	**Foliar program** 8/14, 9/11	**7-Aug** [a] **Rating 1** Mean		SD	**3-Sep** [b] **Rating 2** Mean		SD	**6-Oct** [c] **Rating 3** Mean		SD	**Total SBlight** Mean		SD	**Yield/A** Mean	SD
No Omega	Fontelis 1.5 pt	12.0	a	7.0	23.0	ab	7.0	43.7	ab	10.1	78.7	ab	19.1	4347	511
No Omega	No Fontelis	12.3	a	2.4	25.5	a	10.4	69.8	a	32.5	107.5	a	39.1	4528	462
Omega 1 pt	Fontelis 1.5 pt	6.3	ab	1.5	13.0	bc	3.6	39.7	ab	11.6	59.0	bc	15.1	4855	204
Omega 1 pt	No Fontelis	4.0	b	3.5	15.0	abc	1.7	46.7	ab	8.4	65.7	bc	11.0	4780	300
Omega 1.5 pt	Fontelis 1.5 pt	3.0	b	1.7	13.3	bc	0.6	20.0	b	2.6	36.3	c	4.5	4586	304
Omega 1.5 pt	No Fontelis	7.0	ab	3.2	11.0	c	4.9	26.5	b	4.7	44.5	bc	7.7	4830	311
P>F		0.0561			0.0352			0.0212			0.0085			0.3790	
MSD		7.4			11.7			30.2			37.8			624	
Fontelis vs none		0.6543			0.6905			0.1027			0.1428			0.3992	

[a] 7 days after first Omega; before first Fontelis
[b] 7 days after second Omega; 20 days after first Fontelis
[c] 40 days after second Omega; 25 days second Fontelis

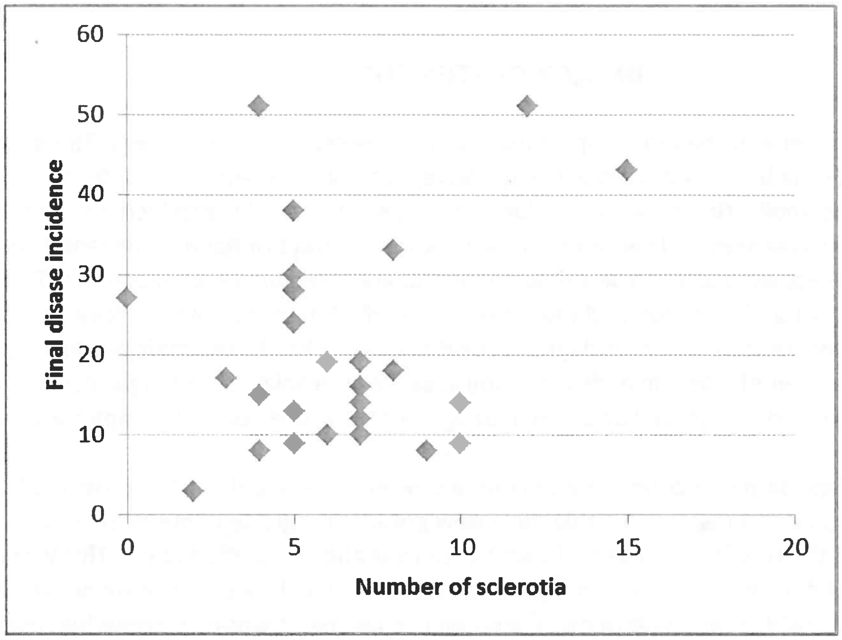

Figure 2. Relationship between the number of Sclerotia assayed and final count of diseased plants at Rocky Mount in 2013

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IMPACT STATEMENT

Issue: Sclerotinia blight is one of the most important peanut diseases in North Carolina. The primary product used for Sclerotinia blight control is very expensive, costing between about $50 and $75 per spray, depending on the application rate. In addition to being expensive, this produce is not known to control any other peanut diseases and cannot be applied within 30 days of harvest. Recently labeled group 7 fungicides have activity against Sclerotinia blight and are somewhat less expensive. They also are active against leaf spot and stem rot, and most have a PHI of 14 days. In spite of these possible advantages, growers have reported various degrees of satisfaction with these fungicides have questions about how to maximize their efficacy. In addition, a soil assay for the Sclerotinia fungus could identify risky fields so that they could be avoided or timely management practices could be implemented.

What has been done: Research was conducted to compare Sclerotinia blight control provided by the currently most used product, Omega, and a relatively new group 7 fungicide Fontelis. Several experiments compared the fungicides under different scenarios and application plans. This works showed that Fontelis performed as well as Omega under relatively low levels of disease but did not provide adequate control at higher levels of disease when used alone. It was effective when used in sequences that included Omega while also providing leaf spot and stem rot control. Soil was sampled in 2013 and 2014 from the field trials Rocky Mount to determine the relationship between the degree of Sclerotinia infestation and the amount of disease present. Only a weak relationship between the number of sclerotia and initial disease incidence was found ($r = .24$; $P=.233$; figure2). The variability in number of sclerotia was low relative to variability in disease. This may indicate that the current assay is not accurate or sensitive enough to pick up differences in numbers of sclerotia.

Impact: This research will help peanut growers to select the best approaches for Sclerotinia blight control under various scenarios and levels of risk. This will result in efficient use of crop protection materials while protecting peanut yield and value.

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