2012–2016 On-Farm Evaluation of Fungicide Programs for Peanut Disease Control in Hamilton County, Florida[1]

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This document summarizes the efficacy of company-based Peanut Rx programs utilizing on-farm demonstrations. These on-farm demonstrations were conducted in Hamilton County from 2012 to 2016. The peanut fungal diseases of interest included early leaf spot (*Cercospora arachidicola*), late leaf spot (*Cercosporidium personatum*), and white mold/stem rot (*Sclerotium rolfsii*). Spray schedules were based on BASF®, Bayer®, DuPont®, Nichino®, and Syngenta® Peanut Rx prescription program recommendations. More information about Peanut Rx programs (Kemerait et al. 2017) can be found at the Georgia Peanut Commission website (http://www.gapeanuts.com/) by clicking on the UGA Peanut Update link.

Fungicide Treatments and Application Schedules

Peanut Rx fungicide prescription programs were based on individual company recommendations during each respective year as shown in Tables 1 to 5. Companies often include products in their programs that were developed by other companies that have become established as industry standard options. Prescription programs generally differ by company and often incorporate newer products developed by the respective company that are expected to be the most effective for managing primary diseases. Programs may also differ by application timing and frequency of certain products due to recommendations or product restrictions.

All treatments are listed by product names, except for certain applications of products with the active ingredients (a.i.) chlorothalonil and tebuconazole. When listed by a.i., applications were one of several generic or name brand formulations as shown in Table 6. All other a.i. can also be found in Table 6.

Growing Conditions and Experimental Design

All demonstrations were conducted on a commercial producer's farm located in Hamilton County, Florida. Each demonstration was conducted at a different field each season. Some fields were used more than once but not consecutively. The peanut demonstrations were planted either behind green beans or carrots that had been fumigated prior to vegetable planting or behind field corn. The peanut cultivar 'Georgia-06G' was planted on 15 May 2012, 22 May 2013, 21 Apr 2014, 25 May 2015, and 24 May 2016 at 7 seeds per foot in single rows with 30" spacing. A rhizobium inoculant was applied at planting. Plants were irrigated as needed, and standard UF/IFAS recommended practices for peanut production were used to manage weeds, insects, and fertility (see *Management and Cultural Practices for Peanuts* http://edis.ifas.ufl.edu/aa258). Total monthly rainfall and average monthly temperatures by season were obtained from the Florida Automated Weather Network (FAWN)

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station at the Suwannee Valley Agricultural Extension Center (SVAEC) in Live Oak (Figures 1 and 2).

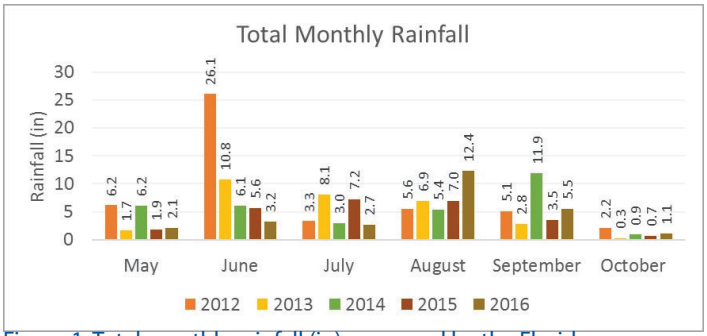

Figure 1. Total monthly rainfall (in) measured by the Florida Automated Weather Network (FAWN) station at the UF/IFAS Suwannee Valley Agricultural Extension Center (SVAEC) in Live Oak.

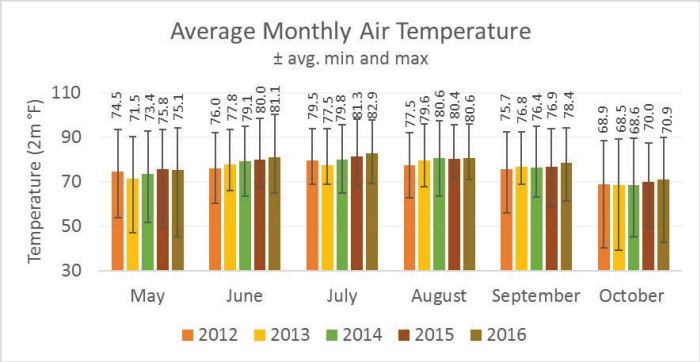

Figure 2. Average monthly air temperature (2m °F) measured by the Florida Automated Weather Network (FAWN) station at the UF/IFAS Suwannee Valley Agricultural Extension Center (SVAEC) in Live Oak. Bars represent ± monthly average minimum and maximum temperature. Numbers represent the monthly means.

The Peanut Rx fungicide programs compared each year are listed by company in Tables 1 to 5. Untreated field sections were not included because of the impact this may have on commercial production. A 400-gallon sprayer was used to apply volumes of 20 gallons per acre using a 24-row boom with a three-point hitch and TwinJet 8004VS flat fan nozzles with 30-in spacing. To integrate a replicated on-farm demonstration with the least amount of difficulty to the producer, the demonstration consisted a 24-row passe for each of four replications per program treatment. Depending on the length of rows, these four replications normally covered a total of 10 acres. With 4 programs to compare, the total for each of the demonstrations consisted of approximately 40 acres per season.

Peanuts were dug on 26 Sep 2012, 7 Oct 2013, 18 Sep 2014, 10 Oct 2015, and 13 Oct 2016 and harvested on 29 Sep 2012, 11 Oct 2013, 22 Sept 2014, 15-16 Oct 2015, and 19-20 Oct 2016 with 6-row equipment. The 12 rows in the center of each 24-row replication were harvested and weighed separately from the 12-row buffers between each plot. Each replication was harvested and collected separately in trailers provided by the local peanut buying point (Suwannee River Peanut Co., Jasper, FL). The trailers were then treated as other producer trailers and dried to 10% moisture, graded by state inspectors, and weighed to determine yield.

Summary of Results

- Low disease levels were present throughout the demonstrations with white mold incidence <10% and general leaf spot severity <25%.
- Peanut Rx programs did not differ significantly in their yields during the 2012, 2014 and 2016 seasons, however, the 2013 and 2014 Syngenta® programs had significantly lower yields than the 2013 Dupont®, and 2015 Bayer®/BASF® programs (Table 7).
- Syngenta programs produced significantly higher market prices than the Bayer® and Nichino® programs in 2013, and Dupont® and Nichino® programs in 2012 (Table 8). No other market price differences were observed.
- Expenses for the fungicide products alone did not exceed crop value per acre and therefore always resulted in a positive return on investment (Table 9).
- In general, there were no differences in the estimated net returns except for a few treatments in 2015 and 2016 (Table 9).

Conclusion

Managing peanut diseases is a critical component of any peanut production system. These on-farm demonstrations show that despite all the factors affecting peanut diseases, they can be managed successfully with our current Peanut Rx programs. While some variation in how the programs perform from year to year exists, they all continue to provide a quality disease control with positive returns on investment. We intend to continue examining these company based programs with on-farm demonstrations to monitor their efficacy and the impacts of novel products on disease management.

Reference

Kemerait, R., A. Culbreath, E. Prostko, T. Brenneman, S. Tubbs, R. Srinivasan, M. Abney, S. Monfort, A. Rabinowitz, B. Tillman, N. Dufault, D. Rowland, M. Mulvaney, A. Hagan, J. Sarver, D. Anco, and N. Smith. 2017. *Minimizing Diseases of Peanut in the Southeastern United States.* 2017 UGA Peanut Update. http://www.gapeanuts.com/grower-info/2017_ugapeanutupdate.pdf.

Table 1. Hamilton County on-farm trial Bayer® Peanut Rx fungicide program schedules by year and number of days after planting (DAP) that the fungicides were applied. (See table 6 for active ingredients.)

DAP	0	35 to 39	51 to 53	60 to 67	75 to 81	90 to 98	104 to 113	118 to 127
Year	In-furrow	1	2	3	4	5	6	7
2012		**Proline** (5.7 fl oz/a)		**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
2013	**Proline** (5.7 fl oz/a)			**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
2014	**Proline** (5.7 fl oz/a)		**Provost 433** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
2015	**Proline** (5.7 fl oz/a)	**TiltBravo** (24 fl oz/a) +	**Provost 433** (10.7 fl oz/a)	**Provost 433** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**Provost** (10.7 fl oz/a)	**TiltBravo** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
		tebuconazole (38.7%) (7.2 fl oz/a)						
2016	**Proline** (5.7 fl oz/a) +	**chlorothalonil (54%)** (24 fl oz/a)		**Provost Opti** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a) +	**Provost Opti** (10.7 fl oz/a)	**Provost Opti** (10.7 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
	Abound (18 fl oz/a)							

Table 2. 2013 Hamilton County on-farm trial company Peanut Rx fungicide program schedules by date and number of days after planting (DAP) that the fungicides were applied. Planting date: 22 May.

DAP	0	35 to 39	48 to 53	60 to 67	75 to 80	90 to 98	104 to 113	118 to 127
Year	In-furrow	1	2	3	4	5	6	7
2012		**Abound** (18 fl oz/a) +		**Abound** (18 fl oz/a)	**tebuconazole (38.7%)** (7.2 fl oz/a)	**Abound** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)	**Bravo WS** (24 fl oz/a)
		Bravo WS (24 fl oz/a)						
2013	**Proline** (5.7 fl oz/a)		**Bravo WS** (24 fl oz/a) +	**Abound** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)	**Abound** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)	**Bravo WS** (24 fl oz/a)
			Monsoon (7.2 fl oz/a)					
2014	**Proline** (5.7 fl oz/a)		**Bravo WS** (24 fl oz/a) +	**Bravo WS** (24 fl oz/a) +	**Abound** (18 fl oz/a) +	**Bravo WS** (24 fl oz/a)	**Abound** (18 fl oz/a) +	**Bravo WS** (24 fl oz/a)
			Monsoon (7.2 fl oz/a)	**Monsoon** (7.2 fl oz/a)	**Alto** (5.5 fl oz/a)		**Alto** (5.5 fl oz/a)	
2015	**Proline** (5.7 fl oz/a)	**TiltBravo** (24 fl oz/a) +	**TiltBravo** (24 fl oz/a)	**Abound** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)	**Abound** (18 fl oz/a)	**TiltBravo** (24 fl oz/a)	**Bravo WS** (24 fl oz/a)
		tebuconazole (38.7%) (7.2 fl oz/a)		**Alto** (5.5 fl oz/a)		**Alto** (5.5 fl oz/a)		
2016 (without Proline)	**Abound** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)		**Elatus** (9.5 oz/a)	**Bravo WS** (24 fl oz/a)	**Elatus** (9.5 oz/a)	**Bravo WS** (24 fl oz/a) +	**Bravo WS** (24 fl oz/a)
							Alto (5.5 fl oz/a)	
2016 (with Proline)	**Abound +** (18 fl oz/a)	**Bravo WS** (24 fl oz/a)		**Elatus** (9.5 oz/a)	**Bravo WS** (24 fl oz/a)	**Elatus** (9.5 oz/a)	**Bravo WS** (24 fl oz/a) +	**Bravo WS** (24 fl oz/a)
	Proline (5.7 fl oz/a)						**Alto** (5.5 fl oz/a)	

Table 3. Hamilton County on-farm trial Dupont® Peanut Rx fungicide program schedules by year and number of days after planting (DAP) that the fungicides were applied. (See table 6 for active ingredients.)

DAP	0	37 to 39	48 to 51	60 to 67	75 to 80	90 to 94	104 to 107	118 to 127
Year	In-furrow	1	2	3	4	5	6	7
2012			**Headline** (9 fl oz/a)	**Fontelis** (16 fl oz/a)	**Fontelis** (16 fl oz/a)	**Fontelis** (16 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
2013	**Proline** (5.7 fl oz/a)		**Headline** (9 fl oz/a)	**Fontelis** (16 fl oz/a)	**Fontelis** (16 fl oz/a)	**Fontelis** (16 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
2015	**Proline** (5.7 fl oz/a)	**TiltBravo** (24 fl oz/a) +	**Fontelis** (18 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**Fontelis** (18 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**Fontelis** (12 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
		tebuconazole (38.7%) (7.2 fl oz/a)						
2016	**Abound +** (18 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a) +		**Fontelis** (18 fl oz/a)	**Fontelis** (18 fl oz/a)	**Fontelis** (18 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
	Proline (5.7 fl oz/a)	**tebuconazole (38.7%)** (7.2 fl oz/a)						

Table 4. Hamilton County on-farm trial Nichino® Peanut Rx fungicide program schedules by year and number of days after planting (DAP) that the fungicides were applied. (See table 6 for active ingredients.)

DAP	0	48 to 53	63 to 66	78 to 81	91 to 98	104 to 113	118 to 127
Year	In-furrow	2	3	4	5	6	7
2012		**Headline** (9 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
			Artisan (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	
2013	**Proline** (5.7 fl oz/a)	**Headline** (9 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%)** (24 fl oz/a)
			Artisan (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	
2014	**Proline** (5.7 fl oz/a)	**Headline** (9 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a)	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%) +** (16 fl oz/a) +	**chlorothalonil (54%)** (24 fl oz/a)
			Artisan (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	**Artisan** (16 fl oz/a)	

Table 5. Hamilton County on-farm trial BASF® Peanut Rx fungicide program schedules by date and number of days after planting (DAP) that the fungicides were applied. (See table 6 for active ingredients.)

DAP	0	37	51 to 53	66 to 67	80 to 81	94 to 98	107 to 113	123 to 127
Year	In-furrow	1	2	3	4	5	6	7
2014	**Proline** (5.7 fl oz/a)		**Priaxor** (6 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**Priaxor** (6 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
				Monsoon (7.2 fl oz/a)		**Monsoon** (7.2 fl oz/a)	**Monsoon** (7.2 fl oz/a)	
2015	**Proline** (5.7 fl oz/a)	**TiltBravo +** (24 fl oz/a)	**Priaxor** (6 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**Priaxor** (8 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**chlorothalonil (54%) +** (24 fl oz/a)	**chlorothalonil (54%)** (24 fl oz/a)
		tebuconazole (38.7%) (7.2 fl oz/a)		**tebuconazole (38.7%)** (7.2 fl oz/a)		**tebuconazole (38.7%)** (7.2 fl oz/a)	**tebuconazole (38.7%)** (7.2 fl oz/a)	

Table 6. List of fungicides included in the on-farm trials in Hamilton County, Florida.

FRAC Group[a]	Active Ingredient	Product Name	Manufacturer
M5 Multi-site contact activity	chlorothalonil (54.0 %)	Bravo Weather Stik®	Syngenta® Crop Protection, LLC
	chlorothalonil (54.0 %)	Generic formulations (Echo® 720, Chloronil® 720)	SipcamAdvan; Syngenta® Crop Protection, LLC
3 DMI (DeMethylation Inhibitors)	prothioconazole (41%)	Proline® 480 SC	Bayer® CropScience LP
	tebuconazole (25.8%) + prothioconazole (12.9%)	Provost® 433 SC, Provost® Opti	Bayer® CropScience LP
	tebuconazole (38.7%)	Generic formulations (TebuStar® 3.6 L, Monsoon® 3.6 L)	Albough, LLC; Loveland Products, Inc.
	cyproconazole (8.9%)	Alto® 100 SL	Syngenta® Crop Protection, LLC
7 SDHI (Succinate Dehydrogenase Inhibitors)	penthiopyrad (20.4%)	Fontelis®	DuPont® Crop Protection
11 QoI (Quinone outside inhibitors)	azoxystrobin (22.9%)	Abound®	Syngenta® Crop Protection, LLC
	pyraclostrobin (23.6%)	Headline®	BASF®
Mixed FRAC Groups			
3 + M5	propiconazole (2.9%) + chlorothalonil (38.5%)	Tilt Bravo™ SE[b]	Syngenta® Crop Protection, LLC
3 + 7	flutolanil (32%) + propiconazole (6%)	Artisan®[b]	Nichino America®, Inc
11 + 7	azoxystrobin (30%) + benzovindiflupyr (15%)	Elatus®	Syngenta® Crop Protection, LLC
11 + 7	pyraclastrobin (28.58%) + fluxapyroxad (14.33%)	Priaxor® Xemium®	BASF®

[a] FRAC is an acronym for the Fungicide Resistance Action Committee. More information can be found at www.frac.info
[b] Propiconazole should not be used if the peanuts will be shipped at any point to the European Union. Contact your local UF/IFAS Extension office for more information.

Table 7. Summary of yields (lb/A) by company Peanut Rx program.

Peanut Rx Program	2012	2013[a]	2014	2015[a]	2016
BASF	--	--	6645	6363 a	--
Bayer	4335	5295 ab	6412	6409 a	5645
DuPont	4147	5767	--	6248 ab	5767
Nichino	4052	5677 ab	6481	--	--
Syngenta A-C[b]	3963	5260 b	6555	6010 b	5484
Syngenta C[c] (without Proline)	--	--	--	--	5769
Mean	4124	5500	6523	6258	5666
P-value	0.276	0.087	0.910	0.097	0.205
MSE	69841	57007	219848	44478	38744

[a] Means followed by the same letter are not significantly different according to Fisher's Least Significant Difference (LSD) test (α=0.05). 2013: LSD = 478 lbs/A; 2015: LSD = 337 lbs/A.
[b] Syngenta programs varied between years where the main sprays were Abound and tebuconazole in 2012–2013 (A), Abound + Alto and tebuconazole in 2014–2015 (B), and Elatus in 2016 (C).
[c] Syngenta program in 2016 (C) without Proline applied in-furrow at plant.

Table 8. Summary of market price ($) per ton based on grade.[a]

Peanut Rx Program	2012			2013			2014		2015		2016	
	Grade	Price ($)[b]		Grade	Price ($)[b]		Grade	Price ($)	Grade	Price ($)	Grade	Price ($)
BASF	--			--			75/4	367.53	77/3	374.09	--	
Bayer	76/5	373.91	ab	77/3	376.12	bc	75/4	367.53	75/5	368.80	76/3	368.56
DuPont	74/5	367.31	b	78/3	382.11	ab	--		76/3	368.76	75/4	367.20
Nichino	75/5	369.39	b	76/4	375.44	c	76/4	369.94	--		--	
Syngenta A-C[c]	78/3	383.98	a	79/3	386.50	a	75/4	368.23	76/4	370.32	75/3	366.50
Syngenta C[d] (without proline)	--			--			--		--		76/3	368.56
Mean		373.65			380.04			368.31		370.49		367.71
P-value		0.099			0.019			0.880		0.470		0.899
MSE		78.01			11.05			23.11		27.37		21.88

[a] Grades are shown as rounded averages of percent total sound mature kernals (smk)/percent other kernals (ok).
[b] Mean market price ($) per ton followed by the same letter are not significantly different according to Fisher's Least Significant Difference (LSD) test (α=0.05). 2012: LSD = $14.13/ton; 2013: LSD = $6.64/ton.
[c] Syngenta programs varied between years where the main sprays were Abound and tebuconazole in 2012–13 (A), Abound + Alto and tebuconazole in 2014–15 (B), and Elatus in 2016 (C).
[d] Syngenta program in 2016 (C) without Proline.

Table 9. Summary of net returns ($/A) as value[a] per acre minus fungicide costs.[b]

Peanut Rx Program	2012	2013	2014	2015[c]		2016[b]	
BASF	--	--	1115.49	1071.89	a	--	
Bayer	704.11	888.90	1066.20	1072.56	a	914.60	ab
DuPont	617.85	966.69	--	1034.94	ab	918.98	ab
Nichino	651.99	943.71	1076.83	--		--	
Syngenta A-C[d]	696.27	903.46	1069.76	990.47	b	871.69	b
Syngenta C[e] (without Proline)	--	--	--	--			a
Mean	**667.56**	**925.69**	**1082.07**	**1042.46**		**915.14**	
P-value	**0.107**	**0.26**	**0.86**	**0.082**		**0.095**	
MSE	**2572**	**2231**	**8292**	**1953**		**1623**	

[a] Value based on yield (lbs/A) and market price ($/ton).
[b] The fungicide costs used to calculate net returns are only estimates and not fixed costs. Costs may be decreased from year to year and may be different depending on prices set by chemical distributors.
[c] Means followed by the same letter are not significantly different according to Fisher's Least Significant Difference (LSD) test (α=0.05). 2015: LSD = $70.69/A. 2016: LSD = $64.43/A.
[d] Syngenta programs varied between years where the main sprays were Abound and tebuconazole in 2012–2013 (A), Abound + Alto and tebuconazole in 2014–2015 (B), and Elatus in 2016 (C).
[e] Syngenta program in 2016 (C) without Proline.