

**Title: Effects of Tank-mixing Herbicides with Fungicides on Weed Control and Disease Development****Personnel and Agency:**

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**Summary.** This was the culmination of a 3-year research project on the effects of tank-mixing commonly used grass (Select, Poast Plus) or broadleaf herbicides (Cobra, Ultra Blazer, Pursuit, Cadre, or 2,4-DB) with some of the newer fungicides (Endura, Folicur, Headline, Omega, or Provost) on weed and disease control in peanut. Postemergence weed control and foliar and/or soil-borne disease control are major issues for peanut growers across the state. Requests from peanut growers about the possibility of mixing postemergence herbicides with a foliar fungicide seem to increase every year because of the need to reduce field operations in order to reduce fuel costs. Also, many growers are asking about the possibility of increasing herbicide rates to offset the possibility of antagonism when using these tank-mixes. Earlier work in different peanut growing regions has shown some antagonism with respect to weed control when herbicides has been tank-mixed with a fungicide and it has been suggested that herbicide and fungicide sprays be separated by approximately 2 to 3 days. Increased trips through the field mean an increase in operation costs as well as an increase in time requirements during a busy part of the year. Prior to this research, little work has been done on tank-mixing the newer fungicides that have come on the market in the past few years with various postemergence herbicides. Most labels do not contain adequate information on tank-mix partners because of the extensive herbicide/fungicide possibilities and suggest that users perform jar tests for physical compatibility only. This type of testing does not provide the necessary information on weed control or disease antagonism.

A summary of the three years of testing have shown that some peanut injury (leaf burn) was noted when certain herbicides such as Cobra or Ultra Blazer were applied in combination with any of the fungicides. Typically, this leaf burn was no more than the herbicides applied alone and in many instances was less than the herbicide alone. Peanut leaf chlorosis and necrosis are common when using Cobra or Ultra Blazer alone. This injury is usually evident for several weeks after application on older tissue and subsequent new growth does not show the effects of the herbicide application. In 2010, leaf burn was noted when Headline was applied alone and this was probably due to the use of a crop oil concentrate (Agridex). In previous years, no adjuvant was included with fungicide alone applications. In two of the three years, reduced leaf spot efficacy was found when either Ultra Blazer was applied in combination with Folicur or Provost or Cadre were applied in combination with Headline. No antagonism was noted for control of annual grasses, smellmelon, or pitted morningglory; however, some antagonism with respect to Palmer amaranth control was noted when Blazer or Cobra were tank-mixed with the fungicides.

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TITLE:

Effects of Tank-Mixing Herbicides with Fungicides on Weed Control and Disease Development in Peanut, 2008. AG-CARES, Lamesa, TX; Texas AgriLife Research Site, Yoakum, TX.

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MATERIALS AND METHODS:

Plot Size:

Yoakum- 2 rows by 20 to 25 feet, 3 replications  
Lamesa- 2 rows by 30 feet, 3 replications  
Stephenville-2 rows by 25 feet, 3 replications

Soil Type:

Yoakum-Denhawken sandy loam  
Lamesa-Amarillo fine sandy loam  
Stephenville-Windthorst fine sandy loam

Planting Date:

Yoakum (weed control studies)-June 16  
Yoakum (disease studies)-June 16  
Halfway-May 1  
Lamesa-April 30  
Stephenville-May 28

Variety:

Yoakum-Tamrun OL02  
Halfway/Lamesa/Stephenville-Flavorrunner 458

Application Dates

Yoakum-Broadleaf weed study: June 21  
Grass study: June 17  
Disease study: August 26  
Halfway-June 9  
Lamesa-June 10  
Stephenville-July 31

Rainfall:

Yoakum (June to October)-7.7 inches  
Halfway (May to October)-12.64 inches  
Lamesa (May to October)-15.92 inches  
Stephenville (May to October)-8.78 inches

Irrigation:

Yoakum (June to October)-7.5 inches  
Halfway (May to October)-  
Lamesa (May to October)-12.4 inches  
Stephenville (May to October)-21.75 inches

Digging Dates:

Yoakum-October 10  
Lamesa-October 27  
Stephenville-October 27

Harvest Dates:

Yoakum-October 20  
Lamesa-November 5  
Stephenville-November 6

INTRODUCTION:

Postemergence weed control and foliar and/or soil-borne disease control are major issues for peanut growers across the state. Requests for information by peanut growers about the possibility of mixing a postemergence herbicide with a foliar fungicide seem to increase each year because of the need to reduce field operations in order to reduce fuel costs. With the increasing costs involved in peanut production, any input cost savings might be the difference between a profit and a loss. Combining a fungicide and herbicide in a tank mixture and making one application rather than two applications may be a way to reduce input costs. Earlier work in different peanut growing regions has shown some antagonism with respect to weed control when a herbicide has been tank-mixed with a fungicide and it has been suggested that herbicide and fungicide sprays be separated by 2 to 3 days to reduce the chance of antagonism. Little or no work has been done on tank-mixing newer fungicides that have come on the market in the past few years with various postemergence herbicides that are presently on the market. Most labels do not contain adequate information on tank-mix partners because of the extensive herbicide/fungicide possibilities and suggests that users perform jar tests for physical compatibility only. This type of testing does not provide the necessary information on weed control or disease antagonism. The objectives of these studies were to evaluate possible weed and disease control antagonisms as well as peanut response to herbicide and fungicide combinations.

RESULTS AND DISCUSSION:

**Weed Control.** *Palmer amaranth.* At Halfway, Cobra or Ultra Blazer alone or in combination with the fungicides Headline, Folicur, or Provost failed to control (< 30%) Palmer amaranth (Table 1). Pursuit alone or in combination with fungicides controlled Palmer amaranth 75 to 82% while Cadre alone or in combination controlled at least 94% Palmer amaranth. Control of Palmer amaranth with 2,4-DB alone or in combination with Headline or Folicur varied from 83 to 88%. However, the combination of 2,4-DB and Provost did result in antagonism with only 30% Palmer amaranth control. At Yoakum, Cobra, Cadre, or 2,4-DB alone or in combination with any of the fungicides did not result in reduced control of Palmer amaranth (Table 1). However, either Ultra Blazer or Pursuit plus Headline and Pursuit plus Headline resulted in reduced Palmer amaranth control from either of the herbicides alone.

*Volunteer sorghum.* No difference in volunteer sorghum control was noted with Pursuit or Cadre applied alone or in combination with any of the fungicides (Table

1). With both Select and Poast Plus, the addition of Headline and Folicur reduced sorghum control compared with either herbicide alone or in combination with Provost (Table 3).

*Smellmelon.* Cobra, Ultra Blazer, Cadre, and 2,4-DB alone or in combination with fungicides provided at least 97% control of smellmelon (Table 1). Pursuit alone controlled smellmelon only 79% while Pursuit in combination with any of the fungicides provided at least 90% control.

*Pitted morningglory.* All herbicides alone or in combination with Headline, Folicur, or Provost controlled pitted morningglory at least 90% with the exception of Cobra plus Headline which resulted in 79% control (Table 1).

*Broadleaf signalgrass.* Select and Poast Plus alone or in combination with Headline, Folicur, or Provost controlled signalgrass 96 to 99% (Table 3).

**Leafspot.** Early leafspot was the predominant species at Lamesa while only early leafspot was present at Yoakum. At Lamesa, leafspot pressure was extremely light while at Yoakum leafspot pressure was moderately heavy. When fungicides were applied in combination with broadleaf herbicides at Lamesa, none of the fungicide-herbicide combinations were different from the untreated check (Florida scale: 2.8) (Table 2). None of the fungicide-herbicide combinations resulted in greater leafspot than the respective fungicide alone. At Yoakum, all fungicide-herbicide combinations resulted in less leafspot than the untreated check (Florida scale: 6.8) (Table 2). When the individual fungicides ratings were compared with fungicide-herbicide combinations, Headline plus Cobra or Cadre and Provost plus Ultra Blazer resulted in higher leafspot ratings than either Headline or Provost alone.

At Lamesa and Yoakum, similar results as seen with the broadleaf herbicides were seen when fungicides were applied in combination with the grass herbicides, Poast Plus and Select (Table 3). The combination of Headline plus Poast Plus did result in greater leafspot pressure than Headline alone.

At Stephenville, no differences in leafspot control were noted between the untreated check and any fungicide treatment alone or in combination with either grass herbicide (Table 4). Omega and Endura have no activity against leafspot.

**Southern Blight.** Southern blight disease pressure was only present at the Yoakum location and was considered light. When fungicides were applied in combination with broadleaf herbicides, all fungicide-herbicide combinations, with the exception of Headline plus 2,4-DB, produced no more disease than the respective fungicide alone (Table 2). When fungicides were applied in combination with grass herbicides, all fungicide-herbicide combinations resulted in no more southern blight than the respective fungicide alone (Table 3).

**Sclerotinia Blight.** The untreated check or grass herbicides alone resulted in at least 33% infection by sclerotinia blight (Table 4). Omega or Endura alone produced 26 and 14.7% sclerotinia blight infection, respectively. Endure or Omega in combination with Select resulted in 15 to 20% sclerotinia blight infection while Poast Plus in combination with these fungicides resulted in 19 to 27% infection.

**Peanut Injury.** When broadleaf herbicides were evaluated, at Halfway only Pursuit and Cadre alone and in combinations and the fungicides alone did not cause any peanut injury (Table 1). Similar results were noted at Yoakum. Under weedfree conditions, at Lamesa, when rated 2 weeks after treatment (WAT), all treatments, with the exception of Pursuit alone, Pursuit plus Headline or Folicur, Cadre alone or in combination with Headline, and Headline or Folicur alone resulted in significant peanut injury when compared with the untreated check (Table 2). When rated 14 WAT, Cobra or Ultra Blazer alone, Cobra, Pursuit, Cadre, or 2,4-DB plus Provost, and 2,4-DB plus Headline resulted in greater peanut injury than the untreated check. At Yoakum, when rated 2 days after treatment, Cobra alone or in combination with either Folicur or Provost, and Ultra Blazer or 2,4-DB alone or in combination with any fungicides resulted in significant peanut injury when compared with the untreated check (Table 2). Similar results were noted when rated 2 WAT. When grass herbicides were evaluated, no peanut injury was noted at Yoakum while at Lamesa, Select plus either Folicur or Provost and Poast Plus in combination with any of the fungicides resulted in significant peanut injury when compared with the untreated check (Table 3).

**Peanut Yield.** Peanut yields were low at Yoakum due to damage from deer and other wildlife. Yields were erratic due to this damage and none of the treatments were different from the untreated check (Tables 2 and 3). At Lamesa, when broadleaf herbicides were evaluated, yield from the untreated check was over 5700 lbs/A (Table 2). Peanut yields were reduced from the untreated check when Cobra was applied alone or in combination with Folicur, Ultra Blazer in combination with Headline, or Cadre in combination with Provost (Table 2). When grass herbicides were evaluated at Lamesa, the untreated check yielded slightly less than 5400 lbs/A (Table 3). No differences from the untreated check or within any herbicide treatments were noted. At Stephenville, no differences in peanut yields were noted between any fungicide treatments and the untreated check (Table 4). Initial fungicide applications were made approximately 60 days after planting and the sclerotinia infestation did not occur until much later in the growing season. Therefore, although there was differences in percent infection between plots that received a fungicide and those that did not, there were no yield differences.

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Table 1. Broadleaf weed control and peanut response to herbicide-fungicide combinations in south Texas and the Texas High Plains.

Treatments <sup>b</sup>		Weeds <sup>a</sup>									
		Palmer amaranth		Volunteer sorghum		Smellmelon		Pitted morningglory		Peanut injury <sup>c</sup>	
Herbicide and rate/A	Fungicide and rate/A	Halfway	Yoakum	Halfway	Yoakum	Halfway	Yoakum	Halfway	Yoakum	Halfway	Yoakum
0	0	0	0	0	0	0	0	0	0	0	0
Cobra 12.5 oz/A	0	22	92	0	99	96	96	5	10		
Cobra 12.5 oz/A	Headline 15.0 oz/A	17	100	0	97	79	79	5	2		
Cobra 12.5 oz/A	Folicur 7.2 oz/A	17	93	0	100	99	99	5	12		
Cobra 12.5 oz/A	Provost 8.0 oz/A	17	93	0	99	100	100	5	12		
Ultra Blazer 1.5 pt/A	0	25	97	0	98	93	93	5	5		
Ultra Blazer 1.5 pt/A	Headline 15.0 oz/A	18	80	0	99	98	98	5	4		
Ultra Blazer 1.5 pt/A	Folicur 7.2 oz/A	18	85	0	99	98	98	5	6		
Ultra Blazer 1.5 pt/A	Provost 8.0 oz/A	30	97	0	99	90	90	5	7		
Pursuit 4.0 oz/A	0	77	100	99	79	97	97	0	0		
Pursuit 4.0 oz/A	Headline 15.0 oz/A	75	86	99	90	99	99	0	2		
Pursuit 4.0 oz/A	Folicur 7.2 oz/A	80	93	98	96	93	93	0	0		

Pursuit 4.0 oz/A	Provost 15.0 oz/A	82	98	98	98	99	98	99	0	0
Cadre 4.0 oz/A	0	96	97	100	98	97	100	97	0	0
Cadre 4.0 oz/A	Headline 15.0 oz/A	94	99	100	99	97	100	97	0	0
Cadre 4.0 oz/A	Folicur 7.2 oz/A	94	93	100	97	99	100	99	0	0
Cadre 4.0 oz/A	Provost 15.0 oz/A	94	99	100	99	99	100	99	0	0
2,4-DB 1.6 pt/A	0	88	96	0	99	100	0	100	3	0
2,4-DB 1.6 pt/A	Headline 15.0 oz/A	86	87	0	99	100	0	100	3	3
2,4-DB 1.6 pt/A	Folicur 7.2 oz/A	83	97	0	97	100	0	100	3	0
2,4-DB 1.6 pt/A	Provost 15.0 oz/A	30	100	0	99	100	0	100	3	1
0	Headline 15.0 oz/a	0	0	0	0	0	0	0	0	0
0	Folicur 7.2 oz/A	0	0	0	0	0	0	0	0	0
0	Provost 15.0 oz/A	0	0	0	0	0	0	0	0	0
LSD (0.05)		19	11	1	9	14	1	14	2	3

<sup>a</sup> Weed control ratings taken approximately 4 wks after treatment.

<sup>b</sup> Agridex at 1.0% v/v added to all treatments.

<sup>c</sup> Peanut injury consisted of spotting of leaves with chlorotic and necrotic areas. Ratings taken 3 days after treatment at Halfway and 15 days after treatment at Yoakum.

Table 2. Peanut disease and peanut response to combinations of broadleaf herbicides and fungicides in south Texas and the Texas High Plains.

Treatments <sup>a</sup>		Leafspot <sup>b</sup>		Target sites	Peanut injury <sup>c</sup>						Yield	
Herbicide and rate/A	Fungicide and rate/A	Lamesa	Yoakum	No./50 ft	Lamesa		Yoakum		%	Lamesa	Yoakum	Lbs/A
		16 WAT <sup>d</sup>	8 WAT		2 WAT	14 WAT	2 DAT	2 WAT				
0	0	2.8	6.8	6.2	0	0	0	0	0	5724	1663	
Cobra 12.5 oz/A	0	2.6	5.5	2.9	10	7	20	6	4983	1662		
Cobra 12.5 oz/A	Headline 15.0 oz/A	2.3	3.5	2.0	4	3	2	0	5202	2179		
Cobra 12.5 oz/A	Folicur 7.2 oz/A	3.1	4.5	1.7	12	3	18	6	4936	1682		
Cobra 12.5 oz/A	Provost 8.0 oz/A	2.7	3.3	2.0	10	5	12	4	5255	2206		
Ultra Blazer 1.5 pt/A	0	2.8	6.9	2.3	5	4	20	7	5175	2069		
Ultra Blazer 1.5 pt/A	Headline 15.0 oz/A	2.5	3.2	2.0	5	3	6	1	4907	1634		
Ultra Blazer 1.5 pt/A	Folicur 7.2 oz/A	2.8	4.0	1.3	9	3	15	4	5249	1537		
Ultra Blazer 1.5 pt/A	Provost 8.0 oz/A	3.3	4.2	0.7	9	3	16	7	5140	1805		
Pursuit 4.0 oz/A	0	3.0	6.0	1.5	0	1	0	0	5367	1337		
Pursuit 4.0 oz/A	Headline 15.0 oz/A	3.1	3.0	1.7	0	2	0	0	5507	1379		
Pursuit 4.0 oz/A	Folicur 7.2 oz/A	3.0	4.0	2.1	0	0	0	0	5186	1761		



Pursuit 4.0 oz/A	Provost 15.0 oz/A	2.8	3.0	2.4	4	1	0	0	0	5358	1334
Cadre 4.0 oz/A	0	2.6	6.3	1.7	0	2	1	0	0	5089	1615
Cadre 4.0 oz/A	Headline 15.0 oz/A	2.2	3.8	1.7	0	2	0	0	0	5613	1837
Cadre 4.0 oz/A	Folicur 7.2 oz/A	2.9	3.3	1.3	10	2	3	0	0	5247	1295
Cadre 4.0 oz/A	Provost 15.0 oz/A	2.3	3.5	2.0	10	5	0	0	0	4875	1859
2,4-DB 1.6 pt/A	0	3.3	7.0	3.0	5	2	0	0	0	5267	1380
2,4-DB 1.6 pt/A	Headline 15.0 oz/A	2.9	3.0	4.9	12	4	5	5	5	5629	1393
2,4-DB 1.6 pt/A	Folicur 7.2 oz/A	2.6	4.0	3.4	6	3	12	1	1	5114	2381
2,4-DB 1.6 pt/A	Provost 15.0 oz/A	2.4	3.5	3.2	12	4	7	4	4	5199	1347
0	Headline 15.0 oz/a	2.8	2.5	1.7	0	1	0	0	0	5597	2378
0	Folicur 7.2 oz/A	3.0	3.7	1.7	0	0	0	0	0	5769	1584
0	Provost 15.0 oz/A	3.3	3.0	2.7	1	0	0	0	0	5796	1857
LSD (0.05)		0.8	1.0	2.5	1	4	4	2	2	736	672

<sup>a</sup> Agridex at 1.0 % v/v added to all treatments.

<sup>b</sup> Florida scale: 0=no disease, 10=plants dead.

<sup>c</sup> Peanut injury consisted of spotting of leaves with chlorotic and necrotic areas. Rating scale: 0=no injury, 100=complete spotting resulting in plant death.

<sup>d</sup> Abbreviations: WAT, weeks after treatment; DAT, days after treatment.

Table 3. Grass control, peanut response, and disease control with herbicide-fungicide combinations in south Texas and the Texas High Plains.

Herbicide and rate/A	Treatments <sup>a</sup>	Weeds <sup>b</sup>		Peanut injury <sup>c</sup>				Leafspot <sup>d</sup>		Southern blight		Yield	
		Broadleaf signalgrass	Volunteer sorghum	Yoakum		Lamesa		Yoakum	Lamesa	Target Sites	Lamesa	Yoakum	
		%		2 DAT <sup>e</sup>	2 WAT	2 WAT	2 WAT	8 WAT	16 WAT	(No/50ft)	Lbs/A		
0	0	0	0	0	0	0	0	6.8	3.0	6.2	5393	1663	
Select 8.0 oz/A	0	98	94	0	0	0	0	6.3	3.0	2.4	5461	1497	
Select 8.0 oz/A	Headline 15.0 oz/A	97	78	1	0	2	2	3.0	2.6	0.7	5486	2200	
Select 8.0 oz/A	Folicur 7.2 oz/A	98	80	0	0	7	7	4.0	2.8	2.7	5370	1665	
Select 8.0 oz/A	Provost 8.0 oz/A	98	92	0	0	5	5	3.7	2.9	2.0	5197	1688	
Poast plus 24oz/A	0	99	83	0	0	0	0	5.7	2.4	2.5	5418	1346	
Poast plus 24 oz/A	Headline 15.0 oz/A	96	55	3	0	5	5	3.5	2.4	1.3	5352	1452	
Poast plus 24 oz/A	Folicur 7.2 oz/A	98	73	0	0	5	5	4.0	2.9	2.7	5503	1756	
Poast plus 24 oz/A	Provost 8.0 oz/A	98	83	2	0	5	5	3.8	2.8	1.0	5371	2124	
0	Headline 15.0 oz/A	0	0	0	0	0	0	2.5	3.0	1.7	5284	2378	
0	Folicur 7.2 oz/A	0	0	0	0	0	0	3.7	3.1	1.7	5357	1574	
0	Provost 8.0 oz/A	0	0	0	0	0	0	3.0	2.8	2.7	5493	1857	
LSD (0.05)		2	7	NS	NS	3	3	1.0	0.6	2.5	NS	672	

<sup>a</sup> Agridex at 1.0% v/v added to all treatments.

<sup>b</sup> Weed control ratings taken approximately 4 wks after treatment.

<sup>c</sup> Peanut injury consisted of spotting of leaves with chlorotic and necrotic areas.

<sup>d</sup> Florida scale: 1=no disease, 10=plants dead.

<sup>e</sup> Abbreviations: DAT, days after treatment; WAT, weeks after treatment.

Table 4. Disease control and peanut response with herbicide-fungicide combinations in central Texas.

Treatments <sup>a</sup>		Leafspot <sup>b</sup>	Sclerotinia blight <sup>c</sup>	Peanut yield	Grade SMK+SS <sup>d</sup>
Herbicide and rate/A	Fungicide and rate/A	1-10	%	Lbs/A	%
0	0	4.8	35.7	1839	65.3
Select 8.0 oz/A	0	6.3	33.3	2420	67.9
Select 8.0 oz/A	Omega 1.5 pt/A	5.7	20.3	3040	65.1
Select 8.0 oz/A	Endura 10.0 oz/A	5.0	15.7	2652	67.0
Poast Plus 24.0 oz/A	0	6.0	33.3	2614	65.7
Poast Plus 24.0 oz/A	Omega 1.5 pt/A	5.0	26.7	2478	64.0
Poast Plus 24.0 oz/A	Endura 10.0 oz/A	4.7	19.3	2556	65.2
0	Omega 1.5 pt/A	6.0	26.0	2730	66.7
0	Endura 10 oz/A	5.5	14.7	3543	65.7
LSD (0.10)		NS	14.8	NS	NS

<sup>a</sup> Agridex at 1.0% v/v added to all treatments. Initial applications made 64 days after planting (DAP) with a sequential fungicide application (for treatments including Endura and Omega), 92 DAP. All plots were cover sprayed with Bravo WeatherStik at 1.5 pt/A, 78 DAP.

<sup>b</sup> Florida scale: 1=no disease, 10=plants dead

<sup>c</sup> Percent of row feet exhibiting symptoms of sclerotinia blight or signs of *Sclerotinia minor*.

<sup>d</sup> SMK=sound mature kernels, SS=sound splits.