

The Influence of Primary Tillage and Flue-Cured Tobacco Management on Palmer Amaranth Populations in a Three Year Crop Rotation

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Presentation Outline

- Brief Introduction
- Project Overview
- Results
- Conclusions
- Volunteer Peanut Control
- Questions



Palmer Amaranth Suppression



} Soybean
2008

} Tobacco
2008

Carthage, NC 2009; photo by Dr. Alan York



Project Overview

- Established a three year crop rotation with differing agronomic practices
 - Year one: Flue-cured tobacco (var. NC 196)
 - Year two: Cotton (var. Phytogen 375 WRF)
 - Year three: Cotton (var. Phytogen 499 WRF)
- Quantify Palmer amaranth density prior to cultivation in tobacco and POST herbicide application in cotton
- Record treatment effect on crop yield and value
- Evaluate the economic impact of treatment combinations

Project Outline & Justification

- Quantify Palmer amaranth suppression in year one of crop rotation.
 - Does row ridging effect Palmer amaranth density?
 - Are there treatments that reduce Palmer amaranth density?
- Quantify the effect of treatments imposed in year one to Palmer amaranth suppression observed in years two and three.
 - Do treatments from year one impact Palmer amaranth density in years two or three?
- Quantify the impact of year one treatments to the three year cumulative economic return.
 - Are alternative management practices worth the cost of application?

Project Outline & Site Description

- Two field sites at the Upper Coastal Plain Research Station
 - 2012-2014 & 2013-2015
- Split-split-plot design
 - Main effect: Primary Tillage
 - Sub-plot: Herbicide Program
 - Sub-plot: Hand Weeding Program
- Four replications per field site
- 20 feet x 90 feet & 24 feet x 35 feet plot dimensions
- Soil Series: Goldsboro Loamy Sand

Treatments^a

Year One: Tobacco	Year Two: Cotton	Year Three: Cotton
Tillage Program ^b + Herbicide Program ^{c,d} + Hand Weeding Program		
Shallow + S/C + Yes	Shallow + POST + Yes	Shallow + POST + Yes
Shallow + S/C + No	Shallow + POST + No	Shallow + POST + No
Shallow + C + Yes	Shallow + POST + Yes	Shallow + POST + Yes
Shallow + C + No	Shallow + POST + No	Shallow + POST + No
Deep + S/C + Yes	Shallow + POST + Yes	Shallow + POST + Yes
Deep + S/C + No	Shallow + POST + No	Shallow + POST + No
Deep + C + Yes	Shallow + POST + Yes	Shallow + POST + Yes
Deep + C + No	Shallow + POST + No	Shallow + POST + No

^a Treatments were evaluated at two field sites from 2012-2014 & 2013-2015

^b Shallow=5 inches; Deep=15 inches

^c S=Spartan @ 5.0 fl. oz./a (Pre-T); C=Command @ 2 pts./a (PPI)

^d POST=Liberty & RoundUp Powermax



Data Collection

Year One: Tobacco

- Weed density quantification
 - Prior to cultivation
- Weed removal, late season
- Yield
- Quality
- Value
- Economic assessment
 - Tillage cost + herbicide cost + hand weeding cost

Years Two & Three: Cotton

- Weed density quantification
 - Prior to POST herbicide app.
- Weed removal, late season
- Cotton yield
 - Seed + Lint
- Cotton value
 - Seed + Lint
- Economic assessment
 - Gin cost + seed value + hand weeding

Results analyzed in SAS ver. 9.4

Year one: Palmer amaranth density at 2 & 6 weeks after transplanting (WAT) as influenced by primary tillage and herbicide program

Treatment Factor	2 WAT	6 WAT
	number acre ⁻¹	
<u>Primary Tillage</u>		
Shallow	29,442*	74,076
Deep	14,293	45,770
<u>Herbicide Program</u>		
Command	72,259*	109,921*
Command plus Spartan	1,471	9,925

* Indicates significance at $p \leq 0.05$ within a treatment factor. Data for each main effect are pooled over other levels of the other treatment factor



Year two: Palmer amaranth population at two and six weeks after planting (WAP) as influenced by primary tillage, herbicide program, and hand weeding

Treatment Factors	2 WAP	6 WAP
	number acre⁻¹	
<u>Primary Tillage</u>		
Shallow	352,053	119,108
Deep	317,340	97,159
<u>Herbicide Program</u>		
Command	464,016	158,074*
Command + Spartan	205,378	58,193
<u>Hand Weeding Program</u>		
Hand Weeding	195,680	58,023
No Hand Weeding	473,714	158,244*

* Indicates significance at $p \leq 0.05$ within a treatment factor. Data for each main effect are pooled over other levels of the other treatment factors.

Year three: Palmer amaranth population at two and six weeks after planting (WAP) as influenced by primary tillage, herbicide program, and hand weeding

Treatment Factors	Palmer Amaranth Population	
	2 WAP	6 WAP
	number acre ⁻¹	
<u>Primary Tillage</u>		
Shallow	190	858
Deep	93	660
<u>Herbicide Program</u>		
Command	182*	1,052*
Command + Spartan	101	466
<u>Hand Weeding Program</u>		
Hand Weeding	94	464
No Hand Weeding	189*	1,054*

* Indicates significance at $p \leq 0.05$ within a treatment factor. Data for each main effect are pooled over other levels of the other treatment factors

Conclusions: Tobacco

Palmer amaranth Density

- Tobacco had higher Palmer amaranth density than soybean
 - Row ridging re-introduced Palmer amaranth seed (65% increase)
- Deep tillage reduced early season Palmer amaranth density by 51%
 - Tillage effect not observed 6 WAT
- Command plus Spartan at 2 & 6 WAT reduced Palmer amaranth density by 98 & 91%, respectively

Yield and Value

- Deep tillage increased yield (347 lbs acre⁻¹) and value (\$786 acre⁻¹)
- Command plus Spartan increased yield and value
 - Hand weeding increased yield and value in the absence of Spartan
- Absence of Spartan increased production cost and reduced economic return

Year One: Tobacco

Shallow Tillage + Clomazone plus Sulfentrazone +
No Hand Weeding



Shallow Tillage + Clomazone plus Sulfentrazone +
No Hand Weeding



Shallow Tillage + Clomazone alone + No Hand
Weeding



Shallow Tillage + Clomazone alone + No Hand
Weeding



Year One: Tobacco

Deep Tillage + Clomazone plus Sulfentrazone +
No Hand Weeding



Deep Tillage + Clomazone plus Sulfentrazone +
No Hand Weeding



Deep Tillage + Clomazone alone + No Hand
Weeding



Deep Tillage + Clomazone alone + No Hand
Weeding



Conclusions: Cotton

Palmer amaranth Density

- Deep tillage did not reduce Palmer amaranth density
- Command plus Spartan application in year one reduced Palmer amaranth density in years two and three
- Hand weeding reduced Palmer amaranth density

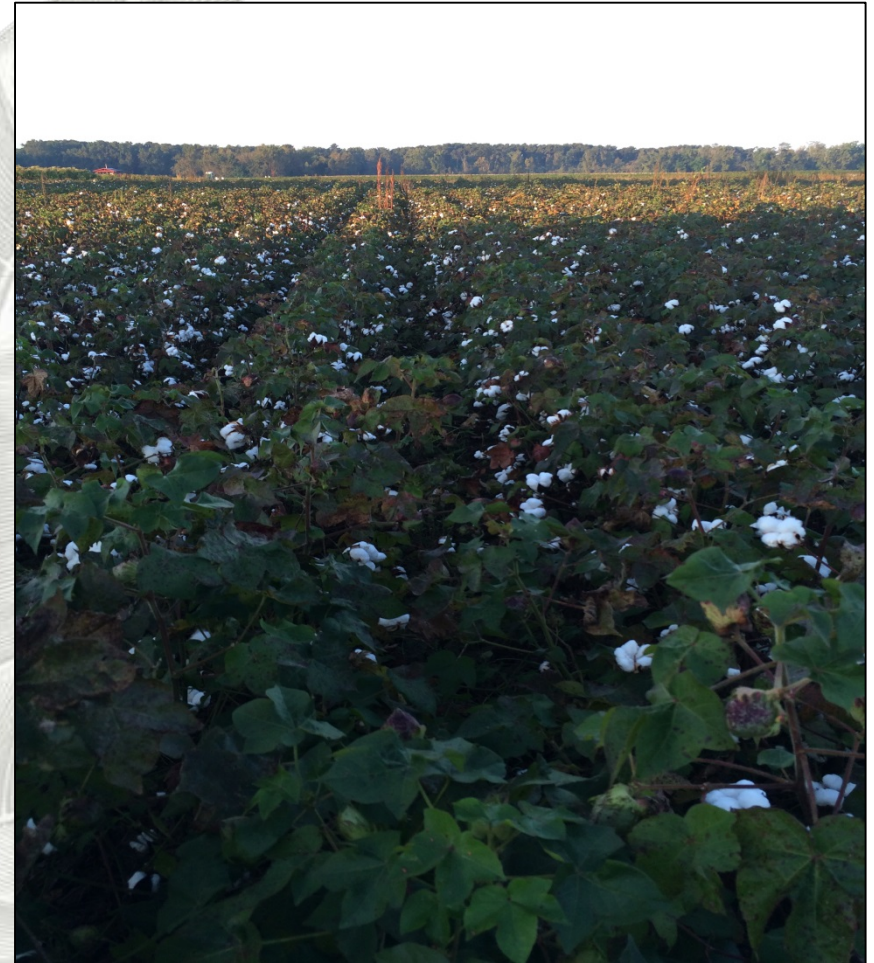
Yield and Value

- Yield and value were not affected by treatments from previous years
- Production cost increased by hand weeding Command alone treatments
 - Increased production cost did not reduce economic return

Year Three: Palmer amaranth Density in Cotton

Clomazone alone + No Hand Weeding

Clomazone alone + Hand Weeding



Pictures taken prior to hand weeding in year three

Year Three: Palmer amaranth Density in Cotton

Clomazone plus sulfentrazone +
No Hand Weeding



Clomazone plus sulfentrazone +
Hand Weeding



Pictures taken prior to hand weeding in year three

Three year cumulative net economic return of tobacco and cotton as influenced by interactions of herbicide program and hand weeding

Treatment Factors		Cumulative Net Economic Return
Herbicide Program	Hand Weeding Program	\$/acre
Command	Hand Weeding	-518 b
Command	No Hand Weeding	-1,925 c
Command plus Spartan	Hand Weeding	1,451 a
Command plus Spartan	No Hand Weeding	1,231 a

Means followed by the same letter within the same column are not significantly different at $p \leq 0.05$, data are pooled over primary tillage factor

Overall Conclusions

- Seed burial from deep tillage was overcome by bedding and post-transplanting cultivation
 - Yield increase observed would be expected where ripping shanks are used during bedding
- Herbicide program was key: Spartan + Command
 - >90% ↓ in tobacco, 50% - 60% ↓ in cotton
- Hand weed as necessary
 - Production cost increase was not significant where Spartan was applied
- Greatest economic return where Spartan was applied in year one

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Questions??

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