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PEANUT Information 2010

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PEANUT Information 2010

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Published by
North Carolina Cooperative Extension Service
College of Agriculture & Life Sciences
North Carolina State University

The North Carolina Peanut Growers Association provided financial support for publishing *2010 Peanut Information.*

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EXTENSION PERSONNEL WORKING WITH PEANUTS

County Extension personnel with peanut responsibilities as of January 1, 2010.

County	*Name*	*City*	*Telephone*
Beaufort	Gaylon Ambrose	Washington	(252) 946-0111
Bertie	Richard Rhodes	Windsor	(252) 794-5317
Bladen	Ryan Harrelson	Elizabethtown	(910) 862-4591
Chowan	Heather Lifsey	Edenton	(252) 482-6585
Columbus	Michael Shaw	Whiteville	(910) 640-6605
Duplin	Curtis Fountain	Kenansville	(910) 296-2143
Edgecombe	Art Bradley	Tarboro	(252) 641-7815
Gates	Paul Smith	Gatesville	(252) 357-1400
Halifax	Arthur Whitehead	Halifax	(252) 583-5161
Hertford	Reba Green-Holley	Winton	(252) 358-7822
Jones	Jacob Morgan	Trenton	(252) 448-9621
Martin	Al Cochran	Williamston	(252) 792-1621
Nash	Charlie Tyson	Nashville	(252) 459-9810
Northampton	Craig Ellison	Jackson	(252) 534-2711
Onslow	Melissa Evans	Jacksonville	(910) 455-5873
Pender	Wayne Batten	Burgaw	(910) 259-1235
Perquimans	Lewis Smith	Hertford	(252) 426-5428
Pitt	Mitch Smith	Greenville	(252) 757-2801
Sampson	Kent Wooten	Clinton	(910) 592-7161
Scotland	Cathy Graham	Laurinburg	(910) 277-2422
Washington	C. L. Sumner & Lance Grimes	Plymouth	(252) 793-2163
Wilson	Norman Harrell	Wilson	(252) 237-0111

N.C. State University Extension specialists with peanut responsibilities as of January 1, 2010, and directors of peanut grower organizations.

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Blake Brown	Economics, N.C. State University	(919) 515-4536
Gary Bullen	Economics, N.C. State University	(919) 515-6095
David Jordan	Agronomy & Weeds, N.C. State University	(919) 515-4068
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Jan Spears	Seeds, N.C. State University	(919) 515-4070
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Dell Cotton	Peanut Growers Cooperative Marketing Association	(757) 562-4103

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina Cooperative Extension nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension agent.

1. SITUATION AND OUTLOOK

A. VIRGINIA TYPE PEANUTS: SITUATION AND OUTLOOK

A. Blake Brown
Extension Economist—Agricultural and Resource Economics

Situation

U.S. peanut production was 3.63 billion pounds in 2009, down from the bumper crop of 5.16 billion pounds in 2008. The November crop estimate indicated 2009 North Carolina production of 244 million pounds of all types of peanuts, down from 358 million pounds in 2008. Harvested acreage in North Carolina was 66,000, down from 97,000 in 2008. Average yield of 3,700 pounds per acre in 2009 was the same as in 2008.

Table 1-1. North Carolina Peanut Acreage by County: Pre- and Post-quota Program

County	2001 Acreage	2008 Acreage	2009 Acreage
Bertie	17,150	9,700	6,343
Bladen	3,130	6,000	4,142
Chowan	5,495	5,000	3,230
Columbus	750	3,200	3,189
Duplin	0	3,100	3,517
Edgecombe	12,625	7,500	3,556
Gates	6,425	3,600	2,380
Greene	0	1,600	1,888
Halifax	19,100	7,400	5,119
Hertford	10,430	5,000	2,888
Jones	0	900	817
Martin	13,305	10,400	7,358
Nash	3,105	3,900	1,584
Northampton	19,750	5,100	3,437
Perquimans	2,845	2,400	1,160
Pitt	4,425	5,100	3,432
Sampson	275	n/a	3,534
Washington	2,495	1,700	1,023
Other counties	1,195	n/a	7,254
Total	122,500	97,000	65,901

Sources: USDA-FSA "North Carolina planted peanut acreage report; preliminary 2009." North Carolina Department of Agriculture North Carolina Agricultural Statistics.

The large 2008 crop led to large stocks going into the 2009 season. Total stocks of U.S. peanuts at the end of December 2008 were 4.26 billion pounds, up from 3.2 billion pounds at the end of 2007. The large stocks combined with the spring 2009 salmonella contamination at one Georgia processing plant led to lower prices for the 2009 crop. Lower prices and the uncertainty near planting time caused by the salmonella scare led to much lower planted acres in 2009. Contract prices in the Virginia-Carolina area were reported to be $450 to $475 per ton for the 2009 crop. With much lower production in 2009, ending stocks for 2009 are anticipated to be much lower than ending 2008 stocks.

Outlook For 2010

The dramatic reduction in acres in 2009 and the consequent reduction in stocks should result in a stronger price outlook for 2010. Contract prices for Virginia type peanuts may move toward the $500 per ton mark for the 2010 season.

B. PEANUT PRODUCTION BUDGETS

S. Gary Bullen
Extension Economist—Agricultural and Resource Economics
David Jordan
Peanut Specialist—Crop Science
Emily Weddington
Agricultural and Resource Economics

Production Costs

The budgets in the following tables represent costs and returns that are achieved by many growers in different regions of North Carolina using strip-till or conventional production technologies. The budgets do not represent average costs and returns. Budgets are intended to be used as guides for planning purposes only. They do not include sprays for Sclerotinia blight or fumigation for CBR. The cost of land plaster is assumed to be $51.51 per ton; less expensive sources are available.

Current information on the peanut outlook and situation, budgets, farm management, and more is available at the North Carolina State University Department of Agricultural and Resource Economics Web site: **www.ag-econ.ncsu.edu**.

Table 1-2A. Estimated Costs and Returns Per Acre of RUNNER STRIP-TILL Peanuts, 2010—3,500-Pound Yield, 4-Row Equipment

Item	Quantity and Unit	Price or Cost/Unit ($)	Total/Acre ($)	Your Farm
1. GROSS RECEIPTS Peanuts (Quota)	3,500 lb	0.24	840.00	
Total Receipts:			**840.00**	
2. VARIABLE COSTS*				
Seed	100.00 lb	0.80	80.00	
Inoculant	1.00 acre	5.00	5.00	
Fertilizer				
Nitrogen	15.00 lb	0.32	4.80	
Phosphate	30.00 lb	0.41	12.30	
Potash	90.00 lb	0.54	48.60	
Boron	2.50 lb	1.13	2.83	
Lime (prorated)	0.50 ton	51.75	25.88	
Land Plaster*	0.00 ton	51.51	0.00	
Herbicides	1.00 acre	44.70	44.70	
Insecticides	1.00 acre	41.21	41.21	
Fungicides	1.00 acre	84.99	84.99	
Scouting	1.00 acre	0.00	0.00	
Hauling	1.75 ton	12.00	21.00	
Drying & Cleaning	1.75 ton	45.00	78.75	
State Check-off Fee	1.75 ton	3.00	5.25	
National Assessment**	735.00 acre	0.01	7.35	
Crop Insurance	1.00 acre	22.00	22.00	
Tractor/Machinery	1.00 acre	95.20	95.20	
Labor	3.40 hours	8.85	30.09	
Interest on Operating Capital	$222.76	9.25%	20.60	
Total Variable Costs			630.55	
3. INCOME FROM ABOVE VARIABLE COSTS			209.45	
4. FIXED COSTS				
Tractor/Machinery	1.00 acre	188.48	188.48	
Total Fixed Costs			188.48	
5. TOTAL COSTS			**819.03**	
6. NET RETURNS TO LAND, RISK, & MGMT.			**20.97**	

Break-even Yield		**Break-even Price**	
Variable Costs	2,627 lb	Variable Costs	$0.18
Total Costs	3,413 lb	Total Costs	$0.23

* Use sampling procedure to determine the need for land plaster.

** National Assessment is 1.05% of gross receipt and is also named National Loss, Promotion, Research Assessment.

Please note: This budget is for planning purposes only. It does not include sprays for Sclerotinia blight or fumigation for CBR.

Table 1-2B. Per-Acre Machinery and Labor Requirements for 3,500-Pound Yield—RUNNER STRIP-TILL Peanuts

Month	Operation	Times Over	Labor Hours	Machine Hours	Variable Costs ($)	Fixed Costs ($)
4	Subsoiler-bedder 4-row	1.00	0.20	0.18	3.74	2.82
4	Strip-till rig 4-row	1.00	0.18	0.16	11.38	23.53
4	Peanut planter 4-row	1.00	0.28	0.25	5.13	7.16
5, 6, 7, 8, 9	Pull-type sprayer	7.00	1.39	1.26	12.53	19.67
6	Fertilizer spreader	1.00	0.13	0.12	1.71	4.25
10	Peanut digger inverter 4-row	1.00	0.61	0.55	40.40	79.16
10	Peanut combine 4-row	1.00	0.61	0.55	20.31	51.89
Per-acre totals for selected operations			3.40	3.07	95.20	188.48
Unallocated labors (hours/acre)						

Table 1-2C. Per-Acre Income Above Variable Costs at Differing Per-Acre Yields and Prices—RUNNER STRIP-TILL Peanuts

	Price ($/lb)				
Yield (lb)	**0.20**	**0.23**	**0.24**	**0.26**	**0.28**
2,900	-34.60	50.97	79.49	136.53	193.58
3,200	15.43	109.85	141.32	204.26	267.21
3,500	65.46	168.73	203.15	271.99	340.84
3,800	115.49	227.61	264.98	339.73	414.47
4,100	165.52	286.49	326.81	407.46	488.10

Table 1-2D. Per-Acre Chemical-Use Assumptions for 3,500-Pound Yield—RUNNER STRIP-TILL Peanuts

Chemical	Quantity and Unit	Price or Cost/Unit ($)	Total Cost per Acre ($)	Month
Herbicides				
glyphosate (generic)	1.00 oz	0.27	0.27	4
paraquat dichloride (Gramoxone INTEON)	8.00 oz	0.27	2.13	5
S-metolachlor (Dual Magnum)	1.00 pt	10.66	10.66	5
2,4-DB	1.20 pt	2.93	3.52	6, 7
bentazon+acifluorfen (Storm)	24.00 oz	0.55	13.26	6
surfactant	2.00 pt	1.75	3.50	7
clethodim (Select)	8.00 oz	0.99	7.92	7
crop oil	0.25 gal	13.75	3.44	7
Insecticides				
aldicarb (Temik)	7.00 lb	3.25	22.75	5
chlorpyrifos (Lorsban)	12.00 lb	1.05	12.60	7
lamda-cyhalothrin (Karate Z)	2.00 oz	2.93	5.86	8
Fungicides				
chlorothalonil (Bravo)	3.00 pt	4.81	14.44	6, 9
pyraclostrobin (Headline)	9.00 oz	2.54	22.85	7
azoxystrobin (Abound)	18.00 oz	2.34	42.19	8
tebuconazol (Folicur)	7.20 oz	0.77	5.51	7, 8
TOTAL			170.90	

Table 1-3A. Estimated Costs and Returns Per Acre of RUNNER CONVENTIONAL-TILL Peanuts. 2010—3,500-Pound Yield, 4-Row Equipment

	Quantity per Unit	Price or Cost/ Unit ($)	Total per Acre ($)	Your Farm
1. GROSS RECEIPTS **Peanuts (Quota)**	3,500 lb	0.24	831.25	
Total Receipts			**831.25**	
2. VARIABLE COSTS				
Seed	100.00 lb	0.80	80.00	
Inoculant	1.00 acre	5.00	5.00	
Fertilizer				
Nitrogen	15.00 lb	0.32	4.80	
Phosphate	30.00 lb	0.41	12.30	
Potash	90.00 lb	0.54	48.60	
Boron	2.50 lb	1.13	2.83	
Lime (prorated)	0.50 ton	51.75	25.88	
Land Plaster*	0.0 ton	51.51	0.00	
Herbicides	1.00 acre	51.80	51.80	
Insecticides	1.00 acre	44.21	44.21	
Fungicides	1.00 acre	84.99	84.99	
Scouting	1.00 acre	0.00	0.00	
Hauling	1.75 ton	12.00	21.00	
Drying & Cleaning	1.75 ton	45.00	78.75	
State Check-off Fee	1.75 ton	3.00	5.25	
National Assessment**	831.25 acre	0.01	8.31	
Crop Insurance	1.00 acre	22.00	22.00	
Tractor/Machinery	1.00 acre	97.53	97.53	
Labor	3.76 hour	8.85	33.28	
Interest on Operating Capital	$228.97	9.25%	21.18	
Total Variable Costs			**647.71**	
3. INCOME ABOVE VARIABLE COSTS			**183.54**	
4. FIXED COSTS				
Tractor/Machinery	1.00 acre	180.20	180.20	
Total Fixed Costs			**180.20**	
5. TOTAL COSTS			**827.91**	
6. NET RETURNS TO LAND, RISK, & MANAGEMENT			**3.34**	

BREAK-EVEN YIELD		**BREAK-EVEN PRICE**	
Variable Costs	2,727 lb	Variable Costs	$0.19
Total Costs	3,486 lb	Total Costs	$0.24

* Use sampling procedure to determine the need for land plaster.

** National Assessment is 1.05% of gross receipt and is also named national loss, promotion, research assessment.

Please note: This budget is for planning purposes only. It does not include sprays for Sclerotinia blight or fumigation for CBR.

Table 1-3B. Per-Acre Machinery and Labor Requirements for 3,500-pound Yield—RUNNER CONVENTIONAL-TILL Peanuts

Month	Operation	Times Over	Labor Hours	Machine Hours	Variable Costs ($)	Fixed Costs ($)
4	Chisel plow 18 ft	1	0.14	0.13	3.57	3.61
4	Heavy disk 16 ft	3	0.40	0.36	10.14	11.64
4	Subsoiler-bedder 4-row	1	0.20	0.18	3.74	2.82
4	Peanut planter 4-row	1	0.28	0.25	5.13	7.16
5, 6, 7, 8, 9	Pull-type sprayer	7	1.39	1.26	12.53	19.67
6	Fertilizer spreader	1	0.13	0.12	1.71	4.25
10	Peanut digger inverter 4-row	1	0.61	0.55	40.40	79.16
10	Peanut combine 4-row	1	0.61	0.55	20.31	51.89
Per-acre totals for selected operations; Unallocated labors (hours/acre)			3.76	3.40	97.53	180.20

Table 1-3C. Per-Acre Income Above Variable Costs at Differing Yields and Prices—RUNNER CONVENTIONAL-TILL Peanuts

	Price ($/lb)				
Yield (lb)	**$0.20**	**$0.23**	**$0.24**	**$0.26**	**$0.27**
2,900	-50.80	34.77	56.16	120.33	148.85
3,200	-0.77	93.65	117.25	188.06	219.54
3,500	49.26	152.53	178.34	255.79	290.22
3,800	99.29	211.41	239.44	323.53	360.90
4,100	149.32	270.29	300.53	391.26	431.58

Table 1-3D. Per-Acre Chemical-Use Assumptions for 3,500-Pound Yield —RUNNER CONVENTIONAL-TILL Peanuts

Chemical	Quantity and Unit	Price or Cost/Unit ($)	Total Cost per Acre ($)	Month
Herbicides				
pendimethalin (Prowl)	1.00 pt	4.19	4.19	4
paraquat dichloride (Gramoxone INTEON)	8.00 oz	0.27	2.13	2× 5/6
2,4-DB	1.20 pt	2.93	3.52	2× 5/6
S-metolachlor (Dual Magnum)	1.00 pt	13.84	13.84	4
bentazon+acifluorfen (Storm)	24.00 oz	0.55	13.26	2× 5/6
surfactant	2.00 pt	1.75	3.50	2× 5/6
clethodim (Select)	8.00 oz	0.99	7.92	2× 5/6
crop oil	0.25 gal	13.75	3.44	7
Insecticides:				
aldicarb (Temik)	7.00 lb	3.25	22.75	5
chlorpyrifos (Lorsban)	12.00 lb	1.30	15.60	7
lamda-cyhalothrin (Karate Z)	2.00 oz	2.93	5.86	8
Fungicides:				
chlorothalonil (Bravo)	3.00 pt	4.81	14.44	6, 9
pyraclostrobin (Headline)	9.00 oz	2.54	22.85	7
azoxystrobin (Abound)	18.00 oz	2.34	42.19	8
tebuconazol (Folicur)	7.20 oz	0.77	5.51	7/8
TOTAL			181.00	

Table 1-4A. Estimated Costs and Returns Per Acre of VIRGINIA STRIP-TILL Peanuts, 2010—3,500-Pound Yield, 4-Row Equipment

Item	Quantity and Unit	Price or Cost/Unit ($)	Total per Acre ($)	Your Farm
1. GROSS RECEIPTS Peanuts (Quota)	3,500 lb	0.29	1,006.25	
Total Receipts			**1,006.25**	
2. VARIABLE COSTS				
Seed	140.00 lb	0.80	112.00	
Inoculant	1.00 acre	5.00	5.00	
Fertilizer				
Nitrogen	15.00 lb	0.32	4.80	
Phosphate	30.00 lb	0.41	12.30	
Potash	90.00 lb	0.54	48.60	
Boron	2.50 lb	1.13	2.83	
Lime (prorated)	0.50 ton	51.75	25.88	
Land Plaster*	0.50 ton	51.51	25.76	
Herbicides	1.00 acre	44.70	44.70	
Insecticides	1.00 acre	41.21	41.21	
Fungicides	1.00 acre	84.99	84.99	
Scouting	1.00 acre	0.00	0.00	
Hauling	1.75 ton	12.00	21.00	
Drying & Cleaning	1.75 ton	45.00	78.75	
State Check-off Fee	1.75 ton	3.00	5.25	
National Assessment**	1006.25 acre	0.01	10.06	
Crop Insurance	1.00 acre	22.00	22.00	
Tractor/Machinery	1.00 acre	95.20	95.20	
Labor	3.40 hours	8.85	30.09	
Interest on Operating Capital	$251.64	9.25%	23.28	
Total Variable Costs			**693.70**	
3. INCOME ABOVE VARIABLE COSTS			**312.55**	
4. FIXED COSTS				
Tractor/Machinery	1.00 acre	188.48	188.48	
Total Fixed Costs			**188.48**	
5. TOTAL COSTS			**882.18**	
6. NET RETURNS TO LAND, RISK, & MGMT.			**124.07**	
BREAK-EVEN YIELD		**BREAK-EVEN PRICE**		
Variable Costs	2,413 lb	Variable Costs	$0.20	
Total Costs	3,068 lb	Total Costs	$0.25	

*Use sampling procedure to determine the need for land plaster.

** National Assessment is 1.05% of gross receipt and is also named National Loss, Promotion, Research Assessment.

Please note: This budget is for planning purposes only. It does not include sprays for Sclerotinia blight or fumigation for CBR.

Table 1-4B. Per-Acre Machinery and Labor Requirements for 3,500-Pound Yield—VIRGINIA STRIP-TILL Peanuts

Month	Operation	Times Over	Labor Hours	Machine Hours	Variable Costs ($)	Fixed Costs ($)
4	Subsoiler-bedder 4-row	1	0.20	0.18	3.74	2.82
4	Strip-till rig 4-row	1	0.18	0.16	11.38	23.53
4	Peanut planter 4-row	1	0.28	0.25	5.13	7.16
5, 6, 7, 8, 9	Pull-type sprayer	7	1.39	1.26	12.53	19.67
6	Fertilizer spreader	1	0.13	0.12	1.71	4.25
10	Peanut digger inverter 4-row	1	0.61	0.55	40.40	79.16
10	Peanut combine 4-row	1	0.61	0.55	20.31	51.89
Per-acre totals for selected operations; Unallocated labors (hours/acre)			3.40	3.07	95.20	188.48

Table 1-4C. Per-Acre Income Above Variable Costs at Differing Yields and Prices— VIRGINIA STRIP-TILL Peanuts

	Price ($/lb)				
Yield (lb)	**0.24**	**0.27**	**0.29**	**0.32**	**0.33**
2,900	19.05	104.61	154.53	247.22	275.74
3,200	80.88	175.30	230.37	332.66	364.13
3,500	142.71	245.98	306.22	418.09	452.51
3,800	204.54	316.66	382.06	503.52	540.90
4,100	266.37	387.34	457.91	588.96	629.28

Table 1-4D. Per-Acre Chemical-Use Assumptions for 3,500-Pound Yield—VIRGINIA STRIP-TILL Peanuts

Chemical	Quantity and Unit	Price or Cost/Unit ($)	Total Cost per Acre ($)	Month
Herbicides				
glyphosate (generic)	1.00 oz	0.27	0.27	4
paraquat dichloride (Gramoxone INTEON)	8.00 oz	0.27	2.13	5
S-metolachlor (Dual Magnum)	1.00 pt	10.66	10.66	5
2,4-DB	1.20 pt	2.93	3.52	6, 7
bentazon+acifluorfen (Storm)	24.00 oz	0.55	13.26	6
surfactant	2.00 pt	1.75	3.50	7
clethodim (Select)	8.00 oz	0.99	7.92	7
crop oil	0.25 gal	13.75	3.44	7
Insecticides				
aldicarb (Temik)	7.00 lb	3.25	22.75	5
chlorpyrifos (Lorsban)	12.00 lb	1.05	12.60	7
lamda-cyhalothrin (Karate Z)	2.00 oz	2.93	5.86	8
Fungicides				
chlorothalonil (Bravo)	3.00 pt	4.81	14.44	6, 9
pyraclostrobin (Headline)	9.00 oz	2.54	22.85	7
azoxystrobin (Abound)	18.00 oz	2.34	42.19	8
tebuconazol (Folicur)	7.20 oz	0.77	5.51	7, 8
TOTAL			170.90	

Table 1-5A. Estimated Costs and Returns Per Acre of VIRGINIA CONVENTIONAL-TILL Peanuts, 2010—3,500-Pound Yield, 4-Row Equipment

Item	Quantity and Unit	Price or Cost/Unit ($)	Total per Acre ($)	Your Farm
1. GROSS RECEIPTS				
Peanuts (Quota)	3,500 lb	0.29	1,006.25	
Total Receipts			**1,006.25**	
2. VARIABLE COSTS				
Seed	140.00 lb	0.80	112.00	
Inoculant	1.00 acre	5.00	5.00	
Fertilizer				
Nitrogen	15.00 lb	0.32	4.80	
Phosphate	30.00 lb	0.41	12.30	
Potash	90.00 lb	0.54	48.60	
Boron	2.50 lb	1.13	2.83	
Lime (prorated)	0.50 ton	51.75	25.88	
Land Plaster*	0.50 ton	51.51	25.76	
Herbicides	1.00 acre	51.80	51.80	
Insecticides	1.00 acre	41.21	41.21	
Fungicides	1.00 acre	84.99	84.99	
Scouting	1.00 acre	0.00	0.00	
Hauling	1.75 ton	12.00	21.00	
Drying & Cleaning	1.75 ton	45.00	78.75	
State Check-off Fee	1.75 ton	3.00	5.25	
National Assessment**	$1,006.25	0.01	10.06	
Crop Insurance	1.00 acre	22.00	22.00	
Tractor/Machinery	1.00 acre	97.53	97.53	
Labor	3.76 hour	8.85	33.28	
Interest on Operating Capital	$256.35	9.25%	23.71	
Total Variable Costs			**706.75**	
3. INCOME ABOVE VARIABLE COSTS			**299.50**	
4. FIXED COSTS				
Tractor/Machinery	1.00 acre	180.20	180.20	
Total Fixed Costs			**180.20**	
5. TOTAL COSTS			**886.95**	
6. NET RETURNS TO LAND, RISK, & MGMT.			**119.30**	

BREAK-EVEN YIELD		**BREAK-EVEN PRICE**	
Variable Costs	2,458 lb	Variable Costs	$0.20
Total Costs	3,085 lb	Total Costs	$0.25

*Use sampling procedure to determine the need for land plaster.

** National Assessment is 1.05% of gross receipt and is also named national loss, promotion, research assessment.

Please note: This budget is for planning purposes only. It does not include sprays for Sclerotinia blight or fumigation for CBR.

Table 1-5B. Per-Acre Machinery and Labor Requirements for 3,500-Pound Yield—VIRGINIA CONVENTIONAL-TILL Peanuts

Month	Operation	Times Over	Labor Hours	Machine Hours	Variable Costs ($)	Fixed Costs ($)
4	Chisel plow 18 ft	1	0.14	0.13	3.57	3.61
4	Heavy disk 16 ft	3	0.40	0.36	10.14	11.64
4	Subsoiler-bedder 4-row	1	0.20	0.18	3.74	2.82
4	Peanut planter 4-row	1	0.28	0.25	5.13	7.16
5, 6, 7, 8, 9	Pull-type sprayer	7	1.39	1.26	12.53	19.67
6	Fertilizer spreader	1	0.13	0.12	1.71	4.25
10	Peanut digger inverter 4-row	1	0.61	0.55	40.40	79.16
10	Peanut combine 4-row	1	0.61	0.55	20.31	51.89
Per-acre totals for selected operations; Unallocated labors (hours/acre)			3.76	3.40	97.53	180.20

Table 1-5C. Per-Acre Income Above Variable Costs at Differing Yields and Prices—VIRGINIA CONVENTIONAL-TILL Peanuts

	Price ($/lb)				
Yield (lb)	**0.24**	**0.27**	**0.29**	**0.32**	**0.33**
2,900	6.00	91.56	141.48	234.17	262.69
3,200	67.83	162.25	217.32	319.61	351.08
3,500	129.66	232.93	293.17	405.04	439.46
3,800	191.49	303.61	369.01	490.47	527.85
4,100	253.32	374.29	444.86	575.91	616.23

Table 1-5D. Per-Acre Chemical-Use Assumptions for 3,500-Pound Yield—VIRGINIA CONVENTIONAL-TILL Peanuts

Chemical	Quantity and Unit	Price or Cost/Unit ($)	Total Cost per Acre ($)	Month
Herbicides				
pendimethalin (Prowl)	1.00 pt	4.19	4.19	4
paraquat dichloride (Gramoxone INTEON)	8.00 oz	0.27	2.13	2× 5/6
2,4-DB	1.20 pt	2.93	3.52	2× 5/6
S-metolachlor (Dual Magnum)	1.00 pt	13.84	13.84	4
bentazon+acifluorfen (Storm)	24.00 oz	0.55	13.26	2× 5/6
surfactant	2.00 pt	1.75	3.50	2× 5/6
clethodim (Select)	8.00 oz	0.99	7.92	2× 5/6
crop oil	0.25 gal	13.75	3.44	7
Insecticides:				
aldicarb (Temik)	7.00 lb	3.25	22.75	5
chlorpyrifos (Lorsban)	12.00 lb	1.05	12.60	7
lamda-cyhalothrin (Karate Z)	2.00 oz	2.93	5.86	8
Fungicides:				
chlorothalonil (Bravo)	3.00 pt	4.81	14.44	6, 9
pyraclostrobin (Headline)	9.00 oz	2.54	22.85	7
azoxystrobin (Abound)	18.00 oz	2.34	42.19	8
tebuconazol (Folicur)	7.20 oz	0.77	5.51	7/8
TOTAL			178.00	

2. PEANUT SEED

Jan Spears
Extension Specialist— Crop Science

A uniform stand of healthy, vigorous plants is essential if growers are to achieve the yields and quality needed for profitable peanut production. It is important for growers to plant high quality seed of varieties adapted to their farm situations, management styles, and intended market uses.

WHAT'S IN A BAG OF PEANUT SEED?

A bag of seed peanuts contains thousands of potential plants. To grow a uniform stand of healthy plants, you need genetically pure seed that has been produced under a management system that maximizes seed health, germination, and vigor. The genetic composition of a peanut variety dictates maturity date, disease and insect resistance, peanut quality, grade, and many other characteristics. The best assurance of obtaining genetically pure seed is to purchase Certified Seed.

Seed health is related to seed-borne pathogens present on or in peanut seeds. Pathogens can reduce germination potential and can in some cases transmit peanut diseases. Professional seed producers take specific measures to reduce the level of seed-borne pathogens. The extra steps they take minimize the chance for the spread of unwanted diseases. Seed lots high in germination and vigor potential will germinate more rapidly and produce more robust seedlings. These seedlings are more likely to survive moderate stress during the weeks following planting.

Always purchase seed from a reputable, professional seed dealer. Bargain seed from a stranger, or even a neighbor, may not be such a bargain. Along with their "seed," you could be buying weed seed or mixed varieties. You could even introduce diseases onto your farm.

PEANUT SEED PRODUCTION

The key component to producing high quality peanut seed is to make the seed crop your highest farm priority. Attention to details is essential and critical steps include:

- field selection,
- seed selection,

- cleaning and tuning up planting equipment,
- applying gypsum and boron at the right time,
- digging the crop when a majority of the pods are close to maturity,
- adjusting harvesting equipment to minimize mechanical damage,
- curing the peanuts slowly, and
- storing the seeds in a cool, dry environment.

Production of high-quality peanut seeds requires a high level of management that begins before planting and continues through delivery of seeds to the peanut farmer. A detailed description of peanut seed production can be found in *Peanut Seed Production: A Guide For Producers of Virginia type Peanut Seed* (AG–622), which can be obtained free from your county Extension center or viewed online: **http://www.peanut.ncsu.edu/peanut.pdf**

SAVING SEED

In years when profits are low, some growers may decide that saving their own seed will help reduce production costs. Cleaning, treating, and bagging seed, however, can be expensive; and a grower may not save more than a few cents per acre. In fact, a loss may occur if the seeds they planted were of poor quality. Seed germination and vigor of saved seed can be an issue, and growers are urged to have germination tests run on saved seed immediately after harvest and again about 6 weeks before planting. Checking the quality of the seed early will tell the grower if the seed is worth saving. The second test will tell the grower if the seed is worth planting. Seed production is a specialized process; varietal purity, seed quality, and seed health are carefully monitored throughout the growing season and during the digging, combining, curing, cleaning, storage, and treating operations. **Saving seed should not be an afterthought, but rather a process that begins well before the seed crop is planted.**

Growers who decide to save seed should be aware that they might be in violation of the North Carolina State Seed Law, the Plant Variety Protection Act (PVPA), and Title V of the Federal Seed Act if they sell that saved seed.

According to regulations, growers may save enough seed of a PVPA-protected variety to plant back on their own holdings (land owned, leased, or rented). If planting intentions change and if a variety is PVPA-1970 protected, the farmer may sell that saved seed, but only that amount saved to plant his or her holdings. If the variety is protected under the amended 1995 PVPA, a farmer may not sell any seed without the permission of the variety owner. See Table 2-1 for a list of popular varieties and their level of protection.

North Carolina Seed Regulations require variety labeling on all peanut seed sold in the state, regardless of whether the seed is certified or farmer stock. No peanut seed can be sold as ***variety not stated,*** even if the variety is not known or the seed is a mixture of varieties.

CO-OP SEED DISTRIBUTION

Some growers are members of a co-op, and questions have been raised about co-op distribution of seed to growers. A farmer may bring saved seed into the co-op to be shelled, cleaned, treated, and bagged. **But, the entire quantity of saved seed must be returned to the farmer who produced it.** The seed may not be co-mingled with seed from any other grower, and the seed may not be sold, traded, nor given to any other grower. These actions are a violation of PVPA and the Federal Seed Act. The amount of peanuts shelled, cleaned, treated, and bagged must not exceed the amount the grower may legally save.

A co-op may become a licensed seed dealer, allowing co-op members to produce their own seed as a group with seed from several growers combined and distributed among the membership. If so, steps

Table 2-1. List of Varieties and Requirements for Sale

Variety	Can you save seed?	Can you sell that saved seed?	Must the saved seed be sold as a class of certified seed?
NC 6	Yes	Yes	No
NC 7	Yes	Yes	Yes
NC 9	Yes*	Yes**	Yes
NC 10C	Yes*	Yes**	Yes
NC-V11	Yes*	Yes**	Yes
NC 12C	Yes*	Only with permission	Yes
VA-C 92R	Yes*	Yes**	Yes
SunOleic 95R	Yes*	Yes**	Yes
SunOleic 97R	Yes*	Only with permission	Yes
VC-1	Yes*	Yes **	Yes
Andru 93	Yes*	Yes**	Yes
AT 120	Yes*	Yes**	Yes
Georgia Green	Yes*	Only with permission	Yes
VA 93B	Yes	Yes	No
Perry	Yes	Only with permission	Yes
VA 98R	Yes	Only with permission	Yes

must be taken before planting to ensure proper certification and State Seed Law requirements have been met. Certified seed must be grown from Foundation or Registered seed, fields must be inspected, and the seed must meet minimum germination standards. The co-op must be licensed under the North Carolina State Seed Law. Contact the North Carolina Crop Improvement Association (919-515-2851) for details on how to certify peanut seed and the North Carolina Department of Agriculture and Consumer Services Seed Section (919-733-3930) for details about becoming a licensed seed dealer.

3. PEANUT PRODUCTION PRACTICES

David L. Jordan
Extension Specialist—Crop Science

Successful production of quality peanuts requires growers to plan an effective production and marketing program and to implement that program on a timely basis during the season. Each cultural practice and marketing decision must be effectively integrated into the total farm management plan to produce optimum profits from the whole farm.

STAND ESTABLISHMENT

Soil temperatures need to be above 65°F for germination to proceed at an acceptable rate. Large-seeded Virginia market type peanuts planted under favorable moisture and temperature conditions will show beginning radicle (root) growth in about 60 hours. If conditions are ideal, sprouting young seedlings should be visible in 7 days for smaller-seeded varieties like NC-V 11 and VA 98R, and 10 days for larger-seeded varieties like Brantley or Gregory.

Peanuts should not be planted until the soil temperature at a 4-inch depth is 65˚F or above at noon for 3 days. Favorable weather for peanut germination should also be forecast for the next 72 hours after planting. The soil should be moist enough for rapid water absorption by the seed. The planter should firm the seedbed so there is good soil-to-seed contact. Growers should establish at least four plants per foot of row regardless of variety. Peanuts can emerge from depths as low as 3 inches.

VARIETY SELECTION

Yield and quality are two major factors that influence variety selection. Growers with significant disease history may need to choose a variety with disease tolerance or resistance. Planting at least three varieties with different maturity dates permits efficient use of limited harvesting and curing equipment. Planting varieties with different genetic pedigrees reduces the risk of crop failure because of adverse weather or unexpected disease epidemics.

The selection of a variety should be based on more than 1 year's data. The 5-year average performance of our most popular peanut varieties from reports prepared by Dr. Tom Isleib (peanut breeder at N.C. State University) is presented in Table 3-1. Information on the varieties Bailey and Sugg are presented in Table 3-2. Yield from research station and on-farm tests by David Jordan and Dewayne Johnson (N.C. Cooperative Extension) are presented in Table 3-3. Varietal characteristics are listed in Table 3-4. Disease reaction of varieties can be found in Chapter 6, "Peanut Disease Management."

Table 3-1. Agronomic Performance of Early Commercially Available Peanut Varieties; Average Across All Locations—5-Year Averages, 2002-2006*

Variety	Percent Fancy	Percent ELK	Percent SMK	Meat Content	Yield (lb/acre)
NC-V 11	81	37	64	72	4,453
Gregory	92	47	61	71	4,160
VA 98R	79	40	63	73	4,325
Perry	80	43	65	73	3,988
CHAMPS	85	41	65	73	4,277
Phillips	84	48	65	74	4,353
Brantley	89	50	63	72	4,155

* Selected data from T. Isleib during 2005-2008 (34 trials).

Table 3-2. Pod Yield and Market Grade Characteristics of Bailey and Sugg Compared with Other Commercially Available Virginia Market Type Varieties

Variety	Percent Fancy	Percent ELK	Percent SMK	Meat Content	Yield (lb/acre)
Bailey	81	43	66	73	4,806
Sugg	88	48	66	74	4,641
NC-V11	81	37	64	72	4,454
Gregory	91	47	61	70	4,160
Perry	80	43	65	73	3,988
Phillips	84	48	65	73	4,332
Brantley	89	50	63	72	4,155
VA 98R	79	40	63	73	4,325
CHAMPS	85	41	65	73	4,277

*Data are from Isleib et al. (September, 2009) and are pooled over 34 tests over 4 years.

Table 3-3. Pod Yield of Commercially Available Peanut Varieties from Research Station and On-farm Tests

	2008			2009	
Variety	Chowan	Duplin	Edgecombe	Bertie	Duplin
NC-V11	3,970	5,294	4,022	—	—
Perry	4,304	5,686	3,734	5,879	5,046
Phillips	3,815	5,347	4,120	5,442	4,849
Gregory	3,866	5,189	3,962	4,901	3,624
CHAMPS	3,487	5,258	4,378	5,855	4,859
Brantley	3,273	4,957	3,698	—	—
VA 98R	3,581	5,176	3,536	5,166	4,357
Florida Fancy	3,692	5,461	3,365	4,224	4,549
Bailey	—	5,433	—	5,515	4,037
Sugg	—	5,156	—	5,837	4,873

* Selected data from D. Jordan and D. Johnson, N.C. Cooperative Extension Service (unpublished data).

Table 3-4. Varietal Characteristics

Factors	Bailey	Brantley	CHAMPS	Gregory	NC 12C	NC-V 11	Perry	Phillips	Sugg	VA 98R	Wilson
Growth habit (R=runner; SR=semi-runner)	SR	SR	R	R	SR	R	SR	SR	SR	R	SR
Heat unit requirement	2,650	2,600	2,500	2,650	2,600	2,650	2,770	2,600	2,650	2,560	2,520
Comparative days to optimum maturity	0*	-3	-9	0	-3	0	+7	-3	0*	-5	-7
Seed coat color	Tan	Tan	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink
Seed per pound	540	460	535	450	460	625	525	545	545	575	575
Need for calcium (M=moderate; H=high)	M	H	M	H	H	M	M	M	M	M	M

Heat unit requirement=degree day accumulation (56°F base and a 95°F ceiling) required to reach optimum maturity assuming adequate soil moisture for sustained growth and development

In comparative days to optimum maturity, - = optimum maturity for the variety occurs prior to ‘0’; += optimum maturity for variety occurs after ‘0’.

*Limited data

Variety Characteristics

Bailey is a new large-seeded Virginia market type peanut with resistance to several key peanut diseases, including tomato spotted wilt. This variety offers tolerance to CBR and *Sclerotinia* blight. Seed size is similar to NC-V 11. Seed for this variety is not available for general production.

Brantley is a large-seeded Virginia market type peanut with a high oleic trait. It will perform agronomically in a manner similar to NC 7.

CHAMPS is a large-seeded peanut that matures slightly earlier than Wilson. It is intermediate in resistance to tomato spotted wilt and is moderately susceptible to most other diseases.

Gregory is a large-seeded Virginia market type peanut with growth habit intermediate between bunch and runner, a pink seed coat, and a high percentage of jumbo pods and extra-large kernels. It is susceptible to most diseases and insect pests. Because of its large seed size, Gregory has a high calcium requirement and may show reduced seedling vigor compared with other varieties. Gregory offers the best resistance to tomato spotted wilt virus of commercially available Virginia market types when planted at optimum seeding rates.

NC-V 11 is a large-seeded Virginia market type peanut with a runner growth habit that is similar to Gregory in maturity. Its major advantage is a high yield and value per acre. NC-V 11 has a lower percentage of fancy pods than Gregory, NC 12C, Wilson, Champs, and Phillips.

NC 12C is a large-seeded CBR-resistant variety that has a moderate level of resistance to early leafspot. NC 12C has high meat content and a thin hull with a tendency to darken upon roasting. Growers of NC 12C should take care to avoid pod damage at harvest and price penalty associated with excessive loose shelled kernels. Under close plant spacing or conditions of high water availability, NC 12C produces excessive vine growth.

Perry is a large-seeded peanut with partial resistance to CBR and some tolerance of *Sclerotinia* blight. It is characterized by a semi-runner growth habit. It matures later than NC 12C or NC-V 11. Perry is susceptible to tomato spotted wilt virus.

Phillips is a large-seeded peanut that matures slightly earlier than Gregory. It has only minor resistance to many of the diseases found in peanut.

Sugg is a new large-seeded Virginia market type peanut with a disease management package that approaches that of Bailey. Although not as resistant to disease as Bailey, Sugg has larger pods.

VA 98R is an early maturing large-seeded peanut with some tolerance to *Sclerotinia* blight. It is characterized by a runner growth habit. It is susceptible to all other peanut diseases in the region. It matures earlier than NC 12C.

Wilson is a large-seeded peanut that matures similar to VA 98R with a semi-runner growth habit. It offers resistance to tomato spotted wilt virus similar to VA 98R, better than Perry but not as good as Gregory.

SELECTING AND MANAGING SOIL RESOURCES

Peanuts are best adapted to well-drained, light-colored, sandy loam soils, such as the Norfolk, Orangeburg, and Goldsboro sandy loam. These soils are loose, friable, and easily tilled with a moderately deep rooting zone for easy penetration by air, water, and roots. A balanced supply of nutrients is needed, as peanuts do not usually respond to direct fertilization. Soil pH should be in the range of 5.8 to 6.2. Peanuts grown in favorable soil conditions are healthier and more able to withstand climatic and biotic stresses.

Crop Rotation

A long crop rotation program is essential for efficient peanut production. The peanut plant responds to both the harmful and beneficial effects of other crops grown in the fields. Research shows that long rotations are best for maintaining peanut yields and quality. Benefits and potential problems associated with crops typically found within peanut-based cropping systems can be found in Chapter 6, "Peanut Disease Management." Research conducted at the Peanut Belt Research Station demonstrate the benefits of long rotations with corn (Table 3-5). Similar results are generally expected with cotton, and the value of rotation is also noted at Rocky Mount (Table 3-6). The value of planting the CBR-resistant variety Perry, compared to Gregory, is presented in Table 3-7. The economic value of planting various rotation crops with peanuts are presented in Table 3-8. These results underscore the importance of considering both biological factors and economics when developing appropriate cropping systems.

In recent years, there has been interest in crop yields, especially grains, when transitioning out of traditional peanut rotations. Results presented in Tables 3-5, 3-6, and 3-7 indicate that corn, soybeans, and wheat are not affected by rotation to the extent that peanuts are affected. The value of sod-based rotations on yields of peanuts and other crops has been demonstrated in the southeastern United States. In North Carolina, a trial was recently completed where peanuts and other row crops were planted in either killed fescue sod or standard reduced-tillage cropping systems, including combinations of cotton and corn. Results for peanuts from 2009 are presented in Table 3-9.

Table 3-5. Influence of Rotation on Crop Yield at Lewiston

Rotation (1997-2009) (CR – Corn, CT – Cotton, SB – Soybeans, WH – Wheat, PN – Peanut)	**Yield (lb/acre)**	**Yield (bu/acre)**			
	Peanut 2006	**Wheat 2008**	**Soybean 2008**	**Corn 2007**	**Corn 2009**
CR – CT – CR – PN – CR – CR – CR – CR – CR – PN – CR – WH/SB – CR	5,920 a	32 a	43 a	16 a	111 a
PN – CR – CR – PN – CR – CR – PN – CR – CR – PN– CR – WH/SB – CR	5,030 b	34 a	44 a	7 a	115 a
CR – PN – CR – PN – CR – PN – CR – PN – CR – PN– CR – WH/SB – CR	4,350 c	31 a	46 a	21 a	102 a
PN – SB – CR – PN – SB – CR – PN – SB – CR – PN – CR – WH/SB – CR	3,800 c	32 a	38 a	32 a	92 a
PN – PN – PN – PN – PN – PN – PN – PN – PN – PN – CR – WH/SB – CR	2,600 d	31 a	38 a	23 a	135 a

Table 3-6. Influence of Rotation Interval and Soybeans on Crop Yield at Rocky Mount

Rotation (2001-2009) (CR – Corn, CT – Cotton, SB – Soybeans, WH – Wheat, PN – Peanut)	**Yield (lb/acre)**	**Yield (bu/acre)**			
	Peanut 2006	**Wheat 2008**	**Soybean 2008**	**Corn 2007**	**Corn 2009**
CT – CT – CT – CT – CT – PN – CR – WH/SB – CR	3,770 a	40 b	15 a	77 a	125 ab
CT – CT – SB – CT – CT – PN – CR – WH/SB – CR	3,090 b	39 b	19 a	73 a	120 b
CT – CT – PN – CT – CT – PN – CR – WH/SB – CR	3,050 b	42 b	15 a	75 a	67 c
CT – PN – CT – PN – CT – PN – CR – WH/SB – CR	2,880 bc	51 ab	15 a	76 a	90 bc
PN – PN – PN – PN – PN – PN – CR – WH/SB – CR	2,420 c	65 a	19 a	85 a	169 a

Table 3-7. Influence of Rotation and Variety on Crop Yield at Whiteville

Rotation (2001-2009) (CR – Corn, CT – Cotton, PN – Peanut, TB – Tobacco)	**Yield (lb/acre)**			**Yield (bu/acre)**	
	Peanut, 2006		**Tobacco 2008**	**Corn 2007**	**Corn 2009**
	Variety				
	Gregory	**Perry**			
CR – CR – CR – CR – CR – PN – CR – TB – CR	3,310 a	3,540 a	3,340 a	141 a	101 a
CR – CR – TB – CR – CR – PN – CR – TB – CR	3,670 a	3,940 a	3,450 a	154 a	92 a
CR – CR – PN – CR – CR – PN – CR – TB – CR	2,330 b	3,030 a	3,230 a	162 a	104 a
TB – CR – PN – TB – CR – PN – CR – TB – CR	2,000 b	2,970 a	3,380 a	139 a	92 a

Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$.

Table 3-8. Plant Condition Rating (Percentage of Plants Expressing Symptoms of CBR), Root Knot Nematode Population in Soil, and Peanut Pod Yield During 2006 and Total Net Return From 2001-2006 at Lewiston-Woodville. *Corn, CT, peanut, and soybean price set at $4.00/Bushel, $0.60/Pound lint, $500/ton farmer stock, and $6.00/Bushel, respectively. The CBR-resistant peanut variety NC 12C was planted during all years.*

Cropping system (2001-2006) (CR-Corn, CT-Cotton, SB-Soybean, PN-Peanut)	Plant Condition (2006) (%)	Nematode Population in Soil (2006) (Log No./ 500 cc soil)	Peanut Yield (2006) (lb/acre)	Total Net Return (2001-2006) $/acre
CR-PN (3 cycles)	4 a	7.6 a	4,180 c	1,027 a
CT-PN (3 cycles)	3 a	1.9 bc	4,200 c	204 c
CR-CR-PN (2 cycles)	6 a	2.6 bc	4,850 ab	1,360 a
CT-CT-PN (2 cycles)	4 a	2.5 bc	4,730 bc	1,302 a
SB-CR-PN (2 cycles)	10 a	4.5 ab	4,130 c	1,079 ab
SB-CT-PN (2 cycles)	5 a	0 c	4,330 bc	738 b
CT-CR-PN (2 cycles)	4 a	1.2 bc	4,930 ab	1,366 a
Continuous PN	2 a	7.1 a	3,040 d	-175 f
CR-CR-CR-CR-CR-PN	4 a	0.6 c	5,540 a	1,324 a

Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$.

Lime

Peanuts grow best on soils limed to a pH of 5.8 to 6.2, provided other essential elements are in balance and available to the plant. Yields of peanuts planted in soil with four differing pH regimens are provided in Table 3-10. Dolomitic limestone is the desired liming material because it provides both calcium and magnesium. Strongly acidic soils reduce the efficient uptake and use of most nutrients and may enhance the uptake of zinc to potentially toxic levels. The efficiency of nitrogen fixation is reduced in acid soils. Molybdenum is an essential element in biological nitrogen fixation, and it can be limiting at low soil pH. Soils too high in pH are not desirable because some elements are less available to the peanut plant and incidence of *Sclerotinia* blight may be greater. Manganese deficiency is often observed in fields that are overlimed. Some research has demonstrated that higher rates of calcium sulfate (gypsum or landplaster) can reduce peanut yield when soil pH in the pegging zone is relatively low (Table 3-11). While these results are somewhat surprising, they remind us that soil pH should be maintained around 6.0 and that gypsum should be applied at rates not exceeding those currently recommended for Virginia market type peanuts.

Increased broiler production in North Carolina and use of manure as a fertilizer source has increased concern over micronutrient

Table 3-9. Peanut Yield in Strip Tillage and Conventional Tillage During 2009 Following 4 Years of Fescue versus 4 Years of Strip Tillage or No Tillage Combinations of Corn and Cotton (2005-2008)

		Peanut Yield (lb/acre in 2009)			
		Strip Tillage		Conventional Tillage	
Location	Soil Series	Fescue	Row Crops	Fescue	Row Crops
Lewiston	Norfolk	4,990	4,700	5,500	5,280
Rocky Mount	Goldsboro/ Raines	2,210	2,160	3,030	2,730
Rocky Hock	Valhalla	4,780	4,860	4,870	4,910
Edenton	Perquimans	4,330	4,060	4,220	4,120

Table 3-10. Yield of Peanuts Grown Under Four Soil pH Regimens

	2001	2003	2004
pH	(lb/acre)		
4.4	1,965	1,820	1,270
4.9	2,434	1,670	1,628
5.4	3,153	2,451	1,969
5.9	3,493	3,297	2,546

toxicity. Several peanut fields have exhibited severe and yield-limiting zinc toxicities. These toxicities are increased in fields with low pH because zinc is more available at a lower pH. Maintaining soil pH around 6.0 is important in minimizing the adverse effects of zinc, and growers are cautioned not to overload fields with high levels of waste products. Micronutrient levels can build up quickly. Peanuts generally are able to tolerate zinc indices of 250. However, zinc toxicity can occur with lower index values if soil pH is low.

Nitrogen

Roots of peanuts can be infected by *Bradyrhizobium* bacteria. Nodules form on the roots at the infection sites. Within these nodules, the bacteria can convert atmospheric nitrogen into a nitrogen form that can be used by plants through a process called *biological nitrogen fixation* (BNF). This symbiotic relationship provides sufficient nitrogen for peanut production if the roots are properly nodulated. Growers should inoculate their peanut seed or fields to ensure that adequate levels of *Rhizobia* are present in each field. The data in Table 3-12 are from multiple locations and give an indication of the possible response of peanuts to inoculant applied as a liquid or granular in the seed furrow. Reponse of peanuts to rotation and inoculant treatment is provided in Table 3-13. These data demonstrate that while peanut response to rotation is often predictable (Tables 3-5, 3-6, 3-7, 3-8),

Table 3-11 Peanut Yield (lb/acre) Following Application of Three Rates of Gypsum.[a]

Location	Year	Soil pH	Relative Calcium Sulfate Rate		
			0	1.0×	1.5×
Lewiston-Woodville	2001	6.0	4,000 a	3,780 a	3,670 a
Rocky Mount	2001	**5.5**	**4,170 a**	**3,970 ab**	**3,730 b**
Lewiston-Woodville	2002	6.1	3,420 a	3,570 a	3,390 a
Rocky Mount	2002	6.2	4,320 a	4,320 a	4,300 a
Lewiston-Woodville	2003	6.0	4,130 b	4,350 b	4,610 a
Rocky Mount	2003	5.8	3,780 a	3,660 a	3,740 a
Lewiston-Woodville	2004	**5.6**	**3,820 a**	**3,760 a**	**3,350 b**
Rocky Mount	2004	6.3	3,150 a	3,110 a	3,270 a
Lewiston-Woodville	2005	6.0	4,530 b	5,110 a	5,120 a
Rocky Mount	2005	6.6	2,540 b	4,490 a	4,630 a

[a]Means for cultivar or for relative calcium sulfate rate within each combination of year and location followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $p \leq 0.05$.

response to inoculant and rotation combinations is less predictable. Therefore, peanuts should be inoculated in all years regardless of previous rotation history to minimize risk and maintain yield.

Commercial inoculants can be added to the seed or put into the furrow with the seed at planting. In-furrow inoculants are available in either granular or liquid form. When inoculants are applied directly

Table 3-12. Peanut Yield Response in Fields Without a History of Peanuts versus Fields With Frequent Plantings of Peanuts (1999 – 2009)

Inoculant Use	New Peanut Fields	Fields with a Recent History of Peanuts
No inoculant	3,368	3,593
Inoculant	4,871	3,763
Difference	1,503	170
Number of Trials	27	23
Years	1999 – 2009	1999 – 2009

Table 3-13. Peanut Response in 2006 to Inoculation Following Various Intervals of Peanut Planting in Previous Years

Test	Range of Years Not Planted in Peanuts	Response to Rotation	Response to Inoculation
Test 1	0 – 5	Yes	No
Test 2	1 – 3	Yes	Yes
Test 3	0 – 5	Yes	No
Test 4	2 – 5	Yes	Yes

Table 3-14. Peanut Yield Response to Nitrogen Rate and Source When Applied in Early July When Nitrogen Deficiency Symptoms Are First Noted. Fields Were Not Planted in Peanuts During Previous Years.

Nitrogen Source	Actual N Rate (lb/acre)	Peanut Pod Yield (lb/acre)				
		Duplin County			Rocky Mount	
		2007	2008	2009	2008	2009
–	–	2,196 c	3,530 f	–	3,247 c	3,877 a
Inoculant	–	3,470 a	6,256 a	3,190 c	3,889 ab	3,484 a
Ammonium sulfate	60	3,333 ab	4,866 de	5,530 ab	3,698 abc	3,905 a
Ammonium sulfate	90	3,072 ab	5,125 cd	5,140 ab	4,070 a	3,910 a
Ammonium sulfate	120	3,624 ab	5,494 bc	6,060 a	3,986 ab	3,913 a
Ammonium sulfate	150	3,181 ab	5,898 ab	5,890 a	3,832 ab	3,821 a
Ammonium nitrate	60	3,290 ab	4,455 e	4,590 b	3,719 abc	4,063 a
Ammonium nitrate	90	2,767 bc	4,992 cde	5,470 ab	3,554 bc	3,837 a
Ammonium nitrate	120	3,247 ab	4,801 de	4,640 b	3,224 c	3,573 a
Ammonium nitrate	150	2,972 ab	5,188 cd	4,880 ab	3,301 c	3,425 a

Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $P \leq 0.05$.

in the seed furrow, either as a spray or granular, it is essential that the product reach the bottom of the seed furrow so that infection occurs as the root system develops. Some growers have had difficulty in obtaining nodulation because soil moved in the seed furrow after seed drop but before inoculant spray or granules entered the seed furrow. Additionally, shallow planting along with in-furrow spray inoculants have performed poorly under hot and dry soil conditions. Peanuts are capable of emerging from depths of at least 3 inches, therefore, it is advisable to plant deep to protect sprayed inoculant from breakdown caused by high temperatures.

Direct applications of nitrogen to peanuts are not generally needed. However, application of nitrogen fertilizers can increase yield, but only when peanuts are not nodulating and nitrogen deficiency is obvious. Research indicates that a minimum of 150 pounds actual nitrogen per acre as a single application may be needed to obtain yields similar to adequately nodulating peanuts when a true nitrogen deficiency exists in some fields. Lower rates also may be effective but perform inconsistently (Table 3-14). Research also suggests that ammonium sulfate is a more effective source than ammonium nitrate. Split applications may be more efficient than a single application. Best results are obtained when applications are made early in the season. Peanuts grown on deep sandy soils often respond to nitrogen fertilization and may lap middles more quickly even when inoculation is adequate. Rapid canopy closure results in cooler soil temperatures in the pegging zone. When soils have high temperatures, gynophores (pegs) cannot survive.

Potassium and Phosphorus

The most efficient and easiest way to apply potassium is to apply it to the crop preceding peanuts. This usually increases the yield of the preceding crop and allows the potassium to leach into the area where the peanut root system obtains most of its nutrients. However, if North Carolina Department of Agriculture and Consumer Services (NCDA & CS) soil test recommendations indicate that potassium and phosphorus are needed, then the appropriate levels of these nutrients should be applied.

Many growers and researchers feel that high levels of soil potassium in the fruiting zone (the upper 2 or 3 inches of soil) result in more pod rot and interfere with the uptake of calcium by pegs and pods, which results in a higher percentage of “pops” and calcium deficiency in the seeds. If the potassium level is high in the fruiting zone, a higher rate of gypsum may be needed.

Most of the peanut soils in North Carolina have adequate levels of phosphorus for good peanut production. Once a medium or higher level of phosphorus is achieved, it remains quite stable over a number of years. The addition of phosphorus-containing fertilizer to peanuts is generally not needed if it is applied to other crops in the rotation. However, soil testing is the only way to be sure.

Calcium

Perhaps the most critical element in the production of large-seeded Virginia market type peanuts is calcium. Lack of calcium uptake by peanuts results in "pops" and darkened plumules in the seed. Seeds with dark plumules usually fail to germinate.

Calcium must be available for both vegetative growth and pod growth. Calcium moves upward in the peanut plant but does not move downward. Thus, calcium does not move through the peg to the pod and developing kernel. The peg and developing pod absorb calcium directly from soil, so it must be readily available in the soil.

Adequate soil calcium is usually available for good plant growth but not for pod development or good quality peanuts. It is important to provide calcium in the fruiting zone through gypsum applications. Gypsum should be applied to all Virginia market types, regardless of the soil characteristics or soil nutrient levels. The calcium supplied through gypsum application is relatively water soluble (compared to other calcium sources) and more readily available for uptake by peanut pegs and pods. Each pod must absorb adequate calcium to develop normally.

Gypsum is available in three forms—finely ground, granular, and phosphogypsum. Several additional by-product gypsums are now

Table 3-15. Gypsum Sources and Application Rates

Source	% $CaSO_4$*	Application Rate (lb/acre)	
		Band (16-18 in)	Broadcast
USG Ben Franklin	85	600	-
USG 420 Granular	83	-	1,215
USG 500	70	-	1,300
Cal-Max AG	85	-	1,200
TG Phosphogypsum	50	-	2,000
Agri Gypsum	60	-	1,800
Power Gyp	85	-	1,200
Buckshot	**	-	2,000

* Guaranteed analysis percentage in registration with N.C. Department of Agriculture and Consumer Services.

**Buckshot is considered a lime by-product material and not a gypsum product.

on the market. The by-product materials vary in elemental calcium content. Studies show that all forms of gypsum effectively supply needed calcium when used at rates that provide equivalent calcium levels uniformly in the fruiting zone. General recommendations for application rates are given in Table 3-15.

The use of gypsum on large-seeded peanuts is very effective in improving peanut seed quality and grades. Some research data indicate that high rates of gypsum may control or reduce the pod rot disease complex. Gypsum should not be broadcast before land preparation or before planting because too much rain may leach the calcium below the fruiting zone.

Best results are obtained when gypsum is applied in late June or early July. The availability of calcium supplied by gypsum application is also influenced by the amount of rainfall. Moisture is needed to make gypsum soluble and calcium available to the peanut fruit. In unusually dry years, peanuts may show symptoms of calcium deficiency, even when recommended rates of gypsum are applied.

Increasingly, there are questions concerning the need to apply gypsum as supplemental calcium to peanuts. Sometimes peanuts do not respond to supplemental calcium. Sometimes peanuts respond well to half the amount given in Table 3-15. The interactions of environmental conditions, seed size, soil series, native fertility, and soil moisture are unpredictable. However, for a consistent response over a wide range of soil characteristics and weather conditions, the full rate of gypsum is recommended for Virginia market types. Growers are encouraged to evaluate peanut response to gypsum on their own farms before leaving off this input or reducing rates below those presented in Table 3-15. Data from several trials (Table 3-16) indicate that gypsum at rates below those recommended in Table 3-15 can, in some cases, be as effective as the rates listed in Table 3-15. For more information on techniques that can be used to compare treatments on the farm, see AG-615, *Knowing Your Field: A Guide to On-Farm Testing for Peanut Growers.*

Table 3-16. Gross Economic Value ($/acre) Following Application of Gypsum at 0.5 and 1 Times the Recommended Use Rate

			Economic Value ($/acre)		
Variety	**Years**	**Trials**	**No Gypsum**	**0.5× Gypsum**	**1.0× Gypsum**
NC 7	1998-1999	2	807	1,127	1,106
Gregory	1997-1999	5	1,202	1,287	1,360
Weighted average	1997-1999	7	1,089	1,241	1,287

There is also a question of whether or not the gypsum rate needs to be increased for extremely large-seeded Virginia market type varieties, such as Gregory. Results from 2001 – 2005 at two locations during each year indicated that a rate of 1.5 times the recommended rate did not increase pod yield over the normal use rate in most experiments (Table 3-11). While the data did indicate that the large-seeded variety Gregory was more responsive to gypsum than the much smaller-seeded variety NC-V 11, there was no advantage to applying gypsum at rates exceeding those rates listed in Table 3-15.

Small-seeded runner and Spanish varieties do not require as much calcium for optimum seed development as do the large-seeded Virginia market types. Recommendations vary in areas where runner peanuts are grown. Some states recommend calcium application regardless of seed size, while other states use the following relationships to determine if supplemental calcium is needed. If the calcium level in parts per million (ppm) exceeds 250 and the ratio of calcium to potassium is at least 3 to 1, additional calcium is not recommended. If growing runners for seed, apply gypsum to ensure proper kernel development and seedling vigor. To determine if supplemental calcium is needed for runner market types, use the following procedure:

Step 1. Take soil samples to a depth of 3 inches in the pegging zone in fields where runner market types are planted when flowering begins, generally in late June, keeping in mind that it could take several days to process soil samples.

Step 2. Determine the concentration of calcium in the soil in ppm using the following formula: **Calcium (% of total CEC) x CEC x 200**

Step 3. Determine the ratio of calcium to potassium using the following formula: **%Potassium (%K) = %Base saturation (%BS) – %Calcium (%Ca) – %Magnesium (%Mg)**

Step 4. Determine the ratio of calcium to potassium using the following formula: **%Ca divided by %K**

Example:

Step 1. The following data were recorded from a soil sample taken at a depth of 3 inches in the pegging zone at initial flowering in a field where a runner market type was planted.
%BS = 74, %Ca = 60, %Mg = 11, CEC = 5.6

Step 2. ppm = %CEC of calcium x CEC x 200 **ppm: 0.60 × 5.6 × 200 = 672**

Step 3. %K = %BS - %Ca - %Mg **%K = 74 – 60 – 11 = 3**

Step 4. %Ca divided by %K **60 divided by 3 = 20**

Recommendation: Do not apply gypsum because the Ca concentration exceeds 250 ppm (672 in this example) and the ratio of Ca to K exceeds 3 (20 in this example).

Manganese and Boron

Two other elements often found to be deficient in peanuts are manganese and boron. Manganese deficiency usually occurs when soil is overlimed. Increasing the soil pH reduces the plant's uptake of manganese. The symptom of manganese deficiency is interveinal chlorosis. This symptom can be confused with carryover of atrazine (from corn) or Cotoran/Meturon (from cotton). A deficiency can be corrected by a foliar application of manganese sulfate. The usual practice is to apply 3.5 to 4 pounds per acre of dry material when the deficiency is observed.

Boron plays an important role in kernel quality and flavor. Boron deficiency may occur in peanuts produced on deep, sandy soils. Deficient kernels are referred to as having hollow hearts. The inner surfaces of the cotyledons are depressed and darkened, so they are graded as damaged kernels. A general recommendation is to apply 0.5 pound of actual boron per acre as a foliar spray in early July. Several formulations of boron are available. Some growers apply boron with their preplant incorporated herbicides, and others have boron added to their fertilizers.

Growers are advised to make sure boron and manganese sources provide sufficient elemental boron. Several liquid boron and manganese formulations are available. Although liquid sources are more convenient to use than some dry products, some of the liquid products contain only a fraction of the needed boron or manganese. The amount of formulated product needed to supply 0.5 lb elemental boron per acre is provided in Table 3-17. Similarly, the amount of formulated manganese product needed to supply 1.0 lb manganese per acre is provided in Table 3-18. Lower rates of boron

Table 3-17. Amount of Formulated Product Needed to Provide Equivalent Amounts of Elemental Boron per Acre

Source	Amount Needed to Supply 0.5 lb Boron per Acre
Boric acid	3.0 lb
Disodium octaborate (Solubor, 17.5% boron)	2.8 lb
Liquid (9.0% boron)	2.2 qt

Table 3-18. Amount of Formulated Manganese Products Needed to Provide Equivalent Amounts of Elemental Manganese per Acre

Source	Amount Needed to Supply 1.0 lb Manganese per Acre
Manganese sulfate (Techmangum, 27% manganese)	3.7 lb
Manganese sulfate (8% manganese)	1.2 gal

or manganese are often applied for "maintenance." However, if a significant deficiency exists, 0.5 pound of boron per acre or 1 pound of manganese if manganese is needed, and growers need to apply a formulation that delivers this amount economically.

The percentage of element (in this case, manganese or boron) or the weight of the element per unit volume of product can be used to determine the amount of liquid product needed to correct a nutrient deficiency. For example, if 1 pound of manganese is needed per acre, the following formulas can be used to determine the amount of 8% water-soluble manganese product needed per acre.

Step 1. Figure the weight of manganese per gallon by multiplying the percent of manganese in product in pounds by the weight of product in pounds per gallon:
% manganese in product × lb product per gal = lb manganese per gal

Step 2. Figure the gallons of manganese product per acre by dividing the desired amount of manganese in pounds per acre by the weight of the manganese per gallon:

$$\frac{\text{desired lb manganese per acre}}{\text{lb manganese per gal}} = \text{gal manganese product per acre}$$

Example:
Step 1. 0.08 × 10.5 lb manganese sulfate per gal = 0.84 lb manganese sulfate per gal

Step 2. $$\frac{\text{1 lb manganese/acre desired}}{\text{0.84 lb manganese per gal}} = \text{1.2 gal 8\% manganese product per acre}$$

LAND PREPARATION

Historically, peanut growers have used the moldboard plow equipped with trash covers to prepare a smooth, uniform, and residue-free seedbed for planting. The burial of old crop residue and weed seed has been effective in the long-term suppression of soilborne diseases and short-term suppression of some weed problems. However, there is a growing trend toward reduced-tillage crop production in North Carolina, and some growers are successfully using these practices. There has also been a significant decrease in the number of growers using moldboard plowing.

There is concern about stratification of nutrients in reduced-tillage systems. For example, repeated applications of potassium in reduced-tillage cotton may result in excessive amounts of this nutrient in the pegging zone when peanuts are planted in a reduced-tillage system. Growers are encouraged to test soils for excessive potassium levels and incorporate this nutrient with tillage, if needed.

Many peanut growers bed their peanut fields either in the fall or spring. Many growers prefer planting on raised beds rather than flat planting. The beds often give faster germination and early growth, provide drainage, and may reduce pod losses during digging. While reduced-tillage systems can be as successful as conventional-tillage systems, reduced-tillage systems often have less consistent yields than in conventional-tillage systems. However, more recently most peanut production has shifted to sandy soils that respond more favorably to reduced-tillage systems.

For example, in experiments conducted from 1997 through 2001, peanut yield was approximately 5 percent higher when planted in conventionally tilled fields compared with planting in strip-tilled fields. In contrast, in experiments conducted from 2002 through 2005, peanut yield was approximately 2.3 percent higher when planted in strip-tilled fields rather than conventionally tilled fields. The change in yield was associated with the greater number of trials during 1997 through 2001 on the finer-textured soils compared to the lower number of trials during 2002 through 2005 on these soils.

Because of concern about digging losses on finer-textured soils, it is recommended that beds be established in the fall with a grass cover crop with peanuts strip-tilled into previously prepared beds. Research during 2005 and 2006 demonstrates that wheat, cereal (cover crop), rye, oats, and triticale can serve equally well as cover crops grown the winter and spring prior to planting peanuts. A risk advisory index has been developed to assist growers in deciding the risk of peanut yield in reduced-tillage systems being lower than yield in conventional-tillage systems (Table 3-19). Research also suggests that prior cropping history generally does not affect peanut response to tillage. However, peanuts are often more responsive to tillage system, primarily because of the digging requirement. The risk advisory index has been modified from the initial version.

PLANTING

Varieties grown in North Carolina generally require 142 to 160 days to reach full maturity depending upon soil moisture and temperature. Early plantings usually give higher yield, more mature pods, and permit earlier harvesting. However, planting date can affect disease and insect development (see Chapters 5 and 6). Less damage from thrips and lower incidence of tomato spotted wilt virus have been associated with later plantings. Peanut yields are often the highest when peanuts are planted in early to mid-May (Table 3-20). However, in some years peanuts planted later can yield quite well. Conditions in the fall, espe-

Table 3-19. Advisory Index for Determining the Risk of Peanut Yield in Reduced-Tillage Systems Being Lower Than Yield in Conventional-Tillage Systems

Soil series Roanoke and Craven…40 Goldsboro and Lynchburg…20 Norfolk…10 Conetoe and Wanda…0 Pod loss on finer-textured soils, such as those on the Roanoke and Craven series, is often greater than on coarser-textured soils, such as Conetoe and Wanda series, regardless of tillage system. Difficulty in digging can increase when these soils become hard in the fall if rainfall is limited.	**Soil series** **Your score:** ________
Tillage intensity No tillage into flat ground…40 points Strip tillage into flat ground…10 points Strip tillage into stale seedbeds…0 points Peanut response to reduced tillage systems is invariable correlated with the degree of tillage. Efficient digging can be difficult when peanuts are planted in flat ground in reduced tillage systems. While fields may appear to be flat and uniformly level, often fields are more rugged than they appear, and setting up the digger to match unforeseen contours in the field can be difficult. Strip tillage into flat ground is a better alternative than no tillage into flat ground, although digging peanuts planted on flat ground can be more challenging regardless of the tillage system. Strip tillage into preformed beds often results in yields approaching those of conventional tillage.	**Tillage intensity** **Your score:** _______
Risk of yield being lower in reduced tillage than in conventional tillage: **40 or Less—Low Risk** **40 to 50—Moderate Risk** **60 or More—High Risk**	**Total Index Value** **Your score:** _______

Table 3-20. Peanut Pod Yield (lb/acre) of the Varieties VA 98R and NC-V 11 Planted Beginning in Early May Through Early June During 2003, 2004, and 2005. *Peanuts for each planting date were dug based on pod mesocarp color.*

Approximate planting date	VA 98R			NC-V 11		
	2003	**2004**	**2005**	**2003**	**2004**	**2005**
May 5	2,660	5,670	4,526	-	**4,230**	4,090
May 15	**3,650**	**5,790**	4,483	3,080	-	**4,453**
May 25	2,780	4,670	**4,686**	-	-	3,661
June 5	3,150	3,280	4,078	**3,420**	3,710	3,582

cially night temperatures, can have a great impact on yield when they prevent peanut pods from reaching optimum maturity. Response of the early maturing cultivar CHAMPS and the later maturing cultivar Perry planted on three dates and dug at four times are presented in Table 3-21.

Seeding Rates and Twin Rows

Table 3-22 provides the conversion of seed per foot of row to pounds per acre in order to establish the desired plant population for a given variety. Germination percentage is not considered in this conversion, but it should be considered when planning planting.

Table 3-21. Peanut Variety Response to Planting and Digging Date

Planting Date	Digging Date	CHAMPS	Perry	Days from Emergence to Digging
May 5	September 5	3,880	4,320	116
May 5	September 20	5,310	5,210	131
May 5	October 5	5,310	5,520	146
May 5	October 20	3,890	4,790	161
May 25	September 5	3,670	3,430	97
May 25	September 20	5,020	4,760	112
May 25	October 5	6,070	5,840	127
May 25	October 20	4,940	6,040	142
June 8	September 5	2,510	2,100	83
June 8	September 20	3,940	3,380	99
June 8	October 5	5,110	4,830	114
June 8	October 20	4,860	4,280	129

Table 3-22. Pounds of Peanut Seed Required per Acre to Provide 3, 4, and 5 Seeds per Foot of Row on 36-inch Rows

		Pounds Per Acre (36-Inch Rows)		
Variety	Seed/lb	3 Seeds/ft	4 Seeds/ft	5 Seeds/ft
Bailey	540	80	110	140
Brantley	500	87	116	145
CHAMPS	535	76	102	127
Georgia Green*	850	52	68	85
Gregory	450	97	129	161
NC-V 11	625	70	93	116
Perry	525	83	111	138
Phillips	545	78	105	135
Sugg	575	76	101	126
VA 98R	575	75	101	126

*Georgia Green is a runner market type. All other varieties are Virginia market types.

In the Southeast, less tomato spotted wilt virus has been associated with twin row plantings than single rows. Similar results have been observed in North Carolina. Higher plant populations and closer row spacings often result in less virus. Seeding peanuts in narrow rows or at extremely high seeding rates has not increased yield over twin row plantings that establish a plant population of 5 plants per foot of row (sum of both twin rows). Although higher seeding rates are needed and higher rates of in-furrow insecticide and inoculant are required, twin rows tend to produce a greater taproot crop rather than a limb crop. This can improve uniformity of harvested peanuts, and in a dry season when peanut vines do not lap, can result in higher yields. One of the detriments of twin row plantings, especially with the higher plant populations, is excessive vine growth, which can make digging more difficult.

IRRIGATION

Having adequate water available throughout the peanut life cycle is important for optimal plant growth and development. Drought or flood can have tremendously negative impacts on peanut yields and quality. Likewise, pest infestation and severity of damage from these pests is influenced by available water, either in the form of rainfall or irrigation. Understanding how environmental conditions, and in particular irrigation, affect pest complexes is important in developing appropriate management strategies. Although less than 20 percent of North Carolina peanut acreage is irrigated, irrigation is a powerful production tool. Irrigation minimizes risk and enhances consistency of yield. Additionally, irrigation improves consistency of pesticide performance and in many ways the predictability of pest complexes. The major production and pest management practices employed in North Carolina peanut production are listed in Table 3-23, with brief comments on how irrigation or ample rainfall affect efforts to manage pests or supply peanuts with adequate nutrition.

DETERMINING MATURITY

Maturity affects flavor, grade, milling quality, and shelf life. Not only do mature peanuts have the quality characteristics that consumers desire; they are worth more to the producer. However, the indeterminate fruiting pattern of peanuts makes it difficult to determine when optimum maturity occurs. The fruiting pattern can vary considerably from year to year, mostly because of the weather. Therefore, each field should be checked before digging begins.

Table 3-23. Impact of Irrigation on Production and Pest Management Strategies

Production or Pest Management Practice	Benefits of Irrigation or Optimum Rainfall
Land Preparation	Helps in establishment of seedbeds, either conventional or reduced tillage.
Seed Germination	Ensures germination of seed when existing soil moisture is marginal for complete stand establishment.
Weed Management	Irrigation or adequate rainfall activates preemergence herbicides and minimizes plant stress. Less moisture stress often enhances control by postemergence herbicides and enables peanut to recover more rapidly from herbicide damage
Insect Management	Important for activation of in-furrow insecticides. Improves plant growth and root establishment, which is important in absorption of in-furrow insecticides. Improves peanut recovery from early-season insect damage and insecticide phytotoxicity. Increases the likelihood of southern corn rootworm survival and subsequent damage to pods, but can protect against damage from lesser cornstalk borer. Minimizes potential damage from corn earworms and armyworms by establishment of a dense canopy that can withstand damage from feeding. Reduces the likelihood of spider mite damage by keeping spider mite populations low.
Disease Management	Wet conditions early in the season can favor infection of peanut by CBR, but can minimize potential for crown rot. Irrigation increases likelihood of having a favorable microclimate for development of foliar and soilborne disease. A dense canopy that is supplemented by irrigation increases humidity within the canopy and minimizes airflow, all of which favor pathogen and disease development. Symptoms associated with tomato spotted wilt of peanut are often more pronounced when peanut are growing under dry and especially hot conditions. Timely irrigation will reduce plant stress and possibly enable plants to withstand tomato spotted wilt more effectively than non-irrigated, water-stressed plants.
Pod Maturation	Irrigation buffers against extremes in moisture and reduces stress (heat and drought), which allows normal flower production and kernel development. Maturation is more predictable and generally earlier. Limited rainfall during reproductive growth often causes delays in maturation and establishment of “multiple crops” or “split crops” on the same plant. Sufficient rainfall is critical for complete kernel development and pod fill. Limited soil moisture during flowering can reduce pegging. Irrigation modeling programs often include soil temperature as a trigger for irrigation during pegging.
Supplemental Calcium	Kernels need adequate calcium to become mature and completely developed. Irrigation buffers against drought, which reduces calcium concentration in soil water and mass flow movement into developing pegs.
Digging	Ability to supply soil water to improve digging conditions (reduces hardness of soil), improves digging efficiency and minimizes pod loss during the digging process.

Figure 3-1 The traditional profile board shown below was developed for runner market type production in the Southeastern United States.

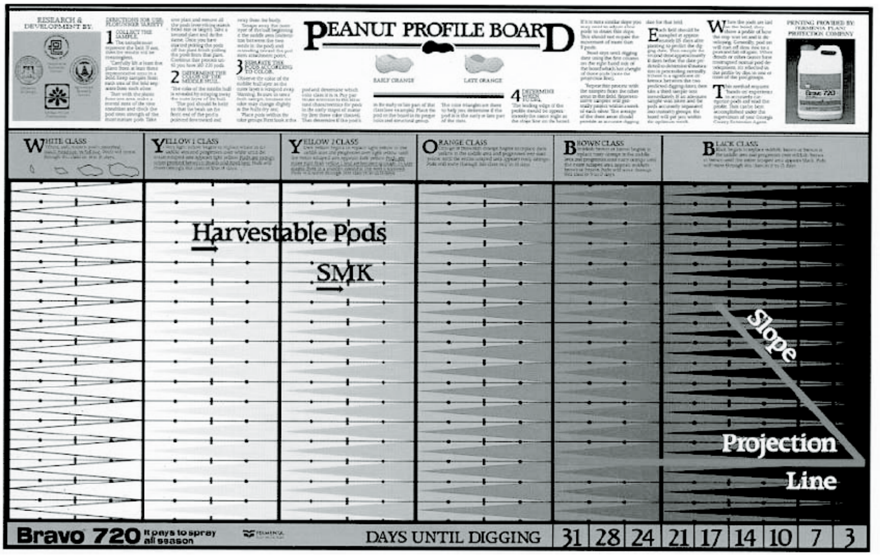
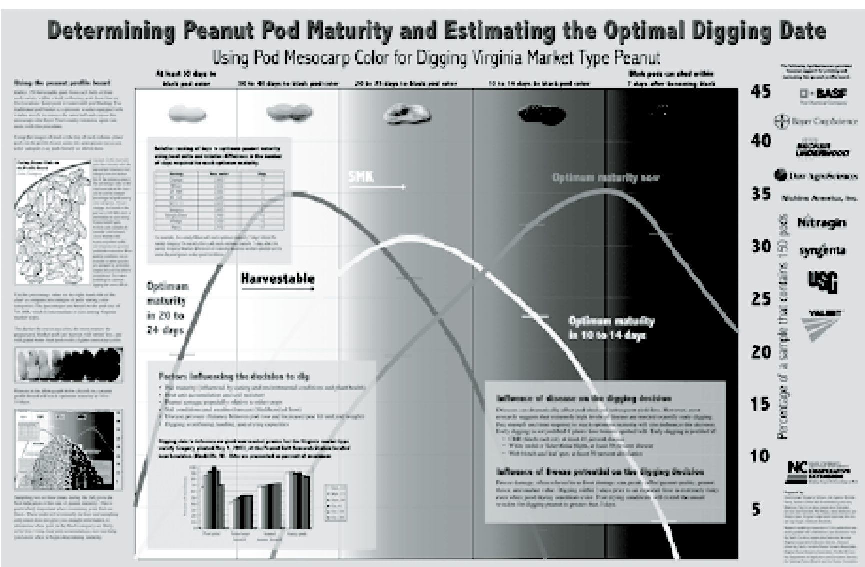


Figure 3-2. The peanut profile board shown below was developed for Virginia market types.



Many attempts have been made to develop precise methods to predict peanut maturity. The most widely used method is the hull-scrape method. The hull-scrape method, currently the most objective method, requires the use of a peanut profile board that is available at county Extension centers. The peanut profile board in Figure 3-1 was developed for runner market types grown in the southeastern United States. A new version of the peanut profile board was developed for Virginia market types grown in the V-C Region (Figure 3-2). It is important to follow a specific maturity prediction method to achieve maximum dollar value for peanuts.

Heat units or growing degree days (DD) can be a means of determining maturity. One growing degree day (base 56°F) accumulates when the average daily high and low temperature is 57°F. If the average daily high and low temperatures were 76°F, then 20 growing degree days accumulate for that day. Research has shown that 2,520 to 2,770 growing degree days are needed for Virginia market types to mature if soil moisture is not limiting. Pod maturation generally ceases in the fall when night temperatures are in the mid- to high 40s for two nights in a row. Even though day temperatures may increase considerably, the plant seldom recovers from these cooler night temperatures.

Pod yields in 2003 and 2004 demonstrate that heat units play a major role in determining optimum maturity (Table 3-24). Optimum yield across the six digging dates occurred when approximately 2,650 DD were accumulated. This number of heat units occurred 20 days earlier in 2004 compared with 2003, and highest pod yield also occurred 15 days earlier in 2004 compared with 2003. Adequate rainfall during both years allowed plant and pod development to continue at a predictable rate, but heat unit accumulation will be a poor indicator of peanut maturity at some locations and in some years, especially when rainfall is limited or stress during the season causes delays in growth and development.

Table 3-24. Yield of the Variety Gregory Planted May 5, 2003, or May 10, 2004, at Lewiston-Woodville

2003		2004	
Digging Date	**Yield**	**Digging Date**	**Yield**
Sept. 14	3,150	Sept. 13	2,910
Sept. 23	3,110	Sept. 17	**4,920**
Sept. 30	4,210	Sept. 24	3,890
Oct. 6	**4,950**	Oct. 1	3,530
Oct. 13	4,440	Oct. 8	1,860
Oct. 20	3,360	Oct. 15	1,290

Based on results from studies evaluating the influence of digging dates on six varieties grown at several locations in North Carolina, growers can loose between 4 and 19 pounds pod yield per acre per day by digging too soon (data not shown). A typical response of peanut to digging date can be seen for the variety Gregory (Table 3-25). Although market grade characteristics often remain high when peanuts are dug later in the fall, yield is often lower due to pod shed. A balance between digging too soon and digging before frost or inclement weather needs to be reached to maximize yield and quality. The dilemma a grower goes through in deciding when to dig is described in Table 3-26 and is based on data presented in Table 3-25. Many growers are concerned about delaying digging and becoming vulnerable to lengthy delays in digging due to adverse weather conditions.

At harvest, growers should follow the weather forecast closely and not dig peanuts when freezing temperatures are expected. It is also important to have adequate harvesting and curing equipment so that the peanut crop can be handled within a reasonable period of time. At least 3 days, and in many cases more than 3 days, are needed between the time of digging and frost to allow sufficient drying to prevent freeze damage.

Table 3-25. Average from 10 Trials for Heat Unit Accumulation, Days from Emergence, Yield, and Grade of the Variety Gregory Planted from 2003 – 2008 at Lewiston-Woodville

Days after Emergence	Heat Unit Accumulation	Yield (lb/acre)	Fancy (%)	Extra Large (%)	Total Sound Mature (%)
124	2,552	4,316	88	44	64
131	2,615	4,816	89	51	67
138	2,771	4,750	88	53	68
147	2,830	4,421	87	54	70
155	2,896	3,726	87	57	71

Table 3-26. Potential Economic Loss when Digging Peanuts 7 Days Prior to Optimum Maturity Compared with Economic Loss when Digging Is Delayed 3 Weeks Past Optimum Maturity

Timing of Digging	Peanut Price (per lb)	Yield Loss (per acre)	Loss in Value (per acre)	Economic Loss on 400 Acres
7 days prior to optimum digging	$0.21	500	$105	$42,000
21 days after optimum digging	$0.21	1,090	$229	$91,600

Demand for runner market type peanuts had declined in North Carolina, but new farm legislation and the federal peanut program has rekindled interest in production of runner market types in the Virginia-Carolina region. Part of this interest relates to market demand, while an appealing aspect of growing runners is potential savings in productions costs relative to Virginia market type peanuts (approximately 80 to 90 pounds of seed for runners versus 115 to 160 pounds of seed for Virginia market types and lower requirements for supplemental calcium by runner market types). However, Virginia market type varieties may mature earlier than many of the runner market type varieties. Yield of the runner type variety Georgia Green has been similar to yields of the Virginia type varieties NC-V 11 or Gregory in many of the experiments conducted in North Carolina over the past 10 years (Table 3-27). In addition to evaluating the

Table 3-27. Comparison of Pod Yield for Virginia and Runner Market Type Peanut Varieties

Test	Variety	Pod Yield (lb/acre)
Test 1 (Average from 16 experiments, 1997 to 1999)	Georgia Green NC-V 11	3,650 3,600
Test 2 (Average from five experiments, 1997 to 1999)	Georgia Green Gregory	4,500 4,360
Test 3 (Average from five experiments with two digging dates during 2003, 2004, and 2005)	Georgia Green Gregory	4,514 4,475

Table 3-28. Comparison of Pod Yield (lb/acre) for Runner, Virginia, and Spanish Market Type Peanut Varieties

		2005			2006		2007	2008	2009
Variety	Market Type	Bertie	Columbus	Pitt	Bertie	Edge-combe	Bertie	Bertie	Bertie
C 99R	Runner	–	–	–	4,744	4,242	5,131	–	–
CHAMPS	Virginia	–	–	4,723	–	–	–	5,510	5,599
Georgia 03L	Runner	4,904	4,501	–	4,633	4,601	4,926	5.651	5,215
Georgia 0C2	Runner	4,650	4,148	–	4,561	4,352	5,006	5,102	5,236
Georgia 0R1	Runner	4,948	3,553	–	4,365	4,055	5,165	5,849	–
Georgia Green	Runner	4,892	4,251	4,625	4,569	5,038	4,986	5,152	5,236
Gregory	Virginia	–	–	4,880	4,924	5,054	5,090	5,753	4,728
NC–V 11	Virginia	4,767	4,913	–	4,712	4,993	5,340	5,219	4,706
Olin	Spanish	–	2,375	–	3,288	3,839	3,370	4,327	–
Perry	Virginia	–	–	–	4,580	4,441	5,019	6,005	5,656
Phillips	Virginia	–	–	4,702	4,474	5,069	5,639	6,054	5,732
Tamspan 90	Spanish	–	3,219	–	3,721	3,777	3,671	4,409	4,002
ViruGard	Runner	–	4,155	5,148	4,185	3,958	5,185	–	–

runner-type Georgia Green, several more recently released varieties were evaluated in from 2005 – 2009 (Table 3-28). Digging dates of approximately September 20 and October 15 were included in these experiments. The highest yield of the two digging dates is included in Table 3-28. These varieties performed as well as the traditionals, although the Spanish market types Olin and Tamspan 90 yielded lower than Virginia and runner market types.

The relationship among cost of production, yield potential in North Carolina, and market price is presented in Table 3-29 for runner and Virginia market types. These data are designed to assist growers in determining if runner or Virginia market types are feasible under various ranges of yield potential, production costs, and market constraints.

Table 3-29 compares the economics of runner and Virginia market type peanuts at different yield potentials under different pricing structures. Yield data for the "high yield potential" comparison are from 31 sites from 1997 to 2004, comparing Georgia Green to NC-V 11 or Gregory. The "lower" and "moderate" yield potentials are estimated based on the "higher" yield potential data. Both market types were dug on the same day. The cost of production was $641 per acre for Virginia market types and $594 per acre for runners. Seeding rates were 140 pounds per acre for Virginia market types and 100 pounds per acre for runners; seed cost 70 cents per pound, so there was a differential of $28 per acre. Gypsum was applied at half rate for runners and at full rate for Virginia market types, so the cost differential was $19 per acre. Budgets do not reflect land rent, cost of fumigation for CBR, or sprays for *Sclerotinia* blight. The numbers used in this example are calculated from budgets used in previous years.

Table 3-29. Economic Comparison of Runner- and Virginia Market Type Peanuts at Different Yield Potentials Under Different Pricing Structures

Market Price ($/ton)	Lower Yield Potential		Moderate Yield Potential		Higher Yield Potentia	
	Runner 3,052 lb/A	Virginia 2,989 lb/A	Runner 3,552 lb/A	Virginia 3,477 lb/A	Runner 4,052 lb/A	Virginia 3,965 lb/A
Loan: $353 to 356	-52	-113	+38	-27	+127	+59
375	**-22**	-81	**+72**	+11	**+166**	+102
400	+16	-43	+116	+55	+216	+152
425	+55	-6	+161	+98	+267	+202
450	+93	**+32**	+205	**+142**	+317	**+251**
475	+131	+69	+250	+185	+368	+301
500	+169	+106	+294	+229	+419	+350

There is some debate about the yield potential of runners versus Virginia market types. Data in Table 3-29 represent actual data and are reliable. However, many of these experiments were conducted on sandy soils. On these soils, pods from Virginia market types are much less prone to shed than when grown on finer-textured soils. While comparing runner and Virginia market types within a yield potential range is important, it also may be helpful to compare yield across yield potential ranges. For example, economic return of a Virginia market type at $450 per ton with a yield potential of 3,477 pounds per acre is $142 per acre (Table 3-29). The runner market type in this yield potential range generates only $72 per acre (3,552 pounds per acre at $375 per ton). But, if higher yields for the runner market types are realized on a finer-textured soil compared to the Virginia market types, economic return even at a lower price is competitive with the Virginia market types (4,052 lb per acre at $375 per ton generates $166 per acre).

CULTURAL PRACTICES AND TOMATO SPOTTED WILT VIRUS

Tomato spotted wilt virus has increased dramatically in North Carolina over the past few years. Planting peanuts in reduced tillage systems (no till or strip till), seeding peanuts at higher rates (establishing 4 or more plants per row foot in single rows), planting twin rows, applying Thimet in furrow, delaying planting until late May, planting tolerant varieties, and maintaining good soil fertility can lessen the impact of tomato spotted wilt on peanut growth and yield. However, each of these cultural practices presents a range of risks and benefits. A tomato spotted wilt virus advisory, AG-638, *Managing Tomato Spotted Wilt Virus in Peanuts in North Carolina and Virginia*, was initially prepared in 2003 with an updated version of the advisory available through your local Cooperative Extension agent. A more in-depth discussion of strategies to manage tomato spotted wilt virus can be found in Chapter 5.

PLANT GROWTH REGULATORS

Apogee (prohexadione calcium) is registered for use in peanuts. Research has demonstrated that Apogee improves row definition, which can lead to increased efficiency in the digging and inversion process (Figure 3). Apogee should be applied when 50 percent of vines from adjacent rows are touching (Figure 4). Sequential applications (7.2 ounces per acre followed by 7.2 ounces per acre) spaced two to three weeks apart are generally needed. Include crop oil concentrate and nitrogen solution (UAN) with Apogee. Depending upon growing conditions, soil fertility, frequency of rainfall and irrigation, and variety selection, row visibility obtained in mid-August may not be sufficient through digging. Research suggests that in addition to increased row visibility, Apogee minimizes pod shed and pod loss during digging and harvesting operations. Significant yield increases have been observed. Research at N.C. State University suggests that the plant growth regulators Chaperone, Early Harvest, and Messenger do not increase peanut yield (Table 3-30).

Table 3-30. Peanut Yield (lb/acre) Following Application of Plant Growth Regulators and Fertilizers

Item	Apogee	Asset RTU	Chaperone	Early Harvest	Messenger	Rescue
No. of Trials	98	8	6	21	8	9
No. of Varieties or Lines	12	2	3	3	2	4
Years	1997-2009	2004-2006	2004-2008	1997-2001	2002-2004	2008-2009
Not Treated	3,977	5,168	4,664	3,910	4,270	4,218
Treated	4,083	4,892	4,624	3,850	4,300	4,282
Difference	+106	-276	-40	-60	+30	+64

Figure 3-3. Peanut response in early September to Apogee applied in late July and repeated in mid-August.

Figure 3-4. Apogee should be applied when 50% row closure is attained.

4. WEED MANAGEMENT IN PEANUTS

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Effective weed management is essential for profitable peanut production. Peanuts are not very competitive with weeds and thus require higher levels of weed control than most other agronomic crops to avoid yield losses. Weeds may also decrease digging efficiency, so effective late-season weed control can minimize losses during harvest. A weed management program in peanuts consists of good weed control in rotational crops; cultivation, if needed; establishment of a satisfactory stand and growing a competitive crop; and proper selection and use of herbicides.

CROP ROTATION

Rotate peanuts with corn or cotton to help manage various pests, including weeds. Crop rotation allows use of different herbicides on the same field in different years. Crop and herbicide rotation, along with good weed control in the rotational crops, helps prevent the buildup of problem weeds and helps keep the overall weed population at lower levels. Crop rotation will also help reduce the chance of developing populations of weeds that are resistant to herbicides.

CULTIVATION

Cultivation is an excellent way to supplement chemical weed control. One or two "non-dirting" cultivations often improve weed control. Additionally, cultivation in combination with banded herbicide applications can reduce costs. However, cultivation can damage the crop and reduce yield if not done properly. Movement of soil onto the lower branches and around the base of the plants causes physical damage and enhances development of stem and pod diseases. Deep cultivation also destroys residual herbicide barriers and brings up additional weed seeds. Cultivate when peanuts are small. Set sweeps to run flat and shallow to avoid throwing soil onto the peanut plants.

WEED SCOUTING

All fields, regardless of the crop being grown, should be surveyed for weeds between mid-August and the first killing frost. Record the weed species present, and note the general level of infestation of each species (light, moderate, or heavy). Weeds present in the fall will be the ones most likely to be problems the following year. Knowing what problems to expect allows you to better plan a weed management program for the following crop.

Scout peanut fields weekly from planting through mid-July to determine if or when postemergence herbicide treatment is needed. Proper weed identification is necessary because species respond differently to various herbicides. Contact your county Extension center for aid in weed identification. Timely application of postemergence herbicides is critical for effective control. Cultivation may be more appropriate if herbicide-resistant biotypes increase in prevalence.

WebHADSS (Herbicide Application Decision Support System), a computer-based program designed to assist in making decisions pertaining to postemergence herbicide applications, is available online through North Carolina Cooperative Extension (http://www.webhadss.ncsu.edu/). Weed density, predicted crop value, predicted weed-free crop yield, herbicide and application costs, and herbicide efficacy are used to develop a ranking of the economics of herbicide options for a specific weed complex. This approach does not consider the long-term effect of weed seed production if weeds are not controlled. The patchiness of weeds in each field and the time needed to scout fields are limitations to this approach. However, this decision support system is beneficial in explaining herbicide options. Listed below is the competitive index value assigned to weeds typically found in North Carolina peanut fields (Table 4-1). Cocklebur, with a ranking of 10, is considered the most competitive weed in peanut.

Table 4-1. Competitive Indices for Weeds in Peanut*

Weed	Rank	Weed	Rank
Common cocklebur	10.0	Fall panicum	1.8
Jimsonweed	5.8	Florida pusley	1.5
Common lambsquarters	5.2	Tropic croton	1.2
Smartweed	4.7	Dayflower	1.2
Redroot pigweed	4.0	Common purslane	1.2
Common ragweed	3.8	Prickly sida	1.2
Sicklepod	3.6	Horsenettle	1.1
Pitted morningglory	3.6	Yellow nutsedge	0.3
Entireleaf morningglory	3.2	Purple nutsedge	0.2
Velvetleaf	3.0	Goosegrass	0.2
Broadleaf signalgrass	1.8	Crabgrass	0.2
Eclipta	1.8		

*10 = most competitive weed.

The combined effect of interference by the weed complex is used to predict yield loss in the WebHADSS program. For example, a weed complex containing two Palmer amaranth, two crabgrass, and two eclipta per 100 square feet (33 feet of row with rows spaced 3 feet apart) would reduce peanut yield by 21 percent, based on a projected weed-free yield of 4,000 pounds per acre (Table 4-2). Using WebHADSS and given a crop value of $550 per ton, adequate growing conditions (good soil moisture for satisfactory herbicide performance), and large size weeds (at least 4 inches tall), WebHADSS would provide the suggestions in Table 4-3 with various economic returns. In this example, peanuts were planted May 10 and emerged May 17. The field was scouted June 4 and herbicide sprayed soon thereafter. Although issues relative to accuracy and time required for weed scouting do exist, the WebHADSS program does allow a relatively quick and clear comparison of herbicide options while taking herbicide efficacy, herbicide cost, and economic return from that investment into account.

Table 4-2. Potential Yield and Economic Losses if Weeds Are Not Controlled as Compared to Weed-Free Peanuts*

Weed species	Population	Yield Loss (lb per acre)	Yield Loss (% of weed-free yield)	Economic Loss ($ per acre)
Palmer amaranth	2	320	8.0	88
Crabgrass	2	16	0.4	4
Eclipta	2	216	5.4	79
Total Estimated Loss	–	552	13.8	152

*Anticipated yield of 4,000 pounds per acre and crop value of $550 per ton farmer stock peanuts.

Table 4-3. Ranking of Selected Herbicide Options Considering Efficacy and Economics*

Herbicide	Rate per Acre**	Gain by Applying Herbicide ($ per acre)	Cost of Weed Control ($ per acre)
Cobra	12.5 oz	114	17
Cobra + 2,4-DB	12.5 oz + 16 oz	110	21
Cobra + Select	12.5 oz + 8 oz	108	28

*Herbicide options other than these were listed. Includes adjuvant and application costs.
**Abbreviation: oz, ounces.

COMMENTS ON PEANUT HERBICIDES

Preplant Burndown Herbicides

Glyphosate (various formulations) and Gramoxone INTEON are relatively nonselective herbicides that control many of the winter weeds present in reduced tillage fields (Table 4-6). Harmony Extra and 2,4-D (various formulations) can also be applied. Harmony Extra can be applied no closer to planting than 45 days before planting. 2,4-D should be applied at least 30 days before planting.

Reduced Rates of Herbicides

When crop prices are low, producers are looking for ways to reduce production costs. One possibility is to reduce the application rate of herbicides. Under certain environmental conditions and with certain weed species or weed complexes, specific herbicides can be applied below the manufacturer's suggested use rate without sacrificing weed control. However, growers are cautioned that herbicides applied at reduced rates often do not control weeds adequately when environmental conditions (soil moisture in particular) do not favor herbicide activity. Applying herbicides at reduced rates to large weeds or weeds that are "hardened" often results in poor control as well. Weeds can also be more difficult to control if they were injured by herbicide with previous treatment. Using reduced rates will require that growers apply herbicides in a more timely manner and when weeds are not stressed. Regardless of the previously mentioned factors relative to reduced rates, manufacturers of herbicides will not back up their products when they are applied below the suggested use rate. **Liability falls exclusively to the grower.**

COMPATIBILITY OF AGRICHEMICALS

Compatibility is an important consideration when applying two or more products in the same tank. AG-653, *Tank Mixing Chemicals Applied to Peanut: Are the Chemicals Compatible,* is a comprehensive guide to agricultural compatibility. This Extension publication is available on the Web at http://www.peanut.ncsu.edu or from your local Extension Center. Consult product labels, AG-653, and your local Extension Agent for more information on agricultural chemical compatibility.

PREVENTING AND MANAGING HERBICIDE-RESISTANT WEEDS

In recent years, populations of weeds that were once controlled by specific herbicides have developed resistance to herbicides. Historically, the resistance of individual weeds within a population of a species has rarely occurred. However, increased selection pressure and the occurrence of cross resistance have resulted in increased frequency of herbicide resistance in some peanut fields. Two steps are critical to prevent yield loss from weed interference and preserve herbicide effectiveness: (1) determine whether weed escapes are herbicide resistant, and (2) develop an appropriate management strategy for herbicide-resistant weeds. While most weed escapes are the result of an application error or weather conditions, herbicide resistance is a real threat. Indicators of herbicide resistance and approaches to managing herbicide-resistant weed populations are listed in Tables 4-11 and 4-12. Contact your local Cooperative Extension agent if herbicide resistance is suspected.

In North Carolina, populations of pigweeds resistant to acetolactate synthase (ALS) inhibiting herbicides have been confirmed. The effectiveness of the herbicides Cadre, Pursuit, and Strongarm will be less in fields where resistant populations exist. Common ragweed resistance to ALS-inhibiting herbicides is also suspected but has not been documented. To manage weeds in these fields, growers should consider using herbicides with a different mode of action than the ALS-inhibiting herbicides. This can be accomplished in a variety of ways, including application of herbicide mixtures to broaden the spectrum of control. For more information on managing herbicide-resistant weeds, see AG-692, *Managing Herbicide Resistant Weeds in Peanuts in the United States*, which is available at your county Extension center and is on the Web at http://www.peanut.ncsu.edu.

Table 4-4. Weed Responses to Herbicides Applied Prior to Peanut Planting in Reduced Tillage Systems[1,3]

Species	Gramoxone INTEON	Glyphosate	2,4-D	Glyphosate + Harmony Extra	Glyphosate + 2,4-D	Glyphosate + Valor SX[2]
Bluegrass	GE	E	N	E	E	E
Buttercup	E	E	G	E	E	E
Chickweed	E	E	P	E	E	E
Curly dock	NP	E	F	E	FG	G
Geranium	GE	PF	PF	GE	F	GE
Henbit	E	E	FG	E	E	E
Marestails	PF	GE	GE	E	E	E
Mustard	FG	FG	GE	GE	E	E
Primrose	PF	F	E	FG	E	G
Ryegrass	G	E	N	E	E	E
Small grains	GE	E	N	E	E	E
Swinecress	P	FG	F	GE	G	E

[1]Gramoxone INTEON can be applied after peanut emergence; see notes in Table 4-7. Glyphosate (various formations) can be applied at or before ground cracking. 2,4-D (various formulations) should be applied 3 or more weeks before planting. Harmony Extra cannot be applied closer than 45 days prior to planting. See specific product labels for tank mixtures with these herbicides.
[2]Valor SX can be applied prior to planting up to 2 days after planting. See product label for information on sprayer cleanout.
[3]E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 50 to 80%; P = poor control, 25 to 50%; N = no control, less than 25%.

CHEMICAL WEED CONTROL IN PEANUTS

Control of witchweed is part of the State/Federal Quarantine Program. Contact the N.C. Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

TABLE 4-5. Herbicide Information for Peanuts

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
PREPLANT INCORPORATED				
Annual grasses and small-seeded broadleaf weeds	alachlor (Intrro) 4 EC	2 to 3 qt	2 to 3	Incorporate no deeper than 2 in.; see label for specific instructions. Unless shallowly incorporated, Intrro is more consistently effective when applied pre-emergence. Weak on Texas panicum. Do not apply more than 4 qt of Intrro per acre per season. Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.
	ethalfluralin (Sonalan) 3 EC	1.5 to 2 pt	0.56 to 0.75	Controls common annual grasses including Texas panicum. Use 3 pt of Prowl H2O or 2 pt of Sonalan for control of broadleaf signalgrass, Texas panicum, and fall panicum. Incorporate 3 in. deep for Texas panicum; otherwise, incorporate 2 to 3 in. deep. See labels for maximum waiting period between application and incorporation. Immediate incorporation is best. Dual Magnum or Outlook may be tank mixed with Prowl or Sonalan to suppress yellow nutsedge.
	pendimethalin (Prowl H2O) 3.8	1.5 to 3 pt	0.71 to 1.43	
Annual grasses, small-seeded broadleaf weeds, and nutsedge	dimethenamid (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	Apply and incorporate in top 2 in. of soil within 14 days of planting. Use high rate of Dual Magnum or Outlook for yellow nutsedge and broadleaf signalgrass. Not effective on purple nutsedge. Weak on Texas panicum. May be tank mixed with Prowl or Sonalan.
	metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Broadleaf weeds and suppression of nutsedge	diclosulam (Strongarm) 84 WDG	0.45 oz	0.024	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual Magnum, Outlook, Prowl H2O, Sonalan, or Stalwart. See label for rotation restrictions, especially corn. Growers are cautioned that Strongarm applied at rates exceeding 0.45 oz per acre can injure cotton the following year on soils with a shallow hardpan (less than 10 inches) and/or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptable to carryover of Strongarm. Some weed species have developed resistance to Strongarm.
Annual grasses, broadleaf weeds, and suppression of nutsedge	diclosulam (Strongarm) 84 WDG + pendimethalin (Prowl H2O) 3.8 or ethalfluralin (Sonalan) 3 EC or metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid (Outlook) 6.0 L	0.45 oz + 1.5 to 3 pt or 1.5 to 2 pt or 1 to 1.33 pt or 16 to 21 fl oz	0.024 + 0.71 to 1.43 or 0.56 to 0.75 or 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Supresses purple and yellow nutsedge. Does not control sicklepod. See Strongarm label for rotation restrictions.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
PPI FOLLOWED BY PRE				
Annual grasses, broadleaf weeds, and supression of nutsedge	pendimethalin (Prowl H2O) 3.8 or ethalfluralin (Sonalan) 3 EC or metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid (Outlook) 6.0 L followed by diclosulam (Strongarm) 84 WDG or flumioxazin (Valor SX) 51 WP	1.5 to 3 pt or 1.5 to 2 pt or 1 to 1.33 pt or 16 to 24 fl oz 0.45 oz or 2 oz	0.71 to 1.43 or 0.56 to 0.75 or 0.95 to 1.27 1 to 1.33 or 0.75 to 1 0.024 or 0.063	Controls most broadleaf weeds. Will not control sicklepod and is marginal on certain large-seeded broadleaf weeds. **Do not incorporate Valor.** Valor SX should be applied to the soil surface immediately after planting. Significant injury can occur if Valor is incorporated or applied 3 or more days after planting. Significant injury from Valor SX was noted in 2001, 2004, and 2006 even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Cotton grown under early season stress from conditions like excessively cool, wet, or crusted soils may be particularly susceptible to carryover of Strongarm. Some weed species have developed resistance to Strongarm.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
SPLIT APPLICATION (PPI + POST)				
Most broadleaf weeds and nutsedge	imazethapyr (Pursuit) 2 AS	2 + 2 oz	0.031 + 0.031	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Pursuit will usually control seedling johnsongrass and foxtails. For control of other annual grasses, Pursuit may be tank mixed with Dual Magnum, Outlook, Prowl H2O, or Sonalan and incorporated. See label for incorporation directions and **rotational restrictions**. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
PREEMERGENCE				
Annual grasses and small-seeded broadleaf weeds	alachlor (Intrro) 4 EC	2 to 3 qt	2 to 3	Apply as soon after planting as possible. All three herbicides are weak on Texas panicum. Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.
	dimethenamid (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	
	metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	
Broadleaf weeds	flumioxazin (Valor SX) 51 WDG	2 oz	0.063	Apply within 2 days after planting. Significant injury can occur if Valor SX is incorporated or applied 3 or more days after seeding. Controls carpetweed, common lambsquarters, Florida pusley, nightshade, pigweeds, prickly sida, and spotted spurge. Does not control sicklepod, yellow and purple nutsedge, or annual grasses. Significant injury from Valor SX was noted in 2001, 2004, and 2006, even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. See product label for comments on sprayer cleanup.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual grasses, broadleaf weeds, and suppression of nutsedge	flumioxazin (Valor SX) 51 WDG + metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid (Outlook) 6.0 L	2 oz + 1 to 1.33 pt or 16 to 21 fl oz	0.063 + 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Apply within 2 days after planting. Significant injury can occur if applied 3 or more days after planting. This combination does not control sicklepod but will control annual grasses (except Texas panicum) and will suppress yellow nutsedge. Significant injury from Valor was noted in 2001, 2004, and 2006, even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. See product label for comments on sprayer cleanup.
Broadleaf weeds and suppression of nutsedge	diclosulam (Strongarm) 84 WDG	0.45 oz	0.024	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual Magnum, Outlook, Prowl H2O, Sonalan, or Stalwart. See label for rotation restrictions, especially corn. Growers are cautioned that Strongarm applied at rates exceeding 0.45 oz per acre can injure cotton the following year on soils with a shallow hardpan (less than 10 inches) and/or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptable to carryover of Strongarm. Some weed species have developed resistance to Strongarm.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual grasses, broadleaf weeds, and suppression of nutsedge	diclosulam (Strongarm) 84 WDG + metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid (Outlook) 6.0 L	0.45 oz + 1 to 1.33 pt or 16 to 21 fl oz	0.024 + 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Supresses purple and yellow nutsedge. Does not control sicklepod. See label for rotation restrictions. Some weed species have developed resistance to Strongarm. Cotton grown under early season stress, such as excessively cool, wet, or dry weather, or crusted soils may be particularly susceptible to carryover of Strongarm.
Most annual broadleaf weeds and nutsedge	imazethapyr (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. Pursuit may be tank mixed with Dual Magnum, Intrro, Outlook, or Stalwart for annual grass control. See label for **rotational restrictions**. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
CRACKING STAGE				
Emerged annual grasses and broadleaf weeds	paraquat (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L	5.4 fl oz 8 fl oz	0.13	Apply at ground cracking for control of small emerged annual grasses and broadleaf weeds. May be tank mixed with Dual Magnum, Outlook, or Stalwart for residual control. Tank mix may cause severe injury to emerged peanuts. Add 1 pt nonionic surfactant per 100 gal spray solution. Follow all safety precautions on label. May also be tank mixed with Pursuit for residual control of nutsedge and broadleaf weeds. Applying Basagran at 0.5 pt per acre will reduce injury.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Additional residual control of annual grasses and certain small-seeded broadleaf weeds	alachlor (Intrro) 4 EC	2 to 3 qt	2 to 3	Use as a supplement to preplant or preemergence herbicides to provide additional residual control of annual grasses and certain small-seeded broadleaf weeds such as pigweed and eclipta. This treatment will not control emerged grasses or broadleaf weeds. Do not apply more than 4 qt Intrro, 21 oz Outlook, or 2.6 pt Dual Magnum or Stalwart per acre per season. Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.
	dimethenamid (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	
	metolachlor (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	
Most annual broadleaf weeds and nutsedge	imazethapyr (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. If weeds are emerged, add surfactant or crop oil according to label directions. See label for **rotational restrictions**. Pursuit may be tank mixed with paraquat. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
Some emerged broadleaf weeds and suppression of eclipta and yellow nutsedge	diclosulam (Strongarm) 84 WDG	0.45 oz	0.024	Strongarm can be applied through the cracking stage. Add 1 qt nonionic surfactant per 100 gal. The spectrum of weeds controlled is much narrower when Strongarm is applied to emerged weeds. Strongarm will not control emerged common lambsquarters or pigweeds but will control common ragweed and morningglories. Strongarm will suppress yellow nutsedge and eclipta. See product labels for information on mixing Strongarm with other herbicides. Some weed species have developed resistance to Strongarm.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
POSTEMERGENCE				
Annual broadleaf weeds	acifluorfen (Ultra Blazer) 2L	1 to 1.5 pt	0.25 to 0.38	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for species controlled, maximum weed size to treat, and addition of surfactant. Do not apply more than 2 pt postemergence per acre per season. May make sequential applications of 1 pt per acre followed by 1 pt per acre. Allow at least 15 days between sequential applications.
	acifluorfen (Ultra Blazer) 2L + 2,4-DB (Butyrac 200) 2 L	1 to 1.5 pt + 16 fl oz	0.25 to 0.38 + 0.25	Addition of 2,4-DB to Ultra Blazer improves the control of certain weeds when weed size exceeds that specified on the Ultra Blazer label. See above comments on Ultra Blazer. See label for suggestions on use of surfactant or crop oil. Apply when peanuts are at least 2 weeks old and before pod filling begins. Make only one application per year. Other trade names for 2,4-DB may be available.
	bentazon (Basagran) 4 L	1.5 to 2 pt	0.75 to 1	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for addition of oil concentrate, species controlled, and maximum weed size to treat. Basagran may also be applied at 1 pt per acre for control of cocklebur, jimsonweed, and smartweed 4 in. or less. Do not apply more than 4 pt of Basagran per acre per season. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
	bentazon (Basagran) 4 L + acifluorfen (Ultra Blazer) 2 L	1 to 2 pt + 1 to 1.5 pt	0.5 to 1 + 0.25 to 0.38	See above comments for Basagran and Ultra Blazer. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual broadleaf weeds (continued)	bentazon + acifluorfen (Storm) 4 L	1.5 pt	0.5 + 0.25	Apply when weeds are small and actively growing. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. These rates of bentazon and acifluorfen may not provide consistent control of lambsquarters, prickly sida, and spurred anoda. Do not apply more than 3 pt of Storm per season. Peanuts normally are very tolerant of Storm. However, injury is occasionally noted when Basagran, one of the components of Storm, is applied to peanuts treated with Di-Syston in-furrow.
	bentazon + acifluorfen (Storm) 4 L + 2,4-DB (Butyrac 200) 2 L	1.5 pt + 8 to 16 fl oz	0.5 + 0.25 + 0.125 to 0.25	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, pigweed, jimsonweed, and citron. Add surfactant or crop oil according to label directions. Make only one appli-cation per year. Apply when peanuts are at least 2 weeks old. Do not apply after pod filling begins. See comments for Storm alone. Peanuts normally are very tolerant of Storm. However, injury is occasionally noted when bentazon, one of the components of Storm, is applied to peanuts treated with Di-Syston in-furrow. Other trade names for 2,4-DB may be available.
	bentazon (Basagran) 4 L + 2,4-DB (Butyrac 200) 2 L	1 to 2 pt + 8 fl oz	0.75 to 1 + 0.125	Addition of 2,4-DB to Basagran improves control of morningglories. See above comments for Basagran. Add surfactant or crop oil according to label directions. Do not make more than two applications per year. Apply when peanuts are at least 2 weeks old and not within 45 days of harvest. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow. Other trade names for 2,4-DB may be available.
	imazapic (Cadre or Impose) 2 AS	4 oz	0.063	Controls most broadleaf weeds except ragweed, croton, lambsquarters, and eclipta. Apply before weeds exceed 2 to 4 in.; see label for specific weed sizes to treat. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. A soil-applied grass control herbicide should be used. However, Cadre and Impose will usually control escaped broadleaf signalgrass, fall panicum, and Texas panicum. See label for **rotational restrictions.** Some weed species have developed resistance to Cadre and Impose.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual broadleaf weeds (continued)	imazethapyr (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Apply when weeds are 3 in. tall or less. Add surfactant or crop oil according to label directions. **See label for rotational restrictions**. Pursuit may be tank mixed with Basagran, Ultra Blazer, paraquat formulations, and 2,4-DB. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
	2,4-DB (Butyrac 200) 2 L	1 pt	0.2 to 0.25	Effective on cocklebur and morningglory; pitted morningglory may be only partially controlled. Best results achieved when applied to small weeds. May use two applications per year. Do not apply within 45 days before harvest. Other trade names for 2,4-DB may be available.
	lactofen (Cobra) 2 EC	12.5 fl oz	0.2	Apply after peanuts have at least six true leaves. Apply to actively growing peanut. Controls most annual broadleaf weeds. Use minimum of 10 GPA and high pressure (40 to 60 psi). See label for species controlled and maximum weed size to treat. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate or methylated seed oil at 1 to 2 pt per acre. See label on when to use various adjuvants. Allow at least 14 days between applications. Can be tank mixed with Basagran, Pursuit, Cadre, Impose, 2,4-DB, and/or Select.
	lactofen (Cobra) 2 EC + bentazon (Basagran) 4 L	12.5 fl oz + 1.5 to 2 pt	0.2 + 0.75 to 1	See above comments for Cobra and Basagran. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual broadleaf weeds (continued)	lactofen (Cobra) 2 EC + bentazon (Basagran) 4 L + 2.4-DB (Butyrac 200) 2 L	12.5 fl oz + 1.5 to 2 pt + 8 to 16 fl oz	0.2 + 0.75 to 1 + 0.125 to 0.25	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, jimsonweed, and citron. See above comments for Cobra, Basagran, and 2,4-DB. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Other trade names for 2,4-DB may be available.
	lactofen (Cobra) 2 EC + imazapic (Cadre or Impose) 2 AS	12.5 fl oz + 4 oz	0.2 + 0.063	See above comments for Cobra and Cadre and Impose. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Cadre and Impose.
	lactofen (Cobra) 2 EC + imazethapyr (Pursuit) 2 AS	12.5 fl oz + 4 oz	0.2 + 0.063	See above comments for Cobra and Pursuit. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Pursuit.
Annual grasses and broadleaf weeds	paraquat (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L	5.4 fl oz 8 fl oz	0.13	See label for weeds controlled and maximum weed size to treat; best results if weeds 1 in. or less. A postemergence application may be made following an at-crack application. Do not make more than two applications per season, do not apply later than 28 days after ground cracking, and do not apply to peanuts under stress. Add 1 pt of nonionic surfactant per 100 gal of spray solution. Will cause foliar burn on peanuts, but crop recovers and yield not affected. Follow all safety precautions on label. Do not apply to peanuts showing symptoms of thrips damage.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual grasses and broadleaf weeds (continued)	paraquat (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L + bentazon (Basagran) 4 L	5.4 fl oz 8 fl oz + 0.5 to 1.5 pt	0.13 + 0.25 to 0.75	See previous comments for Gramoxone Inteon alone. Adding Basagran improves control of common ragweed, prickly sida, smartweed, lambsquarters, and cocklebur and reduces injury to peanuts from Starfire. May be applied any time from ground cracking up to 28 days after ground cracking. Add 1 pt of nonionic surfactant per 100 gal of spray solution. Peanuts normally are very tolerant of Basagran. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
	paraquat (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L + bentazon + acifluorfen (Storm) 4 L	5.4 fl oz 8 fl oz + 1.5 pt	0.13 + 0.5 0.25	See previous comments for Gramoxone Inteon alone. Storm improves control of common ragweed, smartweed, lambsquarters, common cocklebur, tropic croton, and spurred anoda. May be applied anytime from ground cracking up to 28 days after ground cracking. Add 0.5 pt of nonionic surfactant per 100 gal of spray solution. Peanuts normally are very tolerant of Basagran. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow. The mixture of paraquat and Storm is more injurious than these herbicides applied alone.
Florida beggarweed	chlorimuron (Classic) 25 DF	0.5 oz	0.008	Use only for control of Florida beggarweed. Apply from 60 days after crop emergence to within 45 days of harvest. Application to peanuts less than 60 days old will result in crop injury and yield reduction. Apply before Florida beggarweed has begun to bloom and before it has reached 10 in. tall. Larger beggarweed may only be suppressed. Add 1 qt of nonionic surfactant per 100 gal spray solution; do not add crop oil. May be tank mixed with 2,4-DB; see label for rates and precautions. **Recommended as a salvage treatment only.**
Yellow nutsedge	bentazon (Basagran) 4 L	1.5 to 2 pt	0.75 to 1	Apply when nutsedge is 6 to 8 in. tall. A repeat application 7 to 10 days later may be needed. Adding crop oil concentrate at 1 qt per acre will increase control. Do not apply more than 4 pt of Basagran per season. Not effective on purple nutsedge. Peanuts normally are very tolerant of bentazon. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Yellow and purple nutsedge	imazapic (Cadre or Impose) 2 AS	4 oz	0.063	Apply postemergence when nutsedge is 4 in. or less. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. See label for **rotational restrictions.**
	imazethapyr (Pursuit) 2 AS	4 oz	0.063	Apply before nutsedge is larger than 3 in. tall. Add surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. Do not mix with Basagran for nutsedge control. See label for **rotational restrictions.** A split application with half of the Pursuit applied preplant incorporated and half applied early post-emergence may be more effective than applying all of the Pursuit at one time.
Annual grasses	clethodim (Arrow, Select, or Volunteer) 2 EC (Select MAX) 0.97 EC	6 to 8 fl oz 9 to 16 fl oz	0.094 to 0.125 0.068 to 0.121	Apply Arrow, Poast, Poast Plus, Select 2 EC, Select MAX, or Volunteer to actively growing grass not under drought stress. Consult labels for maximum grass size to treat. Apply in 5 to 20 GPA at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre to Poast or Poast Plus. Do not cultivate within 7 days before or after application. Poast Plus is often slightly better than Poast. Add crop oil concentrate at 1 qt per acre to Arrow, Select 2 EC, Select MAX, and Volunteer. Nonionic surfactant at 1 qt per 100 gal can be applied with Select MAX rather than crop oil concentrate. Some herbicides and fungicides can reduce the efficacy of Arrow, Select 2 EC, Select MAX, Volunteer, Poast, and Poast Plus when applied in tank mixtures. See product labels for specific instructions concerning compatibility with other chemicals. Also see AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and is available at your county Extension center.
	sethoxydim (Poast) 1.5 EC (Poast Plus) 1 EC	1 pt 1.5 pt	0.19	

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Bermudagrass	clethodim (Arrow, Select, or Volunteer) 2 EC (Select MAX) 0.97 EC	8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25 0.091 to 0.24	Apply to actively growing bermudagrass before runners exceed 6 in. In most cases, a second application will be needed. Make second application of 1 pt of Poast or 1.5 pt of Poast Plus per acre if regrowth occurs. Add 2 pt per acre of crop oil concentrate. Poast Plus is often slightly better than Poast. If needed, make a second application of Arrow or Select 2 EC at 8 to 16 oz per acre when regrowth is less than 6 in. Add crop oil concentrate at 1 qt per acre to Arrow, Select 2 EC, and Volunteer. Crop oil concentrate (1 qt per acre) or nonionic surfactant (1 qt per 100 gallons) should be applied with Select MAX. See product labels for specific instructions concerning compatibility with other chemicals. Also see AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and available at your county Extension center.
	sethoxydim (Poast) 1.5 EC (Poast Plus) 1 EC	1.5 pt 2.25 pt	0.28	
Rhizome johnsongrass	clethodim (Arrow, Select, or Volunteer) 2 EC (Select MAX) 0.97 EC	8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25 0.091 to 0.24	Apply to actively growing johnsongrass before it exceeds 25 in. tall. Add 2 pt per acre of crop oil concentrate. A second application of the same rates can be made if needed before new plants or regrowth exceeds 12 in. Apply Arrow or Select 2 EC when johnsongrass is 12 to 24 in. tall. If needed, make a second application of 6 to 8 oz per acre when regrowth is 6 to 18 in. Add crop oil concentrate at 1 qt per acre to Arrow, Select 2 EC, Select MAX, and Voluneer. Crop oil concentrate (1 qt per acre) or nonionic surfactant (1 qt per 100 gallons) should be applied with Select MAX. For specific instructions for compatibility concerns with other chemicals, see product labels and AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and available at your county Extension center.
	sethoxydim (Poast) 1.5 EC (Poast Plus) 1 EC	1 pt 1.5 pt	0.19	

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Suppression of large Palmer amaranth and other pigweed species that are resistant to the ALS inhibiting herbicides Cadre, Classic, Impose, Pursuit, and Strongarm	2,4-DB (Butyrac 200) 2 L + lactefen (Cobra) 2 EC or acifluorfen (Ultra Blazer) 2 L	16 oz + 12.5 oz or 1.5 pt	0.25 + 0.20 or 0.38	Suppresses and does not completely control Palmer amaranth and other pigweed species that exceed 8 inches. Suppression of weeds exceeding 12 inches will be less than suppression of smaller weeds. Do not expect suppression to exceed 60%. Applying 2,4-DB 3 to 4 days prior to Cobra or Ultra Blazer may be more effective than tank mixtures of 2,4-DB with Cobra or Ultra Blazer. Cobra is generally more effective on larger Palmer amaranth and other pigweed species than Ultra Blazer. Apply crop oil concentrate at 1% (v/v) with Cobra and Ultra Blazer. Do not apply adjuvant with 2,4-DB alone. See product labels for comments on spray volume and effects on peanut especially during pod set and pod fill. Higher spray volumes are more effective by increasing spray coverage of the contact herbicides Cobra and Ultra Blazer.
	2,4-DB (Butyrac 200) 2 L then lactefen (Cobra) 2 EC or acifluorfen (Ultra Blazer) 2 L	16 oz then 12.5 oz or 1.5 pt	0.25 then 0.20 or 0.38	Two applications of 2,4-DB spaced 10 to 14 days apart will suppress Palmer amaranth and other pigweed species. Although suppression by 2,4-DB is lower than sequential or tank mix application of 2,4-DB and Cobra or Ultra Blazer within two weeks after application, suppression by sequential applications of 2,4-DB 4 to 5 weeks after initial application is only slightly lower than suppression by sequential or tank mix applilcation of 2,4-DB and Cobra or Ultra Blazer. For more information on managing herbicide-resistant weeds in peanut, see AG-692, *Managing Herbicide-Resistant Weeds in Peanuts in the United States*, which is on the Web at www.peanut.ncsu.edu.
	2,4-DB (Butyrac 200) 2 L then 2,4-DB (Butyrac 200) 2 L	16 oz then 16 oz	0.25 then 0.25	

TABLE 4-5. Herbicide Information for Peanuts (continued)

Weed	*Herbicide and Formulation*	*Amount of Formulation Per Acre*	*Pounds Active Ingredient Per Acre*	*Precautions and Remarks*
Annual grasses and certain small-seeded broadleaf weeds	dimethenamid (Outlook) 6.0 L	16 to 21 fl oz	0 .75 to 1	Will not control emerged grasses or weeds; apply following a cultivation or appropriate postemergence herbicide if emerged grasses or broadleaf weeds are present. Benefit likely only on very sandy fields heavily infested with annual grasses that receive above normal rainfall during the first 4 to 5 weeks of the growing season. Lay-by of Dual Magnum or Outlook may also be of value in fields with a history of Eclipta problems; the application must be made before Eclipta emerges. Rates are on a broadcast basis; apply in an 18-in. band to row middles. The maximum use rate of Dual Magnum is 2.6 pt per acre per season. The maximum rate of Outlook is 21 fl oz per acre per season. Do not apply Outlook within 80 days of harvest.
	metolachlor (Dual Magnum) 7.62 EC	0.67 to 0.88 pt	0.64 to 0.84	

Table4-6. Weed Response to Preplant Incorporated, Preemergence, and At-Cracking Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence
Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Species	Prowl or Sonalan PPI	Prowl or Sonalan + Metolachlor PPI	Prowl or Sonalan + Outlook PPI	Metolachlor PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Metolachlor or Outlook + Strongarm PPI or PRE	Pursuit PPI + POST	Metolachlor PRE	Intro PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Metolachlor or Outlook + Valor SX PRE	Metolachlor AC[1]	Intro AC[1]	Outlook AC[1]	Gramoxone Inteon AC	Strongarm AC[2]	Paraquat + Strongarm AC[2]
Bermudagrass	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P
Black nightshade	N	F	F	F	F	N	N	F	G	F	FG	F	E	E	E	F	FG	F	PF	N	G
Broadleaf signalgrass	G	E	E	G	FG	P	G	G	G	G	FG	FG	P	G	FG	G	FG	FG	E	N	GE
Carpetweed	G	G	G	FG	FG	G	G	G	FG	FG	FG	G	—	G	G	FG	FG	G	FG	—	G
Cocklebur	N	N	N	N	N	G	G	G	GE	N	N	N	PF	PF	PF	N	N	N	E	E	E
Common ragweed	N	P	PF	PF	F	G	G	GE	P	PF	PF	F	FG	G	GE	PF	PF	F	F	E	E
Crabgrass	E	E	E	E	E	P	E	E	F	E	E	E	PF	E	E	E	E	E	G	N	G
Crowfootgrass	E	E	E	E	E	—	—	—	—	E	E	E	PF	G	G	E	E	E	E	N	GE
Dayflower	P	GE	—	GE	—	G	G	GE	—	GE	—	—	F	F	GE	GE	—	—	—	—	G
Eclipta	N	G	G	G	G	GE	GE	GE	P	FG	FG	FG	G	G	GE	FG	FG	FG	FG	NP	FG
Fall panicum	G	E	E	E	E	P	E	E	PF	E	E	E	PF	FG	GE	E	E	E	E	N	GE
Florida beggarweed	N	PF	PF	F	F	F	F	F	P	F	F	F	G	GE	E	F	F	F	E	FG	G
Foxtails	E	E	E	E	E	P	E	E	G	E	E	E	PF	E	E	E	E	E	E	N	GE
Goosegrass	E	E	E	E	E	P	E	E	PF	E	E	E	PF	GE	E	E	E	E	E	N	GE

Table4-6. Weed Response to Preplant Incorporated, Preemergence, and At-Cracking Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence
Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Species	Prowl or Sonalan PPI	Prowl or Sonalan + Metolachlor PPI	Prowl or Sonalan + Outlook PPI	Metolachlor PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Metolachlor or Outlook + Strongarm PPI or PRE	Pursuit PPI + POST	Metolachlor PRE	Intrro PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Metolachlor or Outlook + Valor SX PRE	Metolachlor AC[1]	Intrro AC[1]	Outlook AC [1]	Gramoxone Inteon AC	Strongarm AC [2]	Paraquat + Strongarm AC [2]
Jimsonweed	N	N	N	N	N	GE	GE	GE	G	N	N	N	G	G	GE	N	N	N	E	—	E
Johnsongrass, Seedling	G	G	G	PF	PF	N	G	PF	GE	PF	PF	PF	N	FG	PF	PF	PF	PF	E	N	GE
Johnsongrass, Rhizome	P	PF	PF	N	N	N	P	N	FG	N	N	N	N	N	N	N	N	N	P	N	P
Lambsquarters	G	NG	G	F	FG	FG	GE	GE	FG	F	F	FG	GE	GE	GE	F	F	FG	F	N	G
Morningglory	P	P	P	N	N	G	G	G	G	N	N	N	FG	G	G	N	N	N	F	GE	E
Nutsedge, Yellow Nutsedge, Purple	N N	G N	FG N	G N	FG N	FG FG	FG FG	G FG	FG FG	FG N	P N	F N	P P	PF P	FG P	FG N	P N	F N	PF PF	PF NP	G PF
Pigweed	G	E	E	G	G	G	E	E	E	G	GE	GE	E	E	E	G	GE	GE	E	NP	E
Prickly sida	N	P	P	P	P	FG	FG	FG	G	P	P	P	FG	G	G	P	P	P	F	—	G
Purslane	G	GE	GE	G	G	—	G	G	—	G	G	G	G	GE	GE	GE	P	P	—	—	—
Sicklepod	N	NP	NP	NP	NP	P	P	P	P	NP	PF	NP	P	PF	PF	NP	PF	NP	G	N	G
Smartweed	N	N	N	N	N	G	G	G	G	N	N	N	—	—	—	N	N	N	G	—	E
Spurge spp.	P	F	F	PF	PF	—	—	—	P	F	P	F	G	G	G	N	N	N	F	—	F

Table4-6. Weed Response to Preplant Incorporated, Preemergence, and At-Cracking Herbicides in Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence
Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

Species	Prowl or Sonalan PPI	Prowl or Sonalan + Metolachlor PPI	Prowl or Sonalan + Outlook PPI	Metolachlor PPI	Outlook PPI	Strongarm PPI or PRE	Prowl or Sonalan + Strongarm PPI	Metolachlor or Outlook + Strongarm PPI or PRE	Pursuit PPI + POST	Metolachlor PRE	Intro PRE	Outlook PRE	Valor SX PRE	Prowl or Sonalan PPI + Valor SX PRE	Metolachlor or Outlook + Valor SX PRE	Metolachlor AC[1]	Intro AC[1]	Outlook AC [1]	Gramoxone Inteon AC	Strongarm AC [2]	Paraquat + Strongarm AC [2]
Spurred anoda	N	N	N	N	N	FG	FG	FG	G	N	N	N	F	FG	FG	N	N	N	P	—	G
Texas panicum	G	G	G	PF	PF	P	G	PF	PF	PF	PF	PF	PF	G	F	PF	PF	PF	E	N	GE
Tropic croton	N	N	N	N	N	PF	PF	PF	P	N	N	N	—	—	—	N	N	N	F	—	F
Velvetleaf	N	N	N	N	N	GE	GE	GE	FG	N	N	N	F	FG	FG	N	N	N	F	—	FG

[1] Residual control only.
[2] Assumes weeds are 1- to 2-in. tall or smaller.

Key:
E = excellent control, 90% or better
F = fair control, 50% to 80%
G = good control, 80% to 90%
P = poor control, 25% to 50%
N = no control, less than 25%

TABLE 4-7. Weed Response to Postemergence Herbicides — Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence

Species	2,4-DB	Paraquat [1]	Paraquat + 2,4-DB	Paraquat + Basagran	Paraquat + Storm	Basagran	Basagran + 2,4-DB	Ultra Blazer	Ultra Blazer + 2,4-DB	Basagran + Ultra Blazer [2]	Storm	Storm + 2,4-DB	Pursuit + 2,4-DB	Cadre or Impose	Cobra	Cobra + Basagran	Cobra + Basagran + 2,4-DB	Cobra + Cadre or Impose	Cobra + Pursuit	Poast or Poast Plus	Clethodim
Bermudagrass	N	P	P	P	P	N	N	N	N	P	N	N	N	N	N	N	N	N	N	FG	G
Black nightshade	N	PF	PF	PF	G	P	P	G[1]	G[1]	G[1]	G[1]	G[1]	G	G	G[1]	G[1]	G[1]	G	G	N	N
Broadleaf signalgrass	N	GE	GE	E	GE	N	N	NP	NP	P	NP	NP	G	G	N	N	N	G	G	E	E
Carpetweed	P	FG	FG	FG	G	P	P	GE	E	E	G	G	FG	FG	G	G	G	G	G	N	N
Cocklebur	E	G	E	E	E	E	E	G	E	E	E	E	E	E	G	G	E	E	E	N	N
Common ragweed	PF	F	F	G	E	G[4]	G[4]	E[1]	E[1]	E[1]	E[1]	E[1]	P	PF	E	E	E	E	E	N	N
Crabgrass	N	G	G	G	G	N	N	N	N	N	N	N	FG	FG	N	N	N	FG	FG	GE	GE
Crowfootgrass	N	GE	GE	G	GE	N	N	P	P	P	P	P	P	G	N	N	N	G	P	F	G
Dayflower	—	G	G	G	FG	G	G	—	—	G	FG	FG	—	G	—	G	G	G	—	N	N
Eclipta	P	F	F	F	FG	FG	FG	G	G	G	FG	FG	P	F	G	G	G	G	G	N	N
Fall panicum	N	GE	GE	G	GE	N	N	PF	PF	P	PF	PF	PF	G	N	N	N	G	PF	E	E
Florida beggarweed	P	G	E	GE	G	N	P	PF	F	F	P	P	P	F	F	F	F	F	F	N	N
Foxtails	N	GE	GE	G	GE	N	N	PF	PF	P	PF	PF	G	G	N	N	N	G	G	E	E
Goosegrass	N	GE	GE	G	GE	N	N	N	N	N	N	N	N	F	N	N	N	F	N	GE	GE
Jimsonweed	P	G	G	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	N	N
Johnsongrass, Seedling	N	GE	GE	GE	GE	N	N	P	P	P	P	P	GE	E	N	N	N	E	GE	E	E
Johnsongrass, Rhizome	N	P	P	P	P	N	N	N	N	N	N	N	F	FG	N	N	N	FG	F	G	GE
Lambsquarters	PF	F	F	G	G	FG	G[4]	G	G	GE	G	G	P	PF	P	FG	G	PF	P	N	N
Morningglory, Pitted	FG	F	G	FG	E	P	G	E	E	E	E	E	G	GE	G	G	G	GE	G	N	N
Morningglory, Others	E	F	E	FG	E	P	E	GE	E	E	GE	E	E	G	G	G	E	G	E	N	N

TABLE 4-7. Weed Response to Postemergence Herbicides — Peanuts

Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence

Species	2,4-DB	Paraquat [1]	Paraquat + 2,4-DB	Paraquat + Basagran	Paraquat + Storm	Basagran	Basagran + 2,4-DB	Ultra Blazer	Ultra Blazer + 2,4-DB	Basagran + Ultra Blazer [2]	Storm	Storm + 2,4-DB	Pursuit + 2,4-DB	Cadre or Impose	Cobra	Cobra + Basagran	Cobra + Basagran + 2,4-DB	Cobra + Cadre or Impose	Cobra + Pursuit	Poast or Poast Plus	Clethodim
Nutsedge, Yellow	N	PF	PF	FG	G	G[3]	G	N	N	G	F	F	F	G	N	G[3]	G[3]	G	F	N	N
Nutsedge, Purple	N	PF	PF	PF	PF	NP	P	N	N	P	N	N	FG	G	N	P	P	G	FG	N	N
Pigweed	PF	G	G	G	E	N	P	E	E	E	E	E	E	E	E	E	E	E	E	N	N
Prickly sida	F	F	F	G	G	G	G	N	F	G	FG	G	P	G	G	G	G	G	G	N	N
Purslane	FG	—	FG	G	G	G	G	E	E	E	GE	GE	FG	—	E	E	E	E	E	N	N
Sicklepod	G[3]	G	G	G	G	N	G[6]	NP	G[6]	NP	NP	G[6]	G[6]	E	P	P	G[6]	E	F	N	N
Smartweed	PF	G	G	E	E	E	E	GE	E	E	E	E	G	F	F	E	E	F	G	N	N
Spurge	P	F	F	F	F	F	P	P	F	F	F	PF	PF	PF	—	F	F	F	—	N	N
Spurred anoda	P	P	P	FG	G	G	GE	P	P	G	F	F	F	G	F	G	GE	G	F	N	N
Texas panicum	N	GE	GE	G	GE	N	N	NP	NP	NP	NP	NP	NP	G	N	N	N	G	NP	E	E
Tropic croton	PF	F	F	F	G	F	F	G	G	G	G	G	P	P	G	G	G	G	G	N	N
Velvetleaf	P	F	F	G	FG	G	G	PF	PF	FG	FG	FG	FG	G	G	G	G	G	G	N	N

[1] Assumes weeds are 1- to 2-in. tall or smaller.
[2] Assumes optimum rates and ratios of Basagran and Blazer; see labels.
[3] Two applications, 10 to 14 days apart.
[4] Assumes optimum conditions and addition of crop oil concentrate.
[5] Ratings assume weeds in one- to two-leaf stage.
[6] Assumes follow-up treatment with 2,4-DB.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Table 4-8. Restriction on Feeding Peanut Hay to Livestock Following Treatment with Herbicides

Feeding Restricted (Do not feed treated hay to livestock.)	No Feeding Restrictions
2,4-DB , Arrow, Ultra Blazer, Cadre, Cobra, Impose, Poast, Poast Plus, Pursuit, Select, Sonalan, Storm	Basagran, Dual Magnum, Gramoxone INTEON, Outlook*, Prowl

* No restriction on feeding 80 days after last application.

Table 4-9. Suggested Rain-free Periods After Application of Postemergence Herbicides

Herbicide	Rain-free Period (hours)	Herbicide	Rain-free Period (hours)
2,4-DB	NR**	Paraquat	0.5
Arrow	1	Poast	1
Basagran	NR*	Poast Plus	1
Ultra Blazer	NR*	Pursuit	1
Cadre, Impose	3	Select, Select MAX	1
Classic	1	Storm	NR*
Cobra	1		

* No restriction listed on label. Suggest 4 to 6 hours for best results.
** No restriction listed on label. Suggest at least 1 hour for best results.

Table 4-10. Restrictions on Crop Rotation of Herbicides with Significant Residual Activity Applied to Peanuts

Herbicide	Corn	Cotton	Soybean	Tobacco	Wheat
Cadre, Impose	9 months	18 months	9 months	9 months	4 months
Pursuit	No restriction/ 8.5 months*	9.5/ 18 months*	No restriction	9.5 months	4 months
Strongarm	18 months**	9 months	No restriction	More than 18 months	4 months
Valor	No restriction	No restriction	No restriction	No restriction	4 months
Prowl	Following year	No restriction	No restriction	No restriction	4 months
Outlook	No restriction	Following year	No restriction	Following year	4 months
Dual	No restriction	No restriction	No restriction	Following year	4.5 months

*No restriction and 9.5 months if applied postmergence; 8.5 and 18 months if applied preplant incorporated. See label on rainfall and temperature requirements.
**No restriction if appropriate IMI-tolerant corn hybrid is planted. See label for specific instructions.

Table 4-11. Identification and Management of Herbicide-Resistant Weeds.

Possible reasons why herbicides do not control weeds that are NOT associated with herbicide resistance:
Improper herbicide choice or rate. Poor or improper application of herbicide. Poor timing of herbicide application. Weather conditions were not favorable when herbicide was applied. Weeds emerged after the postemergence herbicide was applied. Other chemicals antagonized the herbicide.
Indicators suggesting that weeds are resistant to herbicides:
Herbicide normally controls the weed in question. Performance poor on one species while other species are controlled well. Poor control is confined to spots in the field. Some plants of the weed in question are controlled well while other plants of that species are controlled poorly. Field history of heavy use of herbicides with the same mechanism of action.
Steps to take to prevent or manage herbicide resistance:
Rotate herbicides having different mechanisms of action Use tank mixes or sequential applications of herbicides having different mechanisms of action. Be especially vigilant when using herbicides with higher risk of resistance development. Integrate nonchemical controls when possible. Avoid allowing weeds to produce seeds when herbicide resistance is suspected.

Table 4-12. Categories of Herbicides Prone to Have Weeds Develop Resistance.

Tradename	Common Name	Family
ALS* Inhibitors—Weeds highly susceptible to developing resistance		
Cadre, Impose, Pursuit	imazapic, imazethapyr	Imidazolinone
Strongarm	diclosulam	Triazolopyrimidine
Classic	chlorimuron	Sulfonyl urea
ACCase* Inhibitor—Weeds moderately to highly susceptible to developing resistance		
Arrow, Select, Select MAX, Volunteer	clethodim	Cyclohexanedione
Poast, Poast Plus	sethoxydim	Cyclohexanedione
Microtubule Assembly Inhibition—Weeds moderately susceptible to developing resistance		
Prowl	pendimethalin	Dinitroaniline
Sonalan	ethafluralin	Dinitroaniline
Herbicides at low risk for resistance development		
Basagran	bentazon	Benzothiadiazole
Cobra	lactofen	Diphenylether
Gramoxone INTEON	paraquat	Bipyridilium
Dual Magnum	metolachlor	Chloroacetamide
Outlook	dimethenamid	Chloroacetamide
Storm	acifluorfen + bentazon	Diphenylether + Benzothiadiazole
Ultra Blazer	acifluorfen	Diphenylether
Valor SX	flumioxazin	N-phenylphtalimide derivative
2,4-DB (various formulations)	2,4-DB	Phenoxy

**ALS = acetolactate synthase; ACCase = acetyl CoA carboxylase*

5. PEANUT INSECT AND MITE MANAGEMENT

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Peanut growers had a pretty good year from an insect problem point of view in 2009. Along with 2008, we've had two pretty good years where insects and mites were minor nuisances. We saw problems with a few fall armyworms and spider mites, which are usually not frequent pests. For the most part, the problems were thrips early in the season and corn earworms later; and a few fields with heavier soils got hit with southern corn rootworm.

2009 IN REVIEW

Thrips occurred as usual in peanut fields this year, so tomato spotted wilt virus (TSWV) was present throughout the areas of production. Since growers have been using techniques to minimize TSWV, our end-of-season taproot samples indicate that many fields have had the virus each year, but its presence doesn't cause much of a problem. The thrips migration into peanut fields was normal, and this resulted in the typical stunted plants early in the season. The hot summer temperatures increased the number of plants that showed obvious virus symptoms, but the overall incidence was still low. Corn earworms were a problem, but no more than usual. Spider mites were a problem in isolated areas. We had significant rootworm injury in a few areas as well; and, in some cases, fields treated for rootworms still had some damage. Fall armyworms were more of a problem than usual late in the season, but for the most part their impact on yield was minimal. As a general rule, fall armyworms do seem to have been more of a problem in the past 5 years, but they do not pose the consistent threat that we see from corn earworms.

FOLIAR INSECTS

Thrips and leafhoppers are usually found in peanut fields. An in-furrow systemic insecticide applied at planting is the most common approach used to reduce seedling damage from thrips and reduce leafhopper damage. A number of caterpillars (usually corn earworm) will also attack peanuts during August and September.

Thrips and Tomato Spotted Wilt Virus

Tomato spotted wilt virus incidence was similar to last year and remained much lower than the serious levels we had in 2002. I believe it is safe to assume that this disease is still a threat and can also make a comeback. The incidence of the disease will be influenced by the winter and spring weather and the summer growing conditions. The virus is found in many weeds and even in winter annuals, such as chickweed and henbit, providing an opportunity for the thrips to pick up the virus each spring.

The future of tomato spotted wilt virus in North Carolina cannot be predicted. Dr. David Jordan helped coordinate an effort initiated in 2001 and concluded in 2006 to develop management recommendations based upon field research. Our approach was based on successful efforts in Georgia. One important point to understand is that tomato spotted wilt virus does not justify a foliar treatment at mid-season. Research in Georgia indicates that follow-up treatments to reduce the virus once it is established in the field is like throwing money away. Studies conducted from 2003 through 2006 confirm this management issue for North Carolina. Our research revealed the following trends for managing tomato spotted wilt virus. We saw less virus in VA 98R, NC-V11, and Gregory. Less virus also occurred in twin row production and in plots planted at higher seeding rates. At-plant, in-furrow insecticides do help reduce the virus, and Thimet (phorate) appeared the most effective insecticide for reducing virus, but it was only slightly better than Temik (aldicarb). Reduced tillage or strip till production also appears to help minimize the level of virus.

Our 2003 through 2006 trials indicate that in most years the earliest and the latest planted peanuts are probably at greatest risk from the virus. We have found that varieties like Perry, which are a little more susceptible to the tomato spotted wilt virus, can still be planted with confidence if the grower follows the other practices for reducing virus. Our findings are consistent with the results of testing in Georgia. I am quick to point out, however, that recommended practices help reduce the incidence of virus; they do not eliminate it. Managing TSWV, which outlines a virus index and provides guidance on its management, is found later in this chapter.

Use of Systemic Insecticides

Systemic insecticides are an effective production tool. Over 90 percent of the North Carolina peanut acreage is treated annually with phorate (Thimet), aldicarb (Temik), or acephate (Orthene). This eliminates the need for most foliar insecticides unless worms or mites become a problem in August or September. Systemic insecticides are applied in-furrow at planting as a granular formulation.

Orthene 97, a spray formulation, allows the use of acephate as an in-furrow spray. This approach has proven successful and offers an additional option for at-plant thrips management.

When foliar insecticides are used in addition to fungicides, spider mite outbreaks often occur if hot, dry weather, which favors spider mite buildup, persists. The use of systemic insecticides at planting eliminates the need for foliar insecticide treatments for thrips early in the season and for leafhoppers in July, and may decrease the likelihood of mite buildup. The systemic insecticides are not effective against worms; and if peanuts are attacked by worms in August and September, foliar sprays may be needed.

"On-Demand" Treatments. IPM focuses on treating only when necessary. At-planting treatments are contrary to that idea. However, the convenience and effectiveness of these in-furrow treatments make most other options less attractive. At-planting treatments provide some peace of mind because growers know that they suppress any potential early season pests (thrips and leafhoppers). However, such treatments assume that these insect pests will be present in economically damaging numbers. Foliar treatments do not seem to have as much of an impact in reducing the levels of tomato spotted wilt virus as do at-plant treatments.

On the other hand, "on-demand" foliar insecticides are used only when insect populations reach or exceed a predetermined economic threshold. While insect populations are below this level, there is no need to treat; when they exceed the threshold, treatments can be applied to prevent economic damage. Such an approach requires a commitment to an effective scouting program.

Foliar Insecticides

A number of insecticides are labeled for use on peanuts as foliar sprays. Often, only one insecticide is needed for season-long control of foliar peanut insect pests in North Carolina. Growers should check their fields, know the pest situation, and treat only as needed.

Thrips can be serious pests early in the season if at-planting systemic insecticides were not used, but foliar sprays can be effective. The economic threshold for thrips is 25 percent leaf damage. It is very important to follow this guideline closely. Delaying thrips treatment will still provide control but may not provide any real benefits in plant response.

Potato leafhoppers can also damage peanuts; however, research indicates the economic threshold should be somewhere below 50 percent leaf damage. Such levels are not commonly seen, but leafhoppers have been more of a problem in recent years, particularly in fields not treated for rootworms.

Several types of caterpillars or "worms" may attack the crop later in the season. The most common is the corn earworm. The threshold for treatment varies with the time of year. Generally, earworms occur in August and the threshold for treatment is as soon as the worms reach 4 per row foot. In early September, at least 6 worms per row foot are necessary to cause economic loss, and by mid-September no treatment is justified unless at least 10 worms per row foot are seen. Danitol, an insecticide for corn earworms and spider mites, showed good effectiveness against fall armyworms, as well as earworms, spider mites, and leafhoppers, in one test. In 2002 and 2007, we were hit hard by beet armyworms. Lannate works well when the worms are small, but newer products, such as Steward and Tracer, seem the most effective for beet armyworms and also fall armyworms in peanuts. Formulations of *Bacillus thuringensis,* such as Dipel DF and ES, for corn earworm and Xentari for beet and fall armyworm work well when applied in a timely manner and are considered organic approaches. They can also be applied close to harvest, which is often an issue with the late occurrence of fall armyworms. Fall armyworms were fairly abundant in 2009, but their damage is less than that of corn earworms. Fall armyworms damage the leaves with what I call an "onion skin" appearance. Rather than a complete hole in the leaf, they leave what looks like a small window in the leaflet.

Application of Foliar Sprays. Calibrate the sprayer accurately to ensure application of the recommended amounts of insecticides. Check the calibration periodically during the season.

Spray for thrips, leafhoppers, corn earworms, fall armyworms, and other foliar-feeding insects on peanuts with hollow cone or solid-cone nozzles at a minimum of 40 psi and a total of 10 to 15 gallons per acre. Low-volume sprays are ineffective for spider mite control. Apply a *minimum* of 25 gallons of spray per acre for this pest, with adequate pressure for the nozzle setup on the sprayers. Many growers combine spider mite treatments with their leafspot fungicide application. Spray volume commonly used for fungicide application (12 to 14 gallons per acre) may not be sufficient for good mite control. Change nozzles or slow down if past experience has given poor results.

Use flat fan nozzles to apply a *minimum* of 20 to 40 gallons of spray per acre directed at the base of the plant for lesser cornstalk borer control. Low gallonage applications for lesser cornstalk borer are an absolute waste of time!

Spider Mites

Spider mites were a major problem for only a few peanut farmers in 2009 due to better rainfall pattterns throughout the peanut growing areas. While problems with spider mites usually worsen when certain fungicides and insecticides are used, the overwhelming affect of the weather caused spider mite problems—despite our best efforts to minimize their populations. The use of a leafspot advisory system rather than a calendar approach to fungicide sprays has been documented to help reduce mites in peanuts. Suggestions for reducing the threat of spider mites are listed in the control recommendations at the end of this chapter. The use of Lorsban can also increase the likelihood of spider mite outbreaks. Check peanut fields frequently for spider mites during late July and August, especially if they are next to cornfields. Options for control of spider mites are limited to two miticides at this time—Comite and Danitol. Therefore, it is important to scout fields and use a spray only when necessary. Spider mites have a great ability to develop resistance and, until new materials are available, we run the risk of resistance developing to our only available miticides. It is important to remember that like peanut disease problems, spider mites are very much regulated by the weather, as we observed this past year. Therefore, it is important to look at management of this pest in much the same way one looks at managing a disease. Unlike caterpillars, for example, that once treated are generally gone for the year, spider mites have the ability to bounce back in hot, dry weather.

It is important to note, however, that controlling mites usually requires two applications about 3 to 5 days apart. Treating one time often will not stop a spider mite problem because Comite or Danitol will not kill the eggs. If you find the infestation very early, one application may be effective, but usually we don't see the mites until damage and populations are high. Unless it rains, mites almost certainly will come back with a vengeance in a couple of weeks. Using one spray and taking a "wait and see" approach is often not best unless the problem is caught very early in the season before a lot of eggs are present. With the two-spray technique, the first spray gets the mites already present, and the second gets all the mites that have hatched from the eggs present during the first spray. It is also important to note that using your leafspot spray set-up may not provide good enough coverage to get a high level of mite control. Higher pressure and higher volumes are often required. Keep the practices that reduce mite outbreaks at the forefront because they have served us well over the past 10 to 20 years.

SOIL INSECTS

The **southern corn rootworm** is one of the most troublesome insects for peanut producers. While pests like caterpillars, thrips, and spider mites can cause severe damage that is often quite obvious above the ground, rootworms feed below the soil surface.

Beginning in late July and continuing through August, beetles lay eggs in the peanut field. Egg-laying and the survival of these eggs depend on the soil being moist. If the soil is hot and dry, many eggs will not hatch. Rootworms lay most of their eggs in the soil near the base of the plant, where the soil stays wetter than in the row middles. Adequate rainfall in late July and early August can result in rootworm infestation. Rootworms often damage irrigated fields. Heavier soils also are more likely to have rootworm problems. The heavier the soil, the better its water-holding ability, so this soil is more likely to have the moisture rootworms need for survival. However, this does not mean that sandy soils can't have rootworm problems. If the soil moisture is adequate, rootworms can occur in almost any field.

Management Decisions

The standard management approach for rootworms is an at-pegging granular insecticide application in a band over the row. Dr. Ames Herbert at Virginia Tech and I developed a southern corn rootworm advisory, which is shown later in this chapter. This index relies on soil type for helping make a good decision about treatment. Heavier soils are more of a risk for reasons already discussed. Any soils referred to as "stiff land" probably should be treated. Fields under irrigation run a greater risk from rootworms because higher soil moisture favors egg-laying, egg hatch, and rootworm survival.

Monitoring the soil moisture doesn't offer much help for decision making. The critical time for adequate soil moisture to ensure rootworm survival is early August. But treatments need to be applied before the grower knows if soil moisture is going to be adequate. Even if an at-pegging preventive treatment is applied and the conditions that follow do not encourage a rootworm outbreak, some benefits are still derived from the application. These insecticides protect the crop from leafhoppers, offer some white mold suppression, and give some protection should any cornstalk borers and cutworms be present.

Remember, however, that *this is not a blanket recommendation to* *treat every acre of peanuts with a rootworm insecticide.* Treat those fields that are high risk or those in which problems have occurred in the past. The use of rootworm insecticides can increase the likelihood of spider mite outbreaks, which is another good reason to avoid the unnecessary use of such products.

Treatment and Applications Options

Rootworm treatments are usually applied after the Fourth of July with ground equipment using properly calibrated hopper boxes to place the insecticide in a 16- to 18-inch band over the row. This provides an important "zone of protection" around the developing pods. Check the height of the bander over the row, and make sure that the granules are striking the top of the foliage in at least an 8- to 10-inch band. Granules falling down through the plant should be distributed in a 16- to 18-inch band. Research has shown that light incorporation of the insecticide improves its performance. However, this is often difficult as the row middles may be closed when the materials are applied.

Insecticides can be applied any time from mid-June to the first of August. Treatments applied after August 5 may not prevent some of the early hatching larvae from feeding on pods. Once the larvae hatch and begin feeding, an insecticide treatment is not effective. If growers wait until the end of the first week in August to determine if there was adequate soil moisture to allow a rootworm infestation, it may be too late for the treatment to achieve sufficient control. N.C. State studies have shown that treatments after the first week of August do very little to protect pods from rootworm damage (see section titled "Application after August 1").

Two modified approaches to rootworm control can be used with favorable results, but growers must understand the *risks* involved. With these two options, growers can save a few dollars or gain additional benefits from rootworm treatment, but they may also increase their risk of crop loss. It is also important to keep in mind that we have observed a few isolated fields in which chlorpyrifos (Lorsban and generics) has failed to prevent rootworm damage. We have been studying these situations for several years; and while we do not have the answer as to why this happens, there are some fields where Lorsban does not work at all. We believe these are isolated occurrences and do not apply as a general rule for how well Lorsban and the generics of chlorpyrifos work against rootworms. Our trials have demonstrated that in fields where chlorpyrifos performs poorly, increasing the rate does not improve performance.

Early Application. Many growers have considered the early application of their rootworm insecticides. This early application would be at-flowering or approximately mid-June rather than at-pegging (mid-July). There are several possible advantages to this early application. First, the growers begin gaining the benefits of leafhopper control much earlier. In addition, some products offer white mold suppression. Earlier application would also mean the middles are more open and fewer vines would be run over with the standard 4-row equipment used for granular application. One final benefit would be that some products might offer some lesser cornstalk borer protection should conditions be extremely dry in late June and July. However, I want to point out that over the last three years we have observed some situations in heavier soils, where the early application has not performed as well. We are doing more research on this, but it has caused me to be a little more cautious about recommending early application.

Application after August 1. The option for rootworm control other than the standard pegging-time treatment is a delayed treatment. This delayed treatment is often not intentional, but rather the result of wet weather in July that delayed the ground application. If the application of rootworm insecticides is delayed until after August 1, then there are risks involved. First, the middles will be more closed, so the use of ground equipment will crush more vines. Most importantly, the insecticide must be applied by August 5. Any delay beyond this date may allow rootworms to begin feeding on pods and do significant damage. Although you wouldn't plan this delay, it can often happen if we get substantial rainfall in the first week in August and the soil is too wet to run ground equipment across the field. As a general rule, I do not recommend planning to treat for rootworms after August 1 simply because I've seen too many situations where it rained and treatment was delayed beyond the date for which it will still provide an economic benefit.

PREVENTING INSECT AND MITE PROBLEMS

Many things can be done to help prevent damaging insect and mite infestations. Where possible, consider the following suggestions:

1. Do not treat on a schedule or because a neighbor is spraying. Scout fields and treat only as needed.
2. Remove weeds and brush that serve as wild hosts for spider mites from around fields in fall or early spring.

3. Maintain an area clear of weeds and briars around field during the early growing season. Do not mow weeds around fields from late June through early September.
4. To reduce the probability of spider mite buildup, avoid using foliar insecticides in July and August unless needed to control damaging insect infestations. The fewer insecticide applications used, the lower the probability of creating a pesticide-induced outbreak of mites. Using the leafspot advisory for leafspot applications will help reduce the likelihood of spider mite outbreaks. Avoid unnecessary applications for rootworms.
5. Avoid moving workers and equipment from mite-infested areas to noninfested areas.
6. Avoid planting peanuts immediately adjacent to fields of sweet corn. Spider mite populations often disperse into peanuts as the corn matures.

Safe Use

Phorate (Thimet), aldicarb (Temik), and methomyl (Lannate), are extremely toxic to people, animals, and fish. Some other products, such as Asana XL and Karate, are toxic to fish. Always carefully read and observe all safety precautions on the label when handling or applying these materials. Use only insecticides labeled and recommended for peanuts. Follow suggestions on dosage and time of application to avoid residues. See North Carolina Cooperative Extension publication AG-463-5, *Pesticides and Wildlife—Peanuts*, for additional information on minimizing pesticide impact on wildlife.

5-1. Insect Control on Peanuts

Time to Apply/ Pest	Insecticide and Formulation	Amount of Formulation Per Acre	Precautions and Remarks
SEASONAL CONTROL OF THRIPS AND LEAFHOPPERS			
AT PLANTING (To control thrips, leafhoppers, aphids, and wireworms)	acephate (Orthene 97) (generics available)	0.75 to 1 lb	Apply as in-furrow spray in 3 to 5 gal of water per acre. State (24c) label must be in possession at time of application.
	aldicarb (Temik)	6.6 lb of 15% granules	Use a row applicator to apply in furrow at planting. Taken up by plants and translocated to kill aphids, thrips, and leafhoppers. Note current plant-back restrictions on aldicarb label.
	disulfoton (Di-Syston)	6.6 lb of 15% granules	
	phorate (Thimet) (generics available)	5.0 lb of 20% granules	

5-1. Insect Control on Peanuts

Time to Apply/ Pest	Insecticide and Formulation	Amount of Formulation Per Acre	Precautions and Remarks
CONTROL OF SPECIFIC PESTS			
Beet Armyworm	gamma-cyhalothrin (Prolex) (Proaxis)	 1.02 to 1.54 fl oz 2.56 to 3.84 fl oz	Do not apply within 14 days of harvest.
	methomyl (Lannate LV)	0.75 to 3 pt	Apply broadcast in sufficient water for good coverage when worms are small. Do not apply within 21 days of harvest. See fall armyworm for additional restrictions.
	indoxacarb (Steward)	9.2 to 11.3 oz	Do not apply more than 45 oz per acre per crop. 14-day preharvest interval.
	Bacillus thuringiensis (Xentari)	0.5 to 2 lb	Apply to small caterpillars. Use higher rate for larger worms or high populations. 0-day harvest restriction.
	spinosad (Tracer)	1.5 to 3 fl oz	Do not apply more than 9 fl oz per season or make more than three applications. 3-day preharvest interval.
Corn Earworm, Southern Armyworm, Green Cloverworm, Velvetbean Caterpillar	acephate (Orthene) 97 (generics available)	0.75 to 1 lb	Do not feed or graze livestock on acephate-treated vines. Do not apply within 14 days of harvest (digging).
	Bacillus thuringiensis (Dipel DF)(Dipel ES)	½ to 2 lb1 to 2 pt	Repeat as necessary. Under high populations, use the highest labeled rate. Thorough spray coverage is needed. Dipel DF can be used on organically produced peanuts. 0-day preharvest interval.
	carbaryl (Sevin) 80 S (generics available)	1 to 2 lb	Apply to foliage when four or more worms are present per foot of row and preferably when worms are small. Do not apply methomyl within 21 days of harvest. Do not feed methomyl-treated vines to livestock. Use minimum of 3 gal of water for aerial application.
	esfenvalerate (Asana XL)	2.9 to 5.8 oz	Do not feed Asana-treated vines or graze livestock on treated plants.
	fenpropathrin (Danitol) 2.4 EC	10.67 to 16 fl oz	Do not exceed 2.67 pt per acre per season. Use 10 to 50 gal per acre by ground and 5 to 10 gal per acre by air. Repeat no more often than every 7 days. Do not apply within 14 days of digging and do not feed or graze vines within 14 days of last application.
	gamma-cyhalothrin (Prolex) (Proaxis)	 1.02 to 1.54 fl oz 2.56 to 3.84 fl oz	Do not apply within 14 days of harvest.
	indoxacarb (Steward)	9.2 to 11.3 oz	Do not apply more than 45 oz per acre per crop. 14 day preharvest interval. For corn earworm.
	lambda-cyhalothrin (Karate Z)	1.28 to 1.92 oz	Do not feed or graze livestock on Karate-treated plants.

5-1. Insect Control on Peanuts

Time to Apply/ Pest	Insecticide and Formulation	Amount of Formulation Per Acre	Precautions and Remarks
Corn Earworm, Southern Armyworm, Green Cloverworm, Velvetbean Caterpillar (continued)	methomyl (Lannate LV)	0.75 to 3 pt	Apply to foliage when four or more worms are present per foot of row and preferably when worms are small. Do not apply methomyl within 21 days of harvest. Do not feed methomyl-treated vines to livestock. Use minimum of 3 gal of water for aerial application.
	spinosad (Tracer)	2 to 3 fl oz	Do not apply more than 9 fl oz per season or make more than three applications. 3-day preharvest interval.
Cutworm	carbaryl (Sevin) 80 S (generics available)	2.5 lb	
	chlorpyrifos (Lorsban) 15 G	1.33 lb	Apply in 16- to 18-in. band over row when infestation is first seen. May be applied by air. Do not graze or feed immature crop to livestock.
	esfenvalerate (Asana XL)	5.8 to 9.6 oz	Do not feed treated vines to livestock.
	gamma-cyhalothrin (Prolex) (Proaxis)	 0.77 to 1.28 fl oz 1.92 to 3.20 fl oz	
	indoxacarb (Steward)	9.2 to 11.3 oz	Do not apply more than 45 oz per acre per crop. 14-ay preharvest interval.
	lambda-cyhalothrin (Karate Z)	0.96 to 1.6 oz	Do not use treated vines or hay for animal feed.
	methomyl (Lannate LV)	1.5 to 3 pt	Do not apply within 21 days of harvest. Do not feed treated vines to livestock.
Fall Armyworm	acephate (Orthene) 97 (generics available)	0.75 to 1 lb	Do not apply within 14 days of harvest (digging). Do not feed or graze livestock on vines treated with acephate. Apply 10 to 50 gal spray solution per acre. Do not apply more than 4.13 lb per acre (4 lb a.i. per acre per season).
	Bacillus thuringiensis (Xentari)	½ to 2 lb	Apply as a full coverage spray when 1st or 2nd instar larvae are present. Repeat as necessary. Under high populations, use the highest labeled rate. Thorough spray coverage is needed. Can be used on organically produced peanuts. 0-day preharvest interval.
	fenpropathrin (Danitol) 2.4 EC	10 2/3 to 16 fl oz	Do not exceed 2.67 pt per acre per season. Repeat no more often than every 7 days. Do not apply within 14 days of digging and do not feed or graze vines within 14 days of last application.

5-1. Insect Control on Peanuts

Time to Apply/ Pest	Insecticide and Formulation	Amount of Formulation Per Acre	Precautions and Remarks
Fall Armyworm (continued)	gamma-cyhalothrin (Prolex) (Proaxis)	 1.02 to 1.54 fl oz 2.56 to 3.84 fl oz	Do not apply within 14 days of harvest.
	indoxacarb (Steward)	9.2 to 11.3 oz	Do not apply more than 45 oz per acre per crop. 14-day preharvest interval.
	lambda-cyhalothrin (Karate Z)	1.28 to 1.92 oz	
	methomyl (Lannate LV)	0.75 to 1.5 pt	Effective against all sizes of worms. Use minimum of 3 gal of water for aerial application. Do not apply within 21 days of harvest. Do not feed methomyl-treated vines to livestock.
	spinosad (Tracer)	2 to 3 fl oz	Do not apply more than 9 fl oz per season or make more than three applications. 3-day preharvest interval.
Leafhoppers	acephate (Orthene) 97 (generics available)	0.75 to 1 lb	See remarks under THRIPS.
	carbaryl (Sevin) 80 S (generics available)	1.25 lb	See remarks under THRIPS. May be applied up to day of harvest.
	esfenvalerate (Asana XL)	2.9 to 5.8 oz	Do not feed livestock Asana-treated vines or graze livestock on treated plants.
	fenpropathrin (Danitol) 2.4 EC	6 to 10.67 fl oz	Do not exceed 2 2/3 pt per acre per season. Repeat no more often than every 7 days. Do not apply within 14 days of digging and do not feed or graze vines within 14 days of last application.
	gamma-cyhalothrin (Prolex) (Proaxis)	 0.77 to 1.28 fl oz 1.92 to 3.20 fl oz	
	lambda-cyhalothrin (Karate Z)	0.96 to 1.6 oz	Do not use treated vines or hay for animal feed.
	methomyl (Lannate LV)	0.75 to 3 pt	Do not apply within 21 days of harvest. Do not use treated vines as feed.
Lesser Cornstalk Borer	chlorpyrifos (Lorsban, Pilot) 15 G (generics available)	7 to 14 lb	Apply as directed spray to base of plants in 8- to 10-inch band in 50 gal water per acre.
Southern Corn Rootworm	chlorpyrifos (Lorsban, Pilot) 15 G (generics available)	13.3 lb	Apply in a 16- to 18-inch band over the row just before pegging. Work immediately into top few inches of soil. Do not graze or feed crop to livestock. If NC6 peanut is planted, use only 1/4 the suggested amount per acre.
	phorate (Thimet) 20 G (generics available)	10 lb	

5-1. Insect Control on Peanuts			
Time to Apply/ Pest	**Insecticide and Formulation**	**Amount of Formulation Per Acre**	**Precautions and Remarks**
Spider Mite	propargite (Comite) 73 L	2 pt	Apply in at least 25 gal of water per acre. Spider mite outbreaks are less likely to develop if foliar insecticides are not used during July and August and copper fungicides are used for Cercospora leafspot. Do not apply propargite within 14 days of harvest.
	fenpropathrin (Danitol) 2.4 EC	10.67 to 16 fl oz	Do not exceed 2.67 pt (42 2/3 fl oz) per acre per season. Use 10 to 50 gal per acre by ground and 5 to 10 gal per acre by air. Repeat no more often than every 7 days. Do not apply within 14 days of digging and do not feed or graze vines within 14 days of last application.
Thrips	acephate (Orthene) 97 (generics available)	0.375 to 0.75 lb	Do not feed or graze livestock on treated vines. Apply 10 to 50 gal spray solution per acre to foliage. Do not apply more than 4.125 lb per acre (4 lb a.i. per acre) per season.
	carbaryl (Sevin) 80 S (generics available)	1.25 lb	Do not feed or graze livestock on treated vines. Apply 10 to 50 gal spray solution per acre to foliage.
	gamma-cyhalothrin (Prolex) (Proaxis)	 1.02 to 1.54 fl oz 2.56 to 3.84 fl oz	Do not apply within 14 days of harvest.
	lambda-cyhalothrin (Karate Z)	1.28 to 1.96 oz	Do not use treated vines or hay for animal feed.
	malathion 57 EC	0.8 qt	Apply 20 to 25 gal spray solution per acre to foliage.

MANAGING TOMATO SPOTTED WILT VIRUS IN PEANUTS IN NORTH CAROLINA AND VIRGINIA

Thrips transmit the virus when they feed on peanut plants. Although most of the virus is transmitted early in the season when thrips are most abundant, thrips can transmit the virus throughout the season. Even though very little damage from thrips might be noticed because insecticides kill thrips, the virus is transmitted to the peanut plant rapidly before the thrips are killed with systemic insecticide.

A wide range of plants, both crops and weeds, are hosts for the virus and for the thrips that transmit it. Thrips must acquire the virus by feeding on infected host plants. Thrips feed and overwinter in and among many plants. During the spring while peanut plants are emerging, the thrips move into fields, feeding on peanut plants and transmitting disease.

Even though it seems logical that killing many of the plants that harbor thrips and virus in areas adjacent to peanut fields will reduce levels of virus in peanut, thrips can enter fields from great distances. Depending on wind currents and weather patterns, thrips from many miles away can land and feed on peanuts and subsequently transmit the virus. Efforts to kill all of the vegetation adjacent to peanut fields most likely will not reduce virus in peanuts.

There are no control practices that can be implemented to reduce the virus after peanuts are planted. The major factors that influence the level of virus in peanut—including variety selection, planting date, plant population, in-furrow insecticide, row pattern, and tillage system—are considered and implemented prior to planting.

Poor and inconsistent emergence of peanuts and establishment of spotty peanut stands increase incidence of TSWV regardless of variety selection, planting date, insecticide choice, and tillage system. Establishing optimum plant stands is critical in managing this pest.

An insect management program that effectively controls thrips will lower the amount of TSWV. Unlike many of the other pests found in peanuts, considerable variation in response to management strategies occurs and should be expected. Weather conditions that influence populations of thrips, the vector for this virus, and their subsequent arrival in fields can vary considerably from year to year. Variation in strains of the virus and the ability of the virus to adapt also contribute to variations in response.

Some production practices can be implemented with no additional equipment investment. These variables include planting date, variety selection, seeding rate, and insecticide selection. Planting peanuts in twin rows or in reduced tillage systems may require equipment purchase. The strengths and weaknesses of each input must be considered when developing a tomato spotted wilt virus management program. Contact your local Cooperative Extension agent for additional information on developing pest management and production systems for peanuts grown in North Carolina.

Table 5-2. Advisory Index for Managing Tomato Spotted Wilt in North Carolina Peanuts

Peanut Variety	*Points*	*Score*
Brantley, Perry, NC 12C	40	
VA 98R, CHAMPS, Phillips	30	
Gregory, NC-V 11, Georgia Green, Bailey	20	

Georgia Green is a runner market type. All other varieties are Virginia market types. Variation in response to tomato spotted wilt virus has been noted for the varieties Gregory and NC 12C. Poor emergence and erratic and spotty stand have a major impact on development of tomato spotted wilt virus in varieties. This may be due, in part, because seed of Gregory and NC 12C are large, and peanut emergence may be less uniform than smaller seeded-varieties. Because seed of these varieties are large and more expensive at high seeding rates, growers are tempted to reduce seeding rates below recommended levels. Low planting rates may negate any benefits of partial resistance to TSWV.

Planting Date	*Points*	*Score*
Prior to May 5	20	
May 6-15	10	
After May 15	15	

In absence of spotted wilt, higher yields are often obtained when peanuts are planted prior to May 15. Crop maturity can be affected by many factors. Planting a late-maturing variety such as Perry in late May to avoid spotted wilt may result in lower yields and market grades because pods do not have sufficient time and heat units to adequately mature.

Plant Population (actual, not projected, stand)	*Points*	*Score*
2 or fewer plants per row foot	***25***	
3 to 4 plants per row foot	***15***	
5 or more plants per linear foot of row	***5***	

Seed size and count per pound should always be considered when planting Virginia market type peanuts. The varieties and seeding rates in pounds per acre (listed in parentheses) needed to establish a plant population of 4 plants per row foot **assuming 80% germination (planting 5 seeds per row foot to get 4 plants per row foot)**: NC-V 11 (116 lb/acre), VA 98R (126 lb/acre), Perry (138 lb/acre), NC 12C (158 lb/acre), Gregory (161 lb/acre), Georgia Green (85 lb/acre), Phillips (135 lb/acre), CHAMPS, (127 lb/acre), and Brantley (145 lb/acre). Actual seed count and germination can vary by year and lot. Consider the characteristics of the peanut seed you have purchased when setting your planter. For twin rows, the final plant population per linear foot of row is the sum of individual twin rows.

Insecticide/Nematicide	*Points*	*Score*
None	25	
Orthene early postemergence	20	
Temik or Orthene in-furrow	10	
Thimet 20G or Phorate 20G in-furrow	5	

Table 5-2. Advisory Index for Managing Tomato Spotted Wilt in North Carolina Peanuts

The influence of insecticide on tomato spotted wilt virus should not be the overriding consideration for selection. Also consider effectiveness against thrips, injury potential from insecticides, cost of treatment, and possible interactions of insecticides with herbicides. If Thimet 20G, Phorate 20G, or Orthene is applied, growers will lose the nematode suppression provided by Temik.

Tillage	*Points*	*Score*
Conventional tillage	10	______
Strip tillage into killed cover crop or previous crop residue	5	______
Research in North Carolina and Virginia has shown lower yields on average when peanuts are seeded into stubble from the previous crop. Establishing beds in the fall, seeding a cover crop, and then strip tilling peanuts into the killed cover crop has been the most effective reduced tillage system with yields from this approach similar to yields in conventional tillage systems. Yield potential has been more difficult to maintain on finer-textured soils when peanuts are strip tilled into the stubble from the previous crop and little or no bed is present. Using reduced tillage exclusively to manage tomato spotted wilt virus is not recommended at this time.		
Total Score		

60 or Less = Low Risk 65 to 85 = Moderate Risk 90 or More = High Risk

Examples of the Advisory Index

All management options designed to minimize tomato spotted wilt virus: Plant the variety Gregory (20 points) after May 5 but before May 10 (10 points) in strip tillage (5 points) at a plant population of 5 plants per row foot (5 points) using Thimet 20G in-furrow (5 points).
Advisory Index = 45 (Low Risk)

No management options designed to minimize tomato spotted wilt virus: Plant the variety Perry (40) before May 5 (25) in conventional tillage (10) at a plant population of 2 plants per row foot (25) using no in-furrow insecticide (25).
Advisory Index = 125 (High Risk)

Compromise situation – Finer-textured soil with history of Sclerotinia blight and CBR: Plant the variety Perry (40) between May 6 and 10 (10) in conventional tillage (15) at a plant population of 5 plants per foot of row (5) using Phorate 20G in-furrow (5).
Advisory Index = 75 (Moderate Risk)

Compromise situation – Coarse-textured soil with history of Sclerotinia blight in the extreme northern range of North Carolina production: Plant the variety VA 98R (30) prior to May 5 (25) in strip tillage (5) at a plant population of 5 plants per foot of row (5) using Temik in-furrow (10).
Advisory Index = 75 (Moderate Risk)

Peanut Rootworm Advisory: What's the risk of SCR in your fields?

Table 5-3. One-Minute SCR Field Index Score

Soil texture	***Points***	***Score***
Loamy sand	5	________
Fine -sandy loam	10	________
Loam	15	
Drainage class		
Well drained	5	________
Moderately well drained	10	________
Somewhat poorly drained	15	________
Poorly drained	20	
Field history of rootworm damage		
None	0	________
Low	5	________
Moderate	10	________
High	15	
Planting date		
Before May 1	5	________
May2-May 15	10	________
After May15	15	
Cultivar resistance		
VA 98R and CHAMPS	10	________
NC-V 11, 12C, Gregory, Perry, Phillips, and Brantley	20	________
Irrigation		
No irrigation	0	________
Irrigation	45	
Total score		

70 or above High Risk Treatment Needed
Treat high-risk fields with rootworm insecticides from about June 20 to July 10. All irrigated fields should be treated.

55 to 65 Moderate Risk May Not Need Treatment
Treatment decisions for moderate-score fields depend on additional factors such as weather and land-lease requirements. In many moderate-score fields, especially those at the low end of the range, rootworm damage does not reach economically damaging levels. In most years, these fields will not need treatment. In most years, pod damage in moderate-risk fields is more likely, so

that treatment, even in late July, may still provide protection from severe pod losses.

50 or less **Low Risk** **No treatment needed**
Irrigation or wet weather may make rootworm problems worse. Always treat irrigated fields.

Can You Count on the SCR Advisory?

The SCR advisory was tested on 436 commercial peanut fields in Virginia and North Carolina from 1989-2002. Farmers who followed the recommendations of the advisory were protected 96.5% of the time; 3.5% of the fields examined had damage above the SCR threshold**.**

Was the SCR Advisory Index tested near you?

The SCR Index was tested on farmer fields in these North Carolina counties: Bertie, Bladen, Chowan, Edgecombe, Gates, Halifax, Martin, Northampton, Perquimans, and Pitt. It was also tested in the following Virginia locations: Dinwiddie, Greensville, Isle of Wight, Prince George, Southampton, Suffolk, Surry, and Sussex.

What are the keys to fields with low scores?

- **Resistant cultivars.** The early-maturing pods of VA 98R are not as susceptible to rootworm attack during the peak pest pressure in late July and early August.
- **Good drainage and sandy soils.** SCR larvae prefer moist soils. Irrigation, high loam content, and poor drainage increase the risk of damage. *Always treat irrigated fields.*
- **Early planting.** Early planting reduces risk because pods tend to mature before rootworm feeding.
- **Known history.** Base your estimate on experience in previous years with damage levels in areas of the field not treated with insecticide. If fields have always been treated, estimate a moderate level of damage.

For more information about the SCR Advisory, contact your county Extension agent or look online: **http://www.isis.vt.edu/cgi-bin/scrRisk**

6. PEANUT DISEASE MANAGEMENT

Barbara Shew
Extension Specialist— Plant Pathology

Wise management of disease is essential to profitable peanut production. Long rotations, resistant cultivars, scouting, accurate disease detection, proper pesticide selection, and weather-based disease advisories comprise the basic elements of a disease management strategy.

It is best to avoid plant diseases by using long rotations. Be aware that adding a new crop to your usual rotation has the potential to increase or decrease the risk of disease problems in peanuts. Plant rotational crops that are *not* hosts of peanut pathogens. (Table 6-1).

Host resistance forms the foundation of disease control. Using host resistance is very cost effective: it costs little or nothing while saving fungicide sprays and preserving yield. Always consider planting a resistant cultivar in fields with a history of disease (Table 6-2).The new cultivars Bailey, Sugg, and Florida Fancy have multiple disease resistance.

Early detection and identification of diseases are critical in developing effective and low cost approaches for control. Thorough scouting can detect disease problems when they are easiest to control. Accurate identification of diseases is necessary for selection of the most appropriate management tactics and crop protection products (Tables 6-3 and 6-4). Photos of common peanut diseases can be found online at **http://www.cals.ncsu.edu/plantpath/extension/commodities/peanuts.html**. Contact your county agent for help with disease diagnosis or to submit samples to the North Carolina State University Plant Disease and Insect Clinic.

Integrate disease management practices to achieve maximum benefit. Pesticides should be used only when host resistance and cultural practices are not sufficient to reduce disease levels below economic thresholds. Choose the appropriate fungicide to control the particular disease or diseases of concern (Table 6-4). Keep in mind that inexpensive fungicides may be as effective as more costly materials (Table 6-5) and that wise fungicide choices will help to preserve efficacy (Table 6-6). Apply all pesticides according to label directions and understand all safety precautions. Check the label for formulation changes that may require larger or smaller amounts of a pesticide than you have applied in the past. Calibrate sprayers and other applicators before first use each year, and check calibration from time to time during the season.

Fungicides must be applied immediately before or soon after diseases appear if they are to be effective. To anticipate disease outbreaks, use weather-based disease advisories. Advisories can minimize unnecessary pesticide use and add precision to applications that are necessary.

For many diseases (TSWV, CBR, Sclerotinia blight, pod rot, nematodes), management decisions must be made before the next crop of peanuts is planted. Prepare maps showing where these diseases were located in the current crop. These maps will serve as guides for future rotations, fumigation, and use of resistant cultivars (Table 6-7).

This chapter covers disease identification and management. The following information describes each major disease of peanut, its cause, and unique management considerations.

FOLIAR DISEASES

Peanut leaf spots are caused by two different fungi: *Cercospora arachidicola* (early leaf spot pathogen) and *Cercosporidium personatum* (late leaf spot pathogen). Other diseases cause spots on leaves, but they are not referred to as "leaf spot" (see other diseases listed below).

It can be difficult to distinguish between symptoms of early and late leaf spot. Early leaf spot usually causes brown lesions (spots) that are surrounded by a yellow halo. Although early leaf spot can be found as early as 30 days after planting, first lesions often are not observed until mid-July. Early leaf spots produce tufts of silvery, hair-like spores on the top of the leaf. These spores can be seen with the help of a good magnifying glass.

Late leaf spot causes dark brown to black spots that may or may not have halos. Late leaf spots produce dark brown spores, usually on the underside of the leaf. The mass of spores can be seen without magnification and give the spot a velvety appearance. It is important to determine if late leaf spot is present since it can be more difficult to control.

Because the leaf spot fungi attack only peanuts, rotations (Table 6-1) with any other crop help to reduce disease. Peanut cultivars vary in susceptibility to both early and late leaf spot (Table 6-2); follow a strict control program on highly susceptible cultivars.

In addition to cultural practices, fungicide application usually is required for leaf spot control. Apply fungicides:

- on a set 14-day calendar schedule, OR
- according to a weather-based leaf spot advisory.

In well-rotated fields, the first fungicide spray should be applied at the very early pod stage (R3), which usually occurs in the first week of July. After the first spray, apply fungicides every 14 days or according to the leaf spot advisory. The advisory is a safe way to minimize fungicide applications by spraying only when weather conditions favor disease. Eliminating unnecessary fungicide sprays during dry spells helps to prevent spider mite flare-ups (Chapter 5) and can reduce tractor damage to vines, making them less prone to Sclerotinia blight, Rhizoctonia limb rot, and Botrytis blight. Leaf spot advisories are available by e-mail every day during the growing season.

For more information on advisories in your area or to receive leaf spot advisories by e-mail, contact your county agent.

Fungicides that control early and late leaf spot include chlorothalonil (Bravo; various generic brands); tebuconazole (Folicur; various generic brands); tebuconazole + prothioconazole (Provost); propiconazole plus chlorothalonil (Tilt Bravo, various generic brands); propiconazole plus trifloxystrolin (Stratego); tebuconazole plus trifloxystrobin (Absolute); azoxystrobin (Abound); pyraclostrobin (Headline); fluoxastrobin (Evito); and boscalid (Endura) (Tables 6-4 and 6-5). Many populations of leaf spot pathogens appear to be insensitive to tebuconazole. Performance of tebuconazole can be improved by mixing it with 12 to 16 oz. chlorothalonil.

Web blotch (caused by the fungus *Phoma arachidicola*) can be very serious in wet years and on susceptible cultivars. Large (½-inch) dark patches or blotches with faint or irregular margins form on the upper surface of the leaf. Lesions may have a grayish cast at first and turn dark brown as they age. Infected leaves may dry and crack with age. A good leaf spot control program usually will control web blotch. If you see web blotch, switch to a fungicide that is highly active against the disease.

Use long rotations (Table 6-1) with any crop other than peanut and avoid highly susceptible cultivars (Table 6-2). Fungicides used to control early and late leaf spot also control web blotch (Tables 6-4 and 6-5). Pyraclostrobin (Headline) and boscalid (Endura) show excellent activity against web blotch.

Fungicide Resistance Management

Most fungicides registered on peanut in the past 10 years have very specific modes of action. Continued use of a particular site-specific fungicide may cause resistant strains to build up to damaging levels unless certain precautions are taken. Pathogens resistant to a particular fungicide usually will be resistant to all fungicides within the same chemical group or mode of action. For this reason, it is important to use fungicides from different groups as partners when mixing or alternating sprays (Table 6-6). The group number is prominently displayed on the fungicide label. To maintain fungicide efficacy:

- Mix or alternate sprays of fungicides from different group numbers.
- Do not use site-specific fungicides at less than the recommended rates.
- Do not exceed the total number of sprays allowed for a particular fungicide or group number.
- Use a multi-site fungicide, such as chlorothalonil, for the first and last spray of the season.
- Maintain a good foliar disease control program throughout the growing season.
- Never rely on "rescue" treatments to clean up foliar disease problems.

Fungicide labels provide group numbers and additional resistance management information and recommendations.

Leaf scorch and pepper spot are caused by the same fungus (*Leptosphaerulina crassiasca*). In early to mid-season, large v-shaped areas appear at the tips of the leaves, resulting in a scorch symptom similar in appearance to leaf hopper damage. Later in the season, leaves can be covered with numerous small dark spots that look like pepper. These diseases usually are not a problem when fungicides have been applied for leaf spot control. Pepper spot occasionally has been associated with severe vine decline that sometimes occurs after a heavy late-season rain.

Botrytis blight (caused by the fungus *Botrytis cinerea*) is most commonly seen at the end of the season when conditions are cool and wet. Symptoms appear first on vines or leaves that have been injured by tractor tires or freezing temperatures. Massive numbers of gray to brown spores can be produced on leaves and stems, giving them a fuzzy appearance. Although Botrytis blight usually does not cause serious losses, it can be alarming. Harvesting in a timely fashion and avoiding plant injury will reduce incidence and severity. Botrytis can also cause a leaf spot. Numerous small spots are light tan, irregular in shape, and have no obvious spores at first. Later, spots may increase to large irregular tan blotches with characteristic gray spore masses.

Fungicide sprays for leaf spot control will usually control this phase of the disease.

Irregular (or funky) leaf spot is a problem of unknown cause. Leaf-spot-like symptoms appear scattered on lower leaves early in the growing season. Spores are never observed. Some defoliation may occur, but yield losses have not been demonstrated. Fungicides do not control irregular leaf spot. Leaf-spot-like symptoms appearing within 45 days of planting are probably due to irregular leaf spot or phytotoxicity. Confirm the presence of early leaf spot before making unplanned fungicide applications early in the season (prior to R3). Contact your county agent for a positive diagnosis.

Phytotoxicity (chemical toxicity) caused by systemic insecticides applied at planting can be confused with leaf spots. Spots caused by phytotoxicity usually are found around the margins of the lower-most leaflets and generally are found before mid-June. Herbicides can also cause spots by burning areas contacted by spray droplets. Affected areas lack fungal structures or spores. Spray residues may be visible on some of the spots. Phytotoxicity symptoms tend to be distributed regularly (such as at the ends of rows) or uniformly over the field. Avoid practices that lead to plant injury (see Chapter 4).

SPOTTED WILT

Spotted wilt (caused by *Tomato spotted wilt virus*, TSWV) is found in all peanut counties in North Carolina. TSWV is spread by thrips, which obtain the virus by feeding on infected plants. Symptoms vary and may include stunting, dead terminal buds, pale yellow or white ring patterns on leaves, purple blotches on the undersides of leaves, twisted petioles, stunted pods, and red seed coats. Sometimes, entire plants may wilt and have root rot. These symptoms can be confused with CBR (Table 6-3). A simple test (dipstick ELISA) can be performed by the North Carolina State University Plant Disease and Insect Clinic to confirm the diagnosis.

Rotation is not very effective in managing spotted wilt because the thrips that carry the virus can live on hundreds of cultivated and wild plant species. Spotted wilt outbreaks are unpredictable and cannot be stopped once symptoms appear.

Managing spotted wilt depends on risk prevention. Cultivar choice, plant stand, and planting date have the greatest effect on spotted wilt risk. The new cultivar Bailey has shown high levels of spotted wilt resistance in comparison to other Virginia types. Planting a resistant cultivar (Table 6-2) between May 5 and 15 in a stand of five or more plants per foot of row will minimize risk. Using an in-furrow insecticide also reduces the risk of spotted wilt. Twin rows and minimum tillage slightly reduce the risk of spotted wilt. Each of these choices presents costs and benefits to overall crop productivity. Use the Tomato Spotted Wilt Risk Index (Chapter 5) to assess options for minimizing the spotted wilt risk in a given field.

DISEASES CAUSED BY SOILBORNE PATHOGENS

Soilborne nematodes and fungi attack parts of the plant that grow in or near the soil. The entire plant may become symptomatic or die in advanced stages of disease. Soilborne pathogens are very difficult to control, and most can survive in soil for years. Prevent the build-up of disease problems by using at least a 3-year rotation to non-host crops (Table 6-1). This will allow pathogen numbers to decline to low levels. Once heavy infestations occur, however, only very long rotations can reduce pathogen numbers below economic thresholds.

Soilborne pathogens have limited mobility, so mapping the location and intensity of the diseases they cause is a useful tool for deciding where certain cultural practices and/or chemical treatments should be applied the next time peanuts are grown (Table 6-7). It is equally important to avoid introducing soilborne pathogens into uninfested areas. Use high quality treated seed, and clean equipment frequently. Clean loose soil and debris from combines after they are used to harvest heavily infested fields.

Seed and seedling rots can be caused by many fungi. Seeds may not germinate (seed rot), germinate but not emerge from the soil (preemergence damping off), or die shortly after emergence (postemergence damping off). The result is a poor stand with skips, which can lead to more spotted wilt. Rots often develop after seeds and seedlings are weakened by environmental problems or poor seedbed conditions. Plant in warm soil (65 degrees at a 4-inch depth for 3 consecutive days), since cold soils slow down germination and increase the chance for rots. Poor drainage can cause waterlogging, a major factor in seed and seedling rots. Bedding promotes soil warmth and drainage. Use high-quality seed coated with a good chemical seed treatment fungicide. Replanting is the only remedy for stand loss due to seedling disease.

Aspergillus crown rot (caused by *Aspergillus niger*) causes pre- and postemergence damping off and can kill plants up to 5 weeks after planting. Seedlings rapidly collapse and die. Dark brown discoloration is common on decayed roots and hypocotyls. Later, these areas often are covered with masses of black spores that look similar to bread mold. Aspergillus crown rot generally is of minor importance when high-quality, fungicide-treated seed are planted in well-rotated fields; rotation and seed treatments are effective controls for this disease.

Southern stem rot (caused by *Sclerotium rolfsii*) is found throughout North Carolina. The disease is also known as stem rot or white mold on peanut and as southern blight on vegetables. Stem rot is very common and can be found in most peanut fields in North Carolina. Damage ranges from mild to severe.

Symptoms include wilting of individual stems, stem lesions, shredded stems and pegs, rotted pods, and plant death. Stem lesions and pods are similar in color to a brown paper bag. White, stringy fungus growth, often having a fan-shaped appearance, may be present along with tan to brown sclerotia that look like mustard seed. These fungal structures may be seen on the lower stems and on nearby leaf litter. They distinguish southern stem rot from other diseases caused by soilborne pathogens, but damage can occur even when these signs are absent. Fields with heavy vine growth and high moisture are most prone to stem rot. This disease is most active during the hottest part of the season, especially following rain. In drier seasons, the fungus is most active underground, causing stem and pod damage that may not be noticeable until digging. Southern stem rot often is found together with CBR.

Sclerotium rolfsii has an extremely broad host range, but it does not attack small grains, corn, and other grass species (Table 6-1). Avoid rotations with soybeans, tobacco and vegetables.

In several recent trials in North and South Carolina, the multiple disease resistant cultivar Bailey has shown high resistance to stem rot. All other Vvirginia-type cultivars are considered susceptible.

Some fungicides used to control leaf spots, such as azoxystrobin (Abound), tebuconazole (Folicur), tebuconazole plus prothioconazole (Provost), propiconazole plus flutolanil (Artisan), pyraclostrobin (Headline), and fluoxastrobin (Evito) also control stem rot (Tables 6-4 and 6-5). Higher rates than those used for leaf spot control may be necessary to control stem rot. Flutolanil (Convoy) controls stem rot but not foliar diseases, so continue your leaf spot control program with an appropriate fungicide. Most soil fungicides work best when applied just before disease onset. Using a soil fungicide as part of a leaf spot control program is beneficial in most fields. Apply soil fungicides according to the leaf spot advisory or calendar schedule between July 15 and the end of August.

Rhizoctonia limb and pod rot (caused by *Rhizoctonia spp*) is sometimes confused with southern stem rot. While both affect the stems, Rhizoctonia does not produce white stringy growth or tan sclerotia. Dark- or grayish-brown lesions are usually found where the undersides of stems touch the soil. Lesions may have a dark border and often have a target-like appearance. Rhizoctonia pod rot affects pods at all stages of development and is the most destructive aspect of the disease. This disease is most common in moist or irrigated fields or where vine growth is thick. A foliar blight may be present in these conditions. Management practices and fungicides are the same as for southern stem rot (see above).

Sclerotinia blight (caused by *Sclerotinia minor*) is found in all traditional peanut counties in North Carolina. Because this disease starts by killing individual limbs, careful scouting is required to see symptoms when they first appear. Vines must be pulled back to reveal the white cottony growth of Sclerotinia and bleached stems. Signs and symptoms are most visible on humid mornings and after a rain. The end portion of infected limbs may remain green and look healthy for several days before wilting is evident. Small black irregularly shaped sclerotia that resemble mouse or insect droppings may be present on and in infected tissues. Disease is favored by cool, wet conditions and is more severe on injured vines.

To prevent build-up of damaging levels of Sclerotinia blight, rotate as long as possible with cotton or corn (Table 6-1). Canola and many cool-season vegetables should not be used in rotations. In addition, many common winter annual weeds are hosts. They support reproduction of the fungus during winter fallow, potentially reducing the benefits of rotation. Planting a small grain cover crop may reduce populations of the weeds that host the Sclerotinia blight pathogen.

Minimize trips across the field to reduce vine injury. Frequent application of chlorothalonil (Bravo, various brands) can make Sclerotinia blight more difficult to control and should be avoided. The new multiple-disease-resistant cultivar Bailey has higher resistance to Sclerotinia blight than older, moderately resistant cultivars (Table 6-2); avoid susceptible cultivars in fields with a history of disease.

The fungicides fluazinam (Omega) and boscalid (Endura) are effective against Sclerotinia blight when applied preventatively (Table 6-4). Fields with a history of serious problems should be scouted carefully beginning when vines are within 6 inches of touching, or around July 4. Treat when Sclerotinia blight is first observed (on demand) or 60 to 70 days after planting (calendar program) or according to a Sclerotinia blight advisory. If the disease continues to spread, one or two more applications may be made at 3- to 4-week intervals.

A weather-based Sclerotinia blight advisory can be used to time applications and prevent unnecessary fungicide applications. Sclerotinia advisories are available by e-mail every day during the growing season.

Consult your county agent for more information about Sclerotinia blight advisories or to receive Sclerotinia advisories by e-mail.

CBR (Cylindrocladium black rot or black root rot, caused by *Cylindrocladium parasiticum*) is found in all peanut counties in North Carolina. Entire plants turn light green or yellow, wilt, and die. Roots are blackened, brittle, and rotten. The fungus produces numerous brick-red, pinhead-sized structures on crowns, lower stems, and pods, especially following moist weather. However, CBR may be present even when fungus structures are not evident. If no fungus structures are visible, late season wilting and root rot symptoms of CBR and spotted wilt can be confused (Table 6-3). Typically, a gentle tug will pull up or break off CBR-infected plants due to extensive rotting of the crown and taproot.

Long rotations help to reduce the amount of fungus in the soil (Table 6-1). Non-hosts, such as cotton, corn, sorghum, and small grains, are excellent rotations and will help reduce *Cylindrocladium* populations in the soil.

Peanut following peanut or soybean is a formula for disaster. Once CBR becomes established in a field, these rotations will quickly lead to heavy losses. Because soybean is a host of the CBR fungus, CBR can be a problem even in fields where peanuts have never been planted if there is a history of soybean production. Symptoms of CBR (red crown rot) are not dramatic in soybean, so you may not be aware of the problem until peanuts are planted. If in doubt, select a cultivar with CBR resistance the first time you plant peanuts in a field with a history of soybean production (Table 6-2).

Together with rotation, planting a resistant cultivar is the foundation of CBR control (Table 6-2). Fields with a history of 1 to 10 percent disease should be planted to a resistant cultivar. Even if you plan to fumigate (below), highly susceptible cultivars should not be planted in fields with a history of CBR.

Always use high quality seed to prevent problems with CBR and other diseases (see below).

CBR infects during cool, wet periods in the spring and in the fall. Bed the soil and plant fields with a history of CBR in mid-May to promote soil warmth and drainage. Fall infections cause less damage than spring infections. Symptoms seen in midsummer are usually the result of spring infections.

Root knot and ring nematodes can make CBR problems worse. If CBR has been identified in a field, submit a nematode sample the fall before peanuts are to be planted. Use a CBR-resistant cultivar and treat nematodes (below) in B- or C-category fields that have a history of CBR.

The fungicide prothioconazole (found in Proline and Provost) provides some control of CBR when applied in-furrow (Proline) or as part of a leaf spot control program (Provost). Fungicides perform best when used in combination with a CBR-resistant cultivar and will not correct a CBR problem once symptoms appear.

Soil fumigation with metam sodium (Table 6-4) may be necessary to control CBR in fields with 10 percent or greater disease the last time peanuts were grown. Several new restrictions will be placed on metam sodium fumigation in the spring of 2010, but the new label was not available at the time this chapter was prepared. **The following recommendations may change and additional restrictions will apply when the new product label for metam sodium is approved. Please check with your county agent for the latest label information before using metam sodium.**

Fumigants must be injected 12 inches deep (below the top of the bed) at least 2 weeks prior to planting. Apply after soil temperatures reach 60°F at a 4-inch depth, and temperatures of 60° or higher are forecast for the next 5 days as reported by weather stations or **www.nc-climate.ncsu.edu**. However, do not apply at soil temperatures (3-inch depth) of 90°F or higher. Soil moisture at the start of application must be at 60 to 80 percent field capacity at 2 to 6 inches below the surface. Delay fumigation if an inch or more of rain is forecast within 3 days. Cool and/or wet conditions after fumigation can slow the dispersion of the fumigant, resulting in poor control or damage to young plants. Minimize disturbance of fumigated soil; herbicides can be incorporated prior to bedding and injecting for adequate weed control. Fumigation can be used with strip-tillage.

CBR Seed Transmission

CBR can be transmitted by seed. Infected seed have cinnamon-colored speckles about the size of pencil dots. The speckles are the resting structures (microsclerotia) of the fungus that causes CBR. Most microsclerotia die during winter storage, but any that survive can infect plants as they emerge from the speckled seed and can also infect nearby plants.

To avoid seed transmission of peanut diseases, peanuts produced for seed should be grown in fields with little or no CBR or Sclerotinia blight (which also may be seed transmitted). Use long rotations, fumigate prior to planting, and scout late in the season to identify these diseases. Heavily infested portions of fields should be harvested separately and used as edible peanuts. Screening at the shelling plant to remove speckled seed and use of commercially applied seed treatments will minimize seed transmission of CBR.

Methods to Reduce or Eliminate CBR in Seed

North Carolina Crop Improvement Association supports the following recommendations that will reduce/eliminate seed transmission of *Cylindrocladium parasiticum* (CBR).

- Maintain accurate records of field history and maps of CBR incidence.
- Adopt a minimum of 3-year rotations of peanut with non-hosts of *Cylindrocladium parasiticum* (cotton, corn, etc.).
- Select fields with low levels of CBR.
- Fumigate fields with metam sodium following the guidelines above.
- Inspect fields at the end of the season.
- Selectively harvest infested fields to avoid heavily infested areas.
- Avoid harvesting seed peanuts where disease incidence exceeds 5 percent.

Determining Percent Disease. In most cases, CBR will be clearly above or below the threshold. When in doubt, divide the field into 1-acre blocks, select the worst block, and determine the percent disease by stepping off three 100-foot sections of row, and counting the number of feet within each that were diseased. Five feet of diseased row out of 100 is 5 percent disease. Average the percentages from the three samples. In this manner, you can determine which acres should not be harvested for seed. Field scouts should be careful not to confuse symptoms of CBR and spotted wilt (Table 6-3).

Diplodia collar rot caused by *Diplodia gossypina* is sometimes observed in North Carolina. Individual stems on the lower plant wilt suddenly and then collapse. Often one side of the plant is affected at first; later the entire plant may die. Splitting the root may reveal a dark border surrounding an oblong tan lesion that turns slate-gray in advanced stages of disease. Stems and pods typically are covered with dark-gray fungal structures about the size of a sand grain. Later these structures become quite prominent and turn coal-black. Often the dead plants nearly disintegrate, leaving only a few blackened leaves and stems.

Diplodia collar rot is seed transmitted and can be prevented in most years by use of high quality treated seed. Collar rot is associated with heat and water stress. If available, irrigation can help to reduce Diplodia collar rot. Encouraging rapid canopy development may help to shade stems and prevent heat injury.

Pod rot can be difficult to control because the causes are so diverse. Rotted pods may be infected singly or in combination with *Pythium*, *Rhizoctonia*, *Fusarium*, and several other soilborne fungi. Symptoms include spotting, darkening, and/or rotting of the pods. Pod rot caused by *Pythium* can turn the entire pod black and soft in severe cases. Poorly drained or heavy soils favor the development of Pythium pod rot and should be avoided. Sometimes pod rot symptoms result from poor calcium nutrition or excessive magnesium or potash levels, which weaken the hull and allow various soil fungi to grow into and rot the pod. Follow recommendations for landplaster application (Chapter 3) to reduce the likelihood of this problem.

Severe pod rot is usually the result of very short rotations or poor choice of rotational or cover crops. Long rotations with most grains reduce the numbers of pod rotting organisms in soil (Table 6-1). However, rye is a host of *Pythium* and should be avoided as a rotation or cover crop.

Occasionally, outbreaks of pod rot occur in fields with little or no history of disease. Tops of plants look healthy, but pod rot is found upon digging, along with one or more of the common pod-rot fungi. The reasons for these outbreaks are not known, but most likely are related to weather during pod filling.

All of the diseases caused by soilborne pathogens discussed above can also have a pod rot phase. Rhizoctonia pod rot causes distinct brown areas on the pod. Dark golden-brown fungal growth may be seen on the seed or the inner pod surface. Papery brown pods and shredded pegs are typical of southern stem rot. Pod rot caused by CBR or Sclerotinia blight generally is found in association with other symptoms and the brick-red (CBR) or black (Sclerotinia) fungal structures described above. Cultural practices and fungicides (Table 6-4) that control CBR, southern stem rot, Rhizoctonia, and Sclerotinia blight also help to reduce pod rots caused by these pathogens.

Nematodes attacking peanuts include the Northern root knot (*Meloidogyne hapla*), peanut root knot (*Meloidogyne arenaria*), lesion (*Pratylenchus brachyurus*), ring (*Criconemella ornata*), and sting (*Belonolaimus longicaudatus*).

Nematodes cause stunting, wilting, and yellowing of above-ground portions of the plant. Damage is often seen in clusters within a field. Depending on the nematode species, root systems may be stunted, and pods and roots may have small lesions. Nematode damage can increase susceptibility to black root rot (CBR).

Root-knot nematodes cause galling on roots, pegs, and pods. The Northern root knot nematode (*M. hapla*) is the species most commonly found on peanut in North Carolina. The galls caused by this nematode are similar in size to root nodules, but appear as irregular thickenings around the root. Nodules are round and found attached to the sides of the root. The root system may have a bushy appearance, and pods may have round lesions about the size of a pinhead. The peanut root knot nematode (*M. arenaria*) is much less common and causes large swellings or galls on roots, pegs, and pods.

Planting crops that do not support the reproduction of nematodes reduces their numbers (Table 6-1). Long rotations are the most effective method of controlling nematodes and can be used instead of nematicides.

Checking pods and roots for galls immediately after digging, particularly in areas where plants were yellow or stunted, may indicate where nematode problems are present (Table 6-7). Fields to be planted to peanuts should be sampled for nematode populations in the previous fall (September through November). Twenty probes (1 inch in diameter to an 8-inch depth in the row) should be taken for each sample, with one sample to each 4 or 5 acres. Samples will be more representative of the field if the soil is mixed by disking before samples are collected.

Take samples in a zigzag pattern across the field. Divide fields requiring more than one sample according to the row direction so that you can target infested areas for nematicide treatment if necessary. To prevent decomposition, keep nematode samples cool (50 to 60 degrees) and give them to your county agent or send to the North Carolina Department of Agriculture and Consumer Services Nematode Advisory Service as soon as possible. See the NCDA & CS Web site for further information at **http://www.ncagr.com/agronomi/nemhome.htm**.

Fields that are below threshold levels (A category) need no control procedures. Fields that are B category are borderline cases; treatment may give a return on control investment, but probably will not. C-category fields are above threshold levels and should be treated.

Nematodes are often found in spots or small areas of fields. Treat individual fields or parts of fields instead of the entire crop. Fumigating with metam sodium for CBR control or applying aldicarb (Temik) in the furrow at planting for foliar insect control may help reduce nematode populations, but higher rates may be needed to control nematodes in C-category fields (Table 6-4). Never leave granular nematicides or insecticides on the soil surface. Always incorporate, particularly at the row ends, to avoid bird kills.

GENERAL INFORMATION

Soil pH

Generally, peanuts are less susceptible to disease when plants are not stressed. Acid (low pH) soil may increase the severity of CBR and spotted wilt and make zinc toxicity problems more likely (see below). Conversely, Sclerotinia blight becomes more severe as soil pH increases from 6.0 to 6.5. Carefully weigh all plant health factors when applying lime to fields where Sclerotinia blight is a problem (See Chapter 3).

Zinc Toxicity

Peanuts are very sensitive to zinc toxicity. Symptoms include yellowing, stunting, and characteristic split stems. Typically, patches of poor growth are found in areas where tin-roofed sheds stood for years. This is due to the leaching of zinc from the metal. Old hog pen areas may be contaminated with zinc due to the use of zinc supplements in hog feed.

Zinc also is added to chicken feed and is found in abundance in chicken litter. Repeated applications of chicken litter to soil can cause zinc to build up to levels that are toxic to peanuts (index of 200 to 400). Avoid poultry litter applications to peanut fields and have soil tested if litter has been applied in the past.

Since zinc is not mobile in soil, high levels are likely to damage peanuts for many years. Maintain soil pH in a range favorable for peanut production since zinc toxicity is more severe in acid (low pH) soils.

Digging Dates

In general, early digging to minimize disease losses is a mistake. Measurable yield loss from leaf spots begins at about 30 percent defoliation. Once this level of disease has been reached, there is not a consistent yield difference between peanuts dug early (within 10 days of optimum maturity) or at optimum maturity. For other diseases, harvesting early is a losing proposition until there is at least 50 percent disease. If more than 50 percent of the plants are diseased, early digging may be advisable. Most diseases caused by soilborne pathogens are not evenly distributed across the field. Therefore, if you decide to dig early, dig the most diseased portion of a field early and the remainder at maturity. Clean equipment thoroughly before moving it to healthy fields.

Adjuvants

Many adjuvants and performance enhancing products are marketed for mixing with crop protection chemicals. Except as noted in Table 6-4, fungicides for peanut disease control do not need adjuvants for best performance. The added cost of these products generally will not be offset by increases in yield. Further, certain combinations of adjuvants and fungicides will cause injury or reduce fungicide efficacy and should not be used. Check the fungicide label before adding any adjuvant.

Table 6-1. Rotational Crops for Peanut Disease Management[1]

	Rotational Crop							Years of
Disease	**Cotton**	**Corn**	**Sorghum**	**Soybean[2]**	**Tobacco**	**Small Grains**	**Vegetables or Melons**	**Rotation for Suppression[3]**
Leaf spots (early and late)	+	+	+	+	+	+	+	2
Sclerotinia	+	+	+	-	0	+	-	4+
Southern stem rot (white mold)	+	+	+	-	-	+	-	2 to 4
Pod rot[4]	0/-	+	+	-	-	+	0	2 to 4
CBR	+	+	+	-	-	+	+	2 to 4
Rhizoctonia	0	+	+	0	0/-	+	0	2 to 4
TSWV	0	0	0	0	0/-	0	0/-	---
Northern[5] root-knot nematode	+	+	+	-	-	+	-	2
Peanut root-knot nematode	+	-	-	-	+	+	-	2
Sting nematode	-	-	-	-	+	+	-	2

[1] Makes disease worse (-), is favorable for plant health (+), or has no or variable effect (0). Heavy weed infestations can reduce effectiveness of rotation for disease management.

[2] Rotation with soybean increases problems with northern root knot nematode, CBR, southern stem rot, and Sclerotinia blight. Problems are worse if soybeans are grown in the year proceeding peanuts. Double-cropped soybeans (i.e. with a small grain) result in fewer problems than full-season soybeans planted in the spring.

[3] Number of years a rotation crop is planted (for example, 2 means peanut is planted every third year).

[4] Cotton rotation may increase pod rot if soils are overfertilized with potash. Rye cover crops may increase pod rot problems.

[5] Most common root-knot species.

Table 6-2. Disease Responses[1] of Peanut Cultivars

Cultivar	TSWV	Early Leaf Spot	Late Leaf Spot	Sclerotinia	CBR	Web Blotch
NC-V 11	Moderately Susceptible	Susceptible	Moderately Resistant	Susceptible	Susceptible	Very Susceptible
NC 12C	Very Susceptible	Moderately Susceptible	Moderately Resistant	Very Susceptible	Moderately Resistant	Moderately Resistant
Perry	Very Susceptible	Moderately Susceptible	Very Susceptible	Moderately Susceptible	Moderately Susceptible	Moderately Resistant
VA 98R	Susceptible	Very Susceptible	Moderately Susceptible	Susceptible	Very Susceptible	Very Susceptible
Gregory	Moderately Resistant	Susceptible	Very Susceptible	Susceptible	Moderately Susceptible	Moderately Susceptible
Brantley	Very Susceptible	Susceptible	Susceptible	Very Susceptible	Susceptible	Moderately Susceptible
CHAMPS	Moderately Resistant	Susceptible	Very Susceptible	Moderately Susceptible	Moderately Susceptible	Susceptible
Phillips	Susceptible	Susceptible	Susceptible	Very Susceptible	Susceptible	Moderately Susceptible
Bailey[2]	Very Resistant	Moderately Resistant	Moderately Resistant	Moderately Resistant	Moderately Resistant	Unknown
Sugg	Moderately Resistant	Moderately Resistant	Moderately Resistant	Moderately Susceptible	Moderately Resistant	Unknown
Florida Fancy[3]	Moderately Resistant	Moderately Resistant	Moderately Resistant	Moderately Resistant	Moderately Susceptible	Unknown
Georgia Green	Moderately Resistant	Susceptible	Moderately Resistant	Susceptible	Susceptible	Unknown

[1]Very Susceptible - More susceptible than most cultivars; Susceptible - As susceptible as the average cultivar; Moderately Susceptible - Less susceptible than the average cultivar or variable response; Moderately Resistant - More resistant than the average cultivar; Very Resistant - More resistant than other cultivars. No immunity to disease in any peanut cultivar.
[2]Also very resistant to stem rot. All other cultivars are susceptible to stem rot and/or their response has not been well tested under North Carolina production conditions.
[3]Ratings are based on data from only two years of testing in North Carolina and should be considered tentative.

Table 6-3. A Comparison of CBR and Spotted Wilt Symptoms[1]

Symptoms	TSWV	CBR
Rings on leaves	Sometimes	No
Twisted petioles	Usually	No
Root rot	Sometimes	Yes
Wilting	Sometimes	Usually
Overall yellowing	Sometimes	Yes
Dead terminals	Sometimes	No
Brick-red fruiting bodies on stems or pods	No	Sometimes [2]
Stunted seeds, limbs, plant	Sometimes	No
Red seeds	Sometimes	No
Cracked seed coats	Usually	No
Cinnamon speckles on seed	No	Yes
Clumped in low areas	No	Often
Clearest symptoms	Early to mid-season	Late season
Dipstick ELISA test positive	Usually [3]	No

[1] Plants may have both diseases at the same time.

[2] If visible, CBR definitely is present.

[3] If positive, TSWV definitely is present.

Table 6-4. Peanut Disease Control

Most peanut disease control chemicals leave residues on peanut vines that make them unsuitable for hay. Check each label before using the material if you intend to feed hay to livestock

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
ASPERGILLUS CROWN ROT Aspergillus)	azoxystrobin (Abound)[3] 2.08 F (11)	0.4 to 0.8 oz/1,000 ft of row	At planting	—	Apply as in-furrow spray with 3 to 5 gal water.
BLACK ROOT ROT (CBR) (Cylindrocladium)	metam sodium 42% (various brands) 4.25 F	7.5 to 11 gal	At least 2 weeks before planting or longer if cool and/or wet	—	Inject 10 to 12 in. below the bedded soil surface. If wet and/or cold weather occurs following fumigation, the waiting period should be extended. Soil aeration helps reduce residual chemical. When in doubt use a bioassay such as the lettuce seed germination test to determine if safe to plant. New regulations may impose buffer zones and other restrictions on metam sodium use. See your county Extension center for details.
	prothioconazole (Proline) 480 SC (3)	0.4 fl oz/1,000 ft of row	At planting	—	Apply as in-furrow spray for suppression of CBR. Not a substitute for fumigation in fields with a history of >10% CBR.
EARLY LEAFSPOT (Cercospora) and LATE LEAF SPOT	cupric hydroxide (Kocide, various brands)[1] (M1) 61.4DF 53.8 DF 46.1 DF 77 WP	 1.5 to 3 lb 1 to 2.25 lb 0.75 to 1.25 lb 1.5 to 3 lb	Begin applications at very early pod (r3). Repeat applications every 14 days or according to daily weather-based advisories.	0	Use nozzles that give a cone-shaped spray pattern. Use 12 to 24 gal of water for spray materials applied by ground sprayers. Use 3 to 5 gal of water for materials applied by air. 14-day program: Five or six applications suggested. Begin applications at very early pod (r3). Repeat applications at 14-day intervals. (continued on next page)

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
EARLY LEAFSPOT (Cercospora) and LATE LEAF SPOT	basic copper sulfate (various brands)[1] 36.9 DF (M1)	2 to 4 lb		0	Advisory: Begin applications at very early pod (r3). Repeat applications when weather conditions become favorable as determined by peanut leaf spot advisories.
	mancozeb and copper hydroxide (Mankocide)1 61.1 DF (M3)	4 lb		14	This schedule requires strict adherence to the program guidelines and usually results in fewer fungicide applications than the 14-day schedule. Contact your county Extension center for details.
	mancozeb (Dithane, Manzate, various brands)[1] (M3) M45 F45 DF	 1 to 2 lb .8 to 1.6 qt 1 to 2 lb		14	Leafspot advisories are most effective if used with long rotations, resistant varieties, and high rates of effective fungicides. Scout fields: if 20% or more of leaflets have spots, begin a 14-day spray program.
	Sulfur (various brands and formulations)[1] (M2)	various		0	
	dodine (Elast) 400 F (M7)	1.5 pt	Make no more than 3 applications as part of a full-season 14-day or advisory program	14	

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
EARLY LEAFSPOT (Cercospora) LATE LEAFSPOT (Cercosporidium); WEB BLOTCH (Ascochyta)	chlorothalonil (Bravo, Echo, various brands) (M5) 720, 6 F 82.5 `WDG 90 DF	 1.5 pt 1.4 lb 1.25 lb	Begin applications at very early pod (r3). Repeat applications every 14 days or according to daily weather based advisories. Begin 14-day program if web blotch is found.	14	See Early and Late Leaf Spot above.
	propiconazole + chlorothalonil (Tilt/Bravo SE) (3 + M5)	1.5 pt		14	
	propiconazole (3) + chlorothalonil (Tilt/Bravo, various brands) (M5)	2 fl oz 1 pt		14	
	boscalid (Endura) [5] 70 WDG (7)	10 oz	Make 2 or 3 applications in mid-season as part of a full-season 14-day or advisory program	14	See Early and Late Leaf Spot above. Alternate with another fungicide or mix with 0.75 to 1 pt chlorothalonil to improve leaf spot control. Also controls Sclerotinia blight.
EARLY LEAF SPOT (Cercospora); LATE LEAF SPOT (Cercosporidium); WEB BLOTCH (Ascochyta); LIMB ROT (Rhizoctonia)	propiconazole + trifloxystrobin (Stratego) 250 EC (3 + 11)	7 to 14 fl oz	14 day or advisory beginning at r3	14	See Early and Late Leaf Spot above. Use higher rates for soil-borne pathogens and under wet (rainfall or irrigation) conditions. No more than 6 applications per season.

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
EARLY LEAF SPOT (Cercospora); LATE LEAF SPOT (Cercosporidium); WEB BLOTCH (Ascochyta); LIMB ROT (Rhizoctonia)	tebuconazole + trifloxystrobin (Absolute) 500 SC (3 + 11)	3.5 to – 7 fl oz	14 day or advisory beginning at r3	14	See Early and Late Leaf Spot above. Use higher rates for soil-borne pathogens. No more than 4 applications per season.
	thiophanate methyl (various) (1) 4.5 F 70 WDG 85 WDG	 10 fl oz .5 lb .4 lb	14 day or advisory beginning at r3	14	See Early and Late Leaf spot above. DO NOT apply alone. Mix with another fungicide.
EARLY LEAF SPOT (Cercospora); LATE LEAF SPOT (Cercosporidium); WEB BLOTCH (Ascochyta); LIMB ROT (Rhizoctonia); STEM ROT (Sclerotium rolfsii)	prothioconazole + tebuconazole (Provost 433 SC) [2] (3+3)	7 - 10.7 fl oz	Make 3 or 4 applications in mid-season as part of a full-season 14-day or advisory program	14	See Early and Late Leaf Spot above. . For best control of limb and pod rot, do not use a surfactant. Mix tebuconazole with 0.75 to 1 pt chlorothalonil to improve foliar disease control. Do not apply more than 3 times in a 5-spray program or after the first week in September. Also suppresses CBR at high rate. Resistance management: Site-specific fungicides should be mixed or rotated with another type of fungicide to minimize the risk of fungus resistance development.
	prothioconazole (Proline) [2] 433 SC (3)	5.7 fl oz		14	
	metconazole (Quash) 50 WDG (3)	2.5 to- 4 lb		14	See Early and Late Leaf Spot above. For best control of limb and pod rot, do not use a surfactant. Mix with 0.75 to 1 pt chlorothalonil to improve foliar disease control. Resistance management: Site-specific fungicides should be mixed or rotated with another type of fungicide to minimize the risk of fungus resistance development.
	tebuconazole (Folicur, various) 3.6F (3)	7.2 fl oz		14	

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
EARLY LEAF SPOT (Cercospora); LATE LEAF SPOT (Cercosporidium); WEB BLOTCH (Ascochyta); LIMB ROT (Rhizoctonia); STEM ROT (Sclerotium rolfsii)	flutolanil + propiconazole (Artisan) 3.6 F (7 + 3)	26 to 32 fl oz	Use low rate 2 to 3 times per season OR high rate 2 times per season as part of a full-season 14-day or advisory program.	40	See Early and Late Leaf Spot above. Alternate with another fungicide for foliar disease controlor mix with 0.75 to 1 pt chlorothalonil to improve foliar disease control. Do not plant small grains within 5 months of last application. See label for other plant-back restrictions.
	azoxystrobin (Abound) [2,3] 2.08 F (11)	12.3 to 24.6 fl oz	Make 2 applications per season as part of a full- season 14-day or advisory program	14	See Early and Late Leaf Spot above. Use in mid-season for best control of soil-borne pathogens. Use higher rates for limb rot and stem rot control. Use no more than 2 applications in a 5 spray program.
	fluoxastrobin (Evito) 480 SC) [3] (11)	5.7 fl oz		14	Resistance management: Site-specific fungicides should be mixed or rotated with another type of fungicide to minimize the risk of developing fungal resistance.
	pyraclostrobin (Headline) [2,3] 2.09 EC (11)	6 to 15 fl oz		14	
STEM ROT (white mold, Southern blight, Sclerotium rolfsii); LIMB ROT (Rhizoctonia)	flutolanil (Convoy) 40 SC (7)	16 to 32 fl oz	Following leafspot advisories, make 1 or 2 (high rate) or 2 to 4 (low rate) applications in mid-season	40	If needed, make a second applicaton 30 days after the first application. Do not apply more than a combined total of 64 fl oz in a single growing season. Do not plant small grains within 5 months of last application. See label for other plant-back restrictions. Does not control foliar diseases.

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
NEMATODES	GRANULAR FORMULATION:				
	aldicarb (Temik) 15 G	10 to 20 lb equivalent to 15-22 oz/1,000 ft of row	At planting	90	Apply in-furrow. Moderately effective. Do not leave granules uncovered where birds can feed on them. Disk across row ends to bury chemical residue.
	FUMIGANTS:				
	dichloropropene + chloropicrin (Telone C-17)	5 to 7.5 gal	At least 2 weeks before planting	—	Inject 10 to 12 in. below the row. Very effective against all nematodes. New regulations may impose buffer zones and other restrictions on fumigant use. See your county Extension center for details.
	1-3 dichloropropene (Telone II)	4 to 6 gal	At least 2 weeks before planting	—	
	metam sodium 42% (various brands)[4] 4.25 F	7.5 to 11 gal	At least 2 weeks before planting	—	Moderately effective against Northern root knot nematode (M. hapla). Not very effective on peanut root knot nematode (M. arenaria). New regulations may impose buffer zones and other restrictions on metam sodium use. See your county Extension center for details.
POD ROT, SEED and SEEDLING ROT, STEM ROT (Pythium, Rhizoctonia, Sclerotium rolfsii)	mefenoxam .48% + PCNB 10% (Ridomil Gold PC GR) (4 + 14)	12.5 to 25 lb	Pythium seedling disease: 4-in. band (36-in. row spacing) at planting	75	
	mefenoxam + PCNB 10% (Ridomil Gold PC GR) (4 + 14)	50 lb	Pythium root and pod rot: 8- to 12-in. band (36-in. row spacing) at early pegging	75	Do not apply to wet foliage as foliar toxicity may result. Use with other fungicides for late-season control of stem rot (Sclerotium rolfsii) and Rhizoctonia stem and pod rot (Rhizoctonia spp.).

Table 6-4. Peanut Disease Control *(continued)*

Disease or Diseases Controlled	Pesticide Formulation (Group Number)	Amount of Formulation Per Acre	Application Schedule	Minimum Days to Harvest	Precautions and Remarks
POD ROT, SEED and SEEDLING ROT, STEM ROT (Pythium, Rhizoctonia, Sclerotium rolfsii)	tebuconazole (Folicur) 3.6F (3)	7.2 fl oz	Pod rot: Use 3 or 4 applications in mid-season as part of a full-season 14-day or advisory program	14	See Stem Rot and Rhizoctonia Limb Rot above. Also controls foliar diseases.
	azoxystrobin + fludioxonil + mefanoxam (Dynasty PD)[2] (11 + 12 + 4)	4 oz/100 lb seed	Seedling diseases: Apply to conditioned, untreated seed. Commercial application strongly recommended.	—	Do not plant wheat, oat, rye, triticale, or sorghum for 12 months after use. See label for other plant back restrictions.
SCLEROTINIA BLIGHT	fluazinam (Omega) 500 F (29)	1 to 1.5 pt	1 to 3 applications according to weather-based advisory, field history, and scouting	30	Do not apply more than a combined total of 4 pints in a single growing season. Contact your county Extension center for details on weather-based Sclerotinia advisories.
	boscalid (Endura)[5] 70 WG (7)	8 to 10 oz	1 to 3 applications according to weather-based advisory, field history, and scouting	14	Make no more than two consecutive applications per season. Contact your county Extension center for details on weather-based Sclerotinia advisories. Also controls leaf spots and web blotch.

[1] Less effective than many fungicides; more frequent application may be necessary.

[2] Also suppresses CBR. See label for details.

[3] QOI (group 11) fungicide. Do not apply ANY group 11 fungicide (single product or combination of products) more than two times in sequence or more than three times per season. See www.FRAC.org for information on fungicide resistance management.

[4] Probably not as effective as the other fumigants against nematodes.

[5] Do not apply more than two times in sequence or more than three times per season. May be alternated with group 11 or group 3 fungicides. See www.FRAC.org for information on fungicide resistance management.

Table 6-5. Recommended Uses of Fungicides Labeled for Peanut Disease Control

Brand	Active	Rate per Acre [1]	Controls [2]	Uses
Abound	azoxystrobin	12.3 to 24.6 oz	ELS, LLS, web blotch, stem rot, Rhizoctonia limb and pod rot	Mid-season, especially where soil borne pathogens are a problem; no more than 2 applications of Abound, Absolute, Headline, Stratego, or Evito in a 5-spray program.
Absolute	tebuconazole + trifloxystrobin	3.5 fl oz	ELS, LLS, web blotch	Early season; no more than 2 applications of Abound, Absolute, Headline, Stratego, or Evito in a 5-spray program.
Artisan	propiconazole + flutolanil	26 to 32 fl oz	ELS, stem rot, Rhizoctonia limb and pod rot	Mid-season, especially when soil borne pathogens are a problem; use a good leaf spot fungicide for next calendar or advisory spray
Bravo, various generic	chlorothalonil	1.5 pt	ELS, LLS, web blotch, pepper spot	Inexpensive, resistance management. Repeated application can flare spider mites.
Convoy	flutolanil	1 to 2 pt	stem rot, Rhizoctonia limb and pod rot	Mid-season; does not control foliar pathogens
Endura	boscalid	8 to 10 oz	Sclerotinia blight; ELS, LLS, web blotch	At row closing or according to Sclerotinia advisory
Evito	fluoxastrobin	5.7 oz	ELS, LLS, web blotch, stem rot, Rhizoctonia limb and pod rot	Mid-season, especially where soil borne pathogens are a problem; no more than 2 applications of Abound, Absolute, Headline, Stratego, or Evito in a 5-spray program.
Folicur, various generic	tebuconazole	7.2 oz	ELS, LLS, web blotch, stem rot, Rhizoctonia limb and pod rot	Mid-season, especially where soil borne pathogens are a problem; mix with chlorothalonil or thiophanate methyl to improve foliar disease control
Headline	pyraclostrobin	6 to 15 oz	ELS, LLS, web blotch (all rates); stem rot, Rhizoctonia stem and pod rot (high rates)	Mid-to late season; no more than 2 applications total of Abound, Absolute, Headline, Stratego, or Evito in a 5-spray program.
Omega	fluazinam	1 to 1.5 pt	Sclerotinia blight, suppresses stem rot	At row closing or according to Sclerotinia advisory
Proline	prothioconazole	5.7 fl oz	CBR, Stem rot	Apply in furrow for suppression of CBR and stem rot.
Provost	tebuconazole + prothioconazole	7 to 10.7 fl oz	ELS, LLS, web blotch, stem rot, Rhizoctonia limb and pod rot	Mid-season, especially where soil borne pathogens are a problem
Stratego	propiconazole + trifloxystrobin	7 to 14 oz	ELS, LLS, web blotch, pepper spot	Early season; counts as a strobilurin application
Tilt, Bravo, various generic	propiconazole + chlorothalonil	1.5 pt premix	ELS, LLS, web blotch, pepper spot	First spray, inexpensive, can be used full season if stem rot is not present; resistance management

[1]Rate listed is for most common formulation. Check label. [2] ELS=Early leaf spot; LLS=Late leaf spot.

Table 6-6. Managing the Risk of Fungicide Resistance in Fungicides Commonly Used for Peanut Disease Control

Group	Type	Fungicide	Resistance risk	Alternate With:
M	Multi-site	copper-containing and EBDC fungicides (Kocide, Mancozeb, various) Chlorothalonil (Bravo, various)	Very low	All
3	DMI	Tebuconazole (Folicur, various), Tebuconazole + Prothioconazole (Provost), Prothioconazole (Proline), Metconazole (Quash)	Moderate; some populations of leaf spot pathogens are resistant to tebuconazole	Coppers, EBDCs, cholorothalonil, azoxystrobin, pyraclostrobin, fluoxastrobin, boscalid, flutalonil
3 + M	DMI + multisite	Propiconazole + Chlorothalonil (Tilt/Bravo)	Low when used as a mix	Coppers, EBDCs, chlorothalonil, azoxystrobin, pyraclostrobin, fluoxastrobin, boscalid, flutalonil
7 + 11	DMI + QOI (strobilurin)	Propiconazole + Trifloxystrobin (Stratego), Tebuconazole + Trifloxystrobin (Absolute)	Low when used as a mix	Coppers, EBDCs, chlorothalonil, boscalid, flutalonil
7 + 3	DMI + Carboximide	Propiconazole + Flutalonil (Artisan)	Low when used as a mix	Coppers, EBDCs, chlorothalonil, azoxystrobin, pyraclostrobin, fluoxastrobin
7	Carboximide	Flutalonil (Convoy), Boscalid (Endura)	Moderate	Coppers, EBDCs, chlorothalonil, tebuconazole, propiconazole + chlorothalonil, tebuconazole + prothioconazole, prothioconazole, azoxystrobin, pyraclostrobin, fluoxastrobin
11	QOI (strobilurin)	Azoxystrobin (Abound), Pyraclostrobin (Headline), Fluoxastrobin (Evito)	High	Coppers, EBDCs, chlorothalonil, tebuconazole, propiconazole + chlorothalonil, flutalonil + propiconazole, tebuconazole + prothioconazole, boscalid, fultalonil

Table 6-7. Peanut Disease Management Calendar

Time of Year	Disease	Threshold	Management Tactics
SPRING (APRIL–JUNE)	Spotted wilt virus (TSWV)	See TSWV risk index	Plant a resistant cultivar; use a high seeding rate or twin rows; plant May 5 - 15; apply phorate or aldicarb in furrow.
	CBR (Cylindrocladium black rot)	1% to 10% disease in this field last time peanuts were grown	Plant a resistant cultivar.
		More than 10% disease in this field last time peanuts were grown	Plant a resistant cultivar and fumigate before planting.
JUNE–HARVEST	Leaf spots, Web blotch, Pepper spot	R3 (beginning pods)	Begin calendar sprays or advisory program.
		20% leaflets with spots	Reduce intervals between sprays when over threshold. Switch to a more effective fungicide if late leaf spot, web blotch, or pepper spot becomes predominant. If using advisory, switch to a 14-day spray schedule.
	Southern stem rot	First symptoms if history of serious disease or when favorable weather conditions occur just before vines close	Switch to a foliar fungicide with efficacy against soil- borne pathogens, or apply a soil fungicide.
	Sclerotinia blight	In fields with a history of less than 10% disease	Scout; begin fungicide applications if disease is seen.
		In fields with a history of greater than 10% disease: just before vines close or according to weather-based Sclerotinia advisory	Begin fungicide applications.
SEPTEMBER-OCTOBER	CBR, Sclerotinia blight, Southern stem rot	At digging	Make disease maps to decide future rotations. Inspect inverted roots and pods for disease symptoms. Use resistant varieties, and pinpoint areas for fumigation and fungicide application.
OCTOBER–NOVEMBER	Nematodes	Sample as indicated by the NCDA nematode-testing lab report	Plan rotation and nematicide use based on recommendations.

7. PLANTING, HARVESTING, AND CURING PEANUTS

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PLANTING

Factors discussed in earlier chapters, from land preparation to variety selection, have a direct impact on the planting operation. The planter should be selected and prepared to match the production practices to be used.

Planters are designed to perform five major functions: open a furrow, meter seed, place seed, cover the seed, and firm the soil around the seed. No-till planters, in addition to the five functions listed above, must also manage crop residue and prepare the row for planting. Peanuts are a fragile seed compared to corn, soybeans, or cotton. Seed damaged in planting may not germinate. A peanut planter must not only meter and place the seed accurately, it must handle the seed gently to avoid damage.

Planter Types

Two types of planters are available for peanuts: the plate planter and the air planter. Plate planters are divided into two groups based on the design of the plate: horizontal plate or inclined plate. Air planters used for peanuts also fall into two groups: pressure disk and vacuum disk. Air planters that use a seed drum are not recommended for peanuts.

Horizontal plate planters typically have a plate mounted in the bottom of the seed hopper. The plate for peanuts is modified to allow gentle handling of the seed as well as accurate metering. Usually the plate mechanism is an attachment that must be added in the seed hopper. Inclined plate planters may have one or two seed plates per row. The seed plate cells are sized and selected for peanuts and usually do not require modifications or attachments. Planters that have two seed plates per row have a lower plate speed, which provides gentle treatment. Plate planters, horizontal plate or inclined plate, are accurate and effective if properly set up and operated within the manufacturer's recommended ground speed range.

Air planters use a seed disk to meter the seed. The seed disk is mounted vertically in the metering chamber. Cells are cut or formed in the edge of the disk to meter the seed. Air pressure is used to hold the seed in the cells. Pressure disk planters use a fan to blow air into the metering chamber. Vacuum disk planters have a fan designed to remove air from a chamber behind the seed disk. The vacuum created holds seeds from the metering chamber in the disk's cells much like the pressure disk system. The key to accurate planting with an air planter is controlling air pressure or vacuum. If the pressure or vacuum is too strong, too many seeds may be held in the cell. Likewise, if the pressure or vacuum is too weak, the cells may not be properly filled. Brushes remove extra seeds from each cell. As with the plate planters, gentle treatment is important. Seed disks usually have more cells than seed plates, allowing the disk to turn slower. Air planters can maintain metering accuracy at higher ground speeds than plate planters and tolerate a broader range of seed sizes. Refer to the operator's manual for information on setup, operation, and speeds.

Preparing To Plant

Before the planting season, take time to give planting equipment a thorough examination. Look for signs of worn or damaged parts, drive chains, gears, and seed plates or disks. On air planters, look for cracks or leaks in the air tubes. Also check the air delivery on each fan. Make sure the drives are turning freely and lubricated, if required, according to the manufacturer's specifications. Seed plates are usually driven by a press wheel, gauge wheel, or transport wheel. This wheel provides power to turn the plates or disks, and often fertilizer or pesticide applicators as well. If the wheel is inflatable, check the air pressure. A overinflated or underinflated tire can seriously affect planting accuracy.

Be sure to calibrate fertilizer, pesticide, and planting equipment to ensure accuracy. Refer to the operator's manual to find the proper drive setup for your needs. Table 7-1 gives the necessary seed spacings

Table 7-1. Seed Spacings for Various Seed Populations and Row Widths[1]

Row Spacing (Inches)	**Seed Population** (Seeds per Acre)				
	40,000	**45,000**	**50,000**	**55,000**	**60,000**
	Seed Spacing (Inches per Seed)				
34	4.6	4.1	3.7	3.4	3.1
36	4.4	3.9	3.5	3.2	2.9
38	4.1	3.7	3.3	3.0	2.8

[1] For twin rows on 36-inch beds, multiply the seed spacing for a single row by 2 to get the spacing in each of the twin rows.

for selected seed populations. Once the planter is set up, check its performance in the field to ensure continued accuracy.

HARVESTING

Preparing for Harvest

Successful harvesting begins with proper preseason maintenance of harvesting equipment. Peanut diggers and combines have many key parts that require service for good performance.

On diggers, start with the blades. The edge should be sharp and the blade should not be worn away. As the blade wears it gets narrower and shorter, which means it may not do a good job of lifting the peanuts so the shaker can catch them. The shaker chain or shaker wheels are driven by either PTO or hydraulic power. For PTO-driven units, inspect the driveline carefully for wear or damage. **Replace any missing safety shields!** Repair any worn bearings or other parts in the driveline. For hydraulic powered diggers, inspect the hoses for wear or signs of leakage. Replace any damaged hose. Check the hydraulic control valve and the quick connects as well. Check the shaker chain or wheels for signs of wear. Replace any worn or damaged chain links, rattler bars, or kicker wheels. Also inspect the shafts and bearings for wear and replace where necessary. Finally, check the inverter arms. Be sure they are bent to the proper shape. Once your inspection is complete, hook up the digger and run the shaker. Once again, check for any signs of wear or damage in the system.

For peanut combines, start by checking the input driveline for wear in the universal joints and wear or damage to the telescoping tube and the coupler. Check the lubricant in the gearboxes and service as recommended by the manufacturer. Check chain drives for wear and proper tension. Replace any chain or sprocket which does not measure up to specifications. Check belts for wear and proper tension. Replace worn belts and pulleys as necessary. Check the condition of shafts and bearings to be sure they are acceptable. Look inside the combine and check the condition of stripper bars on the cylinders and on the concaves. Replace any broken stripper teeth. Look for clogged or blocked holes in the concaves. If the openings are blocked, peanuts cannot fall through into the cleaning pan. Check shaker pans or cylinders throughout the combine for proper movement or timing. Inspect the stemmer saws for proper alignment. Replace any blades that are broken. Check the condition of the shaker pans, lip screens, or other cleaning elements, and be sure they are set properly. Inspect fan blades for wear and fan housings and conveyor tubes for air leaks. Air leaks can prevent proper cleaning or handling of the peanuts. Look inside the elevator tubes for obstructions. Peanuts will crack if they hit obstructions, resulting in a lower grade. Finally, check the hopper and dump cylinders to be sure they are working.

Refer to the operator's manual for recommended adjustments and settings. In addition to the recommendations above, give the machine a general inspection to find and repair loose or broken parts. A little time spent in preseason maintenance can save many hours during the harvest season. Above all, observe all safety precautions while servicing or operating the digger or combine!

Digging

Peanuts should be dug when maximum yield and quality can be obtained. The hull-scrape test can help predict the best time to dig. Contact the county Extension center for more information. Pay close attention to the weather when planning digging. If digging and combining are staggered, peanuts won't be left too long in the windrow.

Once digging begins, keep digging losses to a minimum. Most harvesting losses occur in the digging operation and can be enormous if not carefully managed. Heavy digging losses are unavoidable when pegs are weakened due to over maturity or premature defoliation caused by disease, or when the soil is very dry and hard. Under normal conditions, a yield loss of 5 percent or less should be possible if the digger is adjusted and operated properly.

Reducing Digging Losses. Digging losses can occur below ground or above ground. Losses that occur below ground level occur when peanuts are cut off when the blades are run too shallow and when peanuts are lost as the soil is pushed up the blades and fingers onto the shaker and are being lifted out of the soil. Losses also may occur as the plants are being elevated and shaken to remove dirt, and as the peanuts are placed in windrows. These losses are usually seen on top of the ground Adjusting the digger for optimum performance requires considerable operator skill. The following guidelines should help with the adjustment process.

Blades should be sharp and should penetrate to the same depth from side to side. A slight forward pitch of the blades (the back edge slightly higher that the cutting edge) will loosen the soil around the pods, making their removal from the soil less likely to break the pegs. Refer to the operator manual for your blade manufacturer's recommendation. Ideally, the blades should cut the taproot of the plant just below the pods. In some fields, however, the blades may have to be run deeper in the heavier spots. Pay close attention the operator's manual for the digger for guidance on setting the depth of the plow. Most digger blades are designed to run with the bevel facing up or facing down. Install the blades with the bevel up for conditions where the soil is dry or difficult to penetrate. Adequate but not excessive soil moisture improves digger operations. Changes in soil type or moisture within a field can cause the digger to run deeper or shallower. If the digger runs shallow, peanuts will be lost when the blade cuts them off. Pay close attention to the windrow and look for signs of inadequate depth.

Proper synchronization of ground speed and shaker speed is essential to keep from dragging the plants forward, on the one hand, or snatching them backward out of the soil on the other. Optimum shaker speed is slightly faster than ground speed. The plant should rise vertically and fall back to the ground close to where it was growing. If the shaker is PTO-driven, and there is a fixed ratio between ground speed and PTO speed in each tractor gear for most tractors. Thus, speed must be synchronized by selecting the proper gear to operate in. Most modern tractors have a sufficient selection of gears to allow synchronization. Some tractors may offer a PTO that is internally synchronized to ground speed. Hydrostatic drive tractors provide infinitely variable ground speed at any given engine speed, making it easier to achieve synchronization. Hydraulically driven diggers can provide a constant shaker speed at any engine speed that provides adequate oil flow in the hydraulic system. Hydraulic diggers can be synchronized more accurately by adjusting the tractor hydraulic control valve. The operator can chose the best gear for the tractor and then synchronize the digger to match it. Even with proper synchronization, ground speeds in excess of 4 miles per hour will tend to jerk the plants from the soil and cause heavy pod losses.

The final stage of the digging operation, windrowing can also lead to harvest losses. As the peanut vines flow off the shaker, they fall onto a kicker wheel assembly and slide across the inverter guide rods. Check the kicker wheel drive to be sure the kicker wheels are turning with the shaker chain. Carefully inspect the guide rod section of the implement to insure the guide rods are properly spaced and positioned. If the rods are bent out of position, the peanuts will not flow with the rods but will push across them causing peanuts to be raked off the the vine and lost. Make sure the rods are smooth and free of rust. Corroded or damaged rods can also impede the flow of vines and cause harvest loss.

In some cases, heavy vine growth makes it difficult to see the furrows during digging. Using a GPS receiver and a light bar as a guidance tool can make the digger operation much smoother. The light bar can help the operator stay properly positioned on the row and thus reduce potential losses.

Keep Windrows Loose. Windrows should be loose and fluffy for good drying and should be placed on level ground, or preferably, on a slight ridge for drainage. If flat cultivation was practiced, this will not present a problem. Otherwise, mount a device like a drag bar or leveler under the shaker to tear down the row beds and form a slight ridge under the windrow.

Inverters should be adjusted to turn the plants completely upside down so that the peanuts are fully exposed to air and sunlight for fast drying. Peanuts in contact with the ground do not dry as rapidly under normal conditions as those supported off the ground, and they will be much more susceptible to damage during adverse weather conditions. On hot, sunny days, peanuts very close to or in contact with the soil may get too hot and develop off-flavors or poor milling quality.

Reshaking or lifting windows often helps with drying, particularly if the soil was wet at digging or if rain soon after digging stuck the vines to the soil. Careful synchronization of the lifter conveyor with ground speed is necessary. Lifting or reshaking when the vines have become dry and brittle is to be avoided since heavy losses will occur.

Combining

Combining is the culmination of a year's peanut production efforts. As such, it deserves careful assessment to ensure the maximum yield and best quality. Modern combines will get peanuts off the vines under almost any circumstances. Field losses, mechanical injury, germination, and even flavor, however, may be influenced by the feeding rate into the combine, the cylinder speeds and clearances, the cleaning and conveying fan speeds, and the moisture content of both peanuts and vines at picking.

Tests by various researchers have indicated that hull damage, loose shelled kernels, and shelling damage (splitting and skinning) are less for peanuts combined at moisture contents of 25 to 35 percent. However, combining at 20 percent moisture will reduce curing time and costs. During periods of good drying weather, combining can safely be delayed to take advantage of additional infield drying. Vines should be dry enough to break and tear apart readily.

Picking action should be just aggressive enough to remove all the peanuts from the vine with a minimum of vine breakage. Excessive picking action takes more power and breaks the vines into short pieces so that instead of passing out over the vine racks, they fall through with the peanuts and overload the cleaning screens.

Stripper fingers or bars should be adjusted as moisture conditions change during the day. The front strippers are usually set to be more aggressive than those in the rear. Long, clean hay should be discharged from the machine with a minimum of short, broken vines in the hopper.

Cylinder speed should be kept to the manufacturer's recommendation or below and never more than is required to get the peanuts off the vines. Slow cylinder speeds are especially important when combining seed peanuts. Some cylinder speeds are adjustable independently of tractor engine rpm; on others, the speed is regulated by the tractor throttle and is generally correct when the tractor PTO is operating at rated PTO speed or the PTO speed recommended by the combine manufacturer.

Keep tractor engine speed near the recommended level in order for the cleaning and conveying components of the combine to work properly.

Watch Air Velocity. Air conveyors on the combine can cause considerable hull cracking if the fans are operated too fast or the dampers are not adjusted properly. Use only enough air velocity to lift the peanuts into the bin. The air velocity for the cleaning screens also requires frequent checking and adjustment. Sufficient air should be supplied to blow sticks, trash, and "pops", but not marketable peanuts out of the machine. If the screens become heavily loaded with trash, it may not be possible to get good separation. Consequently, either good peanuts will be blown out or trash will go into the bin. Overloading of the screens may indicate that picking action is too aggressive. Tail board adjustment also affects what is blown out of the back for any given fan setting.

Proper synchronization of the combine pickup with forward speed is important to minimize field loss of peanuts. The windrow should flow evenly and smoothly into the combine, without being pulled apart by a ground speed that is too slow or pushed ahead by a ground speed that is too fast. Either situation will cause peanuts to be lost off the vines before getting into the combine. Some combines have an adjustment to quickly change pickup reel speed; on others, a sprocket must be changed. In either case, changing gears on the tractor will affect synchronization and reel speed should be adjusted. The pickup tires should run just above the ground surface. If they are allowed to dig into the ground, they will pick up dirt and carry it in with the peanuts.

Combine pickup and cleaning losses (peanuts picked but blown out) can be appreciable. However, proper adjustment and operation of the equipment can virtually eliminate these losses.

Estimating Harvest Losses

The level of harvest loss in the field can be used to check digger or combine performance. Excessive losses may indicate problems with equipment adjustment or operation. Harvest losses can be estimated based on the number of pods left on or in the ground after digging or combining.

Measure a sample area behind your digger or combine. For example, if your row spacing is 36 inches, and you have 2 rows per windrow, you are working with a sample width of 72 inches or 6 feet. If you measure 20 inches along the row, you will have a sample area equivalent to 10 square feet. Any peanuts you pick up in that 10-square-foot sample can be used to estimate losses using Table 7-2 below. You can use any size area you want, but bear in mind that the larger the area, the more accurate your estimate will be. An alternative would be to use an area of 0.001 acres, 6 feet by 7.26 feet, or 43.56

Table 7-2. Harvest Loss Table

Cultivar	Loss (lb/a) for 1 Pod per Square Foot	Loss (lb/a) for 1 Pod per 10 Square Feet	Loss (lb/a) for 1 Pod per 0.001 Acre
Bailey[1]	219	21.9	5.04
Florigiant[1]	218	21.8	5.01
Gregory[1]	240	24.0	5.51
NC 12C[1]	224	232.4	5.15
NC 7[1]	244	24.4	5.59
NC-V 11[1]	215	21.5	5.95
Perry[1]	232	23.2	5.33
Phillips[1]	221	22.1	5.06
Sugg[1]	222	22.2	5.09
VA 98R[1]	217	21.7	5.08
VA-C 92R[1]	233	23.3	5.35
Wilson[1]	224	22.4	5.14
FCIC-Virginia Type Average[2]	187	18.7	4.29

[1]Based on pod weights from N.C. State University variety test data.

[2]Based on data from the Federal Crop Insurance Corp.

square feet. Again, the number of pods picked up in the sample area are used to estimate yield loss.

To use the table, first measure your sample area and calculate its size. Then count the number of pods found in the sample area. Harvest loss is determined by converting the number of pods found in a given area into a pound per acre estimate. Say for example that you planted the Gregory cultivar. After combining, you marked off a 10-square-foot area and counted 20 pods on the ground. For the Gregory cultivar, the table tells us each pod in a 10-square-foot area is equivalent to 24 pounds per acre. Therefore, harvest losses would be 24 x 20, or 480 pounds per acre. If you used the 0.001-acre sample size, each pod collected in the sample for the Gregory cultivar would be equal to 5.51 pounds-per-acre yield loss. If 60 pods were collected, the yield loss would be 60 x 5.51, or 331 pounds per acre.

When estimating yield losses, particularly behind the digger, bear in mind some of the loss is due to over mature pods, or "shedding" loss. There may be little you can do to the equipment to reduce this loss component.

Harvest Safely

Always remember: tractors, diggers, and combines are potentially dangerous pieces of equipment. There are many moving parts, not all of which can be completely shielded. Always disengage power before making adjustments. Never allow bystanders or riders near the combine when it is in operation. Keep all protective shields and guards in place. Above all, be alert and on the lookout for hazardous situations. Read the operator's manual and observe all safety precautions. Learn to recognize and avoid hazards. Contact the county Extension center for recommendations on improving safety in farm operations.

CURING PEANUTS

Efficient operation of the peanut curing system involves: (1) cleaning and repairing the equipment before harvest, (2) windrow curing the peanuts as long as practical, and (3) operating the equipment properly.

Preseason Operation

The preseason cleaning and repairing of the curing trailer, plenums and canvas connectors, and the fan and heater can pay big dividends. Dirt and old crop residue under the trailer curing floor and in the trailer plenum chamber can block air flow and contaminate the new peanuts with aflatoxin. The best way to clean the curing trailers is to remove the floor assembly and flush out the trailer with a stream of high-pressure water.

Clean leaves or trash from the fan and plenum. These can be a fire hazard when the burner is operating. Cut any grass and weeds that could restrict the air inlet to the fan. Remove all trash that could restrict air flow to the fan screen. Clean the dirt and trash off the fan blades to reduce drag.

Make sure that the LP gas line from the tank to the burner is in good condition and not damaged. Most peanut fans have a ring-type heater with many holes for gas-air mixture. Clean these burner holes to ensure good ignition and an even flame all the way around the burner. If some of the holes are plugged or partially closed, too little gas-air mixture may exit for good ignition or proper burning, which will waste fuel.

Check all electrical wiring, fuses, breakers, and controls. Make sure they are properly installed and functional. Have an electrician make upgrades or repairs.

Check the main air plenum, canvas connections, and the trailer air plenum for holes and leaks. Be sure to repair all leaks to conserve energy. Air leaks waste energy and increase the curing time. A crack or hole measuring only 1 inch by 24 inches will leak approximately 350 cubic feet per minute on a typical curing system. An extra gallon of LP gas will be required to heat the air leaking from this crack every 11 hours when the burner is raising the temperature 20 degrees, and the leak will also slightly lengthen the curing time. Before you begin harvesting peanuts, operate the fan and heater for about 30 minutes to make sure they are functioning properly. Also, while the fan and heater are operating, turn the thermostat and humidistat up and down to make sure that they are functioning properly.

Refer to the owner's manual for further recommendations on adjustments and maintenance of the curing equipment.

Windrow Drying

The cost of curing peanuts is greatly influenced by the time they remain in the windrow. The longer they remain in the windrow, the more the peanuts cure (dry), and the lower the curing fuel cost; however, windrow losses may begin to increase 3 to 5 days after digging and inverting the peanuts. Even though windrow losses may increase when the peanuts remain in the windrow too long, especially in bad weather, curing costs will decrease as the peanut continues to dry in the windrow. The most economical time to combine the peanuts is when the curing cost savings from windrow drying equals the lost value of the additional peanut losses from windrow drying. As the cost of curing fuel increases, the time in the windrow must increase to achieve the maximum profit.

Curing Operations

Air Flow. To properly cure peanuts, maintain sufficient air flow and proper temperature. If air flow rates are too low, the peanuts will mold. If the air flow is excessive, the energy costs will be high. The recommended air flow rates were established to prevent mold development during curing; however, they have also proven to be the most economical. The general recommended air flow of 50 cubic feet per minute per square foot of curing floor (cfm/sq ft) at 0.75 inch static pressure is sufficient to cure up to 25 percent moisture peanuts 5 feet deep. The air flow provides 10 cubic feet per minute per cubic foot of peanuts at a depth of 5 feet.

Once the fan is selected, air flow adjustments must be made by varying the curing depth or by not using all of the trailers for the system. For example, filling all the trailers half full will result in a higher air flow than completely filling half the trailers. When filling the trailer, be sure to level the peanuts to ensure uniform air flow. Avoid overfilling the trailer. The minimum or desired air flow rates along with the maximum curing depth using the recommended curing fan is shown in Table 7-3.

Table 7-3. Recommended Air Flow Rates

Initial Moisture Content (%)	Minimum Air Flow Rate (CFM/cu ft)*	Maximum Curing Depth* (ft)
15	5	8
20	6	6
25	10	5
30	12	4
35	15	3

*Based on a system air flow rate of 50 cfm/sq. ft. At 0.75 in. S.P.

Heat. To maintain good flavor and milling quality in the peanuts, maintain the proper curing temperature. If the curing temperature is too high, the peanuts will split when shelled and may also develop a bad flavor. Never allow temperature to exceed 95° F. The recommended temperatures can be controlled by manually adjusting the heat or using a modulating thermostat, or by using a humidistat and an on-off thermostat. When using manual heat control, adjust the LP gas pressure to achieve the desired temperature rise or curing temperature. Most fan and burner units have a gas pressure versus heat chart. This chart usually shows the British Thermal Units (BTU) output for various gas pressures. If your burner has a "high" and "low" pressure heat value, be sure to use the low position for peanuts. The following formula is a useful aid in adjusting the heat input.

$$BTU/hr = 1.1 \times \text{fan cfm} \times \text{temperature rise}$$

When using an on-off thermostat and a humidistat, adjust the temperature rise to approximately 15 to 20 degrees to reduce the cycling of the burner flame early in the season when the weather is warm. The temperature rise can be increased late in the season when the nights get cold as shown in Table 7-4.

Table 7-4. Temperature Adjustments

	Outside Relative Humidity (%)					
	90	60	30	90	60	30
Outside Temperature (^{0}F)	**Desired Temperature Rise (Added Heat, ^{0}F)**			**Desired CuringTemperature (^{0}F)**		
40	25	20	15	65	60	55
50	20	15	10	70	65	60
60	15	10	5	75	70	65
70	10	5	-	80	75	-
80	5	-	-	85	-	-

The best temperature controller is a modulating thermostat, which varies the temperature by raising and lowering the firing rate (flame size) without cycling when the weather changes. A modulating thermostat should be set on approximately 75° F if a constant temperature is desired; however, adjusting the setting for the weather conditions as shown in Table 7-4 is preferred.

Steps to Increase Curing Efficiency. When the hulls are wet, drying efficiency is very high. After hulls are dry, especially during the last half of the curing cycle, the drying efficiency decreases. Therefore, you need a higher air flow for the first half of curing than during the second half of the curing cycle. Air flow can be reduced during the last part of the curing cycle on a multiple trailer plenum system by partially closing the air gates of the trailers during the last half of the curing period. Generally, having the air gate half open keeps the curing efficiency high during the final curing stage. By reducing the air flow to some trailers in the final curing stages, the other trailers in the first curing stages containing peanuts with wet hulls will receive an increased air flow. Do not partially close enough air gates to restrict the fan or to cause the heater to malfunction.

On many curing systems, the trailer nearest the fan receives the least air. On these systems, the adjustments can be made by starting the newly filled trailers on the furthest end from the fan until the hulls are dry, and then moving this trailer to the other end of the plenum nearest the fan.

Another way to adjust air flow is to fill the peanut trailers only half full for the first half of the curing cycle to dry the hulls, then dump and mix two trailers into one trailer for the final half of the curing cycle. This method is more desirable than adjusting the air gates if dumping and handling facilities are available. The dumping and reloading of the peanuts will remove some dirt and mix the bottom layer of peanuts with the top layer resulting in a more uniform final moisture content.

Another way to save on heat energy cost and possibly improve curing quality is to recirculate part of the curing air to maintain an ideal curing temperature and relative humidity. This will require equipment changes or a specially designed curing building for the trailer and fans. Research indicates that 40 to 50 percent savings in energy consumption can be obtained using the recirculating systems compared to the conventional systems. A key advantage of the recirculating systems is that if the wagons leak air, the air goes back into the building and is recirculated–not lost to the outside. The economics of converting to a recirculating system will depend on the cost of the changes required and current energy cost.

PRECISION AGRICULTURE FOR PEANUTS

Precision agriculture is a combination of information resources, technology, and management practices designed to work together to improve productivity. Some of the technology that can be applied to peanut production includes GPS, GIS, guidance systems, variable rate controls, applicator controls, yield monitors and automatic curing controls. Some of the more common technology resources and their possible application in peanut production are explained in this section.

Global Positioning System (GPS)

GPS receivers are designed to give the user accurate and precise position data, latitude and longitude, wherever the receiver is located, provided it can receive the satellite signal. GPS makes many other technologies in precision agriculture possible. Farmers have a wide range of choices in GPS receivers. The most common point of discussion is "How accurate is it?" GPS accuracy can be evaluated on the basis of *static accuracy*, the ability to return to an exact point after a long period of time. P*ass-to-pass accuracy* usually refers to the system's ability to track positions within a few minutes of each swath.

GPS accuracy is based on the type of differential correction used. Differential GPS (DGPS) systems include beacon correction (Coast Guard and DOT towers), the Wide Area Augmentation System (WAAS), and commercial satellite subscription systems. These systems typically provide meter-level static accuracy and can provide accuracy of several inches in pass-to-pass. Dual frequency GPS receivers are more accurate, providing accuracy of around 1-foot static and a few inches pass-to-pass. The most accurate GPS is real-time kinematic (RTK), which can deliver static and pass-to-pass accuracy of around an inch. RTK systems require a higher level of correction to achieve this accuracy. Farmers can either set up their own base station or take advantage of a dealer or cooperative RTK network that can be shared by many users.

Geographic Information Systems (GIS)

Geographic information systems is the term used to describe a family of computer software products used to manage data and information that can be georeferenced or tied to a map position. Many manufacturers offer a version of GIS software that is customized for farmers. These packages are often very user friendly and include the tools a farmer is likely to need. These include the ability to create field boundary maps, import maps from other sources, record field data, record scouting reports, assign crop enterprises, generate prescription application plans, and analyze yield maps. Some programs are available in both office and mobile versions. Office versions run on desktop or laptop computers, and mobile versions run on laptop or hand-held computers. Mobile software is extremely useful for field scouting and mapping boundaries. Some programs integrate well with other farm management software or programs to give the farmer a complete management package.

Guidance Systems

A guidance system is an electronic control system that aids the operator in steering or guiding a vehicle over a course or swath. Systems used in agriculture are based on the global positioning system (GPS).

GPS data are used to determine accurate machine position, travel speed, and travel direction. Once position, speed, and direction are determined, the control program can monitor and provide correction information to keep the vehicles on the desired path. GPS can be utilized for quidance at any level of correction: WAAS, beacon, satellite subscription, and RTK. However, the higher the accuracy of the GPS service, the more precise the steering control will be.

Current guidance systems fall into two categories, *steering aids* and *automatic steering*. Steering aids include light bars and navigation screens. Light bars use a series of lights to indicate to the operator how much steering correction is needed to keep the vehicle on track. Each light left or right of the center can be programmed to represent whatever level of correction the operator wants to see. Navigation screens use a visual representation of the vehicle on a map. The guideline is projected on the map screen, and the operator uses the vehicle image on the map to keep the vehicle on the swath in the field. Some steering aids use both light bar and map screen layouts.

Automatic steering systems interface with the tractor steering system and provide steering control while the vehicle is on the swath. The operator still takes over steering control for turnarounds. In the event of a problem, the operator can override the automatic steering at any time. Automatic steering systems use guidelines established in the field to steer the vehicle. Like steering aids, the guidelines can be straight lines or curves, depending on the type of system. Once a set of guidelines are created, they can be used repeatedly in that field. Automatic steering systems fall into two types: *steering wheel interface* and *electro-hydraulic interface*. A steering wheel interface can be adapted to a wide range of vehicles. As its name suggests, it is attached to the steering column and engages the steering wheel much like an operator's hand. Precision motors are used to move the wheel to keep the vehicle on the swath. Electro-hydraulic interface systems use an electronically controlled hydraulic valve that is installed in the vehicle's hydraulic steering circuit. These systems must be matched to the specific vehicles they are designed for. Installation will require mounting the valve and its controls and sensors, as well as adding hydraulic hoses to tie into the hydraulic steering circuit.

Guidance systems can be used to advantage in almost any field operation in peanut production. The best uses, however, would be planting, cultivation, chemical application and digging. Guidelines can be created at anytime; however, the best advantage is obtained when the guideline is created early and used to help control other operations throughout the season. For example, a guideline file can be created during bedding or planting and used to guide cultivation, chemical application and digging. In a test conducted at the Peanut Belt Research Station in 2009, plots that were dug using a wheel-interface automatic steering system showed an increase in yield of 363 pounds per acre over plots dug with manual steering. In this test, the peanuts were planted using the automatic steering system and the planting guideline was used for digging. Based on a system cost of $23,500 for the automatic steering components and $0.25 per pound for peanuts, payback can be achieved in 256 acres. Further testing is needed to confirm that these results can be sustained.

Guidance systems used in crop production can provide many advantages:

- More uniform broadcast applications due to reduced skips and less overlap.
- Increased field capacity due if higher operating speeds are possible.
- Controlled traffic to reduce soil compaction.
- Ability to stay on swath in rank vine growth during late season spraying and digging.

Variable Rate and Applicator Controls

Variable rate control systems are available for a wide range of crop inputs: fungicides, insecticides, herbicides, lime, fertilizer, and others. If you can determine, through soil sampling, scouting, or other analysis, areas of a field that do not need as much of a particular input as others, then you may have a situation where variable rate control can be beneficial. Variable rate application may not reduce the total amount of an input, but will certainly allow you to use the input more efficiently by making sure you have the correct amount applied for any given area of the field.

Most variable rate control systems rely on georeferenced prescription maps. Systems are being developed to apply products based on real-time sensor data. The variable rate controller reads position data from a GPS receiver. The controller then determines the rate of input for that location stored on the prescription map. The rate information is converted into a control signal for the valve or motor that drives the applicator. Finally, a feedback signal is picked up and sent back to the rate controller to fine-tune the output. The result is an accurate application of the product based on the prescription recorded on the map. As an added advantage, the controller can also generate a record map of the exact rate applied by the system. This record can prove to be valuable documentation.

Applicator controls are also available to help the farmer control the system's operation in the field, even if a variable rate approach is not used. Many controls are available now that allow the farmer to automatically manage individual sections or rows of a sprayer or a planter. These controls can be particularly useful to avoid areas of double application around headlands in oddly shaped fields.

Yield Monitors

Yield monitoring provides a check to see if management and production practices throughout the season have paid off. Yield maps and the detailed analysis of yield response to inputs can help the farmer fine-tune production practices and enhance efficiency. At this point, there are no widely used commercial yield monitors available for peanuts. A basket load cell-based system was developed and licensed by the University of Georgia; however, it is no longer available from the manufacturer. Several studies have been conducted to adapt the cotton yield monitor to peanuts. Although this has been effective in some cases, it has not been adopted on a wide scale. Development of a reliable yield monitor for peanuts will complete the precision agriculture package.

A Comprehensive Approach

Precision agriculture, like most management systems, has some limitations and problems that must be overcome . When considering using precision agriculture technology for peanut production or for other crops, the farmer should consider the entire production system. Focus on technologies that are applicable to a particular problem, and also explore how these technologies can be used in other areas. Some applications are well developed, while others need further research to determine the best way to use the technology for crops such as peanuts. Multiple uses of equipment help spread the cost over several operations or even several crops. For example, a GPS-based guidance system selected to help guide a planter can also guide a sprayer and a digger. Rate controllers used for sprayers may also be able to control a planter. It may not be necessary to purchase every available technology on the market. Before launching into a system, compare the options and alternatives carefully. Start out with the most applicable technologies first, and then add to them as needed.

8. GUIDELINES AND SURVEY RESULTS ASSOCIATED WITH THE NORTH CAROLINA PEANUT PRODUCTION CONTEST

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BACKGROUND AND CRITERIA

For many years the North Carolina Peanut Growers Association, in co-operation with the North Carolina Cooperative Extension Service, has supported a peanut production contest at county and state levels. The contest involves a combination yield per acre and additional points based on total acreage. The following criteria are currently being used and include an example calculation.

1. Eligibility: Must produce at least 25 acres of peanuts.

2. Requirements:

A. Variety—Any variety can be grown.

B. Acreage—The entire peanut acreage under production by an individual will be used to determine official yields. The applicant enters the county in which he/she is a resident, regardless of the percentage of peanuts they produce in that county. The county of residence for the entrant must have at least 1,000 acres. In addition to applicants from counties with acreage exceeding 1,000 acres, growers in counties with less than 1,000 acres will be pooled into a category. The winner of this category will compete directly with winners from counties with at least 1,000 acres.

C. Entry Requirement—Official yields will be determined by the county Cooperative Extension Service agent. Unlike the past, the contest will require trust that the applicant is accurately providing yield and acreage information. An example of point calculations is provided below. The official entry will be from the contestant's county of residence (Figure 1).

3. Point System

Step 1. Yield—Average yield per acre divided by 100

Step 2. Acreage—Points will be accumulated for acreage as follows:

A. 0-100 acres	0 point
B. 101-200 acres	1 additional point or fraction thereof
C. 201-300 acres	1 additional point or fraction thereof
D. 301-400 acres	1 additional point or fraction thereof
E. 401-500 acres	1 additional point or fraction thereof
F. 501-600 acres	1 additional point or fraction thereof
G. 601 or higher	no additional points

Sample calculation
Farmer produces 1,397,407 pounds on 350.2 acres
Average yield = 1,397,407 divided by 350.2 = 3,990.3 pounds per acre

Figure 1. Sample Certification Form

CERTIFICATION OF POINTS IN PEANUT PRODUCTION CONTEST

Mail to: David Jordan, Box 7620, NCSU Campus, Crop Science Department, 4207 Williams Hall, Raleigh, NC 27695-7620, Phone 919-515-4068, FAX 919-515-7959

Date ______________________________

Applicant _________________________________ County _______________

Address ___________________________________ Total Points ___________

____

Official Yield _________________ ON ALL ACRES PRODUCED BY THE APPLICANT

THE APPLICANT CERTIFIES THAT ______________________ POUNDS OF PEANUTS WERE HARVESTED FROM _________________ ACRES. THE UNDERSIGNED PARTICIPANT GAURANTEES, IN GOOD FAITH, THAT THE PRODUCTION FOR THE GIVEN CROP YIELD AND THE ACRES ON WHICH PRODUCTION OCCURRED ARE ACCURATE.

Average Yield/Acre = _____________________________ points

Acreage

A.	0-100 acres	_________
B.	101-200 acres	_________
C.	201-300 acres	_________
D.	301-400 acres	_________
E.	401-500 acres	_________
F.	501-600 acres	_________
G.	601 or higher	_________
Total		_________
Grand Total		_________

Signatures

County Agent _________________________________

Applicant _________________________________

Step 1. 3990.3/100 = 39.903

Step 2. Acreage

0-100 acres	=	0 point
101-200 acres	=	1 point
201-300 acres	=	1 point
301-400 acres	=	0.502 point

Total Points = 42.405

GROWER SURVEY

Applicants also must complete a survey of production and pest management practices (Figure 2). Results from the survey are incorporated into recommendations for N.C. peanut producers. Following the 2007 growing season, an overall summary of production and pest management strategies based on surveys from 2001 through 2007 were compiled. The survey results were presented at the 2008 annual meeting of the American Peanut Research and Education Society and are summarized later in this chapter.

Figure 2. Sample Production Practices Survey

MANAGEMENT PRACTICES FOR PRODUCTION CHAMPION

Applicants must complete this form to be eligible for the contest.

Name ______________________________County ________________

Address ____________________________

Date ______________________________

1. Planting Date: _________________
2. Seeding rate: __________________
3. Row spacing: ____________ Twin or single rows ______________

Please provide approximate percentage of acres for each.

4. Varieties (please indicate approximate percentage of acres for each variety):

____

5. Rotation Crops:

2004______________ (if more than one, please include percent of acres)

2005______________ (if more than one, please include percent of acres)

2006______________ (if more than one, please include percent of acres)

2007______________ (if more than one, please include percent of acres)

6. Lime applied and rate:

2008 __________________ 2007 _______________________

7. Fertilizer used: __________________________(provide percent of acres)

8. Landplaster (please list trade name):

A. Broadcast or Banded ___________________

B. Bagged, Bulk, or Granular________________

C. Rate and application date ______________________________

9. Herbicides:

Burndown	______________	_______________	______________
Preplant	______________	_______________	______________
Preemergence	______________	_______________	______________
At-Cracking	______________	_______________	______________
Postemergence	______________	_______________	______________

10. Leaf spot program: (list fungicide for each timing)

A.__________________ E. __________________
B.__________________ F. __________________
C.__________________ G __________________.
D.__________________ H. __________________

11. What percent of your acreage was treated for Sclerotinia blight? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

12. What percent of your acreage was fumigated for CBR? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

13. What percent of your acreage was treated with an in-furrow insecticide? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

14. What percent of your acreage was treated for foliar insects? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

15. What percent of your acreage was treated for Southern Corn Rootworm? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

16. What percent of your acreage was treated for spider mites? (circle the percent)
0 20 40 60 80 100 Chemical used ___________________

17. What percent of your acreage was irrigated? (circle the percent)
0 20 40 60 80 100 How many times? ___________________

18. Did you apply Boron? _________ How much and what brand? ____________

19. Did you apply Manganese?_____ How much and what brand? ____________

20. Did you inoculate? What product and what percent of acres?

21. What percent of your acreage received the following tillage practices:

Disk	0	20	40	60	80	100
Chisel	0	20	40	60	80	100
Moldboard plow	0	20	40	60	80	100
Field cultivate	0	20	40	60	80	100
Bed	0	20	40	60	80	100
Rip and Bed	0	20	40	60	80	100
Strip till	0	20	40	60	80	100
No till	0	20	40	60	80	100

What percentage of your acres was infested by tomato spotted wilt virus?
0 20 40 60 80 100

Which of the following practices did you use to deal with tomato spotted wilt virus?
Variety selection
Apply Thimet or Phorate rather than Temik or Orthene
Plant in twin rows rather than single rows
Plant later in the season (mid to late May)
Plant in no till or strip till
Increased in-row seeding rate

25. Did you apply Apogee on your peanuts? If so, what percentage and to what varieties?

What practices contributed most to your success?

SURVEY RESULTS FROM 2001 – 2007

The following abstract was presented at the 2008 annual meeting of the American Peanut Research and Education Society:

Summary of Production and Pest Management Practices by Top Growers in North Carolina. R. RHODES*, L. SMITH, M. WILLIAMS, P. SMITH, F. WINSLOW, A. COCHRAN, B. SIMONDS, A. WHITEHEAD, Jr., C. ELLISON, J. PEARCE, C. TYSON, S. UZZELL, R. HARRELSON, C. FOUNTAIN, M. SHAW, T. BRIDGERS, D.L. JORDAN, R.L. BRANDENBURG, and B.B. SHEW, North Carolina Cooperative Extension State University, Raleigh, NC 27695.

The North Carolina Peanut Growers Association and the North Carolina Cooperative Extension Service recognizes the highest yielding peanut producers each year at annual production meetings. Growers who entered the contest (n = 133 from 2001-2007) were asked to complete a survey of their production and pest management practices. Eighty-one of the growers planted May 1-15 and 42 planted after May. Seeding rates of 100-120 lb/acre (40), 121-140 lb/acre (53), and >140 lb/acre (18) were listed; 21 seeded at 4-6 seed/ft of row. Twenty-three growers irrigated and 122 planted in single row planting patterns whereas 11 planted in twin rows. Tillage included disking (112), chisel plow (27), moldboard plow (25), field cultivate (83), bedding (59), ripping and bedding (56), strip tillage (22), and no till (2). The number of growers with one, two, three, and at least four crops between peanut plantings was 1, 19, 36, and 77, respectively. All but 3 growers applied gypsum while 105 applied fertilizer (N-P_2O_5-K_2O) shortly before planting. Boron, manganese, and inoculant were included by 112, 94, and 102 farmers, respectively. The number of growers planting one, two, three, or four or more cultivars was 21, 36, 34, and 23, respectively. Popular varieties included NC-V 11 (69), Perry (63), Gregory (40), VA 98R (38), and Wilson (22). NC 12C and Phillips were planted by 17 and 15 growers 79 respectively, and 8 or fewer growers planted AP-3, Brantley, CHAMPS, Georgia Green, Georgia Runner, NC 7, VA-C 92R, and ViruGuard. Temik (88), Thimet/Phorate (29), and Orthene (10) were applied in the seed furrow while postemergence applications of insecticides included Lorsban (79), Asana XL (57), Karate Z (42), and Orthene/Acephate (16). Baythroid, Comite, Danitol, Lannate, and Larvin were applied by no more than seven growers for each insecticide. Twenty-three, 57, and 26 growers applied 4, 5, or 6 sprays, respectively, during the season for leaf spot/southern stem rot control. Eight or fewer growers applied less than four or more than 6 fungicide treatments for these diseases. The total number of fungicide applications across all growers and years were chlorothalonil, 233; (Folicur, 205; Headline, 98); Abound, 74; and Tilt, 37. Other fungicides applied 12 or fewer times included Artisan, Provost, Stratego, Tencop, and Topsin. Eighty-one farmers fumigated for Cylindrocladium black rot and 44 sprayed for Sclerotinia Blight on at least a portion of their acreage. Herbicide applications across all methods and timings were Dual or Dual Magnum (110), 2,4-DB (83), Prowl or Pendimax (69), Storm (55), glyphosate (50), paraquat (48), Basagran (45), Cadre (41), Valor SX (35), Strongarm (29), and Pursuit (25). The herbicides Blazer/ Ultra Blazer, Cobra, Frontier/Outlook, Intensity, Sequence, Sonalan, Touchdown, Tough, and 2,4-D were applied no more than 19 times.

The information in this abstract is summarized in Table 8-1. Additional peanut-related research and educational information can be found at: http://www.apresinc.com/

Table 8-1. Production Management Survey Results—N.C. Peanut Production County Champions, 2001 – 2007 (n=133)

Practice	%
Planting Date (percent of growers)	
May 1 – 15	61
After May	39
Seeding Rate (percent of growers)	
100 – 120 lb/acre	30
121 – 140 lb/acre	40
>140 lb/acre	14
4 – 6 seed/ft of row	16
Planting Pattern (percent of growers)	
Single-row	92
Twin-row	8
Irrigated (percent of growers)	17

Table 8-1. (continued)

Practice	%
Tillage (percent of growers for each tillage practice)	
Disking	84
Chisel plow	20
Moldboard plow	19
Field cultivate	62
Bedding	44
Ripping and bedding	42
Strip tillage	17
No-till	2
Crops Between Plantings (percent of growers)	
1 crop	1
2 crops	14
3 crops	27
4 crops	58
Soil Amendments (percent of growers)	
Gypsum	98
N-P-K fertilizer	79
Boron	84
Manganese	71
Inoculant	77
Number of Cultivars Planted (percent of growers)	
1 cultivar	16
2 cultivars	27
3 cultivars	26
4 cultivars	17
At least 5 cultivars	14
Cultivar Selection (percent of growers planting a cultivar on at least a portion of acreage)	
NC-V 11	52
Perry	47
Gregory	30
VA 98R	29
Wilson	17
NC 12C	13
Phillips	11
AP-3, Brantley, CHAMPS, Georgia Green, Georgia Runner, NC 7, VA-C 92R, and ViruGard	6
In-furrow Insecticide Use (percent of growers)	
Temik	66
Thimet/Phorate	22
Orthene	12
Foliar Insecticide Use (percent of growers)	
Lorsban	37
Asana XL	27
Karate Z	20
Orthene/Acephate	7
Baythroid, Comite, Danitol, Lannate, Larvin	3

Table 8-1. (continued)

Practice	%
Fungicide Use—Leaf Spot/Southern Stem Rot Control (percent of growers)	
4 sprays	15
5 sprays	38
6 sprays	23
Less than 4 or more than 6 sprays	2
Fungicide Use—All Fungicide Applications (percent of total applications)	
Chlorothalonil	35
Folicur	31
Headline	15
Abound	11
Tilt	6
Artisan Provost, Stratego, Tencop, Topson	2
Fungicide Use—Cylindrocladium Black Rot Fumigation (percent of growers)	61
Fungicide Use—Sclerotinia Blight Control (percent of growers)	33
Herbicide Applications (percent of total applications)	
Dual or Dual Magnum	16
2,4-DB	12
Prowl or Pendimax	10
Storm	8
glyphosate	7
paraquat	7
Basangran	7
Cadre	6
Valor SX	5
Strongarm	4
Pusuit	4
Blazer/Ultra Blazer, Cobra, Frontier/Outlook, Intensity, Sequence, Sonalan, Touchdown, Tough, 2,4-D	2

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina State University nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension Center.

A PRECAUTIONARY STATEMENT ON PESTICIDES

Pesticides must be used carefully to protect against human injury and harm to the environment. Diagnose your pest problem, and select the proper pesticide if one is needed. Follow label use directions, and obey all federal, state, and local pesticide laws and regulations.

Published by

North Carolina Cooperative Extension Service

Printed by Chamblee Graphics, Raleigh, N.C.

1,500 copies of this public document were printed at a cost of $2,436 or $1.62 per copy.

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Select ***Crop Production*** and ***Peanuts.***

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AG-331 (Revised) 12/09—1.5M—BS E10-51848