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LEAF SPOT MANAGEMENT IN ALABAMA COTTON
Control of Potash-Incited Leaf Spot Diseases and Corynespora Leaf Spot

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In contrast to most other field crops, leaf spot and blight diseases have never impacted the cotton yield. Stemphylium, Cercospora, and Alternaria leaf spots, which are fairly common on cotton grown on lighter Coastal Plain soils, are typically associated with a severe potash deficiency. Given the right conditions, light leaf spotting as seem in Fig. 1A-B can progress to heavy premature defoliation several weeks prior to harvest (Fig. 1C-D). Late season drought conditions along with a heavy fruit load will trigger all of the above leaf spot diseases.

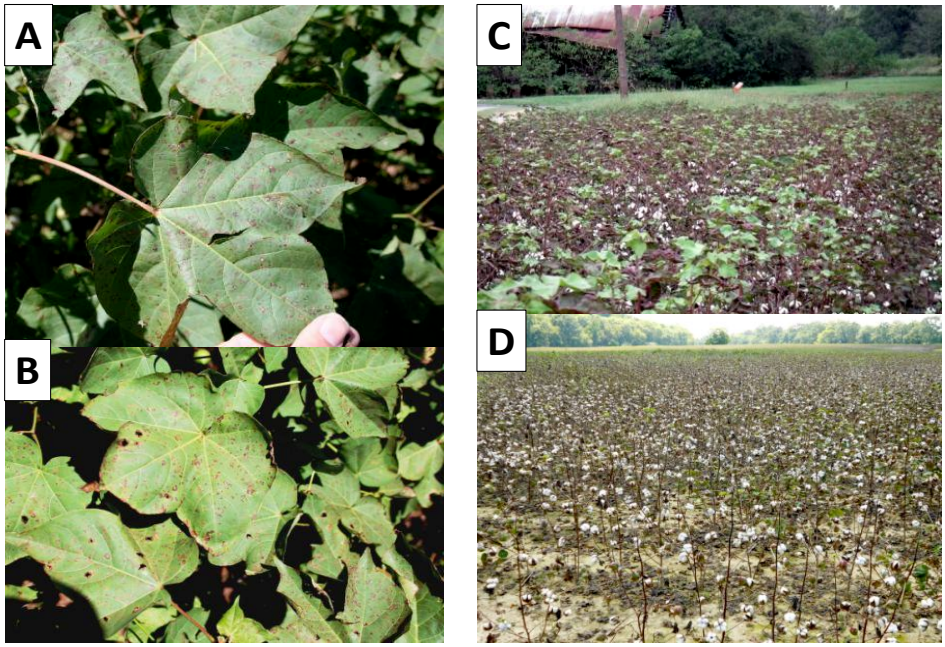


Figure 1. Alternaria/Cercospora/Stemphylium leaf spot complex on cotton with A-B) typical small leaf spots with brown to purple halo around a tan leaf spot, which can intensify from C) a leaf shed in the middle and upper canopy to D) 100% premature defoliation.

Table 1. Prevention of leaf spotting and premature defoliation associated with Alternaria leaf spot in cotton with supplemental pre-plant potash applications.

K_20 lb/A Rate	Memphis silt loam (low K)			Loring silt loam (high K)		
	Intensity	Defoliation	Yield	Intensity	Defoliation	Yield
Conv Till						
0	7.7 A	6.9 A	350 C	3.7 A	0.8 A	1036 A
30	5.8 B	4.5 B	556 B	4.4 A	1.1 A	1057 A
60	5.5 B	2.9 BC	621 B	3.6 A	1.2 A	894 A
120	4.7 B	1.3 C	760 A	3.7 A	1.3 A	987 A
No-Till						
0	7.5 A	5.8 A	360 C	4.8 A	4.5 A	1294 B
30	6.1 AB	4.2 AB	531 B	4.7 A	4.3 A	1312 B
60	5.1 BC	1.6 BC	528 B	4.6 A	4.3 A	1391 A
120	4.5 C	0.6 C	669 A	5.7 A	4.5 A	1313 B

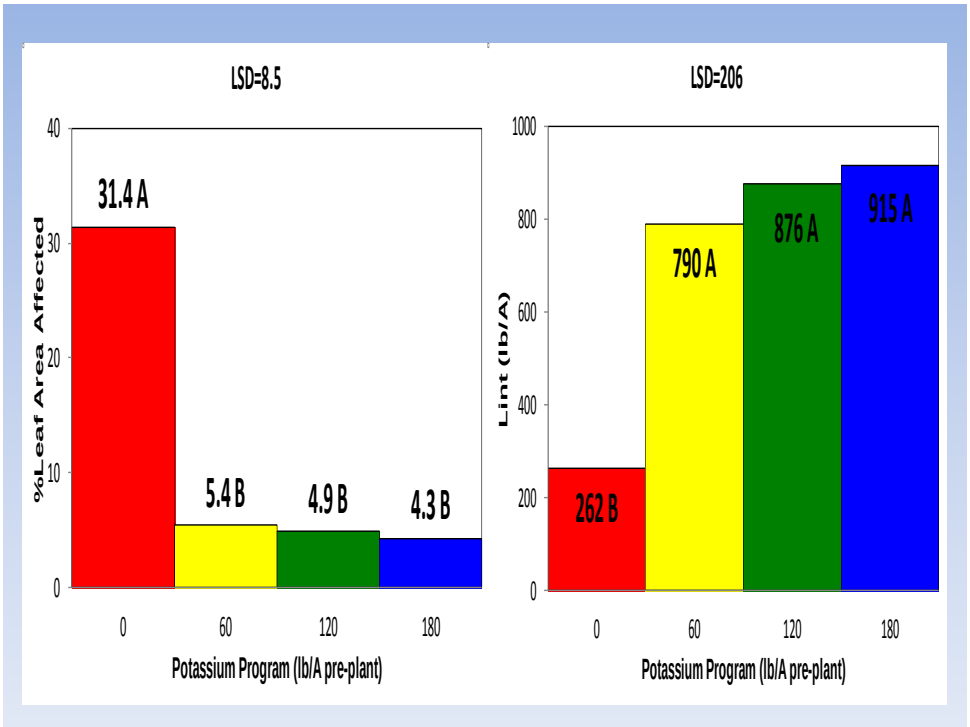
D. D. Howard, M. A. Newman, A. Y. Chambers, Better Crops, 1997

As noted in Table 1, supplemental pre-plant potash applications on a deficient (Memphis silt loam) soil will greatly reduce the level of leaf spotting as well as premature defoliation attributed to Alternaria leaf spot in conventional and reduced till cotton. In the above Tennessee study, between 60 to 120 lb/A of murate of potash was needed to significantly reduce both leaf spot intensity and defoliation. In both the conventional and no-till cotton, highest yield was obtained with the 120 lb/A rate of murate of potash. In contrast, no differences in leaf spot intensity, premature defoliation and yield were noted with increasing rates of murate of potash in the soil with high background potassium fertility. Similar results with pre-plant potash application had also been noted with Stemphylium leaf spot on cotton in a recent Georgia study, where 60, 120, and 180 lb/A of potassium were equally effective in reducing leaf spot levels as well as increasing lint yield (Figure 2).

In contrast to pre-plant potash applications, post-plant foliar potash applications, which typically are started after the leaf spotting and defoliation become noticeable, do little if anything to slow the intensification of Alternaria, Cercospora, or Stemphylium leaf spot in cotton as potassium is not translocated from the leaves into the stems and roots and the amount of potassium in supplement products is insufficient.

While all of the fungicides listed in Table 3 are cleared for the control of Alternaria, Cercospora, or Stemphylium leaf spot, results of multiple screening trials have shown no reduction in symptom severity or yield gains with fungicides.

Figure 2. Impact of pre-plant application of potassium on the intensity of Stemphylium leaf spot and on lint yield of cotton.



Corynespora Leaf Spot or Target Spot

Corynespora leaf spot, which is caused by the fungus *Corynespora cassiicola*, has damaged cotton in southwest Georgia for the last four or five years. Impact of this disease on yield is difficult to gauge. Heavy leaf shed that was seen in some Georgia cotton fields may have occurred so late in the year that the disease served harvest aid rather than reducing yield. With early disease onset, yield losses of 100 to 200 lb/A of lint have been noted. This past summer, Corynespora leaf spot was found in on Alabama cotton from the Florida Panhandle up to the Tennessee River Valley. Leaf spotting and early leaf shed were heavier in no- or strip-till cotton in fields where cotton followed cotton. Frequent showers and/or irrigation along with high nitrogen fertility levels may also contributed to increased disease. Also, differences in cotton variety susceptibility to Corynespora leaf spot have been observed (Table 2). Overall, producers pushing for high lint yields are at greatest risk for damaging disease outbreaks. In contrast, dryland producers are far less likely to have damaging Corynespora leaf spot outbreaks in their cotton.

Development of Corynespora leaf spot differs from the potash deficiency induced Stemphylium, Cercospora, and Alternaria leaf spots. With the former disease, leaf spots first appear on the leaves in the lower canopy and spread upward through the canopy towards the

shoot tips. Individual leaf spots, which are up to ¼ to ½ inches in diameter, have a distinct 'zonate' or 'target spot' pattern with alternating light and dark brown bands (Fig. 3A-B). Once multiple leaf spots appear diseased leaves senesce (Fig. 3C) and fall to the ground (Fig. 3D). The combination of early disease onset and good moisture may trigger premature leaf shed (Fig. 3E). Yield loss is most likely to occur when defoliation begins before bolls in mature, while leaf loss that occurs as the bolls open probably has little impact on yield.

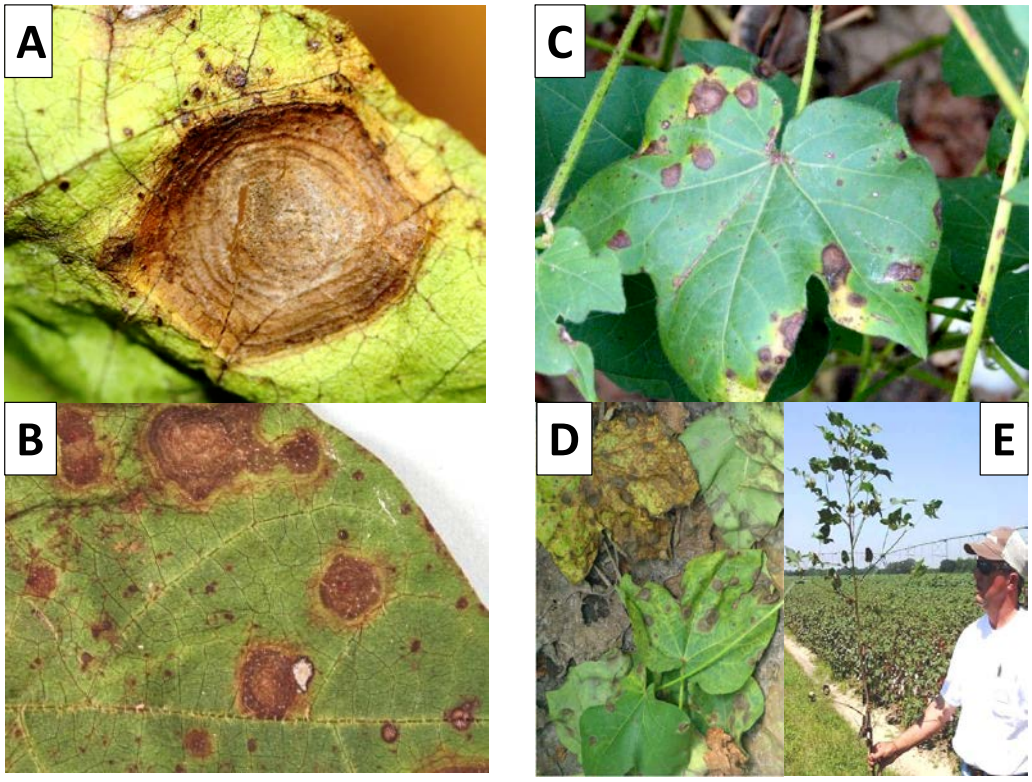


Figure 3. Corynespora leaf spot on cotton A and B) ¼ - ½ inch reddish-brown to brown leaf spots with 'zonate' or 'target spot' pattern of light and dark brown concentric bands or rings; C) multiple leaf spots seen before D) leaves are prematurely shed, which results in E) partially defoliation. Images D and E courtesy of Bob Kemerait, Extension Plant Pathologist, UGA.

While Stemphylium, Cercospora, and Alternaria leaf spot have been associated with a potash- deficiency, factors contributing to the development of Corynespora leaf spot in cotton are unknown. As previously noted, this disease was more prevalent on irrigated land, particularly when cotton follows cotton. Frequent showers will contribute to an increase disease, while extended periods of dry weather patterns should slow disease spread. Influence of tillage practices on the Corynespora leaf spot severity has not been confirmed but strip- or no-till cotton may be at higher risk for disease when cotton follows cotton but not other field or forage crops.

Results of an irrigated cotton variety trial showed significant differences in variety susceptibility to Corynespora leaf spot (Table 2). Highest disease incidence was noted on Phytogen 499, while Phytogen 375 and Phytogen 565 had lower but relatively high leaf spot and

defoliation levels. Disease intensity on other varieties was similar to DP1050, the variety with the lowest Corynespora leaf spot rating. With the exception of DP164, AMX003, DP11R159, and Stoneville 5458, lint yields for the remaining cotton varieties were similar to Phytogen 499, the variety with the highest Corynespora leaf spot rating. Given the study design, impact of Corynespora leaf spot on Phytogen 499, Phytogen 565, and Phytogen 375 yield cannot be determined. Low disease levels on the remaining varieties likely did not influence the yield.

Table 2. Susceptibility of selected cotton varieties to Corynespora leaf spot under irrigation at the EV Smith Plant Breeding Unit in Tallassee, AL in 2011.

Variety	Leaf spot rating	Lint yield lb/A	Variety	Leaf spot rating	Lint yield lb/A
AMX003	3.0 cde	913 e	DP10R052	3.3 cde	1317 abcd
DP164	3.3 cde	931 e	DP11R159	3.3 cde	1132 cde
DP1034	3.5 cd[x]	1406 ab	DynaGro 11622	3.3 cde	1375 abc
DP1048	3.3 cde	1228 abcd	Phytogen 375	5.0 b	1236 abcd
DP1050	2.5 e	1328 abcd	Phytogen 499	6.0 a	1441 a
DP1133	3.3 cde	1277 abcd	Phytogen 565	4.8 b	1243 abcd
DP1137	3.0 cde	1398 ab	Stoneville 5288	2.8 de	1223 abcd
DP10R051	3.8 c	1371 abc	Stoneville 5458	3.3 cde	1186 bcd

Corynespora leaf spot was rated on a 1 to 10 scale where 1 = no disease, 2 = very few leaf spots, 3 = few leaf spots in lower and upper canopy, 4 = some leaf spotting and $\leq$ 10% defoliation, 5 = leaf spots noticeable and $\leq$ 25% defoliation, 6 = leaf spots numerous and $\leq$ 50% defoliation, 7 = leaf spots very numerous and $\leq$ 75% defoliation, 8 = numerous leaf spots on few remaining leaves and $\leq$90% defoliation, 9 = very few remaining leaves covered with leaf spots and $\leq$ 95% defoliation, and 10 = plants defoliated or dead.

Limited information concerning factors that influence the onset and severity of Corynespora leaf spot in cotton complicates the development of effective control strategies. In fields where significant disease was seen in 2011, cropping corn, peanuts, soybean, or summer grazing after cotton should reduce the carryover of inocula of *C. cassiicola*. If rotation is not an option, high risk fields should be deep turned to bury residue from the previous cotton crop and then planted to a less susceptible cotton variety (Table 1). For cotton following peanut or corn, tillage will likely have little or no impact on disease development. In irrigated cotton, water according to crop needs to avoid creating the wet environment that would favor rapid disease spread.

Fungicides have been employed with some success to prevent Corynespora leaf spot-related premature defoliation (Table 1), while their value in protecting cotton yields is harder to define. In Georgia on-farm demonstrations, 100 to 200 lb/A lint gains have been seen. Twinline is the only fungicides in Table 3 with Corynespora leaf spot on the label but little efficacy data is available. Efficacy of Quadris Flowable and Headline 2.09 SC also needs to be confirmed. Generic tebuconazole fungicides are cleared on cotton only for southwest rust control.

Table 3. Fungicides labeled for the control of diseases of cotton found in the Southeast.

Fungicide	Rate/A	Comments
azoxystrobin QUADRIS FLOWABLE	6-9 fl.oz.	**For control of *Anthracnose* and *Ascochyta* blight and boll rot, and hard lock.** Apply before pin head square to early bloom or at early stages of disease development and repeat after 14 to 21 days as needed to control disease. Do not make more than two consecutive applications of Quadris flowable. See label for additional information concerning resistance management for strobilurin (Qol or Group 11) fungicides.
pyraclostrobin HEADLINE 2.09SC	6-12 fl.oz.	**For control of leaf spot and boll rot disease caused by *Alternaria, Asochyta* (blight), *Cercospora, Fusarium* (hard lock), *Glomerella* (anthracnose), *Phoma,* and *Stemphylium*.** Begin applications prior to or at early stage of disease development and repeat after 7 to 14 days if conditions favor disease. Make no more than two consecutive applications of Headline 2.09SC. See label for additional information concerning resistance management with Qol fungicides.
pyraclostrobin + metconazole TWINLINE	7-8.5 fl.oz.	**For control of leaf spot and boll rot disease caused by *Alternaria, Asochyta* (blight), *Cercospora, Corynespora, Fusarium* (hard lock), *Glomerella* (anthracnose), *Phoma,* and *Stemphylium*.** Apply before disease development and follow after 7- to 14-day schedule with a second application. Do not make more than two consecutive applications of Twinline before alternating to another fungicide with a different mode of action.

To determine whether protective fungicide treatments are needed, check for typical Corynespora leaf spot symptoms when scouting cotton for insect pests beginning at pin head square. Target fields for treatment, particularly those planted to a susceptible cotton variety, that have good stand, are irrigated or are getting plenty of rain, have high yield potential (2+ bales per acre) with one of the above fungicides. If wet weather patterns continue after the first application, follow with second about 10 to 14 days later. The number of applications of the Quadris, Headline, and Twinline, all of which contain a strobilurin fungicide, is limited to two. There are no fungicides labeled on cotton with a different mode of action than the above fungicides.

In summary, Corynespora leaf spot may be best avoided by rotating at-risk irrigated fields out of cotton for at least one year as well as turning under cotton trash in fields hit by leaf spot in 2011 and if necessary planting one of the less susceptible cotton varieties. Scout leaf spot symptoms and target only at-risk fields for treatment with a fungicide.