GREY LEAF SPOT OF MAIZE

by Dr Julian Ward

Introduction

Grey leaf spot (GLS) of maize is caused by the fungus *Cercospora zeae-maydis*. The disease is now recognised as one of the most significant yield-limiting diseases of maize worldwide and certainly in the province of KwaZulu-Natal (see Table 1). Not only is it a threat to maize production in the commercial farming sector, it also reduces yields of maize on small-scale farms. The disease was first identified in KwaZulu-Natal in 1989/90 and has since spread to neighbouring provinces and most maize producing countries in Africa.

Symptoms

Symptoms are initially first observed on the lower leaves of the maize plant. The immature lesions are similar to lesions caused by other foliar maize pathogens, and first appear as small tan spots about 1 to 3 mm in size and are irregular in shape. The tan spots usually have yellow or chlorotic borders and, are more easily observed when the leaf is held to light

Mature lesions are readily distinguished from other pathogen symptoms and are distinctly rectangular in shape (5 to 70 mm long and 2 to 4 mm wide), and run parallel with leaf-veins.

Lesions, tan in colour, assume a grey sheen or caste when sporulating. As disease progresses, lesions coalesce and blighting of the whole leaf may result.

Under favourable conditions, blighting progresses upwards on the plant.

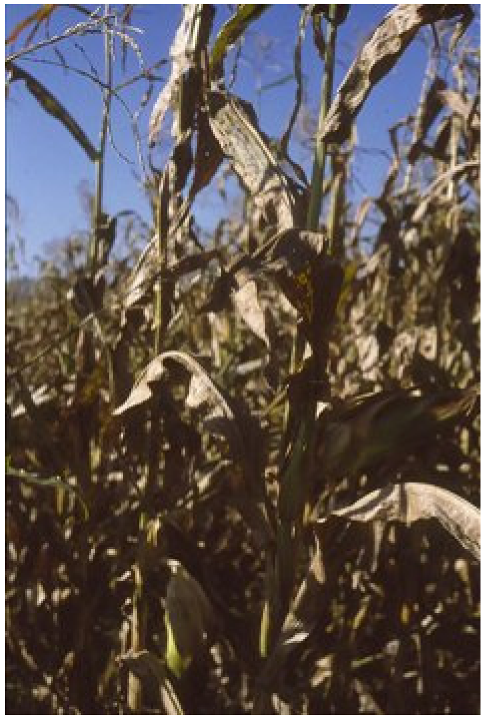
and the whole plant may die before the crop reaches maturity,

and serious yield losses may result.

Under these conditions, the maize plant may be pre-disposed to stalk-rotting fungal attack and resultant severe lodging adding further to the yield losses.

Disease Cycle

Grey leaf spot is highly dependant on favourable weather conditions. It requires frequent and prolonged periods of high humidity and warm temperatures (20E to 30EC) to complete spore gemination and the infection process. Spores (conidia) are produced from infested residues of previous maize crops in spring under conditions of high humidity and these are windblown to infect the newly planted maize crop. The lower leaves are usually the site of primary infection.



Lesions resulting from the initial infection produce spores that are wind- or rain-splashed to the upper leaves. (Ward *et al* 1999). Under unfavourable conditions (hot, dry weather), the fungus can remain dormant and then resume rapid development as soon as favourable weather conditions return (Latterall and Rossi, 1988). In mid- to late-season plantings and under favourable conditions, lesions may first appear on the mid- to upper-canopy as a result of wind-blown spores from adjacent infected maize. Such late season infections may be serious because it is the upper canopy that contributes 75 to 90% of the photosynthate for grain fill (Allison and Watson, 1966).

The occurrence of fewer and/or shorter periods of high humidity early in the growing season may account for the slower rate of early-season disease development (during the months of November and December). In contrast, good early season rains and more periods of high humidity (in November and December) have led to a higher frequency of early-season lesions (and more severe disease) (Ringer and Grybauskas, 1995).

Disease Management

As maize is the only known host for GLS, and the pathogen is not known to be seedborne, GLS is only able to survive from one season to the next on maize debris from a previously infected crop. It is spores produced in the infected debris in spring that are wind-blown to the newly planted maize that triggers the new epidemic.

Agronomic Practices

Tillage practices aimed at reducing initial inoculum by burying infested debris are classical methods of control and have been demonstrated to be effective in managing GLS (Latterell and Rossi, 1983). However, ploughing is less effective in managing the disease in areas with high levels of inoculum and where GLS is already established (Perkins *et al*., 1995). This is because inoculum from neighbouring infected fields, may be wind-blown to infect maize grown under conventional tillage systems. Further, other sources of inoculum may result from production practices used in South Africa. For example the practice of allowing maize to dry down to about 13,5% moisture in the field before harvesting, allows equinoxial winds to remove infected leaf tissue, which may be deposited on contours and headlands in and around maize fields. Such debris, and stubble remaining on the soil surface after ploughing, may act as an important source of inoculum to infect newly planted maize in the late Spring (Ward, 1996). Observations at Cedara have indicated that in dry seasons GLS may be detected three weeks earlier in no-till maize than in conventionally tilled maize. However, the improved moisture conservation under no-till, more than offsets the adverse effects of earlier GLS infection. In seasons favourable for GLS there is little or no difference between no-till and conventional tillage in the time the GLS infects maize.

Crop rotations have shown that even a single year of alternative crops away from maize can reduce initial inoculum. Rotations also provide additional benefits by improving soil quality, conserving soil water content and may reduce maize soil pathogens.

Other practices such as time of planting, plant density and timing of irrigation applications may all play a role in reducing disease severity.

Genetic Resistance

Hybrid resistance is perhaps the most cost-effective strategy of managing GLS. However, few hybrids have sufficient resistance to prevent yield losses due to GLS in commercial maize production. Resistance is due to several genes which are additive in effect, and each of which adds small increments of resistance to the hybrid. Breeders have found that if too high a level of resistance is required, breeding would be time consuming and other genetic characteristics such as yield or growing season length may be sacrificed. This can be observed in Table 1, where the more resistant hybrids, have in general a lower yield potential than hybrids more susceptible to disease. However, each season, more GLS resistant hybrids are being evaluated and their yield potential continues to improve.

Fungicide Control

Although efforts to improve genetic resistance to GLS in maize hybrids, it can be seen that even the most resistant hybrids still respond to fungicide treatment.

Table 1. Cedara Cultivar Trial: 1999 / 2000

Cultivar		Maturity[1]	Lodging %	AUDPC[2]	Unsprayed Yield	Sprayed Yield	Yield Loss due to GLS	
							kg	%
SC	627	157	7	143	8683	9913	1230	12,4
SC	602	150	36	189	11807	12632	825	6,5
CRN	3308	146	2	219	10780	11028	248	2,2

SC	709	165	12	335	8814	10460	1646	15,7
SC	513	145	38	415	7730	9375	1645	17,5
PAN	6777	154	12	621	9267	11016	1749	15,9
PAN	6335	144	11	816	7273	10816	3543	32,8
PAN	6479	148	8	954	7316	10415	3099	29,8
PAN	6573	151	13	965	7945	11348	3403	30,0
PAN	6243	155	6	1023	7585	10358	2773	26,8
PAN	6823	148	10	1080	7900	10253	2353	23,0
PAN	6633	146	24	1193	7143	10911	3768	34,5
PAN	6480	150	10	1224	7578	10233	2655	26,0
PAN	6615	146	30	1335	5954	11001	5047	45,9
SC	407	138	15	1351	8037	9252	1215	13,1
SC	405	138	8	1368	6531	9991	3460	34,6
PAN	6043	147	44	1410	6777	9993	3216	32,2
PAN	6568	155	13	1446	7942	12558	4616	36,8
PAN	6414	154	22	1448	7346	10883	3537	32,5
LS	8503	161	61	1450	5921	10204	4283	42,0
SNK	2911	138	18	1494	6674	9978	3304	33,1
QS	7608	154	23	1503	6197	9661	3464	35,9
PHI	3203	141	7	1507	7019	11269	4250	37,7
LS	8502	151	6	1538	6296	10637	4341	40,8
NS	9100	155	22	1556	5429	10129	4700	46,4
SNK	2972	147	41	1580	6527	10560	4033	38,2
CRN	3891	152	19	1617	6009	10766	4757	44,2
SNK	2021	143	16	1661	5918	10294	4376	42,5
SNK	2778	154	8	1749	8027	11474	3447	30,0
SNK	2266	148	8	1779	6314	10479	4165	39,7
PAN	6146	148	35	1792	5044	11908	6858	57,6
SNK	2969	151	31	1816	5036	9859	4833	49,0
CRN	3760	157	5	1819	6214	12132	5918	48,8
CRN	4502	144	27	1836	5885	10505	4620	44,0
SNK	2959	154	61	1844	4254	9278	5024	54,1

CRN	7821 BT	137	14	1845	5850	10313	4463	43,3
SNK	2682	149	28	1852	6048	11029	4981	45,2
SNK	2340	146	52	1866	5977	11042	5065	45,9
SNK	2472	148	34	1876	6367	11214	4847	43,2
SNK	2957	150	41	1877	5427	11036	5609	50,8
CRN	3604	152	10	1888	5451	10455	5004	47,9
SNK	2721	144	17	1888	5169	10581	5412	51,2
PAN	6710	138	15	1901	6648	11596	5308	44,4
CRN	3815	140	60	1913	4457	8381	3924	43,2
PAN	6364	138	39	1921	5255	9085	3830	42,2
CRN	3549	150	11	1945	4788	10429	5641	54,1
CRN	3524	143	27	1948	5118	10370	5252	50,6
CRN	3818	150	19	1991	4397	11200	6803	60,7
PAN	6242	153	21	1999	5302	11068	5766	52,1
PAN	6332	143	14	2028	5262	10361	5099	49,2
PHI	3442	147	19	2056	3787	10009	6222	62,2
CRN	3414	151	13	2056	4221	10817	6596	61,0
SNK	2041	138	29	2069	5083	10470	5387	51,5
SNK	2945	150	34	2108	4330	9756	5426	55,6
PHI	P30H22	148	24	2221	3939	11926	7987	67,0
PHI	P33A14	134	9	2223	4677	9887	5210	52,7

[1] Maturity in days after planting

[2] AUDPC is the area under disease progress curve, the lower the value, the less susceptible to GLS.

Fungicide sprays are therefore still necessary to maintain maize yield potentials in most circumstances. Combination products belonging to the triazole and benzimidazole chemical groups have been registered for use. The reason for use of combination fungicides is part of resistance management strategies aimed at preventing or delaying pathogen-resistance build-up to the fungicides used. The possibility of development of pathogen resistance is much greater if fungicides of a single chemical group (such as the benzimidazoles) are applied alone. Such irresponsible practices could jeopardise future effectiveness of fungicide control.

Details of fungicide spraying appear in "Fungicide Control of Grey Leaf Spot of Maize".

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