

**Evaluation of Corn Hybrids in Ohio for
Resistance to Northern Corn Leaf Blight,
Helminthosporium turcicum Passerini, and
Expression of Kernel Red Streak**

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INTRODUCTION

Blight

Investigations concerning the resistance of corn to northern corn leaf blight, *Helminthosporium turcicum* Passerini, began following an epidemic of the disease in 1942. This was a time when corn hybrids were replacing open-pollinated varieties (1).

Several studies since then (5, 6, 7, 8, 9) have indicated that resistance is a multigenic, inherited trait with genes located on several chromosomes. It was further shown that the resistance from some resistant inbreds could be readily detected in hybrids in which they were used, while for other resistant inbreds, resistance in hybrids was less or not at all noticeable.

Other workers (2, 3, 4) have studied a unique type of resistance, the H₁ gene, which is monogenic in inheritance. This type of resistance is qualitative in nature. Chlorotic lesions occur on both resistant and susceptible plants, but they are smaller on resistant plants and sporulation is delayed if not almost completely suppressed.

Kernel Red Streak

A relatively new disease of corn, kernel red streak (KRS) was first detected in Ohio in 1963 (10, 12). Nault *et al.* (10) determined that KRS is caused by the feeding of an eriophyid mite, *Aceria tulipae* (K.). KRS is characterized by red-purple pigmented streaks within the pericarp tissue of the kernel (Fig. 1). The streaks extend from the base of the kernel toward the crown. In severe instances of streaking, the kernel may appear completely red.

Inbred lines of corn have shown differential responses to streaking (11, 12). Williams *et al.* noted that the light colored kernel and cob in-

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brids expressed less streaking than those of darker color, provided an adequate population of mites infested the ear. Streaking tends to be expressed more at the tip of the ear, which is probably due to the easy access of the mite and exposure of this portion of the ear to light.

In this circular, evaluations are reported for resistance to northern corn leaf blight and the expression of kernel red streak in corn hybrids which have been sold in Ohio. However, even as this report was written, some of the hybrids reported are being replaced by the various companies with new and better ones which have not been evaluated.

METHODS AND PROCEDURES

The experimental data reported in this paper were obtained in conjunction with European corn borer resistance studies in 1967 and 1968.

The experiments were designed as randomized complete blocks, with each block replicated five times each year. Each block consisted of 139 hybrids from 10 companies in 1967 and 87 hybrids from 8 com-

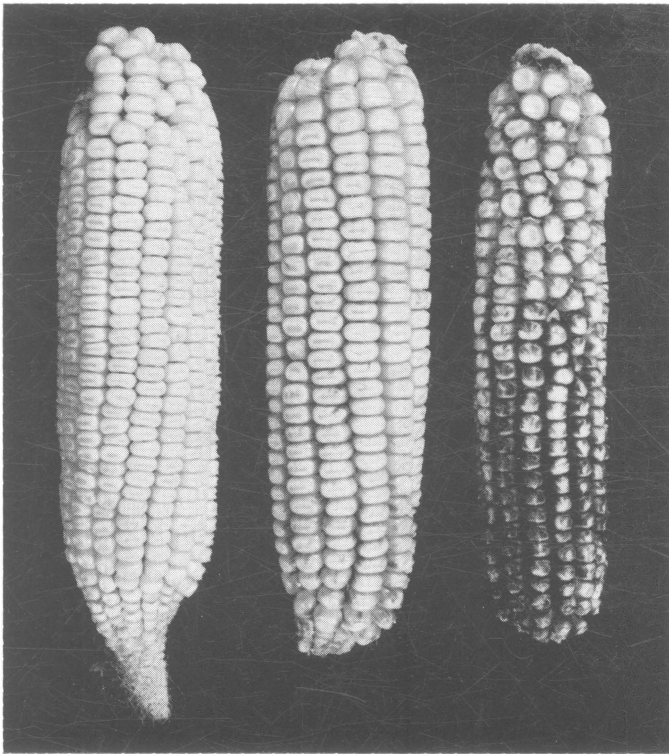


FIG. 1.—Ears of corn showing no streaking, light streaking, and severe streaking.

panies in 1968. Some of the same hybrids were planted both years, while others were planted only in 1967 or 1968 (Table 1). Each hybrid was planted in a single row plot of 30 seeds planted individually in each replication.

The first 10 plants of each plot were rated for European corn borer studies. The last 6 plants of each plot were used for blight evaluation and the 11th to 15th plants were used to determine the severity of kernel red streak.

Plants used to evaluate resistance to blight were each inoculated at two different times with *Helminthosporium turcicum*. These blight organisms were placed on the plants in finely ground leaf tissue with a hand duster immediately after a rain or early in the morning while a heavy dew persisted. Inoculations were made when the plants were near the mid-whorl stage of development.

Blight ratings were made in mid-September. They were made on

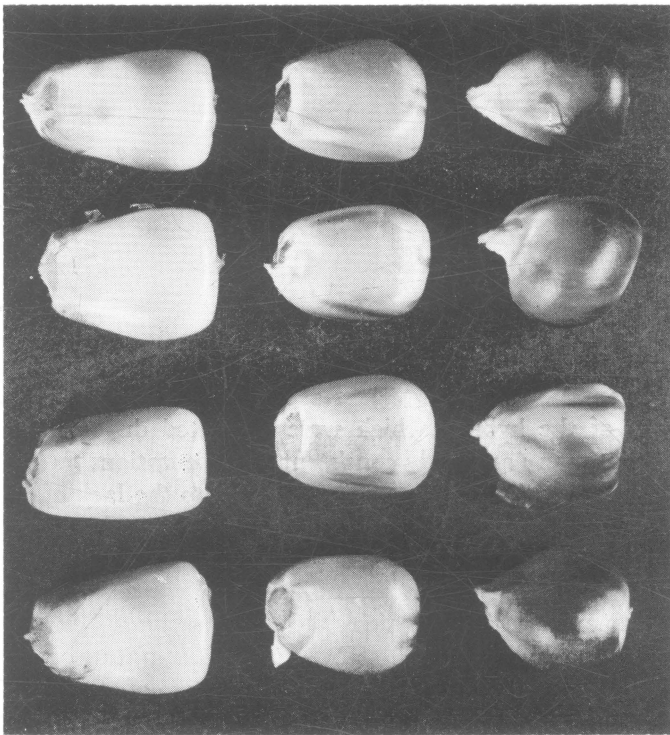


FIG. 2.—Three sets of kernels illustrating the severity ratings of 1 = no streaking, 3 = moderate streaking, and 5 = severe streaking.

a scale of 1 to 9 (1 = resistant, 9 = susceptible) which was adopted from Elliott's and Jenkin's 6-class scale (1).

Five ears were harvested in the fall from each plot and brought into the laboratory for rating the amount and severity of KRS (Fig. 1). The ratings were determined by the severity (redness of kernel, scale of 1 to 5) and the number of kernels streaked in a sample of 20. Fig. 2 shows kernels with ratings of 1, no streaking; 3, moderate streaking; and 5, severely streaked.

In 1967, kernel samples were taken from the tip, middle, and base of each ear but an analysis of the 1967 data indicated that tip samples were sufficient. Consequently, only data concerning the samples from the tips of the ears are presented for both years.

The values for KRS (higher numbers represent more streaking) were calculated by the following formula:

$$\text{Value} = \frac{\sum_{i=1}^n (\text{severity rating} \times \text{number of kernels streaked})}{n}$$

where: n = number of ears per sample.

RESULTS

A total of 163 corn hybrids were evaluated for northern corn leaf blight and KRS during the 1967 and 1968 growing seasons. The results are presented in Table 1.

Both seasons were favorable for blight ratings which were made during mid-September. In 1967, 7.2% of the hybrids evaluated were rated as resistant, 43.9% intermediate, and 48.9% susceptible. The evaluations in 1968 indicated 5.8% resistant, 21.8% intermediate, and 72.4% susceptible.

KRS values, which were on a scale of 1 to 100 (1 = no streaking, 100 = severely streaked), ranged from 10.2 to 96.0 in 1967 and from 10.0 to 72.8 in 1968. These values are presented in Table 1.

Ratings of the hybrids which were evaluated during both seasons vary some, but many are fairly consistent. Observations by Nault (11) indicate that the variability was primarily due to the lack of infestation of the ears by the mites. This would suggest that the higher values for the 2 years in Table 1 are a more valid measurement of the inherent susceptibility for streaking in the particular corn hybrid.

The data presented in this circular are not the only criteria to be used for selecting hybrids. These evaluations for natural resistance to blight and the expression of KRS measure only two of several considerations, such as adaptability, yield potential, ability to grow under high populations, and resistance to stalk rot, European corn borers, aphids, and viruses. During most years, blight and KRS would be considered a lesser potential problem than most of those previously mentioned.

TABLE 1.—Evaluation and Classification of Hybrid Corn for Northern Corn Leaf Blight Resistance and Expression of Kernel Red Streak in Ohio During 1967 and 1968.

Hybrid	Blight Rating			Classification*	KRS Value†	
	1967	1968	Average		1967	1968
Anderson						
AX3	7.6	8.6	8.1	S	60.6	42.7
AX5	4.6	6.0	5.3	I	49.3	67.8
AX9	5.2	5.6	5.4	I	46.2	60.1
A90	8.8	8.8	8.8	S	68.4	29.6
A95	5.6	9.0	7.3	S	76.7	51.5
A100	6.2	7.4	6.8	S	79.2	72.8
A104	5.4	7.8	6.6	S	83.6	70.6
A105	6.4	7.4	6.9	S	49.6	35.4
A110-A	5.6	—	5.6	I	63.6	—
A110-B	—	7.8	7.8	S	—	70.7
A111	6.4	—	6.4	S	75.0	—
A112	7.0	—	7.0	S	58.5	—
A120	6.2	—	6.2	S	55.4	—
3W-100	—	8.2	8.2	S	—	37.2
3W-105	5.4	5.4	5.4	I	56.5	49.5
3W-110	—	8.2	8.2	S	—	50.5
Silo Filler	6.0	4.2	5.1	I	56.7	33.5
Crow						
206	—	8.8	8.8	S	—	29.9
226	—	8.2	8.2	S	—	39.1
416	—	3.2	3.2	R	—	53.0
420	4.2	7.2	5.7	I	68.0	46.2
428	6.0	6.8	6.4	S	66.0	60.0
463	—	7.6	7.6	S	—	36.6
551	—	7.2	7.2	S	—	23.8
722	3.6	4.2	3.9	R	47.7	47.2
806	—	3.0	3.0	R	—	33.2
DeKalb						
XL45	6.8	—	6.8	S	51.1	—
XL342	5.8	—	5.8	I	52.3	—
XL346	7.0	—	7.0	S	53.2	—
XL361	5.4	—	5.4	I	54.1	—
XL362	6.4	—	6.4	S	78.4	—
XT606	4.0	—	4.0	R	18.4	—
XT872	3.8	—	3.8	R	38.8	—
441	6.6	—	6.6	S	67.8	—
640	5.8	—	5.8	I	47.0	—
874	4.8	—	4.8	I	21.0	—

*R = resistant, I = intermediate, and S = susceptible.

†KRS values on scale of 1 to 100 (1 = no streaking, 100 = severely streaked).

TABLE 1 (continued).—Evaluation and Classification of Hybrid Corn for Northern Corn Leaf Blight Resistance and Expression of Kernel Red Streak in Ohio During 1967 and 1968.

Hybrid	Blight Rating			Classifi- cation*	KRS Value†	
	1967	1968	Average		1967	1968
Funk						
G-17A	7.6	—	7.6	S	77.6	—
G-18A	7.0	—	7.0	S	72.5	—
G-38	6.4	—	6.4	S	59.6	—
G-44	6.0	—	6.0	I	91.0	—
G-4222	—	9.0	9.0	S	—	48.6
G-4289	—	9.0	9.0	S	—	28.5
G-4333	—	8.6	8.6	S	—	37.6
G-4355	7.8	—	7.8	S	63.8	55.2
G-4384	6.2	5.6	5.9	I	88.4	—
G-4390	4.6	—	4.6	I	54.6	—
G-4401	7.2	—	7.2	S	59.8	—
G-4411	—	6.4	6.4	S	—	47.3
G-4464	6.4	—	6.4	S	61.4	—
G-4473	8.2	7.6	7.9	S	82.0	41.4
G-4474	6.6	—	6.6	S	75.3	—
G-4476	4.0	7.2	5.6	I	77.4	55.9
G-4545	5.0	—	5.0	I	28.8	—
G-4566	6.2	7.4	6.8	S	38.8	33.1
G-4601	3.4	—	3.4	R	10.2	—
G-4641	5.6	5.0	5.3	I	49.2	42.2
G-4644	6.0	4.2	5.1	I	22.8	13.7
G-4697	6.0	4.6	5.3	I	19.8	17.7
G-5207	—	8.6	8.6	S	—	54.8
18467	—	7.4	7.4	S	—	52.3
Moews						
M16	7.0	—	7.0	S	79.9	—
M516	6.8	6.4	6.6	S	46.0	41.0
M530	6.0	—	6.0	I	68.2	—
M535	6.8	6.8	6.8	S	73.7	46.2
SM3	7.4	8.6	8.0	S	65.5	52.0
SM3B	4.4	5.4	4.9	I	52.3	47.7
SM6	6.6	—	6.6	S	43.9	—
SM44	6.0	6.6	6.3	S	32.7	35.7
SM55A	6.0	6.0	6.0	I	56.3	45.0
SM70	5.6	—	5.6	I	42.5	—
SM327	—	7.8	7.8	S	—	62.4
SM337	—	7.6	7.6	S	—	51.3
SM338	—	6.8	6.8	S	—	55.2
SM627	—	5.8	5.8	I	—	63.2

*R = resistant, I = intermediate, and S = susceptible.

†KRS values on scale of 1 to 100 (1 = no streaking, 100 = severely streaked).

TABLE 1 (continued).—Evaluation and Classification of Hybrid Corn for Northern Corn Leaf Blight Resistance and Expression of Kernel Red Streak in Ohio During 1967 and 1968.

Hybrid	Blight Rating			Classification*	KRS Value†	
	1967	1968	Average		1967	1968
Ohio						
oh524	8.2	9.0	8.6	S	75.9	21.2
oh535	6.0	8.8	7.4	S	—	50.2
oh636	6.6	8.4	7.5	S	75.2	39.7
oh708	6.0	6.8	6.4	S	74.8	52.0
oh710	5.8	8.8	7.3	S	50.4	20.6
oh760	5.0	7.6	6.3	S	39.7	33.6
oh823	4.8	6.2	5.5	I	60.7	44.7
oh824	5.4	5.8	5.6	I	31.2	26.7
oh825	3.0	2.8	2.9	R	46.4	43.1
oh826	3.8	2.4	3.1	R	48.2	14.3
oh827	4.4	3.6	4.0	R	51.8	30.6
Pa555	6.0	9.0	7.5	S	77.9	46.9
O-Y-O						
121	8.0	9.0	8.5	S	65.6	35.9
130A	6.4	9.0	7.7	S	89.6	44.2
135	7.2	9.0	8.1	S	87.9	42.3
225	7.2	8.8	8.0	S	77.1	44.6
240	6.4	—	6.4	S	58.4	—
333	—	4.4	4.4	I	—	64.8
335	5.4	6.4	5.9	I	41.7	40.6
360	4.0	7.6	5.8	I	68.6	70.4
380	5.4	—	5.4	I	52.3	—
410A	5.2	—	5.2	I	66.8	—
425	6.8	7.4	7.1	S	57.8	47.0
435	5.0	—	5.0	I	72.4	—
435A	4.0	—	4.0	R	75.7	—
455	6.2	—	6.2	S	37.1	—
470	7.2	—	7.2	S	45.9	—
501	5.0	—	5.0	I	41.8	—
66-33	5.8	—	5.8	I	85.5	—
Pioneer						
318A	5.8	—	5.8	I	60.0	—
321	—	7.2	7.2	S	—	47.0
325A	6.4	7.2	6.8	S	43.4	14.1
345A	4.8	—	4.8	I	54.3	—
354A	6.8	—	6.8	S	69.6	—
350D	6.4	—	6.4	S	67.6	—
362	7.2	—	7.2	S	80.1	—
368	8.6	—	8.6	S	79.4	—
371	7.4	8.4	7.9	S	77.8	29.8
3280	5.8	—	5.8	I	48.0	—
3304	5.4	4.8	5.1	I	12.2	10.0
3306	5.6	5.4	5.5	I	51.4	24.6
3369	3.8	—	3.8	R	77.9	—
3414	5.0	3.8	6.9	S	52.5	16.2
3466	6.8	9.0	7.9	S	56.7	12.6
3481	6.2	8.4	7.3	S	67.9	33.4
3505	—	4.4	4.4	I	—	17.6

*R = resistant, I = intermediate, and S = susceptible.

†KRS values on scale of 1 to 100 (1 = no streaking, 100 = severely streaked).

TABLE 1 (continued).—Evaluation and Classification of Hybrid Corn for Northern Corn Leaf Blight Resistance and Expression of Kernel Red Streak in Ohio During 1967 and 1968.

Hybrid	Blight Rating			Classifi- cation*	KRS Value†	
	1967	1968	Average		1967	1968
3510	4.4	—	4.4	I	27.9	—
3519	7.2	—	7.2	S	19.0	—
3524	5.0	—	5.0	I	40.6	—
3550	6.8	—	6.8	S	49.7	—
3567	6.0	8.0	7.0	S	82.8	35.2
3580	6.8	—	6.8	S	56.8	—
3658	7.6	—	7.6	S	88.8	—
3675	7.8	—	7.8	S	92.1	—
3715	5.0	9.0	7.0	S	88.0	46.5
3773	7.0	—	7.0	S	35.3	—
3775	7.4	9.0	8.2	S	64.2	58.2
7278	7.4	—	7.4	S	85.0	—
X6066	—	6.8	6.8	S	—	43.9
P. A. G.						
SX7	—	6.4	6.4	S	—	59.9
SX9	7.4	7.2	7.3	S	62.4	54.6
SX19	5.0	—	5.0	I	48.6	—
SX29	4.6	4.6	4.6	I	66.1	26.0
SX31	6.0	6.2	6.1	S	69.7	35.3
SX36	7.6	6.8	7.2	S	62.4	42.7
SX49	5.4	—	5.4	I	78.6	—
SX52	6.6	8.6	7.1	S	68.8	46.4
SX310	7.0	—	7.0	S	41.8	—
62MFC	7.0	—	7.0	S	78.0	—
45	7.8	—	7.8	S	68.7	—
70	7.8	—	7.8	S	86.4	—
272	5.2	—	5.2	I	46.2	—
285	5.0	—	5.0	I	96.0	—
313	7.4	7.0	7.2	S	72.0	43.0
395	5.4	5.0	5.2	I	51.7	51.4
399	6.0	6.4	6.2	S	52.6	22.6
434	5.2	—	5.2	I	28.8	—
437	5.2	—	5.2	I	50.7	—
Marsh						
S20	7.8	—	7.8	S	81.0	—
214A	7.2	—	7.2	S	41.9	—
219A	7.6	—	7.6	S	42.6	—
437A	6.8	—	6.8	S	51.8	—
643A	5.8	—	5.8	I	67.6	—
673A	5.4	—	5.4	I	59.5	—
3X29	7.6	—	7.6	S	54.2	—
S23	6.2	—	6.2	S	40.0	—
S28	7.2	—	7.2	S	49.5	—
S41	7.0	—	7.0	S	73.8	—
S47A	6.0	—	6.0	I	65.6	—

*R = resistant, I = intermediate, and S = susceptible.

†KRS values on scale of 1 to 100 (1 = no streaking, 100 = severely streaked).

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North Central Branch, Vickery, Erie County: 335 acres

Northwestern Branch, Hoytville, Wood County: 247 acres

Southeastern Branch, Carpenter, Meigs County: 330 acres

Southern Branch, Ripley, Brown County: 275 acres

Western Branch, South Charleston, Clark County: 428 acres