

# Kernel Blighting of Malting Barley Varieties

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Barley kernels commonly show melanistic discolorations caused by microflora. More than 265 fungal and bacterial species of microflora have been isolated from barley kernels (2). Barley kernels with a golden or straw-colored appearance are called "bright," while uniformly dark-yellow or tan ones are termed "stained" or "weathered." A kernel with discrete dark brown spots or blotches is called "blighted." Blighted kernels are discounted heavily on the grain market. They also may cause processing difficulties for the maltster and the brewer. Pathogenic fungi, such as *Fusarium* and *Helminthosporium* species, often are associated with the blight spots of infected kernels.

Differences in kernel color occur among several barley varieties. Two North Dakota varieties, Trophy and Larker, for example, have consistently

Table 1. A comparison of kernel microflora and the amount of blighting in four barley varieties grown at Mandan.

Variety	Microflora	Microflora (%)		
		Bright	Stained	Blighted
Conquest	<i>Alternaria</i>	100	100	100
	<i>Helminthosporium</i>	8	12	8
	<i>Fusarium</i>	4	0	6
	Storage molds	8	2	6
	Other	8	12	8
Larker	<i>Alternaria</i>	100	100	100
	<i>Helminthosporium</i>	2	0	6
	<i>Fusarium</i>	4	8	4
	Storage molds	4	2	0
	Other	12	6	18
Trophy	<i>Alternaria</i>	100	100	100
	<i>Helminthosporium</i>	10	4	12
	<i>Fusarium</i>	6	2	2
	Storage molds	0	2	2
	Other	4	10	6
Dickson	<i>Alternaria</i>	100	100	100
	<i>Helminthosporium</i>	6	20	22
	<i>Fusarium</i>	6	2	0
	Storage molds	4	4	4
	Other	4	6	10

Dr. Pepper was formerly assistant professor, Department of Plant Pathology. Research supported in part by the Malting Barley Improvement Association, Milwaukee, Wisconsin.

Table 2. A comparison of kernel microflora and the amount of blighting in four barley varieties grown at Fargo (a).

Variety	Microflora	Microflora (%)		
		Bright	Stained	Blighted
Conquest	<i>Alternaria</i>	100	100	100
	<i>Helminthosporium</i>	22	14	34
	<i>Fusarium</i>	24	20	32
	Storage molds	4	4	2
	Other	0	8	6
Larker	<i>Alternaria</i>	92	96	98
	<i>Helminthosporium</i>	58	60	66
	<i>Fusarium</i>	6	8	10
	Storage molds	10	18	14
	Other	14	16	12
Trophy	<i>Alternaria</i>	98	96	96
	<i>Helminthosporium</i>	54	62	68
	<i>Fusarium</i>	16	2	2
	Storage molds	2	8	4
	Other	12	12	8
Dickson	<i>Alternaria</i>	96	98	96
	<i>Helminthosporium</i>	26	38	38
	<i>Fusarium</i>	28	22	22
	Storage molds	6	8	2
	Other	18	12	16

shown differences in kernel color when grown under humid or sub-humid conditions, with Trophy usually having the brighter appearance.

A recent North Dakota release, Dickson, has shown good field resistance to the common barley foliar pathogens: *Septoria passerinii* Sacc., *Helminthosporium sativum* P., K., & B., and *H. teres* Sacc. (3). A blue-aleurone malting variety, Conquest, with loose-smut resistance has recently been developed in Canada. Conquest has not as yet been approved as a malting variety by the brewing and malting industries in the United States. Some observers claim that Dickson shows a high level of kernel blight when compared with Trophy, Larker, or other midwestern malting barley varieties (1). This study was made to establish whether real differences exist among several common malting varieties in staining, blighting, and microfloral content.

## MATERIALS AND METHODS

Grain samples from four barley varieties commonly grown in North Dakota — Conquest (C.I.

11638), Larker (C.I. 10648), Trophy (C.I. 10647), and Dickson (C.I. 10968) — were obtained from plots growing side-by-side at five locations in the state: Fargo (two location, a and b), Mandan, Minot and Park River. One thousand-kernel samples of threshed grain were taken at random and divided on the basis of appearance into bright, uniformly stained, and blighted categories. Kernels of each variety and location, and in each appearance category, were surface-disinfected and plated on acidified potato-dextrose agar for microfloral assay. The plates were incubated at room temperature for three to five days. Fungi associated with the kernels were identified by colony appearance and microscopic examination. All samples were tested

by code numbers to avoid bias in the interpretation of experimental results.

## RESULTS AND DISCUSSION

The microfloral assays are listed in Tables 1-5. Kernel appearances are shown by variety and location in Figure 1. All varieties showed blighting and the presence of both saprophytic and parasitic microflora. The degree of blighting and the amount of kernel infection was influenced more by location than by varietal response. Barleys grown in less humid areas, such as Minot, were brighter and showed less infection than barleys grown in more humid areas, such as Fargo.

Figure 1. Degree of brightness, staining, and blighting of barley kernels of four varieties grown at five locations.

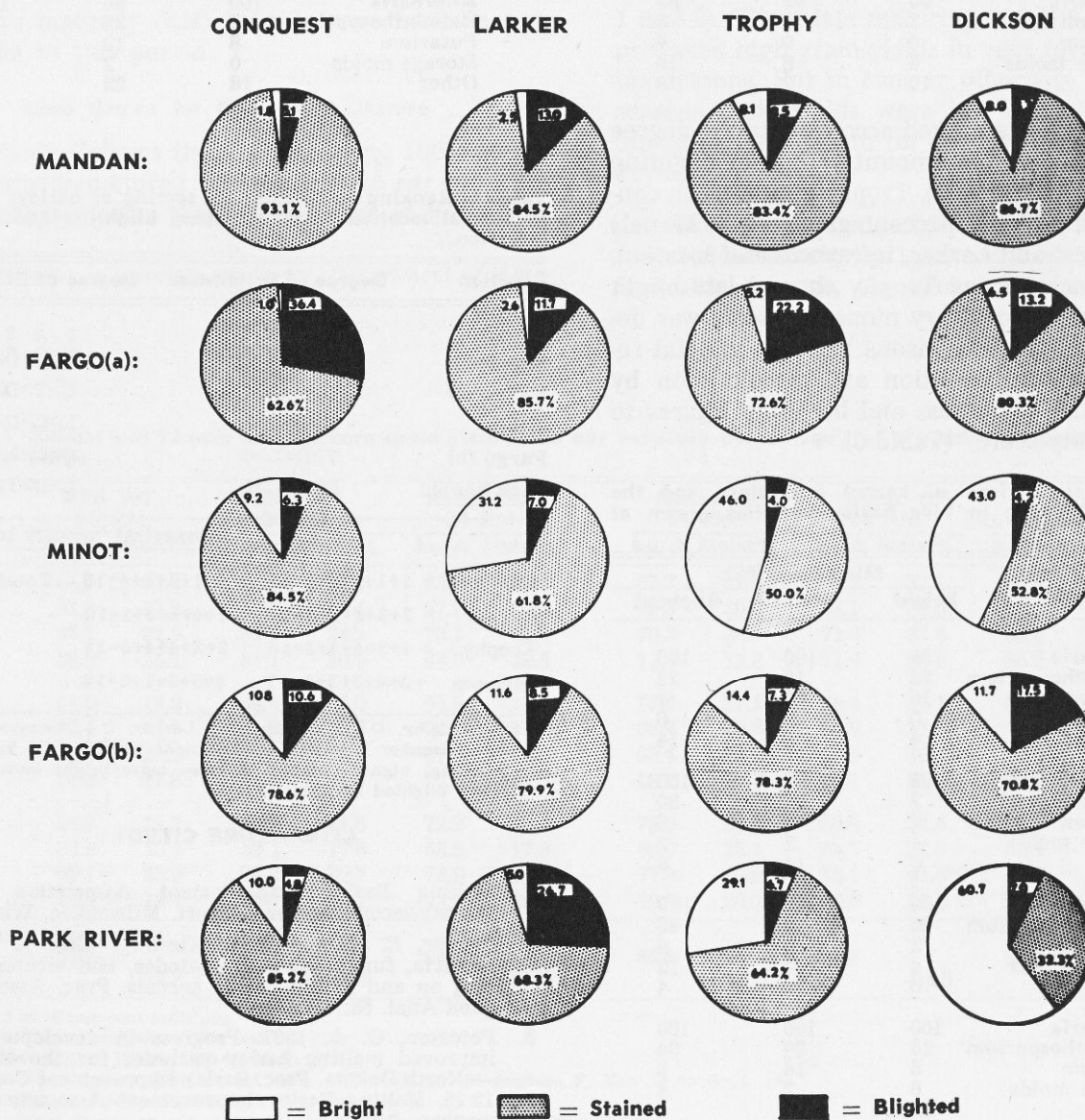


Table 3. A comparison of kernel microflora and the amount of blighting in four barley varieties grown at Minot.

Variety	Microflora	Microflora (%)		
		Bright	Stained	Blighted
Conquest				
	Alternaria	100	100	100
	Helminthosporium	4	2	8
	Fusarium	0	6	4
	Storage molds	20	24	18
	Other	4	0	16
Larker				
	Alternaria	100	100	96
	Helminthosporium	6	12	6
	Fusarium	0	4	8
	Storage molds	4	14	22
	Other	8	24	24
Trophy				
	Alternaria	100	100	100
	Helminthosporium	4	6	4
	Fusarium	2	2	4
	Storage molds	4	8	22
	Other	4	10	16
Dickson				
	Alternaria	96	98	98
	Helminthosporium	2	8	8
	Fusarium	4	0	4
	Storage molds	6	8	10
	Other	10	2	18

Table 5. A comparison of kernel microflora and the amount of blighting in four barley varieties grown at Park River.

Variety	Microflora	Microflora (%)		
		Bright	Stained	Blighted
Conquest				
	Alternaria	98	94	96
	Helminthosporium	10	16	34
	Fusarium	0	4	2
	Storage molds	10	6	8
	Other	2	6	12
Larker				
	Alternaria	100	100	100
	Helminthosporium	20	28	36
	Fusarium	2	8	8
	Storage molds	2	2	2
	Other	12	20	8
Trophy				
	Alternaria	98	94	98
	Helminthosporium	18	24	36
	Fusarium	0	2	4
	Storage molds	2	2	0
	Other	10	4	16
Dickson				
	Alternaria	100	96	100
	Helminthosporium	14	34	40
	Fusarium	8	12	16
	Storage molds	0	2	0
	Other	16	22	14

Varieties were ranked according to the degree of brightness and the amount of kernel blighting (Tables 1-5 and Figure 1). Trophy and Dickson consistently had a higher percentage of bright kernels than Conquest and Larker, irrespective of location. Similarly, Dickson and Trophy showed less blight than Larker. An arbitrary numerical scale was devised to simplify comparisons between varietal responses to kernel infection and discoloration by combining the brightness and blighting figures to give a "quality score" (Table 6).

Table 4. A comparison of kernel microflora and the amount of blighting in four barley varieties grown at Fargo (b).

Variety	Microflora	Microflora (%)		
		Bright	Stained	Blighted
Conquest				
	Alternaria	100	100	100
	Helminthosporium	22	18	26
	Fusarium	10	6	4
	Storage molds	0	2	0
	Other	4	8	14
Larker				
	Alternaria	98	96	100
	Helminthosporium	2	34	30
	Fusarium	2	2	6
	Storage molds	4	2	2
	Other	8	14	8
Trophy				
	Alternaria	100	98	100
	Helminthosporium	26	32	46
	Fusarium	2	0	6
	Storage molds	4	4	10
	Other	6	14	4
Dickson				
	Alternaria	100	100	100
	Helminthosporium	16	20	34
	Fusarium	6	14	8
	Storage molds	6	2	4
	Other	12	8	4

Table 6. Ranking and numerical scoring of barleys grown at several locations and displaying blighting and kernel infection.<sup>1/</sup>

Location	Degree of Brightness	Degree of Blighting	Numerical "quality score" <sup>2/</sup>		
			4	3	2
Mandan	T>D>L>C	L>T>D>C	1	2	3
Fargo (a)	D>T>L>C	C>T>D>L	1	2	3
Minot	T>D>L>C	L>C>D>T	1	2	3
Fargo (b)	T>D>L>C	D>C>L>T	1	2	3
Park Rapids	D>T>C>L	L>D>T>C	1	2	3

Conquest = 1+1+1+1+2=6	4+1+2+2+4=13	Total = 19
Larker = 2+2+2+2+1=9	1+4+1+3+1=10	= 19
Trophy = 4+3+4+4+3=18	2+2+4+4+3=15	= 33
Dickson = 3+4+3+3+4=17	3+3+3+1+2=12	= 29

<sup>1/</sup> T = Trophy, D = Dickson, L = Larker, C = Conquest.

<sup>2/</sup> Lower number indicates fewer bright kernels and increased blighting; higher number indicates more bright kernels and fewer blighted kernels.

#### LITERATURE CITED

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