EFFECT OF TIMED FUNGICIDE SPRAYS ON CONTROL OF FOLIAR DISEASES AND SUBSEQUENT YIELD OF WINTER WHEAT IN KANSAS

by

MAURICE STACEY DANNENBERG

B.S., Kansas State University, 1983

A MASTER'S THESIS

Submitted in partial fulfillment of the requirements
for the degree

MASTER OF SCIENCE

COLLEGE OF AGRICULTURE
KANSAS STATE UNIVERSITY
Manhattan, Kansas
1987

Approved by:

Major Professor

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my major advisor, Dr. Charles L. Kramer, for his encouragement, support, and valuable suggestions throughout the preparation of this manuscript.

I also gratefully acknowledge the valuable assistance afforded to me by Dr. Merle G. Eversmeyer throughout the course of this study and for his help with the computer programming and statistical analysis.

Thanks also are extended to Dr. Don Stuteville for the time he spent serving on my graduate committee.

A special feeling of appreciation goes to my wife, Inci Mine for her understanding, enduring patience, and constant encouragement throughout the entire course of this study.

Maurice Dannenberg

TABLE OF CONTENTS

Leaf rust of wheat, caused by Puccinia recondita Rob. ex Desm. f. sp. tritici, and fungal leaf spots, speckled leaf blotch caused by Mycosphaerella graminicola (Fuckel) Schroeter and tan spot caused by Pyrenophora tritici-repentis (Died) Drechs. are three of the most common and severe foliar diseases of wheat (Triticum aestivum L.) in the hard red winter wheat region of the U.S. Losses in wheat caused by leaf rust are well documented and can reduce yields by as much as 50% (3,14). Leaf blotch may cause losses in wheat yield of 30% to 50% on susceptible cultivars (6,17) while tan spot may reduce yields from 19.7% to 49.4% under severe epidemic conditions (13,16).

Models of predicting disease development and estimating crop loss have been developed (3,4). The fungicides benomyl and triadimefon in the form of foliar sprays have shown promise for control of rust and leaf blotch (1,2,5). Triadimefon also can be used in seed treatment for control of leaf blotch, leaf rust and tan spot (2,10,12). However, fungicides are not routinely used in the hard red winter wheat region because of the high cost of application on the large acreages and relatively low grain yield potential under prevailing

environmental conditions. Thus, the planting of resistant cultivars currently is the most economically feasible method of control of these foliar pathogens of wheat. However, there may be certain years when the application of a fungicide may be economically beneficial.

Yield losses and control of individual foliar pathogens of wheat have been extensively documented (2,5,6,13,14,). However, most of these studies were directed at the effect of the host-pathogen relationship within a single disease pathosystem rather than the combined effects of two or more pests. The occurrence of only one disease on a wheat crop is rarely observed under field conditions.

Leaf rust, speckled leaf blotch, and tan spot are frequently found together in producers' fields and have been the leading cause of substantial wheat yield losses in Kansas over the last ten years. The purpose of this investigation was to study the effect of time of application of foliar fungicides indicated by the various stages of host-plant development on the control of naturally occurring foliar pathogens of wheat and subsequent crop yield losses. A secondary objective of this study was to determine interaction among pathogens through the statistical analysis of disease expressed in

the form of area under the disease progress curve (AUDPC) and final disease severities.

MATERIALS AND METHODS

Field experiments were conducted on a Chase silty clay loam at the Rocky Ford Experimental Farm, Manhattan, Kansas. Planting dates were 13 October 1985 and 7 October 1986. Seed was sown in 1.22 m wide drill strips at a rate of 78.6 kg/ha.

In 1985, only the cultivar Newton was planted. A total of 72 experimental plots 6.1 x 7.6 m in size received the treatments listed in Table 1. Field plots established in 1986 consisted of Newton and Arkan. Newton had a total of 66 experimental plots 4.9 x 6.1 m in size while Arkan had 50 experimental plots 4.9 x 6.1 m in size and 8 that were 7.3 x 6.1 m. Treatments used in 1986 are listed in Table 2.

Field experiments in 1985 and 1986 consisted of foliar fungicide treatments of 153.6 g a.i./ha and 230.5 g a.i./ha of Bayleton, respectively, and 2.25 kg/ha of Dithane M45 in both 1985 and 1986 applied with a hand-held canister sprayer at a rate of 225 l/ha.

TABLE 1. Wheat foliar disease fungicide treatments and subsequent test weights and yields of the winter wheat cv. Newton, 1985

Treatment[a]	Growth Stage Applied[b]	Test Wt (lbs/bu)	Yield (kg/ha)
None		55.2 a[c]	2,923 a
Bayleton 5G	LB	58.2 c	3,361 b
Bayleton 25WP	ED	55.9 b	3,368 b
Bayleton 5G+25WP	LB + HD	57.6 b	3,469 b
Dithane M45 50WP	HD + ED	57.9 c	3,489 b
Bayleton 25WP	HD	58.1 c	3,852 c

[a]Bayleton applied at a rate of 153.6 g a.i./ha for each growth stage applied.
Dithane M45 applied at a rate of 2.25 kg a.i./ha for each growth stage applied.
Bayleton 5G applied at late boot in combination with Bayleton 25WP applied at heading.
[b]Fungicides applied at late boot (LB), heading (HD) and early dough (ED).
[c]Different letters after numbers in the same column indicate statistically significant difference. P=.05.

TABLE 2. Effect of foliar fungicide treatments on severity of leaf rust, speckled leaf blotch, and tan spot and subsequent yield and loss of winter wheat, 1986

Treatment[a]	AUDPC[b]			%Disease Severity[c]			Loss[d]	Yield (kg/ha)
	LR	SLB	TAN	LR	SLB	TAN		
Newton								
No Fungicide	9.63a[e]	5.46a	1.17a	86a	31a	9a	52.2a	2000a
Bayleton (ED)	10.02a	5.41a	1.35a	85a	31a	10a	22.5b	2485ab
Bayleton (H)	6.27b	5.03a	1.11a	44b	27a	6a	9.2bc	2788ab
Bayleton (H) + Dithane M45	5.97b	5.33a	1.47a	43b	28a	10a	0.0c	3044b
Arkan								
No Fungicide	1.92a	4.23a	-	24a	33a	-	9.9a	3792a
Bayleton (ED)	2.22a	4.14a	-	24a	31ab	-	6.7a	3906a
Bayleton (H)	1.11b	3.63a	-	2b	24c	-	-1.3a	4223a
Bayleton (H) + Dithane M45	0.31c	4.04a	-	10b	28b	-	0.0a	4169a

[a]Bayleton applied at early dough (ED) and heading (H) at a rate of 230.5 g a.i./ha and Dithane M45 applied at weekly intervals for 3 weeks following the application of Bayleton at heading at a rate of 2.25 kg a.i./ha.
[b]Area under the disease progress curve for leaf rust (LR), speckled leaf blotch (SLB) and tan spot (TAN).
[c]Disease severity at early dough as rated by the modified Cobb scale.
[d]Loss calculated by subtracting the treatment yield from the Bayleton + Dithane M45 yield and dividing by the treatment yield.
[e]Different letters after numbers in the same column indicate statistically significant difference. P=.05.

Development of pest levels occurred either through natural infection or through introduction of a pest by inoculation. Since Newton was susceptible to the prevailing P. recondita population, inoculation was not necessary. Natural infection occurred to develop sufficient levels of the major foliar pathogens in both 1985 and 1986. However, it was necessary to inoculate Arkan with P. recondita urediospores in 1986 because of Arkan's relative resistance.

Inoculum was obtained by using field-grown plants of Trison which were transplanted into plastic pots at late boot stage and brought into the greenhouse. These were inoculated with an oil suspension of urediospores of P. recondita (PRTUS6) and incubated in a dew chamber at 20 C for 16 hours. The plants then were placed in the greenhouse for disease development. One pot of diseased plants was placed within the upwind end of each drill strip of the experimental plots at four designated growth stages, and left there for one week.

Incidence of the foliar diseases leaf rust, speckled leaf blotch, tan spot, and other pathogens was assessed by visual estimation and rated using the modified Cobb (11) and James (8) scales. Ratings were taken weekly beginning at late joint and continuing until early dough. An average rating was recorded for each disease observed.

In 1986, infrared readings were taken for each experimental plot at three stages of host development: late boot, heading, and early dough. The grain was harvested with a plot combine. Grain yield, test weight, and 1000-kernel weight were recorded for all experimental plots both years.

The area under the disease progress curve (15) was calculated for leaf rust, speckled leaf blotch, and tan spot observed on Newton and leaf rust and speckled leaf blotch observed on Arkan for each of the treatments used in 1986. The percent loss was also calculated for the treatments no fungicide, Bayleton applied at heading, and Bayleton applied at early dough in 1986. This was calculated by subtracting the treatment yield from the Bayleton + Dithane M45 yield and dividing by the treatment yield. Disease severity at early dough stage, AUDPC, percent loss, and yield were subjected to analysis of variance and mean separation by using the general linear model procedure of the Statistical Analysis Sytems (SAS Institute, Inc., Cary, NC) and the Waller-Duncan k-ratio t-test. Correlation coefficients also were calculated by SAS for the variables loss, yield, AUDPC, and disease severity at early dough for each of the treatments. The interaction between diseases was studied through statistical analysis of AUDPC and disease

severity using the general linear model procedure of SAS. A significance level of P=.05 was used in all statistical tests.

RESULTS

The extemely mild winters and wet springs in both 1985 and 1986 were favorable for the early development of leaf rust before speckled leaf blotch or tan spot could become established. Speckled leaf blotch was confined to the lower leaves and rarely exceeded 30% severity. Tan spot severity reached 10% on Newton, while only trace amounts were observed on Arkan.

In 1985, leaf rust severity was significantly reduced by Bayleton foliar spray applied at heading and by Dithane M45 foliar spray treatments compared to the untreated controls. The yield for the treatment of Bayleton foliar spray applied at heading was significantly greater than any other treatment. The Dithane M45 treatment and the Bayleton treatment applied at early dough were also significantly greater than the resulting yield of no fungicidal treatment. Differences in test weight also were significant, with the treatment of Bayleton applied at early dough being greater than the

untreated control, and both the treatments of Dithane M45 and Bayleton applied at heading being greater than the treatment of Bayleton applied at early dough (Table 1).

In 1986, leaf rust severity and AUDPC were significantly reduced by Bayleton when applied at heading and by Bayleton applied at heading followed with three weekly applications of Dithane M45 (Table 2). This was true on both Newton and Arkan. Although some differences in speckled leaf blotch severity were seen between treatments in Arkan, there were no significant differences observed for the AUDPC and disease severity of both speckled leaf blotch and tan spot in Newton. Severity and AUDPC of tan spot was nonexsistent for Arkan.

While there was a significant difference of leaf rust severity and AUDPC between the untreated control and the treatments of Bayleton applied at heading in Arkan, this difference did not remain significant in the subsequent yield nor the percent loss of these treatments. However, there were greater yields associated with a decrease in the disease severity and AUDPC. For Newton, the significant differences of leaf rust severity and AUDPC were carried over into significant differences of yield and percent loss. The Bayleton plus Dithane M45 treatment resulted in the

greatest yield with the treatments of Bayleton at heading, Bayleton at early dough, and the untreated control having successively lower yields. Both the AUDPC (-0.79) and severity (-0.81) of leaf rust were negatively correlated to yield, while AUDPC (0.53) and severity (0.61) of leaf rust were correlated positively to percent loss. The AUDPC of speckled leaf blotch (-0.60) and tan spot (-0.85) were also negatively correlated to yield, however, there appeared to be no significant effect of foliar fungicide treatment on the control of speckled leaf blotch. The infrared readings had very low correlation coefficients in relationship to yield (-.14) and percent loss (.29), indicating that infrared was not beneficial in separating yield differences among treatments.

DISCUSSION

Single applications of Bayleton fungicide effectively reduced the severity of leaf rust epidemics and contributed to yield increases in both 1985 and 1986. Yield increases in 1985 ranged from 438 to 929 kg/ha. The greatest increase was obtained with the treatment of Bayleton foliar spray applied at heading on Newton.

This also was true in 1986 when a treatment of Bayleton foliar spray applied at heading produced increases of 788 kg/ha and 431 kg/ha on Newton and Arkan, respectively. The smallest yield increases in 1985 of 438 and 445 kg/ha were obtained with Bayleton 5G (triadimefon granules) applied at late boot and Bayleton foliar spray applied at early dough, respectively. In 1986, Bayleton foliar spray applied at early dough resulted in the smallest yield increases of 114 kg/ha for Arkan and 485 kg/ha for Newton. Similiar results were observed by Lipps (9), who evaluated single applications of foliar fungicides for control of wheat diseases.

Treatments receiving two or more applications of fungicide also reduced the severity of foliar diseases and resulted in yield increases similiar to those obtained with the treatment of Bayleton at heading. Studies have shown that two or more applications of foliar fungicides reduce severity of foliar diseases and significantly increase grain yield of winter wheat (1,5,7). However, multiple applications are not economically justified in most cases.

There was a significant amount of leaf rust on the flag leaf and lower leaves of Newton in both years for all treatments except with Bayleton applied at heading, Dithane M45 applied weekly from heading to early dough,

and the combination of Dithane M45 applied weekly for three weeks following an application of Bayleton at heading. For Arkan, low levels of leaf rust severity (1-10%) were observed on the flag leaf and was seen only in the experimental units receiving no fungicide or those receiving Bayleton at the early dough stage. While speckled leaf blotch severity values for both cultivars were relatively low and were confined to the lower leaves, the combination of it and leaf rust resulted in a considerable amount of damage on the lower foliage. This may have contributed to a yield reduction. Tan spot also was present on the lower leaves of the canopy, but was detected only in Newton and was observed in only one of the plots in 1986 at levels of 10% or less. Thus, tan spot had little, if any, affect on yield in our trials.

In determining if there was interaction among pathogens, the general linear models procedure of SAS was used with percent loss as the dependent variable and various combinations of leaf rust, speckled leaf blotch, and tan spot AUDPCs and severities as the independent variables. The combination of AUDPC variables of leaf rust, speckled leaf blotch, and the leaf rust x speckled leaf blotch resulted in a F value of 10.07 for the leaf rust x speckled leaf blotch source which was significant at the P=.01 level. Also, in combining the disease

severity variables of leaf rust, speckled leaf blotch, and leaf rust x speckled leaf blotch in the model, a F value of 10.42 significant at the P=.01 level was obtained for the leaf rust x speckled leaf blotch source. These statistical analyses tend to show that there is an interaction among the pathogens. There was no significant interaction observed between leaf rust and tan spot nor between speckled leaf blotch and tan spot.

Yields in 1985, and the AUDPC and yields in 1986 indicate that the application of Bayleton at the early dough stage was not as effective as the application of Bayleton at heading or the combination of Bayleton and Dithane M45 applied at heading and weekly for 3 weeks one week after heading, respectively. However, the yield associated with the application of Bayleton at early dough, although statistically significant only in 1985, was greater than the yield of the control treatment.

Based on this research, it appears that a single, well-timed application of Bayleton foliar spray can effectively reduce the severity of foliar disease and significantly increase yield. Similar conclusions were reached in studies by Cook (5) and Brown (2). Application of Bayleton foliar spray on Newton at heading resulted in yield increases of 929 and 788 kg/ha in 1985 and 1986, respectively. For the treatment of Bayleton

foliar spray on Newton at early dough, a yield increase of 445 kg/ha was obtained in 1985 and one of 485 kg/ha in 1986. Bayleton granules produced similar results when applied at late boot in 1985. This yield increase was probably due to the control of speckled leaf blotch and tan spot earlier in the season. Yield increases for Arkan were not as great, as one might expect due to the resistance of Arkan and the susceptibility of Newton. The early dough treatment produced an increase of 114 kg/ha and the heading treatment 431 kg/ha.

Though leaf rust severities had reached 80% on the flag leaf of Newton before the treatment of Bayleton at early dough was applied, an increase of 485 kg/ha resulted. Although the treatment of Bayleton applied at heading produced greater yields, the increase provided by the early dough treatment indicates that even a later application of Bayleton may be economically feasible to the grower. This would be beneficial in that it would give some time for the producer to react when the availability of the product is in question and when unfavorable environmental conditions prevail.

The use of foliar fungicide treatments has been virtually non-exsistent in the hard red winter wheat region of the United States. However, the results of this study indicate that Bayleton appears to have

excellent potential as a foliar treatment for wheat under severe foliar disease epidemic conditions such as experienced in 1985 and 1986. Although increases in yield may not have been as dramatic with tan spot or speckled leaf blotch as primary diseases, in times when severe epidemics of leaf rust occur, Bayleton foliar spray would be an effective tool in its control.

LITERATURE CITED

1. Anzalone, L. Jr. 1983. Control of foliar diseases of winter wheat with fungicides, 1982. Fungic. Nematic. Tests 38:50.

2. Brown, J. S. 1984. Effect of systemic fungicides applied as seed treatments or early foliar sprays on speckled leaf blotch of wheat, Mycosphaerella graminicola (Fuckel) Schroeter. Crop Protection 3,59-65.

3. Burleigh, J. R., Roelfs, A. P., and Eversmeyer, M. G. 1972. Estimating damage to wheat caused by Puccinia recondita tritici. Phytopathology 62:944-946.

4. Coakley, S. M., McDaniel, L. R., and Shaner, G. 1985. Model for predicting severity of Septoria tritici blotch on winter wheat. Phytopathology 75:1245-1251.

5. Cook, R. J. 1977. Effect of timed fungicide sprays on yield of winter wheat in relation to Septoria infection periods. Plant Pathology 26:30-34.

6. Eyal, Z. and Ziv, O. 1974. The relationship between epidemics of Septoria leaf blotch and yield losses in spring wheat. Phytopathology 64:1385-1389.

7. Hagan, A., Gudauskas, R., and Chapman, C. 1983. Aerial application of Dithane M-45 on wheat for leaf rust control, 1982. Fungic. Nematic. Tests 38:55.

8. James, W. C. 1971. An illustrated series of assessment keys for plant diseases, their preparation and usage. Can. Plant Dis. Sur. 25:259-270.

9. Lipps, P. E. 1983. Single application of foliar fungicide for control of wheat diseases, 1982. Fungic. Nematic. Tests 38:58-60.

10. Luz, W. C. and Bergstrom, G. C. 1986. Evaluation of triadimenol seed treatment for early season control ot tan spot, powdery mildew, spot blotch, and Septoria nodorum spot on spring wheat. Crop Protection 5:83-87.

11. Peterson, R. F., Campbell, A. B., and Hanna, A. E. 1948. A diagrammatic scale for estimating rust intensity on leaves and stems of cereals. Can. J. Res. 26:496-500.

12. Rakotondradona, R. and Line, R. F. 1984. Control of stripe rust and leaf rust of wheat with seed treatments and effect of treatments on the host. Plant Disease 68:112-117.

13. Rees, R. G., Platz, G. J., and Mayer, R. 1982. Yield losses in wheat from yellow spot; comparison of estimates derived from single tillers and plots. Aust. J. Agric. Res. 33:899-908.

14. Samborski, D. J., and Peterson, B. 1960. Effect of leaf rust on the yield of resistant wheats. Can. J. Plant Sci. 40:620-622.

15. Shaner, G. and Finney, R. E. 1977. The effect of nitrogen fertilization on the expression of slow-mildewing resistance in Knox wheat. Phytopathology 67:1051-1056.

16. Sharp, E. L., Sally, B. K., and McNeal, F. H. 1976. Effect of Pyrenophora wheat leaf blight on the 1000-kernel weight of 30 spring wheat cultivars. Plant Dis. Rep. 60:135-138.

17. Ziv, O. and Eyal, Z. 1978. Assessment of yield component losses caused in plants of spring wheat cultivars by selected isolates of Septoria tritici. Phytopathology 68:791-796.

APPENDIX

Treatment labels and their meanings.

LJ1	Inoculated at late joint, no fungicide applied
LJ2	Inoculated at late joint, Bayleton applied at heading
LJ3	Inoculated at late joint, Bayleton applied at early dough
LB1	Inoculated at late boot, no fungicide applied
LB2	Inoculated at late boot, Bayleton applied at heading
LB3	Inoculated at late boot, Bayleton applied at early dough
HA1	Inoculated at anthesis, no fungicide applied
HA2	Inoculated at anthesis, Bayleton applied at early dough
ED	Inoculated at early dough, no fungicide applied
BAY+ M45	Bayleton applied at heading, followed by 3 weekly applications of Dithane M45
M45	Four applications of Dithane M45 applied weekly beginning at heading
NO INOC	No inoculation, Bayleton applied at heading

TABLE 1. Wheat foliar fungicide treatments and subsequent yields and test weights of cv. Newton for plot 1, 1985

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)
No Fungicide			
	1	40.2	56.2
	2	27.1	56.0
	3	23.9	54.8
	4	22.4	57.0
Bayleton 25WP (ED)			
	1	50.1	57.2
	2	47.2	55.7
	3	36.7	56.9
	4	68.6	58.7
Bayleton 25WP (HD)			
	1	57.9	59.3
	2	55.9	58.3
	3	55.4	58.6
	4	73.8	61.1
Bayleton 5G (LB) + Bayleton 25WP (HD)	1	54.6	58.8
	2	50.9	58.6
	3	51.8	58.6
	4	67.4	60.3
Bayleton 5G (LB)			
	1	54.7	58.9
	2	49.8	58.6
	3	50.2	58.9
	4	65.0	59.7
Dithane M45 (ED+HD)			
	1	56.7	59.4
	2	50.5	58.3
	3	50.6	59.0
	4	61.9	60.4

[a]Fungicides applied at late boot (LB), heading (HD), and early dough (ED).
Bayleton applied at a rate of 153.6 g a.i./ha.
Dithane M45 applied at a rate of 2.25 kg a.i./ha.

TABLE 2. Wheat foliar fungicide treatments and subsequent yields and test weights of cv. Newton for plot 2, 1985

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)
No Fungicide			
	1	62.9	59.5
	2	46.4	58.5
	3	48.9	58.2
	4	56.5	60.5
Bayleton 25WP (ED)			
	1	61.4	58.5
	2	45.8	57.1
	3	50.4	58.5
	4	59.1	59.9
Bayleton 25WP (HD)			
	1	65.4	60.4
	2	49.4	58.3
	3	48.9	59.2
	4	51.3	60.4
Bayleton 5G (LB) + Bayleton 25WP (HD)	1	52.5	57.5
	2	44.9	57.4
	3	39.2	58.7
	4	49.0	58.6
Bayleton 5G (LB)			
	1	52.0	59.7
	2	33.4	57.3
	3	41.3	58.6
	4	46.8	59.2
Dithane M45 (ED+HD)			
	1	63.5	60.3
	2	45.1	57.7
	3	41.4	58.5
	4	43.8	59.0

[a]Fungicides applied at late boot (LB), heading (HD), and early dough (ED).
Bayleton applied at a rate of 153.6 g a.i./ha.
Dithane M45 applied at a rate of 2.25 kg a.i./ha.

TABLE 3. Wheat foliar fungicide treatments and subsequent yields and test weights of cv. Newton for plot 3, 1985

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)
No Fungicide			
	1	56.0	50.1
	2	46.2	50.8
	3	49.8	50.5
	4	40.4	50.6
Bayleton 25WP (ED)			
	1	46.5	50.6
	2	47.1	52.2
	3	45.3	50.7
	4	50.2	54.7
Bayleton 25WP (HD)			
	1	53.1	54.9
	2	57.8	55.7
	3	57.8	54.8
	4	61.0	56.2
Bayleton 5G (LB) + Bayleton 25WP (HD)	1	49.1	56.2
	2	51.8	56.2
	3	54.3	54.1
	4	58.4	56.8
Bayleton 5G (LB)			
	1	58.1	56.7
	2	56.5	57.4
	3	57.3	56.8
	4	59.1	56.5
Dithane M45 (ED+HD)			
	1	58.2	56.8
	2	48.7	54.8
	3	46.7	54.6
	4	55.1	55.7

[a]Fungicides applied at late boot (LB), heading (HD), and early dough (ED).
Bayleton applied at a rate of 153.6 g a.i./ha.
Dithane M45 applied at a rate of 2.25 kg a.i./ha.

TABLE 4. Wheat foliar fungicide treatments and subsequent yields, test weights, and 1000-kernel weights in plot 1 of cv. Arkan, 1986

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)	1000-Kernel (g)
No Fungicide				
LJ1	1	65.5	58.6	28.8
	2	51.2	55.8	32.0
	3	.[b]	.	.
	4	49.4	55.4	31.1
	5	.	.	.
LB1	1	48.5	58.7	33.3
	2	.	.	.
	3	52.5	55.3	28.9
	4	.	.	.
	5	65.1	54.3	.
HA1	1	49.8	56.7	31.9
	2	66.0	58.3	33.6
	3	65.0	56.5	27.4
	4	49.5	58.6	24.5
	5	54.6	52.4	.
ED	1	41.8	57.5	32.0
	2	63.5	59.1	33.0
	3	51.6	59.7	31.1
	4	58.7	56.3	31.0
	5	44.5	51.5	.
Bayleton (ED)				
LJ3	1	59.0	58.9	33.2
	2	58.7	57.8	31.3
	3	70.8	57.5	32.4
	4	53.2	57.1	21.1
	5	.	.	.
LB3	1	34.8	56.6	28.1
	2	51.5	57.9	33.7
	3	53.7	58.5	30.9
	4	48.5	58.7	33.3
	5	37.5	51.9	.
HA2	1	.	.	.
	2	57.8	57.8	30.7
	3	52.6	58.8	32.4
	4	67.3	59.0	32.6
	5	44.6	54.0	.

Table 4. (Cont.)

Treatment	Rep	Yield (bu/a)	Test Wt (lbs/bu)	1000-Kernel (g)
Bayleton (HD)				
NO INOC	1	37.3	54.3	32.1
	2	.	.	.
	3	50.2	57.0	33.2
	4	67.6	58.5	26.2
	5	62.4	54.4	.
LJ2	1	52.7	59.5	31.2
	2	79.0	57.9	34.0
	3	65.4	57.7	33.2
	4	48.1	57.9	27.7
	5	49.4	51.9	.
LB2	1	.	.	.
	2	70.0	58.6	34.3
	3	50.9	59.2	34.7
	4	61.2	58.8	23.9
	5	48.0	54.4	.
Bayleton (HD) + Dithane M45	1	54.6	58.9	33.0
	2	69.3	59.2	33.5
	3	.	.	.
	4	.	.	.
	5	56.3	53.2	.
Dithane M45	1	67.6	59.3	34.9
	2	52.6	59.3	34.5
	3	56.9	58.2	34.8
	4	58.7	58.6	30.4
	5	50.7	53.6	.

[a]Bayleton 25WP applied at early dough (ED) and heading (HD) at a rate of 230.5 g a.i./ha.
Dithane M45 in combination with Bayleton was applied at weekly intervals for 3 weeks following application of Bayleton at heading at a rate of 2.25 kg a.i./ha.
Treatment of Dithane M45 alone was applied at weekly intervals beginning at heading and continuing until early dough at a rate of 2.25 kg a.i./ha.
[b]Missing data points indicated by ".".

TABLE 5. Wheat foliar fungicide treatments and subsequent yields, test weights, and 1000-kernel weights in plot 1 of cv. Newton, 1986

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)	1000-Kernel (g)
No Fungicide				
LJ1	1	33.0	52.8	25.0
	2	19.3	43.4	16.2
	3	25.2	47.2	19.2
	4	24.3	47.0	18.6
	5	28.0	49.2	.
LB1	1	27.8	50.3	20.5
	2	16.5	44.7	17.2
	3	24.5	44.7	16.9
	4	.[b]	.	.
	5	21.5	45.1	.
HA1	1	27.5	48.1	21.2
	2	.	.	.
	3	23.9	50.5	19.5
	4	28.1	48.9	19.7
	5	24.9	44.7	.
ED	1	30.0	50.5	23.2
	2	25.0	47.2	20.0
	3	28.4	44.4	.
	4	27.1	50.3	20.8
	5	.	.	.
Bayleton (ED)				
LJ3	1	37.0	51.8	24.3
	2	27.2	50.3	21.5
	3	28.8	48.6	21.4
	4	23.5	48.0	20.7
	5	32.0	49.4	.
LB3	1	37.6	53.1	25.3
	2	.	.	.
	3	28.7	46.7	18.5
	4	35.3	49.7	20.8
	5	27.3	51.7	.
HA2	1	38.2	53.5	23.7
	2	29.7	47.7	19.1
	3	23.1	46.8	18.5
	4	30.9	49.1	21.1
	5	35.6	48.8	.

TABLE 5. (Cont.)

Treatment	Rep	Yield (bu/a)	Test Wt (lbs/bu)	1000-Kernel (g)
Bayleton (HD)				
NO INOC	1	35.3	56.2	28.8
	2	31.5	56.2	27.0
	3	.	.	.
	4	38.6	51.6	23.9
	5	33.7	53.1	.
LJ2	1	.	.	.
	2	35.2	51.3	21.9
	3	.	.	.
	4	30.4	49.9	20.3
	5	.	.	.
LB2	1	52.5	55.8	29.5
	2	38.3	51.7	22.5
	3	33.6	51.5	20.5
	4	.	.	.
	5	35.5	55.8	.
Bayleton (HD) + Dithane M45	1	57.1	55.6	31.1
	2	30.5	53.9	24.2
	3	36.2	50.3	21.4
	4	39.0	48.1	21.4
	5	27.3	45.0	.
Dithane M45	1	.	.	.
	2	31.4	53.2	21.7
	3	30.3	48.7	19.5
	4	27.0	50.1	21.6
	5	24.9	48.6	.

[a] Bayleton 25WP applied at early dough (ED) and heading (HD) at a rate of 230.5 g a.i./ha.
Dithane M45 in combination with Bayleton was applied at weekly intervals for 3 weeks following application of Bayleton at heading at a rate of 2.25 kg a.i./ha.
Treatment of Dithane M45 alone was applied at weekly intervals beginning at heading and continuing until early dough at a rate of 2.25 kg a.i./ha.

[b] Missing data points indicated by ".".

TABLE 6. Wheat foliar fungicide treatments and subsequent yields, test weights, and 1000-kernel weights in plot 2 of Newton and Arkan, 1986

Treatment[a]	Rep	Yield (bu/a)	Test Wt (lbs/bu)	1000-Kernel (g)
Newton				
No Fungicide				
LJ1	1	46.7	55.5	23.1
	2	42.2	53.8	21.6
LB1	1	44.3	55.0	21.5
	2	38.2	52.9	20.3
ED	1	43.3	57.4	24.9
	2	41.8	53.4	20.5
Bayleton (ED)				
LJ3	1	53.2	58.5	26.1
	2	48.9	55.8	23.3
LB3	1	55.4	57.7	26.2
	2	50.2	58.9	27.4
Bayleton (HD)				
LJ2	1	51.1	56.8	23.9
	2	53.9	59.2	28.5
LB2	1	56.4	57.2	24.8
	2	55.0	60.1	28.3
Bayleton (HD) +				
Dithane M45	1	60.7	58.0	24.8
	2	65.9	59.4	28.4
Arkan				
No Fungicide				
LJ1	1	59.6	57.2	30.5
LB1	1	59.5	57.5	30.2
ED	1	59.0	58.2	28.2
Bayleton (ED)				
LJ3	1	57.5	58.1	28.3
LB3	1	64.5	58.0	28.3
Bayleton (HD)				
LJ2	1	70.9	57.7	30.8
LB2	1	61.9	57.7	30.8
Bayleton (HD) +				
Dithane M45	1	71.1	57.0	30.5

[a] Bayleton 25WP applied at early dough (ED) and heading (HD) at a rate of 230.5 g a.i./ha.
Dithane M45 in combination with Bayleton was applied at weekly intervals for 3 weeks following the application of Bayleton at heading at a rate of 2.25 kg a.i./ha.

TABLE 7. Leaf rust severities of Arkan for plot 1, 1986[y]

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27	6-3
No Fungicide							
LJ1	0	0	1	5	5	20	30
	0	0	0	2	2	20	40
	.[z]	.	.	.	.	.	.
	0	0	0	1	2	15	30
	.	.	.	.	.	.	.
LB1	0	0	0	1	2	10	20
	.	.	.	.	.	.	.
	0	0	0	1	2	10	20
	.	.	.	.	.	.	.
	0	0	0	0	2	10	20
HA1	0	0	0	1	2	5	20
	0	0	0	2	2	10	20
	0	0	0	2	2	10	20
	0	0	0	1	2	10	20
	0	0	0	1	2	5	10
ED	0	0	0	1	2	2	10
	0	0	0	1	2	10	20
	0	0	0	1	2	10	20
	0	0	0	1	2	10	10
	0	0	0	1	2	10	20
Bayleton (ED)							
LJ3	0	0	0	5	5	15	25
	0	0	0	1	2	10	20
	0	0	0	1	2	5	10
	0	0	0	1	2	5	10
	.	.	.	.	.	.	.
LB3	0	0	0	0	2	10	20
	0	0	0	2	2	10	25
	0	0	0	0	2	15	30
	0	0	0	1	5	15	30
	0	0	0	1	2	10	20
HA2	.	.	.	.	.	.	.
	0	0	0	1	5	15	25
	0	0	0	1	2	5	5
	0	0	0	1	2	10	20
	0	0	0	0	2	15	30

TABLE 7. (Cont.)

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27	6-3
Bayleton (HD)							
NO INOC	0	0	0	0	1	1	1
	.	.	.	.	.	.	.
	0	0	0	1	1	2	2
	0	0	0	1	2	2	2
	0	0	0	0	1	1	2
LJ2	0	0	0	0	0	1	1
	0	0	0	1	1	1	1
	0	0	0	1	2	2	2
	0	0	0	1	1	1	1
	0	0	0	1	2	2	2
LB2	.	.	.	.	.	.	.
	0	0	0	1	2	2	2
	0	0	0	0	1	5	5
	0	0	0	1	2	2	2
	0	0	0	1	2	2	2
Bayleton (HD) + Dithane M45	0	0	0	1	1	1	1
	0	0	0	1	1	1	2
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	0	0	0	1	2	2	2
Dithane M45	0	0	0	5	5	10	10
	0	0	0	0	1	10	10
	0	0	0	1	2	15	20
	0	0	0	1	2	10	20
	0	0	0	1	2	10	10

[y]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending June 3.
[z]Missing data points indicated by ".".

TABLE 8. Speckled leaf blotch severities of cv. Arkan for plot 1, 1986[y]

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27	6-3
No Fungicide							
LJ1	0	0	5	10	10	20	30
	0[z]	0	5	10	10	20	30
	.	.	.	.	.	.	.
	0	0	5	10	10	20	40
	.	.	.	.	.	.	.
LB1	0	0	5	10	10	20	30
	.	.	.	.	.	.	.
	0	0	5	10	10	15	30
	.	.	.	.	.	.	.
	0	0	2	5	5	20	40
HA1	0	0	5	10	10	15	30
	0	0	5	10	10	15	30
	0	0	5	10	10	20	30
	0	0	5	10	15	15	30
	0	0	5	10	10	15	30
ED	0	0	5	10	10	10	20
	0	0	5	10	10	20	30
	0	0	5	10	10	20	40
	0	0	5	10	10	20	30
	0	0	5	10	10	20	30
Bayleton (ED)							
LJ3	0	0	5	10	10	20	30
	0	0	5	10	10	20	30
	0	0	5	10	10	15	30
	0	0	5	10	10	10	30
	.	.	.	.	.	.	.
LB3	0	0	5	10	10	20	30
	0	0	5	10	10	20	30
	0	0	5	10	10	20	30
	0	0	5	10	10	20	40
	0	0	5	10	10	15	30
HA2	.	.	.	.	.	.	.
	0	0	5	10	10	20	30
	0	0	5	10	10	20	20
	0	0	5	10	10	15	30
	0	0	2	5	5	20	40

TABLE 8. (Cont.)

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27	6-3
Bayleton (HD)							
NO INOC	0	0	5	10	10	10	20
	.	.	.	.	.	.	.
	0	0	5	10	10	10	30
	0	0	5	10	10	10	20
	0	0	5	10	10	20	30
LJ2	0	0	5	10	10	15	20
	0	0	5	10	10	10	20
	0	0	5	10	10	10	30
	0	0	5	10	10	10	20
	0	0	5	10	10	10	20
LB2	.	.	.	.	.	.	.
	0	0	5	10	10	15	30
	0	0	5	10	10	10	30
	0	0	5	10	10	10	30
	0	0	0	2	5	20	30
Bayleton (HD) + Dithane M45	0	0	5	10	10	15	25
	0	0	5	10	10	10	20
	.	.	.	.	.	.	.
	.	.	.	.	.	.	.
	0	0	5	10	10	10	20
Dithane M45	0	0	5	10	10	20	30
	0	0	5	10	10	15	30
	0	0	5	10	10	20	30
	0	0	5	10	10	20	30
	0	0	5	10	10	15	30

[3]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending June 3.
[4]Missing data indicated by ".".

TABLE 9. Leaf rust severities of Newton for plot 1, 1986[y]

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27
No Fungicide						
LJ1	0	2	5	30	30	80
	0	2	5	50	60	90
	0	2	5	50	50	90
	0	2	5	50	50	90
	0	1	2	30	40	80
LB1	0	0	2	30	40	90
	0	1	5	30	40	90
	0[z]	1	5	30	40	90
	.	.	.	.	.	.
	0	0	2	30	40	80
HA1	0	2	5	30	30	80
	.	.	.	.	.	.
	0	2	5	30	30	90
	0	2	5	50	50	90
	0	2	5	30	40	90
ED	0	2	5	30	30	80
	0	2	5	50	60	80
	0	2	5	50	50	90
	0	2	5	30	40	80
	.	.	.	.	.	.
Bayleton (ED)						
LJ3	0	2	5	30	40	90
	0	2	5	30	40	90
	0	2	5	50	60	90
	0	2	5	40	50	90
	0	2	5	50	50	90
LB3	0	2	5	30	40	90
	.	.	.	.	.	.
	0	2	5	60	60	80
	0	2	5	50	50	90
	0	2	5	40	50	90
HA2	0	2	5	30	30	80
	0	2	5	50	50	80
	0	2	5	50	60	90
	0	2	5	40	50	90
	0	2	5	30	40	90

TABLE 9. (Cont.)

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27
Bayleton (HD)						
NO INOC	0	1	2	10	20	40
	0	1	2	25	30	40
	.	.	.	.	.	.
	0	1	2	30	30	40
	0	1	2	30	40	50
LJ2	.	.	.	.	.	.
	0	0	2	30	40	50
	.	.	.	.	.	.
	0	1	5	30	40	60
	.	.	.	.	.	.
LB2	0	1	2	10	20	40
	0	2	5	30	30	60
	0	1	2	30	40	50
	.	.	.	.	.	.
	0	1	2	25	30	30
Bayleton (HD) + Dithane M45	0	2	5	10	20	30
	0	2	2	30	30	50
	0	2	5	30	30	50
	0	2	5	30	30	50
	0	2	2	25	30	40
Dithane M45	.	.	.	.	.	.
	0	2	5	30	40	70
	0	2	5	50	60	80
	0	2	5	50	50	70
	0	2	5	40	50	90

[y]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending May 27.
[z]Missing data points indicated by ".".

TABLE 10. Speckled leaf blotch severities of Newton for plot 1, 1986[y]

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27
No Fungicide						
LJ1	0	2	10	20	25	30
	0	5	10	25	25	30
	0	5	10	20	20	30
	0	5	10	25	25	30
	0	5	10	20	20	20
LB1	0	2	10	20	25	30
	0	5	10	20	25	30
	0	5	10	20	20	30
	.[z]	.	.	.	.	.
	0	2	10	20	25	30
HA1	0	2	10	20	25	30
	.	.	.	.	.	.
	0	2	10	20	20	25
	0	5	10	25	25	30
	0	5	10	25	25	25
ED	0	2	10	20	25	30
	0	5	10	25	25	30
	0	2	10	20	25	30
	0	5	10	25	25	30
	.	.	.	.	.	.
Bayleton (ED)						
LJ3	0	2	10	20	25	30
	0	2	10	20	20	30
	0	5	10	25	25	30
	0	5	10	20	20	30
	0	2	10	25	25	25
LB3	0	2	10	20	20	30
	.	.	.	.	.	.
	0	2	10	20	25	30
	0	5	10	25	25	30
	0	2	10	20	25	25
HA2	0	2	10	20	20	30
	0	2	10	20	20	30
	0	2	10	20	20	30
	0	2	10	20	20	25

TABLE 10. (Cont.)

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27
Bayleton (HD)						
NO INOC	0	2	10	20	20	25
	0	2	10	20	20	25
	.	.	.	.	.	.
	0	2	10	25	25	30
	0	2	10	20	20	25
LJ2	.	.	.	.	.	.
	0	2	10	20	25	25
	.	.	.	.	.	.
	0	5	10	20	20	30
	.	.	.	.	.	.
LB2	0	2	10	20	20	25
	0	2	10	20	25	25
	0	5	10	20	20	25
	.	.	.	.	.	.
	0	2	10	25	25	30
Bayleton (HD) + Dithane M45	0	2	10	20	20	25
	0	2	10	20	25	25
	0	2	10	20	25	30
	0	2	10	20	25	25
	0	2	10	25	25	25
Dithane M45	.	.	.	.	.	.
	0	2	10	20	25	30
	0	2	10	20	20	30
	0	2	10	25	25	30
	0	2	10	20	25	25

[y]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending May 27.
[z]Missing data points indicated by ".".

TABLE 11. Tan spot severities of Newton for plot 1, 1986[y]

Treatment	Date					
	4-21	4-28	5-5	5-12	5-20	5-27
No Fungicide						
LJ1	0	0	0	2	2	10
	0	0	1	5	5	10
	0	0	1	5	10	10
	0	0	1	5	5	10
	0	0	1	5	5	5
LB1	0	0	1	5	5	10
	0	0	1	5	10	10
	0	0	1	5	5	5
	.[z]	.	.	.	.	.
	0	0	1	5	5	10
HA1	0	0	1	5	5	10
	.	.	.	.	.	.
	0	0	1	5	5	5
	0	0	1	5	10	10
	0	0	1	5	5	5
ED	0	0	1	5	5	10
	0	0	1	5	5	10
	0	0	1	5	5	15
	0	0	1	5	5	5
	.	.	.	.	.	.
Bayleton (ED)						
LJ3	0	0	1	5	5	10
	0	0	1	5	5	15
	0	0	1	5	10	10
	0	0	1	5	5	10
	0	0	1	5	5	10
LB3	0	0	1	5	5	10
	.	.	.	.	.	.
	0	0	1	5	10	15
	0	0	1	5	10	10
	0	0	1	5	5	10
HA2	0	0	1	5	5	5
	0	0	1	5	10	10
	0	0	1	5	10	10
	0	0	1	5	5	10
	0	0	1	5	10	10

TABLE 11. (Cont.)

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27
Bayleton (HD)						
NO INOC	0	0	1	5	5	5
	0	0	1	5	5	5
	.	.	.	.	.	.
	0	0	1	5	10	10
	0	0	1	5	5	5
LJ2	.	.	.	.	.	.
	0	0	1	5	5	5
	.	.	.	.	.	.
	0	0	1	5	5	5
	.	.	.	.	.	.
LB2	0	0	1	5	5	5
	0	0	1	5	5	5
	0	0	1	5	5	5
	.	.	.	.	.	.
	0	0	1	5	10	10
Bayleton (HD) + Dithane M45	0	0	1	5	5	5
	0	0	1	5	10	10
	0	0	1	5	10	15
	0	0	1	5	5	5
	0	0	1	5	15	15
Dithane M45	.	.	.	.	.	.
	0	0	1	5	5	10
	0	0	1	5	10	10
	0	0	1	5	5	10
	0	0	1	5	5	10

[Y]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending May 27.
[Z]Missing data points indicated by ".".

TABLE 12. Leaf rust severities of Newton for plot 2, 1986[a]

Treatment		Date 4-21	4-28	5-5	5-12	5-20	5-27
No Fungicide							
LJ1	1	5	10	30	40	70
	2	10	20	30	50	80
LB1	1	5	10	20	40	90
	2	10	20	30	40	90
ED	1	5	10	20	30	70
	2	10	20	30	40	90
Bayleton (ED)							
LJ3	1	5	10	20	30	80
	2	10	20	30	40	90
LB3	2	10	25	40	50	80
	1	5	10	20	40	60
Bayleton (HD)							
LJ2	1	5	10	20	30	40
	1	5	10	20	25	25
LB2	1	5	10	25	40	50
	1	5	10	20	30	30
Bayleton (HD) + Dithane M45							
	1	5	10	20	30	50
	1	5	10	20	30	30

[a]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending May 27.

TABLE 13. Speckled leaf blotch severities of Newton for plot 2, 1986[z]

Treatment		Date 4-21	4-28	5-5	5-12	5-20	5-27
No Fungicide							
	LJ1	1	5	5	10	20	40
		2	10	10	20	25	30
	LB1	2	10	10	20	25	40
		2	10	10	20	25	30
	ED	2	10	10	20	25	30
		2	10	10	20	25	30
Bayleton (ED)							
	LJ3	2	10	10	20	25	30
		2	10	10	20	25	30
	LB3	2	10	10	25	25	40
		2	10	10	20	25	40
Bayleton (HD)							
	LJ2	1	5	5	20	25	30
		1	5	5	10	20	30
	LB2	2	10	10	20	20	30
		2	10	10	20	25	25
Bayleton (HD) + Dithane M45							
		2	10	10	20	25	30
		0	5	5	20	25	40

[z]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending May 27.

TABLE 14. Leaf rust and speckled leaf blotch severities of Arkan for plot 2, 1986[a]

Treatment	Date 4-21	4-28	5-5	5-12	5-20	5-27	6-3
Leaf rust							
No Fungicide							
LJ1	0	0	0	0	2	5	10
LB1	0	0	0	0	2	10	20
ED	0	0	0	0	5	25	30
Bayleton (ED)							
LJ3	0	0	0	0	5	20	30
LB3	0	0	0	0	2	30	40
Bayleton (HD)							
LJ2	0	0	0	0	2	2	5
LB2	0	0	0	0	1	1	2
Bayleton (HD) + Dithane M45	0	0	0	0	2	5	5
Leaf blotch							
No Fungicide							
LJ1	0	0	5	10	10	15	30
LB1	0	0	2	5	10	25	30
ED	0	0	5	10	10	25	30
Bayleton (ED)							
LJ3	0	0	5	5	10	25	30
LB3	0	0	5	10	10	25	30
Bayleton (HD)							
LJ2	0	0	5	10	10	15	25
LB2	0	0	5	10	10	15	30
Bayleton (HD) + Dithane M45	0	0	2	5	10	25	30

[a]Severities were taken using the modified Cobb and James scales and were recorded weekly beginning April 21 and ending June 3.

TABLE 15. Infrared readings of Arkan for plot 1, 1986[y]

Treatment	LB	HD	ED	Treatment	LB	HD	ED
LJ1	-1.3	-5.2	3.8	HA1	-1.9	-4.5	2.0
	-1.9	-5.1	3.0		-2.4	-5.0	2.2
	.[z]	.	.		-2.1	-4.4	0.7
	-3.2	-3.9	1.1		-3.1	-4.0	0.3
	.	.	.		-4.1	-3.5	0.8
LJ2	-1.3	-4.6	1.1	HA2	.	.	.
	-2.5	-4.4	0.2		-3.1	-4.7	1.1
	-3.0	-4.1	-0.4		-2.1	-3.9	1.1
	-1.9	-3.5	0.3		-3.2	-3.9	-0.3
	-3.6	-3.6	0.3		-3.9	-4.8	0.7
LJ3	-0.4	-4.8	2.0	ED	-1.3	-4.4	2.8
	-2.4	-5.2	1.0		-2.6	-4.4	1.9
	-2.7	-4.0	0.6		-1.6	-4.2	1.0
	-2.7	-4.1	-0.7		-1.3	-3.4	0.2
	.	.	.		-3.4	-3.7	1.2
LB1	-0.8	-5.0	3.0	NO INOC	-1.0	-4.8	-1.2
	.	.	.		.	.	.
	-2.3	-4.6	1.0		-3.0	-4.0	0.7
	.	.	.		-1.8	-4.1	-0.9
	-3.3	-3.8	0.9		-3.9	-3.9	-0.3
LB2	.	.	.	BAY + M45	-0.2	-4.5	-1.2
	-2.4	-5.4	-0.2		-2.9	-4.9	0.3
	-2.3	-4.0	1.3		.	.	.
	-3.1	-3.9	-0.8		.	.	.
	-4.0	-3.4	0.2		-3.6	-3.8	-0.4
LB3	-0.7	-4.8	2.2	M45	-0.7	-4.8	-0.5
	-2.0	-4.7	3.1		-2.0	-5.0	2.0
	-2.7	-4.1	0.6		-2.6	-4.5	-0.4
	-2.5	-4.1	-0.7		-3.4	-4.0	-0.5
	-3.9	-3.7	1.1		-3.9	-3.5	0.4

[y]Infrared readings taken at late boot (LB), heading (HD) and early dough (ED).
[z]Missing data points indicated by ".".

TABLE 16. Infrared readings of Newton for plot 1, 1986[y]

Treatment	LB	HD	ED	Treatment	LB	HD	ED
LJ1	-3.8	-3.3	0.5	HA1	-3.6	-4.0	0.3
	-3.1	-3.3	0.5		.[z]	.	.
	-3.7	-3.7	0.6		-2.4	-3.2	1.2
	-3.6	-3.5	0.7		-3.3	-3.6	0.4
	-3.4	-3.4	1.0		-3.5	-3.3	0.7
LJ2	.	.	.	HA2	-3.5	-3.7	0.8
	-2.6	-3.9	0.9		-4.5	-4.7	0.5
	.	.	.		-2.0	-3.8	-0.5
	-3.1	-3.7	0.2		-2.6	-3.8	0.6
	.	.	.		-3.5	-3.3	0.3
LJ3	-3.8	-4.1	0.4	ED	-3.8	-3.5	1.3
	-4.6	-4.1	0.8		-4.3	-4.2	0.2
	-3.9	-3.6	1.4		-3.5	-3.5	0.9
	-1.8	-3.6	0.8		-3.0	-3.7	0.9
	-2.4	-3.3	0.8		.	.	.
LB1	-4.5	-3.9	1.7	NO INOC	-3.9	-3.4	-0.3
	-4.1	-3.9	0.6		-4.6	-3.6	-0.3
	-2.7	-3.7	0.8		.	.	.
	.	.	.		-3.4	-3.4	0.8
	-2.9	-3.1	0.2		-4.4	-3.4	-1.0
LB2	-4.1	-3.6	-0.6	BAY + M45	-4.6	-3.6	-1.0
	-3.4	-4.4	0.5		-4.4	-3.8	-0.4
	-3.2	-3.7	1.4		-2.8	-3.5	0.5
	.	.	.		-3.2	-3.6	-0.2
	-3.0	-3.2	-0.3		-2.6	-3.3	-1.2
LB3	-4.2	-3.2	1.5	M45	.	.	.
	.	.	.		-4.7	-3.6	0.2
	-3.2	-3.3	0.1		-3.7	-3.7	-0.3
	-2.6	-3.2	1.2		-3.3	-3.4	-1.0
	-2.1	-3.3	0.4		-3.5	-3.1	-0.1

[y]Infrared readings were taken at late boot (LB), heading (HD) and early dough (ED).
[z]Missing data point indicated by ".".

TABLE 17. Infrared readings of Arkan and Newton for plot 2, 1986[a]

Treatment	ARKAN			NEWTON		
	LB	HD	ED	LB	HD	ED
LJ1	-0.2	-2.9	0.4	-0.6	-2.6	1.2
				-0.4	-3.0	0.6
LJ2	-0.7	-3.1	0.1	-1.8	-3.0	-0.2
				-0.8	-3.2	1.1
LJ3	0.3	-3.5	1.2	-1.3	-3.2	-0.4
				-1.3	-3.3	-0.5
LB1	-0.5	-2.8	0.1	-1.7	-3.2	0.4
				-0.7	-3.0	1.7
LB2	-0.2	-3.0	0.9	-0.7	-3.5	-1.2
				-0.5	-3.7	0.6
LB3	-0.5	-3.3	0.6	-1.5	-3.9	2.8
				-0.8	-3.2	-1.3
ED	-0.6	-3.3	1.6	-1.2	-3.2	0.7
				-0.9	-3.4	0.2
BAY + M45	-0.5	-3.2	-0.6	-1.1	-3.6	-1.3
				-1.3	-3.3	-2.0

[a]Infrared reading taken at late boot (LB), heading (HD) and early dough (ED).

TABLE 18. Leaf rust severities on the flag leaf of cvs. Arkan and Newton for plot 1, 1986[a]

Treatment	Block 1	2	3	4	5
Arkan					
No fungicide	0	0	.[b]	0	.
	0	.	0	.	5
	0	0	0	0	1
	0	0	0	0	20
Bayleton (ED)	0	0	0	2	.
	0	0	0	0	2
	.	0	0	0	2
Bayleton (HD)	0	0	0	0	0
	.	0	0	0	0
	0	.	0	0	0
Bayleton (HD) + Dithane M45	0	0	.	.	0
	0	0	0	0	1
Newton					
No fungicide	70	90	80	80	80
	80	80	90	.	70
	70	.	90	80	90
	80	80	80	80	.
Bayleton (ED)	80	80	80	80	80
	80	.	90	90	80
	70	80	90	80	80
Bayleton (HD)	.	20	.	30	.
	10	20	30	.	20
	10	25	.	20	20
Bayleton (HD) + Dithane M45	10	20	30	30	20

[a] Severities listed here were recorded at early dough and rated using the modified Cobb and James scales.
[b] Missing data points indicated by ".".

TABLE 19. Leaf rust severities on flag leaf of cvs. Arkan and Newton for plot 2, 1986[a]

Treatment	Arkan	Newton	
No fungicide	0	70	80
	0	90	90
	0	70	80
Bayleton (ED)	0	80	80
	0	70	40
Bayleton (HD)	0	20	5
	0	20	5
Bayleton (HD) + Dithane M45	0	10	10

[a]Severities listed here were recorded at early dough and rated using the modified Cobb and James scales.

EFFECT OF TIMED FUNGICIDE SPRAYS ON CONTROL OF FOLIAR DISEASES AND SUBSEQUENT YIELD OF WINTER WHEAT IN KANSAS

by

MAURICE STACEY DANNENBERG

B.S., Kansas State University; Manhattan, Kansas, 1983

AN ABSTRACT OF A MASTER'S THESIS

Submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

ABSTRACT

In field experiments during 1985 and 1986, the effect of time of application of Bayleton foliar sprays on the control of naturally occurring foliar pathogens of winter wheat (Triticum aestivum L.) was studied. Puccinia recondita tritici (causal fungus of leaf rust) reached severe epidemic levels and was the primary pathogen in both years of study. The fungal leaf spots, Mycosphaerella graminicola (causal fungus of speckled leaf blotch) and Pyrenophora tritici-repentis (causal fungus of tan spot) also were observed in 1985 and 1986 but at much lower levels than leaf rust. Single sprays of Bayleton at early dough and at heading resulted in yield increases of 15% and 32%, respectively, in 1985 for the cv. Newton. In 1986, a yield increase of 24% was obtained with the early dough treatment and one of 39% with the application at heading. Yield increases for the cv. Arkan were less, with the early dough treatment producing a 3% increase and the heading treatment 11%.