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A series of experiments were conducted from 1983 to 1985 to determine the effects of dinoseb [2-(1-methylpropyl)-4,6-dinitrophenol] on winter wheat (Triticum aestivum L. em Thell) yields. Field trials on dinoseb timing and dinoseb plus supplemental pesticides were established in an effort to elucidate the possible factors involved in the yield response of the crop to the herbicide, under weed-free conditions. During the first year (1983-1984), dinoseb (1.7 kg/ha) was applied at several growth stages, from 1 leaf to early booting, to September- and October-planted Yamhill wheat and late October-planted Stephens wheat. Higher yields were obtained in late-planted wheat because of reduced disease attack. The main diseases present during this cropping season were: leaf blotch (Septoria tritici Rob. in Desm.), stripe rust (Puccinia striiformis West.), eyespot foot rot (Pseudocercosporella herpotrichoides (Fron) Dei.), and glume blotch (Septoria nodorum (Berk.) Berk.). Early dinoseb applications increased grain yields and prevented or lowered foliar disease attack. Late applications (after the first node stage) decreased yields, probably because of phytotoxicity. However, the general crop response to application times was erratic. Experiments involving supplemental

pesticides included, in addition to dinoseb, a) preplant fumigation with 50 g/m^2 methyl bromide (bromomethane), b) 2.25 kg/ha phorate {O,O-diethyl S-[(ethylthio)methyl] phosphorodithioate} preplant incorporated, c) 1.12 kg/ha benomyl {methyl 1-[(butylamino)carbonyl]-1H-benzimidazol-2-ylcarbamate} applied in February, 1984, and d) repeat applications of 0.12 kg/ha propiconazole {1-[2-(2,4-dichlorophenyl)4-propyl-1,3-dioxolan-2-ylmethyl]-1-H-1,2,4-triazole} at flag leaf emergence and at heading. Dinoseb increased grain yields and reduced foliar disease infection. December-applied dinoseb plus propiconazole gave the highest yields as a result of effective disease control. Methyl bromide drastically reduced yield, regardless of dinoseb application, because of lodging. Methyl bromide increased plant height and tiller number, and decreased tiller weight. It also increased eyespot attack. Benomyl was the only pesticide that reduced eyespot incidence. Phorate did not affect any of the variables studied.

In the second year (1984-1985) experiments on dinoseb timing, dinoseb decreased foliar disease infection (primarily leaf blotch) in most cases, when applied to October-planted Stephens wheat, and yield increases were obtained with earlier applications as in the previous year. Supplemental-fungicide experiments included a) benomyl, b) propiconazole (single application when flag leaf was just visible), and c) repeat applications of 1.12 kg/ha chlorothalonil (2,4,5,6-tetrachloro-1,3-benzenedicarbonitrile) at 99% flag leaf emergence and 99% head emergence. Dinoseb application did not affect grain yield and slightly reduced foliar disease, in the absence of fungicides. Benomyl increased yield because of improved disease control. Propiconazole was less effective than in the previous year, and chlorothalonil did not influence any of the variables studied.

NON-HERBICIDAL EFFECTS OF DINOSEB ON WINTER WHEAT YIELDS

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Non-herbicidal Effects of Dinoseb on Winter Wheat Yields.

INTRODUCTION

Dinoseb is one of the oldest herbicides still in commercial use. It is used in wheat production in Western Oregon to control broadleaf weeds, especially bedstraw (*Galium* spp.) and speedwell (*Veronica* spp.), which are tolerant to diuron [*N*'-(3,4-dichlorophenyl)-*N*,*N*-dimethylurea], the most widely used herbicide in this crop. In recent years, research conducted by Oregon State University workers has indicated that wheat treated with dinoseb sometimes yields more, even in weed-free plots, and that such response could be the result of fungicidal effects of this herbicide[1].

Several reports in the literature indicate the existence of interactions between herbicides and plant diseases (1, 10, 12, 20, 41). These interactions may increase disease attack by different mechanisms. Herbicides might have stimulatory effects on the pathogen, increase their virulence, increase the susceptibility of the host, and inhibit microflora competing with potential pathogens. Application of herbicides can also reduce plant disease. Several mechanisms have been proposed to explain this effect. They include a decrease in the pathogen population as a result of suppressed formation of propagation or reproduction units (37, 40), physiological disturbances, and direct

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[1]Crop Science Dept. 1981, 1983. Weed Control Annual Reports, Corvallis, OR.

general toxicity to the pathogen. The decrease in disease infection can also be explained in terms of increased host tolerance[2], and stimulation of antagonists which suppress pathogen populations. Changes in humidity, air flow, or air temperature resulting from the elimination of weeds can play an important role in the reduction of disease incidence and severity after the application of herbicides (1, 20)

Huber and co-workers (15), for example, found that diuron consistently reduced the incidence and severity of foot rot of winter wheat. They suggested that this herbicide could stimulate specific soil organisms that affect pathogenicity, or that its beneficial effect could be due to increased host resistance. They also proposed that elimination of weed competition and improved aeration could account for some of these effects (16).

Studies conducted by Bruinsma (6) showed that the application of DNOC (4,6-dinitro-*o*-cresol), a compound closely related to dinoseb, to young winter rye (*Secale cereale* L.) plants increased grain yield about 10%, even in the absence of weed competition. The author suggested that the yield increase was due to a more vigorous root system and stronger shoot growth, together with a longer period of development (6, 7).

Dinoseb has shown activity against organisms other than weeds.

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[2]R. M. Geddens, Ph.D Thesis, 1985. Oregon State Univ., Corvallis, OR.

Dinoseb suppressed root rot caused by *Aphanomyces euteiches* Drechs. and other fungal pathogens in peas (*Pisum sativum* L.) when applied preemergence (19, 33). Similar results have been obtained in beans (*Phaseolus vulgaris* L.) against root and hypocotyl rots, resulting in yield increases (11). Porter and Rud (28) reported reduced severity of Sclerotinia blight (*Sclerotinia minor* Jagger) of peanuts (*Arachis hypogaea* L.) and increased yields after postemergence applications of dinoseb. This herbicide also has been found to be toxic to several insect and spider pests of various crops, including cotton (23, 25, 35), tobacco (27), and peas (36). It reduces aphid (*Macrosiphum avenae* F.) reproduction under laboratory and field conditions (14, 30). Hinz and Daebeler (14) speculate that this effect could be related to changes in the amino acid metabolism of the plant. Dinoseb also affects natural-enemy populations (25, 36). These properties indicate that dinoseb could be considered as a general biocide.

Several studies have been conducted in corn to study the effect of low rates of dinoseb on corn yields (13, 26). Results indicated that dinoseb (7 to 15 g/ha) applied two to three weeks before tassel emergence increased corn yields 5 to 10% (13, 38). Some of the hypotheses that have been proposed to explain yield increases in corn include: a) earlier silking which provides a longer period for kernel fill, b) increased number of kernels per unit area, c) reduced number of barren ears, and d) reduced severity of fungal diseases (13, 31). In some cases, however, negative results or no effect of dinoseb application have been obtained (2, 4, 18, 32). Johnson et al. (18)

suggest that similar rates of dinoseb can produce both yield increases and decreases, depending upon genotype and environment.

This research was undertaken to study the yield response of winter wheat to herbicidal rates of dinoseb under weed-free conditions. Wheat growth and pest development, especially foliar diseases, were monitored. Different supplemental pesticides were also included in an effort to elucidate the possible factors involved in the yield response of winter wheat to dinoseb.

MATERIALS AND METHODS

Three experiments in 1983 and two experiments in 1984 were established at the Hyslop Research Farm, Corvallis, Oregon. All the experiments were on a Woodburn silt loam (fine-silt, mixed, mesic Aquultic Argixeroll). This soil has a mechanical analysis of 9% sand, 70% silt, and 21% clay in the Ap horizon (0-18 cm). This horizon has an organic matter content of approximately 3%, a pH of 5.4, and a cation exchange capacity of about 15.5 meq/100 g.

Dinoseb Timing in Yamhill Wheat, 1983-1984. This experiment consisted of a split-plot arrangement with sowing dates as main plots and dinoseb application dates as subplots, with four replications. Yamhill winter wheat was planted at 100 kg/ha in 18-cm rows on September 14 and October 4, 1983. Plot size was 3.0 by 6.1 m. Diuron was applied broadcast at 1.8 kg/ha to all plots to eliminate weed control from dinoseb as a variable. Diuron applications were made on September 22 and October 6, 1983, to the first and second plantings, respectively. Single applications of dinoseb amine at 1.7 kg/ha were made at the following growth stages: 1 leaf, 2 to 3 leaves, 5 leaves (1 to 2 tillers), 4 tillers, 1 node, 3 nodes, and early booting. An untreated control was included for each seeding date. Application dates of dinoseb are shown in Table 1.

Herbicide treatments were applied with a bicycle-wheel plot sprayer with a 2.4-m boom equipped with 10 equally spaced 8002 nozzles, except the last two applications which were made with a knapsack CO_2-operated sprayer. Application volume was 230 l/ha.

Table 1. Dinoseb application dates for herbicide timing experiments (1983-1984).

Growth Stage	Sowing Date		
	Yamhill wheat		Stephens Wheat
	Sept. 14	Oct. 4	Oct. 17
Check	-	-	-
1 Leaf	Sept. 27	Oct. 18	Nov. 9
2-3 Leaves	Oct. 4	Oct. 28	Nov. 21
5 Leaves	Oct. 12	Nov. 8	Dec. 16
4 Tillers	Oct. 20	Nov. 21	Jan. 31
1 Node	Mar. 9	Mar. 26	Mar. 26
3 Nodes	Apr. 4	Apr. 12	Apr. 12
Early Booting	May 15	May 15	May 24

A broadcast herbicide application for wild oat (*Avena fatua* L.) control was made on March 1, 1984 with 1.12 kg/ha diclofop-methyl (methyl ester of 2-[4-(2,4-dichloro-phenoxy)phenoxy] propanoic acid). Plots were fertilized with 280 kg/ha urea on March 6, 1984.

Several types of evaluations were made to assess the effects of dinoseb treatments. Aphid (*M. avenae* F. and *Rhopalosiphum padi* L.)

counts were made on November 18 to 20, 1983, but no differences among dinoseb treatments were found. Samples were taken on February 18, 1984 to determine the presence of barley yellow dwarf virus (BYDV). Serological tests failed to detect the virus from these samples. The main foliar diseases present were leaf blotch and stripe rust. Because of the difficulty in making separate quantitative assessments, no differentiation between them was made for evaluation purposes, and assessments were based on the percentage of foliar tissue infected. Disease assessment was performed by taking samples of 10 tillers at random from each half of the plots, and assigning percentages of infection to the head, flag leaf, and the leaf below the flag leaf, according to the method proposed by James (17). Lodging, primarily due to eyespot, was also visually evaluated. These evaluations were made on June 19 to 25, 1984. Eyespot attack was evaluated on July 2, 1984. Plots were harvested on August 2, 1984 with a small-plot combine. Grain was cleaned and weighed. Yields were calculated and 1000-kernel weights were obtained.

Dinoseb Timing in Stephens Wheat, 1983-1984. This experiment included the same dinoseb treatments used in the previous experiment (Table 1). Stephens wheat was planted on October 17, 1983, and diuron was applied on the same date. Cultural practices, application techniques, evaluations, and harvesting date were identical to the first experiment.

Dinoseb and Supplemental Pesticides, 1983-1984. The experiment consisted of a split-block arrangement with dinoseb (1.7.kg/ha) treatments as main plots and supplemental pesticides as subplots. A complete randomized block design with six replications was used. Yamhill wheat was planted on October 4, 1983. The entire experimental area was sprayed with diuron (1.8 kg/ha) on October 6, 1983, for weed control . Main plot treatments included an untreated check, and dinoseb applied either on November 21 or December 16, 1983. The supplemental pesticide treatments included: a) preplant fumigation with 50 g/m^2 methyl bromide, b) 2.25 kg/ha phorate preplant incorporated, c) 1.12 kg/ha benomyl applied February 29, 1984, and d) repeat applications of 0.12 kg/ha propiconazole (CGA-64250) at flag leaf emergence (April 28, 1984) and at heading (May 24, 1984). Trade name and formulation of the pesticides used in all experiments are given in Appendix Table 1.

Plot size, application procedures, and cultural practices were similar to those of the previous experiments, including the application of diclofop-methyl for wild oat control. Aphid counts were made on November 18, 1983, showing no differences among treatments. Foliar samples for serological determination of BYDV were taken on February 21, 1984, but no viruses were found. The same disease complex was present in this experiment, that is, leaf blotch, stripe rust, and eyespot. Fresh weight samples were collected on May 17, 1984. Two subsamples of 0.25 m of row were obtained from each plot. Plants were cut at ground level. Fresh weight, tiller number, and plant height were determined, as well as visual assessments for disease-infected foliar tissue. Aphids were counted on two tillers chosen at random from each subsample, but no differences were found. Visual evaluations of lodging were made on June 12 and June 29, 1984. On the later date, disease attack to the head, flag leaf, and the leaf below the flag leaf was evaluated as before. Samples for eyespot assessment were taken July 5, 1984. Plots were harvested July 31, 1984.

1984-1985 Experiments.

The experiments carried out in 1984 to 1985 included another dinoseb timing experiment and a dinoseb plus supplemental fungicides study. Soil preparation, general agronomic practices, and application procedures were identical to those of the experiments of the previous year. Diclofop-methyl (1.12 kg/ha) was applied to the entire experimental area on February 20, 1985. A fertilizer application of 392 kg/ha of 40-0-0-6 was made on March 1, 1985. Plot size was increased to 3.0 by 7.3 m. The most important disease in these experiments was leaf blotch.

Time of Dinoseb Application, 1984-1985. An experiment using a split-plot arrangement of treatments with sowing dates as main plots and dinoseb treatments as subplots was established on a randomized block design with four replications. Stephens wheat was planted on September 27 and October 23, 1984. Fluorochloridone {3-chloro-4-(chloromethyl)-1-[3-(trifluoromethyl)phenyl]-2-pyrrolidinone} at 0.56 kg/ha was applied for weed control to the first and second plantings on October 5 and October 25, 1984, respectively. Dinoseb treatments (1.7 kg/ha) started a month after crop emergence and continued at approximately 3-

week intervals until May, 1985. Dates of application are shown in Table 2.

Table 2. Dates of application of dinoseb to early- and late-planted Stephens wheat (1984-1985).

Application Date	Growth Stage	
	First Planting	Second Planting
Check	-	-
Oct. 30	3 Leaves	-
Nov. 30	2-3 Tillers	2-3 Leaves
Dec. 20	3-4 Tillers	1 Tiller
Jan. 12	5 Tillers	1-2 Tillers
Feb. 4	5-7 Tillers	2 Tillers
Feb. 26	8-9 Tillers	3-4 Tillers
Mar. 25	10 Tillers	6-7 Tillers
Apr. 11	1 Node	1 Node
May 2	Flag leaf	Flag Leaf
May 23	-	Heading

Two evaluations were carried out on April 30 and June 12, 1985. A 30-cm row segment was harvested as before and measurements of fresh weight, number of tillers, plant height, and percentage of infected foliar tissue were collected. Plots were harvested on July 19, 1985.

Dinoseb and Supplemental Fungicides, 1984-1985. The experiment consisted of a factorial arrangement of treatments with five replications. Stephens wheat was planted on October 23, 1984. Treatments included dinoseb application on December 15, 1984, and the corresponding untreated check, each combined with fungicide treatments. Three fungicides were used alone and in combination. These were a) 1.12 kg/ha benomyl applied on March 7, 1985, at the 7 to 8- tiller stage, b) 0.12 kg/ha propiconazole applied on April 25, 1985, when the flag leaf was just visible, and c) repeat applications of 1.12 kg/ha chlorothalonil at the 99% flag leaf (May 16, 1985) and 99% head emergence (May 31, 1985) stages. The rest of the treatments consisted of all possible combinations of the three fungicides. Evaluations were performed on May 9 to 12, and June 19, 1985, following the same procedure of the previous experiment. Plots were harvested on July 19, 1985.

Data from all experiments were subjected to analysis of variance with partitioning of error terms according to the experimental design. Main effects or interaction means indicated as statistically significant at the 5% or lower level of probability in the analysis of variance were separated using Fisher's protected LSD. Only significant variables are reported unless otherwise is indicated.

RESULTS AND DISCUSSION

Dinoseb Timing in Yamhill Wheat, 1983-1984. The effects of planting date and dinoseb timing on yield, and on disease intensity and severity parameters are shown in Table 3. The highest yields were obtained in the late-planted wheat. This is explained by the more severe foliar disease attack and lodging due to eyespot observed in the early planting. A similar response was obtained by Powelson and Rhode (29) in Nugaines winter wheat in Eastern Oregon. Dickens (9) indicated that plants in late seedings attain less vigorous growth than those planted early, and that the microclimatic conditions around the base of the plants are less favorable for infection. This "canopy effect" during the cool, damp portion of the growing season may partially explain the influence of early seeding on eyespot attack (5). Additionally, susceptibility to eyespot infection is related to the physiological age of the plant, tissues becoming more susceptible with senescence (34). Early planting would result in an increase in the number of tillers with senescing leaf sheaths at the time of year favorable for rapid disease development[3]. Kernel weight was higher in the early-planted wheat (Table 3).

Application of dinoseb, independent of the sowing date,

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[3]R. S. Byther, Ph.D. Thesis, 1968. Oregon State Univ., Corvallis, OR.

Table 3. Effect of planting date and dinoseb (1.7 kg/ha) timing on yield and disease severity in Yamhill winter wheat (1983-1984).

Treatment	Grain Yield[1] (Kg/ha)			Disease Attack[2] Flag Leaf (%)			Lodging (%) June 19, 1984		
Seeding Date:	SD 1[4]	SD 2	Average	SD 1	SD 2	Average	SD 1	SD 2	Average
Dinoseb Timing:									
Check	2740	3420	3080 ab[5]	97.2	91.2	94.2 a[5,6]	43.8	3.2	23.5 b[5,6]
1 Leaf	2715	3355	3035 ab	93.9	91.6	92.8 abc	37.5	0.8	19.1 b
2-3 Leaves	2715	3585	3150 a	93.2	86.8	90.0 c	37.5	0.8	19.1 b
5 Leaves	2430	3505	2970 ab	97.6	90.0	93.8 ab	50.0	0.8	25.4 b
4 Tillers	3095	3190	3145 a	95.9	86.0	90.9 bc	23.8	4.2	14.0 b
1 Node	2075	3335	2705 bc	93.5	86.6	90.0 c	75.0	13.0	44.0 a
3 Nodes	2265	2750	2510 c	97.6	90.0	93.8 ab	78.6	8.0	43.4 a
Early Booting	2390	3230	2810 abc	96.3	93.5	94.9 a	40.0	1.8	20.9 b
Average	2550 A	3300 B	2925	95.6 A	89.4 B	92.5	48.3 A	4.1 B	26.2

Table 3. Effect of planting date and dinoseb (1.7 kg/ha) timing on yield and disease severity in Yamhill winter wheat (1983-1984) (Contd.)

Treatment	Eyespot Incidence (% of Tillers)[3]		1000 Kernel Weight (g)		
Seeding Date:	SD 1	SD 2	SD 1	SD 2	Avg.
Dinoseb Timing:					
Check	90.0 a[5,6]	100.0 a[5,6]	36.8	32.3	34.6
1 Leaf	92.5 a	100.0 a	37.8	32.7	35.3
2-3 Leaves	100.0 a	95.0 ab	36.5	32.5	34.5
5 Leaves	97.5 a	85.0 bc	36.2	33.7	34.9
4 Tillers	95.0 a	97.5 a	36.3	32.5	34.4
1 Node	100.0 a	75.0 c	35.6	32.6	34.1
3 Nodes	95.0 a	95.0 a	35.4	32.7	34.0
Early Booting	97.5 a	97.5 a	35.1	33.0	34.1
Average	95.9	93.1	36.2 A	32.8 B	

[1]Based on a harvest area of 6.5 m^2.

[2]Percenatage of infected tissue visually estimated on June 19 to 25, 1984. Based on a sample of 10 leaves, averaged over two samples.

[3]Based on a sample of 10 tillers, averaged over two samples in each of four replications.

[4]SD 1: Seeding date 1 (Sept. 14, 1983), SD 2: seeding date 2 (Oct. 4, 1983).

[5]Means within a group followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD. Capital letters indicate main plot-effects; small letters, split-plot effects.

[6]Data originally subjected to the angular transformation for statistical analysis. Actual (untransformed) percentages are presented.

significantly affected wheat yield. Even though there was no well-defined trend in yield response to dinoseb timing, plots treated earlier, in general, yielded more grain than plots treated later. Perhaps, phytotoxic effects observed after late applications are responsible, in part, for the decrease in yield.

Fungal attack (leaf blotch and stripe rust) to the flag leaf, as evaluated in June, 1984, was higher in the early-planted wheat (Table 3). Dinoseb applications, in general, prevented or lowered disease severity. The lowest severity was obtained when the herbicide was applied at the 2 to 3-leaf or 1-node stage. The extremely high percentage of diseased flag leaf tissue observed could indicate that this evaluation was made too late in the season and that senescence symptoms were confounded with disease symptoms. Dinoseb did not affect lodging, except when applied at the first or third node stage, at which time the herbicide significantly increased lodging, for reasons not understood. There was a significant interaction between planting date and dinoseb timing on the percentage of tillers affected by eyespot, one of the causes of lodging. Dinoseb did not have any effect on this disease in the early planting. In the second planting, dinoseb reduced the intensity of the disease when applied at the 1 to 2-tiller (5 leaves) and 1-node stages. The reasons for these responses are not known.

Treatments had no significant effect on fungal attack to the leaf below the flag leaf, nor to the head.

Dinoseb timing in Stephens wheat, 1983-1984. Of the variables measured, only the percentage of disease attack to the flag leaf was affected by dinoseb timing (Table 4). As observed in the previous experiment, dinoseb tended to prevent or reduce disease severity to about 90% of that observed in check plots. Application of dinoseb did not significantly affect grain yield (Table 4). However, almost all dinoseb applications resulted in a yield decrease of about 7%. The lowest yield was obtained with the latest application of dinoseb. Toxicity symptoms (necrosis) were evident on the flag leaf after treatment, and this probably accounts for such yield reduction. An experiment conducted by Geddens et al.[4] the previous year did not detect significant differences in yield from dinoseb treatments in Stephens wheat planted in October, although dinoseb applications resulted in slight yield increases in contrast to this experiment. Yields for Stephens wheat are higher than those obtained with Yamhill wheat (Table 3). However, they are not statistically comparable because of the difference in planting date.

Considering both dinoseb timing experiments, even though plots treated earlier yielded more grain, yield responses to dinoseb were erratic. The same variability in yield response present in corn (31) apparently also exists in winter wheat.

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[4]Geddens, R. M., A. P. Appleby, and B. D. Brewster. 1984. Nonherbicidal effects of dinoseb application in early- and late-planted winter wheat. West. Soc. Weed Sci. Prog. Rep., p. 203-204.

Table 4. Effect of dinoseb (1.7 kg/ha) timing on yield, and disease attack to the flag leaf in Stephens wheat (1983-1984).

Dinoseb Timing	Grain Yield[1] (kg/ha)	Disease Attack[2] (% of Flag Leaf)
Check	5800 a	68.7 bc[3,4]
1 Leaf	5210 a	71.2 c
2-3 Leaves	5325 a	67.8 bc
5 Leaves	5515 a	60.0 ab
4 Tillers	5590 a	59.8 ab
1 Node	5325 a	66.2 bc
3 Nodes	5915 a	60.5 ab
Early Booting	5110 a	55.1 a

[1]Based on a harvest area of 6.5 m^2.

[2]Percentage of infected tissue visually estimated on June 19 to 25, 1984. Based on subsamples of 10 leaves, averaged over two subsamples in each of four replications.

[3]Means followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

[4]Data originally subjected to the angular transformation for statistical analysis. Actual (untransformed) percentages are presented.

Dinoseb and supplemental pesticides, 1983-1984. Application of dinoseb in December increased wheat yields more than in November (Table 5). These results confirm some of the previously mentioned observations made in recent years in herbicide trials on winter wheat in the Willamette Valley, Oregon. Supplemental pesticide treatments affected Yamhill wheat yields. Over all dinoseb application dates, the highest yield was obtained with the application of propiconazole, although it was not significantly different from the check plot. The increased average yield across dinoseb treatments in propiconazole-treated plots was due to the combined effect of dinoseb applied in December and propiconazole. This treatment caused the highest yield in the experiment as a result of increased disease control. Increases in winter wheat yield after propiconazole treatments also have been interpreted as resulting from effects other than disease control. These effects include maintenance of green leaf area and higher rates of photosynthesis per unit chlorophyll in response to propiconazole application (8, 21). Phorate and benomyl slightly decreased yield, an effect consistently observed within dinoseb times of application. Methyl bromide drastically reduced grain yield, regardless of dinoseb application, probably as a result of increased lodging. No differences in 1000-kernel weight among pesticides were detected in the absence of dinoseb (Table 5). When dinoseb was applied in November, benomyl increased kernel weight, while phorate decreased it. When dinoseb was applied in December, kernel weight was increased by propiconazole. This fungicide has failed to increase kernel weight in other experiments (8, 21).

Table 5. Effects of dinoseb (1.7 kg/ha) timing and supplemental pesticides on yield, 1000-kernel weight, growth parameters, and diseases in Yamhill wheat (1983-1984).

Treatment	Grain Yield[1] (kg/ha)	1000-kernel Weight (g)	Plant Height[2] (cm)	Tillers per 25 cm of row[2]	Tiller Weight[2] (g)	Disease Attack[2] (foliage)
No dinoseb						
Check	3115	33.1 a[3]	116	32	13.1	13.5 b
Methyl bromide	1745	32.7 a	117	36	11.0	19.8 a
Phorate	2925	32.9 a	115	28	13.6	12.3 b
Benomyl	2855	32.6 a	114	27	13.6	19.2 a
Propiconazole	3035	33.2 a	112	29	11.8	17.8 a
Average	2730 B	32.9	115	30	12.6	16.5
Dinoseb November						
Check	3370	32.8 b	111	23	13.8	12.3 a
Methyl bromide	1600	32.8 b	114	35	12.2	15.7 a
Phorate	2945	31.6 c	114	29	13.5	15.7 a
Benomyl	2885	34.3 a	116	32	13.3	13.5 a
Propiconazole	3230	32.3 bc	110	26	12.2	12.5 a
Average	2805 B	32.8	113	29	13.0	13.9
Dinoseb December						
Check	3850	33.8 bc	115	30	12.2	11.5 a
Methyl bromide	1885	32.7 c	120	32	12.7	14.8 a
Phorate	3300	33.4 bc	113	28	12.7	11.8 a
Benomyl	3260	34.4 b	116	30	13.0	14.0 a
Propiconazole	4645	38.2 a	113	30	12.7	6.6 b
Average	3390 A	34.5	115	30	12.7	11.7
Avg. of Suppl. Pestic.						
None	3445 a	33.2	114 bc	28 b	13.1 ab	12.4
Methyl bromide	1745 b	32.8	117 a	34 a	12.0 c	16.8
Phorate	3055 a	32.6	114 bc	28 b	13.3 a	13.3
Benomyl	3000 a	33.8	115 ab	30 b	13.3 a	15.6
Propiconazole	3635 a	34.6	112 c	28 b	12.2 bc	12.3

[1]Based on a harvest area of 6.5 m^2.

[2]Evaluated May 17, 1984. Data are averages of two subsamples of 25 cm of row in each of six replications. Data on tiller number were transformed by the square root transformation for statistical analysis. Disease attack was visually estimated as percentage of infected tissue and data were subjected to the angular transformation. Actual (untransformed) data are presented.

[3]Means within a group followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD. Capital letters indicate main-plot effects; small letters, split-plot effects.

No differences in plant height or tiller number were found among dinoseb treatments (Table 5). Bruinsma (6, 7) found that application of DNOC to winter rye did not affect or reduced the number of shoots per plant, but culms became heavier. Methyl bromide significantly increased both plant height and tiller number. Increased plant height could be a contributing factor for the higher percentage of lodging observed in plots treated with methyl bromide. Benomyl produced a similar response, but of less magnitude. Phorate and propiconazole did not affect either plant height or tiller number when compared to the check plot. Methyl bromide decreased tiller weight. Propiconazole did not affect tiller weight. Similar results were found by Davies et al. (8) with propiconazole in winter wheat.

There was an interaction between dinoseb timing and supplemental pesticides on foliar disease infection when evaluated May 17, 1984 (Table 5). When no dinoseb was applied, plots treated with methyl bromide, benomyl, and propiconazole exhibited the highest disease incidence. This effect is difficult to explain, especially for the two fungicides, which have been shown to control leaf blotch (22, 24). Phorate did not affect disease attack regardless of dinoseb application, an expected response since this insecticide does not have fungicidal properties. When dinoseb was applied in December, 1983, supplemental application of propiconazole drastically reduced disease infection, a response easily detected in the field during the course of the experiment. Such combined effects explain the highest yield obtained from these plots. The other supplemental pesticides did not affect foliar infection. A general reduction in foliage infection was observed with the application of dinoseb, especially at the latest application date. These results provide some indication that dinoseb could increase winter wheat yields because of disease suppression.

During a second evaluation (June 29, 1984), no differences were detected among supplemental pesticides on the severity of disease attack to the flag leaf in the absence of dinoseb, or when dinoseb was applied in December, 1983, (Table 6). An exception was propiconazole, which decreased disease severity when dinoseb was applied in December. Methyl bromide and benomyl decreased fungal attack to the flag leaf in plots treated with dinoseb in November, 1983. However, the reduction was too small to be of practical importance. Plants treated with supplemental pesticides exhibited higher percentages of glume blotch. A general reduction in head infection also was observed from the application of dinoseb, especially when it was applied in December, 1983.

When lodging was evaluated for the first time (June 12, 1984), no significant interaction between dinoseb and supplemental pesticides was observed (Table 6). Dinoseb slightly reduced lodging when applied in November, but increased lodging when applied in December, 1983. Of the supplemental pesticides, methyl bromide drastically increased lodging, probably due to increased plant height and eyespot attack. Propiconazole combined with December-applied dinoseb also increased lodging. None of the other pesticides affected lodging. The second lodging evaluation (June 29, 1983) showed similar results to those obtained on June 12, 1983. Methyl bromide substantially increased

Table 6. Effects of dinoseb (1.7 kg/ha) timing and supplemental pesticides on lodging and diseases in Yamhill wheat (1983-1984)[1].

Treatment	Lodging Percentage (1984) (June 12)	(June 29)	Disease Attack[2] (Flag Leaf)	(Head)	Eyespot Attack[3] (% of tillers) Total	Severe Symptoms
No dinoseb						
Check	3.3	9.7	97.0 a[4]	26.4	77	33
Methyl bromide	30.0	62.5	97.3 a	31.7	95	53
Phorate	1.2	6.2	98.8 a	27.8	98	32
Benomyl	0.0	2.3	98.3 a	31.9	73	13
Propiconazole	5.3	10.3	97.9 a	27.7	93	35
Average	8.0 AB	18.2 AB	97.9	29.1	87	33
Dinoseb November						
Check	0.0	2.3	98.3 b	24.5	92	37
Methyl bromide	35.0	62.5	95.3 a	38.5	100	58
Phorate	0.0	3.2	97.6 b	29.1	87	22
Benomyl	0.0	4.0	97.3 a	25.8	77	12
Propiconazole	0.8	3.2	98.2 b	26.3	98	37
Average	7.2 B	15.0 B	97.4	28.8	91	33
Dinoseb December						
Check	4.2	7.2	97.3 b	21.9	92	30
Methyl bromide	30.0	58.3	97.6 b	31.0	93	47
Phorate	3.3	13.7	98.7 b	29.2	83	35
Benomyl	4.2	7.2	98.1 b	28.6	70	23
Propiconazole	14.2	32.7	83.9 a	22.9	85	45
Average	11.2 A	23.8 A	95.1	26.7	85	36
Avg. of Suppl. Pestic.						
None	2.5 c	6.3 c	97.6	24.3 c	87 a	33 b
Methyl bromide	31.7 a	61.1 a	96.8	33.7 a	96 a	53 a
Phorate	1.5 c	7.7 bc	98.4	28.7 b	89 a	29 bc
Benomyl	1.4 c	4.5 c	97.9	28.8 b	73 b	16 c
Propiconazole	6.8 b	15.4 b	93.3	25.6 bc	92 a	39 ab

[1]Data originally subjected to the angular transformation for statistical analysis. Actual (untransformed) percentages are reported.

[2]Visual estimations of percentage of infected tissue (flag leaf) on 10-tiller subsamples and percentage of glume blotch attack (head) on 10-head subsamples. Reported data are averages of two subsamples in each of six replications.

[3]Visually estimated on two 10-tiller subsamples per treatment. Severe indicates lessions of more than 50% stem circumference.

[4]Means within a group followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD. Capital letters indicate main-plot effects; small letters, split-plot effects.

lodging regardless of the dinoseb application. Propiconazole increased lodging if dinoseb was applied in December. None of the other pesticide treatments differed from the respective check. The same effect of dinoseb timing was observed in this evaluation, that is, a decrease in lodging when this herbicide was applied in November. Samples collected on June 29, 1983, were visually evaluated for eyespot attack, following a slightly modified procedure used by Huber et al. (15). Three categories of infection were used: a) no infection, b) mild attack, when less than 50% of the periphery of the stem showed symptoms, and c) severe, when that percentage was higher than 50. Since no significant differences were found for non-infected stems or tillers showing mild symptoms, only severe attack and percentage of total eyespot infection (severe plus mild) are presented. Benomyl was the only treatment that reduced the incidence (total percentage) of eyespot-infected stems (Table 6). The lowest number of stems showing severe symptoms also was found in plots treated with benomyl. Both responses were consistent across dinoseb applications. The efficacy of benomyl for eyespot control is well documented in the literature (3, 29). Methyl bromide apparently caused an increase in the incidence of eyespot, compared to untreated plots. It was not significantly different from the average of plots not treated with supplemental pesticides. Severity, however, was higher with this fumigant. This effect, together with the increased plant height, could partially explain the increased lodging observed in methyl bromide-treated plots that probably resulted in the low yields obtained after this treatment. Soil fumigation with methyl bromide could destroy antagonistic microbial populations, perhaps creating more conducive conditions for eyespot attack. In addition, taller plants could be more susceptible to the fungus, since it is known that chemicals like CCC [(2-chloroethyl) trimethylammonium chloride] reduce or prevent eyespot by strengthening wheat straw (39).

Results from experiments conducted in 1983-1984 thus indicate that dinoseb could increase winter wheat yields by reduction of disease infection, and that the response of the disease-crop complex to other pesticides depends upon the application of dinoseb.

Time of dinoseb application, 1984-1985. Sowing date did not significantly affect grain yields (Table 7). The effect of dinoseb timing on yield was significant. The highest yields were obtained with earliest applications; however, the general response to application times was rather erratic. As in experiments conducted the previous year, application of dinoseb late in the season tended to decrease grain yield, probably due to phytotoxicity according to field observations. Test weights were lower in the late-planted wheat. Dinoseb application, averaged across all application times, increased test weights ($p=0.07$).

Plant height, fresh weight, and tiller weight were affected by seeding date when assessed on April 30, 1985 (first evaluation, Table 8). Late-planted wheat was shorter and weighed less, both on a per plot and per tiller basis. These characteristics could be associated

Table 7. Effect of dinoseb (1.7 kg.ha) timing on grain yield, grain test weight, plant height, and foliar diseases in Stephens wheat (1984-1985).

Dinoseb Timing (Wks after emergence)	Application Date		Grain Yield[1] (kg/ha)			Test Weight (kg/l)		
	SD 1[3]	SD 2	SD 1	SD 2	Average[4]	SD 1	SD 2	Average[4]
Check	-	-	8813	8412	8612 abc[5]	0.77	0.74	0.76
4	10/30/84	11/30/84	9022	8873	8947 a	0.78	0.78	0.78
7	11/30/84	12/20/84	8784	9140	8962 a	0.80	0.75	0.78
10	12/20/84	01/12/85	8858	8903	8880 ab	0.78	0.75	0.76
13	01/12/85	02/04/85	8769	8041	8405 bcd	0.77	0.77	0.77
16	02/04/85	02/26/85	8962	8858	8910 ab	0.78	0.78	0.78
19	02/26/85	03/25/85	8903	8278	8590 abcd	0.81	0.77	0.79
22	03/25/85	04/11/85	9096	8457	8776 abc	0.76	0.75	0.76
25	04/11/85	05/02/85	8264	7966	8114 d	0.77	0.77	0.77
28	05/02/85	05/23/85	8308	8293	8301 cd	0.78	0.77	0.78
Average			8778	8522	8650	0.78 A	0.76 B	0.77

Table 7. Effect of dinoseb (1.7 kg.ha) timing on grain yield, grain test weight, plant height, and foliar diseases in Stephens wheat (1984-1985) (contd.).

Dinoseb Timing (Wks after emergence)	Application Date		Plant Height (Apr. 30, 1985) (cm)			Foliar Disease Attack (%)[2]	
	SD 1	SD 2	SD 1	SD 2	Average[4]	SD 1	SD 2
Check	-	-	64.2	48.8	56.5 a	3.5 abc	0.85 ab
4	10/30/84	11/30/84	64.9	47.4	56.1 ab	3.0 cd	0.48 b
7	11/30/84	12/20/84	62.2	47.9	55.1 abc	4.0 abc	0.58 ab
10	12/20/84	01/12/85	62.2	44.8	53.5 cde	3.5 abc	0.72 b
13	01/12/85	02/04/85	62.2	41.0	51.6 e	2.0 d	0.98 ab
16	02/04/85	02/26/85	61.0	44.2	52.6 de	2.0 d	0.85 ab
19	02/26/85	03/25/85	64.5	46.0	55.2 abc	4.5 ab	0.48 b
22	03/25/85	04/11/85	62.8	45.2	54.0 bcd	5.0 a	1.40 a
25	04/11/85	05/02/85	61.9	48.2	55.1 abc	5.0 a	0.35 b
28	05/02/85	05/23/85	63.6	44.4	54.0 bcd	3.0 bcd	0.45 b
Average			63.0	45.8	54.4	3.6	0.71

[1]Based on a harvest area of 7.6 m^2.

[2]Percentage of infected tissue visually estimated on April 30, 1985 on 30-cm row samples. Reported data are averages of two subsamples in each of four replications. Data originally subjected to angular transformation for statistical analysis. Actual (untransformed) percentages are presented.

[3]Seeding dates (SD): SD1=Sept. 27,1984; SD2=Oct. 23, 1984.

[4]No seeding date by dinoseb interaction found. Statistical analysis, therefore, conducted on averages over seeding dates.

[5]Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

Table 8. Effect of planting date on growth parameters and disease severity in Stephens wheat (1984-1985)[1].

Planting Date	April 30, 1985			June 12, 1985		
	Plant Height	Fresh Weight	Tiller Weight	Plant Height	Tiller Weight	Foliar Disease Attack[2]
	(cm)	(g)	(g)	(cm)	(g)	(%)
Oct. 5, 1984	63 a[3]	265 a	6.4 a	92 a	45 a	8.8 a
Oct. 25, 1984	46 b	175 b	4.8 b	84 b	21 b	9.9 b

[1] Evaluations made on 30-cm row subsamples. Data are averages of two subsamples in each of four replications across ten dinoseb application times.

[2] Percentage of infected tissue visually estimated. Data originally subjected to the angular transformation for statistical analysis. Actual (untransformed) percentages are presented.

[3] Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

with lower yields in late-planted wheat. No treatment effect on the number of tillers per plot was detected. Dinoseb timing reduced plant height, especially when applied 10 to 16 weeks after wheat emergence (Table 7). A significant interaction between seeding date and dinoseb application time on percentage of infected foliar tissue was found (Table 7). Within the first seeding date, an erratic response to dinoseb timing was obtained. Most of the application times did not differ from the check, although disease infection was worse in late applications. Perhaps damage from late herbicide applications may increase susceptibility of the tissue to foliar pathogens. Within the second seeding date, most of the dinoseb treatments decreased foliar infection, and in those cases where increases were detected, they were not significantly different from the check. Additionally, disease severity was lower in the late-planted wheat.

No dinoseb-timing effect was found on any of the variables assessed on June 12, 1985. Date of planting affected plant height, tiller weight, and foliar disease attack (Table 8). Plant height and tiller weight were lower in the late-planted wheat, whereas percentage of infected foliar tissue was higher.

Dinoseb and supplemental fungicides, 1984-1985. Dinoseb application did not affect grain yield in this experiment (p=0.72). Benomyl alone or in combination with either of the other two fungicides increased yields (Table 9). The other fungicide treatments did not significantly affect grain yields. Over all treatments, application of benomyl increased yield by 10% (from 9740 to 10720 kg/ha). This effect appears

Table 9. Effect of fungicide treatments on grain yield and grain test weight in Stephens wheat (1984-1985).

Fungicide Treatments	Grain Yield[1] (kg/ha)			Test Weight (kg/l)		
	ND[2]	DD	Average	ND	DD	Average
Check	9700	9490	9595 b[3]	0.80	0.79	0.79 a
Propiconazole	9800	9535	9670 b	0.80	0.79	0.79 a
Benomyl	10725	10915	10820 a	0.80	0.80	0.80 a
Chlorothalonil	9860	9760	9810 b	0.80	0.76	0.78 a
Propiconazole + Benomyl	10580	10855	10720 a	0.79	0.79	0.79 a
Propiconazole + Chlorothalonil	9740	10035	9885 b	0.79	0.80	0.79 a
Benomyl + Chlorothalonil	10510	10535	10525 a	0.79	0.80	0.79 a
Propiconazole + Benomyl + Chlorothalonil	10810	10845	10825 a	0.79	0.79	0.79 a
Average	10215	10245	10230	0.79	0.79	0.79

[1]Based on a harvest area of 7.6 m^2.

[2]ND: no dinoseb; DD: dinoseb (1.7 kg/ha) applied in December, 1984.

[3]Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

to be related to improved foliar disease control in the presence of benomyl as seen in Table 11. The efficacy of benomyl for leaf blotch and head blotch control has been documented (22, 24). Yield increases after benomyl treatment can also be related to increased persistence of green leaf tissue, especially of the flag leaf (24). None of the treatments affected test weights.

At the time the first evaluation was made (May 9 to 12, 1985), chlorothalonil treatments had not been applied yet. The entire experimental area was sampled as before, and those plots on which chlorothalonil was going to be sprayed, were used as extra subsamples for the rest of the treatments. Data were then analyzed accordingly. None of the treatments affected plant height, fresh weight, and number of tillers per 30-cm row. Dinoseb slightly reduced ($p=0.12$) percentage of diseased foliar tissue, from 7.2% to 6.6%. Only tiller weight was affected by fungicide treatments (Table 10). Treatments that included benomyl produced the highest tiller weights. Propiconazole did not affect tiller weight. Dinoseb tended to increase tiller weight ($p=0.12$).

Similar effects were noted at the second evaluation (June 19, 1985). Analyses of variance did not show significant effects ($p=0.05$) of any of the treatments on plant height, fresh weight, and tiller number, except for an interaction between dinoseb, benomyl, and chlorothalonil on fresh weight and number of tillers per 30-cm row (Table 11). This interaction indicates that differences in fresh weight were due to differences in the number of tillers per 30-cm of

Table 10. Effect of fungicide treatments on tiller weight in Stephens wheat (1984-1985).

	Tiller Weight[1]		
	No dinoseb	Dinoseb (Dec.)	Average
	(g)	(g)	(g)
Check	6.9	7.0	6.9 b[2]
Propiconazole	6.8	6.9	6.8 b
Benomyl	7.2	7.4	7.3 a
Propiconazole + Benomyl	7.2	7.4	7.3 a
Average	7.0	7.2	7.1

[1]Evaluated on May 9 to 12, 1985, on 30-cm row subsamples.

[2]Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

Table 11. Interaction between dinoseb, benomyl, and chlorothalonil on fresh weight and number of tillers in Stephens wheat (1984-1985).

Pesticide Treatment[1]			Fresh Weight[2]	Tiller Number[2]
			---------- 30 cm of row ----------	
Dinoseb	Benomyl	Cholorothalonil	(g)	(no.)
0	0	0	414 ab[3]	44 ab
0	0	1	437 ab	47 ab
0	1	0	450 ab	49 ab
0	1	1	409 b	42 b
1	0	0	446 ab	47 ab
1	0	1	395 b	43 b
1	1	0	426 ab	46 ab
1	1	1	482 a	50 a

[1]Rates of pesticide application were: dinoseb, 1.7 kg/ha; benomyl, 1.12 kg/ha; chlorothalonil, 1.12 kg/ha. 0 = untreated, 1 = treated.

[2]Evaluated on June 19, 1985. Number of tillers were transformed by the square root transformation. Actual (untransformed) averages from two subsamples in each of five replications are presented.

[3]Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

row. The highest tiller number was obtained with the combination of the three pesticides. Most of the other treatments did not differ from this treatment or the untreated check. As observed in the first evaluation, benomyl slightly increased plant height (p=0.03). Fungicides significantly affected tiller weight and percentage of diseased foliar tissue (Table 12). Treatments including benomyl tended to increase tiller weight, although the differences were not significant. The effect of fungicide treatments on foliar diseases also is shown in Table 12. Treatments in which benomyl was included had lower percentages of foliar infection (p=0.01). Propiconazole was less effective than in the previous year. However, the absence of a second application does not appear to be the reason for this effect (Appendix Table 1). Application of dinoseb in the absence of fungicides slightly decreased foliar disease.

Table 12. Effect of fungicide treatments on tiller weight and foliar disease attack in Stephens wheat (1984-1985).

Fungicide Treatments	Evaluation: June 19, 1985 Tiller Weight (g)			Estimated Foliar Disease Attack[1] (%)		
	ND[2]	DD	Average	ND	DD	Average
Check	9.5	9.5	9.5 abc[3]	47.5	37.5	42.5 ab
Propiconazole	9.6	9.7	9.7 a	40.0	45.0	42.5 ab
Benomyl	9.0	9.0	9.1 bc	40.0	37.5	38.8 b
Chlorothalonil	9.0	9.3	9.0 c	52.5	47.5	50.0 a
Propiconazole + Benomyl	9.5	9.6	9.6 ab	37.5	40.0	38.8 b
Propiconazole + Chlorothalonil	9.8	9.2	9.5 abc	47.5	52.5	50.0 a
Benomyl + Chlorothalonil	10.0	9.8	9.9 a	37.5	42.5	40.0 b
Propiconazole + Benomyl + Chlorothalonil	9.7	9.5	9.6 ab	37.5	40.0	38.8 b
Average	9.5	9.4	9.5	42.5	43.0	42.5

[1] Percentage of diseased tissue visually estimated on 30-cm row subsamples. Data are averages of two subsamples across two dinoseb application treatments in each of five replications. Data originally subjected to angular transformation for statistical analysis. Actual (untransformed) percentages are reported.

[2] ND: no dinoseb; DD: dinoseb (1.7 kg/ha) applied in December, 1984.

[3] Means within a column followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

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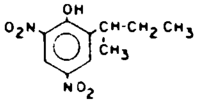
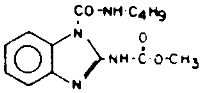
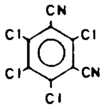
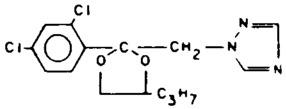
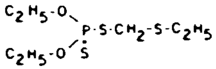
APPENDICES

Appendix Table 1. Common name, chemical structure, trade name, and formulation of pesticides used in wheat experiments (1983-85).

Common name	Chemical structure	Trade name and formulation[1]
Dinoseb		Premerge-3
Benomyl		Benlate 50 W.P.
Chlorothalonil		Bravo 500 F.W.
Propiconazole		Tilt 3.6 E
Phorate		Thimet 20-G
Methyl bromide	CH_3B.	Brom-O-Gas

[1]Trade names are used solely to provide specific information and do not constitute a guarantee or endorsement by the author or Oregon State University.

Appendix Table 2. Effect of dinoseb (1.7 kg/ha) and propiconazole (0.12 kg/ha) on Stephens winter wheat yields (1984-85).

Treatment	Application date	Growth stage	Yield[1]
			(kg/ha)
Check	--	--	8520 a[2]
dinoseb	December 15, 1984	2-3 leaves	8375 a
propiconazole	April 25, 1985	Flag leaf just visible	8770 a
dinoseb + propiconazole (twice)	May 16, 1985 (second propiconazole application)	99% flag leaf emergence	7795 a
dinoseb + propiconazole (3 times)	June 16, 1985 (third propiconazole application)	99% weed emergence	7960 a

[1]Data are averages of four replications.

[2]Means followed by the same letter are not significantly different at the 5% level of probability as determined by the F-LSD.

Appendix Table 3. Effect of planting date and dinoseb (1.7 kg/ha) timing on diseases, lodging, and yield in Yamhill winter wheat (1983-84).

Treatment	Disease attack[1]															Lodging June 19, 1984				
	Flag leaf					Leaf below flag leaf					Head									
	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
	(%)					(%)					(%)					(%)				
Seeding date: Sept. 14, 1983																				
Dinoseb timing																				
Check	93	98	99	99	97	99	99	99	99	99	2	1	11	6	5	25	50	75	25	44
1 leaf	96	84	99	97	94	97	99	99	99	98	2	0	5	5	3	25	25	25	75	38
2-3 leaves	93	93	94	94	93	99	99	99	99	99	5	1	8	5	5	50	25	25	50	38
5 leaves	97	96	99	99	98	99	99	99	99	99	5	0	8	8	5	50	50	25	75	50
4 tillers	97	90	98	99	96	99	99	99	99	99	11	0	6	7	6	25	50	10	10	24
1 node	88	88	99	98	93	99	98	99	99	99	7	0	15	10	8	75	75	75	75	75
3 nodes	99	94	99	99	98	98	99	99	99	99	7	1	9	5	5	75	75	75	90	79
Early booting	98	90	99	99	96	99	99	99	99	99	13	0	11	6	7	50	75	10	25	40
Seeding date: Oct. 4, 1983																				
Dinoseb timing																				
Check	91	81	98	95	91	99	99	99	99	99	1	0	5	5	3	1	1	1	10	3
1 leaf	96	85	99	87	92	99	99	99	99	99	0	1	6	5	3	1	1	1	0	1
2-3 leaves	90	68	99	91	87	99	99	99	99	99	2	0	5	4	3	1	1	1	0	1
5 leaves	91	79	96	95	90	99	99	99	99	99	1	0	5	5	3	1	1	1	0	1
4 tillers	81	85	90	89	86	98	99	99	99	99	1	0	7	4	3	5	1	1	10	4
1 node	81	75	96	94	87	99	99	99	99	99	1	0	6	6	3	1	1	25	25	13
3 nodes	91	78	98	93	90	99	99	99	99	99	1	0	5	7	3	1	5	1	25	8
Early booting	95	86	98	95	94	99	99	99	99	99	1	0	6	6	3	5	1	1	0	2

(Continued)

Appendix Table 3 (continued)

Treatment	Eyespot attack[z]														
	Severe					Mild					Total				
	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
	(% tillers)														
Seeding date: Sept. 14, 1983															
Dinoseb timing															
Check	30	90	40	30	48	70	10	40	50	42	100	100	80	80	90
1 leaf	40	20	10	50	28	60	60	90	50	65	100	80	90	100	92
2-3 leaves	10	50	0	50	30	90	50	90	50	70	100	100	100	100	100
5 leaves	0	100	0	80	45	100	0	90	20	52	100	100	90	100	98
4 tillers	10	90	20	60	45	90	10	60	40	50	100	100	80	100	95
1 node	0	80	60	60	50	100	20	40	40	50	100	100	100	100	100
3 nodes	70	70	20	80	60	30	20	70	20	35	100	90	90	100	95
Early booting	20	50	30	70	42	70	50	70	30	55	90	100	100	100	98
Seeding date: Oct. 4, 1983															
Dinoseb timing															
Check	0	30	30	10	18	100	70	70	90	82	100	100	100	100	100
1 leaf	20	20	20	30	22	80	80	80	70	78	100	100	100	100	100
2-3 leaves	20	0	0	10	75	70	100	90	90	88	90	100	90	100	95
5 leaves	0	30	30	10	18	90	40	60	80	68	90	70	90	90	85
4 tillers	10	0	30	60	25	90	90	70	40	72	100	90	100	100	98
1 node	20	10	10	20	15	80	60	40	60	60	100	70	50	80	75
3 nodes	10	20	10	20	15	90	80	70	80	80	100	100	80	100	95
Early booting	10	40	10	40	25	80	60	90	60	72	90	100	100	100	98

(Continued)

Appendix Table 3 (continued)

Treatment	Grain yield					1000-kernel weight				
	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
	(kg/ha)					(g)				
Seeding date: September 14, 1983										
Dinoseb timing										
Check	3629	2636	2063	2636	2741	38.7	36.3	37.2	34.8	36.8
1 leaf	2712	2407	3897	1834	2712	40.7	37.5	35.9	37.1	37.8
2-3 leaves	2598	2407	2674	3171	2712	37.7	38.0	34.1	36.2	36.5
5 leaves	2139	3018	2980	1566	2427	38.1	36.8	34.0	35.9	36.2
4 tillers	3591	2903	3362	2521	3094	36.7	37.0	35.1	36.4	36.3
1 node	2254	1566	2407	2063	2072	36.0	37.1	35.4	34.0	35.6
3 nodes	2636	1490	3285	1643	2263	34.4	35.8	36.3	35.1	35.4
Early booting	2407	2025	2598	2521	2388	33.7	36.1	34.7	36.0	35.1
Seeding date: Oct. 4, 1983										
Dinoseb timing										
Check	3591	3629	3400	3056	3420	33.7	32.8	31.8	31.1	32.3
1 leaf	3515	3133	3362	3400	3353	34.1	31.7	31.5	33.6	32.7
2-3 leaves	3209	3591	3591	3935	3582	31.7	33.1	31.2	33.9	32.5
5 leaves	3286	3935	3668	3133	3506	34.4	33.3	33.1	33.8	33.6
4 tillers	3171	3935	3094	2560	3191	32.7	33.9	32.2	31.0	32.5
1 node	3209	3438	3362	3324	3333	32.0	32.0	33.1	33.3	32.6
3 nodes	2712	3056	2903	2330	2751	31.3	33.7	31.6	34.0	32.7
Early booting	3209	3591	3247	2865	3227	34.8	31.9	32.3	33.0	33.0

[1]Percentage of infected tissue visually estimated on two 10-tiller subsamples. Data are averages of two subsamples.

[2]Based on a subsample of 10 tillers, averaged over two subsamples.

Appendix Table 4. Effect of dinoseb (1.7 kg/ha) timing on diseases and grain yield in Stephens winter wheat (1983-84).

	Disease attack[1]														
	Flag leaf					Leaf below flag leaf					Head				
Dinoseb timing	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
	(%)					(%)					(%)				
Check	61	38	89	87	69	99	98	99	99	99	2	0	5	5	3
1 leaf	62	40	93	90	71	99	99	99	99	99	2	1	6	4	3
2-3 leaves	54	35	92	92	68	97	97	99	99	98	1	1	5	5	3
5 leaves	34	40	82	84	60	93	96	99	99	97	1	1	5	5	3
4 tillers	31	38	89	81	60	97	99	99	99	98	1	0	6	5	3
1 node	56	30	97	83	66	97	99	99	99	98	2	1	4	4	3
3 nodes	39	36	80	88	60	99	91	99	99	97	1	1	4	4	3
Early booting	37	32	80	72	55	88	96	99	99	96	2	1	4	4	3

(Continued)

Appendix Table 4 (continued)

	Eyespot attack[2]														
	Severe					Mild					Total				
Dinoseb timing	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
	(%)					(%)					(%)				
Check	0	0	20	0	5	90	100	50	70	78	90	100	70	70	82
1 leaf	0	0	10	10	5	90	90	40	90	78	90	90	50	100	82
2-3 leaves	0	0	0	90	22	70	100	90	10	68	70	100	90	100	90
5 leaves	0	0	0	0	0	100	90	90	60	85	100	90	90	60	85
4 tillers	10	0	10	0	5	70	100	60	70	75	80	100	70	70	80
1 node	0	20	10	0	8	90	80	80	60	78	90	100	90	60	85
3 nodes	0	0	20	10	8	80	60	30	70	60	80	60	50	80	68
Early booting	0	0	10	0	2	80	90	90	90	88	80	90	100	90	90

(Continued)

Appendix Table 4 (continued)

Dinoseb timing	Grain yield R1	R2	R3	R4	Avg	1000-kernel weight R1	R2	R3	R4	Avg
	(kg/ha)					(g)				
Check	5348	5310	7373	5157	5798	38.3	38.5	39.8	38.9	38.9
1 leaf	5501	5234	5157	4928	5205	35.0	37.4	37.3	33.9	35.9
2-3 leaves	5692	5616	5272	4699	5319	37.5	36.8	34.9	35.5	36.2
5 leaves	5387	5730	5425	5501	5510	36.9	42.2	39.3	38.6	39.3
4 tillers	5540	5730	4928	6151	5587	38.0	36.6	33.4	39.0	36.7
1 node	5425	5654	4737	5463	5319	36.6	38.2	31.0	39.6	36.3
3 nodes	6456	6074	5769	5348	5912	40.8	41.0	36.4	37.2	38.8
Early booting	5501	5005	5005	4928	5110	37.2	37.7	33.7	37.1	36.4

[1]Percentage of infected tissue visually estimated on two 10-tiller subsamples. Data are averages of two subsamples.

[2]Based on samples of 10 tillers collected on July 2, 1984.

Appendix Table 5. Effects of dinoseb (1.7 kg/ha) timing and supplemental pesticides on growth parameters, diseases, lodging, and yield in Yamhill wheat (1983-84).

Treatment	Tillers per 25 cm of row[1]							Fresh weight[1]							Plant height[1]						
	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg
	(No.)							(g)							(cm)						
No dinoseb																					
Check	43	34	35	34	26	17	32	473	445	436	458	388	244	407	111	116	121	118	117	113	116
methyl bromide	36	36	38	52	24	28	36	282	448	380	612	308	296	388	104	120	127	120	114	116	117
phorate	34	27	30	23	30	24	28	454	325	386	327	384	398	379	118	117	116	112	109	116	115
benomyl	24	38	30	24	28	20	27	313	498	322	433	322	292	363	112	118	118	117	102	117	114
propiconazole	27	36	38	26	27	20	29	259	420	354	382	352	251	336	101	113	116	118	114	115	113
dinoseb, November																					
Check	27	30	26	22	19	14	23	307	347	380	324	249	254	310	108	111	116	110	104	119	111
methyl bromide	42	28	40	16	48	34	35	589	306	473	208	555	404	422	116	112	120	109	116	116	115
phorate	34	38	25	36	31	12	29	410	441	300	488	463	191	382	111	120	113	114	118	107	114
benomyl	39	34	42	32	25	18	32	412	423	531	444	386	278	412	107	111	123	114	115	124	116
propiconazole	26	26	36	26	20	23	26	360	266	346	296	240	350	310	108	101	116	110	108	120	110
dinoseb, December																					
Check	40	28	37	24	26	27	30	458	308	408	317	345	370	368	115	108	120	113	114	119	115
methyl bromide	34	35	34	30	36	24	32	382	395	492	403	475	306	409	116	123	124	121	116	118	120
phorate	24	25	34	26	24	32	28	268	306	410	364	299	458	351	106	108	118	112	116	120	113
benomyl	35	32	34	26	32	24	30	416	361	421	414	397	338	391	113	116	120	118	110	120	116
propiconazole	34	27	37	34	19	27	30	355	336	412	462	272	383	370	106	116	120	113	107	118	113

(Continued)

Appendix Table 5 (continued)

Treatment	Disease attack[1]							Lodging percentage (1984)													
	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg
	(% of foliage)							June 12							June 29						
No dinoseb																					
Check	20	12	12	10	12	15	14	0	0	0	0	0	20	3	5	1	1	1	25	25	10
methyl bromide	35	18	18	18	10	20	20	30	35	25	25	35	30	30	50	75	75	50	50	75	62
phorate	18	12	10	10	12	12	12	2	0	0	0	5	0	1	10	10	5	1	10	1	6
benomyl	40	18	15	12	12	18	19	0	0	0	0	0	0	0	5	5	1	1	1	1	2
propiconazole	38	12	15	12	15	15	18	2	0	0	10	20	0	5	25	1	5	5	25	1	10
dinoseb, November																					
Check	15	12	15	12	8	12	12	0	0	0	0	0	0	0	1	1	1	5	5	1	2
methyl bromide	18	20	8	15	15	18	16	20	25	35	30	40	60	35	75	50	75	50	75	50	62
phorate	12	20	12	20	12	18	16	0	0	0	0	0	0	0	1	1	10	1	5	1	3
benomyl	15	18	10	10	10	18	14	0	0	0	0	0	0	0	1	1	10	1	1	10	4
propiconazole	15	10	12	12	8	18	12	0	0	0	0	5	0	1	1	1	1	1	10	5	3
dinoseb, December																					
Check	15	12	10	10	10	12	12	0	0	0	0	25	0	4	1	1	10	1	25	5	7
methyl bromide	15	20	12	12	18	12	15	25	25	50	30	30	20	30	75	50	50	75	50	50	58
phorate	12	15	12	10	12	10	12	0	0	0	0	5	15	3	1	5	25	1	25	25	14
benomyl	20	12	12	15	10	15	14	0	0	0	0	15	10	4	1	1	5	1	25	10	7
propiconazole	8	8	8	5	5	5	6	0	0	30	30	25	0	14	10	1	75	50	50	10	33

(Continued)

Appendix Table 5 (continued)

Treatment	Disease attack (%)[z] Flag leaf R1	R2	R3	R4	R5	R6	Avg	Leaf below flag leaf R1	R2	R3	R4	R5	R6	Avg	Head R1	R2	R3	R4	R5	R6	Avg
No dinoseb																					
Check	98	88	98	99	99	99	97	99	99	99	99	99	99	99	20	28	32	28	20	28	26
methyl bromide	97	97	99	98	95	98	97	99	99	99	99	99	99	99	28	17	45	40	30	31	32
phorate	99	99	99	98	99	99	99	99	99	99	99	99	99	99	18	31	41	30	26	21	28
benomyl	99	98	96	99	99	99	98	99	99	99	99	99	99	99	28	30	30	44	32	27	32
propiconazole	94	99	98	99	99	98	98	99	99	99	99	99	99	99	22	30	28	35	22	28	28
dinoseb, November																					
Check	96	98	99	99	99	99	98	99	99	99	99	99	99	99	23	19	28	27	24	26	24
methyl bromide	95	95	91	96	95	99	95	99	99	99	99	99	99	99	34	32	38	42	41	42	38
phorate	98	93	99	99	99	98	98	99	99	99	99	99	99	99	21	38	37	30	30	18	29
benomyl	96	99	98	96	99	97	97	99	99	99	99	99	99	99	18	14	22	32	34	35	26
propiconazole	98	98	99	99	99	97	98	99	99	99	99	99	99	99	30	24	23	28	32	22	26
dinoseb, December																					
Check	93	96	99	98	99	99	97	99	99	99	99	99	99	99	23	13	22	31	24	18	22
methyl bromide	95	99	99	99	97	98	98	99	99	99	99	99	99	99	28	50	30	32	20	26	31
phorate	98	99	99	99	99	99	99	99	99	99	99	99	99	99	38	19	31	28	28	30	29
benomyl	98	98	97	99	99	99	98	99	99	99	99	99	99	99	22	28	30	30	40	22	29
propiconazole	78	74	88	88	92	83	84	99	99	99	99	99	99	99	26	24	22	31	22	13	23

(Continued)

Appendix Table 5 (continued)

Treatment	Eyespot attack[3]																				
	Severe							Mild							Total						
	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg	R1	R2	R3	R4	R5	R6	Avg
No dinoseb																					
Check	50	50	50	40	0	10	33	50	50	40	40	60	90	55	100	100	90	80	60	100	88
methyl bromide	60	80	50	80	40	10	53	40	20	20	20	60	90	42	100	100	70	100	100	100	95
phorate	10	40	70	10	10	50	32	90	50	30	90	90	50	67	100	90	100	100	100	100	99
benomyl	0	10	20	20	20	10	13	90	30	40	80	40	80	60	90	40	60	100	60	90	73
propiconazole	40	60	20	30	50	10	35	60	40	60	60	40	90	58	100	100	80	90	90	100	93
dinoseb, November																					
Check	70	40	40	10	30	30	37	30	60	40	70	70	60	55	100	100	80	80	100	90	92
methyl bromide	20	70	70	90	60	40	58	80	30	30	10	40	60	42	100	100	100	100	100	100	100
phorate	60	30	20	10	10	0	22	40	70	50	50	80	100	65	100	100	70	60	90	100	87
benomyl	20	0	0	10	40	0	12	60	90	70	40	60	70	65	80	90	70	50	100	70	77
propiconazole	40	20	70	40	20	30	37	50	80	30	60	80	70	62	90	100	100	100	100	100	99
dinoseb, December																					
Check	30	40	0	20	80	10	30	40	60	90	80	20	80	62	70	100	90	100	100	90	92
methyl bromide	50	40	30	70	20	70	47	40	40	60	30	80	30	47	90	80	90	100	100	100	94
phorate	50	70	70	10	0	10	35	50	30	30	40	50	90	48	100	100	100	50	50	100	83
benomyl	60	30	10	10	20	10	23	30	70	10	20	60	90	47	90	100	20	30	80	100	70
propiconazole	20	90	0	70	0	90	45	60	10	60	20	80	10	40	80	100	60	90	80	100	85

(Continued)

Appendix Table 5 (continued)

Treatment	Grain yield R1	R2	R3	R4	R5	R6	Avg	1000-kernel weight R1	R2	R3	R4	R5	R6	Avg
	(kg/ha)							(g)						
No dinoseb														
Check	2903	3591	4241	2025	2751	3171	3114	33	35	34	30	32	34	33
methyl bromide	1719	1452	1299	1414	2674	1910	1745	33	33	32	31	34	32	33
phorate	2636	3018	2407	3744	1872	3858	2922	34	34	31	34	32	34	33
benomyl	2636	3591	2712	3094	1948	3133	2853	33	33	31	32	33	34	33
propiconazole	2254	3706	1987	3324	2636	4279	3030	34	32	34	34	32	33	33
dinoseb, November														
Check	3362	3515	3858	3133	3056	3285	3368	32	33	32	32	32	34	33
methyl bromide	1222	1414	1414	1643	2025	1872	1598	34	33	31	33	33	34	33
phorate	2865	2598	2330	3400	2636	3820	2942	33	31	30	34	28	33	32
benomyl	3515	1910	3247	2865	2369	3400	2885	34	36	34	35	33	33	34
propiconazole	3400	2942	2521	3438	3324	3744	3227	32	34	33	32	31	32	32
dinoseb, December														
Check	3744	5234	3973	4279	3362	2483	3846	35	34	33	34	33	34	34
methyl bromide	1604	1261	1834	1796	2827	1987	1884	33	32	32	32	34	33	33
phorate	3018	4202	3133	4088	2445	2903	3298	33	34	33	34	33	34	33
benomyl	3476	4050	2942	3438	2483	3171	3260	36	34	33	35	35	33	34
propiconazole	5769	5883	2942	2483	4241	6533	4642	38	38	38	39	37	39	38

[1]Evaluated May 17, 1984. Data are averages of two subsamples of 25 cm of row. Disease attack was visually estimated as percentage of infected tissue.

[2]Evaluated June 29, 1984. Data are averages of two 10-tiller subsamples.

[3]Evaluated July 5, 1984.

Appendix Table 6. Effect of seeding date and dinoseb (1.7 kg/ha) timing on growth and foliar disease attack in Stephens wheat when evaluated on April 30, 1985.[1]

Dinoseb timing (weeks after crop emergence)	Application date	Tillers per 30 cm of row					Plant height					Fresh weight					Foliar disease attack				
		R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg	R1	R2	R3	R4	Avg
		(No.)					(cm)					(g)					(%)				
Seeding date: Sept. 17. 1984																					
Dinoseb application																					
Check	-	46	39	43	30	40	65	62	67	64	64	282	240	306	218	261	3.0	5.0	3.0	3.0	3.5
4	10/30/84	59	44	39	45	47	66	63	64	66	65	372	258	256	295	295	3.0	3.0	1.0	5.0	3.0
7	11/30/84	36	37	48	36	39	59	61	65	64	62	204	234	320	238	249	5.0	5.0	3.0	3.0	4.0
10	12/20/84	44	42	44	40	42	64	61	63	62	62	282	248	258	258	262	3.0	3.0	3.0	5.0	3.5
13	01/12/85	37	40	43	40	40	61	60	66	62	62	226	240	284	269	255	1.0	1.0	3.0	3.0	2.0
16	02/04/85	41	31	34	39	36	62	60	61	62	61	237	202	234	240	228	1.0	1.0	3.0	3.0	2.0
19	02/26/85	43	36	56	44	45	64	60	69	66	64	276	216	276	324	298	5.0	5.0	3.0	5.0	4.5
22	03/25/85	49	44	36	43	43	64	62	62	63	63	299	278	227	276	270	5.0	5.0	5.0	5.0	5.0
25	04/11/85	40	38	41	44	41	59	58	64	66	62	224	212	267	300	251	5.0	5.0	5.0	5.0	5.0
28	05/02/85	29	31	54	56	42	64	62	62	67	64	250	206	329	346	283	3.0	3.0	3.0	3.0	3.0
Seeding date: Oct. 23, 1984																					
Dinoseb application																					
Check	-	54	32	50	24	40	49	48	53	46	49	260	170	281	130	210	0.1	0.6	2.6	0.1	0.8
4	11/30/84	56	38	46	28	42	50	49	48	42	47	243	180	224	146	198	0.1	0.6	0.6	0.6	0.5
7	12/20/84	40	33	49	39	40	48	46	50	48	48	172	164	238	213	197	0.1	0.6	0.6	1.0	0.6
10	01/12/85	43	28	42	36	37	44	38	48	48	45	185	114	224	187	178	0.1	0.1	2.6	0.1	0.7
13	02/04/85	33	31	36	28	32	44	40	40	40	41	154	120	161	124	140	0.1	0.6	2.6	0.6	1.0
16	02/26/85	35	33	36	24	32	46	43	48	40	44	166	166	188	108	157	0.1	0.6	2.6	0.1	0.8
19	03/25/85	34	34	36	35	35	46	48	46	46	46	154	158	186	165	166	0.1	0.6	0.6	0.6	0.5
22	04/11/85	48	39	34	34	39	42	49	49	42	45	175	180	175	169	175	0.6	1.0	3.0	1.0	1.4
25	05/02/85	38	40	36	28	36	48	46	50	48	48	187	193	194	150	181	0.1	0.1	0.6	0.6	0.4
28	05/23/85	39	28	40	24	33	40	44	50	43	44	148	131	214	118	153	0.1	0.1	0.6	1.0	0.4

[1]Data are averages of two subsamples of 30 cm of row. Disease attack was visually estimated as percentage of infected tissue.

Appendix Table 7. Effect of seeding date and dinoseb (1.7 kg/ha) timing on growth, foliar disease, and yield in Stephens winter wheat when evaluated on June 12, 1985.

Dinoseb timing (weeks after crop emergence)	Application date	Tillers per 30 cm of row[1] R1	R2	R3	R4	Avg	Plant height[1] R1	R2	R3	R4	Avg	Fresh weight[1] R1	R2	R3	R4	Avg	Foliar disease attack[1] R1	R2	R3	R4	Avg
		(No.)					(cm)					(g)					(%)				
Seeding date: Sept. 17, 1984																					
Dinoseb application																					
Check		46	38	32	44	40	88	94	89	96	92	327	371	264	402	341	50	50	50	38	47
4	10/30/84	33	39	40	40	38	91	92	96	93	93	278	362	330	320	322	50	50	50	25	44
7	11/30/84	31	29	46	50	39	86	92	95	96	92	272	265	393	416	337	38	50	50	50	47
10	12/20/84	48	32	46	44	42	96	90	92	92	92	435	294	354	365	362	50	38	50	38	44
13	01/12/85	38	43	42	40	41	92	89	95	92	92	340	378	358	341	355	38	50	50	38	44
16	02/04/85	48	43	32	36	38	88	94	90	92	91	398	408	275	330	353	50	50	38	38	44
19	02/26/85	44	28	37	38	37	92	91	92	92	92	402	328	326	365	355	50	38	50	50	47
22	03/25/85	39	36	38	49	40	86	93	92	94	92	346	326	260	417	337	38	50	38	38	41
25	04/11/85	39	46	42	44	43	92	91	97	91	93	334	382	389	398	376	38	38	50	38	41
28	05/02/85	36	36	48	36	39	90	90	91	88	90	325	290	411	295	330	50	62	50	38	50
Seeding date: Oct. 23, 1984																					
Dinoseb application																					
Check		35	34	45	34	37	84	87	86	80	84	342	320	463	360	371	25	18	25	10	19
4	11/30/84	40	44	48	32	41	85	90	84	80	85	417	439	474	310	410	25	25	38	18	26
7	12/20/84	45	30	31	48	38	86	83	80	87	84	434	316	294	462	376	25	18	25	25	23
10	01/12/85	36	31	40	48	39	84	80	84	86	84	398	324	364	443	382	25	18	25	18	21
13	02/04/85	38	25	37	28	32	82	80	84	82	82	406	244	352	256	314	25	8	10	10	13
16	02/26/85	25	36	33	38	33	87	81	80	88	84	266	357	336	418	344	25	18	18	18	19
19	03/25/85	40	34	46	42	40	87	84	83	84	84	413	335	438	410	399	25	18	18	18	19
22	04/11/85	30	32	37	38	34	84	84	82	80	82	320	299	352	364	334	25	18	18	18	19
25	05/02/85	51	38	46	32	42	90	84	86	84	86	446	342	420	318	381	25	25	25	10	21
28	05/23/85	36	30	52	43	40	34	87	86	83	85	398	333	500	383	403	25	25	25	18	23

(Continued)

Appendix Table 7 (continued)

Dinoseb timing (weeks after crop emergence)	Application date	Grain yield R1	R2	R3	R4	Avg	Test weight R1	R2	R3	R4	Avg
		(kg/ha)					(kg/l)				
Seeding date: Sept. 17, 1984											
Dinoseb application											
Check		8204	8561	9690	8799	8813	0.77	0.75	0.75	0.80	0.77
4	10/30/84	9274	9393	8620	8799	9022	0.80	0.80	0.75	0.80	0.79
7	11/30/84	7728	9631	8858	8918	8784	0.82	0.80	0.80	0.80	0.80
10	12/20/84	8858	9690	8026	8858	8858	0.77	0.80	0.80	0.75	0.78
13	01/12/85	8442	7847	9393	9393	8769	0.80	0.77	0.77	0.75	0.77
16	02/04/85	8620	9571	8679	8977	8962	0.77	0.80	0.77	0.77	0.78
19	02/26/85	8442	9512	8799	8858	8903	0.82	0.82	0.80	0.80	0.81
22	03/25/85	9274	9334	8799	8977	9096	0.73	0.80	0.75	0.77	0.76
25	04/11/85	7669	8145	8501	8739	8264	0.80	0.77	0.73	0.80	0.77
28	05/02/85	8204	8323	8323	8382	8308	0.77	0.80	0.80	0.77	0.78
Seeding date: Oct. 23, 1984											
Dinoseb application											
Check		8085	8145	9036	8382	8412	0.75	0.71	0.77	0.75	0.74
4	11/30/84	9334	8918	8799	8442	8873	0.80	0.77	0.80	0.77	0.78
7	12/20/84	9036	8739	9393	9393	9140	0.77	0.75	0.75	0.73	0.75
10	01/12/85	9571	8680	8382	8977	8903	0.73	0.80	0.71	0.77	0.75
13	02/04/85	7907	7966	8680	7610	8041	0.80	0.77	0.73	0.77	0.77
16	02/26/85	9631	8442	9096	8264	8858	0.80	0.77	0.77	0.77	0.78
19	03/25/85	8799	7669	8323	8323	8278	0,77	0.75	0.80	0.77	0.77
22	04/11/85	8442	9274	8918	7193	8457	0.73	0.75	0.77	0.75	0.75
25	05/02/85	8442	8026	7253	8145	7966	0.73	0.80	0.77	0.77	0.77
28	05/23/85	8442	7847	9215	7669	8293	0.77	0.77	0.77	0.75	0.77

[1]Data are averages of two subsamples of 30 cm of row. Disease attack was visually estimated as percentage of infected tissue.

Appendix Table 8. Effect of dinoseb (1.7 kg/ha) and supplemental fungicides on growth and foliar disease attack in Stephens winter wheat when evaluated on May 9-12, 1985.[1]

Treatment	Tillers per 30 cm of row											Plant height										
	R1		R2		R3		R4		R5		Avg	R1		R2		R3		R4		R5		Avg
	S1[2]	S2	S1	S2	S1	S2	S1	S2	S1	S2		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
	(No.)											(cm)										
No dinoseb																						
Check	36	52	68	48	56	40	44	40	50	44	48	62	68	64	65	68	61	59	60	65	61	63
propiconazole	40	46	50	54	64	42	54	44	42	47	48	64	64	60	64	66	62	62	58	61	58	62
benomyl	43	42	48	50	64	46	40	48	38	30	45	66	65	64	63	66	66	61	64	60	60	64
propiconazole + benomyl	47	50	48	43	44	42	32	64	40	39	45	64	65	60	62	63	62	60	68	62	60	63
Dinoseb (December)																						
Check	45	56	46	48	42	35	34	36	36	46	42	66	67	60	62	60	57	61	60	60	62	62
propiconazole	50	46	58	38	50	53	40	52	29	35	45	65	64	62	61	62	62	60	66	59	60	62
benomyl	44	60	58	36	79	64	42	45	38	53	52	65	68	62	61	68	66	66	62	62	64	64
propiconazole + benomyl	42	48	52	63	46	50	38	44	44	37	46	65	64	64	66	62	64	66	62	64	59	64

(Continued)

Appendix Table 8 (continued)

Treatment	Fresh weight											Foliar disease attack										
	R1		R2		R3		R4		R5			R1		R2		R3		R4		R5		
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	Avg	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	Avg
	(g)											(%)										
No dinoseb																						
Check	248	364	462	356	391	268	284	254	358	292	328	10	10	5	5	3	5	10	10	10	10	8
propiconazole	288	313	326	408	440	284	355	270	294	298	328	10	8	5	5	3	3	10	8	8	10	7
benomyl	348	323	324	360	433	343	266	342	282	214	324	10	10	3	5	5	5	8	8	10	8	7
propiconazole + benomyl	332	364	328	306	314	292	214	498	284	300	323	10	10	5	3	5	8	8	8	10	5	7
Dinoseb (December)																						
Check	328	422	326	340	290	208	243	248	252	334	299	10	10	5	5	8	3	8	8	8	8	7
propiconazole	370	334	406	257	334	342	261	389	200	236	313	10	10	5	5	5	5	5	5	10	8	7
benomyl	350	412	378	260	571	456	341	304	287	418	378	10	10	3	3	3	5	8	8	10	5	6
propiconazole + benomyl	321	336	402	458	324	348	282	324	352	261	341	10	8	1	5	5	5	5	8	8	10	6

[1]Data are averages of two samples of 30 cm of row. Disease attack was visually estimated as percentage of infected tissue.

[2]S1: Subsample 1; S2: Subsample 2.

Appendix Table 9. Effect of dinoseb (1.7 kg/ha) and supplemental fungicides on growth, foliar disease attack, and yield in Stephens winter wheat.

Treatment	Tillers per 30 cm of row[1]						Plant height[1]						Fresh weight[1]					
	R1	R2	R3	R4	R5	Avg	R1	R2	R3	R4	R5	Avg	R1	R2	R3	R4	R5	Avg
	(No.)						(cm)						(g)					
No dinoseb																		
Check	34	46	48	56	26	42	80	85	85	86	77	83	316	440	452	538	253	399
propiconazole	42	44	58	54	27	45	82	86	88	86	78	84	382	417	552	492	296	428
benomyl	59	54	45	43	29	46	87	86	80	86	82	84	534	499	373	402	274	416
chlorothalonil	47	52	52	50	46	49	84	85	86	85	82	84	410	437	466	458	436	441
propiconazole + benomyl	52	56	60	44	42	51	86	86	87	87	84	86	508	486	559	448	420	484
propiconazole + chlorothalonil	48	40	52	42	40	44	84	84	86	82	81	84	478	375	499	408	409	434
benomyl + chlorothalonil	36	58	34	55	40	44	83	90	84	86	84	86	388	586	311	504	420	442
propiconazole + benomyl + chlorothalonil	28	39	42	46	38	39	84	86	86	88	87	86	289	324	404	482	379	376
Dinoseb (December)																		
Check	42	40	62	52	62	52	84	87	88	86	88	87	406	396	560	482	612	491
propiconazole	40	47	42	47	34	42	82	86	83	85	86	84	398	424	408	427	350	401
benomyl	40	40	56	44	40	44	82	83	86	86	84	84	384	332	450	412	372	390
chlorothalonil	43	52	48	30	45	43	84	85	86	83	79	83	417	454	416	261	462	402
propiconazole + benomyl	52	38	56	54	44	48	82	84	88	90	85	86	468	365	478	566	437	463
propiconazole + chlorothalonil	50	34	46	45	35	42	86	84	84	84	84	84	492	268	364	426	393	388
benomyl + chlorothalonil	41	46	58	60	48	51	80	83	90	89	86	86	431	392	540	613	499	495
propiconazole + benomyl + chlorothalonil	33	56	62	54	45	50	85	88	90	84	82	86	351	466	578	503	448	469

(Continued)

Appendix Table 9 (continued)

Treatment	Foliar disease attack[1]						Grain yield						Test weight					
	R1	R2	R3	R4	R5	Avg	R1	R2	R3	R4	R5	Avg	R1	R2	R3	R4	R5	Avg
	(%)						(kg/ha)						(kg/l)					
No dinoseb																		
Check	50	38	50	38	62	48	9809	10166	9274	9869	9343	9702	0.80	0.80	0.80	0.80	0.80	0.80
propiconazole	38	25	50	38	50	40	9869	9809	9631	9571	10107	9797	0.80	0.77	0.82	0.80	0.80	0.80
benomyl	25	25	50	38	62	40	10939	10760	10225	11177	10523	10725	0.80	0.80	0.80	0.77	0.82	0.80
chlorothalonil	50	38	62	50	62	52	9571	10225	9750	10047	9690	9857	0.77	0.80	0.80	0.82	0.80	0.80
propiconazole + benomyl	25	38	38	38	50	38	9988	10642	10344	10820	11117	10582	0.80	0.82	0.77	0.77	0.77	0.79
propiconazole + chlorothalonil	50	50	50	50	38	48	9750	9690	9512	9571	10166	9740	0.82	0.80	0.77	0.77	0.77	0.79
benomyl + chlorothalonil	38	25	50	38	38	38	9988	10582	10285	10820	10879	10511	0.77	0.80	0.77	0.77	0.82	0.79
propiconazole + benomyl + chlorothalonil	25	38	50	38	38	38	10642	11474	10404	10285	11236	10808	0.80	0.77	0.75	0.80	0.82	0.79
Dinoseb (December)																		
Check	38	38	38	38	38	38	10225	8739	9036	9571	9869	9488	0.77	0.77	0.77	0.82	0.80	0.79
propiconazole	38	38	50	50	50	45	9750	9096	8858	9928	10047	9536	0.77	0.77	0.80	0.80	0.80	0.79
benomyl	25	25	50	38	50	38	10642	11355	10523	10879	11177	10915	0.80	0.80	0.80	0.80	0.82	0.80
chlorothalonil	38	50	62	50	38	48	9988	9631	9453	10225	9512	9762	0.75	0.75	0.77	0.77	0.77	0.76
propiconazole + benomyl	25	50	50	25	50	40	9809	10939	10701	11533	11296	10856	0.80	0.80	0.77	0.77	0.80	0.79
propiconazole + chlorothalonil	25	50	75	50	62	52	9571	10523	9690	9869	10523	10035	0.77	0.82	0.82	0.80	0.77	0.80
benomyl + chlorothalonil	38	38	50	38	50	42	9512	11058	10820	10760	10523	10534	0.80	0.80	0.82	0.77	0.82	0.80
propiconazole + benomyl + chlorothalonil	50	38	38	38	38	40	10642	10939	10642	10642	11355	10844	0.80	0.80	0.80	0.80	0.77	0.79

[1]Evaluated on June 19, 1985. Data are averages of two subsamples of 30 cm of row. Disease attack was visually estimated as percentage of infected tissue.

Appendix Table 10. Daily precipitation (mm) and monthly totals for the period September, 1983 to July, 1985. Observations taken from Hyslop Research Farm for the 24-hour period ending at 8:00 a.m.

Date	1983				1984							
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug
1	7.11	0.00	5.84	7.62	0.51	0.00	3.05	0.00	18.80	0.00	0.00	0.00
2	1.52	0.00	1.78	0.25	2.03	0.00	4.83	2.79	7.62	0.00	0.00	0.00
3	T	0.25	10.41	1.27	13.21	0.00	0.25	0.25	10.16	0.00	0.00	0.00
4	0.00	0.25	11.43	1.27	0.25	0.00	0.00	0.00	0.25	25.40	0.00	0.00
5	0.00	0.00	0.00	14.73	0.00	0.00	0.00	1.27	3.05	0.51	0.00	0.00
6	0.00	0.00	8.89	18.29	0.00	0.76	0.00	2.03	2.03	19.56	0.00	0.00
7	0.00	0.00	5.33	3.56	0.00	0.00	0.00	0.25	0.00	13.21	0.00	0.00
8	0.00	0.00	0.76	19.05	0.25	1.02	0.00	21.34	2.03	1.27	0.00	0.00
9	2.03	0.00	9.91	4.06	0.00	2.79	0.00	0.51	0.51	0.76	0.00	0.00
10	0.51	0.00	1.27	9.65	9.65	19.30	2.29	12.95	0.25	4.06	0.00	0.00
11	1.02	0.00	12.70	10.92	17.53	7.37	0.00	8.13	5.59	0.00	0.00	0.00
12	0.00	0.00	4.83	0.25	0.00	8.38	6.10	12.19	0.25	0.00	0.00	0.00
13	0.00	0.00	22.35	11.43	0.00	56.39	10.67	2.79	0.00	0.00	0.00	0.00
14	0.00	1.52	14.22	13.97	0.00	4.06	5.84	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	3.81	8.13	0.00	3.05	6.35	0.00	1.52	0.00	0.00	0.00
16	0.00	0.00	13.97	0.00	0.00	14.99	1.27	0.76	5.84	0.00	0.00	0.00
17	0.00	0.76	18.29	0.00	0.00	0.00	13.21	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	28.45	0.00	0.00	2.54	5.33	2.54	0.00	0.00	0.00	0.00
19	0.51	0.00	10.16	0.00	0.25	0.00	5.33	0.00	0.25	0.00	0.00	0.00
20	0.00	0.25	17.78	1.02	0.00	6.60	0.25	1.52	4.06	4.83	0.00	0.00
21	0.00	0.00	0.51	0.25	6.60	11.43	15.75	1.27	0.00	23.88	0.00	0.00
22	0.00	9.91	0.25	0.00	11.94	0.76	1.27	0.51	1.52	1.27	0.00	0.00
23	0.00	0.25	9.14	0.00	1.02	1.27	0.76	0.00	17.02	0.00	0.00	0.00
24	T	0.00	21.08	0.25	5.59	20.07	0.00	0.00	0.51	0.00	0.00	0.00
25	0.00	0.00	6.60	1.02	13.21	13.72	1.02	0.00	0.00	0.00	5.08	0.00
26	0.00	0.00	5.59	5.59	0.25	0.00	8.89	1.52	11.94	0.00	0.00	0.00
27	0.76	0.00	0.25	4.83	0.00	0.00	0.51	0.00	0.00	5.84	0.00	0.00
28	0.00	0.00	0.76	0.00	0.00	1.27	2.29	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.76	9.65	0.51	0.00	1.78	3.05	0.00	9.65	0.00	0.00
30	0.00	7.37	5.08	27.94	0.00	0.00	0.00	10.92	0.00	0.00	0.00	0.00
31		6.10	0.00	11.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	13.46	26.67	252.22	186.69	82.80	175.77	97.03	86.61	93.22	110.24	5.08	0.00

(Continued)

Appendix Table 10 (continued)

Date	1984 Sept.	Oct.	Nov.	Dec.	1985 Jan.	Feb.	March	April	May	June	July
1	0.00	0.00	0.00	0.25	0.00	0.51	0.00	0.25	0.00	1.52	0.00
2	0.00	0.00	68.07	0.00	0.00	4.06	1.27	0.00	0.00	0.00	0.00
3	0.00	0.00	23.37	2.29	0.00	1.52	0.00	0.00	0.76	0.00	0.00
4	0.00	4.57	10.16	0.00	0.00	0.00	5.33	0.00	1.78	2.03	0.00
5	0.00	3.81	0.00	0.00	0.00	0.00	0.51	0.00	0.25	0.00	0.00
6	13.97	0.25	4.57	0.00	0.00	0.25	5.59	0.00	0.25	18.54	0.00
7	0.51	0.00	5.33	0.00	0.00	6.10	0.00	0.00	0.00	33.78	0.00
8	0.00	0.25	1.27	0.00	0.76	30.48	0.00	0.00	0.00	0.51	0.00
9	0.00	5.84	17.02	5.59	0.00	13.21	0.00	0.00	0.00	0.00	0.00
10	0.00	12.70	30.99	20.32	0.00	14.73	0.00	0.00	0.00	0.00	0.00
11	0.00	12.95	6.86	0.25	0.00	5.33	0.00	0.25	1.02	0.00	0.00
12	0.25	4.83	25.15	10.16	0.00	5.59	0.00	0.00	0.00	0.00	0.00
13	0.00	5.59	8.89	2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	3.05	0.76	0.00	0.25	0.00	0.00	0.00	2.29	0.00	0.00
15	0.00	5.08	0.00	1.27	0.00	2.54	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.25	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	8.38	19.30	1.78	0.25	0.00	0.00	0.25	0.00	0.00	0.00
19	0.25	16.26	1.27	0.00	0.00	1.02	0.00	3.30	0.00	0.00	0.00
20	3.05	9.91	20.83	0.00	0.76	7.11	2.29	3.05	0.00	0.00	0.00
21	0.00	0.51	2.29	3.81	0.00	0.00	8.64	1.27	0.00	0.00	0.00
22	0.51	0.00	0.00	0.51	0.00	0.25	10.92	6.35	0.00	0.00	0.00
23	0.25	0.00	0.25	3.05	0.00	0.00	21.59	8.13	0.00	0.00	0.00
24	0.00	1.52	11.43	0.00	0.00	0.00	17.78	2.79	0.76	0.00	0.00
25	0.00	0.25	16.76	0.25	0.00	0.00	6.60	0.51	0.00	0.00	0.00
26	0.00	6.35	3.81	3.30	0.00	0.00	15.24	0.25	0.00	0.00	0.00
27	0.00	8.89	19.56	8.64	0.00	0.00	17.53	0.00	0.00	0.00	0.00
28	0.00	5.84	27.43	9.65	1.02	0.00	2.03	0.25	0.76	0.00	0.00
29	0.00	0.51	5.08	3.05	1.52	0.00	0.25	0.00	0.76	0.00	0.00
30	0.00	0.00	13.72	21.34	0.00	0.00	2.29	0.00	0.00	0.00	0.51
31	0.00	0.51	0.00	2.54	1.78	0.00	7.62	0.00	15.24	0.00	13.21
Total	18.80	118.11	344.17	101.85	6.35	92.71	125.48	26.67	23.88	56.39	13.72

Appendix Table 11. Daily minimum and maximum surface temperature (°C) for the period September, 1983 to July, 1985. Observations taken from Hyslop Research Farm for the 24-hour period ending at 8:00 a.m.

Date	1983								1984			
	September		October		November		December		January		February	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	22.8	12.2	22.8	1.1	13.9	8.9	3.9	0.6	10.0	0.6	10.0	-1.7
2	22.8	9.4	22.2	3.3	15.6	11.1	5.6	1.7	5.0	0.6	10.6	-1.7
3	23.3	9.4	18.3	7.8	16.1	12.2	10.0	3.3	10.6	3.9	11.1	-1.1
4	24.4	13.3	22.8	9.4	16.7	7.2	6.7	-0.6	15.6	8.3	11.1	-2.2
5	22.8	9.4	19.4	2.8	15.0	3.3	7.2	1.1	17.2	8.3	15.6	-1.7
6	22.2	7.2	20.6	3.9	11.7	5.6	8.9	2.2	12.2	8.9	12.8	-0.6
7	26.1	8.9	18.3	3.3	12.8	5.0	6.1	3.9	10.6	6.1	16.7	1.7
8	21.1	7.2	20.0	3.9	12.2	0.0	8.9	3.9	11.7	2.2	9.4	3.9
9	19.4	7.2	18.9	5.0	7.8	1.1	10.6	5.0	9.4	3.3	16.1	5.6
10	21.1	8.9	16.7	9.4	15.0	7.2	11.1	5.0	7.2	4.4	8.3	2.8
11	21.1	12.2	19.4	5.6	14.4	7.8	11.1	3.9	8.9	4.4	8.9	3.9
12	23.3	10.0	21.1	5.0	13.9	6.7	7.8	0.6	10.0	4.4	11.1	5.6
13	26.1	8.9	21.7	5.0	12.2	5.6	8.9	6.1	6.1	0.6	12.8	7.8
14	26.7	11.1	14.4	5.6	10.0	6.1	11.1	7.8	8.3	-0.6	10.0	1.7
15	22.8	8.9	17.2	4.4	12.8	6.7	8.9	3.3	6.1	-2.2	8.3	2.8
16	26.1	10.0	16.1	-1.1	14.4	8.9	8.3	1.7	4.4	-6.1	11.7	3.3
17	22.8	7.2	14.4	0.0	12.2	7.2	3.9	-0.6	3.9	-6.1	9.4	-1.1
18	20.0	9.4	16.7	2.2	10.0	6.1	4.4	0.0	4.4	-5.0	11.1	-0.6
19	17.8	6.7	13.9	2.8	11.1	6.1	3.3	0.6	2.2	-5.0	12.8	5.0
20	20.6	6.1	15.6	6.1	11.7	3.3	5.6	-2.2	4.4	-5.0	11.7	6.1
21	25.0	11.1	17.2	4.4	7.2	3.3	-1.1	-8.9	1.1	-4.4	11.7	3.9
22	27.8	11.7	15.6	9.4	9.4	3.9	-5.0	-9.4	9.4	0.0	10.0	0.0
23	27.8	11.7	15.6	7.8	6.7	4.4	-6.1	-11.7	11.1	6.1	7.2	1.7
24	22.2	7.8	15.6	1.1	13.9	6.1	-3.9	-11.7	11.1	5.6	8.3	3.9
25	23.9	8.9	16.7	1.1	10.0	3.3	-2.8	-9.4	14.4	9.4	8.3	1.7
26	26.1	9.4	18.3	2.8	8.9	3.3	0.6	-4.4	11.1	2.2	11.1	0.6
27	19.4	7.2	21.1	3.9	10.0	5.0	3.3	-3.3	8.9	1.1	10.0	1.7
28	17.8	3.9	12.8	6.7	11.7	6.7	1.7	-3.3	12.8	1.7	14.4	2.8
29	19.4	2.8	10.0	7.2	11.7	1.1	0.6	-1.7	11.7	2.2	13.9	3.3
30	21.1	4.4	11.1	7.8	7.2	1.1	2.2	-0.6	13.3	4.4		
31			16.7	7.2			7.8	1.1	13.9	-1.7		
Avg.	22.8	8.6	17.3	4.8	11.8	5.4	4.9	-0.6	9.2	1.7	11.2	2.2

(Continued)

Appendix Table 11. (continued)

Date	1984 March Max.	March Min.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1	12.2	5.6	16.7	2.2	12.8	6.7	18.3	5.6	22.2	9.4	28.3	13.9
2	13.3	4.4	13.3	4.4	15.6	7.8	20.0	7.2	27.2	12.2	24.4	13.3
3	12.8	2.2	15.0	5.0	15.0	6.7	19.4	3.9	25.6	12.8	26.1	10.0
4	10.6	1.7	12.8	5.6	15.6	3.3	17.8	9.4	28.3	13.9	25.0	6.7
5	16.7	2.8	12.2	6.7	12.8	4.4	16.1	9.4	30.0	11.7	27.2	9.4
6	16.1	0.0	12.8	0.0	12.8	0.0	13.9	8.3	25.0	8.3	24.4	6.7
7	18.9	2.2	13.9	4.4	15.6	1.7	14.4	8.3	22.8	8.9	26.7	8.3
8	17.2	3.9	12.8	5.0	23.9	6.7	15.6	5.6	25.6	9.4	31.1	12.2
9	20.6	6.1	11.7	3.9	18.3	5.0	16.1	8.9	26.7	6.7	34.4	12.2
10	18.9	8.3	10.0	5.0	15.0	6.7	15.6	5.0	25.6	9.4	33.3	10.6
11	16.7	2.8	12.2	4.4	15.6	7.8	18.3	5.6	27.2	7.2	29.4	8.9
12	10.0	4.4	11.7	7.2	18.3	8.9	20.6	8.9	21.7	10.6	25.0	11.1
13	13.3	5.6	12.2	1.7	17.8	10.0	22.2	7.2	22.8	10.0	22.8	5.6
14	14.4	6.7	15.0	3.3	18.9	3.3	22.8	8.3	26.1	11.1	25.6	6.7
15	13.9	7.8	24.4	8.9	13.9	3.3	25.6	7.8	29.4	13.3	27.2	7.2
16	14.4	7.2	13.3	7.2	14.4	1.1	22.2	4.4	33.3	14.4	30.0	10.6
17	12.2	4.4	13.9	0.6	18.3	4.4	18.9	6.7	35.0	12.8	27.8	11.1
18	12.8	6.1	14.4	6.1	21.1	5.6	22.2	6.7	32.2	8.3	27.2	8.3
19	11.7	6.7	15.6	4.4	22.2	10.0	23.3	6.7	28.9	7.2	26.1	9.4
20	16.7	8.9	13.9	5.0	16.7	6.1	23.9	11.7	26.7	11.1	26.1	8.3
21	16.1	6.1	15.6	4.4	15.6	3.3	15.0	10.6	25.6	8.3	29.4	6.7
22	13.9	5.6	13.3	2.8	17.2	4.4	16.7	6.1	25.0	12.2	28.9	7.8
23	16.1	7.8	17.2	2.2	12.8	5.6	23.9	8.3	31.7	11.1	25.0	11.1
24	14.4	2.8	13.9	2.8	16.7	3.3	29.4	8.3	27.8	12.8	23.9	8.9
25	13.3	5.6	11.1	1.1	15.6	7.8	27.8	11.1	28.3	13.9	26.1	9.4
26	10.0	6.1	11.1	0.6	15.6	10.0	29.4	10.6	20.6	8.3	30.0	10.6
27	13.9	0.6	16.1	0.6	20.0	7.2	21.1	13.3	27.2	8.9	33.9	8.3
28	15.0	6.7	17.8	0.6	22.8	10.0	27.8	12.8	25.6	11.1	25.6	12.2
29	12.8	1.7	13.3	4.4	28.9	9.4	25.0	10.6	25.6	10.0	25.0	9.4
30	12.8	-0.6	12.8	5.0	28.9	10.6	25.0	6.7	27.8	11.7	28.9	8.9
31	14.4	2.8			16.7	2.8			32.2	11.7	23.9	13.9
Avg.	14.5	4.6	13.9	3.9	17.7	5.9	21.0	8.2	27.2	10.6	27.4	9.5

(Continued)

Appendix Table 11 (continued)

Date	1984 September Max.	Min.	October Max.	Min.	November Max.	Min.	December Max.	Min.	1985 January Max.	Min.	February Max.	Min.
1	21.7	12.8	18.3	6.7	10.6	2.8	9.4	0.6	3.3	-1.7	4.4	-1.1
2	24.4	7.2	21.1	6.1	12.2	3.9	4.4	0.6	3.9	-1.7	8.3	0.6
3	27.8	5.0	23.3	5.6	14.4	7.8	6.7	1.1	5.0	-3.9	2.8	-3.9
4	28.9	8.9	20.6	7.2	15.0	5.6	7.2	-0.6	4.4	-3.9	2.8	-7.2
5	29.4	10.0	17.8	5.0	15.0	4.4	6.1	-0.6	2.2	-3.9	3.3	-6.7
6	22.8	7.8	16.1	5.6	11.1	6.7	6.7	-3.9	3.9	-1.7	6.7	0.0
7	19.4	10.6	25.6	9.4	12.2	5.6	6.1	-3.3	4.4	-0.6	8.9	1.7
8	22.8	15.6	28.9	10.0	13.9	2.8	7.2	0.0	5.6	-2.2	5.0	0.0
9	23.9	14.4	21.7	8.9	8.3	4.4	6.7	2.8	5.6	-2.8	5.6	0.0
10	21.7	8.9	20.0	10.0	10.6	5.0	7.8	3.9	6.7	-3.9	6.7	0.0
11	21.1	9.4	13.3	8.9	13.3	8.3	7.2	0.0	0.0	-3.9	8.3	2.8
12	20.6	6.7	15.0	7.8	11.1	9.4	8.9	1.1	4.4	-3.9	10.6	1.1
13	22.2	8.3	16.1	8.3	14.4	8.3	8.9	1.1	5.6	-4.4	9.4	-1.7
14	26.1	11.1	15.6	6.1	10.6	0.6	8.9	1.7	3.9	-4.4	9.4	-0.6
15	28.9	8.9	11.7	2.2	10.0	2.8	7.8	0.0	10.0	0.6	13.3	0.0
16	27.2	8.3	10.0	2.8	8.3	3.3	4.4	0.6	6.1	1.1	11.7	0.0
17	28.3	8.9	11.7	1.1	12.8	1.7	6.7	1.1	8.9	-0.6	8.3	0.0
18	30.6	10.0	12.8	2.2	10.0	2.8	5.0	-3.9	3.9	-1.1	11.1	-2.2
19	29.4	13.9	8.3	6.1	12.2	5.0	0.6	-6.7	8.3	-0.6	11.1	-1.1
20	18.9	13.3	12.2	6.7	10.0	5.6	-1.1	-8.9	5.6	1.7	7.2	1.7
21	20.0	7.8	8.9	2.2	10.6	1.1	2.8	-5.6	10.0	1.7	10.0	2.8
22	18.9	7.8	9.4	3.9	6.1	2.8	7.8	1.7	11.7	-2.2	11.1	5.0
23	17.2	2.8	10.0	1.7	10.0	1.1	7.8	3.3	10.6	-2.8	14.4	2.8
24	17.8	1.7	9.4	3.3	10.0	0.6	9.4	1.7	8.3	-2.2	16.7	5.6
25	19.4	3.9	13.9	8.3	6.1	1.7	7.8	0.6	7.8	-1.7	13.9	-1.7
26	21.1	3.9	17.2	7.2	7.2	-1.7	3.3	1.7	7.8	-4.4	10.6	0.6
27	22.8	6.1	11.1	5.0	8.3	0.0	8.3	2.8	7.2	-4.4	11.1	0.6
28	24.4	11.1	10.0	4.4	8.9	6.7	7.2	0.0	1.7	-3.3	14.4	-0.6
29	26.1	5.0	12.8	2.2	10.0	3.3	7.2	1.1	5.6	-1.7		
30	26.1	7.2	12.2	2.8	7.2	5.0	6.7	3.9	6.1	-3.3		
31			10.6	1.7			8.9	1.1	2.2	-1.7		
Avg.	23.7	8.4	14.9	5.4	10.7	3.9	6.4	-0.1	5.9	-2.2	9.4	.0

(Continued)

Appendix Table 11 (continued)

Date	1985									
	March		April		May		June		July	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	15.0	0.6	15.0	10.0	21.7	6.7	18.3	6.1	23.9	8.9
2	11.1	-0.6	19.4	6.7	22.8	5.0	17.8	7.8	31.7	11.1
3	11.1	0.0	20.6	6.7	22.8	6.1	22.2	7.2	31.1	7.8
4	7.8	1.7	16.1	4.4	13.9	1.7	18.9	10.6	30.6	10.0
5	7.8	2.8	16.1	4.4	15.6	0.6	22.2	11.1	28.3	7.8
6	9.4	-1.1	19.4	5.6	16.1	5.0	20.6	12.8	26.1	11.1
7	11.1	-0.6	23.3	6.7	15.6	4.4	18.3	12.8	30.0	12.2
8	10.6	-1.7	15.6	6.7	16.1	0.6	18.3	6.7	32.2	9.4
9	12.8	-0.6	20.6	5.0	14.4	2.2	21.1	7.2	33.3	11.7
10	15.0	0.6	25.6	7.8	18.3	4.4	23.9	6.1	35.6	10.6
11	16.1	-2.2	19.4	10.0	15.0	-2.2	26.7	8.3	30.0	12.2
12	15.0	0.0	18.3	4.4	13.9	-1.1	28.9	10.0	31.1	11.1
13	11.1	0.0	22.2	5.6	18.3	2.2	26.7	8.9	29.4	9.4
14	13.9	-1.1	23.3	6.7	17.8	1.1	27.8	12.2	29.4	10.6
15	14.4	1.1	22.8	6.7	16.1	5.6	25.0	13.9	32.8	8.3
16	15.6	0.0	17.2	6.7	26.1	8.9	23.9	7.2	30.6	10.6
17	14.4	1.1	13.9	6.1	27.8	6.1	27.2	12.8	28.9	11.7
18	13.9	1.7	16.1	6.7	23.3	9.4	33.3	12.2	29.4	13.3
19	16.1	2.2	11.1	2.8	22.8	7.2	34.4	11.1	36.1	13.9
20	13.3	6.1	11.1	2.2	19.4	6.7	30.6	7.2	37.2	10.6
21	13.9	2.2	12.2	4.4	20.0	7.8	27.2	8.3	35.0	12.2
22	9.4	2.8	11.1	2.8	26.1	7.8	27.8	8.9	31.7	14.4
23	9.4	3.9	11.1	5.6	28.9	12.8	23.9	4.4	30.0	12.2
24	10.0	2.2	13.3	4.4	21.7	13.9	20.0	2.8	29.4	14.4
25	9.4	1.1	11.1	0.0	21.7	10.6	17.8	3.3	27.2	11.1
26	9.4	0.0	11.7	4.4	21.1	11.7	25.6	7.8	32.2	12.8
27	7.2	0.6	14.4	7.2	20.6	7.8	27.2	5.6	34.4	10.0
28	7.8	1.1	18.3	8.3	17.8	9.4	20.6	6.1	33.9	10.6
29	11.1	-0.6	15.0	4.4	16.7	6.1	25.0	7.8	34.4	10.0
30	8.9	1.1	18.3	1.1	16.1	7.8	20.6	8.9	26.1	15.0
31	11.7	7.8			19.4	9.4			17.2	14.4
Avg.	11.6	1.1	16.9	5.3	19.5	6.0	24.3	8.6	30.9	11.4

Appendix Table 12. Daily relative humidity (%) and monthly averages for the period September, 1983 to July, 1985. Observations taken from Hyslop Research Farm for the 24-hour period ending at 8:00 a.m.

	1983				1984									
Date	September	October	November	December	January	February	March	April	May	June	July	August	September	October
1	61	23	99	80	99	63	63	36	80	34	30	43	60	56
2	51	24	64	80	99	60	56	50	70	32	39	50	45	48
3	46	49	93	90	99	64	54	31	62	41	37	47	30	46
4	46	M	86	91	99	64	61	61	47	44	32	43	34	51
5	44	45	66	99	85	47	37	64	59	84	31	45	34	71
6	32	34	88	83	99	64	39	41	M	65	42	47	51	70
7	42	38	64	85	99	53	36	38	M	90	31	34	58	46
8	33	26	62	95	82	99	45	74	27	50	29	31	62	34
9	48	44	99	83	92	69	47	53	41	56	28	36	60	62
10	22	63	62	95	99	85	48	72	47	49	34	33	50	51
11	65	61	88	76	99	79	40	44	50	45	28	40	48	62
12	42	41	63	99	96	88	81	50	56	36	50	51	47	63
13	40	29	69	99	90	92	60	51	66	47	44	45	36	68
14	41	74	86	87	44	65	63	58	55	53	35	38	36	51
15	39	49	69	62	35	70	61	41	62	48	41	37	28	66
16	24	32	50	58	48	80	46	64	63	42	M	35	30	69
17	42	54	88	83	53	67	63	46	43	47	19	43	40	64
18	31	72	85	86	48	62	53	40	M	39	26	47	32	62
19	46	71	75	76	55	62	95	33	52	29	37	37	34	86
20	24	72	80	54	69	99	94	43	64	M	25	32	83	83
21	16	72	100	55	75	88	64	50	42	74	41	29	47	83
22	16	97	72	41	99	52	55	82	36	54	40	23	48	76
23	27	78	99	70	75	71	49	44	70	40	31	49	48	78
24	47	46	100	72	98	84	39	41	38	34	49	45	48	81
25	40	48	75	99	95	75	40	46	42	35	36	41	32	83
26	30	50	80	76	77	55	99	44	76	34	63	31	39	69
27	53	48	100	74	93	62	52	44	M	88	39	34	42	67
28	30	86	M	99	71	52	33	18	36	44	45	48	34	77
29	21	100	71	99	80	51	46	37	33	38	42	35	30	57
30	17	100	66	83	61		48	51	33	42	46	43	30	52
31		99		99	58		35		35		37	58		65
Avg	37	57	79	82	80	70	55	48	51	49	37	40	43	64

(Continued)

Appendix Table 12 (continued)

Date	1984 November	1984 December	1985 January	1985 February	1985 March	1985 April	1985 May	1985 June	1985 July
1	45	64	81	66	56	78	40	52	36
2	55	81	64	61	45	63	47	52	26
3	65	61	59	62	37	48	35	42	22
4	50	57	55	48	65	46	50	58	28
5	53	60	62	45	67	48	45	48	26
6	70	54	64	74	54	46	43	48	35
7	70	56	60	62	44	40	44	78	28
8	60	74	62	87	50	60	42	56	34
9	78	80	74	74	46	50	47	36	28
10	81	78	61	58	40	41	38	37	31
11	77	71	94	54	36	37	47	28	43
12	75	66	59	77	48	49	36	33	23
13	68	67	56	56	50	37	32	44	31
14	68	70	60	60	46	38	42	39	24
15	74	67	78	69	47	40	40	52	25
16	66	79	90	53	46	64	36	40	27
17	57	69	62	52	54	53	28	33	41
18	83	60	92	59	50	46	42	28	42
19	63	47	74	49	52	54	44	36	20
20	72	57	88	69	40	48	50	M	29
21	70	85	62	61	79	44	49	41	22
22	85	81	59	72	79	61	31	34	26
23	62	80	52	56	79	60	36	32	58
24	65	74	56	48	77	58	57	36	44
25	87	73	56	47	58	56	49	56	43
26	75	89	55	51	56	46	48	34	33
27	M	62	53	55	36	63	52	39	26
28	81	75	80	48	62	54	54	46	25
29	78	67	66		52	42	53	33	28
30	76	78	62		57	43	54	45	50
31		80	88		78		41		92
Avg	69	70	67	60	54	50	44	43	34