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PERFORMANCE OF PUBLIC AND PRIVATE SMALL GRAINS IN INDIANA, 2004

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Performance of Public and Private Small Grains in Indiana, 2004

INTRODUCTION

Winter wheat and spring oats (small grains) are evaluated annually at several locations in Indiana. These trials are conducted according to the policies and procedures of Indiana Agricultural Research Programs at Purdue University. In this bulletin, results of the 2004 small grain performance trials are presented for those entries which are believed to be available to producers for seeding. Data for experimental entries are not included.

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http://www.agry.purdue.edu/ext/variety.htm

Bulletin copies may be available, in Indiana, from local county Agricultural Extension Offices.

Performance results for both private and public entries are presented. Certified seed was used for seeding most of the public varieties. Private entries, entered voluntarily by the owner, were accepted in the trial after meeting the requirements for eligibility and payment of a testing fee. No verification has been made that the seed or the quality of the seed entered in this trial is the same as that offered for sale to the public.

Plans and rules for entering this trial are available, upon request, to anyone at any time. Persons wishing to enter the small grain performance trial should contact the author by August 1 for winter wheat and by February 1 for spring oats.

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PERFORMANCE TRIAL METHODOLOGY

This section contains information on locations and procedures used in conducting the trials.

Trial Locations

In 2004, trials were conducted at five locations for winter wheat and two locations for spring oats (see Figure 1). The locations, numbered from north to south, are:

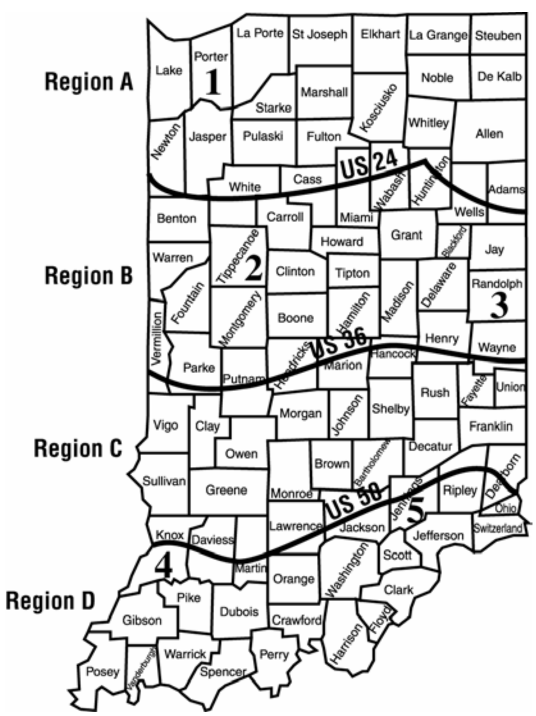
Location 1. Porter County at the Pinney Purdue Agricultural Center near Wanatah, on Runnymede loam, a dark gray depressional soil under laid by sandy substrata.

Location 2. Tippecanoe County, near Lafayette, at the Purdue University Agronomy Center for Research and Education, on Drummer (Chalmers) silty clay loam, a very dark gray or black, poorly drained depressional soil.

Location 3. Randolph County at the Davis Purdue Agricultural Center near Farmland, on Blount silty clay loam, a dark grayish-brown, somewhat poorly drained soil.

Location 4. Knox Co., at the Southwest Purdue Agricultural Center near Vincennes on Ade loamy fine sand, a very dark gray, gently sloping somewhat excessively drained soil. Ade soil has low available water capacity and rapid permeability. Organic matter is relatively high and surface runoff is slow.

Location 5. Jennings Co., at the Southeast Purdue Agricultural Center near Butlerville, on Avonburg silt loam, a light grayish, nearly level, somewhat poorly drained soil, with fragipan in the sub-soil.



Hessian fly-free dates in Indiana:

Region A, Sept. 22 (north) to Sept. 26 (south)
Region B, Sept. 26 (north) to Oct. 1 (south)
Region C, Oct. 1 (north) to Oct. 6 (south)
Region D, Oct. 6 (north) to Oct. 9 (south)

Figure 1. Trial locations and Hessian fly-free dates.

Methods Used in the Trials

Seedbeds were prepared using conventional farm equipment. A randomized complete block design, with 4 blocks, was used in all trials. The wheat plots were planted in drill strips 35 feet long and 75 inches wide, and the oat plot drill strips were 75 feet long and 70 inches wide. All plots were end trimmed at harvest to approximately 20 feet in length for wheat and oats, and all rows were harvested. Plot width of 75 inches for wheat and 70 inches for oats was used for calculating harvest area for yield.

The plots were harvested with an Almaco plot combine, and were weighed and moisture tested automatically, on the combine, using a Seed Spector II and a Psion Workabout (computer). The Almaco plot weight and moisture equipment was calibrated using a Chantillon scales and a Motomco moisture meter, and the calibrations were checked throughout the harvest season.

It should be pointed out that the electronic weighing and moisture testing equipment, on the Almaco plot harvester, are not the same as equipment used to meet official grain grading standards, but are believed to be suitable for field plot work.

Grain yields from the test plots are reported as estimates of bushels per acre, adjusted to 14 percent moisture content.

Test weights were performed after harvest, in the Vartest building, using standard test weight equipment.

Lodging is expressed in percent from 0 to 100. Plots with a score of 0 to 25 percent are generally harvestable with conventional equipment, from either direction, and at optimum speed. Plots with a lodging score of 25 to 50 percent are harvestable, but may require reduced speed. As lodging percentages exceed 50 percent, harvesting problems escalate quickly and beyond 75 percent some grain may be lost, or damaged by contact with the soil.

Plant height, taken at harvest, was from the center of the plot and was measured to the nearest inch from the soil surface to the top of the head.

Winter killing data, at all locations, are generally taken when the plants were beginning spring growth. The data are based on visual observation and not on actual stand count, and are influenced by differences in plant vigor and vegetative growth. In 2004, no winter killing was observed in the winter wheat performance trials.

Date headed is the day when 80 to 90 percent of the heads have ruptured the boot.

Fertilization programs are described in the footnotes of each table. Starter fertilizer was applied, at planting, at all locations, and all winter wheat trials were top-dressed with supplemental nitrogen in the spring.

Soil test results for each of the trials, in 2004, are presented in the footnotes. The soil test values for phosphorus (P) and potassium (K) are expressed in parts per million (ppm) instead of pounds per acre (lbs./acre). To change ppm to lbs./acre, multiply ppm by 2. Conversely, to change lbs./acre to ppm, divide lbs./acre by 2.

Seeding rates for proprietary wheat entries were chosen by the owner, and ranged from 1.4 to 1.8 million live seeds per acre. Public wheat varieties were seeded at 1.8 million live seeds per acre, and the oat trials were seeded at 1.69 million live seeds.

Seed Size and Plant Populations

Seed size will vary among seed lots for any entry. In extreme cases, the smallest size seed may contain nearly double the number of seeds per bushel in comparison with the largest size seed.

A final stand of 1 to 1.3 million plants per acre, or 30 plants per square foot, is the optimum population for soft red winter wheat production in Indiana. Yields generally plateau at this population and any additional yield increases are due to favorable weather combined with best management practices.

Approximately 90 percent of the live seed sown should emerge, if high quality seed is sown in a firm, moist seedbed. A seeding rate of 1.5 million live seeds per acre should produce a final stand of 1.35 million plants per acre, which is about 30 plants per square foot.

The number of seeds per pound may be determined by counting out 100 seeds and weighing them on a gram scale (most grain elevators have one). Divide the weight of the 100-seed sample into 454 (the number of grams in a pound), and multiply by 100 (the number of seeds counted). Example: 100 seeds weigh 3.2 grams; 454 divided by 3.2 times 100 = 14,188 seeds per pound. Then adjust for germination to determine the final seeding rate. If the seed germinates 95 percent, there will be 13,478 live seeds per pound (14,188 times 0.95). Dividing 1,500,000 by 13,478 gives 111 pounds of seed per acre, or the amount needed to establish a stand of 30 plants per square foot.

This information is useful in deciding the population you want to achieve in the original stand, and for decisions you may need to make regarding an inadequate stand. Ask your seed dealer to furnish the seed count, in number of seeds per pound, and the recommended seeding rate for the seed lot you are planting. Then calculate the pounds per acre needed to provide an optimum population in the original stand.

The same principle applies to oats. However, the original stand is more important in oats, because during some seasons there may be little or no tillering, particularly if seeding is delayed, or moisture is deficient. The recommended oat population is 35 plants per square foot or 1.52 million plants per acre. This would require a seeding rate of 1.69 million live seeds per acre, assuming 90 percent emergence.

A plump-seeded oat variety (3 grams per 100 seeds) would require about 118 pounds of live seeds per acre. Use the same procedure for calculating oat seeding rates and stands as for wheat, but remember that oat populations need to be greater than wheat populations.

Stand reductions, in winter wheat, may occur if winter conditions are severe. The wheat plant, if properly hardened through a gradual hardening process, should be able to tolerate temperatures as low as –5° F without injury. At temperatures of –5° to –10° F injury could occur if unfavorable conditions such as dry soil, low phosphorus, late planted and/or small plants, or other plant stresses are present. If temperatures reach -10° F or lower, and remain at that temperature for two hours or longer, injury is likely. The extent of the injury will depend on the condition of the plant, how low the temperature goes, and how long it remains at that level.

Snow cover of 1 to 2 inches on wheat offers excellent protection against sub-zero temperatures. If cold weather is forecast, keep a record of the amount of snow cover, the extreme low temperature and the duration of the low temperature. This will be useful information in predicting the possibility of damage to the wheat crop.

When making stand counts on small grains, divide 144 (the number of square inches in a square foot) by the drill row spacing in inches to get the number of linear inches of drill row needed to equal 1 square foot. Example: 144 divided by 7 inches (drill row spacing) = 20.5 inches of linear drill row needed to equal 1 square foot. Make numerous random spot checks throughout the field by counting the number of plants or seeds in 20.5 inches of row length, and average several observations to estimate the population.

For purposes of making yield estimates, each wheat plant should produce one culm (main stem) and one or more tillers. The culm normally produces a head, but under stress the tillers may not produce heads. Less than ideal conditions reduce grain production in the tiller first and then in the culm.

One head of wheat usually produces one gram of seed (or grain), which is normally 30 to 32 grains of wheat. One head of wheat per square foot is equal to 1.6 bushels per acre. At 30 heads per square foot (one head per plant), the estimated yield potential is 48 bushels per acre.

At 30 plants per square foot, under ideal growing conditions, each plant may produce two heads (one culm and one tiller), which would have a yield potential of 96 bushels per acre.

A population of 15 plants per square foot may produce acceptable yields (15 to 20 percent yield loss), but 10 plants per square foot may reduce yields by 50 percent or more, and weed problems are likely.

During the unusually warm weather in the winter of 2001-2002, questions were raised about the vernalization of the winter wheat crop. Dr. Fred Patterson, Wheat Breeder and Professor Emeritus of the Purdue University Agronomy Department provided the following information on vernalization:

> **Vernalization** requirement of winter wheat is the period of cold conditioning necessary before the wheat plant will go from the vegetative tillering stage into the jointing and heading stages. Temperatures just above freezing are adequate. Different winter wheat cultivars (varieties) have different lengths of vernalization requirements from about 42 to 70 days. In a vernalization cold room for greenhouse winter wheat plants, Purdue wheat breeders use 65 days at 36° to 38° F, with short day-length light period of 12 hours. For a normal Indiana winter wheat crop, the vernalization requirement would be met by about January first. If vernalization is interrupted by a period of hot weather, as sometimes occurs in south Texas, winter wheat does not resume vernalization and would not head.
>
> Cold acclimatization for survival is a separate process and requires below freezing temperatures to develop the ability of the wheat plants to survive Indiana's coldest winter periods.

PERFORMANCE TRIAL RESULTS

An analysis of variance and a test of significance were computed on all performance categories where sufficient data were available. The analysis of variance for bushels per acre yield, was significant at the 10 percent probability level this year (2004) for all of the single-year, single location, yield data presented, except for the winter wheat and spring oat trials in Porter County, Location 1, (Tables 1 and 8) and the spring oat trial in Tippecanoe County, Location 2, Table 9.

The Waller-Duncan Bayesian k-ratio t test is used in determining significant differences for the Indiana small grain performance trials. The Bayesian procedure has a direct dependence upon the calculated F-value for entries. As the F-value increases, the Bayesian least significant difference (BLSD) decreases. In computing the BLSD for the test of significance, a k ratio of 100:1 was used. This ratio may be considered in a loose sense to take the place of the 5 percent level of significance. The BLSD value may be used to make all possible pair-wise comparisons, i.e., any two values in the same column of a sub-table may be compared.

Multiple-year results, especially those having the greatest number of years, are generally best for predicting performance. This is because no interaction of entries by years can be computed for one-year data. This interaction (entry by year) is usually larger than the experimental error in one-year analyses.

The coefficient of variability (C.V.) is an indication of the precision of the test. The coefficient of variability is a relative term. It is the ratio of the standard deviation to the grand mean of the test, expressed as a percent. On the western side of Indiana a small grain test with good precision will have a C.V. for yield of 5 percent or less; and on the eastern side of the state, the C.V. will be 10 percent or less. Whenever the C.V. is larger than normal for a test location it indicates that the precision of the test was below normal. When yields are high and the experimental error in the test is small, the C.V. will be small.

Across the years, tests have been performed to determine whether there are specific areas of adaptation for small grain varieties. Is there a variety that is superior on sand, or clay, or adapted to a particular part of the state? To date, there is no evidence to support such a claim.

In long-term averages, those entries that are either at the top or bottom in yield, are generally the same at each test location. For normal production situations, these small grain performance data have broad application in Indiana.

At Location 1 (Porter Co.), in 2003, August rain totaled 2.10 inches and September 2.81. The wheat plots were planted October 11 in a firm seedbed. The planting date was approximately 2 weeks after the Hessian fly-free date. The first sharp freeze (27° F) came on October 17 and 18. October rain totaled 3.10 inches. Wheat emergence was normal and uniform, vigorous stands were established.

November precipitation totaled 3.28 inches, with only a trace of snow the last week of the month. November temperatures were generally mild and wheat growth continued through the month.

December precipitation totaled 1.36 inches with most of it coming as snow the first of the month. Snow cover was present during the first and last week of the month. Total snowfall was 5.6 inches Temperatures cooled gradually, hardening the wheat plants before the coldest weather arrived. The coldest December temperature was 9° F and was recorded on December 13.

January 2004 precipitation totaled 0.73 of an inch. Snow fall for the month totaled 10.6 inches. Snow arrived on January 5 and protected wheat plants for the rest of the month. Six days recorded below 0° F temperatures, and snow cover was present on all of those days. The coldest January temperature (-10° F) came on the night of January 31.

February precipitation was 0.45 of an inch, and came in snow fall which totaled 4.5 inches. Snow cover of 1 to 5 inches remained for the first 22 days of the month, and was present during the 3 days when temperatures were below 0° F. Temperatures moderated the last week of the month and snow cover melted completely.

The coldest March temperature came on the night of March 12, when temperature dropped to 15° F. The highest March day temperature (76° F) was recorded on March 29. Precipitation for the month was 3.65 inches.

The spring oat trial was planted April 5, 2004 in a firm, dry seedbed. Precipitation for the month was 0.82 inches. Oat emergence was slow, due to dry weather, and marginal oat stands were established. Temperatures reached 88° F on April 19, and 6 days, in April, had temperatures 80° F, or above. The wheat trial began spring growth during April, and no winter killing was observed in the wheat plots.

May rain totaled 5.15 inches. The largest amount (1.16 inches) came on May 10, the next heavy rain (1.12 inches) came on May 31. The rest of the precipitation came in showers of less than three-quarters of an inch. The first 90° F temperature of the spring growing season came on May 7. Otherwise, temperatures were generally mild and provided excellent growing weather for both wheat and oats.

June rain totaled 3.87 inches. The heaviest rain (0.84 and 1.34 inches) came on June 11 and 12. The rest of the precipitation was distributed throughout the month with most of the showers bringing rain of half of an inch or less. June 9 and 10 had daytime high temperatures of 92° and 90° F, respectively. Wheat made rapid growth and development during June, and the wheat trial was harvested June 30, 2004.

Precipitation from July 1 through 15 measured 1.24 inches, and came in amounts of less than one inch. Eleven of the first fifteen days in July had temperatures above 80° F. The oat trial was harvested on July 15.

From October 1, 2003 through March 31, 2004 the wheat trial received a total of 12.57 inches of moisture. From April 1, 2004 through June 30, 2004, rain totaled 9.84 inches. Total moisture for the wheat trial was 22.41 inches. The oat trial, from planting to harvest, received 11.08 inches of rain.

Data for 2004, for winter wheat, in Table 1 at Location 1, are not statistically significant, at the 10 percent probability level. The information from the 2004 winter wheat trial should be compared, and used, with multiple year data when making performance comparisons. See Table B for wheat disease and insect ratings.

The oat trial at Location 1, presented in Table 8, has higher yields, more lodging and earlier heading dates than in previous years. Yields are not, statistically, significantly different in either the 2004 trial data, or the multiple year averages.

Wheat and Oat data from Location 1 are also included in the 2004 multi-location averages in Tables 7 and 10 respectively.

At Location 2 (Tippecanoe Co.)**,** in 2003, August rain totaled 3.55 inches with more than half of it coming the last two days of the month. September was wet with 7.14 inches of rain. The heaviest rain (2.51 inches) came on September 1; the next heavy rain (1.67 inches) fell on September 27. The remainder of the precipitation was scattered throughout the month in amounts of 0.80 of an inch or less. The regular date-of-seeding wheat trial was planted October 1 (less than a week after the Hessian fly-free date) in a firm moist seedbed. A brief shower (0.19 of an inch) came three days after planting.

October was dry and mild. Rain totaled 1.3 inches for the month, and came in showers of less than two-thirds of an inch. Daily high temperatures ranged from 50° to 82° F and low temperatures ranged from 27° F (on October 2) to 53° F. The regular date of seeding wheat trial, three weeks after seeding, had vigorous, uniform stands and 2 to 3 inches of growth

The late-seeded wheat trial was planted October 21, 2003 (about three weeks after the Hessian fly-free date). The seedbed was moist and firm. By November 2, the late seeded wheat had developed good stands and plants were about one inch tall.

November rain (4.07 inches) was distributed throughout the month, and temperatures were mild. Daytime highs ranged from 30° to 78° F, and nightly lows from 17° to 58° F. Wheat growth and development continued through November.

Temperatures cooled slowly at the beginning of December. The coldest December temperature (13° F) came on the nights of December 20 and 21. Precipitation for the month was 2.76 inches. Snow arrived on December 5 and 6, and provided about 2 inches of cover for a few days. From the middle to the last of the month, snow cover was light and was generally less than an inch deep.

January snow did not arrive until January 26. The last 6 days of the month had about 2 inches of snow cover, which provided protection from the coldest temperatures of the month. Precipitation for the month totaled 2.2 inches. The coldest January 2004 temperature (-11° F) came on January 31.

February was dry, with 0.46 inches of precipitation. February snow totaled 2.8 inches. Snow cover (from January) remained in depths of 1 to 3 inches during the first 16 days of the month. The coldest February temperature (-11° F) was on February 1. The warmest temperature (56° F) was on February 29. Wheat remained dormant during the month.

March precipitation was 4.08 inches. An inch and a half of snow cover remained for 1 day during the middle of the month and that was the end of snow cover for the season. The coldest night temperature (17° F) came on March 12, 13 and 22. Day temperatures, during the month, ranged from the lowest (34° F) on March 17, to the highest (77° F) on March 29. Wheat growth began during the last half of March.

The spring oat trial was planted April 6 in a firm seedbed with little moisture. Only three rain showers came during the month (April 21 0.64, 23 0.48, and 25 0.21) and totaled 1.12 inches. Oat emergence was slow, and stands were thin and uneven. Emergence was not complete until the middle of May. April night temperatures ranged from 25° F on April 5 to 63° F on April 19. Day temperatures ranged from 49° F on April 14 to 87° F on April 19.

May rain totaled 5.96 inches. Fourteen days in May received measurable precipitation. The heaviest rain (1.17 inches) fell on May 1, and the rest of the precipitation was distributed through out the month in showers of less than one inch. May temperatures were warm, with low temperature for the month (33° F) on May 3. Fifteen days, in May, had high temperatures at or above 80° F. The warmest day, May 21, reached 92° F. Wheat developed rapidly during May.

June rain totaled 9.89 inches, with most of it coming during three days, June 11 (3.19 inches) June 12 (4.22 inches) and June 13 (1.10 inches). Temperatures were mild. One day (June 9) a high temperature of 91° F. The regular and late-seeded wheat trials were harvested June 23, 2004.

The spring oat trial was harvested July 15. Rain, the first 15 days of the month, totaled 2.27 inches. Temperatures were mild and were generally at, or above, 80° F.

From October 1, 2003 through March 31, 2004 the winter wheat trials received 14.87 inches of precipitation. From April 1, 2004 through June 23, 2004, rain, on the winter wheat trials, totaled 16.44 inches. Total precipitation for the wheat trials was 31.31 inches. The spring oat trial, from April 1 through July 15, 2004 received 19.24 inches of rain.

Precision was acceptable in both the regular date-of-seeding, and late date-of-seeding winter wheat trials at Location 2, Tables 2 and 3. Performance was similar to previous test years. Data from both wheat trials should be useful in making performance comparisons.

The spring oat trial at Location 2, Table 9, did not overcome the problems associated with delayed emergence and uneven stands. Yield differences are not, statistically, significantly different and the data should not be considered reliable for performance comparisons. For the oat trial, multiple year averages are a better source of information. Wheat and Oat data from Location 2 are also included in the 2004 multi-location averages in Tables 7 and 10 respectively. See Table B for wheat disease and insect ratings.

At Location 3 (Randolph Co.), in 2003, August rain totaled 3.21 inches. September rain (8.17 inches) came during the first two, and last seven days of the month. October was dry, with measurable rain on eight days. Rain totaled 2.67 inches for the month. The winter wheat trial was planted October 13, 2003 in a dry firm seedbed, approximately two weeks after the Hessian fly-free date. The first hard freeze (28° F) came on October 2 and 3. Uniform, vigorous stands were established during the fall.

November was mild, with daily high temperatures averaging 55.2° and nightly lows averaging 37.2° F. Rain for the month totaled 3.98 inches.

December precipitation totaled 2.23 inches. The coldest December temperature (18° F) was on December 20. An inch of snow fell on December 6, and there was light snow cover during the middle of the month.

January snow totaled 4.5 inches. Precipitation for the month was 2.64 inches. The last six days of January had low temperatures ranging from 25° to –10° F. Three to four inches of snow cover provided good protection during the coldest January temperatures.

February snowfall totaled 1.6 inches and precipitation totaled 0.53 of an inch. Snow cover, beginning with 4 inches and ending with 1 inch, provided good protection, from cold temperatures, for the first 17 days of the month. The coldest February day (-10° F) was February 1. After the first week of February, temperatures warmed. Daytime average high for the month was 36.9° and average nightly low temperature was 19.1° F.

March precipitation totaled 3.43 inches, which included 2.5 inches of snow. March was relatively mild. Average daytime high temperature was 53.4°, and average nighttime low was 30.7° F.

April was dry. One rain (1.07 inches) fell on April 23. The rest of the precipitation came in showers of less than a quarter of an inch. Rain total for the month was 1.65 inches. Temperatures were mild. The daily high averaged 63.0° and the daily low averaged 39.6° F.

May rain totaled 5.43 inches. May temperatures averaged 75.4° for the daily high and 55.9° F for the nightly low. Temperature reached 90° F on one day, May 10. Rain was distributed throughout the month. A shower of 1.27 inches came on May 28. The rest of the precipitation came in amounts of three-quarters of an inch or less. Mild temperatures and favorable distribution of moisture promoted wheat growth and development in May.

June rain totaled 4.36 inches. June 11 received 1.58 inches of rain. The rest of the moisture was distributed throughout the month in showers of less than eight-tenths of an inch. Daily high temperatures averaged 78.0° F. Night temperatures averaged 58.5° F. Wheat matured rapidly in June, and the trials were harvested on June 29, 2004.

From October 1, 2003 to March 31, 2004 the winter wheat trial received 15.48 inches of moisture. From April 1, 2004 through June 30, 2004 rain totaled 11.71 inches. For the season, October through June, precipitation totaled 27.19 inches.

Trial results, for Location 3, presented in Table 4, are similar to the trial results from previous years. Precision in the trial is good and the data should be useful for making performance comparisons.

Wheat data from Location 3 are also included in the 2004 multi-location averages in Table 7. See Table C for wheat disease ratings.

At Location 4 (Knox Co.**)**, in 2003, August precipitation came mostly at the beginning and on the last two days of the month, and totaled 4.44 inches. September precipitation also came mostly in the last week of the month and totaled 5.84 inches.

October rain totaled 2.05 inches and came throughout the month in showers of less than three-quarters of and inch. Daytime temperatures averaged 69° and night temperatures averaged 44° F. The wheat trial was planted in firm, moist soil on October 6, 2003, (on the Hessian fly-free date). Uniform, vigorous stands were established.

November rain totaled 5.20 inches and was scattered throughout the month. Daytime high temperatures averaged 58° and nightly lows averaged 39° F. The first freeze (27° F) was on November 8 , and the first frost on November 14. The wheat trials developed an excessive amount of growth (approximately 12 inches) during November.

Temperatures remained warm during December, and wheat growth continued during most of the month. High temperatures averaged 44° and low temperatures averaged 30° F. The coldest December night temperature (14° F) came on December 20. Three inches of snow fell on December 13 and lasted about three days. December precipitation totaled 1.78 inches.

The last half of January was the coldest part of the month. Single-digit low temperatures, the last 4 days of January 2004, ranged from 0° to 6° F. Snow (6.18 inches) began arriving January 26 and provided snow cover of 2 to 4 inches through the end of the month. Precipitation for January was 4.46 inches.

Snow cover remained for the first 6 days of February. Precipitation for the month was 0.64 on an inch. Daytime high temperatures averaged 42° F. Nighttime low temperatures averaged 20° F. The coldest night temperature (3° F) came on February 3.

March temperatures moderated and wheat growth began in mid-March.. Daytime high temperatures averaged 59° F and nightly lows averaged 35° F. The coldest night temperature was 20° F on March 22. After that, temperatures warmed rapidly and remained favorable for wheat growth. Wheat stands improved over the winter. Rain total for the month was 3.01 inches, and was distributed, throughout the month, in showers of less than one inch.

Temperatures warmed in April and averaged 68° F for daytime highs, and 46° F for nighttime lows. April was dry. Rain came in showers of less than a third of an inch, and totaled 1.03 inches. Wheat made rapid growth and continued to improve during April.

May was warm with high temperatures averaging 80° and low temperatures averaging 60° F. Wheat heading was underway the first week of May, and the plants were beginning to lodge during heading. May rain totaled 8.18 inches. Most of the rain came the last week of the month. The heaviest rain (1.86 inches) came on May 28.

June rain totaled 2.23 inches. Prior to harvest (June 13 through 22) the trial received 2.23 inches of rain. During that time, the wheat was severely lodged, and the grain quality deteriorated. The wheat trial was harvested June 24, 2004.

From October 1, 2003 through March 31, 2004, the wheat trial received 17.14 inches of precipitation. From April 1, 2004 through June 24, 2004, the trial received 11.34 inches of rain. Total precipitation for the winter wheat trial was 28.48 inches. During the spring, 2004, winter wheat growing season, the daytime high temperature reached 91° to 93° F five times (June 9, 11, 12, 15 and 16).

Trial results for Location 4, in 2004, presented in Table 5, are not similar to performance in previous years, and do not provide useful information for performance comparisons. Better performance data are found at the other test locations and in the multi-year summaries. Data from Location 4 are not included in Table 7, multi-location data for 2004. See Table C for wheat disease ratings.

At Location 5 (Jennings Co.)**,** in 2003, August rain totaled 2.37 inches, September 5.05 inches, and October 3.09 inches. The wheat trial was planted October 7, 2003 (a day after the Hessian fly-free date) in a firm, moist seedbed. A week after planting, 1.32 inches of rain provided good moisture for the plots. Most of the October precipitation came the last half of the month. Good uniform, vigorous stands were established. The first sharp freezes (29° to 26° F) came on the nights of November 7, 8 and 9.

November rain totaled 5.38 inches. Day temperatures ranged from 80° F at the beginning of the month to 37° F at the end of the month. Nightly lows ranged from 56° F down to 24° F. One major rain (1.06 inches) fell on November 12 and the rest of the rain came in showers of less than an inch.

December precipitation totaled 2.17 inches, which included one snow, 3.5 inches on December 14. Temperatures cooled beginning in December and the coldest December temperature (12° F) came on December 20, 2003. Temperatures warmed rapidly the last week of the month, and the highest December temperature (63° F) came on December 28.

During January, daytime high temperatures ranged from 12° to 66° F and nightly lows ranged from -17° to 48° F. Precipitation for January totaled 4.85 inches, which included two snows, 2.5 inches January 26, and 3.0 inches January 29.

February precipitation totaled 1.32 inches. Temperatures ranged from daytime highs of 28° to 65° F, and nightly lows from 9° to 39° F.

March precipitation totaled 2.61 inches. Included in the March precipitation is 0.75 of an inch of snow on March 16. The coldest nights were March 12 and 13 with a low of 19° F. Temperatures warmed rapidly and the warmest day of the month was March 28 with a low of 57° and a high of 79° F. Wheat began spring growth in March.

April rain totaled 3.89 inches. Daytime high temperatures ranged from 40° to 84° F. Nighttime low temperatures ranged from 28° to 64° F. Wheat made rapid growth and development in April and May.

May continued warm and very wet. Rain totaled 7.68 inches. Eighteen days in May had temperatures at or above 80° F. Daily high temperatures ranged from 56° to 87° F and nightly lows ranged from 34° to 72° F.

June was warm with 21 days of temperatures at or above 80° F. June rain totaled 6.74 inches. The wheat trial was harvested June 24, 2004.

From October 1, 2003 through March 31, 2004 precipitation on the winter wheat trial totaled 19.42 inches. From April 1, 2004 through June 26, 2004, rain totaled 18.31 inches. For the winter wheat growing season, precipitation totaled 37.73 inches.

Trial results for Location 5, in 2004, presented in Table 6, are similar to trial results from previous trials and should be useful in making performance comparisons. Multi-location data, which includes Location 5 can be found in Table 7. See Table C for wheat disease ratings.

Weather Summary

Information presented in this section is based on the weekly Indiana Crop and Weather Report, published by the Indiana Agricultural Statistician.

For the week ending September 22, 2003, Indiana topsoil moisture was rated 2 percent very short, 15 percent short, 78 percent adequate and 5 percent surplus. Subsoil moisture was similar to topsoil, and was rated 4 percent very short, 14 percent short, 76 percent adequate and 6 percent surplus. Four percent of the winter wheat crop was planted, compared with 3 percent last year and 4 percent for average. Beneficial rain arrived the last week of September and brought topsoil and subsoil moisture ratings to 71 percent adequate, and 13 to 22 percent surplus.

Wet weather slowed winter wheat planting the first half of October. By the end of October, wheat planting (88 percent planted) was ahead of last year and ahead of the five-year average.

At the beginning of November, 94 percent of the wheat was planted, and this was on par for average. Seventy-four percent of the winter wheat acreage had emerged, also on par for average. By November 9, 2003, ninety-nine percent of the wheat was planted, also on par for average.

The final crop and weather report for 2003, issued November 17, reported 97 percent of the wheat had emerged. This was on par for average. The wheat crop was rated 11 percent excellent, 68 percent good, 19 percent fair, and 2 percent poor.

Topsoil moisture was rated 0 percent very short, 3 percent short, 71 percent adequate and 26 percent surplus. Subsoil moisture was rated 4 percent very short, 6 percent short, 81 percent adequate and 9 percent surplus.

The first Indiana Crop and Weather report for the 2004 growing season, issued for the week ending April 4, 2004, rated the winter wheat crop as 12 percent jointed compared to 10 percent jointed for the 5-year average. The wheat condition was rated 85 percent good to excellent compared to 80 percent for the previous year. Soil moisture ratings (in percent) for topsoil were, very short 0, short 1, adequate 54, and surplus 45. Subsoil moisture ratings were, very short 2, short 3, adequate 68, surplus 27 percent.

Wheat growth and development (jointing and heading) proceeded at a normal pace, statewide, during April. The crop was rated 86 percent good to excellent. Soil moisture remained mostly adequate to surplus.

In mid May, the wheat condition was rated 84 percent good to excellent. Sixty-five percent of the crop had headed compared to 57 percent for average. By the end of May the wheat crop rating declined to 75 percent good to excellent. High winds and standing water contributed to the decline in the rating. At the end of May, topsoil moisture was rated 47 percent adequate and 52 percent surplus. Subsoil was 5 percent short, 65 percent adequate and 29 percent surplus.

By June 6, ninety-nine percent of the wheat was headed, which was average. The crop rating declined to 70 percent good to excellent. The June 13 report indicated wheat harvest was 6 percent complete, and by June 27, wheat harvest was 51 percent completed.

By the fourth of July, 78 percent of the wheat was harvested compared to 54 percent for average. A week later, July 11, 96 percent of the wheat was harvested compared to 80 percent for average. Wheat harvest in the north was 89 percent complete, 99 percent in central Indiana and 99 percent in southern Indiana. Statewide, by July 18, 99 percent of the wheat crop was harvested. Topsoil moisture was 1 percent very short, 14 percent short, 76 percent adequate and 9 percent surplus. Subsoil moisture was 1 percent very short, 15 percent short, 78 percent adequate and 6 percent surplus.

In summary, the crop was established in a timely manner and came through a mild winter. Recurring showers over most of the state, after the wheat headed, contributed to substantial disease problems in the grain. See the section on Disease and Insect Summary, and Tables B and C.

Dr. E. P. Christmas evaluated fields which were showing symptoms of nitrogen deficiency and reports as follows:

> A number of wheat fields exhibited symptoms of stunting and light green color at early to mid boot stage this spring. Examination of the areas in many of these fields with the above symptoms showed evidence of soil compaction. Some fields had narrow streaks about the width of the combine tire, which were very compacted, and most likely were the result of wet soil conditions during harvest last fall. Other fields showed darker green streaks that corresponded to tile lines in the respective fields while other fields were rather uniform with a light green color. In all of these cases, the probable cause was nitrogen deficiency resulting from the combined effects of a shallow root system and denitrification.

> The denitrification was most likely caused by soil compaction resulting in the upper layer of soil remaining saturated for a sufficient period of time to cause the denitrification. In nearly all cases, an adequate quantity of nitrogen was applied as a top-dress at the proper time.

Wheat Condition and the Potential of Cold Injury to the Wheat Plant

On the morning of May 3 and/or 4, seven stations across northern and central Indiana reported low temperatures between 26° and 31° F. Six stations reported temperature of 26° or 31° F on May 3 and five stations on May 4, 2004.

The stage of growth of the wheat varied from head stage in southwestern Indiana to early joint stage in northern Indiana. Once wheat has reached the boot stage, temperatures at or below 28° F for a period of two or more hours can result in freeze damage to the wheat plant. Symptoms of this injury may include floret sterility, head entrapment, stem damage or leaf discoloration. From emergence of the head until early milk stage, temperatures at or below 30° F for a period of two or more hours can result in freeze damage to the wheat plant. This damage can be characterized by floret sterility, white awns or heads, stem damage or leaf discoloration. The extent of the injury is dependent on the actual temperature and length of time the plant was subjected to the low temperature.

The temperatures reported above may not represent the actual temperatures in the field at the level of the developing wheat heads. It is not unusual for the temperature at the level of the heads to be 4 to 5 degrees colder than the temperatures at the official height of the recording thermometer.

It is not possible to confirm freeze damage to wheat until the plant has had at least 5 days to continue to grow and develop. Table A gives a summary of the temperature required to cause freeze injury to the wheat plant, at various stages of growth, and the symptom most likely to be evident.

State-wide Harvest Summary

The Indiana Agricultural Statistics Service, in a report issued July 20, 2004, estimated the 2004 Indiana winter wheat production as follows:

> Based on conditions July 1, Indiana's 2004 winter wheat crop is expected to total 28.6 million bushels, 4 percent below last year's estimate of 29.7 million bushels.
>
> The expected yield of 65 bushels per acre is unchanged from the June 1 forecast. If realized, this would be 4 bushels below the previous record of 69 bushels per acre established in 2003. Intended acreage for harvest as grain, at 440,000 acres, is up 2 percent from a year earlier. …………

Wheat Disease and Insect Summary

Several diseases occurred on entries in the test during 2004. By far the most severe disease, not only in the test plots, but throughout the state, was Fusarium head blight (scab). The disease was present at all test locations. In none of the tests was there a tendency for disease to be any less or worse depending on heading date, suggesting that weather was uniformly conducive for disease development over the range of flowering dates of all entries. There were significant differences among entries for both head blight incidence and head blight index. Incidence is a measure of the percentage of heads that show any blight symptom. The head blight index is the product of incidence and the average amount of blight on affected heads, and reflects the overall amount of blight in the field.

Leaf blotch, caused by *Septoria tritici* and *Stagonospora nodorum*, was present at all locations, but not as severe as in some past years. *Stagonospora nodorum* was the predominant pathogen this year. Leaf blotch tends to progress from the lower to the upper leaves during the spring, and causes serious damage only when the flag leaves are killed prematurely by infections. This year, lesions only progressed to the flag leaf at Location 4, Knox Co.. At each location there was a narrow range among entries in the severity of leaf blotch. Statistically, these small differences were significant, and probably reflect genetic differences in susceptibility.

Leaf rust was more severe this year than it has been for several years. It was uniform enough to score reactions at both Location 1, Porter Co., and Location 4, Knox Co. A few entries were susceptible and had heavy rust, enough to reduce yield and test weight. Others had sufficient resistance to hold rust to a low level; a few were completely resistant. The leaf rust fungus does not survive winters in Indiana. Wind carries spores from southern states to this area in the spring, so every year there is the potential for damage from this disease if a susceptible variety is grown.

Armyworms caused severe defoliation at Location 1, Porter Co., and Location 2, Tippecanoe Co. There were substantial differences in the amount of defoliation among entries. It is not known if this is because females prefer some varieties over others for oviposition preference, or because the larvae are able to feed more readily on some varieties than others.

Stripe rust occurred at some locations, but not in amounts great enough to score differences among entries or to cause any damage. See Tables B and C.

INFORMATION CONCERNING SEED

Information concerning certified seed may be obtained from the Indiana Crop Improvement Association, which certifies seed from both public and private sources. Publicly developed varieties, presented in this bulletin, are listed under the Indiana Crop Improvement Association address. In both the wheat and oat trials, older public varieties are included as check varieties.

Private companies have requested that inquiries concerning proprietary entries, presented in this bulletin, be directed to the addresses listed below.

Lower case letters preceding the entry name are; v-variety, b-brand, m-mixture (blend), and h-hybrid. Other names associated with the entry name are brand or company names usually associated in the trade with the entry name.

AgriPro Wheat
520 East 1050 South, P.O. Box 411
Brookston, Indiana 47923
Telephone: 765-563-3111

v Benton
v Douglas

Indiana Crop Imp. Assoc.
7700 Stockwell Road
Lafayette, Indiana 47909
Telephone: 765-523-2535

Oats

v Classic	Public
v INO 9201	Public
v Jay	Public

Wheat

v Hopewell	Public
v Patterson	Public
v Roane	Public

Miles Seed
P.O. Box 22879
2760 Keller Road
Owensboro, Kentucky 42304
Telephone: 270-926-2420

v Abigail	Exsegen
v Esther	Exsegen
v Judith	Exsegen
v Rebekah	Exsegen
v Sarah	Exsegen

Ohio Seed Improvement Assoc.
6150 Avery Road, P.O. Box 477
Dublin, Ohio 43017
Telephone: 614-889-1136

v Bravo	OSIA
v Daisy	OSIA

Steyer Seeds
6154 North County Road 33
Tiffin, Ohio 44883
Telephone: 419-992-4570

b Besecker	Steyer
b Wiley	Steyer

Syngenta Seeds, Inc.
P.O. Box 729
Bay, Arkansas 72411
Telephone: 870-483-7691

v NK Coker 9312
v NK Coker 9375
v NK Coker 9474
v NK Coker 9663

Virginia Crop Imp. Assoc.
2229 Menokin Road, P.O. Box 338
Warsaw, Virginia 22572
Telephone: 804-333-3485

v Madison	Public
v McCormick	Public
v Sisson	Public

DISCUSSION

Soft Red Winter Wheat

Indiana's climate and soils are well suited for the production of high quality soft red winter wheat. In the southern half of Indiana, where double cropping (wheat-soybeans) is common, many growers plant early maturing varieties. Even in northern Indiana, varieties with relatively early maturity may produce higher quality grain because they mature before hot, humid weather which often occurs during July.

Wheat varieties differ in agronomic characteristics. Each has certain advantages, but none possess all of the most desirable traits. Winter hardiness, grain yielding ability, grain quality, straw strength, plant height, and resistance to diseases and insects are important traits to consider when choosing which wheat to plant.

Many diseases attack wheat in Indiana. Resistant varieties are the mainstay for managing disease. A grower should carefully examine resistance ratings for any wheat considered for production. The originator of a variety should have resistance ratings for the diseases mentioned in this discussion, and seed dealers should have this information available for customers.

Important wheat diseases in Indiana include root rots, several leaf diseases, and diseases of the wheat head itself. Probably the most consistently troublesome wheat disease in Indiana is leaf blotch, caused by either of two fungi, *Septoria tritici* and/or *Stagonospora nodorum*. Both fungi cause a foliage blight that results in premature leaf death and poorly filled grain. *Stagonospora nodorum* can also infect heads, producing a disease known as glume blotch.

Varieties differ in their degree of susceptibility to leaf and glume blotch, but none has a high degree of resistance. Partial resistance, which tends to keep the upper two leaves green until normal maturity, can protect test weight.

Early seeding favors leaf blotch, yellow dwarf, spindle streak, and the fungus root and foot rots, especially take-all. Seeding after the Hessian fly-free date (see Figure 1) is suggested to reduce the severity of these diseases.

In addition to *Stagonospora nodorum*, three other fungi can infect wheat grain directly. Loose smut and common bunt are two diseases with a long history in Indiana, but have been essentially eliminated by the use of modern, systemic fungicide seed treatments. The best time to detect loose smut is just after the wheat heads. Of much greater concern is scab (*Fusarium* head blight). A widespread fungus, *Fusarium graminearum*, can infect wheat during flowering and early grain filling. Infected grain is badly shriveled, resulting in low test weight. The grain may also contain a toxin produced by the fungus (deoxynivalenol, also known as DON or vomitoxin). Elevators may refuse to buy grain that has more than 2 to 4 ppm of DON. Wheat breeders are working to develop varieties resistant to scab, but so far only a few varieties, with a modest degree of resistance, have reached the marketplace.

Three other potentially damaging diseases are powdery mildew, leaf rust, and stem rust. Fortunately, most varieties adapted to Indiana have good resistance to these diseases. The pathogens which cause these diseases are genetically variable, and strains may arise that can overcome resistance. However, in recent years, this has not been a serious problem in Indiana.

The resistance of some varieties to powdery mildew is of the partial type. Powdery mildew will develop in these varieties, but does not normally become severe enough to damage the crop. High levels of nitrogen, even if not sufficient to induce lodging, can negate partial resistance and result in severe disease in a variety that would not be damaged under moderate levels of nitrogen.

In most years (normal warm weather), wheat matures before stem rust has time to reach destructive levels. However, in years when maturity is delayed, because of cool spring weather, stem rust may reach damaging levels during late June. Some wheat, offered for sale in Indiana, may not have resistance to stem rust.

Three virus diseases of wheat are common in Indiana: wheat spindle streak, soilborne wheat mosaic, and yellow dwarf. Most varieties have at least some resistance to the viruses that cause these diseases. A susceptible variety can be severely damaged by any one of these diseases.

Wheat performance data are presented in Tables 1 to 7. Disease and Insect Ratings are presented in Tables B and C.

Wheat Hybrids and Blends

Proprietary wheat hybrids were first included in the 1982 performance trials. Some hybrids were produced using a chemical to sterilize pollen in the seed parent. Other hybrids were produced using the cytoplasmic male sterile and nuclear restorer system. Techniques of hybrid wheat production are often less than 100 percent effective. Therefore, the seed produced on the seed parent may not be 100 percent hybrid.

By Indiana law, seed labeled as hybrid must contain at least 75 percent hybrid seed, and if less than 95 percent hybrid, the hybrid percentage must be stated on the seed label.

Seed having less than 75 percent hybrid is considered a blend. Seed from hybrid wheat, like corn, should not be saved for seeding the following year.

Spring Oats

Spring oats are the most heat tolerant of the spring-seeded small grains and are the only spring-seeded small grain adapted for Indiana. Adaptation to hot weather is usually important in choosing a spring oat. Late maturing varieties perform well, if planted early, in years with ample rainfall and relatively cool temperatures during June and July.

Frequently in Indiana, temperatures are in the upper 80° and low to mid 90° F range, and moisture becomes a limiting factor when oats are filling. This results in low test weights and reduced yields in late-maturing varieties. The farther south a variety is planted, the earlier maturing and more heat tolerant it must be. Yield, straw strength, grain quality and resistance to barley yellow dwarf virus and crown rust are also important in choosing an oat variety.

Oat performance data are presented in Tables 8 to 10.

Table A. Temperatures that cause freeze injury to wheat, at spring growth stages. Symptoms and yield effect of spring freeze injury.

Growth stage	Approximate injurious temperature (2 hours)	Primary symptoms	Yield effect
Tillering	12° F (-11° C)	Leaf chlorosis; burning of leaf tips; silage odor; blue cast to the field.	Slight to moderate
Jointing	24° F (-4° C)	Death of growing point; leaf yellowing or burning; lesions, splitting , or bending of lower stems; odor.	Moderate to severe
Boot	28° F (-2° C)	Floret sterility; head trapped in boot; damage to lower stem; leaf discoloration; odor.	Moderate to severe
Heading	30° F (-1 C)	Floret sterility; white awns or white heads; damage to lower stem; leaf discoloration.	Severe
Flowering	30° F (-1° C)	Floret sterility; white awns or white heads; damage to lower stem; leaf discoloration.	Severe
Milk	28° F (-2° C)	White awns or white heads; damage to lower stems; leaf discoloration; shrunken, roughened, or discolored kernels.	Moderate to severe
Dough	28° F (-2° C)	Shriveled, discolored kernels; poor germination.	Slight to moderate

Table B. Wheat disease and insect ratings in the 2004 winter wheat performance trials, at two Indiana locations; 1) Porter Co., and 2) Tippecanoe Co., regular date of seeding, and late date of seeding trials.

Entry		Loc 1				Loc 2 Regular			Loc 2 Late		
Entry Type and name (1)		FHB (2)	SLB (3)	LR (4)	Army (5)	FHB (2)	SLB (3)	Army (5)	FHB (2)	SLB (3)	Army (5)
v Madison	Public	32	8.0	1	74	19	6.4	25	30	6.3	1
v Patterson	Public	26	8.0	14	80	6	6.5	58	11	6.9	15
v Hopewel	Public	9	7.3	14	5	4	6.2	13	3	6.6	3
v NK Coker 9474						1	7.6	26			
v NK Coker 9663						10	6.8	29			
v Roane	Public	7	7.1	7	68	3	6.8	15	3	6.6	0
v Sisson	Public	33	8.0	32	18	4	6.6	6	17	6.5	0
v Bravo	OSIA	13	7.5	28	85	5	6.5	23	6	6.8	8
v Benton		12	7.7	12	49						
v Douglas		20	7.5	0.1	37						
v Daisy	OSIA	24	8.0	42	78	6	7.4	27	10	6.8	0
v NK Coker 9375						8	7.3	45			
v NK Coker 9312						5	6.5	7			
v McCormick	Public	6	7.5	12	24	3	6.9	8	2	6.4	0
b Besecker	Steyer					7	6.9	45			
b Wiley	Steyer					2	7.1	17			
LSD (0.05)		8	0.5	11	37	4	0.8	29	11	8	0.4

(1) Lowercase letters indicate entry type as follows: v-variety, or b-brand. Public entries were developed by Agricultural Experiment Stations (Indiana Agricultural Programs) or in cooperation with the Agricultural Research Service of the USDA. Other names are company or brand names associated in the trade with variety or blend names.

(2) FHB = Fusarium head blight (scab). Disease intensity is expressed as percentage of severity, calculated as the product of the incidence of blighted heads and the average severity per head. It is an indication of the overall severity of blight in the field. At the various locations, disease was rated when entries were in the late milk to early dough stages of growth.

(3) SLB = leaf blotch, caused mainly by Stagonospora nodorum, but also possibly by Septoria tritici. Leaf blotch severity is scored on a scale of 0 to 9.5, based on percentage of upper four leaves blighted. Ratings were made at the same time as head blight ratings. Percentage area blighted, for these four leaves, for scale-values of 6 through 9 are as follows:

Scale value	Percent leaf area blighted Flag (F)	F-1	F-2	F-3
6		1-10	25-75	90-100
7		10-50	75-100	100
8	1-20	50-90	100	100
9	20-90	90-100	100	100

(4) LR = leaf rust, recorded as the percentage of flag leaf area affected at the same time that Fusarium head blight was rated.

(5) Army = armyworm damage, recorded as the percentage of flag leaf defoliated by feeding at the same time that Fusarium head blight was rated.

Table C. Wheat disease ratings in the 2004 winter wheat performance trials, at three Indiana locations; 3) Randolph, 4) Knox and 5) Jennings Counties.

Entry Type and name(1)		Loc 3 FHB (2)	Loc 3 SLB (3)	Loc 4 FHB (2)	Loc 4 SLB (3)	Loc 4 LR (4)	Loc 5 FHB (2)
v Madison	Public	23	7.6	22	7.5	5	31
v Patterson	Public	10	7.8	10	8.5	0.5	23
v Hopewell	Public	2	7.2	23	8.6	7	39
v Roane	Public	4	7.2	26	8.1	8.3	8
v Sisson	Public	5	7.3	12	7.6	4.0	24
v Bravo	OSIA	5	7.2	13	8.0	2.0	13
v Esther	Exsegen			7	7.3	4.8	12
v Abigail	Exsegen			10	8.1	1.5	20
v Rebekah	Exsegen			6	7.8	10.3	13
v Sarah	Exsegen			25	8.8	11.0	17
v Benton				33	8.3	5.0	
v Daisy	OSIA			11	7.4	7.8	19
v NK Coker 9375		12	7.8				
v NK Coker 9312		9	7.3				
v McCormick	Public	6	7.3	21	8.1	9.0	9
v Judith	Exsegen			10	7.8	3.5	29
b Besecker	Steyer			10	7.6		
b Wiley	Steyer			24	8.0	0.5	
LSD (0.05)		8	0.4	14	0.9	3.3	5

(1) Lowercase letters indicate entry type as follows: v-variety, or b-brand. Public entries were developed by Agricultural Experiment Stations (Indiana Agricultural Programs) or in cooperation with the Agricultural Research Service of the USDA. Other names are company or brand names associated in the trade with variety or blend names.

(2) FHB = Fusarium head blight (scab). Disease intensity is expressed as percentage severity, calculated as the product of the incidence of blighted heads and the average severity per head. It is an indication of the overall severity of blight in the field. At the various locations, disease was rated when entries were in the late milk to early dough stages of growth.

(3) SLB = leaf blotch, caused mainly by *Stagonospora nodorum*, but also possibly by *Septoria tritici*. Leaf blotch severity is scored on a scale of 0 to 9.5, based on percentage of upper four leaves blighted. Ratings were made at the same time as head blight ratings. Percentage area blighted for these four leaves for scale-values of 6 through 9 are as follows:

Scale value	Percent leaf area blighted: Flag (F)	F-1	F-2	F-3
6		1-10	25-75	90-100
7		10-50	75-100	100
8	1-20	50-90	100	100
9	20-90	90-100	100	100

(4) LR = leaf rust, recorded as the percentage of flag leaf area affected at the same time that Fusarium head blight was rated.