August 1999
Station Bulletin
No. B 784

PERFORMANCE OF PUBLIC AND PRIVATE SMALL GRAINS IN INDIANA, 1999

Agricultural Research Programs
Purdue University
West Lafayette, Indiana
Cooperative project with the
Agricultural Research Service
U.S. Department of Agriculture

CONTENTS

Authors

K. M. Day, Senior Research Agronomist
W. P. Lorton, Technician
Department of Agronomy

G. C. Buechley, Cell Biologist Research Associate
Dr. G. E. Shaner, Professor
Department of Botany and Plant Pathology

(The authors wish to acknowledge desktop publishing performed by
Carol Summers, Department of Agronomy.)

Performance of Public and Private Small Grains in Indiana, 1999

INTRODUCTION

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 1999 small grain performance trials are presented for those entries which are believed to be available to producers for seeding purposes. Data for experimental entries are not included.

This information is presented under authority granted Indiana Agricultural Research Programs to conduct performance trials, including interpretation of data to the public, and does not imply endorsement or recommendation by Purdue University. Also, any small grain not included in this bulletin does not imply criticism by Purdue University.

This bulletin may be accessed on the World Wide Web at the following URL address:

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

Additional bulletin copies may be available from:

Agricultural Communication Service
Media Distribution Center
301 South 2nd Street
Lafayette IN 47905

Telephone: 765-494-6795
FAX: 765-496-1540

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 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 test 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 fall-seeded small grains and by February 1 for spring-seeded small grains.

Mr. K. M. Day
Vartest Building
Purdue Agronomy Research Center
4540 US 52 West
West Lafayette IN 47906

Telephone: 765-583-1406
(no FAX number available)

PERFORMANCE TRIAL METHODOLOGY

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

Location of Trials

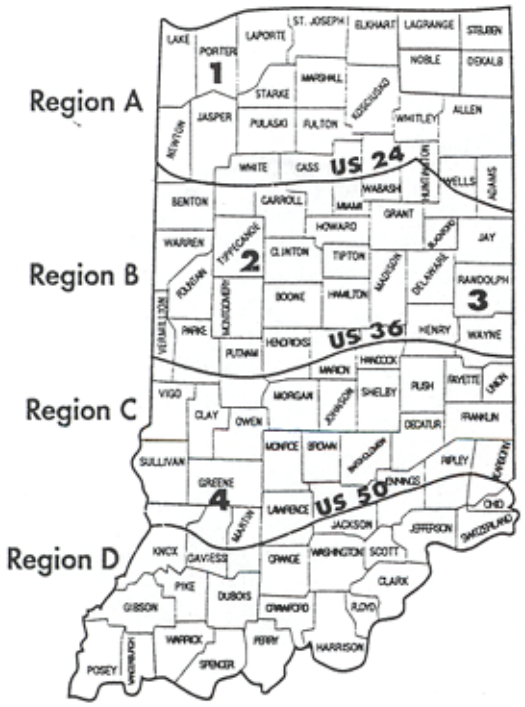
In 1999, trials were conducted at four locations for winter wheat and two locations for spring oats (see Figure 1). The locations, numbered from north to south, are:

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

Location 2. Tippecanoe County at the Purdue University Agronomy Research Center near Lafayette, on 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. Daviess County at the Tom Boyd farm near Washington, on Lyles sandy loam, a very dark-gray, deep, very poorly drained, moderately permeable soil, formed in sandy and loamy out wash.



The fly-free dates in Indiana are: 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); and Region D, Oct. 6 (north) to Oct. 9 (south).

Figure 1. Location of trials and 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 25 feet for oats, and all rows were harvested. Plot width of 75 inches for wheat and 70 inches for oats was used for calculating 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 HC 110. The plot weight and moisture equipment were calibrated using a Motomco moisture meter and Chantillon scales, and the calibrations were checked throughout the harvest season. All yields were adjusted to 14 percent moisture and are reported as bushels per acre. After harvest, test weights were performed in the Vartest building, using standard test weight equipment.

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 sampling standards, but are believed to be suitable for field plot work.

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, were taken when the plants were beginning spring growth. The data are based on visual observation and not on actual stand count, and were influenced by differences in plant vigor and vegetative growth.

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 at locations 1, 2 and 3, supplemental nitrogen was applied to wheat in the spring. At location 4, anhydrous ammonia with N-serve as applied in the fall of 1998.

Soil test results for each of the 1999 trials 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 1.3 to 1.8 million live seeds per acre. Public wheat varieties were seeded at 1.5 million live seeds per acre, and the oat tests were seeded at 1.53 million live seeds per acre.

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, with any additional yield increases 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 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.

A plump-seeded oat variety (3 grams per 100 seeds) would require about 112 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° F 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.

PERFORMANCE TRIAL RESULTS

Grain yields from the test plots are reported as bushels per acre adjusted to 14 percent moisture content. 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 yield, in bushels per acre, was significant at the 10 percent probability level in the 1999 single-year yield data presented, except for the wheat tests at locations 1 and 4.

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, several 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 top or bottom yielders 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, the wheat plots were planted in a firm, dry seedbed on September 25, l998. Early October rains helped produce uniform, vigorous stands. For the month, precipitation totaled 2.87 inches and temperatures averaged 52° F. November was drier, with total precipitation of 1.47 inches, and average temperature of 42° F.

Wheat continued to grow in December, until below freezing temperatures at nighttime, arrived the second week of the month. Temperatures dropped rapidly on December 22 to –1° F; then recovered to the teens and then dropped again on the last two days of the month to –5° and –8° F, respectively. Snow cover provided some protection the last two days of December.

The low temperature for the winter was –26° F on January 5, 1999. For nearly a week in early January, low temperatures ranged from 5° F to –26° F. Deep snow cover provided excellent protection during the first 3 weeks of January.

February was much warmer, with only one day of single digit (9° F) temperature. Precipitation in February was 1.86 inches and snow cover was light.

Beginning the second week of March, single digit cold temperatures persisted for about a week. A warm up trend began the third week in March, and wheat began spring growth.

The spring oats performance test was planted March 24, 1999 in a firm moist seedbed. Stands were generally thin and there was virtually no tillering. Temperatures warmed sharply the first of April, and coupled with abundant moisture, wheat made excellent growth. April precipitation totaled 7.25 inches, and temperatures averaged 48° F.

Fortunately, May was dry and cool. Precipitation totaled 1.68 inches and the average temperature was 61° F. This helped prevent disease development in the lush vegetative growth of the wheat canopy. June continued dry until the middle and the latter part of the month. Total precipitation was 3.61 inches and average temperature was 69° F. High humidity delayed wheat harvest, and when conditions were dry enough for harvest, the wheat and oat plots were both harvested on July 8, 1999.

Wheat yields were higher than normal, and other traits such as test weights were good; lodging, less than normal; plant height, normal; no winter killing; and date headed about a week earlier than normal. Although yields were high and other traits impressive, the precision of the test was not good. The coefficient of variability (C. V.) of 10.2 percent was about twice the desirable C.V. level. Although there was a 20-bushel spread from top to bottom, it was not possible to determine if the yield difference was due to variety (treatment) or chance (random error). The three-year and two-year sub-tables should be used for making performance decisions.

Although the oat test did not develop desirable stands, the test had good precision; all agronomic traits were near normal, and the oat test should be useful in making performance comparisons.

At Location 2, August 1998 precipitation totaled 1.39 inches and September rain totaled 0.89 inches. The regular-date-of-seeding wheat test was planted in a dry, firm seedbed on September 30, l998. Showers, the first week of October, helped establish a vigorous stand of wheat. October received 2.84 inches of rain for the month, and temperatures averaged 55° F. The late-seeded wheat was planted October 20, 1998 and got off to a good start, due to some timely showers at the end of the month. November rain totaled 2.28 inches and temperatures averaged 44° F.

December was dry, with only 0.96 inches of precipitation, and temperatures remained mild until the beginning of the last week of the month. Wheat growth was excessive in the regular-date-of-seeding test, and there were concerns about the plants being hardened in preparation for winter. Below freezing nighttime temperatures arrived the second week of the month, and provided some hardening for the wheat plants. Temperatures dropped to the single digits at the beginning of the last week of December and then dropped to –3° F on the last day of the month. A light snow cover provided some protection from the below zero temperature the last day of the month.

At location 2, the coldest day of the winter was –20° F on January 5. Below zero temperatures were recorded on 9 of the first 11 days of January. Snow cover ranged from an inch on January 1, to 13 inches during January 8 through 12. This snow cover provided excellent protection. January precipitation totaled 3.60 inches and the average temperature was 23° F.

February was much warmer with an average temperature of 34° F and drier, with 2.68 inches of precipitation. March was dry, with only 1.36 inches of precipitation, and temperatures warmed rapidly toward the end of month.

The spring oats performance test, at location 2 was planted on March 26, 1999. Good oat stands were obtained and the oat plants produced desirable tillers.

Wheat growth began in mid-March, and progressed rapidly in April. April rain totaled 5.51 inches and temperatures warmed to an average 52° F.

May weather was drier with 3.63 inches of rain, and warmer with an average temperature of 63° F. June received 3.22 inches of rain and the average temperature was 72° F. During the last week of June, light showers continued nearly every day and the humidity was high. This kept grain moisture levels too high for harvesting. Grain dried rapidly on the last three days of June, and both the regular and the late-seeded tests were harvested June 30.

In the regular-date-of-seeding wheat test, some of the highest yields ever recorded were produced this year. Precision in the test was good, as indicated by the coefficient of variability (C.V.) of 6.1 percent. Other agronomic traits were outstanding and the results should be useful for comparing performance. The late-seeded test also produced good yields and should be useful in making yield comparisons. The spring oats performance test also should be useful in making performance comparisons.

At Location 3, moisture conditions during August and September were much better than at locations 1 and 2. Rains in early August and in early September of 1998 totaled 5.76 inches for the two months combined. The wheat plots were planted on October 1, 1998 in an excellent seedbed. The plots benefited from excellent rains during the week after planting and excellent, vigorous stands were established. October rain totaled 4.22 inches and temperatures averaged 54° F.

November was dry and cool, with 1.81 inches of rain and temperatures averaged 44° F. Wheat growth continued until the end of the first week of December. The second week of December, below freezing nighttime temperatures provided some much need restriction to vegetative growth, and provided some plant hardening for winter protection. At the beginning of the last week of December, nighttime temperatures dropped to the single digits, warmed to the teens and low 20's, and then dropped to 9° F on the last day of the month. There was light snow cover (1 inch) on the last day of December. Precipitation for the month was 1.55 inches and the average temperature was 36° F.

Snow cover ranged from an inch on the first day of January to 12 inches during the second week of the month and then declined to 2 inches on January 21. For the month, January had 3.87 inches of precipitation and the average temperature was 25° F.

February was warmer, with an average temperature of 34° F and precipitation totaled 3.22 inches. The second week of March was cold, with temperatures ranging from 0° to 17° F. During that time, snow cover from 2 to 5 inches provided some protection. A warming trend started at the beginning of the third week of March and continued through the end of the month. March was generally dry, with 1.11 inches of precipitation, and temperatures averaged 33° F.

Temperatures warmed rapidly in April and averaged 52° F for the month. Rain totaled 4.55 inches, and wheat made excellent growth during April. May rain totaled 2.79 inches and temperatures averaged 63° F. Disease development was generally light in the wheat canopy.

June rain totaled 2.50 inches and temperatures averaged 72° F. Light rain and high humidity the last week of June, prevented wheat harvest until July 2, 1999.

Wheat yields were high, and other agronomic traits were normal or above. The coefficient of variability (C.V.) is normal for east central Indiana, but the three-year and two-year sub-tables should support any decisions based on the 1999 test results.

At Location 4, the weather station at Vincennes is approximately 20 miles from the performance test location in Daviess County. For that reason, the weather data presented here (especially precipitation), may not represent what the plot area actually received.

August and September of 1998 were dry. The wheat performance test was planted on October 13, 1998 and adequate stands were obtained. October remained relatively dry, with the Vincennes station reporting 1.51 inches of rain for the month, and temperatures, averaged 58° F. November precipitation was reported to be 2.01 inches and temperature averaged 47° F. The wheat continued to grow in December, with some hardening when temperatures dipped below freezing the second week of the month. At the beginning of the last week of December, nighttime temperatures dropped to 9° F for two consecutive days, and remained below freezing for the rest of the month. December precipitation was 2.72 inches.

The coldest winter temperatures occurred during the first two weeks in January. On January 6, the temperature was –6° F. During the first nine days of January, 2 to 3 inches of snow provided protection. January precipitation totaled 5.03 inches and temperatures averaged 30° F.

February temperatures warmed rapidly and averaged 39° F for the month. Precipitation totaled 5.05 inches. Wheat growth began early when temperatures warmed in early March. March precipitation was 3.0 inches, and temperatures averaged 40° F.

Wheat growth and development progressed rapidly in April. Precipitation totaled 4.87 inches, and temperatures averaged 56° F. May was relatively dry and cool, with precipitation totaling 2.86 inches, and temperatures averaging 66° F. June precipitation totaled 5.46 inches, and the average temperature was 73° F. The wheat was ripe and ready to harvest the last week of June, but recurring showers and high humidity delayed harvest until July 7, 1999.

Although the wheat was a week to 10 days post ripe, no shattering was observed at harvest. Test weights were probably lowered due to the weather conditions prior to harvest. The coefficient of variability (C.V. 15.6 percent) was higher than normal, and the BLSD (k=100), of 25.7 bushels made the test results of questionable value. A better source of information is Table 6 which combines the performance test results from Porter, Tippecanoe and Randolph counties.

Weather Summary

Information presented here is based on the weekly Indiana Crop and Weather Reports, published by the Indiana Agricultural Statistician.

By the end of September 1998, soil moisture conditions were rated 80 percent, short to very short, over most of the state. Wheat planting was under way by the end of September, with 7 percent of the crop planted. Planting progressed rapidly, with 44 percent planted by the week ending October 11, and 18 percent had emerged.

The wheat crop was 98 percent planted by November 8, and 89 percent had emerged. The condition of the crop was rated 73 percent good to excellent. The percent planted was slightly behind the five-year average and the percent emerged was 4 percent more than average.

The first crop report for 1999, issued April 5, reported 7 percent of the crop jointed, which was average, and the condition of the crop was rated 74 percent, good to excellent. During April, soil moisture conditions improved, with most areas reporting moisture adequate to surplus.

The first May report indicated 91 percent of the wheat was jointed, compared with 67 percent for average. Three percent was headed and the crop condition improved to 85 percent rated, good to excellent. At the end of May, 98 percent of the wheat was headed compared with 72 percent for average. The condition of the wheat was rated 86 percent good to excellent, compared to 71 percent for average.

Virtually all wheat was headed by the first of June, well ahead of the 87 percent for average, and the condition of the crop was rated 84 percent good to excellent. During the first part of June, soil moisture conditions remained adequate to surplus over most of the state. Hot weather, in early June, with several days of 90°+ F, hastened wheat maturity. Harvest began in the southwestern part of the state, and by the end of the second week in June, 1 percent of the wheat crop was harvested. By the end of June, wheat harvest was 36 complete, or about 8 days ahead of normal.

During the first week in July, excessive moisture in southern Indiana, delayed wheat harvest for a few days. Otherwise, wheat harvest made rapid progress. By the second week in July, harvest progress was only 1 day behind the record set in 1988. Wheat harvest was virtually complete by July 18th.

In summary, the 1999 Indiana winter wheat crop was planted on time, in soils that were generally dry. In many places, stands got off to a slow start, but improving moisture conditions coupled with mild temperatures until mid-December permitted good to

excessive vegetative growth. Winter temperatures were mild and during some of the coldest days, there was snow cover over most of the state. There was virtually no winter killing. The excellent prospects of early spring continued on through the season. Disease impact was minimal over most of the state. Oats generally produced good yields and had less lodging problems compared to previous years.

State-wide Harvest Summary

The Indiana Crop and Livestock Reporting Service, in a report issued July 20, 1999 estimated the 1999 Indiana winter wheat production as follows:

> Based on conditions July 1, Indiana's 1999 winter wheat crop is expected to total 33.2 million bushels, 8 percent above the June 1 forecast of 30.6 million bushels, but 7 percent below the 35.8 million bushels produced in 1998. The expected yield of 65 bushels per acre is 5 bushels more than the June 1 forecast. If realized, this would be a record high average, topping the previous record of 61 bushels per acre established in 1994. Intended acreage for harvest as grain, at 510,000 acres, is down 22 percent from a year ago, and 23 percent below 1997. As of July 4, wheat harvest had advanced to 51 percent complete. This compares with 66 percent last year and 34 percent for average.
>
> Nationally, winter wheat production is forecast at 1.67 billion bushels, up 4 percent from the June 1 forecast, but down 11 percent from than the 1998 crop. Yield is expected to average 47.0 bushels per acre, up 2.3 bushels from the last forecast and a new record high. Area for harvest as grain is forecast at 35.6 million acres, down 11 percent from 1998.
>
> Indiana's oat production is expected to total 1.5 million bushels, unchanged from a year earlier. Area for harvest at 250,000 is down 5,000 acres from 1998.

Disease Summary

Diseases were not a serious problem on wheat in Indiana during 1999. Results of disease observations taken at the Purdue University Agronomy Research Center, Location 2, Tippecanoe County, are presented in Table A. Wheat survived the winter well, and stands were generally thick. A mild spring promoted lush vegetative growth. Powdery mildew developed early in many fields, but most varieties have a degree of resistance that prevented the disease from becoming a serious problem. Leaf blotch can be found to some extent every year in nearly all wheat fields, but was not a serious problem this year. Lesions did not reach the upper leaves until late in the season. Scab could be found in many wheat fields, but the percentage of heads affected was very low. The two most prevalent diseases were yellow dwarf and leaf rust. Yellow dwarf is caused by the barley yellow dwarf virus and is transmitted by aphids. Short, erect, yellow flag leaves could be seen in scattered plants in many fields. This symptom is typical of barley yellow dwarf infection that takes place in the spring. Leaf rust was more common and severe this year than it has been for many years. However, the disease developed late in the season and did not cause serious reduction in yield or grain quality.

The varieties in the test at location 2 were evaluated for severity of powdery mildew (caused by *Erysiphe graminis*), leaf rust (caused by *Puccinia triticina*), and leaf blotch (caused by *Septoria tritici* and *Stagonospora nodorum*). Severity of each disease was rated on quantitative scale, which reflected the amount of leaf area affected. Varieties with lower values have less disease, and therefore presumably a greater degree of resistance.

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. Arthur is a wheat variety which is no longer available but is included as a long-time check.

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 Seeds, Inc.
6025 West 300 South
Lafayette, Indiana 47905
Telephone: 765-572-2001

v Foster	AgriPro
v Mason	AgriPro
v Patton	AgriPro

Beck's Superior Hybrids, Inc.
6767 East 276th Street
Atlanta, Indiana 46031
Telephone: 317-984-3508

b Beck 101
b Beck 103
b Beck 107
b Beck 108
h Beck 101A
h Beck 107A
h Beck 108A
h Beck 108B

Diener Bros.
371 North Diener Road
Reynolds, Indiana 47980
Telephone: 219-984-5837

b DB 494W
b DB 555W
b DB 556W
b DB 559W

Indiana Crop Improvement Association.
7700 Stockwell Road
Lafayette, Indiana 47909
Telephone: 765-523-2535

Oats

v Blaze	Public
v Chaps	Public
v Classic	Public
v Jay	Public
v Noble	Public
v Ogle	Public
v Rodeo	Public
v Vista	Public

Indiana Crop Improvement Association, continued.

Wheat

v Arthur	Public
v Caldwell	Public
v Cardinal	Public
v Clark	Public
v Freedom	Public
v Goldfield	Public
v Madison	Public
v Patterson	Public
v Roane	Public

Land O' Lakes, Inc.
11937 Exit 5 Parkway
Building 3
Fishers, Indiana 46038
Telephone: 317-915-3000

v Countrymark 529W
v Countrymark 539W
v Countrymark 569W

Novartis Seeds, Inc.
P.O. Box 729, HWY 158 East
Bay, Arkansas 72411-0729
Telephone: 870-483-7691

v NK Coker 9474
v NK Coker 9543
v NK Coker 9663

Ohio Foundation Seeds
P.O. Box 6, 11491 Foundation Road
Croton, Ohio 43013
Telephone: 614-893-2501

v Glory	Public
v Hopewell	Public

Pioneer Hi-Bred International, Inc.
P. O. Box 308
Tipton, Indiana 46072-0308
Telephone: 800-258-3579

v 2540	Pioneer
v 25R26	Pioneer
v 25R57	Pioneer

Terra International, Inc.
600 Fourth Street, P.O. Box 6000
Sioux City, Iowa 51102-6000
Telephone: 800-831-1002 ext. 7285

b Terra E219
b Terra Exp218
b Terra-SR215
b Terra-SR216

DISCUSSION

Soft Red Winter Wheat

Indiana's climate and soils are well suited for the production of high quality soft red winter wheat, and local industries provide a market for the crop. No one wheat has all of the most desirable characteristics, but each has certain advantages. Performance data are presented in Tables 1 to 6.

At higher fertility levels, resistance to powdery mildew and lodging become important factors. Winter hardiness, yielding ability, straw strength, plant height and grain quality are important points to consider when choosing which wheat to plant. Disease resistance to leaf rust, Septoria blotch, and powdery mildew, and insect resistance to Hessian fly are also very important factors in selection. A few entries are better suited to acid soils where aluminum toxicity is a problem.

Early seeding favors Septoria blotch, barley yellow dwarf virus, spindle streak, and the fungus root and foot rots, especially take-all and Fusarium. Seeding after the fly-free date is suggested to reduce severity of these diseases.

The organisms causing plant disease are continually evolving, and occasionally new strains, races or biotypes appear that can attack previously resistant wheat. Strains of the leaf rust fungus that have overcome the resistance of older wheats are now widespread in Indiana. Likewise, the powdery mildew fungus has overcome the resistance of older varieties. Leaf rust and powdery mildew can reduce yields of susceptible varieties by 20 percent or more. Strains of the loose smut fungus that can infect older wheat varieties are also present in the state. The best time to detect this disease is just after the wheat heads. Certain fungicide seed treatments will control loose smut.

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°'s and low to mid 90°'s F, 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 7, 8 and 9.

Table A. Wheat disease ratings in 1999 in the regular seeding trials in Tippecanoe County, Location 2, west central Indiana.

Entry Type and Name[1]		28-May-99 Powdery Mildew[2] (%)	11-Jun-99 Leaf rust[3] (%)	11-Jun-99 Leaf blotch[4] (0-9.5)
v Arthur	Public	5.3	10.0	8.1
b Beck 101		2.8	12.5	7.6
h Beck 101A		1.8	10.0	6.5
b Beck 103		0.9	0.5	6.9
b Beck 107		1.8	2.4	7.0
h Beck 107A		6.5	0.1	7.2
b Beck 108		0.3	3.5	7.0
h Beck 108A		12.0	5.4	6.9
h Beck 108B		1.3	5.6	7.0
v Caldwell	Public	8.3	3.3	7.6
v Cardinal	Public	7.5	1.3	6.6
v Clark	Public	11.8	23.8	7.3
v Countrymark 529W		0.8	1.4	7.5
v Countrymark 539W		7.5	4.5	7.4
v Countrymark 569W		0.3	2.3	7.3
b DB 494W	Diener Bros	1.0	1.3	7.2
b DB 555W	Diener Bros	2.0	2.6	7.0
b DB 556W	Diener Bros	2.3	3.5	6.7
b DB 559W	Diener Bros	0.4	1.5	7.1
v Foster	AgriPro	3.8	13.3	7.1
v Freedom	Public	3.0	5.3	6.6
v Glory	Public	0.6	11.8	6.8
v Goldfield	Public	6.0	2.8	6.5
v Hopewell	Public	0.3	15.0	7.3
v Madison	Public	0.0	4.8	7.6
v NK Coker 9474		1.0	0.0	7.1
v Patterson	Public	6.8	7.5	7.3
v Patton	AgriPro	4.0	2.0	6.6
v 2540	Pioneer	0.0	9.3	6.8
v 25R26	Pioneer	2.8	0.0	6.8
v 25R57	Pioneer	0.0	4.1	6.7
v Roane	Public	0.0	0.5	6.1
b Terra-E219		3.0	16.3	7.9
b Terra-Exp 218		0.5	2.3	7.3
b Terra-SR215		2.5	2.9	6.9
b Terra-SR216		1.8	1.9	7.4
LSD (0.05)		3.2	5.4	0.50

[1] Lower case letters indicate entry type as follows: v-variety; b-brand; m-mixture (blend); h-hybrid. Public entries were developed by Agricultural Experiment Stations (e.g. Indiana Agricultural Programs) or in cooperation with the Agricultural Research Service of the USDA. Other names are company or brand names, generally associated in the trade with variety, hybrid, or blend names.

[2] Powdery mildew is rated as the percentage leaf area of the upper four leaves covered by mildew.

[3] Leaf rust is rated as the percentage flag leaf area covered by rust pustules.

[4] Leaf blotch is rated on a scale of 0 to 9.5 that reflects how far up the canopy symptoms have progressed and the area of each of leaf layer showing symptoms: 6=no symptoms on the flag (F) leaf, 1-10% of the first leaf below the flag (F-1) affected, and 25-75% of leaf F-2 affected; 7=no symptoms on F, 10-50% of F-1 affected, and 75-100% of F-2 affected; 8=1-20% of F affected, 50-90% of F-1 affected; 9=20-90% of F affected, 90-100% of F-1 affected.