FIELD FACTS

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Wheat Management Practices to Increase Yields and Profits

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Introduction

Wheat acres are surpassed only by those of corn and soybeans in many states in the Midwest, Midsouth and Eastern U.S. This *Field Facts* will discuss wheat management practices that can help growers increase yields and profits.

Variety Selection

The importance of variety selection in wheat production cannot be overemphasized. Wheat varieties differ significantly in yield potential, maturity, winterhardiness, drought tolerance, grain characteristics, resistance to lodging, diseases, and insects as well as other traits. Choosing the right variety for your field is the most important step in growing a profitable wheat crop.

Pioneer Hi-Bred offers a full line-up of wheat varieties adapted to all major wheat-growing areas. Pioneer provides **trait ratings**, **management comments**, and **suitability placement guidelines** on these varieties to assist growers in selecting the best products for their fields (Table 1).

Table 1. Trait ratings[1] for Pioneer® brand wheat varieties.

Yield and Maturity	Disease/Insect Resistance
Yield for Primary Area	Leaf Blight
Heading Date North	Leaf Rust, Stripe Rust
Heading Date Mid-South	Powdery Mildew
Growth Characteristics	Scab
Lodging Resistance	Spindle Streak Mosaic Virus
Height	Soil-borne Mosaic Virus
Winterhardiness	Hessian Fly
Drought Tolerance	
Grain Characteristics	**Flour Characteristics**
Test Weight	Flour Yield Score
Grain Drydown	Flour Softness Score
Seed Size	Gluten Strength Score

[1]Varieties are rated on a 1 to 9 scale (9 = best or highest). Heading Date and Hessian fly are rated differently.

Table 2. Pioneer wheat varieties have suitability placement guidelines for the following environments.

Environment	Environment
Double-crop with soybeans	High barley yellow dwarf virus conditions
Areas prone to winterkill	
High yield environments	High stripe rust conditions
Intensive management	
Low yield environments	High Fusarium conditions
Drought prone soils	
Low population	High Hessian fly environments
Late planting	

[2] Varieties are rated as Highly Suitable, Suitable, or Poor Suitability to the indicated environment.

In addition to these ratings, Pioneer sales professionals can provide yield data and other local expertise to assist growers in selecting the right varieties for their fields.

Seeding Rate

To establish sufficient stands, agronomists recommend seeding 1.3 to 1.6 million seeds/acre (30 to 37 seeds/ft.^{2}) when seeding at the optimum time. When seeding late, more seeds may be required to establish adequate stands for optimum yields. For example, Ohio State extension recom-

mends planting from 1.6 to 2.0 million seeds/acre when planting 3 to 4 weeks past the fly-free date.

Adequate stands are required for top production. Pioneer multi-year research showed that across varieties and locations, yield losses averaged 5.5% (range of 3% to 8%) when seeding rates fell below 20 seeds/ ft.^{2}. For this reason, agronomists recommend at least 20 to 24 plants with 3 to 5 tillers per plant, which could produce 60 to 120 heads/ft.^{2}. Stands of only 10 to 12 plants/ft.^{2} are usually candidates for replanting to corn or soybeans. Row length can be converted to square feet as shown in the table below (Table 4).

Table 4. Conversion of row feet to square feet.

Row Width (inches)	Length of Row Required to Equal One ft.^{2} (inches)
7	20.5
7.5	19.2
8	18.0
10	14.4

Planting Date

Wheat planting should be timely but after the fly-free date, which varies north to south. See your state extension recommendations regarding planting date to avoid Hessian fly infestation). A study conducted by the University of Kentucky showed a very significant planting date effect (Figure 1).

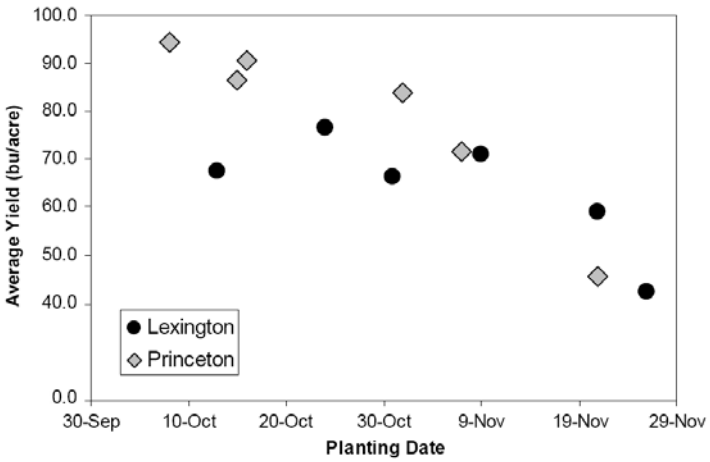

Figure 1. Yield of wheat planted on various dates at Lexington and Princeton, KY. Source: University of Kentucky.

Disease Management

Viruses, leaf diseases and head diseases may all affect the wheat crop and reduce yields.

Viral Diseases

The barley yellow dwarf virus is the most common virus affecting wheat. Like other virus diseases, it is vectored by aphids, which feed on wheat plants in both the fall and the spring. Controlling virus diseases in wheat requires controlling the aphids that vector the disease. There are several aphids that feed on wheat, but distinguishing them is largely unnecessary because control is the same for all.

The University of Kentucky lists the following guidelines for treating wheat for aphids:

Table 5. Treatment thresholds for aphids in wheat:

Timeframe	Number of aphids per foot of row
Plant emergence to 30 days post-emergence	3
30-60 days post emergence	6
More than 60 days post emergence	10

University of Missouri entomologists list a higher threshold of 25 aphids per linear foot of row at the early seedling stage.

Leaf and Head Diseases

Most fungal wheat diseases survive on wheat residue or that of other grasses and on wheat seed, and spread during wet conditions. Three of the primary leaf and head diseases of wheat are highlighted below.

Powdery Mildew is a leaf disease of wheat that is favored by cool temperatures below about 77 F and moist conditions common in some environments, especially with dense stands and high applied nitrogen. After fall infection, the disease may appear on the lower leaves in April and May and spread during the tillering and jointing stages of growth.

Leaf and Glume Blotch may be caused by any of three fungal pathogens including Septoria. Spread of these fungi is favored by wet, windy weather. During periods of wet weather, these fungi spread rapidly from the lower leaves to the upper leaves.

Small chocolate brown spots enlarge into lens shaped lesions with dark brown edges. The centers of lesions bleach and brown specks form in centers. Similar lesions appear on glumes as on leaves. Heads develop dark, chocolate color. Infected seed are dark, shriveled, and may not germinate

Head Scab (Head Blight) is caused primarily by the fungus *Fusarium graminearum*, the same pathogen that causes Gibberella ear rot and stalk rot of corn. This disease overwinters in diseased seed, wheat and corn residue, and other grasses in surrounding fields. Spores are produced and

blown onto the wheat heads, which germinate in free water on the head and invade the flower. The disease is favored by warm temperatures (77 to 85F) and high humidity / rainfall before, during and after heading and flowering.

Symptoms occur on the head after flowering. Individual spikelets or the entire head may be prematurely bleached. The bleached spikelets usually contain shriveled, scabby seeds and brown or black lesions may be present where the head joins the stem.

Management - Fungal diseases should be managed by practices that reduce disease inoculum, including rotation to a non-host crop and in some cases, burying crop residue by tillage. Also, varieties differ in resistance to some diseases, including downy mildew and head scab, so variety selection can play an important role. In addition, timely application of fungicides can help protect plants and reduce disease spread. Some commonly used fungicides are shown in Table 6.

Table 6. Fungicides commonly used to manage diseases in wheat.

Fungicide / Rate and Application Information	Diseases Controlled
Quilt® / 10.5 – 14 ozs/acre Apply at 50% - 100% flag leaf emergence for leaf diseases. Can be applied through full head emergence (Feekes GS 10.5) 45 Day PreHarvest Interval (PHI)	Rust Powdery Mildew Leaf Blight Glume Blotch Tan Spot Kernel Blight
Headline® / 6– 9 ozs/acre Apply at 50% - 100% flag leaf emergence for leaf diseases. Apply NO later than beginning of flowering (Feekes GS 10.5) 14 Day PreHarvest Interval	Rust Powdery Mildew Septoria Leaf and Glume Blotch Tan Spot Kernel Smudge
Folicur® + Proline® (Sect.18 Label) / **4 oz + 4 ozs /acre** Optimal timing is at +/- 15% flower (Feekes 10.51) 75 to 100% of heads fully emerged and 50% in flower.	Fusarium Head Blight

Nutrient Management

Winter wheat production requires attention to fertility needs of the crop in the fall and the spring. Adequate nitrogen (N) and phosphorus (P) are required for fall and spring growth and tillering. In the spring, the rapid green-up and growth of wheat requires timely nitrogen supply.

Phosphorus and Potassium

Wheat is more responsive to phosphorus than most crops (Figure 2). Without adequate P, fall growth will be slow, and leaf purpling may occur. A Bray P1 test of 45 ppm or above (90 lbs/acre) indicates adequate P for vigorous fall growth and early tillering (Figure 3). For potassium (K), exchangeable K soil tests from 150 to 200 ppm or 301 to 400 pounds per acre are considered optimum. Growers are encouraged to test soils to determine the need for additional P and K for their wheat crop.

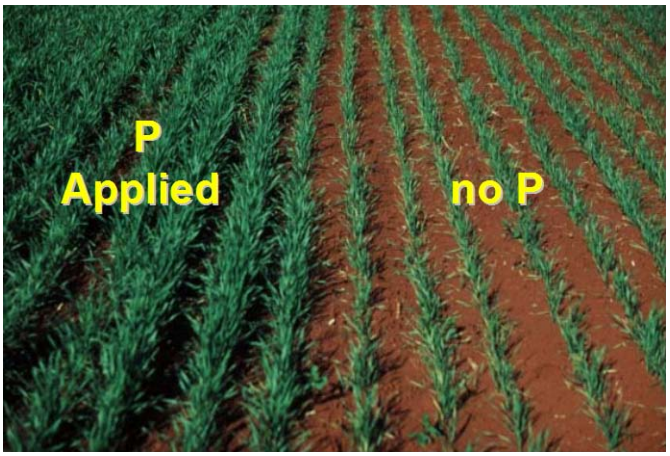

Figure 2. Wheat requires adequate phosphorus for vigorous early growth.

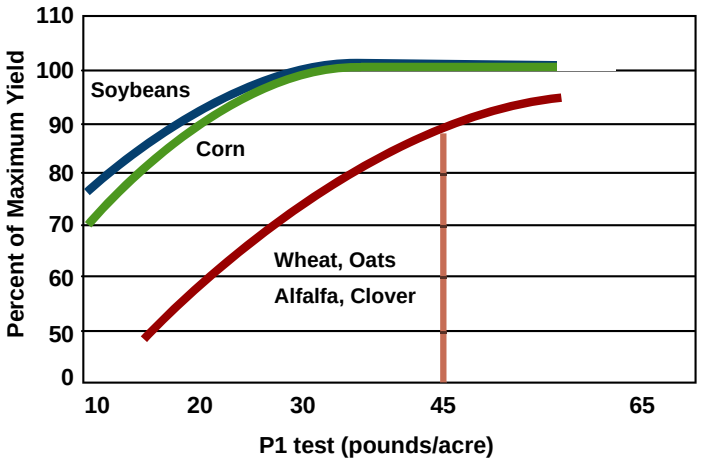

Figure 3. Yield response of various crops to P soil test levels. Source: University of Illinois.

Nitrogen Management

Management of nitrogen, including rate, timing and form of nitrogen applied is critical to maximize profit-ability in wheat production. Nitrogen is important in stimulating tiller development and supplying proteins for rapid growth and grain fill beginning at jointing.

Nitrogen timing: Much like corn, wheat takes up most of its nitrogen needs during a relatively short period of rapid vegetative growth often referred to as the "exponential growth phase" (Figure 4). Because this peak nitrogen requirement occurs in early spring, growers may wonder if fall application of N is also needed. Studies have shown that fall application may be profitable on sandy soils, after exceptional corn yields, or when application costs can be minimized, such as applying when P is also needed. In such cases, 20 to 30 lbs of N is usually recommended.

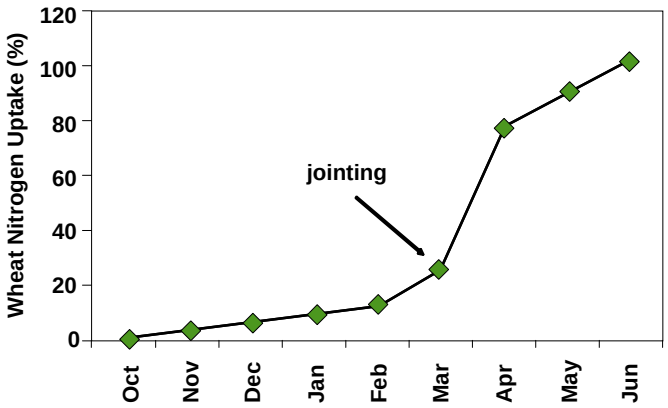

Figure 4. Nitrogen uptake by wheat.

Numerous studies have shown that March is the best time for N applications to wheat, even in mid-South areas where weather and field conditions would allow earlier application. This is because January or February application may allow nitrogen to be lost before it is needed by the crop, and also because excessive tillering may result from early N application.

On the other hand, if stands are thin in February (likely due to limited N), an application of N at this time may be advisable to stimulate new tiller development.

Advantage of March Application of Nitrogen

20 bu/acre more than January (2 studies)

5 bu/acre more than February (10 studies)

8 bu/acre more than February when yield is above 70 (4 studies)

When urea is topdressed in advance of crop need, growers should consider the use of an N stabilizer such as Agrotain® or ESN®, a polymer-coated urea. In research studies, Agrotain was about 4 bu/acre higher yielding than urea alone at all planting dates (Jan., Feb. and March.) ESN was superior to regular urea at Jan. and Feb. application dates.

Split spring applications – Studies have generally not shown an economic advantage for splitting spring applications of N, except on sandy soils. Sandy soils don't hold N well, so the potential of N loss is high. They also do not provide N well due to low organic matter. On these soils, studies have shown an average yield advantage of about a 5 bu/acre for splitting spring applications of N.

Nitrogen application rates and sources – In 16 studies conducted by the University of Missouri, the best topdress N rate for wheat ranged from 35 to 130 lbs/acre, or an average of about 85 lbs/acre. Assuming the fall N supply to wheat was about 15 to 30 lbs/acre, agronomists estimate the total N requirement at about 100 to 115 lbs/acre.

Studies have shown that ammonium nitrate (NH_4N0_3) is the best source of N for topdressing wheat, with a yield advantage of about 5 bu/acre over urea. However, this form of nitrogen is not available in many areas. A widely available, convenient source of N for topdressing wheat is urea-ammonium nitrate solution (UAN). However, both immobilization of N and volatilization losses can reduce the effectiveness of this N source when applied in contact with surface crop residues.

Sulfur

In 15 research studies on sulfur application to wheat over the past 9 years, 5 studies showed a positive yield response, with an average yield increase of just over 4 bu/acre. The remaining 10 studies showed a negligible response. Because some fields are responsive, agronomists often recommend including 10 lbs of sulfur in topdress applications of N.

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