Illinois Seed News

Special Edition

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Hybrid Wheat Standards

The Association of Official Seed Certifying Agencies (AOSCA) has been working with industry to establish guidelines for hybrid wheat certification standards. While the concept of hybrid wheat is not new, the method of production differs from the standards previously established for Chemically Assisted Hybrid Wheat or Cytoplasmic Male Sterile Hybrid Wheat Certification Standards. The forthcoming stand-ards will be written to address the genetic and hybrid purity standard from the standpoint of cytoplasmic male sterile hybrid wheat produced with co-mingled parent lines.

Research has identified hybrid varieties with superior performance, but producing those hybrids at a price point that keeps seedsmen competitive with leading varieties has been the underlying challenge. Hybrid wheat is a non-starter if farmers don't feel the price and performance of hybrid seed is competitive. But breeders and seed producers are getting serious about hybrid wheat again with the comingled parent line concept.

Wheat pollen is a relative brick in the botanical world and does not lend itself well to hybrid seed production. With the advent of genetic height differences in the male pollinator lines and co-mingled or blended hybrid production fields effective pollination can be achieved. This type of hybrid seed production can be found in other grains, primarily in Canada and Europe, and the development of the wheat standards by AOSCA have been influenced by these standards.

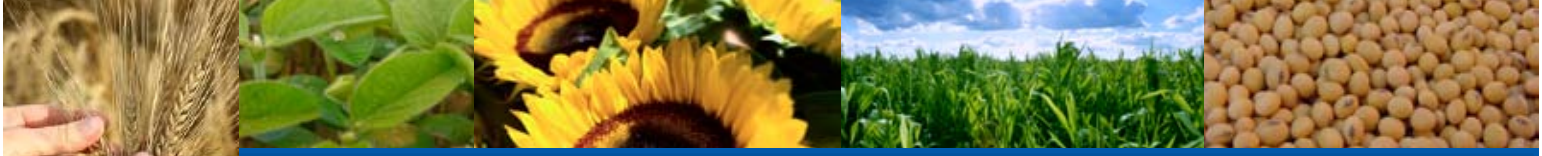
In addition to the high cost of producing hybrid cereal seeds, the complex genome has also hampered efforts to bring hybrids to market. Brasetto hybrid fall rye, available to Canadian growers in 2015, has been shown to deliver 20 to 25 per cent higher yield than check varieties and is considered the first economically viable hybrid cereal for Canadian growers.

According to the developers of Brasetto hybrid fall rye, "There have been attempts to create a hybrid winter wheat, but it's never been economical. That's because the cost of hybrid seed production for cereals have always been high and couldn't be recouped with the yield increase growers could expect to get, which has typically been in the five to 10 per cent range."

AOSCA continues to work with all segments of the industry in brining improved crop seeds to market. The forthcoming hybrid wheat standard is evidence that the association stands ready to provide a system of quality control and protection for both seed producers and farmers.

Featured Articles

Why Wheat in Illinois?..... 2
What Are Proximates?.....3
What About Ash Content?.....4
What is Vomitoxin or DON?.....4
DON in Wheat Straw.....5
What is Sprout Damage and Falling Number Tests?.....5
What Kind of Flours Do You Like?.....6
IL Crop's Service to Seed.....7



Why Wheat in Illinois?

The type of wheat produced in Illinois is soft red winter. It does not have the level of protein and gluten required for yeast breads. However, it is used in many other food products, especially as an ingredient where fine particulate flour is needed. Some of the uses are flat breads, cereals, cakes, cookies, pretzels, pas-tries, pancakes, crackers, biscuits, ice cream cones, part of all-purpose flour, batter and breading, wheat germ, etc. Some of its other uses include pet foods and glues.

About 83 percent of Illinois' wheat production is in the southern half of Illinois, from about Springfield south. Southern Illinois offers a longer growing season. This allows wheat to be harvested early enough that soybeans can be planted as a "double-crop" enterprise and still reach maturity before frost. The combined income from the wheat and double-cropped soybeans is competitive with either corn or soybeans alone in southern Illinois.

In addition to the income, producers like wheat because: Risks are spread out with several different crops. Diversifying the crop rotation reduces pest problems. Labor and machinery needs are spread out. It provides income in June and July to pay spring bills. The ground cover over the winter lessens chance of soil erosion. It provides straw as a by-product. It serves as a "cover" crop when establishing a hay field.

Wheat is seeded in late September or early October in northern Illinois and in October in southern Illinois. After initial fall growth, wheat is dormant throughout the winter. Growth resumes in late winter. About that time, growers apply nitrogen fertilizer to maximize production.

A little later, a herbicide may be applied to control wild garlic. Wheat begins to head about the first week in May. From that period to harvest, environmental conditions greatly affect the possibility of foliar diseases that can have a significant effect on yield. Harvest begins in the middle of June in southern Illinois and ends in early July in northern Illinois.

More than 100 years ago Illinois led the nation in the production of wheat. Wheat was sold for cash and it flourished in this climate. You can see that the long-term trend in acres harvested each year has been declining. With better yields, an adequate supply is now obtained from fewer acres. Also, corn was only raised to feed to livestock and soybeans were not discovered until modern times. Because of the rising demand for corn and soybeans after World War II, these crops have been displacing wheat on Illinois farms. It remains an important crop, but its rank is now third.

(Source Illinois Wheat Association)

About The Illinois Wheat Association

The Illinois Wheat Association (IWA) is a member organization serving all aspects of the Illinois wheat industry from producer to processor. Illinois Wheat Association provides educational opportunities, encourages research relating to wheat and wheat products, promotes marketing alternatives, and represents its members in state and federal legislative activities relating to the needs of the Illinois wheat industry.

What are Proximates and How Do You Determine their Percentage?

Proximates are the major components that make up grain. To determine the percentage of proximates in wheat for example, you can use the nondestuctive Near Infra-Red (NIR) Proximate Analysis procedure. This method, offered by Illinois Crop Improvement, includes protein content and moisture content but does not include ash content.

Proximate Analysis to determine protein content and moisture content is also available using wet chemistry methods. But, unlike the nondestructive NIR method, the sample must be ground.

Wet chemistry can be described as going "straight to the horse's mouth" or a direct measurement of each component by analytical chemistry for reference purposes.

To determine protein content the Combustion (Dumas) Method can be used. It has replaced the slow, dangerous, and environmentally unfriendly Kjeldahl procedure for most applications. The combustion method is an approved method and has become the most common reference ("wet chemistry") method to calibrate the protein content in NIR procedures The combustion method is often employed for samples for which no NIR calibration exists. In those cases, the combustion method is applied as a reference check and as a routine method of analysis.

For combustion analysis, a 50-300 mg representative sample (ground solid) is burned at a high temperature in a sealed system. The nitrogen in the sample is converted into nitrogen gas, separated from the other chemical components, and then measured by thermal conductivity. The nitrogen content can be converted to protein content by using a conversion factor (typically 6.25 x nitrogen) to obtain "as is" protein percentage. This test is performed in duplicate, and the moisture content in the original sample is determined by the air oven method to convert the protein content to dry basis. Protein contents measured by the combustion method can range from very low (0.1%) to 90+%.

The air oven method of determining moisture is also an approved method and is a common wet chemistry reference method. There are situations in which the air oven method may not be a suitable method for moisture measurement. For this test, a representative sample is weighed into a tared cup and placed in an oven. Oven temperatures and residence times vary by substance. The dried sample is then cooled in a dessicator and the weight of the remaining material is recorded. The weights are used to determine the amount of water removed in the oven. Moisture content is reported as the amount of water removed from the original sample. Solids content is the weight of material remaining after drying, divided by the original sample weight. Moisture content and solids content are reported "as is" or wet basis percentage. They are related by the equation: Moisture Content ("as is") + Solids Content ("as is") = 100%

Fast Stats on Wheat Protein

- **Protein Content ranges from 4-17% and is typically 8-15%**
- **Hard wheats are typically higher in protein (12-15%) than soft wheat (5-10%)**
- **Various end users have different demands for wheat composition;**
- **12-15% protein for breads, bagels, and other yeast-leavened products.**
- **8-11% protein for cookies, crackers and pastries**
- **5-8% protein for cake flour**
- **Results (other than Moisture Content) are reported on a dry basis percentage (percent of non-water material)**
- **Moisture Content is reported "as is" (percent of total sample weight)**

What About Ash Content?

Ash content is determined by high temperature incineration in an electric muffle furnace. When a sample is incinerated in an ash oven, the high temperature drives out the moisture and burns away all the organic materials (starch, protein, and oil), leaving only the ash. The residue (ash) is composed of the non-combustible, inorganic minerals.

In general, higher protein levels typically translate into higher ash content. Ash can affect color, by imparting a darker color to flour and finished products. Applications requiring particularly white flour may call for low ash content while whole wheat flour may call for relatively high ash content. Ash content was used in the 1920's as an indicator of pure flour with less bran and aleurone. However, changes in varieties and production practices has resulted in more mineral content in the endosperm distancing the relationship between flour purity and ash content. Ash content, also know as mineral content and ash count, for wheat or flour ash are expressed as a percentage of the initial sample weight; for example, wheat ash of 1.58 percent or flour ash of 0.52 percent.

Fast Stats on DON

DON is short for Deoxynivalenol and is also known as vomitoxin

The U.S. Food and Drug Administration has issued the following guidelines for DON

- **1 part per million (PPM) for wheat products for human consumption**
- **5 PPM in grain and grain products destined for swine and all other animals (not to exceed 20% of the diet)**
- **10 PPM for ruminating beef and feedlot cattle (not to exceed 50% of the diet)**
- **DON can also be found in wheat straw**

What is Vomitoxin or DON?

Vomitoxin, also known as DON, is a grain mycotoxin (fungal toxin) produced by the fungus *Gibberella zeae* (also known as Fusarium graminearum). The occurrence of head scab does not mean that DON is present, but high levels of bleached heads and tombstones kernels in the harvested grain are an indicator of possible toxin production by the fungus. Vomitoxin adversely affects swine to a larger degree than other animals. The most common effect of feeding wheat containing DON to swine is weight loss or reduced weight gain due to refusal of feed, reduced feed intake, or vomiting after eating. This has been observed at levels as low as 5 parts per million.

Fusarium Head Blight Scab In a Germination Test

The initial infection on the wheat head may produce additional spores that can infect other wheat heads. This secondary infection can be especially problematic in uneven wheat stands with late flowering tillers.

Lengthened or variable head emergence can also affect fungicide efficacy resulting in elevated DON levels in asymptomatic wheat (wheat with relatively few scab heads or tombstone kernels). Thus, it is also possible to have high levels of DON in wheat that exhibited a relatively low incidence of visible head scab in the field.

For DON, a GIPSA-approved Enzyme-Linked Immunosorbent Assay (ELISA) is utilized to quantify the vomitoxin level of a sample. Possible Values can be 0-20+ PPM with typical Results 0-2 PPM.

DON in Wheat Straw?

DON is obviously a challenge in wheat production and preliminary research has shown that DON can be present in wheat straw. A University of Illinois study stated the following conclusions.

In some cases, Mycotoxins were detected at very high levels in wheat straw. This could pose a threat to the livestock industry and warrants further investigation.

Fungicides were inconsistent in their effect on DON levels in straw.

Cultivar appeared to have the largest effect in decreasing DON levels in straw, but resistance to DON accumulation in grain did not always relate to resistance to DON accumulation in straw.

Source: Influence of Management Practices on Fusarium Mycotoxins in Wheat Straw. Poster Presentation by C.A. Bradley, K.A. Ames, Y. Dong, E.A Brucker and F.L. Kolb.

What is Sprout Damage and Falling Number Tests?

Sprouting or the germination process can be initiated multiple times in wheat. As part of the germination process, there is a spike in the activity of the alpha-amylase enzyme. Alpha-amylase breaks down the starch in the kernel to create usable sugars, the nutrition source for the seedling, until it begins photosynthesis.

The germination process lowers test weight and affects the viability of the seed as the seed swells and carbohydrates are reduced due to the expenditure of energy towards embryo growth. The simplest most effective way for growers to assess sprout damage is to visually inspect the seed. Look for a weathered appearance, seed swelling, a split seed coat with exposed embryo, and emergence of the coleoptile and radicle (the seedling shoot and root).

The falling number test is a measure of wheat quality, often used by millers, to determine if undesirable enzyme activity or sprout damage has occurred. This test is performed by making a paste from a ground wheat sample and water, heated, and then mixed to "gelatinize" the starch. During gelatinization, the starch granules swell and start to become solubilized. Samples with higher alpha-amylase activity will form a paste with a less viscous consistency as compared to undamaged samples. The time (in seconds) required for a plunger to travel a specific distance is measured. Undamaged wheat will typically have a Falling Number higher than 325 seconds. A Falling Number greater than 300 is desired in most applications. Possible Values are 150-500 seconds with typical Results of 250-350 seconds

Sprout damage is also detrimental to the quality of seed intended for planting. As the degree of sprout damage increases, the germination rate decreases. Severely sprout-damaged kernels may not grow if planted. While infected seed wheat can be treated with fungicides, density separation on a gravity table is the only way to remove low test weight kernels that may have sprout damage. High quality seed from a reputable dealer is always a good buy.

Sprout Damage
Photo by NDSU

What Kind of Flours Do You Like?

The protein content of the type of flour affects the strength of the dough. The different wheat flour types contain varying amounts of the gluten forming proteins. Hard wheat, mainly grown in midwestern U.S. has a high protein content. Soft wheat, grown in southern U.S. has less protein. In yeast breads, a strong gluten framework is desirable, but in cakes, quick breads and pastries, a high protein flour makes a tough product.

Bread flour is a hard wheat flour with about 12 percent protein. Bread flour is used for yeast raised bread because the dough it produces has more gluten than dough made with other flours. Sufficient gluten produces a light loaf with good volume. Slices hold together, rather than crumble.

Cake flour is a soft wheat flour that is 7.5 percent protein. The lower gluten content causes products to have a tender, more crumbly texture that is desirable in cake.

All purpose flour is blended during milling to achieve a protein content of 10.5 percent. This medium protein flour can be used for all baking purposes. If using all purpose flour in place of cake flour in a recipe, substitute 1 cup minus 2 tablespoons all purpose flour for 1 cup cake flour.

Whole wheat flour may be substituted for part of the white flour in yeast and quick bread recipes, but the volume of the finished product will be reduced. Whole wheat flour contains the nutritious germ and bran as well as the endosperm of the wheat kernel. Bran particles cut through the gluten during mixing and kneading of bread dough, resulting in a smaller, heavier loaf. If substituting a very coarsely ground whole wheat flour for all purpose flour, use 1 cup plus 2 tablespoons whole wheat flour for every cup of all purpose flour. To substitute whole wheat flour in a white bread recipe, use half whole wheat and half bread flour for the best results.

Wheat germ, though not a flour, is often used in place of part of the flour in recipes for flavor and fiber. Protein, vitamins, minerals, and polyunsaturated fats are concentrated in the germ of grain kernels. Wheat germ, preferably toasted, can be used in place of up to 1/3 of the flour in a recipe.

Rye flour is often used in combination with wheat flour for bread. Light rye flour can be successfully substituted for 40 percent of wheat flour in a recipe without loss of volume. Medium and dark rye flours should be limited to 30 percent and 20 percent, respectively, of the total flour amount.

Triticale flour is a hybrid of wheat and rye. It has an average protein content higher than that of wheat flour. In yeast bread dough, triticale flour has better handling properties than rye flour because it will form gluten, but does not handle as well as wheat dough. For a good quality dough, ferment yeast dough made with triticale flour for a shorter period than wheat flour dough.

Source: Nebraska Cooperative Extension NF94-186. March 1994. Functions of Baking Ingredients By Sharon Lauterbach, Extension Assistant Julie A. Albrecht, Extension Food Specialist University of Nebraska Cooperative Extension Service.

Fast Facts of Wheat Protein

Wheat contains 5 different classes of Protein

- **Albumin (soluble in water)**
- **Globulin (soluble in salt solution)**
- **Gliadin (soluble in 70% aqueous ethanol)**
- **Proteose**
- **Glutenin (soluble in dilute acid or alkali)**

Special Edition News

Illinois Crop Improvement's Service to Seed

Illinois Crop Improvement is a freestanding, non-profit corporation that provides seed certification and crop improvement services in support of the state's agricultural economy. The primary vehicle chosen to positively affect the state's agricultural viability has been quality seed, and consequently, the grain derived from quality seed. Illinois plays a pivotal role in the global seed and grain industries from seed development through grain processing. Illinois Crop has grown into a leading source of authentication, testing and winter farm services known and respected worldwide.

Illinois Crop Improvement has no stockholders and pays neither dividends nor patronage refunds. Should Illinois Crop ever be dissolved for any reason, 100 percent of the assets will revert directly to the Illinois Agricultural Experiment Station to once again assure the assets will be used for the public benefit. Illinois Crop is allowed to generate and retain appropriate reserves to assure its ability to provide service to the industry during down business cycles. The reserves may be used to support the exploration and development of new services that may benefit the industry. Illinois Crop has used these reserves to establish and operate the Puerto Rico Station in 1985, the Identity Preserved Grain Lab in 1988, and the Greenhouse Program in 1994. Reserves were also used in 1991 to purchase and develop the headquarters' facility in the Interstate Research Park.

Member of AOSCA

Illinois Crop Improvement is a member of AOSCA (Association of Official Seed Certifying Agencies). AOSCA's membership includes Seed Certifying Agencies across the US, and Global membership including Canada, Argentina, Brazil, Chile, Australia, New Zealand, and South Africa.

The organization and its members establish minimum standards for genetic purity and identity and recommend minimum standards for seed quality for the classes of certified seed. AOSCA also cooperates with seed regulatory agencies in the determination of policy, regulations, definitions or any procedures relating to the labeling and distribution of seed moving in intra-state, inter-state or international commerce.

Many of the services Illinois Crop Improvement provides today can trace their roots directly to seed certification. Seed certification has four main components; 1) source of seed 2) field inspection 3) seed testing and 4) labeling. Specific standards and procedures are in place within each of the main components and certified seed production is a continuous process that builds upon the previous steps to deliver a product that meets minimum standards. Of the four main components of seed certification two offer standalone services to the seed industry, Field Services and Seed Testing.

Field Services

The field services department is responsible for in-field and on-site services for Illinois Crop Improvement's various authentication and certification programs.

The department also provides genetic trait testing as a standalone service or in conjunction with the Illinois Crop Improvement Seed Lab and Identity Preserved Grain Lab.

During the crop season, purity, isolation and pollen control inspections for Certification, Quality Assurance, Identity Preserved or custom field inspection programs is the primary focus of the department. Illinois Crop Improvement is accredited by the National Seed Health System to provide phytosanitary field inspections for seed production that will be shipped internationally. Specialty programs such as Wildland collected native seed inspections, weed-seed free forage and mulch inspections and on-farm assessments of compliance for Insect Resistance Management are also part of the services Resistance Management are also part of the services performed by the department and its field inspectors.

As harvest begins, trait testing by the greenhouse and immunoassay laboratory methods become the focus of the department. The full time field services staff includes a Certified Genetic Technologist to ensure that trait testing is being performed by trained and qualified individuals.

Seed Laboratory

Shortly after Illinois Crop Improvement Association was created, the need for a seed laboratory to help assess the quality

continued on page 8

continued from page 7

of seed being certified was evident. The first laboratory was operated in conjunction with the University of Illinois Ag Experiment Station. As time went by and seed testing volume increased, it was necessary to bring the seed laboratory into IL Crop's headquarters building. Many things have changed in seed production and testing since IL Crop was founded. Seed certification is still a part of our business, but the seed laboratory has evolved into a full service laboratory offering traditional seed testing for professional seed production companies and seed testing services for all segments of the agricultural industry.

The laboratory offers a wide range of seed testing services including germination, seed purity, seed vigor, seed count, TZ, all state noxious weed exam and other seed testing services on row-crops, forage, grains/cereals, grass/turf, native species, vegetables and more.

Illinois Crop Improvement has three Registered Seed Technologist on staff to ensure quality testing and reliable results in addition to the internationally recognized ISO:IEC 17025:2005 laboratory accreditation.

For more information on Illinois Crop Improvement's services and capabilities visit us at www.ilcrop.com or give us a call today at 217-359-4053.

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USDA – BQMS
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Composition
Processing
Non-GMO
Mycotoxin

Winter Farm

USDA - BQMS

Growouts
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Seed Production
Research
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