TIGER® TECH NEWSLETTER

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Sulphur: Wheat Production and Characteristics for End User

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Wheat is a cool season crop grown in most states within the United States, and western provinces in Canada. It is widely adapted and produced in several countries around the world. The type of wheat produced varies with regions in the United States, Canada, and throughout the world. There are six classes of wheat, divided into two groups:

WINTER WHEAT	SPRING WHEAT
1) Hard Red Winter	1) Hard Red Spring
2) Soft Red Winter	2) Hard White Spring
3) Hard White Winter	3) Soft White Spring
	4) Durum

Hard Red Winter Wheat is used predominately for bread and all-purpose flour. Approximately 40% of production is in the Great Plains region of United States.

Soft Red Winter Wheat is used to make pastries, flat breads, and crackers. It is grown east of the Mississippi River and is approximately 20% of total wheat production.

Hard Red Spring Wheat has very good bread-baking characteristics due to its high protein content (13-16%). It is produced in the Dakotas, Montana, Minnesota, and California and comprises approximately 20% of total wheat production in United States. It is the primary wheat produced in Canada.

Hard White Spring Wheat is used in yeast breads, tortillas, and oriental noodles.

Soft White Spring Wheat is used for baking same products as soft red wheat and is grown in the Pacific Northwest, Michigan, New York, and California. It tends to have lower protein content and greater yield potential.

Durum Wheat has a protein content of 12-16% and is good for pasta, macaroni, and spaghetti. It is grown predominately in North Dakota and to lesser extent in Montana and California. The southern regions of Alberta and Saskatchewan have suitable climate for durum wheat production (Beuerlein, 2001).

THE TIGER® TECH QUARTERLY NEWSLETTER

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WHEAT PHYSIOLOGY AND NUTRIENT UPTAKE

Approximately 60% of wheat production in United States is winter wheat. "Some benefits to winter wheat are higher yield potential, more efficient use of labor and machinery as it is planted and harvested during periods of few competing field activities, greater profitability as it requires less inputs than spring wheat, and establishment of cover to reduce wind and water erosion" (Wiersma et al. 2012). Winter wheat is different from spring wheat physiologically as it requires a vernalization period to activate reproductive growth process. Although, winter wheat may have greater yield potential, all wheat varieties require ample supply of plant available nutrients. Fertilization and maintaining optimum soil pH are critical wheat management practices. "A properly managed soil fertility program can improve yield and quality more than any other single management practice" (Harris, 2013).

During early growth stages vegetative shoots (tillers) emerge from buds at crown of wheat plants. Multiple tillers are desirable as each tiller will develop a seed head. Therefore, more tillers per plant contribute to greater yield potential. Adequate plant available nutrients in the root zone are critical to tiller development and growth. General N application rates are 80 – 120 lbs./ac. Regional adjustments need to be considered and credit provided for previous legume crops and manure applications.

Approximately 65% of total phosphorus (P) and 90% of total potassium (K) uptake occurs before the boot stage. These nutrients should normally be applied before planting (Harris, 2013). The boot stage of growth is when the developing seed head is visible within the stem just below the flag leaf (Photo 1.0). The flag leaf is the last leaf before seed head emergence. Application rates should be based on local university recommendations considering many factors that may influence productivity.

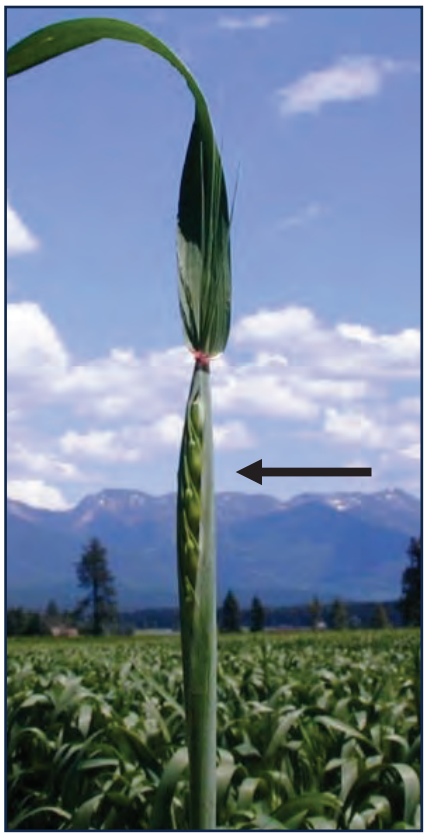

Photo 1.0
Wheat in boot stage of growth.
(Photo: Montana State Univ.)

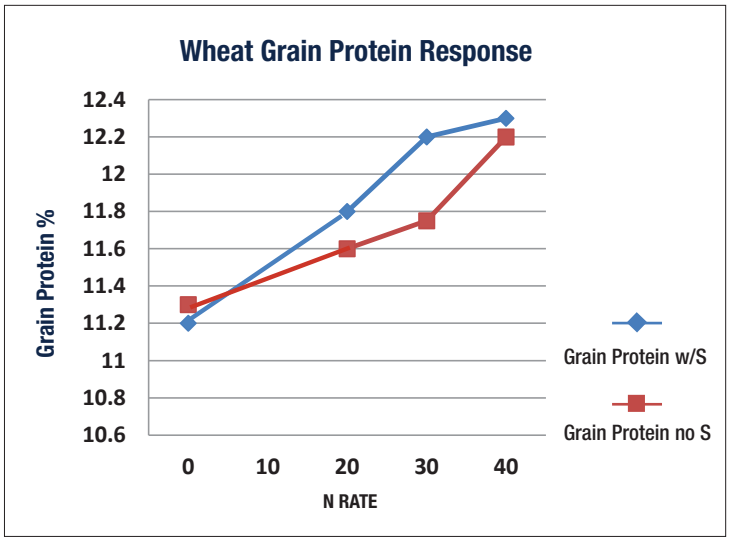

Figure 1.0
Adapted from Thomason et al., 2008

SULPHUR INFLUENCE ON END USER BENEFITS

The 4th major nutrient is sulphur. It is a primary component of the amino acids methionine, cysteine, and several coenzymes. Sulphur is an important factor in bread-making quality including protein, loaf volume, and texture (Munier et al., 2006). Figure 1.0 shows grain protein concentration increased an average of 0.2% when late season N was applied in conjunction with S (Thomason et al., 2008). Thomason also concluded that "the inherent genetic potential and composition of a given cultivar has major impact on the magnitude and biological significance of the effects that a fertility management regime likely will have on grain, flour, and end use characteristics".

SULPHUR DEFICIENCY IN WHEAT

Coarse textured soils tend to have low sulphur levels, but medium texture soils with moderate organic matter content have become more prevalent with low plant available sulphur . No-till systems and field with heavy crop residue are also thought to increase the chance of S deficiency. If a S deficiency is misdiagnosed as a N deficiency the application of fertilizer N will make the S deficiency worse, therefore tissue sampling is recommended to positively identify the limiting nutrient (Camberato & Casteel, 2010). Sulphur is not mobile within the plant and when a deficiency occurs, it results in a general yellowing of youngest plant tissue which is in the top of the plant. Photo 2.0 has sulphur deficient wheat that received 100 lbs./ac. nitrogen and no sulphur in center. Wheat on both sides received 100 lbs./ac nitrogen and 30 lbs./ac. sulphur.

Photo 2.0
Sulphur deficient wheat surrounded by wheat that responded with 30 lbs./ac S.
(Photo: Purdue University)

NUTRIENT MANAGEMENT

Nitrogen and S metabolism influence each other. Wheat takes up approximately 0.25 pounds of S per bushel per acre. Therefore, S application rate should be based on anticipated yield. Typical application rates are 15 – 40 lbs./ac. TIGER 90CR® or 16 – 42 lbs./ac TIGER XP™. Oftentimes S recommendations for wheat include the sulphate form as wheat is a cool season crop and much of its growth occurs prior to soil temperature rising above 65°F. Soil microbial activity increases significantly as the soil temperature rises above 65°F. Soil temperature and moisture enhance the microbial activity. Sulphur bentonite products will provide sufficient sulphate-S for wheat when the 4R strategy is utilized in application management (Figure 2.0). The source has been determined; selecting the right rate with right timing of product placement provides greatest potential S benefit to the crop. Both TIGER 90CR and TIGER XP should be applied prior to planting wheat. Another option would be to apply these products prior to planting the crop before wheat. For example, if the wheat will be planted following soybeans either product can be applied prior to planting the soybeans.

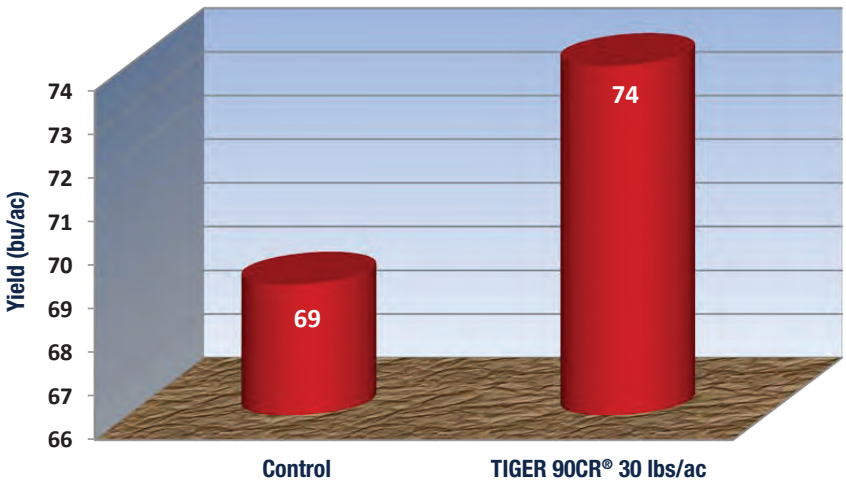

Figure 2.0
Wheat response to sulphur bentonite.TIGER-SUL & Arise Research & Development

Generally, micronutrient additions are not required for wheat. Exceptions include alkaline soils and organic soils. Two micronutrients that tend to be deficient in soils with high pH are zinc (Zn) and manganese (Mn). Application rates for both products are function of the soil test levels and soil pH. Lower soil test levels and higher soil pH require greater amounts of added nutrients. Additional Zn requirements could be 1 – 6 lbs./ac. of actual Zn and Mn rates of 2 – 10 lbs./ac. These requirements could be fulfilled with TIGER Micronutrients® Zn 18% at 6 – 35 lbs./ac. and TIGER Micronutrients® Mn 15% at 15 – 67 lbs./ac. Both products provide required micronutrients and sulphur. Same application management can be employed with these micronutrient products as described earlier for TIGER 90CR and TIGER XP. They should be applied prior to planting wheat. The sulphur oxidation process is gradual throughout the growing season. As the sulphur is oxidized the micronutrient oxide is acidulated and converted to the sulphate form available for plant uptake. The gradual micronutrient conversion minimizes chemical fixation in the soil of the Zn and Mn. These control release characteristics provide TIGER-SUL Products a unique fit into the 4R best nutrient management practices of right source, right rate, right place, and right time.

References:

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