CROP EXCELLENCE

CLOSING OUT STRONG
GOOD START, GOOD FINISH FOR WINTER WHEAT DEMANDS NURTURING COME SPRING

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So, we got the start rolling with attention to detail in wheat management – here comes the essential piece, closing this plant up by giving it the necessary physiological resources and enjoying a solid harvest both in yield and grain quality terms.

Why is winter wheat different to spring wheat? Winter / fall seeded varieties are in the ground longer so with appropriate management can be a bigger yielder versus a spring seeded variety – makes sense. However, winter wheat can be managed for quality such as grain protein content and yield to equal spring varieties. Genetics are key and here comes vernalization – the need for certain wheat varieties to be exposed to lower temperatures during early leaf and tiller development in the fall, to switch to reproductive growth come spring. From a physiological perspective, thereafter we have a number of nurturing tasks, not least fertility.

As wheat emerges from winter and switches from vegetative growth to reproductive phases, a lot of physiological processes come in to play that can be encouraged to push yield and plant health, for example:

- At the end of tillering, switching to stem extension, nitrogen demand moves from about 1 pound N per acre per day to at least 3 lbN/ac/day – a massive change that needs to be fed with N fertilizer top-dressings but in turn that additional N can only be supported by adequate secondary and micronutrient supplementation.

- Moreover, solid levels of phosphorous, potassium and sulfur at a macronutrient level are essential, not an option.

- Secondary nutrients including sulfur, calcium, magnesium and even chloride will also have a profound positive effect on yield and quality where used appropriately.

Dwelling here momentarily, S improves N nutrition, Ca is essential to provide the cell wall components needed for rapid growth, Mg is an essential component of chlorophyll and thus photosynthetic capacity and Cl will assist in disease resistance – all scientifically documented but often ignored at field production levels. Think about it – you set up the factory / power station – keep it fed – as physiologists we fertilize plants, not soils.

What else comes to mind? An age-old concept for me that runs prominent is transient and subliminal deficiencies. As a physiologist, these are different phenomena at a plant and crop level but are concepts often conflated in standard literature.

- Transient usually refers to a temporal (time) or spatial (positional) unavailability induced by environmental conditions such as soil compaction, waterlogging and so forth – we can address and treat accordingly with respect to nutrients but it is tough to claw back the lost yield potential – again, pre-emptive management and historical knowledge will assist here. In other words the soil or tissue tests indicate plenty of nutrient but it is simply not available where and when the plant needs it.

- Subliminal deficiency is a little more pervasive and often ignored by crop practitioners – I personally make a distinction for plants in the same way an MD will tell you based on this blood analysis you are borderline diabetic but carry on....I want to know what to do about it – hey! Diet! Subliminal is the plant equivalent of close but no cigar – official tissue analysis data indicates all is well but not deficient – based on what? The plant needs a voice here and usually expresses its discontent by not realizing yield potential because of a shortage of an essential element – winter wheat is a brilliant example of this concept.

As a visual, explain this.... The sufficiency level for a microelement may be 20 ppm, below which it is deficient – what about 19 ppm or 21 ppm? Insurance, gut feel, site history and intuition all come in to play here for a crop advisor.

My advice, what are the aspirations of you client with this wheat crop? Feed and nurture accordingly.. This brings us to attention to detail, vis a vis the micronutrients, often forgotten in intensive wheat production – here's a few pointers to consider and implement perhaps.

These sufficiency data for winter wheat (top two leaves, just before heading) are presented in Bryson, Mills et al (Plant Analysis Handbook III, 2014) and I like the range concept...

Micronutrients	ppm
Iron (Fe)	10 - 300
Manganese (Mn)	16 - 200
Boron (B)	1.5 – 4
Copper (Cu)	5 – 50
Zinc (Zn)	20 – 70
Molybdenum (Mo)	0.1 – 0.5

So given my previous comments, where do you want to see zinc tissue levels – 19 or 21ppm or maybe 45 ppm? Insurance at worst….? Let's take a brief look at each one of these essential nutrients:

Iron: Seldom an issue in wheat but can be deficient on high pH soils but can be toxic on low pH soils, notably those irrigated with sour water. In the latter case, root toxicity is the issue, in the former, low functioning photosynthesis and poor nitrogen utilization

Manganese: a dark horse in all micronutrient applications! Irrespective of tissue and soil analysis, and certainly the characteristic necrotic foliar spots of full blown deficiency by which time yield is lost – this nutrient is a vital engine in crop health. It will drive energy production (photosynthesis), structural integrity (cell health, disease resistance such as root take-all) and chemical biosynthesis – anti-fungal compounds and lignin synthesis for example. An element missing in many intensive wheat production systems since the absence of dithiocarbamate fungicides such as maneb and mancozeb.

Copper: This is a squirrely element but essential nonetheless in energy transfer processes and related photosynthetic pigments. In wheat, however, copper insufficiency will manifest itself as "blind" ears or sometimes referred to as "rat-tails" on a spike/head appearance. Wheat is self-pollenating and the cell division that recombines genetic material for pollen grains and differentiation occurs at the end of tillering in wheat and early stem extension at which time the embryo ears are formed. Insufficient Cu levels at this critical period will therefore have a profound effect on yield.

Zinc: Photosynthetic efficiency, sunlight capture, carbon fixation, energy production, nutrient (notably P) uptake and portioning – a no-brainer in any crop production system. Note the above mentioned wide sufficiency range – you got high soil P, you got low plant zinc!

Boron (and Molybdenum): I am going to put these two together as there is a common history and bond! Historically, boron was always considered toxic to wheat..of course when you put on 10 lb/ac as sodium borate! However, with refined foliar delivery systems, B applications in wheat have been realized as an essential component in late season nitrogen assimilation (uptake) and partitioning such as N to grain protein. Moreover, B is an essential companion to Ca in cell wall construction in rapidly growing plant tissue.

Remember the N partitioning and utilization roles of B, like all of us it needs a helping hand! In non-legumes like wheat, Mo plays a role in nitrogen incorporation at a foliar level to create amino acids and proteins in essential metabolic processes. Needed at very low levels but a great tag-team partner with B.

So, I go back to my original thesis – good start, good finish. Attention to detail and be pre-emptive . Fertilize the plant!