correlated with grain yield in all growing seasons since so many factors can negatively impact the wheat crop from Feekes 4 to maturity. However, our interest was in developing a yield goal parameter that was "seasonal-sensitive", intrinsic, and that would more accurately reflect yield potential likely to be realized in that season. If growth was poor from planting to Feekes 5, it is unlikely that a high yield potential would be realized. Similarly, if growth was excellent from planting to Feekes 4, but declined from Feekes 4 to Feekes 5 (drought, frost damage, etc.), yield potential would be expected to be lower.

In-season estimates of yield potential need to be viewed as refined estimates of yield goal. We are presently evaluating topdress N fertilization rates based on the in-season estimate of yield potential. Nitrogen fertilizer rates are estimated using the following equation:

$$\text{N rate} = \frac{[(\text{Predicted grain yield x \% N in the grain}) - (\text{predicted forage N uptake at Feekes 5})]}{0.70}$$

Predicted grain yield was estimated from INSEY, percent N in the grain was obtained from average values associated with winter wheat at different yield levels (higher percent N at low yield and lower percent N at high yield), and predicted forage N uptake at Feekes 5 was based on the published relationship with NDVI. This method is aimed at increasing yield (recognizing the need for increased N rates in areas with increased yield potential) and N use efficiency (decreased N applied where forage N uptake was already high). Our work assumes that the production system allows for in-season application of fertilizer N and that failing to apply preplant N has no adverse effect on grain yield. However, we recognize that using yield goals combined with soil nitrate-N (NO_3-N) testing remains as one of the more useful tools in establishing fertilizer N rates when preplant fertilizer N application is the only option.

If accurate estimates of yield potential are to be realized, these estimates will be needed at resolutions (10 sq. ft.) where differences in soil test parameters are found. If a coarser resolution (>100 ft.) is used, the variation in yield potential will be masked by averaging, and benefits that may be realized in treating the variability can be lost. In summary, the use of INSEY offers an alternative method of refining topdress N rates by basing N fertilizer need on in-season prediction of yield potential.

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Research Notes

California: Nickel – A Micronutrient Essential for Higher Plants

Research has established nickel (Ni) as an essential element for cereal crops. Using barley, the researchers satisfied the criteria of essentiality that (1) the plant cannot complete its life cycle without Ni and (2) no other element can substitute for it. They report: "Under Ni-deficient conditions, barley plants fail to produce viable grain because of a disruption of the maternal plant's normal grain-filling and maturation processes that occur following formation of the grain embryo. Since Ni was previously shown to be essential for legumes in unrelated research, it is concluded that Ni is essential for growth and reproduction of all higher plants.

Various researchers have shown that Ni deficiency affects plant growth, plant senescence, nitrogen (N) metabolism, and iron (Fe) uptake and may play a role in disease resistance. Nickel is the first micronutrient to be discovered as essential since chloride (Cl) was added to the list in 1954.

Source: Brown, Patrick H., Ross M. Welch, and Earle E. Cary. 1987. Plant Physiol. 85:801-803.