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Nitrogen Management for High Yield and Protein in Winter Wheat

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Protein premium incentives led producers to ask "can the protein content of wheat be increased with appropriate management? To answer that question, an understanding of the factors that influence protein content is needed.

The protein content in wheat grains is largely dependent on genotype. Higher protein varieties tend to be lower yielding. Care should be taken when selecting varieties to consider not only yield but protein potential as well as other agronomic characteristics.

Environment also influences protein content. Climatic conditions such as precipitation (timing and quantity) and temperature (degree days) during the growing season are the overriding environmental factors most affecting protein content. However, successful production of winter wheat with acceptable protein content could be achieved with an effective nitrogen (N) management.

Fertilizer management for high grain protein content is challenging because it is not possible to predict growing conditions (moistures and temperature) when fertilization is most convenient. High rates of N applied at or prior to planting to increase protein content have a high level of investment risk under dryland farming. Investment in fertilizer may not generate any additional income if precipitation does not occur. On the other hand, if plenty of rainfall occurs and a crop is under fertilized, income potential is lost.

Protein content is also affected by the timing of N fertilization. An adequate application of N at or prior to planting is essential to establish yield potential. However, N taken up by the plant after the boot stage has been shown to increase protein content to a greater extent than yield. Therefore, the supply of N to the plant should be maintained through the boot stage to provide for optimum yield and protein content.

Split applications of N, with some fertilizer at or prior to planting and an in-season application is one strategy to manage protein content. The risk of applying a single, high rate of N early in the season is largely reduced with this approach. The decision to apply additional N during the season can be based on established crop potential and mid-season growing conditions.

However, there are also risks associated with split applications. Broadcast granular fertilizer or dribble-banded liquid must be followed by rain to move the N to the root zone. A mid-season drought can temporary strand the N at the soil surface. Another risk of the split application is the potential of N from urea or liquid urea ammonium nitrate to volatilize and be lost to the atmosphere, especially under warm soil conditions common during the critical boot stage of the crop.

Past cropping practices and land management can affect N availability over the growing season. Livestock manure, and annual or perennial legume crop residues may release N for two or more years through the process of mineralization. Nitrogen released from these past practices may substantially increase protein content of subsequent wheat crops.

Another important component of grain protein is sulfur. The sulfur requirement is up to one-tenth of the N requirement.

Soil testing to determine plant-available N is the best way to decide on appropriate rate of N fertilizer application. Soil samples must be taken to 24 inches. Information provided by the soil analysis can be used in conjunction with fertilizer cost, grain yield goal, and protein response to weigh the economic feasibility of N fertilizer application.

Producers can contact their local extension agent, specializing in agronomy, to discuss fertilizer requirements to achieve their yield and protein goals.

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