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Using Soft White Wheat Protein to Our Advantage

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Foreign and domestic buyers are concerned about the protein level in Pacific Northwest soft white wheat. High protein is not acceptable for many products using soft white wheat. Protein content of Pacific Northwest soft white winter wheat averaged 10.6 percent in 1986 and 9.9 percent in 1987, according to the Pacific Northwest Grains Council Quality Survey. Korea, a major importing country, tendered in 1987 for soft white wheat with a maximum of 9.5 percent protein. The Oregon Wheat Commission reported that Korean importers paid a premium as high as $.11 per bushel for low-protein wheat.

The magnitude of such a premium, and whether it is extended beyond the exporter to inland terminals and producers, will depend on continued buyer interest in low-protein wheat and the availability of low-protein stocks at terminals near ports. A price incentive for local producers and elevators will be necessary if producers are to change current production practices and intentionally produce low-protein soft white wheat.

Protein-Yield Relationships

Protein in irrigated wheat is determined mostly by varietal characteristics and crop management practices that are under the producer's control. All other conditions being equal, protein in the grain is most easily reduced by limiting the soil or fertilizer nitrogen (N) available to wheat. Reducing the N applied will also reduce production costs. Increasing market price while reducing production costs is appealing. Unfortunately, producing soft white wheat with protein below 10 percent may not be possible without also sacrificing production.

Understanding the relationship between wheat protein and wheat production is essential for determining whether it is in the producer's best economic interest to produce low-protein soft white wheat. Fig. 1 shows the relationship between protein and relative yield (percentage of maximum yield with adequate N) of Stephens wheat, using the results from several irrigated field studies conducted in southern Idaho. This relationship can be used

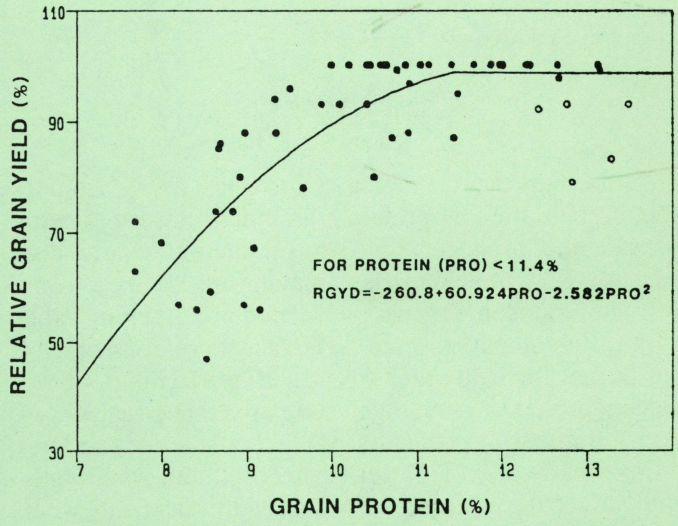

Fig. 1. Relative grain yield (percent of maximum yield) of Stephens soft white winter wheat as affected by grain protein (PRO) at harvest. Data from studies at Parma, 1978-85. (Open circles are relative grain yields reduced because of lodging.)

to estimate the relative yield associated with different levels of protein in Stephens wheat. For example, wheat protein of 9.5 percent was associated with a relative yield of approximately 85 percent.

To determine the economic feasibility of intentionally producing soft white wheat with lower protein, the grower must weigh the advantages of potentially higher market prices and lower production costs against the disadvantage of reduced production.

Maximum economic returns to producers can occur at different relative yield percentages, depending on the costs of production and market prices. If the maximum economic return for a particular producer normally occurs at 95 percent relative yield, and 9.5 percent soft white wheat is associated with 85 percent relative yield, then production of low-protein wheat will result in approximately 10 percent relative yield loss. Using a $2.50 per bushel market

price for wheat and considering both the revenue lost from reduced production and the cost savings from reduced N applications, the producer would need a market premium of about $.24 per bushel to compensate for lost income.

Here is how to determine the premium required to fully compensate the low-protein white wheat producer for lost production. This illustration assumes a yield difference of 10 bushels per acre between 95 and 85 percent relative yield, and 85 percent relative yield was taken as 85 bushels per acre. Other assumptions included a cash market price of $2.50 per bushel, an N requirement of 2 pounds N per bushel of wheat and N cost of $.25 per pound.

$$\text{Revenue Lost} = \text{Yield Loss} \times \text{Market Price}$$

$$= 10 \text{ bu} \times \frac{2.50}{\text{bu}} = \$25.00$$

$$\text{Fertilizer Savings} = \text{Yield Loss} \times \text{N Requirement} \times \text{N Cost}$$

$$= 10 \text{ bu} \times \frac{2 \text{ lb N}}{\text{bu}} \times \frac{\$.25}{\text{lb N}} = \$5.00$$

$$\text{Premium Required} = \frac{\text{Revenue Lost} - \text{Fertilizer Savings}}{85\% \text{ Relative Yield}}$$

$$= \frac{\$25 - \$5}{85 \text{ bu}} = \frac{\$.235}{\text{bu}}$$

As the market price increases for wheat above 9.5 percent protein, the low-protein premium necessary to compensate the producer for lost production would also increase. Low-protein market premiums necessary to compensate producers for lost production are given in Table 1 for different market prices. The recent premium of $.11 per bushel for soft white wheat with a maximum of 9.5 percent protein was not high enough to compensate growers who might intentionally produce wheat for the low-protein market. An $.11 per bushel premium would fully compensate the producer for low-protein wheat only when the market price is $1.45 per bushel or less, a highly unlikely prospect.

Table 1. Market price influence on the low-protein premium ($/bushel) required to compensate low-protein soft white wheat producers for lost production.

	Cash market price ($/bu)						
	1.60	2.00	2.40	2.80	3.20	3.60	4.00
Premium required	.129[1]	.176	.223	.270	.317	.364	.411

[1]N requirements = 2 lb N per bu wheat. N costs = $.25 per lb of N.

Producers who sacrifice production to produce low-protein soft white wheat may suffer economic loss in yet another way. If they are involved in the government farm program, their deficiency payment is based on ASCS-proven yields. If proven yield over time is reduced because of sacrificed production, deficiency payments to producers will also be reduced. Deficiency payments frequently make the difference between profit and loss for the producer. If deficiency payments continue to be tied to ASCS-proven yields, intentional low-protein wheat production and the associated production sacrifice may not be in the producer's best interest.

Table 1 does not include the economic impacts of reduced deficiency payments. If the reduced income from lower deficiency payments is taken into consideration, then the premiums required to compensate low-protein soft white wheat producers for lost production would be higher than the values in the table.

Testing for Wheat Protein

Low-protein soft white wheat is produced each year by some producers who limit N fertilization, either because they underestimate the N required to produce optimum yield or they lack the capital to purchase needed inputs. Leaching caused by excessive irrigation may also reduce N available to wheat.

Should premiums for low-protein wheat ever be extended to local elevators and producers, the premiums may partially compensate growers whose production is reduced from limited N applications. To take advantage of any premium, however, producers will have to know the protein content of their wheat stocks. Protein can be estimated from wheat grain samples submitted to elevators, Federal Grain Inspection Stations or any lab that routinely analyzes plant tissue for total N.

Because N available to wheat is directly related to wheat protein, wheat protein can provide important information about the effectiveness of N fertilization practices. Based on the relationship in Fig. 1, the lower protein falls below 11.4 percent, the more likely yield was limited and the greater the yield that was probably lost to inadequate N fertilization or poor use by the wheat of applied N. Above 11.4 percent grain protein, relative yield was not limited by inadequate N but yield reductions caused by lodging were more likely. The exact relationship of wheat protein and relative yield may depend to some extent on variety and environment.

Grain yield at harvest is generally used to measure the effectiveness of an N fertilization program. Unfortunately, grain yield alone may be deceiving. Where yield is appreciably increased from the previous year because of environmental conditions or crop management practices other than N fertilization, one might conclude that N was adequate. However, low-wheat protein with higher yield may indicate that yield was actually limited due to a shortage of N. The combined use of yield and protein would provide a more accurate evaluation of the N fertilization program. Knowing wheat protein could be useful to producers who wish to evaluate their N fertilization practices with a view toward optimizing economic returns with N fertilization in the future.

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