

## FERTILIZING FOR END USE QUALITY

Larry Robertson

### INTRODUCTION

Chemical fertilizers generally represent the most expensive purchased input into a cereal cropping system. Nitrogen is most often the nutrient most limiting and is required in the greatest amounts. Proper application of nutrients is important not only for optimizing grain yield but also has a major impact on grain quality and is thus, a major contributor to price received for the grain. Malting barley and soft white wheat require low to moderate protein levels while hard wheat requires high levels of protein. Because of these quality differences, fertilizer management, especially N management, is important. Nutrient deficiencies reduce plant growth and grain yield and may have negative impacts on grain quality. Excessive amounts of applied nutrients are wasteful of inputs, can cause environmental problems, promote excessive vegetative growth, can increase lodging, may promote disease development, and again, may cause problems with grain end-use quality.

Figure 1 shows the generalized relationships between N and yield, test weight and percent plump. The first added increments of N generally result in quite large yield increases but as the N level increases, smaller and smaller increments are achieved until a plateau is reached after which added N can cause yield reductions. Grain protein content starts out quite low and continues to increase even after yield ceases to increase. Percent plump goes the other way, it starts high and drops as additional N is added to the system. Test weight behaves in a similar manner to plump, it is reduced as N is increased.

### DETERMINING N NEEDS

The University of Idaho publishes nutrient guidelines for most crops grown in the state and for most major nutrients. Several factors need to be considered as needs are assessed. We strongly suggest that soil tests should be taken and this should be the beginning point in determining nutrient needs. Generally, soil test results are given in parts per million (ppm). Multiplying the ppm value by 4 converts the value to pounds per acre. Crops following cereal crops or other crops leaving large amounts of residues in the field require up to 15 pounds N/ton of residue to help break down the residues. Crops following row crops do not need the extra N and crops following alfalfa or other legumes have a reduced N requirement. Realistic yield goals and desired protein content of the grain also need to be considered. Nitrogen recommendations are a moving target and are often slightly different from year to year and from management system to management system. Use previous experience to adjust the numbers if you have records to support

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changes. Soil organic matter will also alter N requirements due to the amount of N mineralized during the crop season. As a guide, 30-40 lbs of N are mineralized in most southern Idaho soils per year. To determine the N needed, start with the total crop need, subtract the amount indicated from soil tests, add any requirements to compensate for previous crop residue, then subtract the amount of mineralized N for the season. If producing irrigated hard wheat, it is almost always necessary to apply 30-60 lb/acre at heading time to give a protein boost. This amount can be fairly accurately determined by assessing the N content of flag leaves. Values below 4.2% will generally benefit from a heading date application. Research at Aberdeen has indicated grain protein content is increased by 1.0-1.5% with 20 lb N/acre and 2.0-2.5% with 40 lb N/acre when flag leaf N is 3.65 or below. Higher flag leaf N concentrations will give lower increments of protein increase.

In summary, start with good soil tests, then adjust fertilization based on crop and intended use, realistic yield goals, previous crop residues, and previous experience.