



**Press Release: August 29, 2008**

Contact: Karen Hertsgaard  
701-231-5384  
karen.hertsgaard@ndsu.edu

### **Importance of Barley Plumpness and Protein for Malt Quality**

Initial reports on the 2008 barley crop are coming in to the Institute of Barley and Malt Sciences (IBMS) at NDSU in Fargo, and yield and quality generally appear good. However, lower than optimal grain plumpness and higher than desired protein have been reported in areas of Idaho, Montana and North Dakota. DON, mold and pre-harvest sprouting have been observed in some later crop in North Dakota.

Low plumpness and high protein are most often attributable to high temperatures and moisture stress during grain filling. These factors are of concern to maltsters and brewers for a number of reasons.

According to Dr Paul Schwarz, director of the IBMS *the main concern with these factors is that they predict potentially lower extract in the finished malt. Extract determines the amount of malt that must be used by the brewer to produce a given volume of beer, and therefore is an economic concern. Typically 79 to 81% of the grain is extractable in laboratory tests.*

*Most of the extract and all fermentable sugars are derived from starch. Starch synthesis occurs during grain fill, and when environmental stresses reduce this process, less starch and proportionally more protein are formed in the kernel. The grain tends to be thinner, and has a higher proportion of husk to endosperm.*

*Aside from extract, there are a number of other problems associated with the malting and brewing of high protein barley. High protein can lead to haze problems in the beer, and it is also more difficult for maltsters to control the color of malt during processing. Beer color is derived from the malt, and most popular American beers are very light in color. Higher protein barley tends to yield dark malts.*

*Protein content and kernel plumpness affect the speed at which barley goes through the malting process. In malting, the grain is first soaked in water (called "steeping") to approximately 45% moisture. It is then allowed to germinate for 4 to 5 days until proper modification, or changes in the grain structure and composition, are achieved. The germinated barley is then dried, (called "kilning") to approximately 5% moisture. The entire process takes 6 to 8 days depending upon the sample.*

*Thin grain will absorb water and modify at a faster rate than plump grain. In samples with a wide distribution in kernel plumpness, maltsters may first grade the barley into a number of size fractions and malt them separately. Grading is more frequently required with six-rowed barley than with two rowed, but can be used to achieve better uniformity in the final malt. Protein also affects the rate of water uptake and speed of modification, and for this reason maltsters will segregate shipments by protein content and malt them separately.*

*One other issue that tends to arise when discussing protein in malting barley is whether to blend high and low protein barley lots to meet protein specifications. The end result of this would be a non-uniform rate of modification in malting which leads to serious problems for brewers. Essentially some of the grain in such a sample may be properly modified while another portion is either over- or under-modified. Dealing with a non-uniform malt is actually a larger problem than dealing simply with a uniformly high protein sample.*



**I**nstitute of  
**B**arley and  
**M**alt  
**S**ciences

**Press Release: August 29, 2008**

Contact: Karen Hertsgaard  
701-231-5384  
karen.hertsgaard@ndsu.edu

*The end result concerning protein in malting barley is that maltsters and brewers are generally reluctant to use six-rowed barley with more than 13.5% protein, and two-rowed with more than 13.0%. These limits, however, vary between specific companies and depend upon their brewing processes, and the products they produce. Some protein is needed in brewing for things like good beer foam and proper yeast growth in fermentation. Therefore, there are also minimal limits on protein, but low protein is rarely a problem, especially under dryland barley production.*