

# **SPECIALTY SMALL GRAINS RESEARCH PROJECT**

## **Development and Management of Specialty Small Grain Varieties for High-Value End-Use Markets**

### **Summary**

A large proportion of the U.S. population and consumers of products derived from small grains, such as winter wheat and barley, reside in the eastern states. The eastern U.S. is well situated regarding feed grain demand in that poultry and swine operations provide domestic demand and local export markets provide foreign demand. Likewise a majority of the flour mills, feed and food processing plants are strategically located along the east coast. Production of winter barley and wheat in the region has declined significantly (30 to 45%) during the past decade mainly due to low commodity market prices, even though the region is a feed and food grain deficient area. A majority of the grain used by Virginia's feed and food industries, including corn and wheat, is grown and shipped at considerable cost from Mid-Western states.

Most flour mills in the Mid-Atlantic region utilize both soft red winter (SRW) and hard red winter (HRW) wheat and about one third of wheat milled in the eastern U.S. is hard wheat. Potential exists to develop, produce and market HRW wheat, which garners a price premium compared to local SRW wheat, in the Mid-Atlantic region. Millers in the region have expressed great interest in obtaining more locally grown HRW wheat as well as specialty high protein, strong-gluten SRW wheat. Such locally grown specialty wheat most likely would be used in blends, reducing the quantity of Mid-Western wheat required. Currently, we have the capability of producing high-protein, strong-gluten SRW wheat; therefore, one of the primary objectives of this research initiative is to develop high quality HRW wheat varieties adapted to our region along with optimal production protocols. Bread wheat lines will be developed at Virginia Tech and these and other HRW wheat and European bread wheat lines from other breeding programs will be evaluated in field trials.

Prior to 1990, winter-barley breeding programs in the United States developed only hulled-barley varieties, having high grain fiber and low energy content, which was not a preferred ingredient in poultry and swine rations due to low nutritional value. An objective of the proposed research is to improve the end-use quality and feed value of barley by developing novel hullless-type varieties having lower fiber, reduced phytic acid content, higher starch and metabolizable energy. This transformation should bring the feed value of barley closer to that of wheat and corn, making its use in monogastric rations more desirable. In addition, the growing need for domestic energy independence and the potential use of hullless barley in ethanol production offers an additional market opportunity. Development of hullless barley varieties

possessing high starch, low fiber, and low beta glucan content would make barley more suitable for production of ethanol and distiller's dry grains having higher protein content than those derived from corn for use in feed rations. Unlike corn and wheat, barley grain contains 3-7% beta glucan, a complex starch that is not readily converted to glucose upon digestion by monogastric animals or via distillation to produce ethanol, both of which lead to viscosity problems. However, addition of beta glucanase enzymes to feed or mash are effective in alleviating this problem. The USDA-ARS Eastern Regional Research Center is collaborating with our program in providing grain compositional analyses of our hulless barley lines and conducting ethanol production pilot studies including the use of different beta glucanase enzyme treatments to reduce viscosity problems and increase ethanol production. Research focuses on the development of superior hulless barley varieties having desirable agronomic and end-use quality traits, and on crop management protocols to maximize production and quality.

### **Specialty Agriculture Development - Impact**

Over 55 million people live in the Mid-Atlantic region of the United States. This population desires processed grain products such as bread and other dough products. The mills in our region can utilize 2,900,000 tons of wheat per year. Hard wheat and certain strong gluten soft wheat varieties are suitable for use in making bread and dough products. Because the market exists for bread wheat and because it is usually of higher value than soft wheat (\$0.40 per bushel or more), growers are interested in acquiring adapted varieties and optimal production management protocols to successfully grow bread wheat in the Mid-Atlantic region. In 2006, it is estimated that Virginia will produce 9.5 million bushels of soft red winter wheat; increasing the value of just 10% of the crop by \$0.40 per bushel would increase net worth by \$381,000 for these producers alone. In addition, availability of adapted high-value specialty wheat varieties and optimal production protocols would stimulate an increase in total wheat acreage planted and harvested, considering that current wheat acreage is nearly 40% lower than that produced just prior to 1996 due to a steady decline in wheat prices. Significant savings in grain shipping costs alone would in turn increase profits of local mills in the state and region.

The impact of hulless barley production in the Mid-Atlantic region for grain producers and the animal feeding industries could be significant. Winter barley is an ideal crop for double cropping with soybean because barley can be harvested nearly two weeks before wheat, and soybean yields double cropped behind barley are significantly higher than those following wheat. Swine feeding trials have demonstrated that the feed value of hulless barley is near that of corn (based on average daily weight gain), making locally-grown hulless barley a best-cost new-crop ration additive that could save these industries \$2/ton or more depending on the cost

of other ingredients. Hulless barley feeding trials with poultry have produced similar favorable results with feed consumption and feed efficiency equal to or greater than that of corn. The impact for grain producers is potentially \$30 per acre on 20,000 acres initially and could increase by another fifty percent as marketing efforts succeed. This only takes into account current harvested barley acreage, which also has the potential to increase by 46% and return to production levels similar to those prior to 1996. Logistically, hulless barley also has good potential for use in ethanol production, which is increasing significantly each year and likely will become even more important with new emphasis on renewable fuels. Because hulless barley has high digestible energy due to elevated starch and reduced fiber content, it would appear to be ideally suited for ethanol production. Use of hulless barley for fuel production has several potential advantages over wheat and corn. The price of barley relative to those of wheat and corn is lower, and hulless barley has the potential of producing a distiller's grain product with higher protein (34%) and lysine content than that derived from corn (28%) for use in ruminant feed rations.

The potential impact of a high level of hulless barley and bread wheat production on the agricultural economy in Virginia is well over five million dollars annually. The infrastructure and experience gained by producers working with identity preserved small grains also will facilitate the adoption of this approach in other grain crops. In addition these high-value crops have the potential to revitalize agricultural production and the economy in southeastern and south-central regions of the Commonwealth where peanut and tobacco acreages have declined in recent years.