NITROGEN FERTILITY AND PERFORMANCE OF HULLESS AND HULLED BARLEY

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Introduction:

The recent high price of nitrogen (N) and good soybean prices have caused many growers to question whether to plant wheat followed by double-crop soybeans or simply opt for full season soybeans. High wheat input costs coupled with the late planted soybean yield penalty associated with double-cropping behind wheat have some growers second guessing the double-crop system.

Winter small grains, such as wheat and barley provide growers an important source of income during the summer months. Winter cover crops also reduce soil erosion, add organic matter to the soil, provide moisture conserving residues, as well as N for the succeeding crop, and reduce ground water contamination by utilizing residual N from the previous crop.

Barley has the potential to minimize or eliminate the late planted double-crop soybean yield penalty in Kentucky since it is harvested two weeks before wheat. Although the price of barley has increased in recent years, it is always lower than wheat. With high input costs, the margin of barley production profitability is questionable. In order for barley's potential benefit in a double-crop system to be realized, input costs must decrease and/or barley price increase.

With intensive management practices, N is applied to barley in a split spring application of typically 40 lbs N/acre at green-up and 60 lbs N/acre at jointing. Researchers at Virginia Tech and the University of Maryland have shown that barley yields can frequently be maximized with a single spring application of 60lbs N/acre, substantially less than the recommended rate. To follow up on these studies, N fertility tests were conducted on 20 barley (hulled and hulless) lines.

Reducing N input cost can affect the profit margin, but barley price is obviously also important. Barley was once an important feed source for livestock, but the demand and production declined as poultry and swine enterprises became more integrated and demanded a lower fiber, higher energy diet. Hulless barley may be a solution, and has the potential to reclaim lost animal feed markets and develop new markets for ethanol, human food and nutraceuticals. Unlike traditional barley, hulless barley sheds its fiberous hull during harvest and results in an energy dense grain. The low fiber, hulless grain with high starch and protein content has shown the potential to stimulate new markets.

The development of new hulless barley varieties may result in higher barley prices associated with increased demand and nutritional value. The response of hulless barley varieties/ breeding lines to N fertility was evaluated to determine if any lines had the ability to utilize N more efficiently. In the process of developing new hulless barley varieties, identifying the genetic ability to utilize N more efficiently and attain high yields at lower N rates would be an important breeding trait.

Objectives:

1. To determine the effect of nitrogen rate and application timing on the agronomic performance of barley.

2. To evaluate the response of hulless barley varieties / breeding lines to N rate and application timing. Do some varieties/lines utilize N more efficiently and have maximum yields at lower N rates than others?

Methods:

In 2007 and 2008, 18 hulless barley and 2 traditional hulled barley varieties were evaluated for the effect of N rate and application timing on grain yield. Six N treatments were applied at spring green-up (mid-February) and/or at jointing (mid/late-March). The treatments were 40/70; 0/70; 70/0; 40/40; 0/40; 40/0 (at green-up/jointing stage – lbs. N per acre). No fall N was applied. The tests were conducted at Princeton, KY in a split plot design with 3 replications. Main plots (N treatments) were arranged in a randomized complete block design with varieties/lines assigned to the split plot. Liquid UAN (28% N) was the form of N applied.

To maximize the potential for identifying hulless barley breeding lines with the ability to more efficiently use N, the 18 hulless barley varieties/lines were selected to maximize genetic diversity by using varieties/lines that did not share a common parent. These entries were tested to determine if any particular entry had a greater ability to achieve maximum yields at lower N rates than other entries.

Results and Discussion:

The results (table 1) indicate that yields were maximized at a single application rate of 70 lbs N/acre at jointing and an additional N application at green-up showed no benefit. The 40/70 and 0/70 treatments had higher yields than the 40/40 and 70/0 treatments which were subsequently higher than the treatments w/ 40 lbs N applied at either green-up or jointing. Plant height for the 0/40, 40/0 treatments was 1 to 2 shorter than the other treatments and there was no treatment differences in grain test weight or heading date (data not shown). There was no difference in response between hulled and hulless barley lines.

There was no response of varieties/lines to N treatments. The varieties/lines selected for this test did not indicate a potential for one entry to utilize N more efficiently than others (data no shown). There were examples of particular varieties/lines showing maximum yields at all treatments with the exception of the 40/0 and 0/40 treatments, but this effect was not consistent across years for a particular line. Among entries, maximum yields were never attained with the 40/0 and 0/40 treatments.

There are many benefits of double-cropping. Barley appears to have lower N requirements than wheat and can minimize the late planted soybean yield reduction associated with double-cropping behind wheat. These factors along with potential new markets and demand for hulless barley may make future double-crop decisions a bit easier.

Table 1. Effect of Spring Nitrogen Application Rates on Barley* Yield.

Nitrogen Rate <u>(lbs N/acre) at:</u>		Yield (bu/acre)	
Green-Up	Jointing	2008	2007
40	70	75.8	52.6
0	70	75.1	53.6
40	40	72.7	45
70	0	72	45.8
0	40	64.1	44.3
40	0	61.4	36.4
	LSD (0.05)	2.7	5
*18 hulless and 2 hulled lines; six N treatments			