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*Wheat breeder battles:*

# HARD RED VERSUS WHITE

*Success in wheat breeding requires clear communication among stakeholders.*

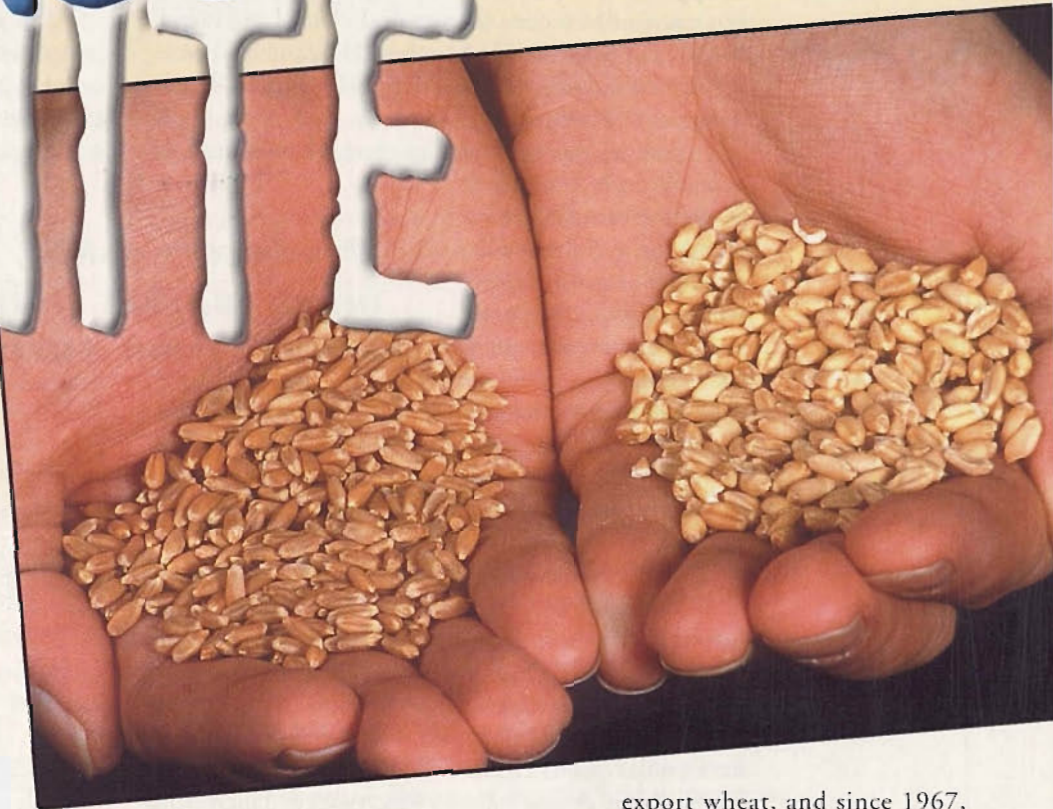
*by Michael Boland, Marc Johnson, and Sara Schumacher*

Hard red winter wheat is the dominant cereal grain of the Great Plains. Even so, land grant universities in the central Great Plains have reallocated wheat breeding resources from hard red winter wheat (HR) to hard white winter wheat (HW). For example, the Kansas State University Agricultural Experiment Station and Cooperative Extension Service (K-State R&E) is now devoting over 50 percent of its public and private wheat breeding resources to HW (Wheat Research Center).

The switch in resources has brought questions: What are the differences between HR and HW? Why are public wheat breeding efforts now moving to HW, and why are special interest groups asking for exclusive access to new HW varieties?

## Hard Red and Hard White

Hard red wheat was brought to the Great Plains by immigrants from Russia in



1874. It has long dominated the other five wheat classes (durum, hard red spring, soft red winter, HW, soft white wheat) because of its ability to adapt to the climate and soils of the Plains, and its head resists pre-harvest moisture-induced sprouting that can render the mature wheat useless to millers. Over time, plant breeders have developed versatile HR varieties with a wide range of protein content to satisfy the requirements of different end uses. Current HR and HW varieties are close substitutes in baking qualities, HW can be milled to yield slightly more flour per bushel than HR, and finally, HW lacks, but HR carries, the polyphenol oxidase enzyme which causes discoloration in raw noodles.

Hard white wheat is Australia's major

export wheat, and since 1967, Australia's production of HW has doubled with almost all of the product being sold in foreign markets. For much of the past decade, Australian white wheat has been priced competitively with U.S. HR at export terminals, but when transportation costs are added, U.S. produced HR is higher priced in many importing countries. In addition, the Australian varieties display superior noodle qualities—a desirable trait in many Asian markets.

Even with the growing importance of Asian markets, HW accounted for a very small percentage of world wheat production in 1997. Apparently, economic incentives have not been sufficient to warrant the shift to HW in the Northern Plains, so why have resources switched into breeding white wheat varieties?



## Hard White Comes to Kansas

Kansas is the largest producer of HR in the United States, and for over fifty years, the majority of the new wheat varieties in the state have been developed by K-State R&E. The wheat breeding program began developing HW almost 30 years ago after a K-State plant scientist returned from a sabbatical in Australia where he had been impressed with the emphasis on end-user needs in varietal development. These observations led to some experimental efforts with HWs. Several HW varieties were developed and made available in the late 1980s. A cooperative, the American White Wheat Producers Association (AWWPA), was established to promote the new varieties but had limited success (Brester et al., Duval and Biere). K-State R&E continued research on HW, and by the late 1990s, three more varieties (Betty, Heyne, and Trego) were ready for release.

In practice, breeders develop more varieties than are actually made available to producers. Varieties are evaluated for various quality attributes such as yield, protein, and agronomic properties. Varieties thought to have superior qualities are then "released" to the public. Land grant universities typically release a new variety to entities such as a Crop Improvement Association which produce and sell seed under a "certified seed" label.

Wheat breeders implied that HW would bring immediate economic incentives from export markets. This helped justify the movement of breeding resources, but producers asked, "How much market share will we take from Australia"? and "How large a premium can we expect for our wheat in the short-run if HW and HR varieties have similar quality characteristics?" Profit-minded producers always choose varieties which are yield increasing and resistant to pre-harvest sprouting rather than varieties with slightly superior milling qualities. Clearly, the market would have to signal its preference for HW.

## The Release Decision

Questions arose regarding the release of HW seed. The early HW varieties had been released to a producer-owned cooperative (AWWPA); not to the general public. The fear of mixing red and white wheats in the marketing channels was used to justify the non-public release.

A HW Wheat Committee was formed to provide input to the Dean of the College of Agriculture who would ultimately decide how to release the three new varieties. The committee identified two major options: 1) use the traditional release procedures or 2) implement a restricted release procedure as had been done with the earlier HW varieties.

**Traditional Public Release Procedures**— The traditional system could result in HW being grown in small

plots throughout the state which would not lead to widespread adoption due to low volume harvests. Because HR and HW are separate classes, the Kansas Feed and Grain Association and other industry associations feared that the new HW varieties would not be widely adopted because of the fear of mixing.

**Restricted Release** — A restricted release involved allowing a limited number of firms to grow and sell the new wheat. This option allowed firms with experience in production (the Kansas Crop Improvement Association (KCIA) and selling wheat (Cargill, Farmland Industries, AWWPA, 21st Century Grain Processing Cooperative) to partner in the process.

After much discussion, a 30-day public comment period was allowed for considering the two release procedures. More than 40 individuals, firms, and organizations commented and were overwhelmingly positive about a non-public release. A Call for Proposals followed. Inter-

ested firms were required to submit a production and marketing proposal that would describe their abilities to: 1) increase seed production; 2) gain access to domestic and international markets; and 3) involve as many certified seed growers

## *Producers asked, "How much market share will we take from Australia"?*

as possible.

Proposals were received from: 1) Cargill (sell the wheat) in cooperation with Goertzen Seed (increase seed production with selected KCIA growers); 2) Farmland Industries (sell the wheat) in cooperation with the 21st Century Grain Processing Cooperative and Monsanto's HybriTech wheat breeding firm (increase seed production with selected KCIA growers); 3) AWWPA (sell the wheat); and 4) a new producer cooperative formed by KCIA called AGVantage IP (increase seed production).

Only one proposal met all the requirements, but providing the seed to only one firm was not a reasonable option. After further consultations with firms in the grain industry, the Dean followed the committee's recommendation to use a traditional public release.

## Economic Incentives Fall Short

Breeders had predicted that economic incentives would come from export markets. However, careful evaluation by experts determined that short-run economic incentives likely would be driven by domestic millers, because they provided the immediate market for wheat (Boland and Howe, Barkley). Given time, millers likely would convey their preferences for HW by discounting HR rather than paying a premium. In addition, Australia was exploiting markets for "noodle wheats," while the new Kansas varieties were "bread wheats" not as highly demanded in Asian markets. Thus, it was unlikely that exports would be important short-run sources of economic incentives.



Two varieties, Betty and Heyne, were released in 1998 and Trego in 1999. KCIA seed growers in AGvantage IP pooled seed production in 1998 and 1999. In return for a \$.10 per bushel premium, AGvantage IP contracted with Farmland and Cargill for June 2000 delivery to selected elevators in south central Kansas. AGvantage IP priced the HW seed at \$9.00 per bushel, \$3.50 above the \$5.50 per bushel price for certified HR seed. Only 13,000 acres were planted in 1999 rather than the 50,000 acres which had been projected (Wheat Research Center). The lack of HW varieties with proven increased yields coupled with the risk from pre-harvest sprouting led most producers to believe that the premium was more than offset by a high seed price.

***Developing a new variety must be based on considerations of who will buy it.***

**Lessons Learned**

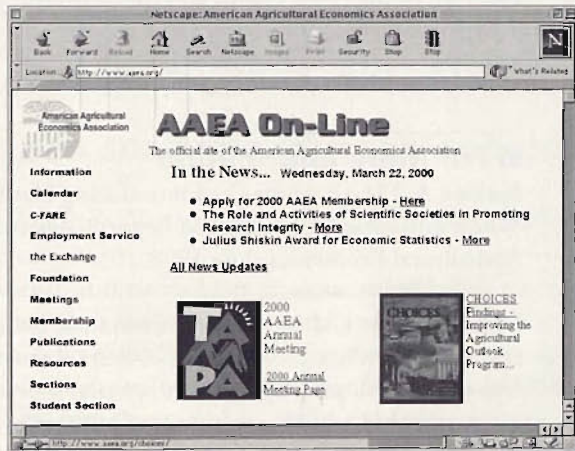
Two lessons can be learned from this experience: First, there must be clear communication among scientists, economists, producers, and millers if a shift in class of wheat is to be successful. Second, the appropriate role of special interest groups must be understood from the outset.

Clear communication is needed between scientists, economists, and producers in breeding decisions and educational programs, because developing a new variety must be based on considerations of who will buy it. Economic incentives are especially important for a product which has a clear close substitute.

In the HW case, information on economic incentives was needed but little or no research was available to help justify moving wheat breeding resources to HW. No public study had been done to

verify the higher flour yield of HW, so no economic incentive was evident to millers. An economic engineering study that provided accurate flour yield information would have helped answer questions from producers and millers.

Research on the economic tradeoffs between certified seed and farm saved seed, the economic costs of segregating wheats of different classes at country elevators, and additional research and evidence on why U.S. wheat may be higher priced relative to Australian wheat was needed. Studies on these subjects are currently underway and will be finished soon. However, the results would have been more helpful if the studies had been started and essentially



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completed before breeders moved 50 percent of their resources into HW.

Special interest groups, such as commodity associations, are important sources of funding for production-related research at land grant universities. Approximately 25 percent of the K-State R&E wheat breeding program is funded through wheat checkoff funds. Another five percent is funded by seed growers, and the remainder is funded by taxpayers. The Kansas Wheat Commission and KCIA has funded most of the HW research since the late 1980s.

Special interest groups exerted intense pressure to obtain exclusive rights to the HW varieties in order to obtain higher seed prices or premiums at harvest for selected growers who purchased stock in AWWPA or AGvantage IP. Conflicts of interest by individuals in leadership positions within these special interest groups clouded the education process done by K-State R&E with regard to its Call for Proposals. Despite KCIA's relatively minor role in funding research, its support was important for seed production. However, its leadership also had ownership in AWWPA and AGvantage IP. Consequently, it was not surprising that KCIA was unwilling to work with the companies that submitted a proposal under the second option.

These special interest groups were also suspicious of the partnerships that had been established between K-State R&E and Cargill and Farmland Industries. The

concern was that these firms were somehow going to reap the economic benefits of producer checkoff investments. Finally, some producers had not realized the desired return on equity from early investments in AWWPA, so they wanted the varieties released to that organization in an effort to recoup their initial investments. The effort to develop and release a new variety of wheat was much more controversial than many scientists and industry leaders had thought.

## Hindsight

The lasting objectives of K-State R&E's wheat breeding program are to develop varieties which have quality attributes desired by end-users and to increase the net revenues of the producers. The increase in net revenues can come from a reduction in costs or an increase in revenues. The current HW varieties do not reduce producer costs. In fact, they increase costs through the higher seed prices and the need for segregation. The current price premium may accurately reflect the increased flour yield and any changes in demand, but it likely does not totally offset the risk of pre-harvest sprouting. Given the investment by K-State R&E and the commodity associations, it is clear that future HW varieties must incorporate traits which provide greater economic incentives including resistance to pre-harvest sprouting; desirable end-user quality characteristics; and increased on-farm yields. The alternative is the status quo: hard red winter wheat will continue to dominate the fields of the Great Plains, and concerned people will ask why the wheat breeding resources were not used to improve hard red in the first place. ■

## ■ For More Information

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