# National Association of Wheat Growers
# &
# Wheat Industry Resource Committee

## Research Priorities for Fiscal Year 2001

## March 2000

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Note: A PDF version of this document is available at http://www.wheatworld.org and http://www.scabusa.org.

# *The National Association of Wheat Growers Research Priorities for Fiscal Year 2001*

## *Executive Summary*

The National Association of Wheat Growers, in consultation with the Wheat Industry Resource Committee and the National Wheat Improvement Committee, has established its FY2001 funding priorities. These priorities have been selected in regards to their ability to provide the greatest impact to the wheat industry. They are listed below in the order of most importance.

**Priority 1. Create a National Small Grains Molecular Plant Breeding Laboratory at Kansas State University. Requested amount: $500,000.**

The establishment of this laboratory will allow public and private sectors to collaborate for the benefit of all components of the wheat and barley industries, from producer to consumers. Such an investment will provide benefits throughout the US. The potential impact will also be economically important. Molecular markers linked to important traits like *Fusarium* head scab resistance could mean rapid relief to the U.S. wheat and barley industries which have lost about $3 billion in the 1990's. Markers lined to value added traits could also hasten the development of emerging markets leading to higher grain prices for the producer.

**Priority 2. Provide additional funding to the U.S. Wheat and Barley Scab Initiative (*Consortium of Land Grant Universities*). Requested amount: $800,000.**

(FY2000 program provided funding for projects in AR, CA, GA, IA, IL, IN, KS, KY, LA, MD, MI, MN, MO, NC, ND, NE, NY, OH, OK, SD, VA, WA, WI)

In FY2000, Congress increased funding for the ARS National Wheat and Barley Scab Initiative (Consortium of Land Grant Universities) by $1.8 million, bringing total gross funding to $5.3 million. ***This support is greatly appreciated***. However, $500,000 of this funding was allocated to ARS base budget additions at locations conducting critical scab research, there is an overall 10% ARS overhead charge, and a mandated 2.5% small business assessment is applied to all grants awarded to non-ARS scientists. Thus, only $4.32 million was available for grants for scab research. Requests for FY2000 totaled almost $6 million. In addition, university overhead charges on grants, further reduces funding available for actual research.

**Priority 3. Establish a national wheat and barley disease position, fill a vacant wheat genetics position, and increase funding for current projects at the USDA-ARS Northern Crop Science Laboratory, Fargo, ND. Requested amount: $750,000.**

The USDA/ARS barley, oat, hard red spring, and durum wheat research projects at the Northern Crop Science Lab (NCSL) at Fargo are all funded at a level significantly below the amount that USDA/ARS considers the minimum amount to adequately conduct research. The amount requested will increase funding for all current projects and the filling of a vacant wheat genetics project to a level of $300,000 per scientist and provide $300,000 for one additional scientist for small grains (primarily wheat and barley) disease research. The money requested will increase both the efficiency and level of research that can be directed toward solving problems faced by the small grains industry.

**Priority 4. Construct an advanced molecular genetics laboratory addition to the ARS National Small Grains Germplasm Research Facility (NSGGRF) in Aberdeen, ID. Requested Amount: $3 million.**

The ARS program at Aberdeen, Idaho, includes several advanced molecular genetics research programs in wheat, barley, and potatoes. Ongoing research in genetic improvement of feed and malting barley, particularly low phytic acid grains for fish, swine and poultry diets, and potato varieties with enhanced quality and storage characteristics, is greatly constrained by inadequate laboratory facilities. Furthermore, the University of Idaho's (UI) wheat genetic research capabilities at Aberdeen will be greatly enhanced by the proposed advanced genetics laboratory addition at the ARS facility. Currently the UI wheat genetics program conducts laboratory experiments in limited areas, without a single dedicated laboratory.

**Priority 5. Restore cuts to USDA-ARS wheat units in Raleigh, NC and Pullman, WA. Requested Amount: $250,000 NC, $425,000 WA.**

These established programs are critical to the health of the wheat industry in the U.S.

**Priority 6. Allocate additional support to the regional Wheat Quality Laboratories in Wooster, OH; Manhattan, KS; Pullman, WA; and Fargo, ND. Requested Amount: $775,000 OH; $1,000,000 KS; $550,000 WA; and $675,000 ND.**

Beginning in the 1930's, Congress established four Wheat Quality Laboratories in the Agricultural Research Service - including the **Soft Wheat Quality Laboratory** at Wooster, Ohio; the **Hard Winter Wheat Quality Laboratory** at Manhattan, Kansas; the **Western White Wheat Quality Laboratory** in Pullman, Washington; and the **Hard Red Spring and Durum Wheat Quality Laboratory** in Fargo, North Dakota. Their mission is still very appropriate today and includes 1) working with breeders to improve the quality of U.S. wheat and 2) developing quality measurement methods. Since their establishment, the number of tests that are being performed on each new variety has increased significantly and additional funds are needed to support these additional tests.

# National Association of Wheat Growers

The National Association of Wheat Growers (NAWG) serves as the eyes and ears for America's wheat producers in Washington, DC, and is their only national organization. Through a well-developed grassroots network and professional staff, NAWG is in daily communication with the decision-makers in Congress, USDA, and other government agencies and organizations that affect the lives and operations of our farmer members.

NAWG works hard to ensure that the wheat producer's voice is heard loud and clear on Capitol Hill and is hard at work on several key issues. These issues include securing federal financial support for farmers, promoting federal funding of research, making meaningful reforms to the federal crop insurance program, and the elimination of trade sanctions on U.S. agricultural products. In fact, NAWG was a primary facilitator in urging President Clinton to lift sanctions on the commercial sale of agricultural products and medicine to Sudan, Libya, and Iran.

NAWG's long record of achievements would not be possible without the participation and leadership of its 23 state associations, which are made up of over 25,000 individual wheat producers. NAWG, in conjunction with its wheat partners, U.S. Wheat Associates and the Wheat Foods Council, hold a Wheat Industry Conference and Exposition each year that brings together wheat producers, industry leaders, researchers, government officials, and other agribusiness professionals.

## Contacting NAWG

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# Wheat Industry Resource Committee

The Wheat Industry Resource Committee (WIRC) is a committee composed of scientists from land grant institutions and the private industry. The objectives of the WIRC are those that are generally associated with an educational and scientific corporation qualified for exemption under Section 501(c)(3) of the Internal Revenue Code of 1954 as amended or a comparable section of subsequent legislation. The activities of the WIRC encompass the following more specific objectives:

1. To provide a common forum for the exchange of research and educational information among members of the WIRC and the National Association of Wheat Growers (NAWG).
2. To serve in an advisory capacity to the NAWG on research and educational matters.
3. To coordinate multi-state educational and applied research efforts involving wheat.
4. To conduct educational programs and applied research efforts as deemed necessary by WIRC and NAWG.

## Wheat Industry Resource Committee Officers

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William F. Johnson, Ph.D., Vice Chair, University of Arkansas
Michael T. Edwards, Secretary, DuPont Ag Products, CO
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# National Wheat Improvement Committee

The National Wheat Improvement Committee (NWIC) is a non-profit, independent organization representing public and private wheat researchers from each of the four major U.S. wheat-growing regions. The NWIC addresses issues that have a direct, or indirect, effect on U.S. wheat; including areas of research, production, marketing and end-use. The committee provides information and counsel to congressional leaders and U.S. Agricultural policy makers, with the long-term goal of improving wheat production and marketing opportunities. NWIC members serve as an expert committee and are willing to provide either written or verbal testimony regarding wheat research issues in the United States.

The NWIC meets annually. Minutes of the Committee meetings, resolutions, and letters are published each year in the Annual Wheat Newsletter.

## National Wheat Improvement Committee Members

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# *Proposal to create a USDA-ARS Regional Wheat and Barley Molecular Genotyping Laboratory at Manhattan, KS*

## *Background and Significance*

**Resources Requested: $500,000**

**Precedent and Rationale**

The Agriculture Research Service of USDA has set the precedent in the last century of providing leadership and services when local resources have not been available to meet national needs in crop improvement. Regional ARS laboratories have been established to improve cereal quality and rust resistance, as well as the regional germplasm repositories that distribute and characterize germplasm collected from around the world.

Molecular genotyping promises to become the next critical tool in crop breeding and the development of new germplasm. New technologies will allow molecular marker-based selection to enhance plant breeding through improved accuracy and speed of genotype identification. Gains in efficiency and novel technologies have reduced the cost of a single observation by 5 fold. Molecular breeding tools represent the technology of promise as we enter the next era of plant breeding. As markets move away from a commodity basis toward a value-defined, end product basis, plant breeders must equip themselves with gene-specific markers that give them rapid access to traits of value.

To sustain and strengthen the USDA-ARS role in solving problems of regional and national scope it is critical to incorporate molecular genotyping technology. The adoption of this technology will position the USDA-ARS to facilitate the rapid deployment of critically needed genes for wheat and barley.

**Mechanisms and Objectives**

We propose establishing a regional cereal molecular genotyping laboratory for barley and wheat that will serve public plant breeding programs in the US. Currently, many genes for important traits are mapped due to efforts like the International *Triticae* Mapping Initiative. These markers are waiting full utilization in current breeding programs. The proposed laboratory will be involved in:

- Identifying new molecular markers linked to traits of value such as end use quality and resistance to insects and to diseases like *Fusarium* head scab, rust, wheat streak mosaic virus, and Karnal bunt. The laboratory will then be involved in mapping these markers in agronomically relevant populations.
- Creating marker profiles of cultivars and breeding lines that are used as parents and provide this information to the plant breeders so that markers can be selected that will be useful in a particular cross. Marker profiles will also be cross-linked to other genetic information.
- Screening populations, individuals and lines provided by breeders; determine marker genotype, then report back to breeders to facilitate speed and efficiency in germplasm release.

This laboratory will be included as part of the Plant Science and Entomology Research Unit of the Grain Marketing Production Research Center in Manhattan, KS which has lead scientists with

expertise in germplasm development, mapping, and molecular biology. The unit already has an established wheat genomics facility that is a partnership with the Wheat Genetics Resource Center of Kansas State University. The major equipment necessary (automation and analysis) for a genotyping facility has already been purchased. Yearly funding of $500,000 is necessary for a scientist, support staff, and operating costs.

**Impact**

The establishment of this laboratory will allow public and private sectors to collaborate for the benefit of all components of the wheat and barley industries, from producers to consumers. The potential impact will also be economically important. Molecular markers linked to important traits like *Fusarium* head scab resistance could mean rapid relief to the U.S. wheat and barley industries which have lost about $3 billion in the 1990's. Markers lined to value added traits could also hasten the development of emerging markets leading to higher grain prices for the producer.

## *USDA-ARS National Wheat and Barley Scab Initiative*

## *Background and Significance*

**Resources Requested: $800,000**

Fusarium Head Blight emerged in the past decade as a widespread and powerful enemy of American agriculture. This disease, also known as 'Scab', inflicts yield and quality losses on farms in at least 18 states. Food industries throughout the U.S. incur losses from the cost of dealing with the mycotoxin contaminated grain that often accompanies scab infection. Combined losses to all steps in the food system are difficult to estimate, but the bill at the farm-gate alone is estimated to exceed 3.0 billion dollars since 1990.

Scab of wheat and barley is one of several plant disease complexes accorded special status in the federal budgeting system. The existing private, state, and federal research system of the U.S handles most of the newly emergent pests and diseases. But some, like wheat and barley scab, present unusual challenges that warrant new approaches to research. There are several reasons why scab is a special problem requiring new approaches:

- **Scab is an economic threat to growers, processors and consumers of wheat and barley throughout much of the U.S.**
- **Research should be done in a wide array of disciplines, with possible solutions including:**
  - resistant varieties (from conventional or biotechnology approaches),
  - alternative residue and rotation management schemes,
  - crop protection via chemical and biological controls, and
  - detoxification or alternative processing of contaminated grain.
- **The interaction of the scab pathogen with local and regional farming practices are complex and poorly understood.**
- **Recent experience clearly signals that no single institution can bring to bear the critical mass of research this problem demands.**
- **Scab solutions are likely to be both site and system specific, which dictates involvement of local experts in all of the at least 18 directly affected states.**
- **Opportunities for acquiring competitive funds for scab research from traditional federal sources are extremely scarce.**

Federal level recognition that scab is a strategic threat that is unlikely to be countered by the current way of doing business is an important milestone. However, the real challenge comes in the design and implementation of a national, multi-disciplinary, and multi-institutional research system that can win the war on scab in the most time and resource efficient manner possible.

During the past three years, federal and state scientists have worked closely with growers, input providers, millers, and food processors from across the country to design and fund just such a system. The result of these efforts is the U.S. Wheat and Barley Scab Initiative. The Initiative's goal is simple: promote research that develops and deploys as quickly as possible effective control measures that minimize the threat of scab to the producers, processors, and consumers of wheat and barley. In one sense, the Initiative is a self-organized "contact group" on scab. The Initiative seeks

to surmount normal institutional, regional, disciplinary, and sector interests in order to resolve and fund a best-case research agenda. Relevance of targeted research is assured by the central role that industry (growers and processors) plays in the Initiative's work. Accountability and relevance to practical solution discovery are guiding principals for the Initiative. The structure of the Initiative is simple and includes a broad-based Steering Committee with representatives from all stakeholder groups and regions. The Steering Committee has recruited national leaders in each of the major research areas to serve on committees that advise the Steering Committee on research agendas.

The Scab Initiative's research and steering committees undertook a process in 1998 that generated a comprehensive first-year research plan involving 111 projects in six research areas to be executed by 66 scientists from 19 Land Grant colleges and the USDA's Agriculture Research Service (ARS). Every conceivable solution area was considered, and the resulting mix of research projects is truly comprehensive. The prioritization process was competitive by its very nature, since researchers had to demonstrate their ability to contribute to the overall solution. On the other hand, the final research agenda consisted of a mix of projects identified via both directed and purely competitive processes. In almost all cases, funds proposed by the Initiative were heavily leveraged by existing sources of investments in personnel, facilities, and supplies.

In 1999, the Scab Initiative's research and steering committees once again collaborated to generate a comprehensive research plan for 2000. This plan incorporated 1999-funded research projects that were successfully meeting their goals, new high priority research projects, and 5 baseline budget additions for USDA-ARS. In total, 73 scientists from 22 land grant universities and the USDA-ARS will engage in 104 projects during 2000.

**After the various administrative costs are removed, the total funding for U.S. Wheat and Barley Scab Initiative-recommended projects is less than $4.0M. Yet the U.S. Wheat and Barley Scab Initiative could not support excellent project proposals whose combined budgets exceeded $1.5M. We are therefore requesting that Congress appropriate an additional $800,000 in FY2001 to the USDA-ARS partnership with the U.S. Wheat and Barley Scab Initiative.**

See WWW.SCABUSA.ORG for up-to-date information on the Scab Initiative.

## *The USDA-ARS Cereal Crops Research Unit at the Northern Crop Science Laboratory in Fargo, North Dakota*

## *Background and Significance*

**Resources Requested: $750,000**

The USDA-ARS barley, oat, hard red spring, and durum wheat research projects at the Northern Crop Science Lab (NCSL) at Fargo are all funded at a level significantly below the amount that USDA/ARS considers the minimum amount to adequately conduct research. The amount requested will increase funding for all current projects and the filling of a vacant wheat genetics project to a level of $300,000 per scientist and provide $300,000 for one additional scientist for small grains (primarily wheat and barley) disease research. The money requested will increase both the efficiency and level of research that can be directed toward solving problems faced by the small grain industry.

**Justification:**

Small grain diseases and other pests are in a constant state of change with new races and biotypes continually developing. As a result pest problems are never permanently solved. Since 1993, Fusarium Head Blight (FHB) has ravaged wheat and barley in the Northern Great Plains and the Midwest. This disease has cost producers billions of dollars and has been a factor in the mass exodus of producers from agriculture. Stem rust has and continues to be a major threat. In 1998, a new race of leaf rust was observed in our most commonly grown spring wheat varieties. In 1999 this race caused significant economic losses. Septoria, net blotch, and tan spot are disease problems that are increasing under conservation tillage production. Pests continually change, adapt to resistance, and return to threaten commercially grown barley, wheat and oats. Genetic sources of disease and pest resistance that will serve as parental material of future varieties can be derived only from basic research and the incorporation of wild, diverse, and alien germplasm. As consumers become more health and quality conscious and the market more specialized, U.S. producers must have varieties to grow and sell that are able to compete in the world and domestic market. The genetic material identified by the USDA-ARS researchers located at the NCSL for pest resistance, quality and agronomic characteristics are made available to public and private plant breeders and researchers in a form which they can then cross into adapted elite material to develop pest resistant, high yielding, and high quality varieties for commercial production.

**Recent scientific contributions by cereal scientists at the NCSL include**:

Identification of genetic material for wheat scab, leaf and stem rust resistance for use by HRS and durum wheat breeding scientists. Material from this project has been especially critical in allowing plant breeders to maintain stem rust resistance in wheat.

Improvement of tissue culture systems allowing easier and more rapid insertion of genes into commercial barley varieties.

Improvement of techniques to successfully make wide crosses with diverse and wild wheat germplasm to insert desirable genes into commercial varieties.

Development of a rapid technique for determination of soluble fiber content in oat germplasm and identification of genetic material that will increase the value of oat for milling and animal feed markets.

Determination of viral genetic codes to understand and ultimately provide viral resistance in barley. Elimination of seed born viral diseases in the USDA-ARS barley germplasm collection.

Identification of stem rust and scab resistance genes in barley.

Transfer of genes from wild emmer to durum for scab resistance, increased protein, improved pasta quality and increased yield.

Research conducted by USDA-ARS scientists at the NCSL has had and continues to have a major impact on small grain production. This research is critical for the advancement of crop yields by reduction of pest losses, increased agronomic adaptability and crop quality for specific uses. The current low level of funding and the vacant wheat genetics position dilutes research efforts toward solving problems that restrict the production of U.S. spring sown small grain and industry prosperity. The new position would allow researchers to identify genetic material and provide basic information on increasing disease problems.

## *Laboratory Addition at the USDA-ARS National Small Grains Germplasm Research Facility, Aberdeen, ID*

## *Background and Significance*

**Amount Requested: $3 million**

The National Association of Wheat Growers requests $3 million for the construction of an advanced molecular genetics laboratory addition to the ARS National Small Grains Germplasm Research Facility (NSGGRF), Aberdeen, ID.

**Current Status:** The ARS program at Aberdeen, Idaho, includes several advanced molecular genetics research programs in wheat, barley, and potatoes. Ongoing research in genetic improvement of feed and malting barleys, particularly low phytic acid grains for fish, swine and poultry diets, and potato varieties with enhanced quality and storage characteristics, is greatly constrained by inadequate laboratory facilities. Furthermore, the University of Idaho's (UI) wheat genetic research capabilities at Aberdeen will be greatly enhanced by the proposed advanced genetics laboratory addition at the ARS facility. Currently the UI wheat genetics program conducts laboratory experiments in limited areas, without a single dedicated laboratory.

**Background/Justification:** Construction of a $3,000,000 laboratory addition for advanced molecular genetics research in barley, oats, wheat and potatoes will provide significant benefits to the small grains and potato industries throughout the US. The USDA NSGGRF houses one of the foremost crop germplasm collections in the world, including over 100,000 small grain accessions. This institution maintains seed stocks, distributes seed to researchers worldwide and serves as a center of small grains and potato genetics research.

The proposed laboratory addition will greatly enhance the molecular genetics capability in both small grains and potatoes for the benefit of barley, wheat, oats and potato industries in Idaho and the US. This addition also will provide state of the art laboratory space for current research in low phytic acid grains, which is currently housed in inadequate facilities.

Wheat genetics research -- The University of Idaho's wheat genetics program at Aberdeen is a key national program applying molecular and traditional genetics to improving the competitiveness of US wheat in global markets, without genetic transformation technologies. Among its successes is the cultivar Idaho 377s, developed to expand Pacific Rim exports to Asia and Latin America to compete with premium exports from Australia and Canada. Idaho 377s is the most widely grown hard white wheat in the US. Current research is transferring to the marketplace new genetic traits such as high amylopectin starch, low polyphenol oxidase flour, high anti-oxidant wheat, and low phytic acid mill feed. Using a whole systems approach, including advanced genetic screening techniques, on-farm research, industry advisory panels, and innovative grain marketing, the wheat program is facilitating collaboration between the farming, shipping, and food processing sectors to improve the competitiveness of US products. The Advanced Genetics Laboratory will house state-of-the-art gene sequencing and mapping equipment and will strengthen UI-private-public institution partnerships to expand markets for US wheat.

Low phytic acid barley research -- Barley genetics research at the NSGGRF has led to the development of the world's first feed grains with essentially no phytic acid phosphorous (95% phytic acid free). The phytic acid or phytate form of phosphorous contained in grains cannot be digested by nonruminant animals and humans, causing antinutritional concerns in the diet as well as phosphorous waste management problems. The objectives of this research are to develop genetic approaches to the phytic acid problem that are useful in crop breeding and improvement; to work with plant breeders in the use of these genetic resources; and to cooperate with human and animal nutritionists in studies on nutritional improvements and phosphorous waste reduction. The development of low phytic acid barley cultivars will lead to the increased use of barley in nonruminant animal and human diets.

Barley genetics research -- The NSGGRF supports extensive research in barley and oat breeding and genetic engineering. The genetic complexity in the inheritance of various desirable traits makes the development of superior varieties an ongoing, long-term process involving many generations of crossing, selecting, and testing. This breeding process will be greatly enhanced by more precise genetic techniques. Specific work is currently focusing on understanding the genetics of plant regeneration and developing efficient transformation systems that are less dependent on tissue culture systems that generate undesirable changes in agronomic and quality traits.

Potato genetics research -- A primary objective of the ARS potato genetics research program at Aberdeen is to develop new superior russet cultivars with the desirable traits of Russet Burbank, without its susceptibility to environmental stresses. Benefits of improved varieties are expected to result in reduced production costs, more uniform quality, less storage problems, and better processing recovery. Ranger Russet is an example of a russet cultivar released from the Aberdeen program that has benefited the Idaho potato industry. Ranger Russet's improved yield, disease resistance, tuber size, and starch content as compared to Russet Burbank has resulted in increased profitability for both growers and the processing industry. It is now the second-most widely grown cultivar in Idaho after Russet Burbank, accounting for 9.0% of the planted acreage in 1999 (National Agriculture Statistics Service). In the United States, Ranger Russet is the third most widely grown potato cultivar, indicating that the breeding efforts also benefit the national potato industry.

The Aberdeen potato breeding program will be developing molecular techniques to more rapidly incorporate desirable traits such as disease resistance from wild potato species to the cultivated potato. Incorporation of these molecular techniques into the program is limited at this time due to inadequate laboratory space with less than satisfactory HVAC properties.

The benefit to the Idaho, Pacific Northwest, and US small grains and potato industries will be the more rapid development of adapted barley, wheat, oat and potato cultivars that meet the exacting end-use specifications of global customers. Barley, wheat and potato production generates more than $2.5 billion in farm-gate receipts in the Pacific Northwest region (1996-1998 average).

## *Additional Support for the USDA-ARS Wheat Quality Laboratories*

## *Background and Significance*

**Requested Amount: $3 million**

Beginning in the 1930's, Congress established four wheat quality laboratories in the Agricultural Research Service - including the **Soft Wheat Quality Laboratory** at Wooster, Ohio; the **Hard Winter Wheat Quality Laboratory** at Manhattan, Kansas; the **Western White Wheat Quality Laboratory** in Pullman, Washington; and the **Hard Red Spring and Durum Wheat Quality Laboratory** in Fargo, North Dakota. Their mission is still very appropriate today and includes 1) working with breeders to improve the quality of U.S. wheat and 2) developing quality measurement methods. Since their establishment, the number of tests that are being performed on each new variety has increased significantly and now includes the measurement of kernel size, weight, and hardness; protein content and quality; lipid content and quality; and numerous additional performance tests. In addition, the numbers of cultivars, varieties, and test lines that are being developed by public and private breeding programs and evaluated by these laboratories have increased dramatically. Thus, the amount of work that is required in order for these laboratories to complete their mission has increased exponentially since their establishment.

Another major problem for these laboratories arises from the fact that their support dollars have remained constant for the past ten years. This means that, as salaries and equipment costs increase, less money is available to support needed research programs. The laboratories have adjusted by not replacing retiring scientists and technicians. As a result, the capabilities of these laboratories are affected. Thus, additional support is needed to maintain research and wheat variety evaluation programs and to expand into the development of new uses and markets for U.S. wheat.

**Specific funding needs for each of the four laboratories are listed below:**

**Soft Wheat Quality Laboratory at Wooster, Ohio**

Current Funding Level - $500,000; **Additional Dollars Needed - $ 775,000**

**Rationale:**

$225,000 is needed to update laboratory equipment that is 20-50 years old, $150,000 is needed to adequately fund wheat evaluation programs, $150,000 is needed to adequately fund current research efforts, and $250,000 is needed to restore a second Category I research scientist position that was lost due to lack of funding in 1994. Current research efforts are focused on 1) grain quality and its effects on wheat and flour value and 2) the development of DNA marker-assisted breeding. The additional scientist will research and implement DNA marker-assisted selection to aid in determining which lines are released from the 25 eastern U.S. wheat breeding programs the Laboratory serves.

**Hard Winter Wheat Quality Laboratory at Manhattan, Kansas**

Current Funding Level - $1,690,000; **Additional Dollars Needed - $ 1,000,000**

**Rationale:**

$350,000 is needed to update laboratory equipment and to provide adequate support for the scientists in this laboratory. $650,000 is needed to expand the research to include one Category I scientist to concentrate on the development of end-use quality traits that meet industry needs and one Category I scientist to focus on the development of reliable quality tests for non-bread products such as noodles, tortillas, etc.

**Western Wheat Quality Laboratory in Pullman, Washington**

Current Funding Level - $544,000; **Additional Dollars Needed - $ 550,000**

**Rationale:**

Past attrition has reduced staffing to its current level of one Category I research scientist. $350,000 is needed to add a second Category I scientist with a research focus on Asian food product qualities in order to keep U.S. wheat competitive in Asian markets. $200,000 is needed to update laboratory equipment and to raise the funding of current research programs to an adequate level.

**Hard Red Spring and Durum Quality Laboratory in Fargo, North Dakota**

Current Funding Level - $495,000; **Additional Dollars Needed - $ 675,000**

**Rationale:**

$175,000 is needed to provide needed laboratory equipment, $200,000 is needed to hire additional support personnel including a milling specialist to replace one lost due to inadequate funding, and $300,000 is needed to upgrade research space for sample handling, cold storage, etc.

**SUMMARY:**

**Total Current Funding Level - $3,229,000**

**Total Additional Funding Needed to Maintain & Expand Research and Variety Evaluation Programs - $3,000,000**