APPENDIX 5
Economic impact report of WheatCAP, TCAP and USDA-ARS genotyping labs

Economic impact of public wheat varieties in 2017: $ 4.3 billion/year

Wheat ranks third among U.S. field crops in planted acreage, production and gross farm receipts, behind corn and soybeans. In 2015, 21 million full- and part-time jobs were related to the agricultural and food sectors (11.1 % of total U.S. employment). Wheat is an important component of the economic contribution of agriculture to the US economy. In 2017, 46 million acres of wheat were planted in the US, resulting in production valued at $ 8.14 billion dollars (USDA-NASS 2017 statistics).

To study the contribution of the public wheat breeding programs, we completed a survey that includes wheat planted acreage and production value for 34 states, covering 98.4% of the US wheat acreage (Appendix I). Based on this survey, public varieties accounted for 56.9% of the 2017 wheat acreage and contributed $ 4.3 billion in value of production. These numbers document the importance of the public wheat breeding programs to the US economy.

The public wheat breeding programs are an example of a successful collaboration between the private and public sectors. Growers provide funding for the core breeding activities and USDA provides support to these activities through the NIFA-USDA CAP grants and the USDA-ARS high-throughput genotyping laboratories and quality laboratories.

The $4.3-billion value of the wheat produced from public wheat varieties is amplified several times through the milling and baking industries, which contribute additional jobs and value to the economy. In 2017, the Bureau of Labor Statistics reported 210,000 jobs in bakeries and tortilla manufacturing, 291,000 in retail bakeries and 60,140 in milling (including grains and oil seeds) https://www.bls.gov/cps/cpsaat18b.htm. Another amplification factor of the value of the public wheat varieties is their frequent use by private breeding companies in their crosses, which transfers part of their value to the private sector and multiplies the economic benefits from the public breeding activities.

Public varieties yield additional economic benefits through their improved disease resistance and quality, but those are difficult to quantify. The use of molecular markers has enabled breeders to pyramid multiple resistance genes improving resistance durability and minimizing the use of pesticides and potential negative impacts on people and the environment. In addition, the ability of the public sector to emphasize socially desirable quality and nutritional traits for which the market may provide limited economic incentives, provides a more desirable and nutritive product to US consumers and improves the value of US wheat internationally. We include at the end of this report a letter from the National Association of Wheat Growers documenting the value of the WheatCAP research and training for US wheat growers.

Impact of CAP projects on production values of wheat varieties

The genetic information and molecular assays generated by the WheatCAP projects and USDA-ARS genotyping labs during the past 10 years have become an essential part of the breeding efforts in most public wheat breeding programs in the US. This is documented by the increase in the proportion of planted wheat varieties that benefited from these technologies. In 2012, roughly 20% of the US wheat acreage included varieties that benefited from marker technologies

provided by WheatCAP and USDA-ARS genotyping labs (2013 Economic Impact report TCAP). This percentage doubled in 2017, and represented 41% of the wheat acreage planted in the USA ($3.1 billion in direct production value). In 2017, 72% of the public varieties benefited in some degree from the support provided by the WheatCAP and USDA-ARS genotyping labs.

To estimate how much of the $3.1 billion value of those varieties was added by the WheatCAP and USDA-ARS genotyping labs, we made the following assumptions:

1) If a variety is grown commercially there must be a perceived increased value compared to other available varieties. Thus, we assumed that the currently grown varieties developed by these projects have at least a 5% advantage in production values to justify the grower's decision to buy seed for a new variety. Therefore, we calculated first the 5% of the production value of the public varieties that benefited for the WheatCAP-genotyping labs support (5% of 3.1 billion= $156.6 million).

2) Public wheat varieties differ in the proportion of funds received for their development from WheatCAP and local growers' support. A survey including CA, KS, MT, ND, OK, and TX showed that the funding provided by the WheatCAP (direct costs) and USDA-ARS genotyping labs represented between 20% and 40% of the combined funding received by these public wheat breeding programs in 2017. To be conservative, we estimated that 10% of the variety development cost was contributed by the support of the current and past CAP and the USDA-ARS genotyping labs. Therefore, we applied this 10% to the $156.6 million, resulting in an estimated $15.7 million value added by the USDA funding support.

The estimated $15.7 million return is roughly 2.3-fold the amount provided in 2017 by USDA-NIFA to the WheatCAP and five satellite IWYP (International Wheat Yield Partnership initiative) projects (~$3.5 million) and by USDA-ARS to the genotyping labs (~$3.2 million). This positive return should be consider with caution because the 5% and 10% estimates used in the calculations are speculative. However, this result is consistent with previous studies. For example, Hurley et al. (2016) reported an estimated return to research and development investments in wheat to be on average 47.4% per year (based on 221 studies).

The returns on the investments in the WheatCAP, TCAP and genotyping labs are complicated by the different contributions of research, extension and breeding investments to the development of specific public wheat varieties, and by the long time it takes for breeding investments to materialize in economic returns. However, the exact return rate of these particular projects does not affect the fact that the public wheat varieties contributed $4.3 billion production value to the US economy in 2017.

Economic impact of the information and technological tools generated by WheatCAP and USDA-ARS genotyping labs

In addition to the value captured directly through production using the public wheat varieties, additional value is generated by the transfer of improved public varieties to the private sector to be used as parents for their crosses and by technology transfer. The maps, marker information, and marker technological developments (ISelect 9K and 92K chips, exome capture platforms, maps, etc.) are actively used by the wheat breeding programs in the US private sector. Many private companies use markers developed by the public sector, and some use the USDA marker labs. For example, most wheat breeding private companies in the USA have requested the KASP

assays developed by the USDA-ARS genotyping laboratory located at Raleigh, NC. Private companies also use the MASWheat site for MAS protocols. Many "private" varieties actually originate from public institutions (e.g. Purdue University and the University of Illinois release most varieties for licensing to private companies). The genes and linked markers identified by the WheatCAP and the genotyping labs accelerates the deployment of useful traits into the breeding programs. The WheatCAP grants have been transformative for the wheat breeding enterprise in the USA by generating marker densities and imputation strategies that have made genomic selection possible in several wheat breeding programs.

In summary, the WheatCAP and USDA-ARS genotyping labs wheat varieties and research results serve well the entire US wheat industry as indicated at the end of this report by a positive support letter from the National Association of Wheat Growers.

Economic impact of the training provided by the CAP grants

In addition to the wheat varieties and technological developments, the WheatCAP projects have made a significant contribution to train the next generation of plant breeders. The previous decade has witnessed limited training opportunities for students interested in plant breeding, and has resulted in a shortage of plant breeders nation-wide. The wheat breeding programs represent one of the last reservoirs of active breeding programs in the public sector to provide hands on training to the students. Previous and current WheatCAP projects have supported the training of multiple graduate and undergraduate students and postdocs (Appendix 2). The CAP grants have also provided training opportunities by providing seminars, workshops and online courses.

The value of this training is documented by the demand of industry for the students trained by the WheatCAP projects, which have been rapidly incorporated into different breeding industries in the US and abroad. To document this impact, we performed a survey of the jobs filled by the people trained during previous WheatCAP projects (Appendix 2). Among the 168 individuals trained in the WheatCAP and TCAP projects, 79% work in the US and 21% abroad, 60% are males and 40% female, and 49% work in academic or government positions and 51% in the private sector. This data confirm the large and balanced contribution of the WheatCAP projects to train the people required by the public and private sector in the agriculture and food sectors.

References

Hurley, T.M., P.G. Pardey, X. Rao and R. Andrade. Returns to Food and Agricultural R&D Investments Worldwide, 1958-2015. InSTePP Brief. St. Paul, MN: International Science & Technology Practice & Policy center, August 2016.

Appendix I. Acreage and production from wheat public varieties supported by WheatCAP and USDA-ARS genotyping labs

State	Acres Planted	Public var. ac planted	%	Ac public var. suppoted by CAP & genotyping labs	%	Production in $	$ Production Public Varieties	$ Production supported by CAP & Genotyping labs
ALABAMA	150,000	62,400	41.6%	62400	41.6%	35,420,000	14,734,720	14,734,720
ARIZONA	115,000	37,500	32.6%	37,500	32.6%	72,912,000	23,775,652	23,775,652
ARKANSAS	200,000	65,400	32.7%	65400	32.7%	28,600,000	9,352,200	9,352,200
CALIFORNIA	420,000	175,560	41.8%	124,740	29.7%	67,854,000	28,362,972	20,152,638
COLORADO	2,260,000	2,000,100	88.5%	2,000,100	88.5%	328,529,000	290,748,165	290,748,165
DELAWARE	75,000					22,918,000		
FLORIDA	20,000	18,000	90.0%	18,000	90.0%	2,072,000	1,864,800	1,864,800
GEORGIA	160,000	128,000	80.0%	128,000	80.0%	13,489,000	10,791,200	
IDAHO	1,165,000	435,710	37.4%	388,295	33.3%	415,657,000	155,455,718	138,538,478
ILLINOIS	500,000	125,000	25.0%	125,000	25.0%	162,526,000	40,631,500	40,631,500
INDIANA	290,000	156,600	54.0%	156,600	54.0%	84,360,000	45,554,400	45,554,400
IOWA	16,000					2,067,000		
KANSAS	7,600,000	3,868,400	50.9%	3,245,200	42.7%	1,334,400,000	679,209,600	569,788,800
KENTUCKY	480,000	100,800	21.0%	100,800	21.0%	109,802,000	23,058,420	23,058,420
LOUISIANA	20,000	16,000	80.0%	16000	80.0%	2,512,000	2,009,600	2,009,600
MARYLAND	410,000	164,000	40.0%	102,500	25.0%	60,421,000	24,168,400	15,105,250
MICHIGAN	480,000	229,800	47.9%	181,000	37.7%	151,088,000	72,333,380	56,972,767
MINNESOTA	1,170,000	698,490	59.7%	667,756	57.1%	436,548,000	260,619,156	249,151,913
MISSISSIPPI	45,000	12,420	27.6%	12420	27.6%	6,018,000	1,660,968	1,660,968
MISSOURI	640,000	161920	25.3%	161920	25.3%	161,568,000	40,876,704	40,876,704
MONTANA	5,140,000	3,727,000	72.5%	1,285,000	25.0%	674,243,000	488,891,763	168,560,750
NEBRASKA	1,120,000	840,000	75.0%	756,000	67.5%	185,334,000	139,000,500	125,100,450
NEVADA	29,000					4,925,000		
NEW JERSEY	23,000					5,005,000		
NEW MEXICO	330,000					17,010,000		
NEW YORK	140,000	42,000	30%	42,000	30%	38,106,000	11,431,800	11,431,800
NORTH CAROLINA	450,000	148,500	33.0%	148,500	33.0%	95,906,000	31,648,980	31,648,980
NORTH DAKOTA	6,680,000	3,392,310	50.8%	2,105,000	31.5%	1,384,140,000	702,908,977	436,169,865
OHIO	460,000	69,000	15.0%	69,000	15.0%	157,731,000	23,659,650	23,659,650
OKLAHOMA	4,500,000	3,690,000	82.0%	3,240,000	72.0%	379,610,000	311,280,200	273,319,200
OREGON	775,000	523,900	67.6%	514,600	66.4%	238,654,000	161,330,104	158,466,256
PENNSYLVANIA	210,000	63,000	30.0%			56,700,000	17,010,000	
SOUTH CAROLINA	90,000	18,000	20.0%	18,000	20.0%	15,986,000	3,197,200	3,197,200
SOUTH DAKOTA	1,887,000	1,175,601	62.3%	1,175,601	62.3%	233,464,000	145,448,072	145,448,072
TENNESSEE	370,000	50,000	13.5%	0	0	87,588,000	11,836,216	0
TEXAS	4,700,000	2,270,100	48.3%	1,175,000	25.0%	255,563,000	123,436,929	63,890,750
UTAH	134,000					28,954,000		
VIRGINIA	210,000	31,500	15.0%	31,500	15.0%	44,979,000	6,746,850	6,746,850
WASHINGTON	2,195,000	1,212,200	55.2%	420,000	19.1%	680,266,000	375,680,385	130,164,793
WEST VIRGINIA	8,000					1,297,000		
WISCONSIN	210,000	44,100	21.0%	44,100	21.0%	46,818,000	9,831,780	9,831,780
WYOMING	135,000					11,025,000		
TOTAL	**46,012,000**	**25,753,311**	**56.9%**	**18,818,908**	**40.9%**	**8,142,065,000**	**4,288,546,961**	**3,131,613,371**

Appendix 2. Current positions of people trained during previous WheatCAP and TCAP projects. Total 168.

- 79% working in US and 21% working abroad
- 49% working in academia and government, versus 51% in private industry
- 60% male and 40% female

State	Trainee	Current position
AR	Dennis Lozada	Postdoc at Washington State University
CA	Malena Faricelli	Pioneer USA
CA	Iago Hale	Professor at the University of New Hampshire
CA	Juan Carlos Brevis	Onion Breeder Bayer
CA	Cristobal Uauy	Project Leader at the John Innes Centre, UK
CA	Kati Wu	Amyris Biotechnologies Associate scientist
CA	Marco Maccaferri	Researcher University of Bologna
CA	Juan Sanchez	Monsanto
CA	Eligio Bossolini	Bayer Europe
CA	Rebeca Turner	Onion Breeder Bayer
CA	Tyson Howell	Molecular Breeder Bayer
CA	Nicolas Cobo	Strawberry breeder UCD
CA	Josh Hegarty	Triticale breeder UCD
CA	Brittany Hazard	Project Leader Institute of Food Research, UK
CA	Youngjun Mo	Researcher in NICS Korea
CO	Kelsey Salvo	U.S. Peace Corps, Senegal
CO	Jessica Davis	USDA, Pullman
CO	Elizabeth Bloetvogel	Eurofins STA Labs, Longmont, CO
CO	Beth Econopouly	Gates Foundation, Seattle
CO	Erena Edae	USDA-ARS, Manhattan, KS
CO	Anna Pranger	Syngenta, Longmont, CO
CO	Annie Heiliger	Cargill, Fort Collins, CO
CO	Shusong Zheng	Academy of Sciences, Beijing
CO	Wahid El-Feki	University of Alexandria, Egypt
CO	Melaku Mekonnen	Syngenta, Junction City, KS
CO	Joshua Butler	Busch Agricultural Resources
CO	Sally Clayshulte	Bayer Crop Science
CO	Ben Beyer	Advanta US
CO	Jennifer Andeway	Monsanto
CO	Victoria Valdez	Colorado State Univ.
CO	Karla Rippe	Pioneer
CO	Nelson Hevner	Monsanto
CO	Steve Becker	Corn breeder, Beck's Hybrids
CO	Hung Dao	Agricultural Hi-Tech Park, Vietnam
CO	Grogan Sarah	Bayer Biologics
CO	Melaku Mekonnen	Syngenta lettuce breeder, CA

CO	Erena Edea	Research Associate Univ. of Minnesota, St. Paul
CO	Jessica Moore (Cooper)	GS specialist at Cargill Specialty Oils, Fort Colins, CO
CO	Wahid Awad	Professor Cairo Univ. Egypt / CILcare (French company)
CO	Susan Latshaw	BASF, wheat breeder
IA	Shenqiang Zhong	Monsanto
IA	Elliot Heffner	Pioneer Hibred Intl.
IA	Yi Jia	Dow Agrosciences
IA	Aaron Lorenz	Associate Professor, University of Minnesota
IA	Jesse Poland	Professor, Kansas State Univ., Manhattan, KS
IA	Victoria Blake	Geneticist, USDA-ARS, Albany, CA
IA	Deniz Akdemir	Postdoctoral Fellow, Cornell University, Ithaca, NY
IA	Martha Hamblin	Senior Research Associate, Cornell University, Ithaca, NY
ID	Reuben Mclean	Production manager at Pendleton Flour Mill, Blackfoot, ID
ID	Maqsood Rehman	DowAgscience, leader Soybean breeding for North America
ID	Mackenzie Ellison	DowAgscience wheat breeding Pullman, WA. Research tech
ID	Justin Wheeler	Support scientist at University of Idaho
ID	Junli Zhang	Project Scientist, University of California, Davis
ID	Ping Li	Assistant Professor, Huazhong Agric. Univ. Wuhan, China
ID	Brian Bowman	Sweet corn breeder, HM Clause USA
ID	Yuxiu Liu	Assistant Professor, Northwest A&F Univ. China
KS	Xiaofei Wang	Bioinformatician University of Kansas
KS	Shubing Liu	Research Scientist in KSU
KS	Amy Bernardo	Research Scientist in KSU
KS	Irazema Fuentes-Bueno	USDA-ARS, Manhattan, KS as technician
KS	Jin Cai	Jiangsu Academy of Agricultural Science in China
KS	Meng Lin	Postdoc Cornell Univ.
KS	Yue Lu	Postdoc in Yangzhou Univ. China
KS	Fatima Nosheen	Professor Nat. Univ. of Science and Technology, Pakistan
KY	Lloyd May	Monsanto
KY	Beiyan Zeng	Monsanto
KY	Virginia Verges	Don Mario Seeds
KY	Andres Agostinelli	Limagrain
KY	Ana Balut	Monsanto Argentina
KY	Carrie Knott	UK faculty
KY	Herry Utomo	LSU
KY	Katlyn Hitz	Barley breeder MillerCoors
KY	Kathleen Russell	Colorado State Univ. Station Manager
MN	Xiuling Zhang	Corn Breeder, Pioneer Hi-Bred, Mankato MN
MN	Alex Rigor	Rice Breeder, Pioneer Hi-Bred, Philippines
MN	Toi Tsilo	Wheat Geneticist, Agricultural Research Council, South Africa
MN	Ed Quirin	Marker Analytics, Pioneer Hi-Bred, Johnston IA
MN	Godwin Macharia	Kenya Agricultural Research Institute, Kenya
MN	Brian Seda	Corn Breeder, Syngenta, Brookings, SD

MN	Trevor Keith	Research Associate, Pioneer Hi-Bred
MN	Jon Massman	Research Scientist, Pioneer, Johnston, IA
MN	Carol Powers	Coordinator, Grad Student Prof. Dev., Oklahoma State Univ.
MN	Vikas Vikram	Trait Assessment & Deployment, Bayer
MN	Warren Kruger	N. America Soybean, Cotton and Wheat Breeding Lead, Bayer
MN	Hongyun Wang	Pioneer Hi-Bred
MN	Michael Van de Weghe	Pioneer Hi-Bred Intern
MN	Prabin Bajgain	Postdoc Univ. of Minnesota, St. Paul
MN	Kathryn Turner	Research Associate, The Land Inst. KS.
MT	Hussein Abdul-Haleem	University of Georgia
MT	Jeremy Jewell	Washington State University
MT	Deven See	Washington State University
MT	Steve Larson	USDA-Logan, Utah
MT	Don Lee	Univ. Nebraska, Lincoln
MT	Jeong Shin	Seoul University
MT	Jason Cook	Monsanto
MT	Yukiko Naruoka	Washington State University
MT	Gail Sharp	Monsanto
MT	John Erpelding	USDA Scientist
MT	Megan Hartzell	Forage Genetics
MT	Peng Wah Chee	University of Georgia
MT	Xueyan Shan	Misissippi State University
MT	Eric Storlie	Colorado State University
MT	Yukiko Naruoka	Hybrid Wheat Breeder, Syngenta
MT	Andrea Varella	Limagrain, wheat breeder
MT	Jay Kalous	Limagrain, wheat breeder
MT	Afaf Nasseer	Scientist, Iraq Ministry of Agriculture
NY	Chiranth C. Rajashekar	Sathguru, India
NY	Keith Williams	PepsiCo Inc.
NY	Emily Combs	DuPont Pioneer
NY	Nick Santantonio	Postdoc at Cornell Univ.
NY	Jessica Rutkoski	Assistant professor IP-CALS, Research scientist IRRI
NY	Lynn Veenstra	Heinz, tomato breeder
ND	Ana Correa-Heileman	Monsanto
ND	Magan Lewis	Dow AgroSciences
ND	Fabio Pedraza	Seeds 2000
NE	Nicholas Crowley	Corn Breeder, Pioneer
NE	Neway Mengistu	Corn Breeder, Pioneer
NE	Kayse Onweller	Station Manager, BASF
NE	Ali Bakhsh	Professor, College of Agriculture Dera Ghazi Khan
NE	Anyamanee Auvachanon	Professor, Kasetsart University at KPS, Thailand
NE	Ibrahim Salah El-Baysoni	Professor, Damanhour University, Egypt
NE	Mary Guttieri	USDA-ARS Manhattan Research Geneticist

NE	Katherine Frels	Postdoc Univ. of Minnesota, St. Paul
NE	Hussain Waseem	Mahyco wheat breeder / postdoc UNL
NE	Tadele Kumssa	Postdoc Noble foundation
NE	Kayse Onweller	BASF, station manager
NC	Jared Benson	Molecular Breeding Scientist, Pioneer Hi-Bred
NC	Leandro Perugini	Research Scientist, Pioneer Hi-Bred
NC	Tristan Coram	Agronomic & Phenotyping Group Leader at Dow AgroSciences
NC	Raja Kota	Senior Scientist, Syngenta
NC	Eric Olson	Professor, Wheat Breeding Michigan State University
NC	Marla Hall	Wheat Breeder, Limagrain Cereal Seeds
NC	Eddie Lauer	PhD student, North Carolina State Univ.
NC	Martin Sarinelli	GDM Seeds, soybean breeding manager
OH	Mao Huang	Post-Doc at Ohio State University
OH	Amber Hoffstetter	Post-Doc at Michigan State University
OH	Antonio Cabrera	Scientist at BASF Bayer Crop Science
OH	Nafeti Mheni	Wheat breeder, Tanzania Agricultural Research Institute
OH	Elias Balimponya	Manager, Tanzanian Official Seed Certification Institute
OK	Chor_Tee Tan	Texas A&M University - Texas AgriLife
OK	Tilin Fang	Oklahoma State University
OK	Tianrong Huang	Inst. Grain Crops, Xinjiang Acad. Agric. Sci., P.R. China
OK	Xinkai Zhu	Yangzhou University, P.R. China
OR	Juan Rey	Dow Agrosciences
OR	Scott Fisk	Oregon State University
OR	Alfonso Cuesta-Marcos	Oregon State University
OR	Natalie Graham	Cos County, Oregon
OR	Yada Chutimanitsakun	Kasetsart University
OR	Kelley Richardson	USDA/ARS
TX	Silvano Ocheya Assanga	Corn breeder, Monsanto
TX	Chor-Tee Tan	Greenhouse Manager, Australia
TX	Yan Yang	Postdoc in Joint Genome Institute
VA	Greg Berger	Partner in Hopkins Ag Research in Portland, TX
VA	Mark Christopher	Assistant Wheat Breeder, KWS-U.S., IL
VA	Pat O'Boyle	Sugar Beet Breeder, Betaseed, Inc., Shakopee, MN.
VA	Sam Markell	Assistant Professor, North Dakota State University, Fargo, ND
VA	Jianli Chen	Associate Professor, University of Idaho, Aberdeen, ID
VA	Jafar Mammadov	DOW Agro Sciences, Indianapolis, IN
VA	Robert Paris	High School teacher, Xenia OH
VA	Sixin Liu	Molecular Biologist, USDA-ARS, Kearneysville, WV
VA	Young-Soo Chung	Professor, Korea University, Seoul, South Korea
WA	Jayfred Godoy	Wheat breeder, Australia
WA	Shiferaw Gizaw	Quantitative geneticist, Sakata Seed
WA	Megan Lewien	Onion breeder, Bayer Crop Science
WA	Bryn Hulbert	Monsanto

WA	Kendra Jernigan	Assistant Professor, Abilene Christian University
WA	Weizhen, Liu	Post-Doctoral Researcher, Cornell University
WA	Graham Ellis	PhD Candidate, potato breeding WSU
WA	Carter, Arron	Associate Professor / breeder, Washington State University

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National Association of Wheat Growers

Dr. Jorge Dubcovsky,
Project Director of the USDA-NIFA WheatCAP Grant
Distinguished Professor, University of California-Davis
Dept. of Plant Sciences, One Shields Ave.
University of California, Davis, CA 95616

Dear Dr. Dubcovsky:

The National Association of Wheat Growers (NAWG), its member states and state wheat organizations across the country have long supported the USDA-National Institute of Food and Agriculture (NIFA) WheatCAP grants efforts to improve wheat. We appreciate the copy of the second year WheatCAP report and, based on the reported progress and excellent work, we are pleased to reiterate our support for this vital work.

We are impressed by the progress achieved in such a short period and by the National scope of the project. In particular, we would like to recognize the WheatCAP for the release of 42 new wheat varieties and improved germplasm in the first two years of the project. These improved varieties are essential to maintain the competitiveness of the wheat crop and wheat growers. Improved varieties from the current WheatCAP and previous USDA-funded CAP projects are having a positive economic impact on our industry. It has long been recognized that the release of a new cultivar represents a significant return on investment. An economic analysis of Kansas wheat breeding by Barkley (1997) estimated a return of 39% on investment of public dollars (KAES Progress Report 793). Thus, it is clear that the economic impact of the new variety releases is significant.

We are very interested in the WheatCAP focus on grain yield and grain yield components, and hope that the discoveries in this area can accelerate the rates of grain yield improvement. We are happy to see that the increased yield of the new varieties has been accompanied by continuous efforts to increase resistance to different wheat pathogens and pests. This has enormous agronomic, environmental and economic benefits, since it reduces the need for expensive fungicides and increases the productivity and profitability of the wheat growers.

We also recognize the long-term impact of the WheatCAP project's emphasis on training new wheat breeders. The list of trained people presented in your economic impact report is

impressive. It documents well the positive impact that this training has had in both the academic and private industry. Wheat growers understand that wheat research is a long-term proposition that requires an investment in the development of human resources. The ability of the WheatCAP participants to work closely with the next generation of breeders may be one of the most significant contributions of this project to the overall economic health and longevity of the wheat industry.

In summary, we continue to be grateful for the WheatCAP project's focus on wheat improvement as well as the significant economic impact that this project is already having on the wheat industry. We look forward to continued work together with you and your colleagues.

Sincerely,

Jimmie Musick
President
National Association of Wheat Growers