

Outdoor Heritage Fund Grant Application

The purpose of the North Dakota Outdoor Heritage Fund is to provide funding to state agencies, tribal governments, political subdivisions, and nonprofit organizations to:

Directive A. Provide access to private and public lands for sportsmen, including projects that create fish and wildlife habitat and provide access for sportsmen;

Directive B. Improve, maintain, and restore water quality, soil conditions, plant diversity, animal systems and to support other practices of stewardship to enhance farming and ranching;

Directive C. Develop, enhance, conserve, and restore wildlife and fish habitat on private and public lands; and

Directive D. Conserve natural areas for recreation through the establishment and development of parks and other recreation areas.

Exemptions

Outdoor Heritage Fund grants may not be used to finance the following:

- A. Litigation;
- B. Lobbying activities;
- C. Any activity that would interfere, disrupt, or prevent activities associated with surface coal mining operations; sand, gravel, or scoria extraction activities; oil and gas operations; or other energy facility or infrastructure development;
- D. The acquisition of land or to encumber any land for a term longer than twenty years; or
- E. Projects outside this state or projects that are beyond the scope of defined activities that fulfill the purposes of Chapter 54-17.8 of the North Dakota Century Code.

Application Deadline

Applications for the first grant round cycle are due on **December 2, 2013 at 5:00 p.m. CST.** All information, including attachments, must be submitted by that date. See instructions below for submission information.

Instructions

It is our intent to have this form available on line. However, until that on-line form is available we are asking that you submit your application as a Word document. Please download this Word document (available on the Industrial Commission/Outdoor Heritage Fund Program website at <http://www.nd.gov/ndic/outdoor-infopage.htm>) to your computer and provide the information as requested. You are not limited to the spacing provided except in those instances where there is a limit on the number of words. After completing the application, save it and attach it to an e-mail and send it to outdoorheritage@nd.gov .Then submit the Word document as noted in the following paragraph.

Attachments in support of your application may be sent by mail to North Dakota Industrial Commission, ATTN: Outdoor Heritage Fund Program, State Capitol – Fourteenth Floor, 600 East Boulevard Ave. Dept. 405, Bismarck, ND 58505 or by e-mail to outdoorheritage@nd.gov . The application and all attachments must be received or postmarked by the application deadline. You will be sent a confirmation by e-mail of receipt of your application.

You may submit your application at any time prior to the application deadline. Early submission is appreciated and encouraged to allow adequate time to review your application and ensure that all required information has been included. Incomplete applications may not be considered for funding. Any item noted with an * is required.

Oral Presentation. Please note that you will be given an opportunity to make a ten-minute Oral Presentation at a meeting of the Outdoor Heritage Fund Advisory Board tentatively scheduled for the week of January 13, 2014. These presentations are strongly encouraged.

Open Record. Please note that your application and any attachments will be open records as defined by law and will be posted on the Industrial Commission/Outdoor Heritage Fund website.

Name of Organization * North Dakota Barley Council

Federal Tax ID# * 45-0380578

Contact Person/Title * Steven Edwardson, Executive Administrator

Address *505 40th Street SW, Suite E

City * Fargo

State * ND

Zip Code *58103

E-mail Address *steven.edwardson@ndbarley.net

Web Site Address (Optional) www.ndbarley.net

Phone *(701) 239-7200

Fax # (if available) (701) 239-7280

List names of co-applicants if this is a joint proposal

Phoenix Seed, Inc. - Federal Tax ID# 45-0405292 – 717 14th St. S., Fargo, ND 58103
701-293-5146; cefastnaught@msn.com

MAJOR Directive: (select the Directive that best describes your grant request)*

Choose only one response

Directive A. Provide access to private and public lands for sportsmen, including projects that create fish and wildlife habitat and provide access for sportsmen;

Directive B. Improve, maintain, and restore water quality, soil conditions, plant diversity, animal systems and to support other practices of stewardship to enhance farming and ranching;

Directive C. Develop, enhance, conserve, and restore wildlife and fish habitat on private and public lands; and

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Additional Directive: (select the directives that also apply to the grant application purpose)*

Choose all that apply

Directive A. Provide access to private and public lands for sportsmen, including projects that create fish and wildlife habitat and provide access for sportsmen;

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Directive D. Conserve natural areas for recreation through the establishment and development of parks and other recreation areas.

Type of organization: (select the category that describes your organization)*

State Agency

Political Subdivision

Tribal Entity

Tax-exempt, nonprofit corporation, as described in United States Internal Revenue Code (26 U.S.C. § 501 (c))

Project Name* Food Barley - Adding Value and Diversity to Western ND Farms

Abstract/Executive Summary. An Executive Summary of the project stating its objectives, expected results, duration, total project costs and participants.* (no more than 500 words)

Food Barley is a contractually grown crop ideal for western ND. Market potential for this crop increased in 2006 when the FDA approved the health claim "Barley lowers cholesterol". The North Dakota Barley Council proposes a public/private partnership with Phoenix Seed, Inc. to develop barley varieties that are "nutritionally enhanced" containing high levels of the soluble fiber compound active in lowering cholesterol and decreasing risk of heart disease. This 2 year project would utilize existing genetic resources from Phoenix Seed to quickly identify, test and increase breeder seed of 1 or 2 varieties in 2015. In addition, new genetic resources would be acquired and hybridized utilizing "speed breeding" growth chambers with subsequent generation advancement, cereal quality assurance testing, and line increases that would lay the foundation for future varieties. Certified seed only contracts and end-use royalties (in addition to existing check-off) would fund future variety development and research.

The many forms of barley are an important resource to the cropping systems of Western ND providing diversity and post-harvest food habitat for upland game and fowl. This project would be an investment in a market that can build prosperity and promote stewardship of these resources. The proposal is requesting \$193,850 over a 2 year period with matching funds or in-kind from Phoenix Seed of \$64,800 plus the existing genetic resources. Dr. Christine Fastnaught, co-owner and primary scientist of Phoenix Seed will direct this project. Her experience includes 10 years in barley and wheat breeding and 23 years in cereal chemistry including 8 years in the Food & Nutrition Dept at NDSU. Dr. Fastnaught authored the petition for the FDA health claim and is recognized globally as an expert in Barley Health Benefits. The North Dakota Barley Council has invested funding for barley product development and a barley foods course at the Northern Crops Institute. This project would enhance those efforts by providing higher yielding, higher quality varieties to advance the development of new markets for the barley industry.

Amount of Grant request \$ * 193,850 over 2 years

Total Project Costs \$* 258,650

(Note that in-kind and indirect costs can be used for matching funds)

Amount of Matching Funds: \$ 64,800

(\$9,500 cash, \$31,200 in-kind labor, \$24,100 in-kind equipment)

If applicable; Please indicate if the matching funds will be in-kind, indirect or cash.

Source(s) of Matching Funds: Phoenix Seed, Inc.

If applicable

Certifications *

- I certify that this application has been made with the support of the governing body and chief executive of my organization.

- I certify that if awarded grant funding none of the funding will be used for any of the exemptions noted on Page 1 of this application.

Narrative

Organization Information – Briefly summarize your organization’s history, mission, current programs and activities. *

Include an overview of your organizational structure, including board, staff and volunteer involvement. (no more than 300 words)

The North Dakota Barley Council was formed in 1983 as a state agency to promote barley utilization in malting and brewing, livestock feeding, and human food products. Promotional programs focus on both domestic and international markets. The Council supports barley variety development at North Dakota State University (e. g. plant breeding, plant pathology), market development via collaboration with U. S. Grains Council, and risk management research to enhance crop insurance and refine barley contracting programs. The Council is governed by a board of 5 directors. The Council collaborates with private and public entities to leverage resources in an effort to maintain and expand barley production, thus keeping barley agronomically sound, economically profitable, and environmentally sustainable.

Purpose of Grant – Describe the proposed project identifying how the project will meet the specific directive(s) of the Outdoor Heritage Fund Program *

Cropping systems in Western ND have changed dramatically in the past 20 years. Eighteen different crops were listed in the 2013 Crop Budget guides for western North Dakota. Predicted acre returns were greatest for crops grown under a contract, such as malting barley, and for crops with high yields/prices like corn. But even these choices are not enough and not all enhance wildlife habitat. The long term future of ND is mainly based on the value of its natural resources and its people. Farming and the farm communities need to remain prosperous. Investment in diverse crops and markets can build that prosperity and promote stewardship of these resources.

Barley is a member of the cool season grass family that dominated the native prairie of North Dakota. In fact, foxtail barley is a native grass of ND. Post-harvest barley gleanings are an excellent source of food for upland game fowl including pheasant. Keeping barley of any form in a mix of ND crops enhances the ecological and recreational value of the ND outdoors.

“Food Barley” grown under contract has this potential. While any type of barley can be used for food, there is a premium market for “nutritionally enhanced” barley. Nutritionally enhanced barley is hullless (retains whole-grain nutrients) and has high soluble (beta-glucan) fiber which is clinically proven to lower cholesterol and moderate starch conversion to sugar (ideal in a diabetic diet). In fact, the Food and Drug Administration approved a claim in 2006 that allows foods containing high levels of soluble fiber from barley to make food label claims such as “Barley helps lower cholesterol” or “may reduce heart disease”. Future claims may include lowering blood sugar and improving immune response. A list of human clinical trials that have studied the affect of barley consumption is attached (Appendix 1).

Not all barley is “nutritionally enhanced”. Optimum malting barley has a hull (desirable in the brewing process) and low levels of fiber (detrimental in brewing process) in addition to a number of other quality characteristics. Public and privately funded breeding programs for malting barley variety development are found in ND and the western US (optimum environments for growing barley). But, the strict requirements of the malt/brew industry depend on these programs to focus on yield and disease improvements while retaining the uniform quality characteristics.

Private development of “nutritionally enhanced” varieties for North Dakota resulted in the release of “Pronghorn” by WestBred in 2006 which was granted a variety patent in 2010. A nutrient comparison of food, malt and feed barley is attached (Appendix 2). While better adapted varieties were desired by companies like ConAgra and Kashi, the “food barley” breeding program was dropped by WestBred in 2011 to focus on wheat. Thus an opportunity exists for the development of adapted varieties by and for North Dakota.

The North Dakota Barley Council has supported research at the Northern Crops Institute to develop products containing “nutritionally enhanced” barley and optimize formulations and processes for the food industry. Barley flour and flakes can be used in breads, quick breads, pastries, crackers, pasta, snacks and chips. Barley berries can be blended with rice to easily increase dietary fiber. The NCI has engaged in workshops to train food and nutrition scientists in the utilization of barley by food manufacturers.

A focused breeding/research project on “nutritionally enhanced” barley would provide a strong foundation for a future “Food Barley” industry in western North Dakota. This project provides the following benefits:

1. Select, test and increase to breeders seed 1 or 2 varieties during the next 2 years;
2. Produce a diverse collection of genetic resources from which “nutritionally enhanced” barley varieties could be selected over the next 3-7 years;
3. Provide cereal quality analysis and data on the nutritional enhancement required for labeling food products derived from these varieties;
4. Consult with processors and end users to promote export and domestic markets for “Food Barley”;
5. Structure a royalty stream from value added products to provide long term funding.
6. Provide diversity for cropping systems in western North Dakota.
7. Provide diversity for habitat for upland game.

Nutritional enhancement of barley is associated with a number of naturally occurring genes found in barley. The USDA World Collection of Barley contains a few nutritionally enhanced varieties which are not adapted to ND. Standard hybridization and breeding can be used to transfer the hullless and high beta-glucan or high fiber traits to varieties adapted to ND while retaining the yield and disease/agronomic traits required for successful production. Speed breeding (generation advancement utilizing 24 hour lights and southern winter nurseries) can decrease the time it takes to release a new variety but must be partnered with streamlined cereal quality analyses to identify the lines with the greatest “nutritional enhancement”.

The project would begin by requesting additional lines from the USDA World Collection and released varieties from breeding programs in the region. A few of these were already acquired in 2012 and used to develop the lines being grown in Yuma AZ. Crosses could be made this winter and a generation advanced to plant segregating material in the field this spring. Additional crosses could be made at any point as material is acquired. Selected material can be harvested in August and advanced in growth chambers, tested and sent to AZ as single heads in November 2014 for additional advancement, increase and testing. This would provide material for testing and yield trials in summer 2015.

The material in AZ which was planted in November 2013 would be selected and planted as increases, yield trials and line rows for purity and further selection. Quality assurance testing would begin with the material returned from AZ. Good lines could produce up to 5 bushels which would allow a 5 acre increase in AZ in November 2014. This increase could be a single line or up to 3 lines depending upon data from 2014. Past production experience would suggest that a minimum of 250 bushels of a new variety/varieties could be harvested and planted in ND in summer 2015. These increases could also be used to introduce the ND Food Barley industry to companies identified as having in interest in Food Barley as an ingredient.

Table 1 provides a project timeline with details on activities and locations.

Table 1. Food Barley - Adding Value and Diversity to Western ND Farms Project Timeline and Activities

Funding	Year	Season	Location	Activity	Generations
Phoenix Seed	2014	Winter	Yuma, AZ	Purification & Single Row Increases	F4
Heritage Fund	2014	Winter	Fargo Growth Chambers/Lab	Crosses, generation advancement, selection	Cross F1 to F4
Heritage Fund	2014	Summer	Casselton, ND	Segregating line selection, yield trial, increases, quality analyses	F2 to F6
Heritage Fund	2014	Summer	Belfield, ND	Yield trial and increase	F5
Heritage Fund	2014	Fall	Fargo Growth Chambers/Lab	generation advancement, selection, quality analyses	F3 to F5
Heritage Fund	2014-2015	Winter	Yuma, AZ	Purification & Single Row Increases	F4 to F6
Heritage Fund	2014-2015	Winter	Brawley, CA	Bulk Increases	F6
Heritage Fund	2015	Winter	Fargo Growth Chambers/Lab	Crosses, generation advancement, selection, quality analyses	Cross F1 to F4
Heritage Fund	2015	Summer	Casselton, ND	Segregating line selection, yield trial, increases, quality analyses	F2 to F7
Heritage Fund	2015	Summer	Belfield, ND	Yield trial and increase	F5 to F7
Heritage Fund	2015	Summer	Dickinson, Williston, Hettinger NDAES	Yield trials	F6 to F7
Heritage Fund	2015	Fall	Fargo Growth Chambers/Lab	generation advancement, selection, quality analyses	F3 to F6
	2015	Winter	Yuma, AZ	Purification & Single Row Increases	F4 to F8
	2015	Winter	Brawley, CA	Bulk Increases	F4 to F8

Management of Project – Provide a description of how the you will manage and oversee the project to ensure it is carried out on schedule and in a manner that best ensures its objectives will be met.*

Phoenix Seed, Inc. (Fargo, ND) is a private breeding/seed research company that developed barley and wheat varieties for the Northern Plains from 1988 to 1994. The company utilized a proprietary “speed breeding” process to quickly develop varieties with specific attributes important to ND. WestBred purchased the Phoenix Seed germplasm in 1994 and hired one of the owners, Dr. Greg Fox, as a breeder. Directed by the other owner, Dr. Chris Fastnaught, Phoenix Seed remained active in seed research support for WestBred and consulting on Food Barley for the National Barley Foods Council. WestBred hired Dr. Fastnaught as a barley breeder/cereal chemist in 2007. Following Dr. Fox’s retirement from WestBred in 2012, a small project was initiated to develop a “Food Barley” variety for ND. This material was sent to Yuma, AZ in November 2013 for selection and increase. With Dr. Fastnaught’s retirement from WestBred in 2013, Phoenix Seed once again, has the background and expertise to renew a dedicated barley breeding/research program. Appendix 3 provides Dr. Fastnaught’s vita.

Evaluation – Describe your plan to document progress and results. *

How will you tell if the project is successful? Please be specific on the methods you will utilize to measure success. Note that regular reporting, final evaluation and expenditure reports will be required for every grant awarded.

Evaluation of the project will include:

1. Number of varieties released at end of 2 years and amount of seed available to license for certified seed production.
2. Registration of released varieties for future certified seed production.
3. Number of crosses made and generations advanced to produce the genetic resources available for selection and testing in subsequent years.
4. Reports providing data for end-user nutritional labels.
5. Expansion of acres contracted.
6. Evaluate wildlife utilization of habitat via inclusion of border strips that will be maintained for wildlife (e.g. upland game) and thus left unharvested.

Financial Information

ATTACHMENT: Project Budget – Using the standard project budget format that is available on the website at <http://www.nd.gov/ndic/outdoor-infopage.htm> , please include a detailed total project budget that specifically outlines all the funds you are requesting.*

The project budget should identify all matching funds, funding sources and indicate whether the matching funds are in the form of cash or in-kind services. As noted on the standard project budget format, certain values have been identified for in-kind services. Please utilize these values in identifying your matching funds. **NOTE: No indirect costs will be funded.**

Phoenix Seed has or will invest in the following assets to facilitate this project:

1. 6 growth chambers (4' x 8' benches with 8 adjustable light fixtures);
2. Equipment/chemicals for cereal quality (beta-glucan fiber) analysis;
3. Genetic resources (USDA gene collections, PVP varieties with breeders exemption);
4. Two years of preliminary line development.

I certify that a project budget will be sent to the Commission*

Sustainability – Indicate how the project will be funded or sustained in future years. *

Include information on the sustainability of this project after all the funding from the Outdoor Heritage Fund has been expended and whether the sustainability will be in the form of ongoing management or additional funding from a different source.

Future funding will be available from variety license fees and end-user royalty fees. Food Barley varieties will be registered under the certified seed program and protected under the Plant Variety Protection program. Production contracts will be written as “certified seed only” in order to maintain the genetically pure status of the Food Barley varieties. This will “guarantee” a high quality grain product which meets the labeling requirements of the food industry and provide future research funds.

Partial Funding – Indicate how the project will be affected if less funding is available than that requested. *

Reduced funding will result in smaller increases of potential varieties, fewer resources to generate breeding material for future varieties and an increase in the amount of time it takes to release these varieties for market development. Typical breeding can take 5-10 years to release a variety. This project is designed to reduce this time to 3 years by implementing 4-5 generations/year. The number of generations is related to the amount of funding available for the project. It will also result in a longer development of time for this diverse wildlife habitat.

Appendix 1 Recent Barley Human Clinical Trials or Reviews

Chillo, S. et al., Glycemic response and glycemic index of semolina spaghetti enriched with barley β -glucan, *Nutrition* 27,653, 2011.

EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA), Scientific Opinion on the substantiation of a health claim related to barley beta-glucans and lowering of blood cholesterol and reduced risk of (coronary) heart disease pursuant to Article 14 of Regulation (EC) No 1924/2006. *EFSA Journal*, 9, 2471, 2011.

Rondanelli M. et al., Beta-glucan- or rice bran-enriched foods: a comparative crossover clinical trial on lipidic pattern in mildly hypercholesterolemic men, *Eur. J. Clin. Nutr.*, 65, 864, 2011.

AbuMweis. S.S., Jew. S. and Ames. N.P., Beta-glucan from barley and its lipid lowering capacity: a meta-analysis of randomized, controlled trials. *Eur. J. of Clin. Nutr.*, 64, 1472, 2010.

Vitaglione, P. et al., Satiating Effect of a Barley Beta-Glucan–Enriched Snack, *J. Am. Coll. Nutr.*, 29, 113, 2010.

EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA), Scientific Opinion on the substantiation of health claims related to beta-glucans and maintenance of normal blood cholesterol concentrations (ID 754, 755, 757, 801, 1465, 2934) and maintenance or achievement of a normal body weight (ID 820, 823) pursuant to Article 13(1) of Regulation (EC) No 1924/2006, *EFSA Journal*, 7, 1254, 2009.

Alminger, M. and Eklund-Jonsson, C., Whole-grain cereal products based on a high-fibre barley or oat genotype lower post-prandial glucose and insulin responses in healthy humans, *Eur. J. Nutr.*, 47, 294, 2008.

Sundberg B., Cholesterol lowering effects of a barley fibre flake product. *Agro Food Industry Hi-Tech*, 19, 14, 2008.

Nilsson A.C., et al., A cereal-based evening meal rich in indigestible carbohydrates increases plasma butyrate the next morning, *J. of Nutr.*, 140, 1932, 2010.

Hinata, M. et al., Metabolic improvement of male prisoners with type 2 diabetes in Fukushima Prison, Japan, *Diabetes Res. Clin. Pract.*, 77, 327, 2007.

Keenan, J.M. et al., The effects of concentrated barley β -glucan on blood lipids and other CVD risk factors in a population of hypercholesterolemic men and women, *Brit. J. of Nutr.*, 97, 1162, 2007.

Shimizu, C., et al., Effect of High β -Glucan Barley on Serum Cholesterol Concentrations and Visceral Fat Area in Japanese Men—A Randomized, Double-blinded, Placebo-Controlled Trial, *Plant Foods for Human Nutr.*, published online 12 December 2007.

Aman, P., Cholesterol-lowering effects of barley dietary fibre in humans: scientific support for a generic health claim, *Scan. J. Food Nut.*, 50, 173, 2006.

Behall, K.M., Scholfield, D.J., and Hallfrisch, J.G., Barley β -glucan reduces plasma glucose and insulin responses compared with resistant starch in men. *Nutr. Res.*, 26, 644, 2006.

Behall, K.M., Scholfield, D.J., and Hallfrisch, J., Whole-grain diets reduce blood pressure in mildly hypercholesterolemic men and women, *JADA*, 106, 1445, 2006.

Cheung, N.-K.V., Therapy-enhancing glucan, *U.S. Patent Appl. Publ.*, US 2006/0020128 A1, 2006.

FDA, Food labeling: health claims; soluble dietary fiber from certain foods and coronary heart disease, final rule, *Fed. Reg.*, 71, 29248, 2006.

Ostman, et al., Glucose and insulin responses in healthy men to barley bread with different levels of (1→3,1→4)- β -glucans; predictions using fluidity measurements of in vitro enzyme digests. *J. Cereal Sci.*, 43, 230, 2006.

FDA-DHHS, Health claims: soluble fiber from certain foods and risk of coronary heart disease. *Code of Fed. Reg.*, 21CFR101.81, 2007.

Bjorklund, M. et al., Changes in serum lipids and postprandial glucose and insulin concentrations after consumption of beverages with β -glucans from oats or barley: a randomized dose-controlled trial, *Eur. J. Clin. Nutr.*, 59, 1272, 2005.

Modak, S. et al., Rituximab therapy of lymphoma is enhanced by orally administered (1→3),(1→4)-D- β -glucan, *Leukemia Res.*, 29, 679, 2005.

Behall, K.M., Scholfield, D. and Hallfrisch, J., Diets containing barley reduce lipids significantly in moderately hypercholesterolemic men and women, *Am. J. Clin. Nutr.*, 80, 1185, 2004.

Behall, K.M., Scholfield, D.J. and Hallfrisch, J.G., Lipids significantly reduced by diets containing barley in moderately hypercholesterolemic men, *J. Am. Coll. Nutr.*, 23, 55, 2004.

Hallfrisch, J., Scholfield, D.J. and Behall, K.M., Physiological responses of men and women to barley and oat extracts (Nu-trimX). II. Comparison of glucose and insulin responses. *Cereal Chem.*, 80, 80, 2003.

Hallfrisch, J., Scholfield, D.J., and Behall, K.M., Blood pressure reduced by whole grain diet containing barley or whole wheat and brown rice) in moderately hypercholesterolemic men, *Nutr. Res.*, 23, 1631, 2003.

Keogh, G. F. et al., Randomized controlled crossover study of the effect of a highly β -glucan enriched barley on cardiovascular disease risk factors in mildly hypercholesterolemic men, *Am. J. Clin. Nutr.*, 78, 711, 2003.

Li, J. et al., Effects of barley intake on glucose tolerance, lipid metabolism, and bowel function in women, *Nutrition*, 19, 926, 2003.

Ross, G.D. Development of an oral barley beta-glucan adjuvant, Dept of Defense Award # DAMD17-02-1-0445, 2003.

Behall, K.M. and Hallfrisch, J., Effects of grains on glucose and insulin responses, in *Whole-Grain Foods in Health and Disease*, Marquart, L. et al., Eds., American Association of Cereal Chemists, St. Paul, 2002, 269.

Cavallero, A. et al., High (1→3,1→4)-β-glucan barley fractions in bread making and their effects on human glycemic response. *J. Cereal Sci.*, 36, 59, 2002.

Sacks, F. M. et al., Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet, *N. Engl. J. Med.*, 344, 3, 2001.

Pick, M.E. et al., Barley bread products improve glycemic control of Type 2 subjects. *Intl. J. Food Sci. and Nutr.*, 49, 71, 1998.

Hawrysh, Z.J. et al., Barley bread products in the diet: community study with diabetic subjects. *Cereal Foods World*, 42, 620, 1997.

Yokoyama, W.H. et al., Effect of barley beta-glucan in durum wheat pasta on human glycemic response. *Cereal Chem.*, 74, 293, 1997.

Wursch, P. and Pi-Sunyer, F.X., The role of viscous soluble fiber in the metabolic control of diabetes. *Diabetes Care*, 20, 1774, 1997.

Ascherio, A. et al., Prospective study of nutritional factors, blood pressure, and hypertension among US women, *Hypertension*, 27, 1065, 1996.

Ikegami, S. et al., Effect of boiled barley-rice-feeding in hypercholesterolemic and normolipemic subjects, *Plant Foods for Hum. Nutr.*, 49, 317, 1996.

Liljeberg, H.G.M., Granfeldt, Y.E. and Bjorck, I.M.E., Products based on a high fiber barley genotype, but not on common barley or oats, lower postprandial glucose and insulin responses in healthy humans. *J. Nutr.*, 126, 458, 1996.

Granfeldt, Y. et al., Glucose and insulin responses to barley products: influence of food structure and amylose-amylopectin ratio. *Am. J. Clin Nutr.*, 59, 1075, 1994.

Lupton, J., Robinson, M.C., and Morin, J.L., Cholesterol-lowering effect of barley bran flour and oil, *J. of the Am. Diet. Assoc.*, 94, 65, 1994.

Narain, J.P. et al., Metabolic responses to a four week barley supplement, *Int. J. Food Sci. Nutr.*, 43, 41, 1992.

McIntosh, G.H. et al., Barley and wheat foods: influence on plasma cholesterol concentrations in hypercholesterolemic men, *Am. J. Clin. Nutr.*, 53, 1205, 1991.

Newman, R.K. et al., Hypocholesterolemic effect of barley foods on healthy men, *Nutr. Rep. Int.*, 39, 749, 1989.

Newman, R.K., Newman, C.W. and Graham, H., The hypocholesterolemic function of barley beta-glucans, *Cereal Foods World*, 34, 883, 1989.

Klopfenstein, C.F. and Hosney, R.C., Cholesterol-lowering effect of beta-glucan- enriched bread. *Nutr. Rep. Int.*, 36, 1091, 1987.

Appendix 2
Nutrient Composition of Food, Malt and Feed Barley

Component (g/100g @10% moisture basis)	Malt or Feed Barley	Food Barley Ultra High Fiber	Food Barley
Starch	55	25	50
Amylose	25	0	0
Protein	12	18	15
Lipids	2	7	3
Sugars	2	6	4
Total Dietary Fiber	15	30	15
Soluble	3	12	6
Beta-Glucan	4	15	7
Minerals	3	3	3

Appendix 3.
Christine E. Fastnaught, Ph.D.
717 S. 14th St. • Fargo, ND 58103
Phone/Fax (701) 293-5146 • cefastnaught@msn.com

PROFESSIONAL EXPERIENCE

Monsanto Company (WestBred), Fargo, ND. 2012 to 2013. Cereal Chemist/Breeding Support Specialist. Coordinated wheat quality lab and introduced advanced NIR for wheat protein and quality. Established scannable data collection for seed and quality labs. Coordinated company-wide wheat variety PVP & patent applications. Managed company-wide wheat germplasm introduction, pipeline advancement and variety identification databases. Managed Fargo site human resource/accounting processes and supervised up to 10 lab/field assistants.

Monsanto Company (WestBred), Fargo, ND. 2009 to 2011. Barley Breeder/Cereal Chemist. Developed 3 nutritionally enhanced hulless barley varieties. Analyzed barley varieties/products for quality specifications. Coordinated company-wide barley variety PVP & patent applications.

WestBred LLC (Phoenix Agri-Research), Fargo, ND/Bozeman, MT/Yuma, AZ. 2007 to 2009. Barley Breeder/Cereal Chemist. Developed nutritionally enhanced hulless barley varieties and products for food markets. Analyzed barley varieties/products for quality specifications. Developed process/template for barley variety patent applications.

Barley Foods Consulting, Fargo, ND. 1998 to 2007. Consulting Scientist, Barley Foods Research. Consulting scientist for the National Barley Foods Council. Authored successful FDA petition for barley and soluble fiber health claim granted May 2006. Presented updates on Nutritional Benefits of Barley at meetings in the US, Canada, Japan and Taiwan.

Food & Nutrition Dept., North Dakota State University, Fargo, ND. 1990 to 1998. Cereal Chemist. Directed research for "Alternative Uses of Barley" grant, screening barley genotypes for human food use.

EDUCATION

PH.D.	Montana State Univ., Bozeman	Plant Breeding & Genetics
M.S.	Univ. of Arizona, Tucson	Genetics
B.S.	Univ. of Arizona, Tucson	Agronomy

Minors in biochemistry and statistics. Post-graduate courses in Molecular Biology and Food Safety.

ASSOCIATIONS/MEMBERSHIPS/AWARDS

American Association of Cereal Chemistry
Chair, Barley and Barley Products Technical Committee, 1998 to 2001
Institute of Food Technology
Barley Foods Research Steering Committee, Chair, 1999-2007
North Dakota Governors Award for Excellence, 1996
Staff Recognition Award, NDSU/College of Human Development and Education, 1994 & 1995

TECHNICAL & SPECIALIZED SKILLS

Cereal Chemistry: NIR/Kjeldahl protein; Soxhlet Lipid; Dietary Fiber;
Wheat - SDS Sedimentation;
Barley- Beta-Glucan/Carbohydrates;
Productivity Software: Microsoft Word, Excel, PowerPoint; Adobe Acrobat Pro;
Bartender Bar Code & Labeling;
Proprietary data collection and lineage programs;
Statistical Software: Analyze-It; SAS;
HR & Accounting: SAP;

PUBLICATIONS

- Fastnaught, C.E. 2009. Barley fiber. In, eds. S. Cho and P. Samuel, *Fiber Ingredients: Food Applications and Health Benefits*. CRC Press, Boca Raton, FL. pp. 323-358.
- Fastnaught, C.E., Berglund, P.T., Dudgeon-Bollinger, A.L., and Hadley, M. 2006. Lipid changes during storage of milled hullless barley products. *Cereal Chem.* 83:424-427.
- Fastnaught, C.E. and Webster, F. 2005. Amendment & Petition for Unqualified Health Claim: Barley β -glucan Soluble Fiber and Barley Products Containing β -glucan Soluble Fiber and Coronary Heart Disease. FDA Dockets 2004P-0512, August 3, 2004 & 2004P-0512, September 25, 2003.
- Fastnaught, C.E. 2001. Barley fiber. In, eds. S. Cho and M. Dreher, *Handbook of Dietary Fiber*. Marcel Dekker, NY, NY. pp. 519-542.
- Dudgeon-Bollinger, A.L., Fastnaught, C.E., and Berglund, P.T. 1997. Extruded snack products from waxy hull-less barley. *Cereal Foods World* 42:762-766.
- Fastnaught, C. E., Berglund, P. T., Holm, E. T., and Fox, G. J. 1996. Genetic and environmental variation in beta-glucan content and quality parameters of barley for food. *Crop Science* 36:941-946.

Food Barley: Adding Value and Diversity to Western ND Farms
Budget Standard Form

Please use the table below to provide a detailed total project budget that specifically outlines all the funds you are requesting and if there are any matching funds being utilized to fund this project. Please note if the matching funds are in the form of cash, indirect costs or in-kind services. The budget should identify all other committed funding sources and the amount of funding from each source. Match can come from any source (i.e. private sources, State and Federal funding, Tribal funding, etc.) Note match funding is not required but an application will be scored higher if match funding is provided. (See Scoring Form.)

Note that NO INDIRECT COSTS will be funded from the Outdoor Heritage Fund.

Project Expense	OHF Request	Applicant's Match Share (Cash)	Applicant's Match Share (In-Kind)	Applicant's Match Share (Indirect)	Other Project Sponsor's Share
Contracted Labor (1)	\$79300	\$1000	\$31200	\$	\$
Building Rent (2)	\$19200	\$	\$	\$	\$
Building Utilities (3)	\$14400	\$	\$	\$	\$
Equipment Purchase (4)	\$10750	\$	\$22700	\$	\$
Equipment Rental (5)	\$16000	\$	\$	\$	\$
Supplies (6)	\$10000	\$	\$1400	\$	\$
Land Rental (7)	\$21200	\$1000	\$	\$	\$
Travel (8)	\$9000	\$7000	\$	\$	\$
Contract Testing (9)	\$4000	\$	\$	\$	\$
Independent Nutritional analyses (10)	\$8000	\$	\$	\$	
Shipping (11)	\$2000	\$500	\$	\$	\$
Total Project Costs	\$193,850	\$9500	\$55300	\$	\$

- | |
|--|
| (1) Year 1+2: Intern 20hr/week; Plot maintenance 12 wks@40 hrs/wk; Breeder 20 hr/week;
Year 2: AZ manual harvest 5 people@4 days |
| (2) Year 1+2: \$800/month |
| (3) Year 1+2: 24 hr lights + standard utilities approximate \$600/month |
| (4) Year 1+2: Moisture balance, oven, Udy sample mill, pH meter for quality assurance; benches and chairs for lab. Growth chambers (6), lights (48), centrifuge, sample balance, spectrophotometer, water bath, glassware acquired previously. |
| (5) Year 1+2: Research planter and combine - 16 days of planting and harvest |
| (6) Year 1+2: chemicals, soil, containers, fertilizer, bulbs, etc. |
| (7) Year 1+2: AZ research acre =\$4000/a; ND research acre=\$400/a (research acre rental includes land prep, fertilizer, herbicide/fungicide etc.); CA increase acres=\$2000/a; ND increase acre=\$40/a.
Year 1: AZ research=1/4a; ND research=4a;
Year 2: AZ research=1a; CA increase=5a; ND research=5a; ND increase=200a. |
| (8) Year 1+2: Four trips to AZ; 16 trips to western ND; daily summer trips to Casselton, ND. |
| (9) Year 2: Yield trial testing at ND AES Dickinson, Williston, Hettinger \$400/entry/location |
| (10) Year 1+2: Nutrient label analysis required for end-products. |
| (11) Year 1+2: Shipment of winter seed production from AZ/CA to ND in May for immediate planting. |

In-kind services used to match the request for Outdoor Heritage Fund dollars shall be valued as follows:

- Labor costs \$15.00 an hour
- Land costs Average rent costs for the county as shown in the most recent publication of the USDA, National Agricultural Statistics Services, North Dakota Field Office
- Equipment Any equipment purchased must be listed separately with documentation showing actual cost.
- Equipment usage Actual documentation
- Seed & Seedlings Actual documentation
- Transportation Mileage at federal rate
- Supplies & materials Actual documentation

More categories will be added as we better understand the types of applications that will be submitted. We will use as our basis for these standards other State and Federal programs that have established rates. For example the North Dakota Nonpoint Source Pollution Management Program has established rates. If your project includes work that has an established rate under another State Program please use those rates and note your source.

Approved by OHF Advisory Board: October 17, 2013

Approved by Industrial Commission: October 22, 2013

BREEDING RESEARCH		Phoenix Seed Match	2014	2015
Labor				
	Intern 20 hr/wk @ \$15/hr		\$15,600	\$15,600
	Breeder 20 hr/wk @\$15/hr	\$31,200	\$15,600	\$15,600
	Plot maintenance-12 wks/40 hr/\$15/hr		\$7,200	\$7,200
	AZ Harvest Labor	\$1,000		\$2,500
Labor Total		\$32,200	\$38,400	\$40,900
Seed Lab				
	Facility			
	monthly rental- \$800/month		\$9,600	\$9,600
	utilities -		\$7,200	\$7,200
	Growth chambers -6			
	chambers @\$1000 each	\$6,000		
	lights-48 @\$250 each	\$12,000	\$1,000	\$1,000
	Equipment/furniture			
	seed drying oven, benches, chairs	\$200	\$500	
	Supplies			
	soil, containers, fertilizer, misc		\$3,000	\$3,000
Seed Lab Total		\$18,200	\$21,300	\$20,800
End-Use Quality Analyses				
	Lab furnishing			
	benches, chemical storage (refrigerator, freezer & room temp)	\$1,500	\$500	\$0
	Waxy starch analysis			
	chemicals	\$200	\$200	\$0
	Beta-glucan fiber analysis			
	chemicals	\$1,200	\$600	\$1,200
	Equipment			
	Moisture Balance		\$2,000	\$0
	Moisture Oven		\$750	\$0
	Udy Sample Mill		\$6,000	\$0
	pH meter		\$1,000	\$0
	balance, centrifuge, spectrophotometer, water bath, glassware, misc	\$3,000		
	Product Label Nutrient analysis (independent lab)		\$4,000	\$4,000
End-Use Quality Analyses Total		\$5,900	\$15,050	\$5,200
Field Research/Increase				
	Summer			
	Land/testing	Casselton, ND	\$800	\$1,600
		Belfield, ND	\$800	\$4,000
	Contract trials \$400/entry/location			\$4,000
	Planting equipment rental		\$3,000	\$5,000
	Harvest equipment rental		\$3,000	\$5,000
	Travel		\$4,000	\$3,000
	Winter			
		Brawley, CA		\$10,000
		Yuma, AZ	\$1,000	\$4,000
		Travel	\$3,000	\$3,000
		Shipping	\$500	\$2,000
Field Research/Increase Total		\$8,500	\$10,600	\$41,600
BREEDING RESEARCH TOTALS		\$64,800	\$85,350	\$108,500
	FUNDING REQUEST		\$193,850	
	PROJECT TOTAL		\$258,650	