


Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL GRANT APPLICATION

1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE Name: South Dakota State University Address: Office of Research Assurance and Sponsored Programs Attn: Dianne Nagy (Phone Number: 605-688-6696) SAD 200, Box 2201, Brookings, SD 57007-0001		
2. TITLE OF PROPOSAL Breeding winter wheat varieties with FHB resistance and straw strength		
3. PRINCIPAL INVESTIGATOR(S) Sunish K. Sehgal Gazala Ameen Peter Sexton	4. PI #1 BUSINESS ADDRESS 2380 Research Parkway, Seed Tech 113B, Department of AHPS, SDSU, Brookings, SD 57007 E-mail: sunish.sehgal@sdsu.edu	
5. PROPOSED PROJECT DATES (Jan 1 – Dec 31) January, 1 2022- December 31, 2024 Note: Annual Research Reports are Due November 15th	6. TOTAL PROJECT COST \$16,060 x 3 years = \$48,180	7. PI #1 PHONE NO. 605-688-5709
8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant) Overall goal of the project is to release new and improved winter wheat varieties adapted to the region providing producers an opportunity for fall grain crops in rotation. The specific objectives of the project are to 1) Enhance the FHB resistance and straw strength in soft and hard winter wheat. 2) Develop soft and hard wheat varieties for the region to enhance crop diversity and value addition. The newly developed lines will be submitted for testing in Southern Minnesota Small Grains Research & Outreach Project.		
Attach a 2-page detailed discussion of importance of the proposal to wheat profitability; how study complements previous research in area; procedures to be used; and competency of the research group in achieving research objectives. (Please keep the proposal concise, only 2 pages will be provided reviewers).		
Signature 	Date 1/4/2022	

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RESEARCH PROJECT PROPOSAL

Breeding winter wheat varieties with FHB resistance and straw strength

Abstract:

SD Winter wheat breeding program routinely develops winter wheat varieties under a 100 % regenerative management system working closely with producers through on-farm trials for the last 55 years. Winter wheat (soft wheat and hard wheat) offers several advantages over spring wheat including a 20% yield increase and fits well with cover crop rotation, conserves soil moisture, improves water quality, reduces soil erosion, and builds soil structure and soil health. With the establishment of CJ foods in the region (Sioux Falls) and the presence of Schwan's and Grain Millers Inc., there is an opportunity for increased local demand for soft and hard wheat in southern and western MN, northwestern IA, and the I-29 corridor in SD. Therefore, there is a need to develop varieties with good Fusarium head blight resistance and straw strength adapted to this region. The primary objectives of the project are 1) to enhance the FHB resistance and straw strength in soft and hard winter wheat; 2) to develop and release soft and hard wheat varieties for the region. Once new lines are developed these will be submitted for testing in Southern Minnesota Small Grains Research & Outreach Project.

Background:

SDSU Winter wheat breeding program has successfully developed and released several cultivars and many of them performing in top-yielding groups in MN Winter Wheat Field Crop Variety Trials <https://varietytrials.umn.edu/winter-wheat>. SD winter wheat varieties like Winner, and SD Andes rank in the top 5 across five MN locations and have good winter hardiness and disease resistance package. Further with the opportunity of local demand for soft and hard wheat in southern and western MN, northwestern IA, and the I-29 corridor in SD we initiated soft white wheat trials (in third year) in SD and initiated breeding efforts in 2021. These efforts will also increase crop diversity and provide growers with an opportunity of a cover crop and utilize fall moisture.

Research methods:

Each year about 40-50 crosses/backcrosses for both soft and hard winter wheat will be developed for FHB resistance and straw strength as the main goals of the breeding effort. The major sources of FHB resistance will be *Fhb1*, *Fhb5A*, and *Fhb6* and for increasing straw strength, the focus will be on semidwarf genotypes carrying *Rht1b*, but we will also evaluate the potential of other dwarfing genes *Rht24b* in winter wheat. Recently *Rht24* was cloned and has shown a less negative impact on yield with reduction of plant height. The F₁'s will be backcrossed or seed increased in the greenhouse and then 500 F₂ plants will be advanced using mini-bulks using speed breeding or in the field to F₄ generations. The F₄ population will be space planted to select plants. That selected plants will be planted in short 5 ft 4-row observation plot (EOT). The EOT entries will be screened for FHB markers and selected based on winter-hardiness, resistance to other diseases (rust and Bacterial Leaf Streak), and agronomic traits like plant height, maturity, yield, test weight, grain protein. The best performing breeding lines will be advanced to Advanced Yield Trials (AYT) and evaluated at three locations. Currently, we are evaluating 20-24 lines in our AYT. The AYT lines will also be evaluated for FHB resistance in our mist irrigated FHB field nursery. Further quality parameters of the advanced lines will also be evaluated. The 2-3 lines showing superior performance in AYT will enter into the Minnesota State Variety trials conducted by (Dr. Jared J. Goplen and Dr. Jochum J. Wiersma) at 5 locations in MN.

Timeline for completion:

We have already developed 25 crosses in 2021 and the second season of crosses will be performed in spring 2022 and continue yearly thereafter. The lines will be advanced to F₄ in 2023 and Advanced Yield Trials will be conducted in 2024 and continue thereafter.

Outreach plan:

The information generated in the breeding program through the trials will be shared with producers through field days, social media (Twitter: <https://twitter.com/WheatInnovation>), field inspector schools, professional meetings, extension publications, publications in scientific peer-reviewed journals, etc. A web seminar can be delivered to winter wheat growers in MN that will benefit from the outcome of the study. In addition, the outcome will provide a basis for discussion and education among researchers, extension educators, seed distributors, and others in the farming community.

Research group (other collaborators not listed as PIs):

Dr. Jochum J. Wiersma, Extension Small Grain Specialist, University of Minnesota

Dr. Eric Olson, Wheat Breeder, Michigan State University

Dr. Gideon Francois Marais, Winter Wheat Breeder, NDSU

Relationship to past projects and research conducted by you or others in the region:

This is new project submitted to MNWRPC, but the hard winter wheat breeding effort has been supported by South Dakota Wheat Commission, SDAES, and USWBSI for a long time, however, limited funds are available for soft wheat breeding efforts. We initiated soft wheat breeding at SDSU in 2020 because of the likely demand for soft white wheat in MN, IA, and SD due to the establishment of CJ Foods and the presence of Schwan's and Grain Millers Inc. as primary buyers of the wheat. The support will help in continuing the in developing winter wheat varieties for the region.

<https://www.marshallindependent.com/news/local-news/2021/01/cj-foods-to-build-frozen-food-plant-in-sioux-falls/>

<https://www.agweek.com/business/manufacturing/6834732-Schwans-Company-affiliate-to-bring-new-facility-600-jobs-to-Sioux-Falls>

Budget Justification:

Fund are requested for a research assistant/undergraduate student labor that will help with planting, harvesting plots head rows, threshing, seed cleaning, seed preparation for trials, nurseries, and mostly contractual cost to cover for greenhouse, field space, other operational cost and supplies.

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RESEARCH PROJECT PROPOSAL BUDGET

Project Title: Breeding winter wheat varieties with FHB resistance and straw strength			
Principal Investigator(s) / Project Director(s) Sunish Sehgal	Funds Requested For		
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)
A. Salaries and Wages	\$6,060	\$6,242	\$6,429
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates – Post Doctorate			
4. Other Professionals Research Assistant/Undergraduate students	6,000	6,180	6,365
5. Graduate Students			
6. Prebaccalaureate Students			
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	60	62	64
C. Consulting and Professional Services			
D. Supplies and Services			
E. Travel			
F. Sub-Contracts			
G. Repairs & Maintenance			
H. Rentals & Lease			
I. Other Expenses	10,000	9,818	9,631
TOTAL AMOUNT OF THIS REQUEST (per year)	\$ 16,060	\$ 16,060	\$ 16,060