PROJECT NO: New

TITLE: Quantity and characterization of starch granules in soft white winter wheat

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JUSTIFICATION:
The primary objective of soft white winter wheat (SWWW) breeding is to develop new cultivars with increased yield and improved agronomic traits, disease resistance, and end-use quality. There are hundreds of intermediate generation F_5 lines for selection to potentially move up to F_6 for further trials, but only about 10% of F_5 lines can be selected into F_6 trials. So SWWW breeders face the problem of selecting excellent lines for the F_6 generation. While yield and disease resistance can be selected based on the yield data and the performance, the problem is quality selection. One common criterion for quality selection is based on protein content because of its importance in wheat end-use quality. However, starch is the major ingredient in wheat flour (70-75%) [4]. Although its role in dough is still not very clear [4], the rheological behavior of wheat dough appears to be influenced by the specific properties of the starch granule [5]. Therefore, the goal of this study is to identify the relationships among starch granules, protein content, and yield in order to provide information that will help wheat breeders with intermediate generation quality selection.

HYPOTHESIS & OBJECTIVES:
Wheat endosperm contains two types of starch granules: large A- and small B-type. A- and B-type starch granules have significantly different chemical compositions and functional properties such as amylose, amylopectin, pasting characteristics, and baking properties [9].

Our objectives are to:

1. Isolate and measure A-type and B-type starch granules in selected lines.
2. Identify the relationships among starch granule (A-type and B-type) content, protein content and yield.

PROCEDURES:

Materials: 2015 SWWW intermediate generation F_6 seeds were prepared for this experiment. After measurement of plot weight, seed protein content was determined using near infrared reflection (NIR) (Infratec Nova, FOSS). The samples were divided into four yield groups: Group 1 (138-134 Bu/Ac), Group 2 (131-128 Bu/Ac), Group 3 (125-122 Bu/Ac) and Group 4 (119-116 Bu/Ac). In each yield group, the samples with lower, middle and higher protein content were selected respectively. These samples will be used for this experiment (Table 1).

Methods: A- and B- type starch granule will be separated and measured for each samples. We will use the methods described in references [3, 6, 9].

Table 1. Low protein content and high protein content among different grain yield groups in F_6 seeds

Group 1			Group 2			Group 3			Group 4		
138-134 (Bu/Ac)			131-128 (Bu/Ac)			125-122 (Bu/Ac)			119-116 (Bu/Ac)		
Genotype	Protein Content	Grain Yield	Genotype	Protein Content	Grain Yield	Genotype	Protein Content	Grain Yield	Genotype	Protein Content	Grain Yield
	%	Bu/Ac		%	Bu/Ac		%	Bu/Ac		%	Bu/Ac
						10-08611	8.6	122.3	10-45902	8.6	119.0
10-01402	9.4	137.6	10-29107A	9.6	129.2	10-11605A	9.6	123.2	10-03720	9.7	116.6
						Huffman (ck)	10.2	125.2			
10-03703	10.5	134.9	10-03718A	10.4	128.2	10-48301	10.6	122.0	10-36137A	10.7	117.0
10-33843A	11.1	136.7	10-43202A	11.5	128.6	10-03749	11.7	121.8	10-19730A	11.6	118.0
									10-12607	12.0	116.1

DURATION: 2 years (2016-2018)
First year (2016-2017): 2015 SWWW F_6 seeds will be used.
Second year (2017-18): 2016 SWWW F_6 seeds will be used to repeat the results.

COOPERATION:
This experiment will be conducted at University of Idaho, Moscow.

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER:
Wheat protein content is correlated with flour end-use quality. Lower protein content is better for SWWW quality. Our goal is to identify the relationships among starch granule, protein content and grain yield. The results can be used to develop a screening method for wheat breeders to select good quality F_6 lines according to the quantity and characterization of starch granule.

LITERATURE REVIEW:
Wheat starch has some unique properties that determine its functionality in many food applications, in particular bread-making [4]. It is a mixture of two molecular polysaccharides: amylose, an essentially linear fraction, and amylopectin, a highly branched fraction, forming a complex structure with a hierarchical order [10]. The amylose/amylopectin ratio differs between starches, but typical concentrations of amylose and amylopectin are 25–28% and 72–75%, respectively [4]. Starch has been suggested to act as inert filler in the continuous protein matrix of the dough since the rheological behavior of wheat dough is influenced by the specific properties of the starch granule [2, 5]. Wheat starch granules include two types: large A- and small B-types. A- and B-type starch granules have significantly different chemical compositions and functional properties such as amylose, amylopectin, pasting characteristics and baking properties [9]. The proportion of A- to B-type starch granules in wheat flour affects the noodle quality [1] and bread quality [7, 8].

References Cited:

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IDAHO WHEAT COMMISSION - BUDGET FORM

Allocated by	Idaho Wheat Commission	during FY 2015	$	-
Allocated by	Idaho Wheat Commission	during FY 2016	$	-

REQUESTED FY 2016 SUPPORT:

	Salary	Temporary Help	Fringe	Travel	OE	Graduate Tuition/Fees	TOTALS
Idaho Wheat Commission	$ -	$ 1,600	$ 627	$ -	$ 2,000	$ -	$ 4,227

OTHER RESOURCES (not considered cost sharing or match):

TOTAL OTHER RESOURCES	$ -

TOTAL PROJECT ESTIMATE FOR FY 2017:	$ 4,227 *(Requested)*	$ - *(Other)*	$ 4,227 *(Total)*

BREAKDOWN FOR MULTIPLE SUB-BUDGETS:

	(PI name)	*(PI name)*	*(PI name)*	*(PI name)*
Salary	$ -	$ -	$ -	$ -
Temporary Help	$ -	$ -	$ -	$ -
Fringe Benefits	$ -	$ -	$ -	$ -
Travel	$ -	$ -	$ -	$ -
Operating Expenses	$ -	$ -	$ -	$ -
Graduate Student Tuition/Fees	$ -	$ -	$ -	$ -
TOTALS	$ -	$ -	$ -	$ -

Total Sub-budgets	$ -

10.7.2015 - Version